12 Sheets—Sheet 1.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. Patented Dec. 9, 1879.

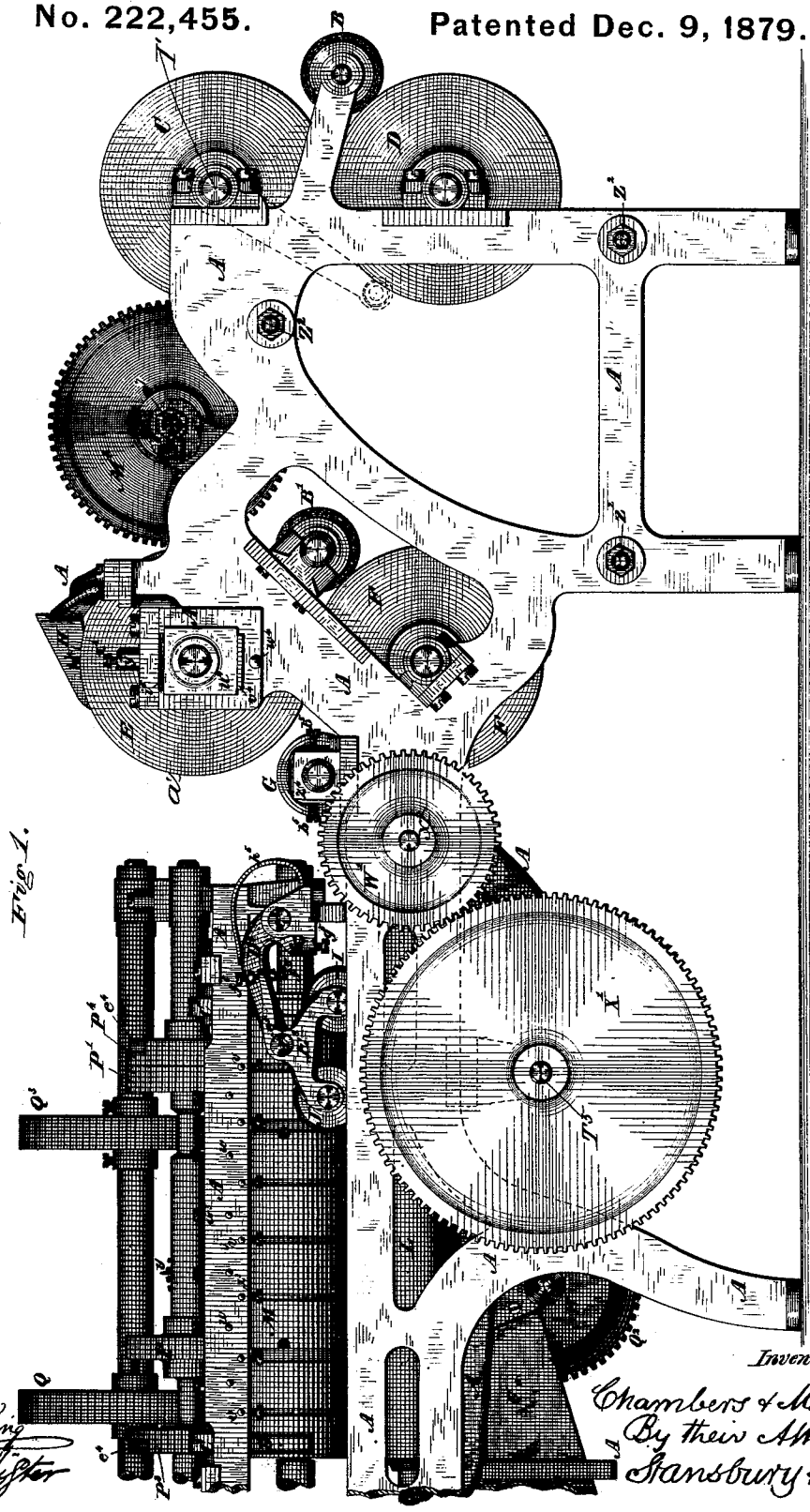


Fig. 1.

Side Elevation. Scale ½ to 1.

Witnesses.

Harry King

J. Wm. Mister

Inventors.

Chambers & Mendham,
By their Attorneys,
Bansbury & Munn

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12 Sheets—Sheet 2.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. **Patented Dec. 9, 1879.**

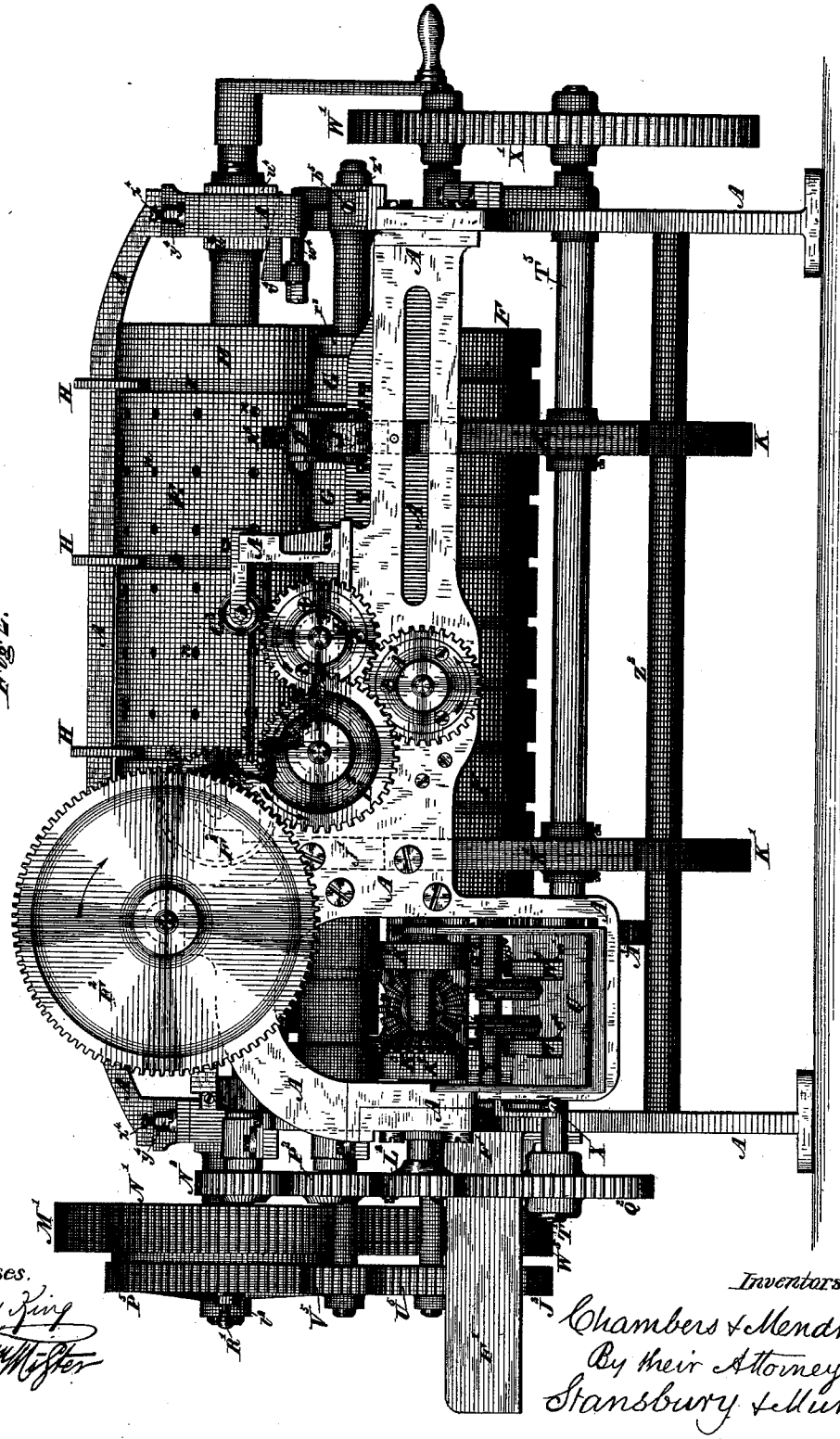


Fig 2.

Rear End Elevation.
Face View of Gearing System to 2nd & 3 Fold Rollers.
Scale ½ in.

Witnesses.
Harry King
J. Wm. McIlster

Inventors.
Chambers & Mendham,
By their Attorneys,
Stansbury & Munn

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12 Sheets—Sheet 3.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. **Patented Dec. 9, 1879.**

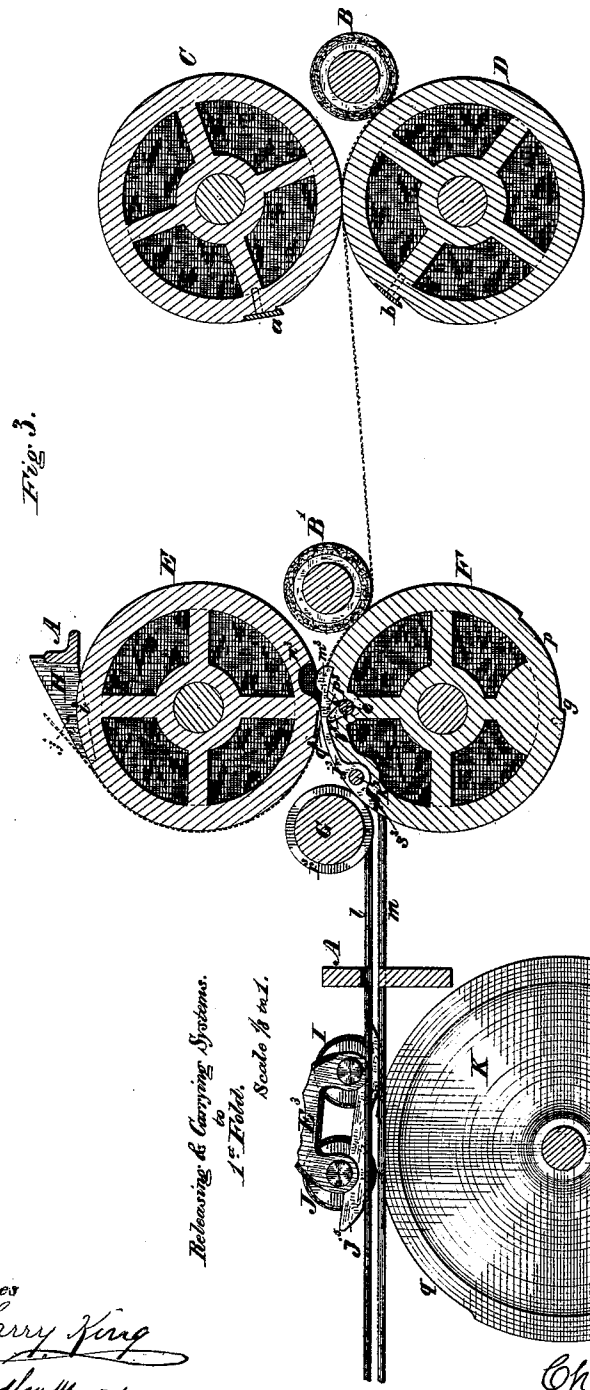


Fig. 3.

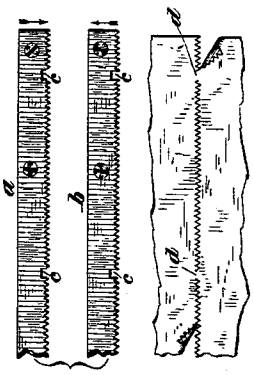


Fig. 4.

Fig. 5.

Witnesses

Harry King

J. Wm. Mighter

Inventors.

Chambers & Mendham

By their Attorneys,

Stansbury & Munn

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12 Sheets—Sheet 4.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. Patented Dec. 9, 1879.

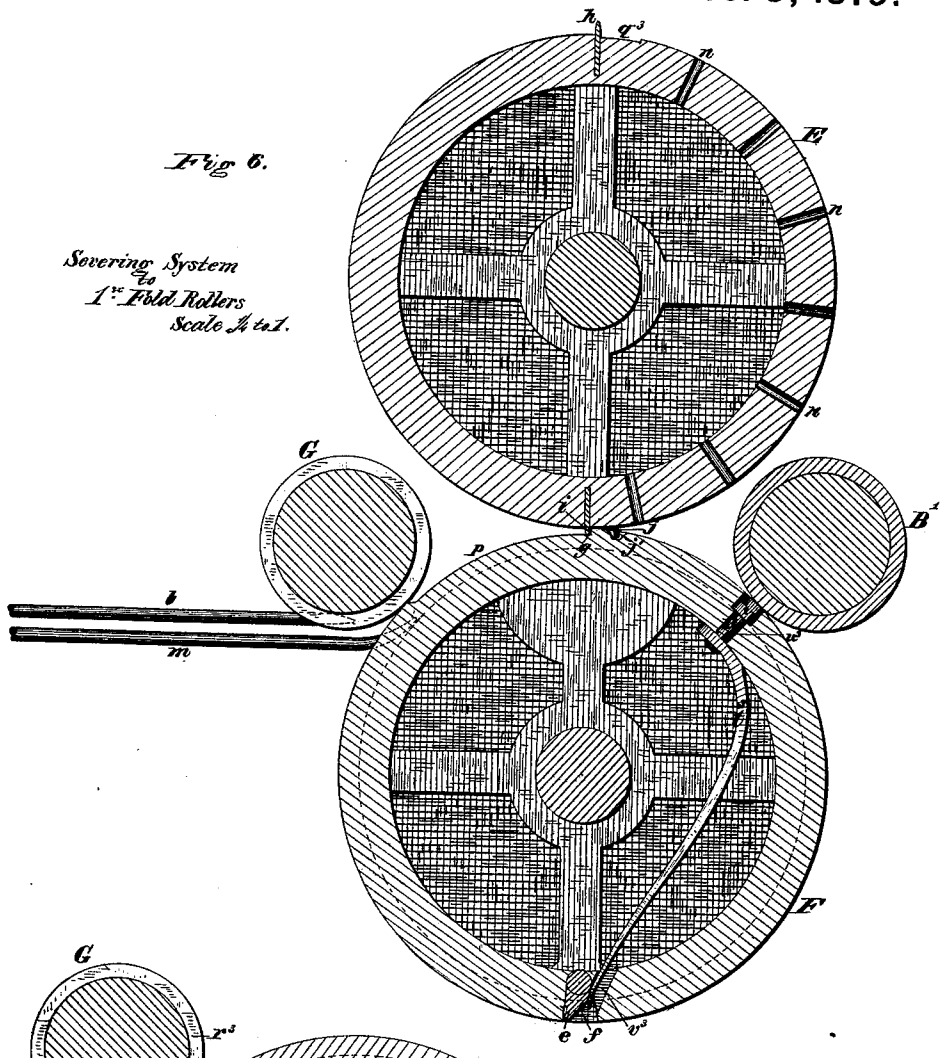


Fig 6.

Severing System to 1st Fold Rollers
Scale ½ to 1.

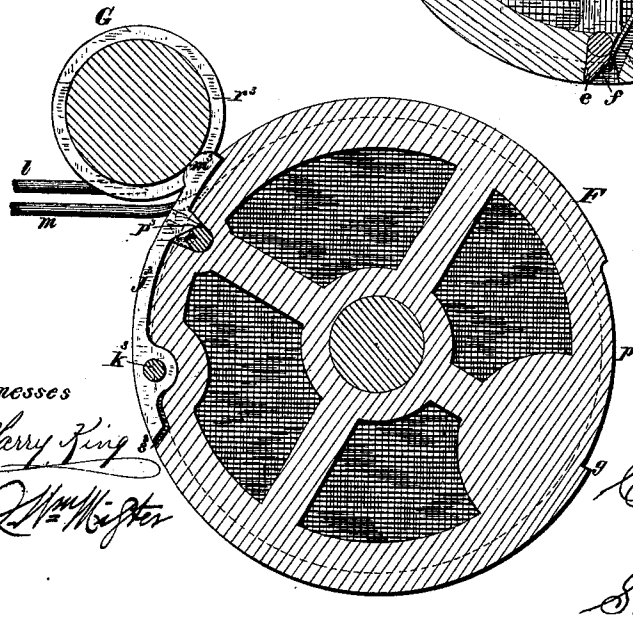


Fig 7.

Releasing System to 1st Fold Rollers Second Movem.t
Scale ½ to 1.

Witnesses
Harry King
L. Wm. Meister

Inventors
C. Chambers & W. Mendham
By their Attorneys,
Stansbury & Munn

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

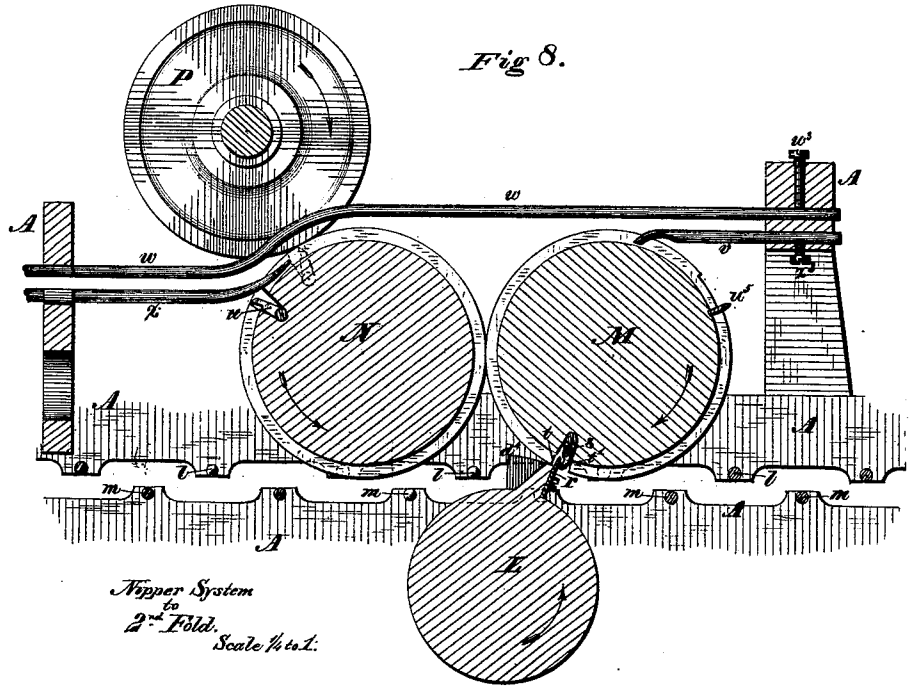
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C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

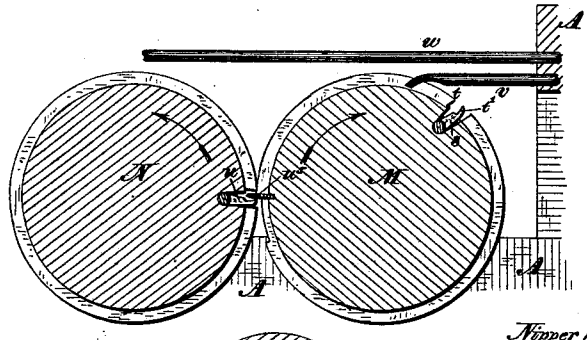
No. 222,455. **Patented Dec. 9, 1879.**

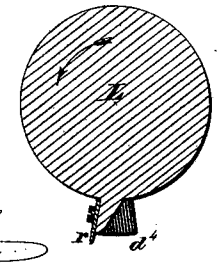
Fig 8.



Nipper System to 2nd Fold. Scale ½ to 1.

Fig 9.





Nipper System to 3d Fold Scale ½ to 1.

Witnesses

Harry King

J. McMaster

Inventors.

Chambers & Mendham,

By their Attorneys,

Stansbury & Munn

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12 Sheets—Sheet 6.

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Printing and Folding Machine.

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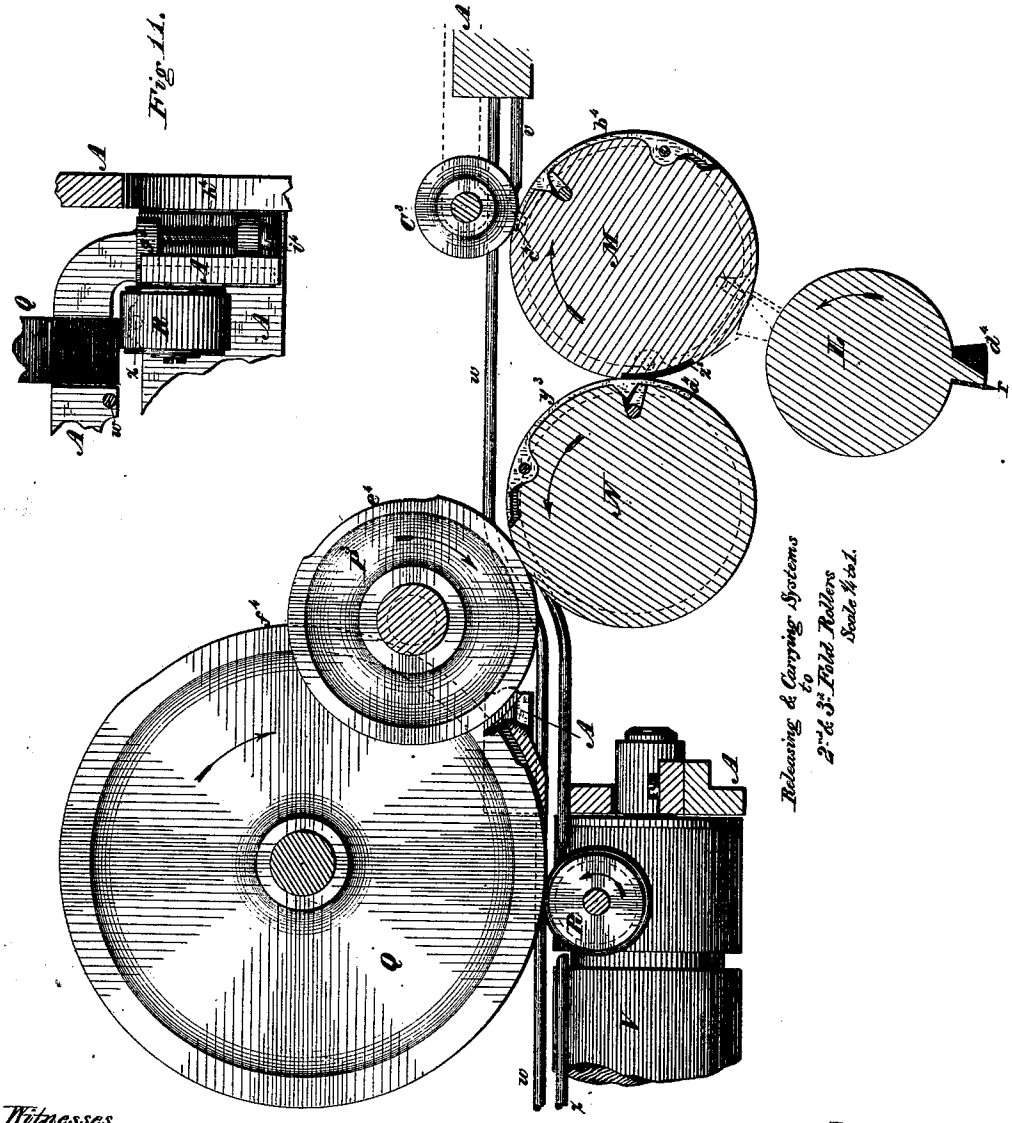


Fig. 10.

Witnesses

Harry King.

J. Wm. McIlster

Inventors

Chambers & Mendham

By their Attorneys,

Stansbury & Munn.

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12 Sheets—Sheet 7.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. **Patented Dec. 9, 1879.**

Fig 12.

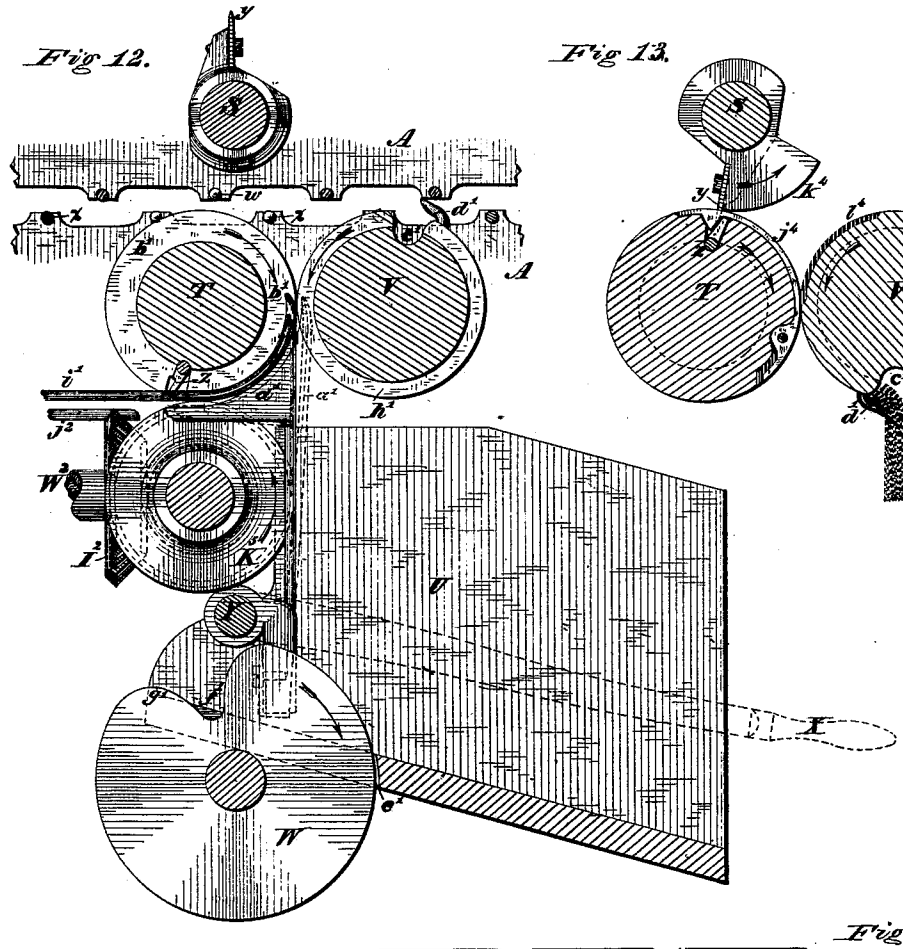
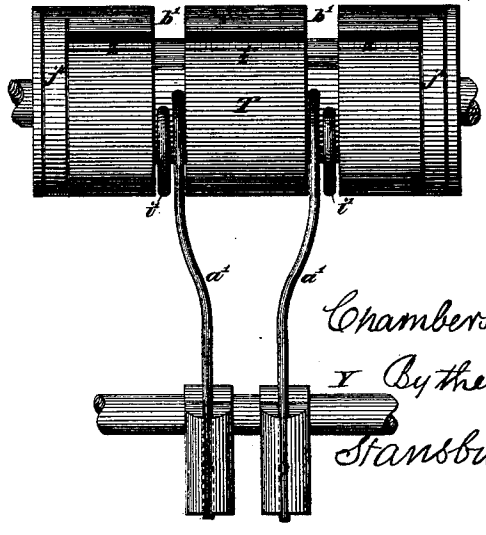


Fig 13.

Fig 14.



Nipper & Releasing Systems, Cut-Off & Packer to 4th Fold.

Scale ½ to 1.

Witnesses

Harry King

J. Wm. Mister

Inventors.

Chambers & Mendham,

By their Attorneys,

Stansbury & Munn

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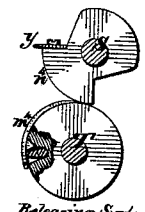
12 Sheets—Sheet 8.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

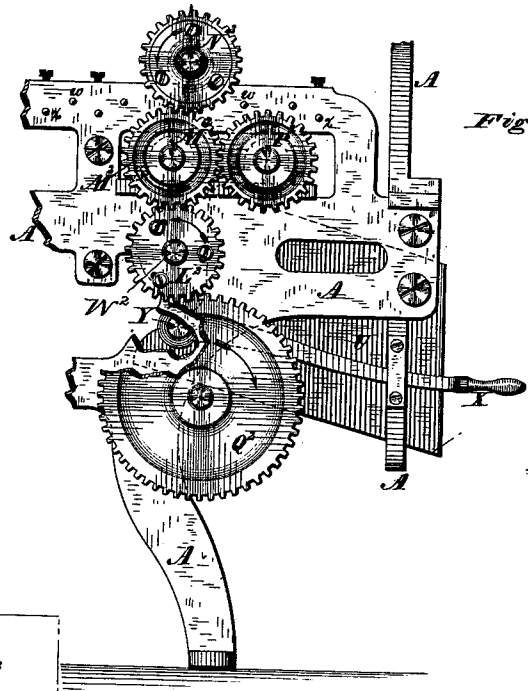
No. 222,455. Patented Dec. 9, 1879.

Fig. 16.



Releasing System.
to
4" Fold Rollers.
Scale ½ to 1.

Fig. 15.



Gearing System
to
4" Fold Rollers.
Scale ½ to 1.

Fig. 18.

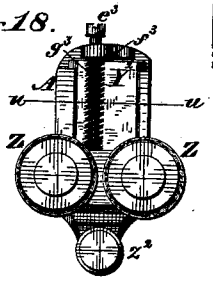
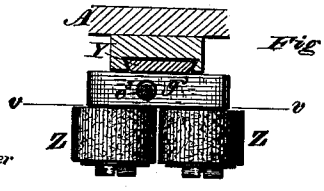
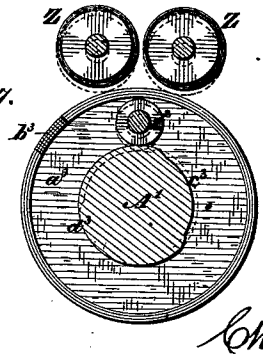


Fig. 19.



Details of Carrier
to
5" Fold.
Scale ½ to 1.

Fig. 17.



Witnesses.

Harry King

J. Wm. Wigter

Inventors.

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By their Attorneys,
Stansbury & Munn

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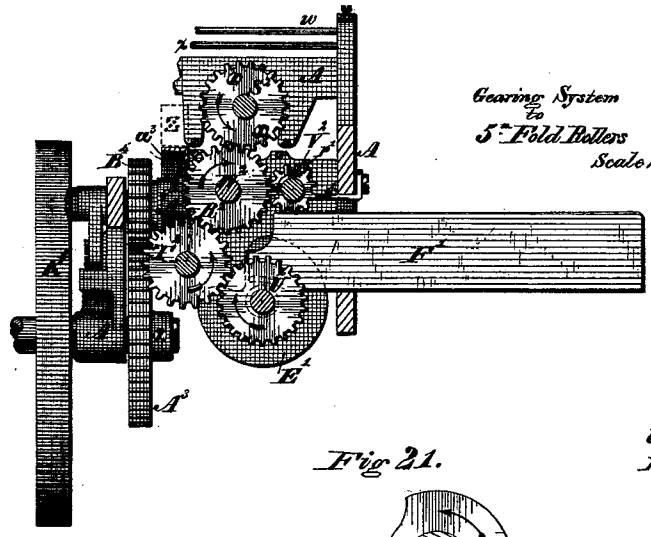
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C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

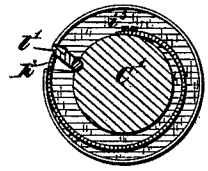
No. 222,455. **Patented Dec. 9, 1879.**

Fig 20.



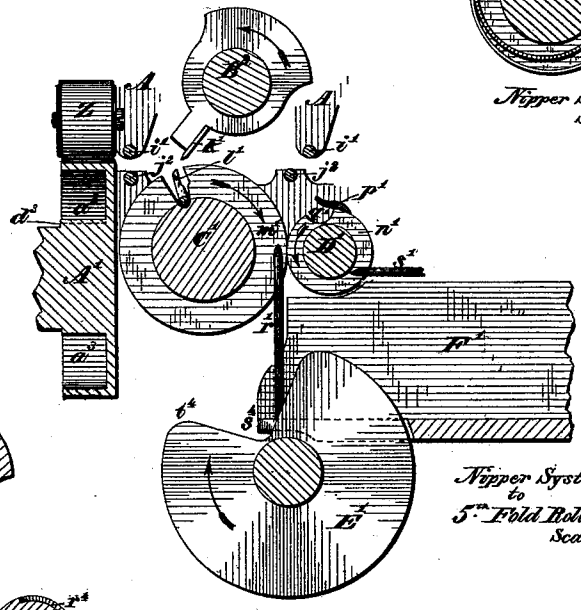
Gearing System to 5th Fold Rollers. Scale ½ to 1.

Fig 22.



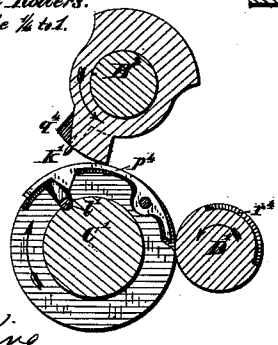
Nipper Spring. Scale ½ to 1.

Fig 21.



Nipper System to 5th Fold Rollers. Scale ½ to 1.

Fig 23.



Releasing System to 5th Fold Rollers. Scale ½ to 1.

Witnesses

Harry King

J. McMeister

Inventors.

Chambers & Mendham

By their Attorneys,

Stansbury & Munn

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12 Sheets—Sheet 10.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

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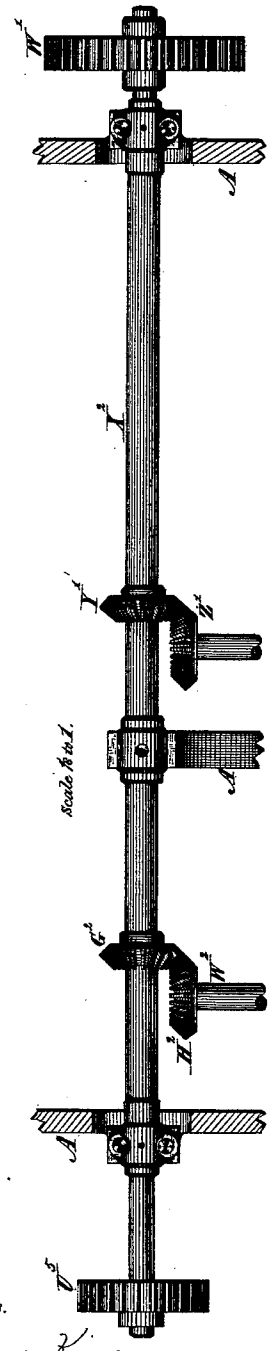


Fig 24.

Scale ½ in. l.

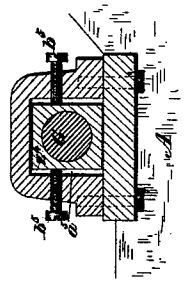


Fig 26.

Scale ½ in. l.

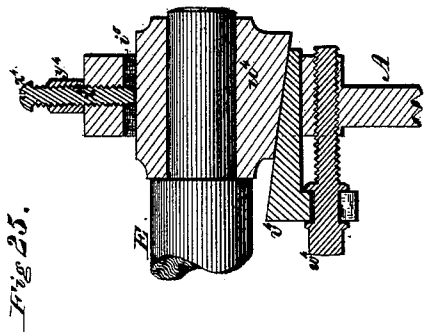


Fig 25.

Witnesses.

Harry King

J. Wm. Mighter

Inventors

Chambers & Mendham,

By their Attorneys,

Stansbury & Munn

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12 Sheets—Sheet 11.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. **Patented Dec. 9, 1879.**

Fig 27.

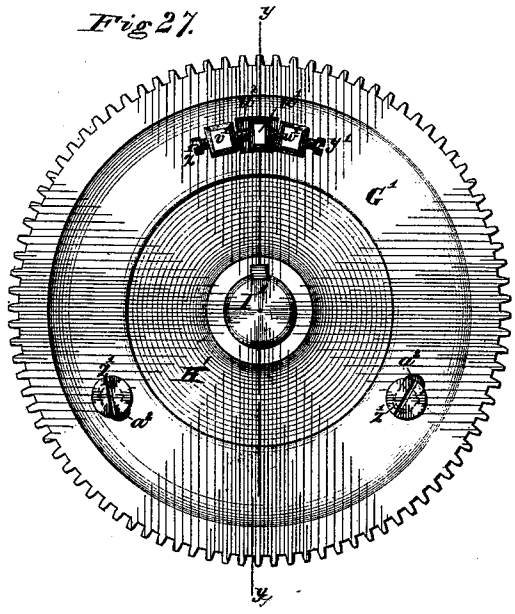
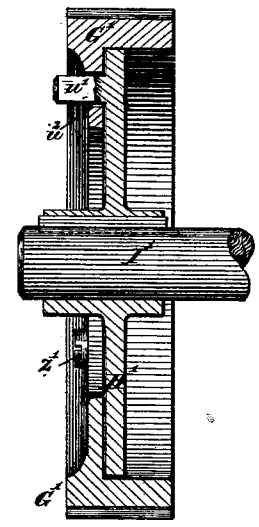


Fig 28.



Details of Adjustment for Gearing. Scale ½ to 1.

Fig 29.

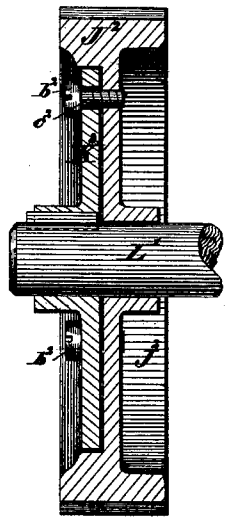
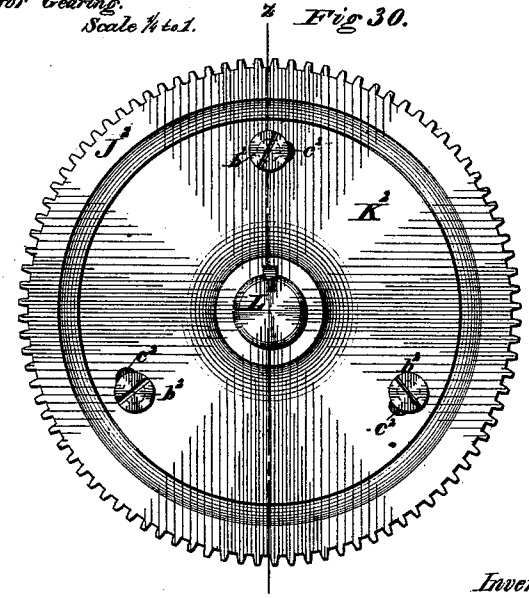


Fig 30.



Witnesses.

Harry King

Wm. McMaster

Inventors.

Chambers & Mendham,
By their Attorneys.
Stansbury & Munn.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

12 Sheets—Sheet 12.

C. CHAMBERS, Jr., & W. MENDHAM.

Printing and Folding Machine.

No. 222,455. **Patented Dec. 9, 1879.**

Fig 31.

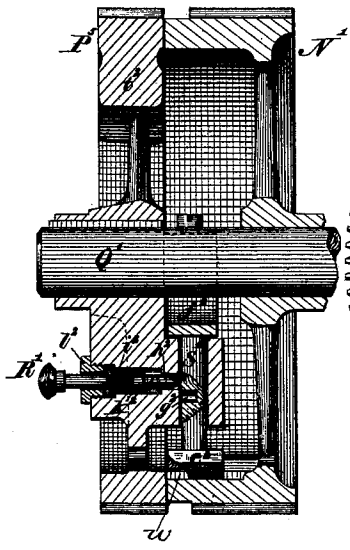


Fig 32.

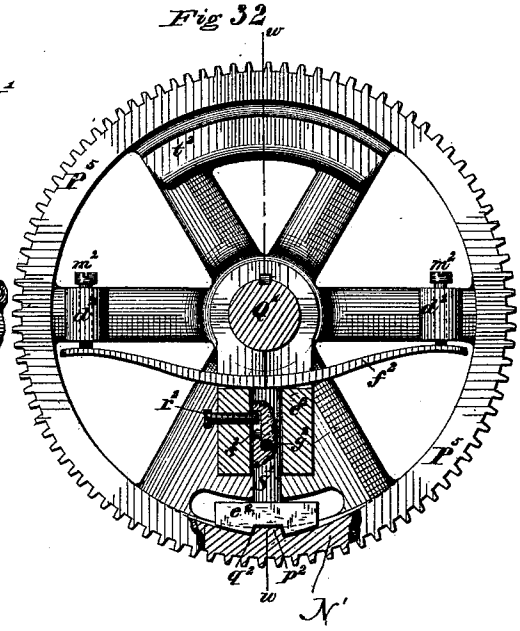


Fig 33.

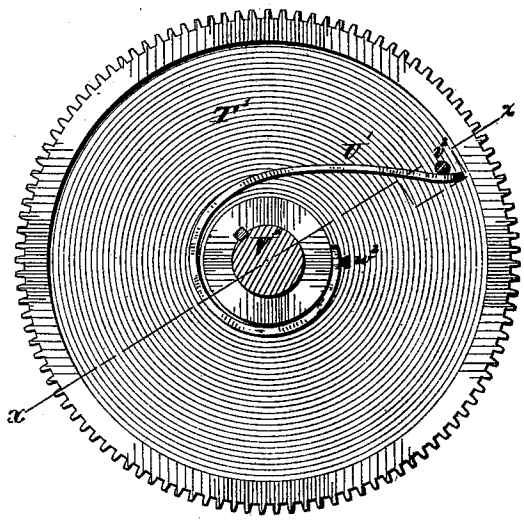
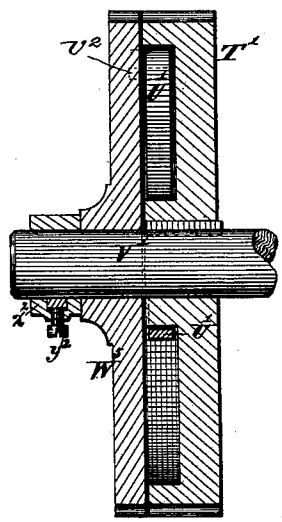


Fig 34.



Witnesses

Harry King

Wm. M. Lipton

Fig 35.

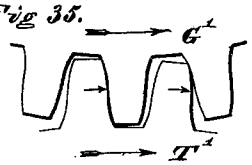
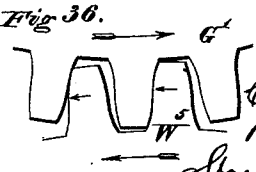


Fig 36.



Inventors.

Chambers & Mendham

By Their Attorneys

Stansbury & Mann

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CYRUS CHAMBERS, JR., AND WILLIAM MENDHAM, OF PHILADELPHIA, PA.; SAID MENDHAM ASSIGNOR TO SAID CHAMBERS.

IMPROVEMENT IN PRINTING AND FOLDING MACHINES.

Specification forming part of Letters Patent No. **222,455**, dated December 9, 1879; application filed February 4, 1878.

To all whom it may concern:

Be it known that we, CYRUS CHAMBERS, Jr., and WILLIAM MENDHAM, of Philadelphia, Pennsylvania, have invented Improvements in Folding-Machines and Printing-Machines Combined; and we do hereby declare the following to be a full and correct description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the machine. Fig. 2 is a rear end elevation. Fig. 3 is vertical longitudinal section of the mechanism for making the first fold. Fig. 4 is a detail view of the notched and serrated severing-blades. Fig. 5 is a similar view of the partially-severed sheet. Fig. 6 is a vertical section on an enlarged scale of the severing and griping mechanism of the first pair of folding-rollers. Fig. 7 is a similar view of the releasing mechanism of the same rollers. Fig. 8 is a vertical section of the nipping mechanism for the second fold. Fig. 9 is a similar section of the same mechanism applied to the third fold. Fig. 10 is a side elevation, partly in section, and face view of the carrying and releasing mechanism of the second and third set of folding-rollers. Fig. 11 is a detail view of the carrying mechanism of the third fold. Fig. 12 is the switching and packing device for the fourth folding mechanism. Fig. 13 is a vertical section of the nipping and releasing mechanism of the fourth fold. Fig. 14 is a face view of the switch or mechanism for delivering the sheet to either of the two packing-troughs. Fig. 15 is a side elevation of the gearing of the fourth folding mechanism and of the packing device connected therewith. Fig. 16 shows the nipping and releasing mechanism of the fourth folding device. Figs. 17, 18, and 19 are details of the carrying mechanism of the fifth folding device. Fig. 20 shows the gearing of the fifth folding mechanism. Fig. 21 shows the nipping, carrying, and packing devices of the fifth folding mechanism. Fig. 22 is a transverse section of a roller, showing the arrangement of the spring which operates the nipping device. Fig. 23 is a vertical section, showing the releasing device of the fifth folding mechanism. Fig. 24 is a perspective view of the transverse shaft by which motion is transmitted from the second to the subsequent folding mechanisms. Fig. 25 is a detail of the adjusting device for regulating the position of the upper roller of the first folding mechanism. Fig. 26 is a detail section of the horizontal adjustment of the small folding-roller of the first set. Figs. 27 and 28 are details of the device for adjusting the gearing of the first severing-rolls relatively to the printing-machine, so as to secure exact register. Figs. 29 and 30 show another device for making a similar adjustment, applied to the lower roller of the first folding mechanism. Figs. 31 and 32 are details of the device for allowing the printing mechanism to run when, from any cause, the folding mechanism is stopped. Figs. 33 and 34 are details of the device for compensating for or preventing lost motion or backlash. Figs. 35 and 36 are diagrams illustrating the action of the device shown in the two previous figures.

The drawings are made to scale, and the same letter of reference indicates the same part wherever it occurs in the figures.

Our invention relates to the combination, with a web-printing machine, of a folding mechanism to which the printed paper is automatically delivered in a continuous web and in accurate register, and is then severed, folded, and packed by all rotary mechanism and by all positive movements, the paper being at all times completely under the positive control of the machinery by which it is carried to and through the folding mechanism.

Our invention consists in the mechanism, hereinafter particularly described, for receiving, registering, presenting, holding, conducting, severing, creasing, nipping, releasing, carrying, guiding, regulating, folding, and packing paper printed in a web-machine and delivered to a folding-machine to receive in proper register, a predetermined number of folds, and be packed and delivered.

It further consists in details of construction, arrangement, and adjustment of the devices constituting the mechanism for the performance of any, or any combination, of the several functions hereinbefore referred to, all as hereinafter more fully set forth.

The construction and operation of our ma-

chine are fully illustrated in the accompanying twelve sheets of drawings, whereon A marks the frame of the machine, in which the operative parts are supported. The machine is to be attached to and work in harmony with a web-printing machine of any preferred construction. It receives the printed web of paper from the machine in proper register under the binder-roll B, which holds it to the severing-cylinder D and insures its passage between the severing-cylinders C D. These cylinders are adjusted to run in exact register with the printing-machine by a device hereinafter described. They are provided with serrated cutters *a b*, which are shown in detail in Fig. 4. Their serrated cutting-edges are not continuous, but are provided at intervals with blank or open spaces or notches *c c*, where the cutters do not sever the sheet of paper from the web, but leave it attached by a narrow tag, *d*. These cylinders have their circumferences equal in length to the length of the sheet to be cut off, or a multiple of that length, and they cut the sheet at the proper lines across its entire width except at the tags left by the spaces *c c*.

Of the cutters *a b*, the lower one, *b*, is flush with the surface of cylinder D, the upper one, *a*, projecting sufficiently at its ends to insure severance of the paper, and a little more at the center to produce a slightly shear cut and prevent the whole strain of the cut from being exerted at once. The condition of the paper on the cut line, after passing between the cutters, is shown in Fig. 5, where *d d* mark the uncut portions or tags, by which the sheet is slightly held to the web, after being severed in the rest of its width, until it reaches the folding-cylinders.

The cutting-blades *a b* may, if preferred, be placed directly on the folding-cylinders E F, thus dispensing with the independent cutting-cylinders C D and the binding-rolls B B′. In such case the grooves *k* in cylinders E F are made verry narrow, the tags or uncut portions of the paper being of corresponding width, and the separation of the sheet from the web is effected by a device hereinafter described.

The cylinders E F are shown on an enlarged scale in Figs. 6 and 7, Sheet 4. They are equal in circumference to the length of the sheet to be folded, or to some multiple of that length. The upper one, E, is provided with a row of pins, *j*, upon which the leading end of the paper is impaled in order to be led between the rollers. It also has a creasing-blade, *h*, and a breaking-bar, *i*. The lower roller has a line of gripers, *e*, and a creasing-groove, *f*, in the line of the fold, and a breaking-groove, *g*, on the opposite side.

The creasing-blade *h* of cylinder E works into the nippers *e* in the groove *f*, and the breaking-bar *i* into groove *g*. The blade *h* forces the paper on the line of the first fold into the bite of the nippers *e* in the creasing-groove *f*. The blade *h* is cut away opposite the nippers *e*, so that when the paper is forced into the groove *f* and into the bite of the nippers *e* the nippers may close upon the paper and hold it securely before the blade *h* is withdrawn.

The pins *j* in the cylinder E are near the breaking-bar *i*. When the end of the sheet is impaled upon them it is carried up, supported by the surface of cylinder E, until it reaches the stationary inclined strippers H, (see Figs. 1, 2, 3,) whose forward ends enter grooves *k* in roller E. These strippers lift the forward half of the sheet from the roller E at the instant that the nippers *e* have seized it in the line for the first fold, and the further rotation of the roller F draws the forward part of the sheet down and off of the cylinder E, and carries the creased edge or line of fold in between cylinder F and small roller G to complete the fold, the nipper *e* being opened to release the sheet by means of the lever j^3 working on fulcrum k^3, and operating the wedge-shaped dog p^3, which opens the nippers. The lever j^3 is operated by means of the boss or cam m^3 on the end of its longer arm coming at the proper instant into contact with the surface of roller G, as clearly shown in Fig. 7. The curved bars *l m*, entering grooves in roller G and cylinder F, respectively, withdraw the folded edge of the paper from the groove *f* and nippers *e*, and guide it out into position for receiving another fold.

In our first trials of the machine the cylinder E was solid on its surface, and we found that as the sheet was drawn off from the surface of cylinder E, to be carried in the opposite direction, there was a tendency to create a vacuum between the sheet and the roller, which often caused the sheet to be drawn out of the nippers or torn. To remedy this the cylinder E is now perforated with numerous holes *n*, which allow free access of air to the under side of the sheet and completely relieve the tendency referred to. The sheet, positively held between cylinder F and roller G, is by them propelled forward between the rods *l m* until its folded edge reaches the bite of the carrying-rollers I J K I′ J′ K′, Figs. 1, 2, 3, the distance between their bite and that of the cylinder F and roller G being just half the length of the sheet to be folded. The sheet is released from the bite of F and G at the proper instant by means of the clearance-space *p*, cut in the face of the roller F just in front of the breaking-groove *g*.

Of the carrying-rollers just referred to the smaller ones, I J I′ J′, (see Fig. 3,) are idlers, operated by contact with the larger ones, K K′. They are hung (see Fig. 1) in frames or brackets E^3, adjustably supported upon arms D^3, to which they are pivoted at d^5. Each frame or bracket has an arm, e^5, the free end of which is adjusted by set-screws f^5 f^5, passing through lugs on arm D^3. This adjustment regulates the relative position and pressure of the rollers I J upon the full arc of the roller K. The arm D^3, pivoted at c^5 to the cross-framing, is pressed down by the spring h^5,

which is counteracted by the set-screw g^5, which supports the rollers I J in such a position that they do not enter the clearance-space q in the face of roller K. These adjustments provide for the nice regulation of the contact and pressure between the small rollers and the carrier-rolls, with which they co-operate in carrying forward the sheet to the position to receive its second fold.

The lower and larger rollers, K K′, of the first set of carrying-rollers (see Figs. 2 and 3) have a greater circumference than the folding-cylinders E F, and, as they make one turn for each sheet folded, their surfaces move faster than the speed at which the sheet is traveling when its folded edge enters the bite between these rollers and the binder-rolls which co-operate with them in its propulsion. The speed of the partially-severed and once-folded sheet is therefore suddenly increased over that of the web of paper the instant it enters the bite of the carrying-rolls. At the same instant the breaking bar and groove seize the front end of the succeeding sheet and impale it upon the pins j. The once-folded sheet in the bite of the carrying-rolls is thus torn from the sheet which follows it at the moment when the forward end of the latter is impaled upon the line of pins j. The increased speed of the carrying-rolls not only causes the bar i to sever the sheet from the succeeding one, but creates an interval between them which gives sufficient time for making the second fold in one sheet before the next sheet is presented to receive it.

The rollers K K′ have each a portion of the periphery cut away to form a clearance-space, q, so that before the tail end of the full periphery reaches the second small binder-roll, J, the sheet has been carried to its proper position to receive the second fold, and is released at the precise instant at which it is grasped by the blade r of shaft L and the griper of roller M in the second folding mechanism. To effect this the carrying-rolls K K′ are provided with means of accurate adjustment upon their shafts, so that they may be set with precision to the exact time for releasing the sheet to the positive control of the second folding device. As the sheet enters the bite of these carrying-rollers I J K, &c., on their full diameter, and as their circumference, less the clearance-space q, is greater than half the length of the once-folded sheet, the adjustment last above referred to does not affect the entrance of the sheet, but only its delivery to the subsequent operation.

The binder-rolls, as before stated, are adjusted so as to bear with the proper degree of pressure upon the full arcs of the carrying-rolls, and yet are not permitted to drop into the clearance-space q, below the surface-line of the full arc. Hence the sheet is released the instant the last binder-roll passes off of the full arc of the lower carrier-rolls.

The once-folded sheet, in its progress to the mechanism which imparts the second fold, slides on the rods m, under the rods l, and is further supported by the roller L, whose upper surface is on a level with the upper surface of rods m, as seen in Fig. 8. The creaser-roll L does not turn in contact with rollers M or N. If it did, it is obvious that there would be no space for the introduction of the sheet endwise to the second folding-rollers to receive one or more folds at right angles to the preceding one.

The creasing-blade r is attached to roller L in the manner shown in Figs. 8, 9, and 10, and during the greater part of the rotation of the roller L is entirely removed from the path of the sheet in its passage to the second folding mechanism. The blade is cut away at a number of points in its length to allow the projections on the nipper-bar s in roller M to gripe the edge of the sheet without grasping the blade.

The rollers L, M, and N are at right angles to cylinders E F and roller G, and give to the sheet two folds parallel to each other and at right angles to the first fold.

The second fold is made by blade r introducing the sheet to the nipping-groove of roller M, and the rotation of that roller in the direction indicated by the arrow, carrying the creased line of fold between rollers M and N and up to the stripper-rods v, which take the folded edge out of the gripe of bar s and carry it in between rods v and w. Just as this occurs the creasing-blade u^5, attached to roller M, (see Fig. 9,) introduces the sheet at the line proper for receiving the third fold into the griping device u of roller N, and the edge of the now thrice-folded sheet is carried by that nipper to the releasing-bars x, where it is taken from the nipper and passed on between rods x w and between rollers N and P^3 to the bite of carrying-rollers Q R. The roller Q, by reason of its circumference being longer than that of rollers N M, accelerates the speed of the sheet as it passes to the mechanism for giving the fourth fold. Rollers P^3 and Q are, respectively, provided with clearance-spaces e^4 f^4, for the purpose of releasing the sheet at the proper instant in the manner already described. The second nipper-bar, s, forms, when open, one side of the groove for making the crease, the projections t t' of said bar being equal to the thickness of the blade r, or a little more.

From the third folding mechanism the thrice-folded sheet, impelled by rollers Q R, passes between bars w and x, over rollers V T, and under creaser-blade y, attached to shaft S, Figs. 12 and 13. The rollers T V are at right angles to the rollers M N, and are located directly over the packing-box U.

The fourth fold is made in the same way as the second, by the operation of the blade y tucking the sheet into the nipping-groove z of roller T and carrying it down between rollers T V, when, if no more folds are required, it drops into the packing-box U, being guided into it by the switch-rods a' being thrown back

into the grooves b' in roller T by means of lever X, attached to shaft Y, to which rods a' are fixed. (See Figs. 12 and 14.)

The roller V has a longitudinal groove, c', in it, Figs. 12 and 13, into which the top of the four-times-folded sheet is carried by the hooks d', attached to said roller. The distance from the bottom of trough U to the under side of roller V is less than the length of the folded sheet, and the top of the sheet is received in groove c' and carried past the roller V by the hooks d', thus insuring the top of the sheet being moved forward out of the way of the descent of the following sheet.

In the bottom of trough U are two disks, W W^3, Figs. 2 and 12, running in slots e' in harmony with the top roller, V, and having recesses f', into which the folded edge of the sheet enters when it falls from the folders, and is pushed forward into the trough by the shoulders g' of the recesses. Thus the sheet is packed simultaneously at top and bottom by the joint action of the roller V at top and the disks W W^3 at bottom, both having continuous rotary movement, and forming together a rotary packing device.

When it is desired to give the sheet of paper five folds the bars a' of the stripping device or switch, Figs. 12 and 14, are thrown into the grooves h' of roller V by depressing lever X, and the four-times-folded sheet, instead of falling into trough U, is guided out horizontally between the rods i' j^2 to the fifth folding mechanism. The folding-rollers of this device are at right angles to those of the fourth, and operate to give the fifth fold in the same manner as those heretofore described. The sheet is carried over the roller C′ between rods i' j^2 by the carrier-rollers Z A′, Fig. 21. The creaser-blade k' introduces the sheet to the nipper-groove in roller C′, where it is seized by the nipper l' and carried down between folding-rollers C′ and D′, and received by the packing device in trough F′. This device consists of a roller, D′, having a groove and hooks similar to those in roller V, and the revolving disks E′, similar to disks W W^3, turning in slits in the bottom of trough F′. It operates by continuous rotary movement to pack the sheets in trough F′ in the same manner as the packing device for the four-times-folded sheet hereinbefore described.

The folding-machine is driven by being geared to the printing-machine with which it is intended to operate. The winch, Figs. 1 and 2, indicates the point of application of the driving-power.

The gearing connecting the printing-machine with the folding-machine requires to be adjusted with the greatest accuracy, so that the printed web of paper may reach the folding mechanism in perfect register. In order to facilitate this, we have devised two methods of making the adjustment, which are illustrated in Figs. 27 and 28 and Figs. 29 and 30.

Fig. 27 is a face view of a compound gear, consisting of an annular rim, G′, concentrically attached to and adjustable upon a central disk, H′, fixed to the shaft I′ of cylinder C by a feather or other suitable means. The rim G′ is provided with three slots, two marked a^2 and a third marked u^2, through which the clamping and adjusting devices work. Binding-screws z' z' are inserted through the slots a^2 a^2. A stud, u', attached to the face of disk H′, projects through slot u^2, and is held in any desired position by means of adjusting-screws x' y', passing through lugs v' w', attached to the face of rim G′. By loosening screws z' and operating screws y' x' the desired adjustment of the toothed rim G′ relatively to shaft I′ can be made upon the central disk, H′, and the adjustment, when made, can be maintained by tightening the screws z' z' to clamp the disk and rim together.

Figs. 29 and 30 illustrate a device, substantially the same as the foregoing, with the studs u' and the lugs v' w' omitted, they being replaced by simple slots c^2 and binding-screws b^2, and the adjusting movement between the movable toothed wheel J^2 and the central disk, K^2, fixed to shaft L′, being moved by hand, and held by binding-screws b^2, passing through slots c^2 into the body of wheel J^2, as clearly shown in the figures.

It sometimes happens that the folding-machine is stopped or jammed by accident. It is important that provision should be made for automatically preventing the stoppage of the folding mechanism from arresting the movement of the printing mechanism. This we accomplish by what we call a "tripping device," which is shown in central section in Fig. 31 and in front elevation in Fig. 32, and which we will now describe.

P^5 (see also Fig. 2) is an outer gear, fixed by a feather to shaft Q′ of cylinder E, and forming part of the train of gearing by which the folding mechanism is driven. It receives motion from the train of gearing from the printing-machine by reason of its connection with inner gear, N′, on shaft Q′, which is not fixed to that shaft, but is attached to gear P^5 by the tripping device, which holds the two together as long as both printing-machine and folder are running, but disconnects them as soon as the folding mechanism stops. When such a stoppage occurs the gear N′, driven by M′, continues to rotate like a loose pulley on shaft Q′ without turning said shaft or the gear P^5. This disengagement of N′ from P^5 is due to the action of spring-latch S′, whose head e^2 is provided with a recess, q^2, which engages with an inclined shoulder, p^2, on the inside of the rim of the wheel N′ and holds that wheel to P^5 until the latter stops, when the head e^2 rides up on shoulder p^2, forces the latch S′ back till it is caught and held by spring-dog R′, the inner end, h^2, of which enters recess g^2 in latch S′, and holds the latch-head e^2 out of contact with shoulder p^2 until dog R′ is retracted by hand. The latch S′ is impelled outward by the reaction of bow-spring f^2, whose tension is regulated by screws m^2 m^2,

passing through lugs d^2 on gear P^5. The latch is held in its socket e^6 by screw r^2 entering groove s^2 in the side of the latch.

To insure smoothness of running and compensate for lost motion or backlash, we employ the device shown in Figs. 33 and 34.

The gears T′ and W^5, running side by side on shaft V′ of cylinder D, both mesh into the gear G′ on the end of the shaft of cylinder C. The gear T′ is keyed to the shaft V′; but the gear W^5 is free to turn on that shaft, and is held in contact with gear T′ by collar x^2, held on the end of the shaft by set-screw y^2. A stud, v^2, projecting from the inner face of gear W^5, receives the reaction of the free end of a coiled spring, U′, whose fixed end is attached by screw w^2 to the nave of gear T′. The effect of this construction is to keep the teeth of the gears T′ W^5 at all times in positive contact with the teeth of the gear G′, which drives them, the teeth of gear T′ bearing against one side of the teeth of G′, and those of gear W′ bearing against the other side, as illustrated in Figs. 35 and 36.

The movements of the machine are derived from the power which drives the printing-machine by suitable connections, the point of application of the power to the folder being at the end of the shaft of cylinder C. (Indicated by the winch in Figs. 1 and 2.) On the other end of said shaft is a gear, G′, which meshes into and drives gear W′ on the end of the shaft of cylinder D, which, in turn, drives the binder-roll B. Gear G′ also engages with reversing-gear M′, which drives the train of gearing of the first set of folding-rolls and the binder-roll B′. The last gear in this train is U^5, on the end of shaft X^2, which carries the gears which impart motion to the second and subsequent folding mechanisms. Gear G^2 meshes into gear H^2 on the end of shaft W^2, and thus drives the mechanism for the fifth fold. Gear Y′ on the same shaft meshes into gear Z′ on the shaft of the creaser-roll L of the second and third folding mechanisms. Gear W′ on the end of shaft X^2 meshes into gear X′ on the end of shaft T^5, to which the carrying-rolls K K′ are adjustably attached.

On the rear end of roller L is gear A^2, which meshes into gear B^3 on the end of folding-roll M. B^3 meshes into gear C^2 on shaft of roller N, and gear C^2 into gear D^2 on the shaft of carrying and releasing rolls P P′ P^3 P^4, Fig. 1. On the end of shaft of roller N is gear E^2, which drives gear F^2 on end of the shaft of carrying-rolls Q Q^3.

Rolls C^3 are narrow pulleys operating on the edge of roller M to open the nippers in the ordinary way. Rolls P P′ are carriers, and P^3 P^4 are releasing-rolls operating on the ends of roller N to open the nippers. Gear A^3 on the inner end of shaft T^5 drives the carrying mechanism for the fifth folding device. (Shown in detail in Figs. 17, 18, and 19.) It engages with a gear connected with the shaft of cam A′, which operates the releasing-rollers Z Z by means of the friction-roller Z^2, attached to the same frame, which rolls in contact with the face of cam A′, and raises and lowers the rollers Z Z at the proper times. The cam is counteracted by a spring, g^3, around rod e^3, which presses down the roller-frame. (See Fig. 18.) Gear G^2 on shaft X^2, Fig. 24, engages gear H^2 on end of shaft W^2, on the other end of which is gear I^2, which operates gear K^3 on the shaft of gear L^2, Fig. 2. Gear L^2 drives gear Q^2 on the end of shaft of the packing-disks W W^3 in packing-trough U. It also drives gear M^2 (see Fig. 15) on end of shaft of folding-roller T of the fourth folding mechanism. Gear M^2 drives gear N^2 on creasing-blade shaft S, also gear P^2 on end of shaft of packing-roller V.

On shaft W^2 is gear R^2, Fig. 20, which drives gear S^2 on shaft of creaser R^2, Fig. 21. It also drives gear V^2 on shaft of gear D′ and gear T^2, intermediate to gear U^2 on end of recessed packing-disk E′, Fig. 20.

The device for the vertical adjustment of folding-cylinder E is shown in Fig. 25. The journal of cylinder E turns in a box, u^4, held in a slot, i^5, in the frame A, large enough to admit of the extreme adjustment which may be required.

The box u^4 is inclined on its lower side, as shown, and below it is placed a wedge, v^4, operated by the screw w^4, which carries it in or out, as required, to raise or lower box u^4. A set-screw, x^4, entering above the box, serves to clamp it at the required position.

The device for effecting the lateral adjustment of folder G is shown in vertical section in Fig. 26. The journal of folder G turns in box z^4, placed in a slot, a^5, in the frame. The screws b^5 b^5 govern and fix its position.

We do not in this application claim any features of this machine which have been shown in prior applications by ourselves or others, of which have been in interference with the claims of other parties.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination, with the perforated cylinder E, provided with the creaser *h* and brake-bar *i*, of the griping-cylinder F, binder-roll B′, and folding-roll G, all arranged and operating substantially as set forth.

2. The combination, with the grooved and perforated cylinder E, provided with the pins *j*, of the inclined lifting-fingers H, constructed and located as described, for the purpose stated.

3. In combination with the cylinder E, having the breaking-bar *i*, and the roller F, provided with the breaking-groove *g*, the carrying mechanism, consisting of the roller G, rods *l m*, rollers K K′, and their binder-rollers, for the purpose of detaching the partially-severed sheet from the web and accelerating its motion, as described.

4. The binder-rolls I J, supported in the frame E^3, pivoted to the arm D^3, hinged to the framing of the machine, and adjusted by the screw g^5 and spring h^5, in combination with

carrying-rollers, as and for the purpose specified.

5. The roller-frame E^3, carrying the rolls I J, and having an arm, c^5, controlled by adjusting-screws f^5, for the purpose of regulating the relation of the rolls I J to the large carrying-roller K, in the manner set forth.

6. The carrying-rolls K K′, made of larger diameter than the folding-rollers, from which they draw the sheet, and provided with clearance-spaces q, and a mechanism, as described, for binding the sheet to their peripheries, all as and for the purpose described.

7. In combination with the described positive rotary mechanism for folding paper, the described positive rotary mechanism for receiving the folded sheets and delivering them to the packing-trough, all as specified.

8. The combination, with the packing-trough U, of the roller V, provided with the groove c' and hooks d', and the rotating disks W W^3, provided with the recesses f', all constructed, arranged, and operating as and for the purpose stated.

9. The combination, with a carrying roller or cylinder having a portion of its surface cut away so as to be below the level of the rest, of adjustable binding-rollers, for the purpose of binding and releasing a traveling sheet of paper at predetermined lines, all substantially in the manner described.

10. A paper-carrying mechanism consisting of a carrying roll or cylinder provided with binder-rolls applied and released by reason of connection with a cam attached to and placed within the carrying-cylinder, all as described, and as illustrated in Figs. 17, 18, and 19 of the drawings.

11. The combination of roller a^3, cam A′, rollers z^2 Z Z, their common frame and spring g^3, all constructed and operating as specified and shown.

12. In a paper-folding machine, a carrying-cylinder provided with perforations to admit air under the paper and prevent the undue adhesion of the sheet to the cylinder, all as set forth.

The above specification of our said invention signed and witnessed at Philadelphia this 17th day of July, A. D. 1877.

CYRUS CHAMBERS, JR.
WILLIAM MENDHAM.

Witnesses:
H. A. HAWORTH,
CHAS. F. STANSBURY.