2 Sheets--Sheet 1.

T. J. MAYALL.
Printing Presses.

No. 150,874.

Patented May 12, 1874.

Fig. 1.

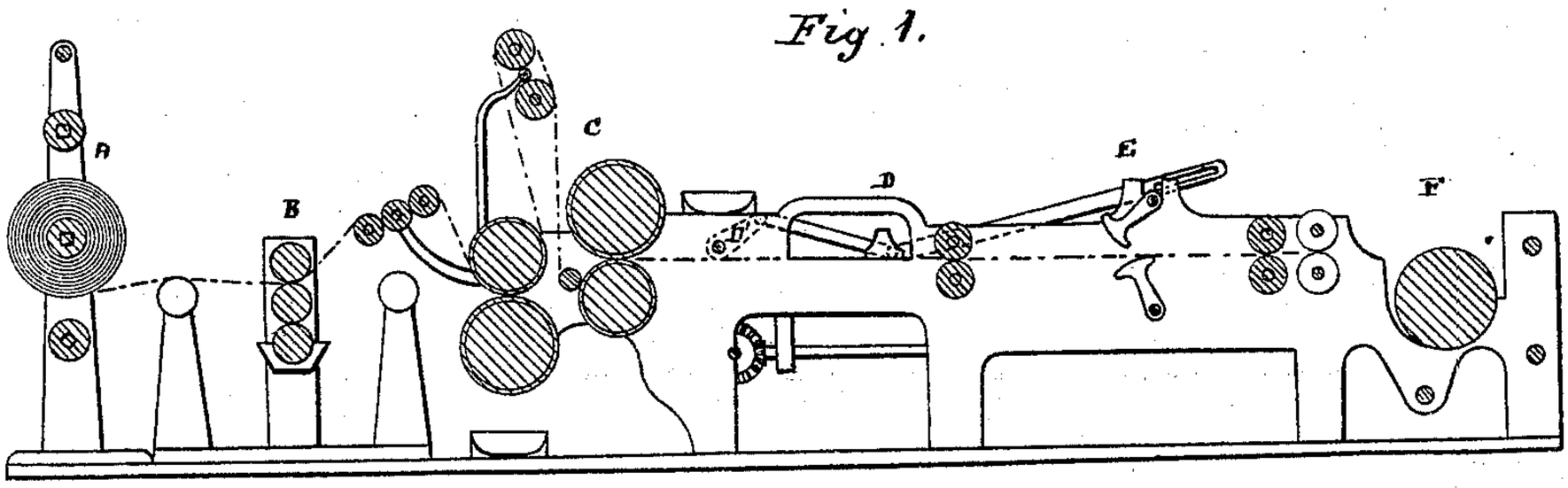
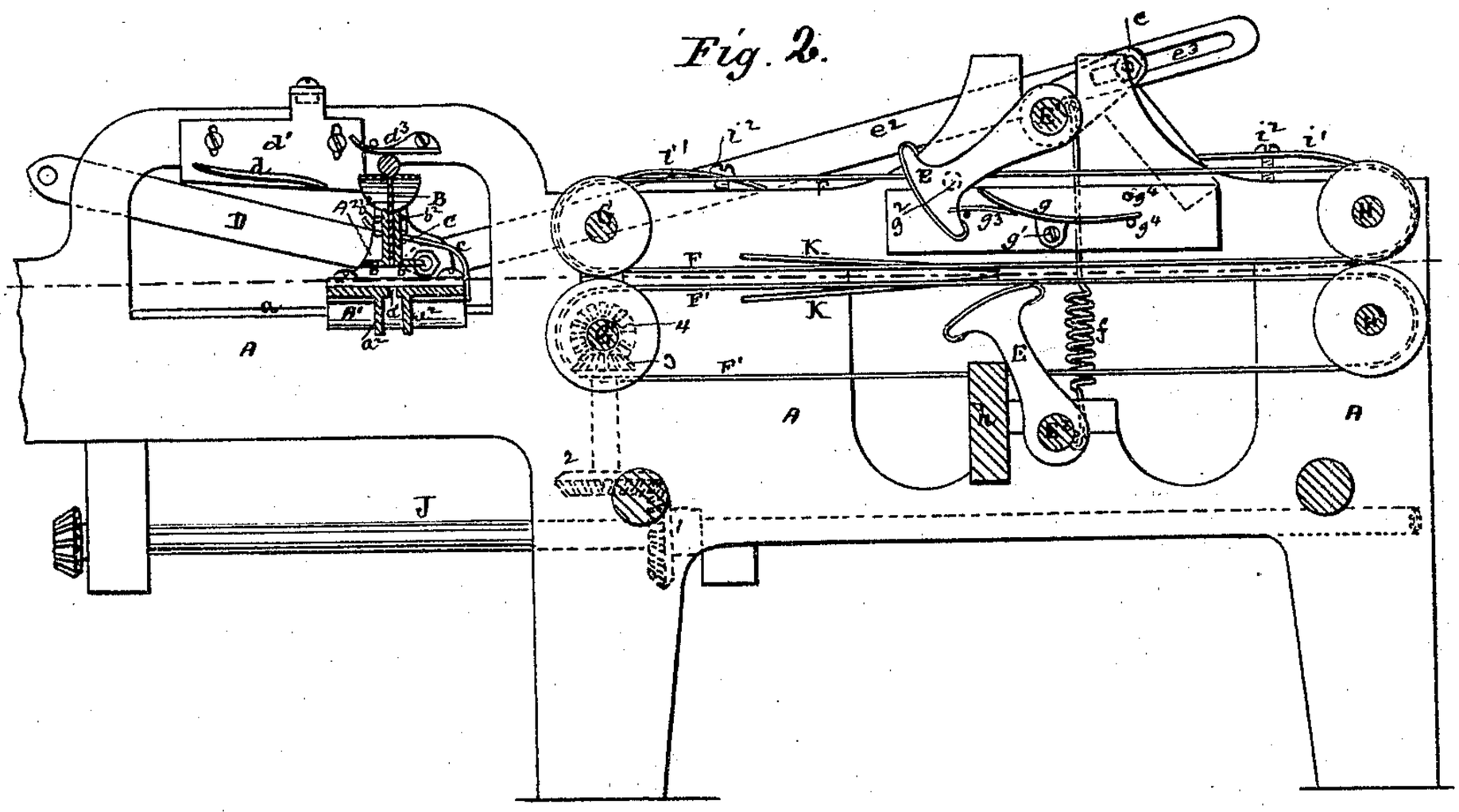


Fig. 2.



Witnesses

Arthur Bickley

Chas. C. Wilson

Inventor.

Thos. J. Mayall by

atty, A. Pollok.

2 Sheets--Sheet 2.

T. J. MAYALL.

Printing Presses.

No. 150,874. Patented May 12, 1874.

Fig. 3.

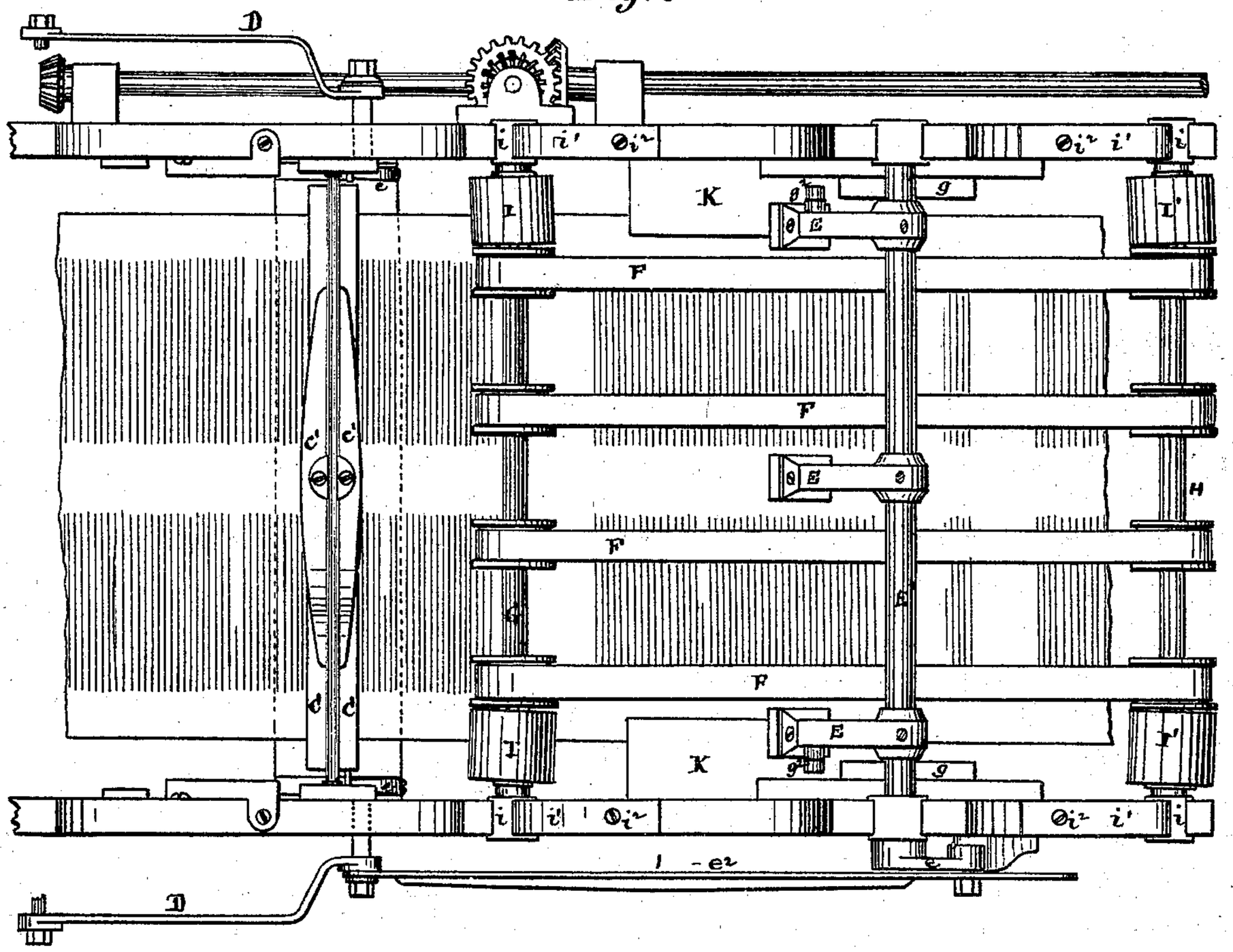


Fig. 4.

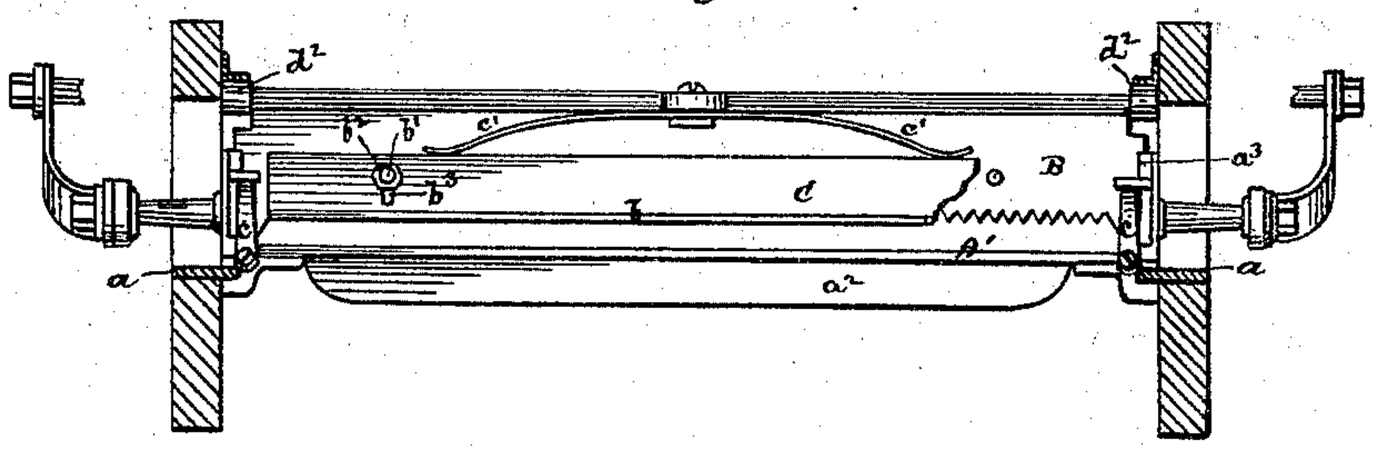


Fig. 5.

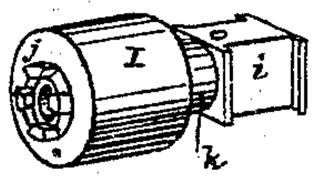
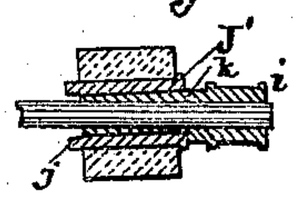


Fig. 6.



Witnesses

John Buckley

Chas. Wilson

Inventor.

Thos. J. Mayall

by Atty Pollock

UNITED STATES PATENT OFFICE.

THOMAS J. MAYALL, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN PRINTING-PRESSES.

Specification forming part of Letters Patent No. **150,874**, dated May 12, 1874; application filed July 21, 1873.

CASE C.

To all whom it may concern:

Be it known that I, THOMAS J. MAYALL, of Boston, Suffolk county, Massachusetts, have invented certain new and useful Improvements in Printing-Presses, of which the following is a specification:

These improvements relate to that class of printing-presses in which the paper is unwound from a roll and run through the printing apparatus proper in a continuous length, and is then cut up or divided into sheets. My invention has special reference to the apparatus for dividing up the paper band into sheets; and it has been particularly designed with a view to its use as part of a "perfecting-press," so called, for the various subdivisions of which press I have filed separate applications for Letters Patent of even date herewith. My invention, however, is susceptible of other uses, and I contemplate its employment in any suitable press in which the paper requires to be divided up into sheets.

The apparatus in which my invention is comprised is characterized by the following principal features: First, a reciprocating perforator or pricker, which, at the proper time, closes on the paper to perforate it in a line transversely to the length of the paper band. Second, vibrating nippers, which, at the proper time, close upon the paper at a point beyond the line of perforations and jerk or suddenly pull the paper to divide or tear it apart, following the lines of perforations. Third, feed-rolls and tapes for carrying along both the paper band and the detached sheet, a portion of said feed-rolls being interposed between the nippers and the perforator to hold tightly the band of paper on one side of the line of perforations, while the nippers draw on or jerk the paper from the other side of said line in order to detach a sheet, the object of this arrangement of the feed-rolls being to prevent the nippers from exercising any strain on that part of the paper immediately under the perforator.

Other important features of my invention, dependent in great measure upon the above, will be developed in the course of the following description, which I shall now proceed to give, of the manner in which my invention is or may be carried into effect, reference being had to the accompanying drawing, in which—

Figure 1 is a side elevation, partly in section, of the perfecting-press above referred to, intended to indicate the position occupied by the hereinafter-described apparatus relatively to the other parts of the press.

It is here unnecessary to describe the press further than to state that A is the tension-rack for holding the roll or rolls of paper; B, the dampening apparatus; C, the printing apparatus proper; D, the perforator; E, the nippers; F, the delivery.

Fig. 2 is a longitudinal vertical central section of the apparatus, in which my present improvements are embodied. Fig. 3 is a plan of the same. Fig. 4 is a transverse vertical section through the perforator. Figs. 5 and 6 are views of detached parts, hereinafter referred to.

Similar letters of reference in Figs. 2, 3, 4, 5, and 6 indicate corresponding parts.

The frame that supports the various parts of the apparatus is shown at A. In the front part of the frame is located the perforator. This mechanism consists of a transverse horizontal bed-plate, A^1, a toothed blade, B, and a presser or clamp, C. The bed-plate is supported and arranged to slide back and forth on horizontal guides or ways *a*, Figs. 2 and 4, formed on each side of frame A, and it is provided with longitudinal stiffening-ribs a^2 on its under side. Extending centrally and longitudinally through the bed-plate is a slot, a^1, of such width as to just permit the toothed blade B to pass into it. This blade is arranged vertically above the bed-plate in the plane of the slot, and is supported at the ends in vertical grooves or guides a^3, formed in upright end pieces A^2 on the bed-plate, in which guides said blade is capable of sliding up and down, so that its serrated lower edge may enter or be lifted above the slot in the bed-plate, as occasion demands. The blade is clasped by two angle strips or bars, C, whose lower flanges *b* are horizontal with their under faces in the same plane. These bars are about half the height of the blade, and are united with it by bolts b^1 extending through the bars and

intervening blade, and provided with nuts b^2 on their ends, by tightening which the parts are held together. The lower face of the clamp thus formed, when the blade is in its normal position, is even with or a little below the serrated edge of the blade. In order, therefore, when the clamp has descended upon the paper which passes between it and the bed-plate, to permit the blade to have a farther downward movement, so that its toothed edge may slightly enter slot a^1, and thus perforate the paper, the holes in the clamp-bars, through which the bolts b^1 pass, are elongated, as seen at b^3, Fig. 4, thus permitting a farther descent of the blade after the clamp is pressed on the paper. Lifting-springs c, on each end of the bed-plate, engage the blade and serve to raise it and the clamp or presser when superior pressure is not applied to force the blade downward. When this superior pressure is applied the blade descends, overcoming the resistance of springs c'. On each side of the blade is a bowed plate-spring, c^1, attached to a central boss projecting laterally from the head of the blade, and having its two ends resting on the top edge of the vertical portions of the clamp or presser-bars c. This spring serves to keep the serrated edge of the blade above the plane of the lower face of the clamp when the blade is not downwardly pressed. If pressure be applied to the head of the blade, the blade and clamp will move downward together until the latter comes in contact with the paper resting on the bed-plate. The pressure being continued, the springs c^1 will yield and the serrated edge of the blade will, as before stated, be forced downward slightly below the face of the clamp, and will thus perforate the paper. When the pressure is withdrawn, springs c^1 will retract the serrated edge, and the lifting-springs c will, at the same time, instantly raise the whole device from the paper.

The main object of the clamp or presser C is to surround and hold firmly the paper on all sides of the blade during the perforating operation, in order to prevent any possible tearing of the paper during the operation.

I contemplate facing both the clamp and the bed-plate with thin vulcanized rubber, to prevent any liability of the paper slipping between them.

The perforator, thus organized and arranged, is caused to reciprocate back and forth by suitable means, which, when it moves forward, and clamps and perforates the paper during such forward movement, cause it to travel at the same rate of speed as that at which the paper moves. This movement, in the present instance, is imparted to the perforator by means of connecting-rods D—one at each end of the bed-plate—jointed at one end to the perforator, and at the other end to cranks (one of which is indicated at D′, Fig. 1) on a shaft revolving in unison with the printing-cylinder, each crank being of a length equal to the radius of the said cylinder. The cranks, during the time the perforator is clamping and perforating the paper, are moving through the middle portion of the upper half of their stroke or rotation, so that their outer ends are traveling in the direction of the perforator at about the same speed as that at which the paper is passing to the latter from the printing-cylinder, and, consequently, there will be no strain or drag of the perforator on the paper clamped by it. Before the cranks have reached that part of their stroke where they descend rather than advance the clamp and blade have completed their work, and are lifted from the paper.

The means provided for pressing down the blade and clamp during the forward movement of the perforator consist of laterally-projecting cam-like ribs or flanges d, formed on, or secured to, the interior opposite faces of plates d', secured to the inner side of the frame at each end of and over the perforator. These cams are highest at the ends on the left of the machine in Fig. 2, and thence gradually slope downward. The height of these elevated ends of the cams is such that the top of the blade will, in its normal position, just pass under them, while the opposite ends are considerably lower, so that the top of the blade, in such normal position, will be above them, as indicated in Fig. 2. The ends of the blade, at the top, are provided with friction-rollers d^2, which run under or over the cam-flange d, according as the perforator is moving forward or backward. Suppose the perforator to be moving forward: The rollers d^2 will pass under the flange d, and as the perforator progresses it will be gradually depressed, and by the time it reaches the ends of the flanges the perforating of the paper will have been effected. The rollers d^2 now, by the continued movement of the perforator, will be carried out from under the cam-flanges, and the springs c and c^1 will at once throw up the blade and the clamp and remove them from the paper, as indicated in Fig. 2. Stop-pieces d^3 are provided to prevent the blade and clamp from being thrown up too far. The perforator, having completed its forward movement, begins to retreat, and during this movement the rollers d^2 travel over the top of the cam-flanges until they are carried beyond the elevated ends of the same, the blade being slightly lifted at this point. As soon as the rollers pass beyond these elevated ends the blade drops to its normal position, and rollers d^2 are again in position to pass under the cams. Thus, during the reciprocations of the perforator the friction-rollers on the ends of the blade pass alternately under and over the cams.

The plates d^1 are made adjustable up and down by set-screws or other means, so that the cams may be set up or down, to cause the blade to penetrate or pass through the paper to any desired extent.

The paper after having been thus perforated is then acted on by the nippers E, which act to jerk or pull on the paper, so as to tear it into sheets, following the lines of perforations

made by the preceding perforator. There are two sets of these nippers, the one mounted or fixed on a rock-shaft, E^1, supported in suitable bearings in frame A, and located above the path of the paper; the other mounted upon a similar rock-shaft, E^2, located vertically below the upper shaft E^1. The nippers are designed to act in pairs, each upper nipper being directly over a corresponding nipper on the under shaft. The shafts are at such distances apart that when they are moved so as to turn the upper and lower nippers toward each other and in line, the adjoining faces of each pair so brought into line will be in contact, so as to exert considerable pressure on the paper which may be between them. Each nipper is formed of a radial stem, fixed on its shaft and terminating at its outer end in a segment-like plate or shoe, convex on its exterior face, as shown in Fig. 2. These curved surfaces are covered with thin rubber or other suitable material, which will allow the faces of each pair to fit more tightly together, and to take a bite on the paper between them. The lower nippers in their normal position are slightly inclined in the direction shown in Fig. 2, the toes of their convex sides being in contact with the under surface of the paper passing above them. The upper nippers in their normal position occupy very nearly the same relative position on the upper side of the paper, excepting that they are so tilted as to be lifted entirely from contact with the paper. When the nippers are in this position it will be seen that if the upper rock-shaft be suddenly and quickly rotated to swing its nippers forward, the toes of these nippers will come in contact with the toes of the under nippers, and the latter will be compelled to partake of the movement of the frame, so that the two will move together with what may be called a rolling friction, biting the paper between them and jerking it forward. The paper band, having just before been perforated and partly severed by the perforator, will not be able to withstand this action of the nippers, but will be completely severed, the line of division following the previously-formed line of perforations. The nippers should now be returned to the position they first occupied.

In order to effect the above vibratory movement of the nippers any suitable mechanism can be employed. The drawing represents a convenient arrangement for the purpose.

To a crank-arm, e, on one end of the upper rock-shaft is connected a rod, e^2, by means of a pin on said crank-arm fitting in a slot, e^3, in the connecting-rod. The other end of the rod is jointed to the bed-plate of the perforator, as seen in Figs. 2 and 3. The slot e^3 is designed to give the rod a certain amount of play independently of the nippers, so that for a considerable portion of its reciprocation the nippers will remain at rest, the crank-arm of the rock-shaft being drawn up to effect a forward movement of the nippers only during the receding of the rod following the retreating movement of the perforator. Thus only after the perforator has pricked the paper, and is receding to renew its work, is the nipping mechanism brought into action to complete the division of the paper. The nippers and their crank are so proportioned that they (the nippers) have a slightly faster motion than that of the paper, just sufficient to induce the tension on the latter requisite to separate the paper along the line of perforations. To lugs or projections on the shafts E^1 and E^2 are attached stout spiral springs f, which are stretched between the shafts, and, owing to their arrangement and manner of connection with the shafts, tend always to bring them and their nippers to the position indicated in Fig. 2. When the upper nippers are vibrated forward by the connecting-rod e^2, the springs f are necessarily distended; consequently as soon as the upper nippers have moved far enough forward to clear the under ones, the latter, being released, will at once be thrown back by the contraction of the springs, resuming their original positions before the upper nippers commence to move back.

In order to press the vibratory nippers together when they move forward, and to separate and keep them from contact with one another when moving back, I employ on each side of the machine a laterally-projecting cam-flange, g, pivoted, as indicated at g^1, at about its center to the frame, so as to be capable of a slight vibratory movement on a horizontal axis. Laterally-projecting friction-rollers g^2 are provided on the end nippers of the upper shaft, which are so located as to engage said cams. Springs g^3, at the front ends of the tilting-cams, serve to keep those ends more elevated than the opposite ends, whose movement is limited by stop-pins g^4, as seen in Fig. 2. The upper shaft is mounted in boxes which are capable of sliding motion, and are provided with spring-cushions that tend to keep the shafts apart. When the upper nippers move forward the friction-rollers g^2 enter under the front ends of the cams, and thence travel along the gradually-descending under faces of the cams until they reach the center points or pivots g^1 of the same. The two nippers of each pair will thus be brought together with considerable force to take a firm hold on the paper. The moment, however, the rollers pass beyond the center points the cams will tilt, their ends, which before were in contact with the lower stop-pins g^4, now being thrown up against the upper stop-pins. The recoil of the springs of the boxes of the upper shafts causes this upward movement in great measure. The moment the upper nippers are thus released the under nippers spring back to their original position, bringing up against a cross-bar, h, which is adjustable toward and away from the nipper-shaft, so as to sustain the nippers in a more or less vertical position, as may be desired. The upper nippers vibrate forward far enough to clear the lower ends of the cams, which lower ends are returned to their normal

position by the springs g^3. In the backward movement of the upper nippers, which is caused partly by the springs f and partly by the connecting-rod and crank, the friction-rollers g^2 pass above the cams g instead of below them, thus lifting the upper nippers, during their receding, entirely off from and above the paper. The cams g should be made adjustable in order to obtain the proper action of the nippers.

From the foregoing it will be noted that but one set of nippers—viz., the upper set—is driven directly by power. The under set, moved by frictional contact with the upper set to clamp the paper, and to move far enough to jerk and separate the paper, is then at once released, and returned to its original position automatically and without dependence upon the upper set, which completes its forward movement and returns independently of the under set, there being no further conjoined movement of the two until the moment when the paper is clamped between and pulled by them.

It is necessary for several reasons that the paper should be clamped and fed along to the nippers by mechanism intermediate between the perforator and the nippers, not only to carry the perforated board of paper to the nippers, but also to keep it spread out and smoothed, and to clamp it firmly, so that when the nippers act the paper may be held at a point near to the line of separation, and any strain induced by the pulling action of the nippers may be sustained by the clamping device, leaving the paper beyond the clamping device and toward the perforator free to move without being subjected to the pulling action of the nippers.

This mechanism is shown plainly in Figs. 2 and 3 of the drawing, consisting of two sets of endless traveling tapes, F F′, arranged horizontally and close together, between which passes the paper. The tapes pass around pulleys on shafts G G′ H H′. The two shafts G H of the upper set of tapes are arranged crosswise in the machine, the one intermediate between the nippers and the perforator, the other a suitable distance the other side of the nippers. The lower shafts G′ H′ are arranged in a similar manner directly under the upper shafts. On the shafts, outside of the tape-pulleys, are binding-rollers I I′, passed to the shafts, which rolls are preferably made of soft vulcanized rubber. The rolls are arranged on the two sets of shafts, so that the rolls of the lower set will be immediately under and in contact with the corresponding rolls of the upper set. The boxes i of the upper shaft are capable of sliding in vertical ways, and are pressed down on top by springs i', which force down the upper rolls I I′ onto the lower rolls with considerable force, to cause them to take a tight hold on the paper between them. Shaft G′ is revolved by power taken from the press, so regulated that the rolls I shall carry the paper along at the same rate of speed as that at which it is delivered from the printing-cylinders. Power is in this instance derived from a shaft, J, driven by the prime mover, motion being taken from this shaft through the medium of a counter-shaft and gearing, 1 2 3 4, as indicated in Fig. 2. The rolls I′ are slightly larger than rolls I, inasmuch as they take the paper after it has been pulled along by the nippers and divided into sheets; and they therefore require to be made a little larger in order that they may carry along the paper thus divided somewhat faster. The rolls I I′, which thus serve to feed and at the same time to clamp the paper, are designed, also, to smooth and spread out and laterally stretch the paper. To this end they are set at a slight angle horizontally with their shafts, as indicated in Fig. 3, diverging from front to rear. It will be seen that under this arrangement, while the diverging rolls carry the paper along their rubber surfaces act in some sort as fingers, continuously pulling the paper laterally, and stretching and smoothing it.

Various methods of mounting the rolls in this position on their shafts may be employed. One convenient mode is shown in Figs. 5 and 6. I make the roll in the first instance separate from the shaft, with an internal metallic bushing, J′, projecting on one side from the roll in the shape of teeth j, which are intended for one-half of a clutch. I take the shaft-bearing or box i, and provide it with a tubular stem, k, the interior or bore of which is a prolongation of the axis of the shaft and box. The exterior of this stem, however, is not turned parallel with the internal cylindrical bore, but it is so turned that the roll, when fitted on it, will tilt or set at an angle, as seen in Fig. 2. The roll is united with the shaft by sliding the stem and box on the shaft until the clutch part j on the hub of the roll engages a corresponding clutch part formed on the contiguous portion of the shaft, or of the pulley next to which the roller may be located. The springs i^1 of the upper shaft-boxes i are removable from the boxes, being pivoted at i^2 to the frame in such manner that, when desired, they can be turned back from the tops of the boxes on which their free ends rest and press. This allows the shafts to be either taken out entirely or to be lifted sufficiently to permit the paper beneath to be readily straightened, should this be necessary. In order to guide the paper, and assure its position under the nippers, I place at this point side guides, consisting of two pairs of converging plates, K, one on each side of the paper, between which plates the edges of the paper pass.

It will be seen that the various parts of the apparatus above described are so located and proportioned with respect to the printing apparatus that the perforator will form the lines of perforations along the margins or blank spaces between the successive sheets or impressions, and that the nippers will take hold of the paper to tear or sever the same before that portion of the paper in which the line of

perforations has just been formed has reached them.

The foregoing specification renders unnecessary any detailed description of the operation of the press. It will suffice to say that the paper passing from the printing-cylinders is clamped and pricked by the perforator, and then, after it has traveled far enough to bring the line of perforations beyond the rolls I, it is seized and jerked by the nippers in such manner as to sever it along the line of perforations. The separated sheet is then carried along, at a slightly-accelerated speed, by the end rolls I′, and from there passes to any suitable delivery or fly.

Having described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. The perforator, composed of a reciprocating slotted bed-plate, combined, as described, with a vertically-movable serrated blade arranged over and in the plane of the slot in said bed-plate, and a clamp carried by said blade, the blade and clamp being carried by the bed-plate and united, substantially as set forth, to allow the blade a movement independent of that of the clamp, so that, when the latter has descended to clamp the paper on the bed-plate, the blade may continue its descent beyond the clamp, to puncture or perforate the paper so clamped, for the purposes stated.

2. In combination with the reciprocating bed-plate and vertical perforating-blade carried by, and arranged to slide up and down on, the same, the cams for depressing the blade at the proper time during the forward movement of the bed-plate and blade, substantially as set forth.

3. In combination with the reciprocating bed-plate, vertically-sliding perforating-blade, and the depressing-cams, the lifting-springs, arranged to throw up the blade after the same in its forward movement has cleared the cams, substantially as shown and described.

4. The combination, with the reciprocating bed-plate, vertically-sliding perforating-blade, depressing-cams, and lifting-springs, of the clamp carried by and connected with said blade, as described, and the springs interposed between said clamp and blade, and operating substantially in the manner and for the purposes shown and stated.

5. The combination, with the vertically-reciprocating perforating-blade, carried by the reciprocating bed-plate, as described, of depressing-cams, adjustable up and down, to regulate the depth of puncture or the extent to which said blade shall penetrate the paper passing between it and the bed-plate, substantially as shown and set forth.

6. The vibratory nippers arranged on parallel shafts, in pairs, to grasp or bite the paper passing between them and jerk on it during their forward vibratory movement, the one shaft being driven positively to produce the movement of its nippers, while the nippers on the other shaft derive their forward movement by frictional contact with the nippers thus driven positively, and, after clearing said positively-driven nippers, are returned to their normal position independently of the same, substantially in the manner and by the means shown and described.

7. The combination of the vibratory nippers and their shafts with the springs connecting said shafts, the connecting-rod and crank for giving a positive vibratory movement to the upper shaft, and the two sets of conveying or carrying tapes, under the arrangement and for operation substantially as herein shown and set forth.

8. The combination of the nippers, nipper-shaft, and mechanism for imparting a vibratory movement to the same, sliding boxes, and recoil box-springs of the upper shaft, and the tilting-cams for depressing the upper nippers during their forward movement, arranged together for joint operation, substantially as shown and described.

9. In combination with the lower nipper-shaft and its nippers, operating in connection with the upper nippers, as described, the cross-bar *h* supporting the said lower nippers and adjustable toward and away from the same, substantially as and for the purposes set forth.

10. The combination, with the vibratory nippers and reciprocating perforator, of pressure and feed rolls intermediate between the two, arranged to carry along the paper at the same rate of speed at which it passes from the perforator, and to hold the paper against the jerking action of the nippers, substantially as herein shown and set forth.

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

Witnesses: THOS. J. MAYALL.
JOHN BULKLEY,
JAS. CROSBY.