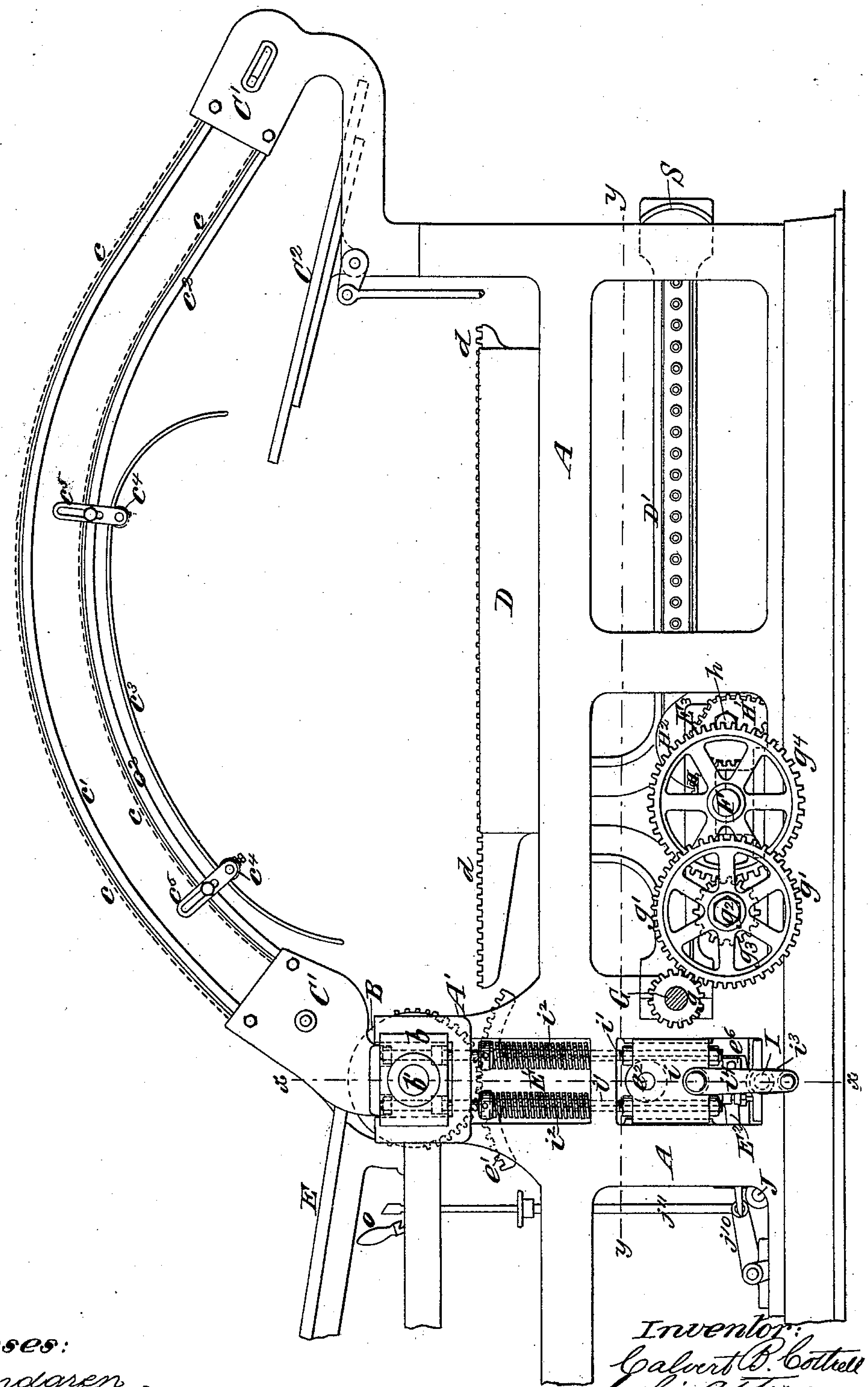
(No Model.) 4 Sheets—Sheet 1.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 424,097. Patented Mar. 25, 1890.

Fig. 1.



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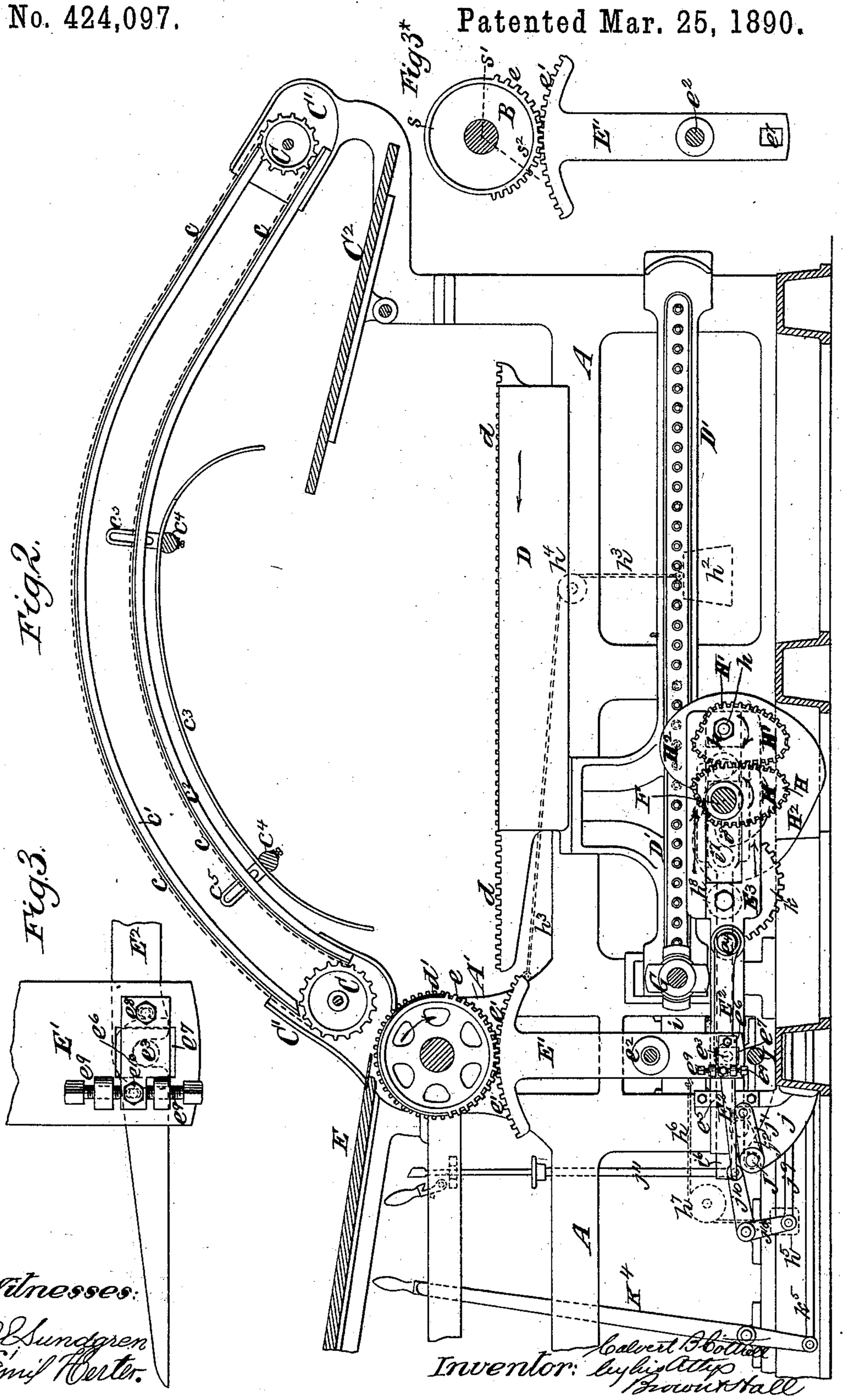
(No Model.) 4 Sheets—Sheet 2.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 424,097. Patented Mar. 25, 1890.



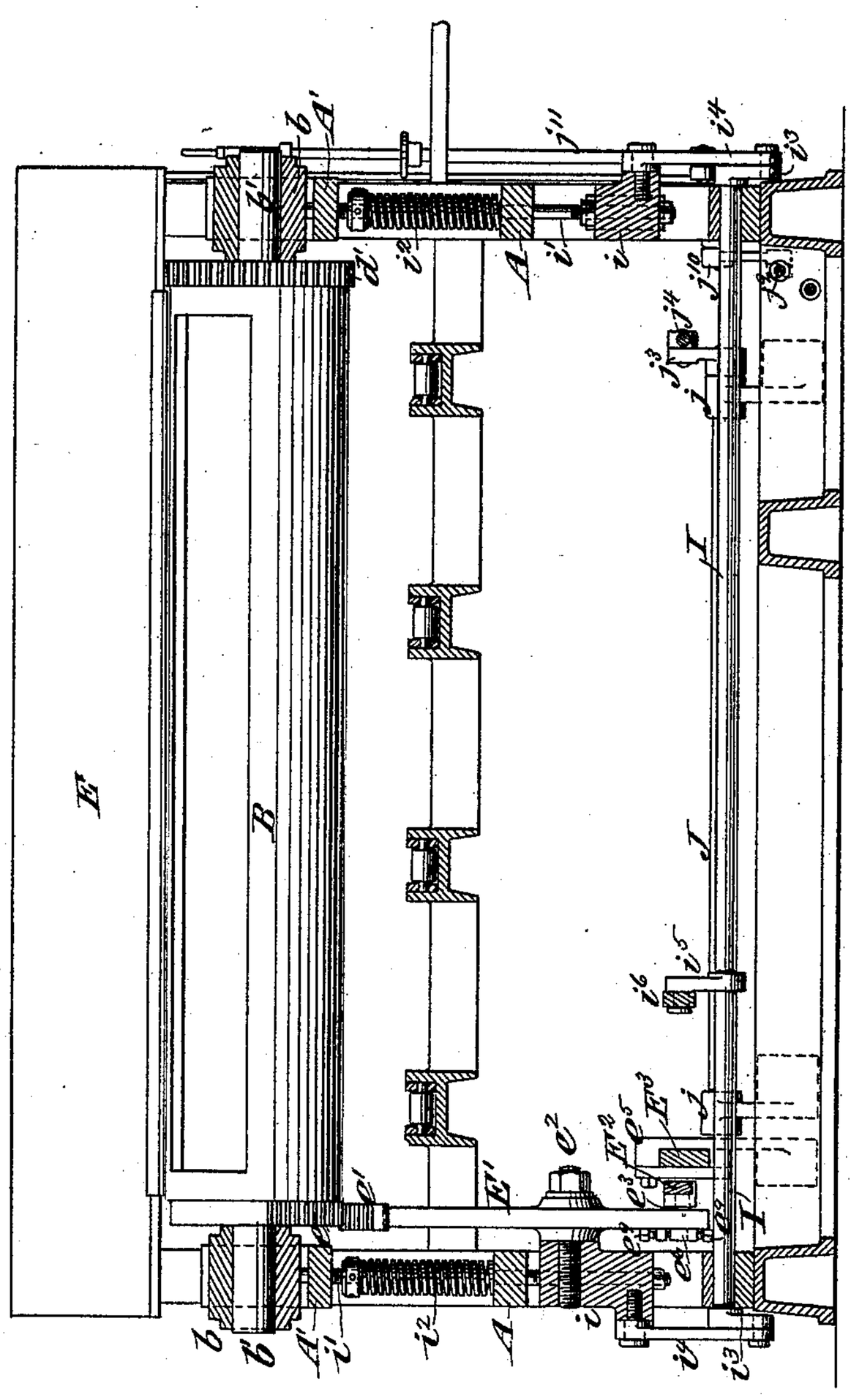
(No Model.) 4 Sheets—Sheet 3.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 424,097. Patented Mar. 25, 1890.

Fig. 4.



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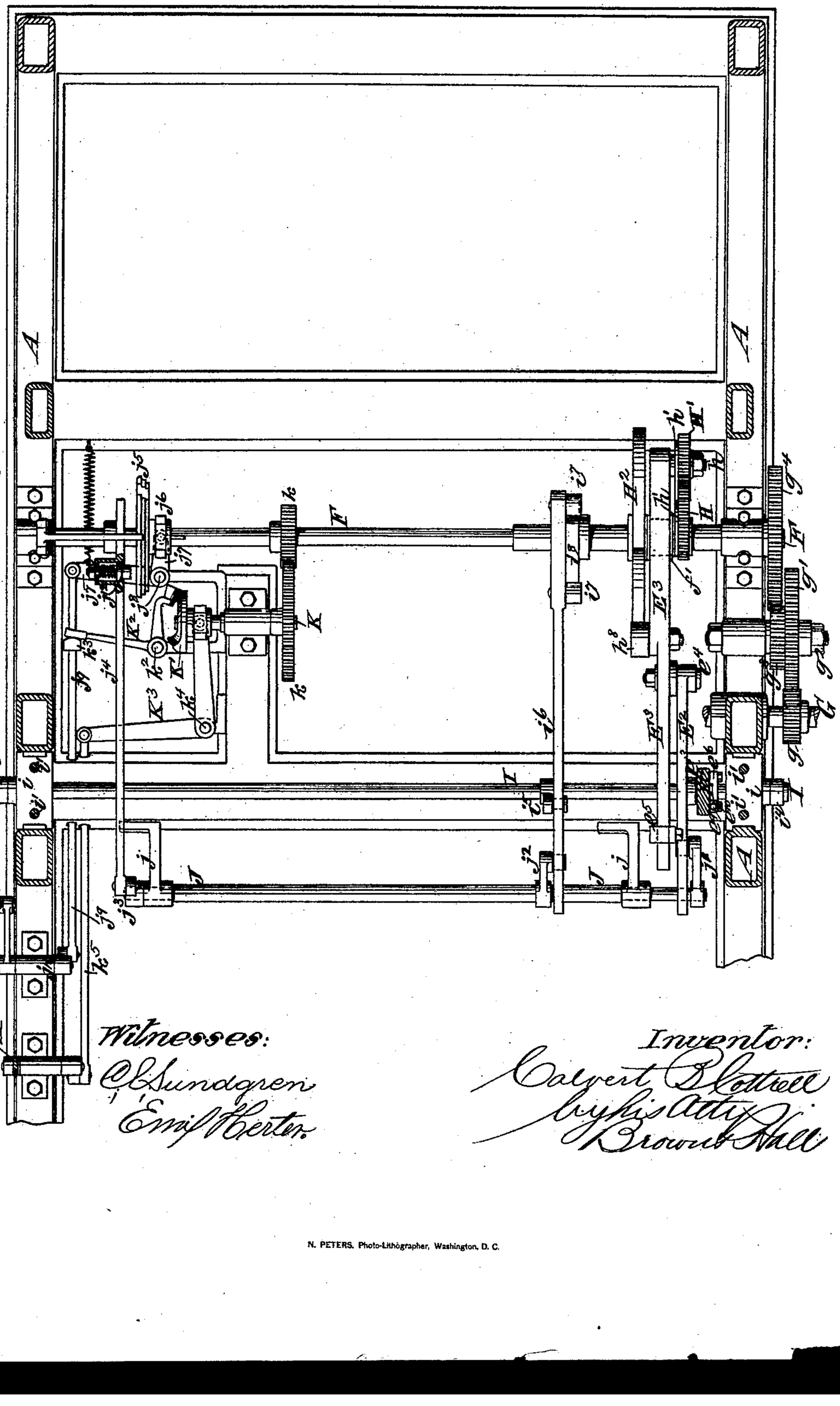
(No Model.) 4 Sheets—Sheet 4

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 424,097. Patented Mar. 25, 1890.



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UNITED STATES PATENT OFFICE.

CALVERT B. COTTRELL, OF STONINGTON, CONNECTICUT.

CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 424,097, dated March 25, 1890.

Application filed June 23, 1887. Serial No. 242,233. (No model.)

To all whom it may concern:

Be it known that I, CALVERT B. COTTRELL, of Stonington, in the county of New London and State of Connecticut, have invented a new and useful Improvement in Cylinder Printing-Machines, of which the following is a specification.

My invention relates to the class of printing-presses which comprise a rotary cylinder and a reciprocating bed, and my improved press or machine has certain characteristics both of a two-revolution and stop-cylinder press. In an ordinary stop-cylinder press as usually constructed the cylinder is rotated to print and deliver during the movement of the bed in one direction and remains stationary during the movement of the bed in a reverse direction.

An important object of my invention is to secure the necessary movement of the cylinder to print and deliver the sheet by the use of a cylinder of comparatively small size, and also to lift the cylinder clear of the bed, so that its rotation may be continued to deliver the printed sheet even while the bed is making its return movement. To operate the cylinder when out of gear with the bed, I employ a starting-lever and a cam-actuated bar which carries a gab-hook, as is usual in stop-cylinder presses, and the parts of my press are organized so that the cylinder in starting is moved about one-fourth a revolution, or thereabout, until it acquires the speed of the bed by the operation of the starting-lever, is then moved by the bed-rack more than a full revolution—say about one and one-fourth revolution—and is then taken up by the starting-lever again and has its two revolutions completed while the bed is making its return movement, and then remains stationary until the bed has completed its return movement. The cylinder therefore makes two revolutions in about two-thirds the time required for the double movement of the bed and remains stationary during the remainder of the time required for such double movement, and in consequence of this peculiarity of operation a comparatively small cylinder may be employed to properly print and deliver the work.

As so considerable a portion of the rotation of the cylinder in this press is produced by the starting-lever, a long movement of the cam-actuated bar for operating the starting-lever is necessary, and owing to such movement an ordinary cam and truck roll for operating the starting-lever, gab-hook, and bar is impracticable, because of the large throw and hard-working points which the cam would necessarily have. To avoid these objections I employ two cams for operating the starting-lever bar, one of said cams being upon an ordinary cam-shaft and the other being pivoted to the bar, and these cams are combined with cam-wheels or are provided with teeth, so that by the operation of the cam which is upon the cam-shaft, and the synchronous operation of the similar cam which is upon the bar the reciprocation of the bar is insured; and to maintain said two cams in engagement, so that their synchronous rotation is insured, I employ a third cam, a weight, or other equivalent means, as hereinafter described.

As in my press a portion of the forward rotation of the cylinder is made while the bed is performing its return or backward stroke, it becomes necessary to lift the cylinder, so that its gear will be raised entirely above the bed-rack, and I therefore mount the starting-lever upon a block which is connected with a cylinder-box and lifting-gear, and is raised simultaneously with the cylinder, thereby maintaining the starting-lever in engagement with the cylinder-sector.

The invention consists in novel combinations of parts, which are hereinabove briefly referred to and hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a press or machine embodying my invention. Fig. 2 is a longitudinal section thereof upon a plane which is just inside one of the side frames. Fig. 3 is a detail view upon a larger scale, showing a lower portion of the starting-lever and a gab-hook engaged therewith. Fig. 3* is an elevation illustrating the cylinder in a position of rest, with the starting-lever engaging therewith. Fig. 4 is a transverse section upon about the plane indicated by the dotted line *x x*, Fig. 1; and Fig. 5 is a horizontal section

upon about the plane indicated by the dotted line *y y*, Fig. 1, the mangle-rack and its operating-gear being, however, omitted.

Similar letters of reference designate corresponding parts in all the figures.

A A designate the fixed side frames of the machine; A′, the upward projections therefrom, or the cylinder-frames in which are fitted the boxes *b*, which support the journals *b′* of the cylinder B. In this example of my invention a front delivery apparatus is employed similar to that which I have before patented, and which comprises chain-wheels C, mounted one pair adjacent to the cylinder in frames or housings C′, and the other pair at the front end of the press, where the receiving-table C^2 is arranged. Over these chain-wheels C passes an endless carrier composed of chains represented by dotted lines *c*, and which are connected by cross-bars provided with delivery-grippers. An example of delivery mechanism of this character is shown in my patent, No. 319,460, granted June 9, 1885, and no further description, therefore, of the delivery mechanism is necessary. The endless chains which compose the carrier C run upon upper and lower tracks or ways *c′* c^2, extending between the chain-wheels C C, and by the endless carrier the printed sheets are conveyed high over the form upon the bed D and are finally deposited upon the receiving-table C^2.

In order to prevent the sheets from dropping down in their transit and at the back end, I have represented longitudinal supporting-strips c^3 as arranged between the endless chains and just beneath the lower tracks or ways c^2. These bent strips may be supported by cross-bars c^4, hung by brackets c^5 from the lower tracks or ways c^2.

E designates the feeding-table or feed-board from which the sheets are fed to the cylinder B, which is provided with the usual cylinder-grippers, and in Fig. 3* I have represented at *s* the feeding-edge of the cylinder and its starting-point. Upon the bed D is a rack *d*, which, by gearing with a wheel *d′* at one end of the cylinder, serves to operate the cylinder for printing, and upon the opposite end of the cylinder is a sector *e*, which, as shown in Fig. 3*, extends about half the circumference of the cylinder, and with which engages a starting-lever E′, having at the upper end a sector *e′* for engagement with the wheel or sector *e*. The starting-lever E′ is fulcrumed at e^2 and provided with a pin e^3 at its lower end, with which engages a gab-hook E^2, which is pivoted at e^4 to a reciprocating and cam-actuated bar E^3. At one end the bar E^3 is fitted to a suitable guide or slideway e^5, and at its opposite end is slotted or forked, so as to pass over the usual cam-shaft F, and the bar slides upon a rectangular box *f′*, in which the shaft turns.

G designates the main shaft, which has coupled with it the ordinary mangle-shaft, which engages with and operates the rack D′ upon the bed D, and upon the shaft G is a pinion *g*, engaging a wheel *g′*. Secured to the wheel *g′* so as to turn therewith and upon a fixed stud g^2 is a pinion g^3, which engages a wheel g^4 on the end of the cam-shaft F, and it will be understood that this cam-shaft makes one revolution at each double stroke of the bed. As here represented, the gab-hook E^2 engages with the pin e^3, which is fastened to a block e^6, and projects through an opening e^7 in the lower end of the starting-lever E′. The block e^6 is pivoted at e^8, and at its opposite ends fits between adjusting-screws e^9 upon the starting-lever E′. By adjusting these screws e^9 the pin e^3 may be raised or lowered in the lever E′, so as to virtually and accurately vary the length of the lower arm of the lever, and may then be clamped in place by a screw e^{10}, all as shown in Fig. 3.

In the operation of the press, and when the cylinder stands still with its edge *s* in the position shown in Fig. 3*, and when the bed commences to move in the direction indicated by the arrow in Fig. 2, the starting-lever E′ commences to impart motion to the cylinder B in the direction indicated by the arrow in Fig. 2, and after it has moved the cylinder so as to move its receiving-edge from the point *s* to the point *s′* in Fig. 3* the speed of the cylinder has been increased so that as the bed-rack *d* comes into gear with the cylinder-gear *d′* at the point *s′* the bed and the cylinder have the same surface speed. The bed-rack *d* continues to operate the cylinder during an entire revolution and by the distance from *s′* to s^2 more than a revolution, and as it then completes its movement toward the left of Fig. 2 and commences its return movement the starting-lever E′ comes into gear with the sector *e*, and, the cylinder and lever being raised, the lever continues the rotation of the cylinder until the receiving-edge again reaches the position indicated by *s* in Fig. 3*, and thus the cylinder has imparted to it two full revolutions, which are ample for printing and delivering the printed sheet, and to enable the cylinder to be made of comparatively small size and the sheet at the same time delivered easily therefrom.

The engagement of the starting-lever with the cylinder occurs when the bed has a uniform speed and after the mangle-pinion has rounded the shoe S at the end of the rack.

In order to produce the large movement of the cylinder by the starting-lever E′, which is necessary in this press, I employ in lieu of the usual cam and truck roll for operating the bar E^3 from the cam-shaft F two eccentric or cam-shaped gear-wheels H H′, the form of which is best seen in Fig. 2. One of these cam-shaped wheels H is upon the cam-shaft F, and the other of them is pivoted at *h* to the bar E^3, and from the shaft G rotary motion is transmitted to the cam-shaft F in the direction indicated by the arrow in Fig. 2. The contour of the two cams H H′ is coincident with the pitch-line of the wheels which

they form, and, as best shown in Fig. 5, the cams have smooth surfaces (designated by the letter h') at the side of their toothed portions. Consequently as the cam H is rotated in the direction of the arrow in Fig. 2 the cam H′, being in gear with it, is also rotated, and hence the necessary throw for operating the bar E^3 is divided between the two cams H H′, and is not all concentrated in one cam, as is necessary when a simple cam acts upon a truck-roll. During the time that the gap in the cylinder-sector e is passing the lever-sector e' the cams H H′, having completed their greatest throw of the bar E^3 in the direction indicated by the arrow in said bar in Fig. 2, are operating to relieve the bar and permit it to move in a direction the reverse of said arrow in order to return the starting-lever E′, and various means which are the equivalent of each other in the combinations may be employed for producing a resistance to the movement of the bar E^3 in the direction indicated by the arrow in Fig. 2 and for imparting to said bar a tendency to move in a reverse direction, thereby maintaining the cam-shaped wheels H H′ always in engagement. I may, for example, suspend a weight h^2 by means of a cord h^3 from the upper end of the starting-lever E′, said cord passing over a pulley h^4, or I may suspend a weight h^5 by a cord h^6 from the lower end of the starting-lever, said cord passing over a pulley h^7. These arrangements of weights are shown by dotted lines in Fig. 2. In lieu of the weights I may employ a cam H^2, fixed upon the cam-shaft F and acting upon a truck-roll h^8 upon the reciprocating bar E^3. Inasmuch as a portion of the direct rotation of the cylinder must be performed while the bed D is moving in a reverse direction to that indicated by the arrow in Fig. 2, or, in other words, is on its return-stroke, it is necessary to raise the cylinder or impart lifting motion thereto sufficient to enable the cylinder-wheel d' to clear the bed-rack d. Inasmuch, also, as this lifting motion is considerable, it is desirable to also lift the starting-lever E′, so that it may always be in engagement with the sector e to a uniform degree. I have shown the starting-lever E′ as fulcrumed at e^2 to a block i, which is guided in a suitable opening in the side frame A of the press, and these blocks i are connected by rods i' with the cylinder-boxes b, and springs i^2 are applied to these rods and have a constant tendency to lift the cylinder and the blocks i.

I designates a shaft extending transversely across the machine, as best shown in Fig. 4, and having at opposite ends arms i^3, which are connected by links or rods i^4 each with one of the blocks i. When the shaft I is turned so that the center of the arm i^3 lies directly in line with the center of the shaft and the point of attachment of the rod i^4 with the block i, the cylinder will be maintained in its lowermost position; but when the shaft is turned so as to throw these centers out of line the springs i^2 exert an instant tendency to raise the cylinder and the blocks connected with the cylinder-boxes. It will be understood that at the side of the press opposite the starting-lever there is a similar block i to that to which the starting-lever is fulcrumed, and both the blocks i are connected by links or rods i^4 to the arms i^3 of the rock-shaft. The rock-shaft I has an arm i^5, with which engages a gab-hook i^6, or rather a rod i^6, provided with a gab-hook, and this gab-hook has truck-rolls i^7, between which operates a cam i^8 on the shaft F. Consequently at each double stroke of the bed, when operating with single rolling, the shaft I will be turned and the cylinder and also the starting-lever E′ will be lifted.

It is sometimes desirable to stop the cylinder and have it remain motionless while the bed continues to operate, and in such case the gab-hook E^2 should be lifted from the pin e^3, and the gab hook or rod i^6 should be lifted from the pin on the arm i^5. Both these offices are performed by the rock-shaft J, which is journaled in suitable bearings j, and has two arms j' j^2, which respectively underlie the gab-hook E^2 and the gab hook or rod i^6. The shaft J likewise has an arm j^3, with which is connected a rod j^4, and this rod is operated by a cam j^5, the construction and operation of said parts being as shown in my Letters Patent No. 347,922, of August 24, 1886. The cam j^5 has a groove in its face, and by a fork j^6 and bell-crank lever j^7 is connected with the cam. This bell-crank lever j^7 is fulcrumed at j^8, and on one arm it carries the fork j^6, while with its other arm is connected a rod j^9, extending from a bell-crank lever j^{10}. The rod j^9 is connected with one arm of said bell-crank lever, while with the other arm is connected a foot-rod j^{11}, which, when depressed, serves to move the cam j^5 toward the rod j^4, which it operates. In the rod j^4 is a spring-supported pin j^{12}, and if when the cam j^5 is moved against the rod j^4 its groove is not in a position to receive the pin j^{12} the pin is simply pressed inward, as permitted by its supporting-spring, until the groove in the cam comes into coincidence with the pin, whereupon the rod j^4 is operated positively to turn the shaft J and lift the gab-hooks E^2 i^6.

When the press is operating with single rolling, the gab-hooks E^2 i^6 are left permanently in engagement with the pins on which they operate, unless it be desired for some purpose to stop the cylinder; but when the press is operating with double rolling it is necessary to lift the gab-hooks E^2 i^6 at every second revolution of the cam-shaft F. To effect this result I provide a double-rolling shaft K, which by a wheel and pinion k k' is geared with the cam-shaft F, so as to receive only half the speed of said cam-shaft, and upon this double-rolling shaft K is a cam K′, which may be slid lengthwise thereof, so as to operate upon the roll carried upon one end of a bell-crank lever K^2, which is ful-

crumed at k^2, and the other end or arm of this bell-crank lever engages a stop k^3 upon the rod j^9. The cam K′ may be shifted by a bell-crank lever K^3, which is fulcrumed at k^4, and with the other arm of which is connected a rod k^5, extending from a lever K^4. When the lever K^4 is operated, the cam K′ is moved forward upon its shaft K, and by acting through the bell-crank lever K^2 moves the bell-crank lever j^7 and shifts the cam j^5, so as to move it into engaging position with its rod j^4. When the gab-hooks E^2 i^6 are to be maintained permanently out of engagement with the pins with which they operate for any material length of time, a latch *o*, as shown in Fig. 2, may be swung over into engagement with the end of the push-rod j^{11}. The arrangement and manner of operation of the tripping-cam j^5, its rod j^4, and also the double-rolling cam K′ and its connections are all as described in my aforesaid Letters Patent No. 347,922.

From the above description it will be understood that my improved machine is of novel construction in that it combines both features of a stop-cylinder press and of a two-revolution press. In stop-cylinder machines as heretofore constructed the cylinder is turned during the direct movement of the bed, and either remains stationary during the whole return movement of the bed or during all but a little of the first portion of said movement, when it is turned slowly backward, and therefore the printing of the sheet and the delivery of the printed sheet must be wholly or almost entirely accomplished while the bed is making its direct movement, and the cylinder has therefore to be of large size.

According to my present invention I provide lift mechanism for raising the impression-cylinder, and in this respect my machine is like a two-revolution press or machine. In the operation of the machine and at the proper time the impression-cylinder is lifted, and its forward motion is continued by the starting-lever to complete the delivery of the sheet and to slow down the cylinder while the bed is making its return movement, so that in my machine the cylinder is turned to print and deliver a sheet during about two-thirds of the time which is required to make a complete double movement of the bed. Were the cylinder not lifted, the entire rotation of the cylinder would have to take place during the direct movement of the bed, and hence the cylinder would have to be of comparatively large size to print and deliver the printed sheet during the direct movement of the bed, and the cylinder would be at rest during a longer time than is necessary. By my invention I get the advantage of a stop-cylinder to secure the proper register of the sheets upon it, and I obtain a small cylinder and a higher rate of speed than in the two-revolution press, or, in other words, I get the high speed of a two-revolution press with the accuracy of register of a stop-cylinder press.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a stop-cylinder printing-machine for type, plate, or lithographic printing, the combination, with a form-carrier, of an impression-cylinder that is caused to make two entire revolutions to each impression, the motion being arrested at the end of the second revolution, substantially as specified.

2. The combination, with a reciprocating form-bed, of an impression-cylinder that is caused to make two revolutions to each impression, the motion being arrested at the end of the second revolution, substantially as specified.

3. The combination, in a printing-machine, of a form-carrier, an impression-cylinder constructed and arranged to move against the type, stone, or plate to make the impression and away from the same when the impression is completed, and which makes two entire revolutions to each impression, its motion being arrested at the end of the second revolution, and suitable mechanism for imparting the said motions to the cylinder and for arresting its motion, substantially as specified.

4. In a printing-machine, the combination of a form-carrier, an impression-cylinder that is caused to make two entire revolutions to each impression and to release the sheet at the end of the first revolution and be brought to a full stop at the end of the second revolution, and a delivery-carriage the grippers of which catch the sheet when released by the cylinder-grippers at the end of the first revolution of the cylinder and take it from the cylinder during the second revolution thereof, substantially as specified.

5. In a printing-machine, the combination, with an impression-cylinder and a uniformly-reciprocating bed geared therewith during printing, of lift mechanism whereby the cylinder is lifted out of the bed-rack after printing, and the cam-actuated starting-lever whereby the cylinder is slowed down after it is lifted out of gear with the bed-rack while the bed is returning and whereby the cylinder is started forward to come again into gear with the bed-rack at its next direct movement, substantially as herein described.

6. In a printing-machine, the impression-cylinder and uniformly-reciprocating bed geared with the cylinder during printing, a starting-lever whereby the cylinder is started and stopped, and a lift mechanism for raising and lowering the cylinder, all organized and combined for operation substantially as herein described, whereby during each double movement of the bed the cylinder makes two revolutions to print and deliver the sheet and remains at rest to take a new sheet during

the balance of the time required for the double movement of the bed, substantially as herein described.

7. The combination, with a cylinder and lifting-gear applied to its bearings for lifting the cylinder away from the bed, of a starting-lever and a movable fulcrum-piece for the lever also connected with the lifting-gear to be raised and lowered with the cylinder, substantially as herein described.

8. The combination, with a cylinder and a bed having a rack of a length to produce more than a complete rotation of the cylinder for printing, of a starting-lever for starting and completing the movement of the cylinder and lifting-gear for raising the cylinder during the return movement of the bed, substantially as herein described.

9. The combination, with the bed and cylinder of a printing-machine, of a starting-lever, a bar through which motion is imparted to the lever, a cam-shaft, and two engaging cam-shaped gear-wheels, one upon said shaft and the other pivoted on the said bar, substantially as herein described.

10. The combination, with the bed and cylinder of a printing-machine, of a starting-lever, a bar through which said lever is operated, a cam-shaft, two cams bearing one on the other, one of the two being on the cam-shaft and the other pivoted to the bar, and a resistance device applied to said bar for maintaining said cams in engagement, substantially as herein described.

11. The combination, with a bed and cylinder D B, of the starting-lever, the cam-shaft F, the bar E^3, the toothed cams H H′, one upon the cam-shaft and the other upon the bar, and the cam H^2, keeping the toothed cams in engagement, substantially as herein described.

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