(No Model.)

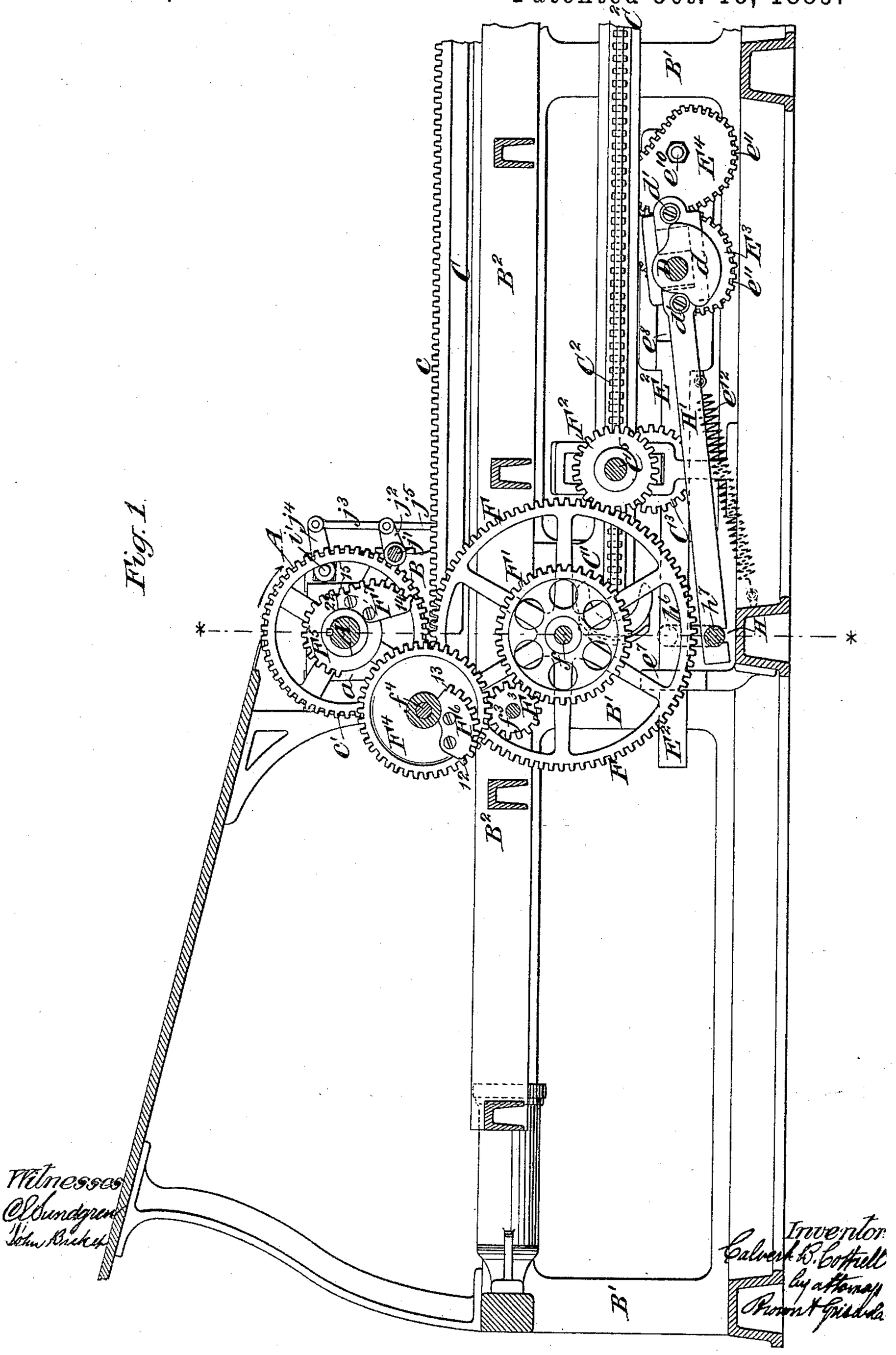
5 Sheets—Sheet 1.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 412,877. Patented Oct. 15, 1889.

Fig. 1.



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CYLINDER PRINTING MACHINE.

No. 412,877. Patented Oct. 15, 1889.

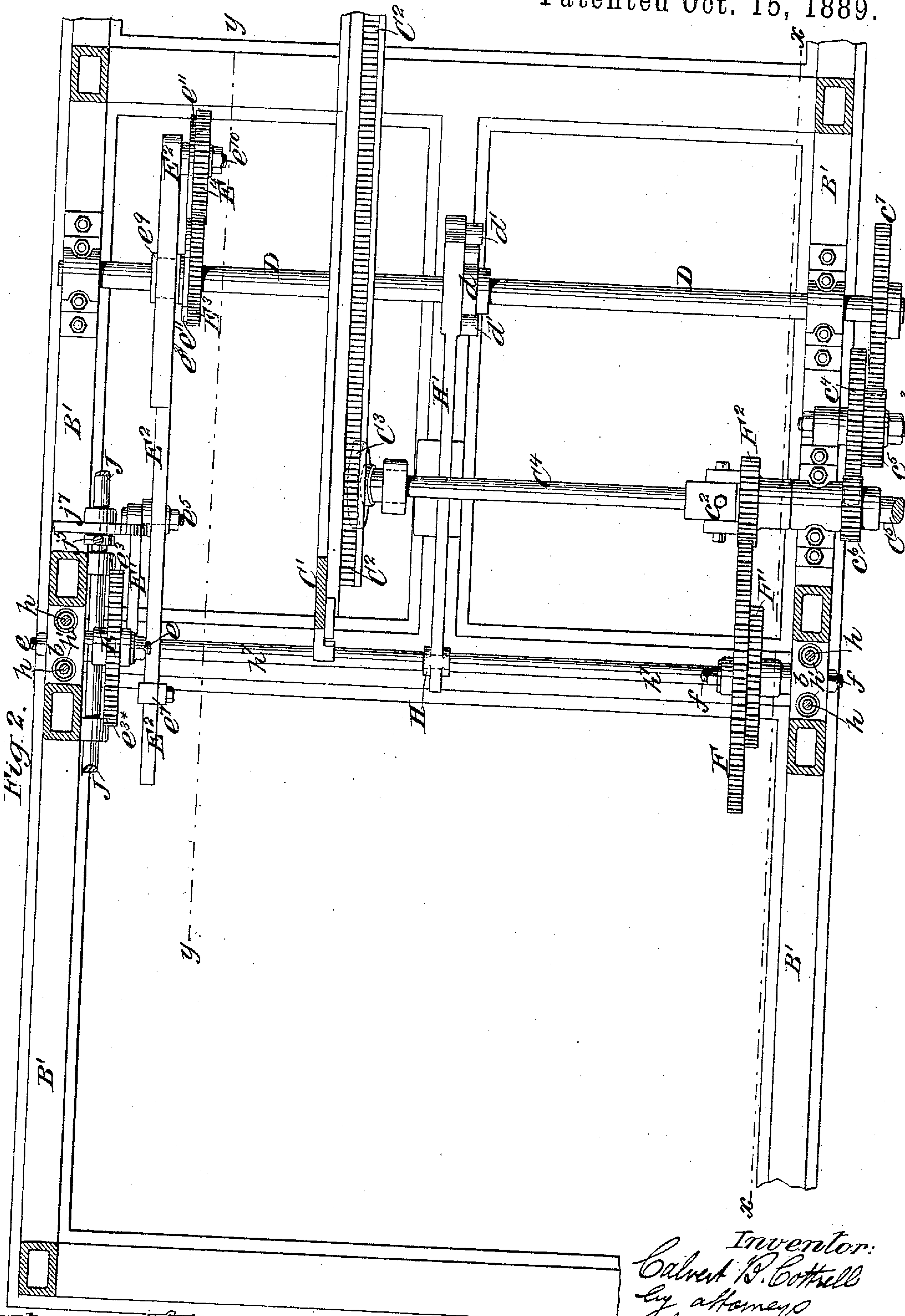

Fig. 2.

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N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 3.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 412,877. Patented Oct. 15, 1889.

Fig. 4.

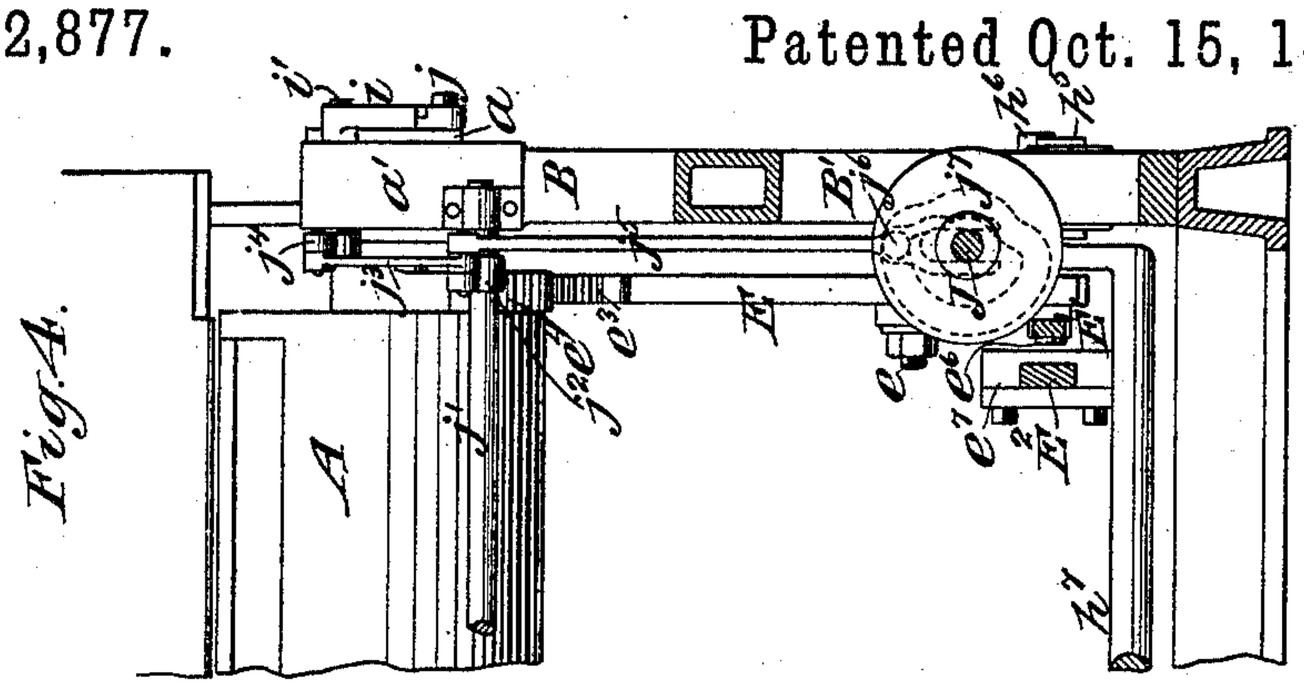
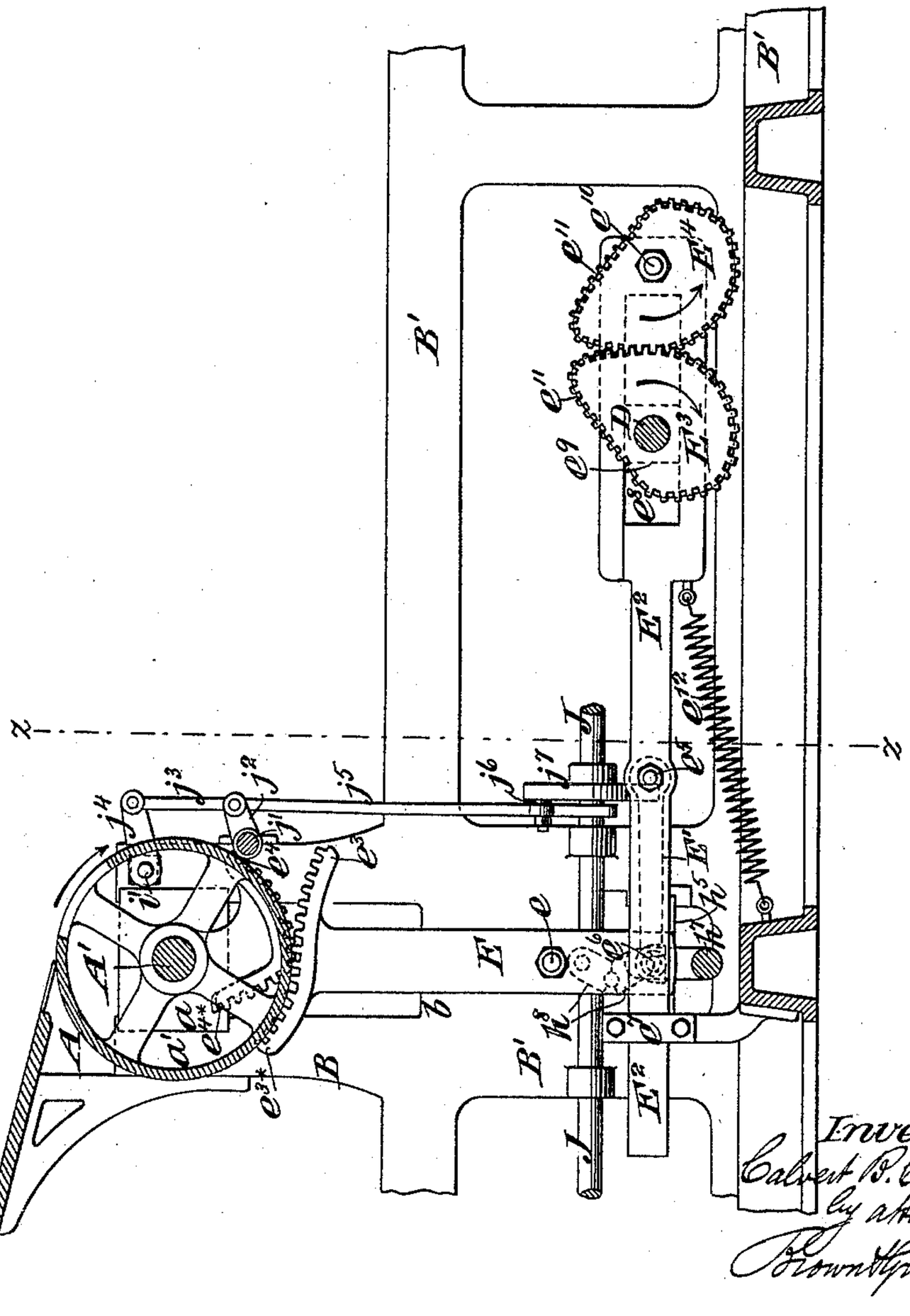


Fig. 3.



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(No Model.) 5 Sheets—Sheet 4.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 412,877. Patented Oct. 15, 1889.

Fig. 6.

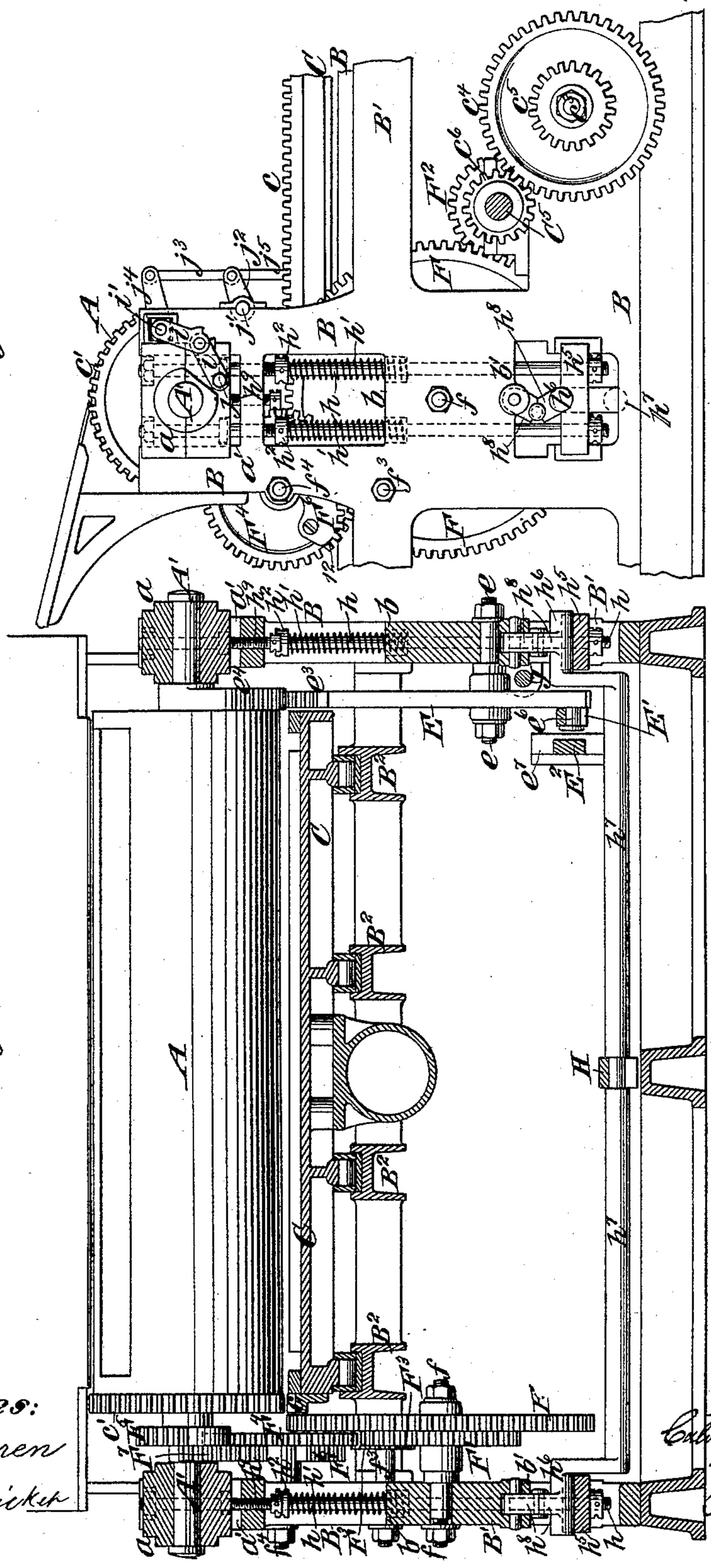

Fig. 5.

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(No Model.) 5 Sheets—Sheet 5.

C. B. COTTRELL.

CYLINDER PRINTING MACHINE.

No. 412,877. Patented Oct. 15, 1889.

Fig. 8.

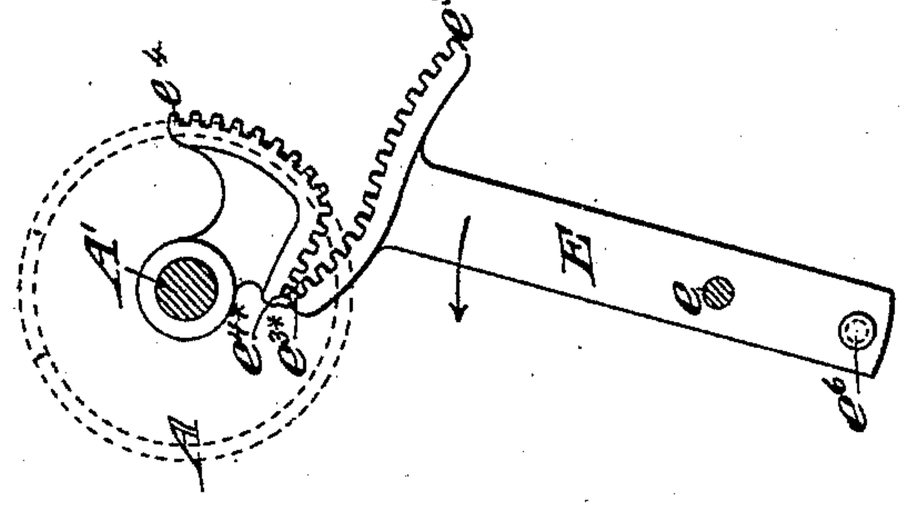
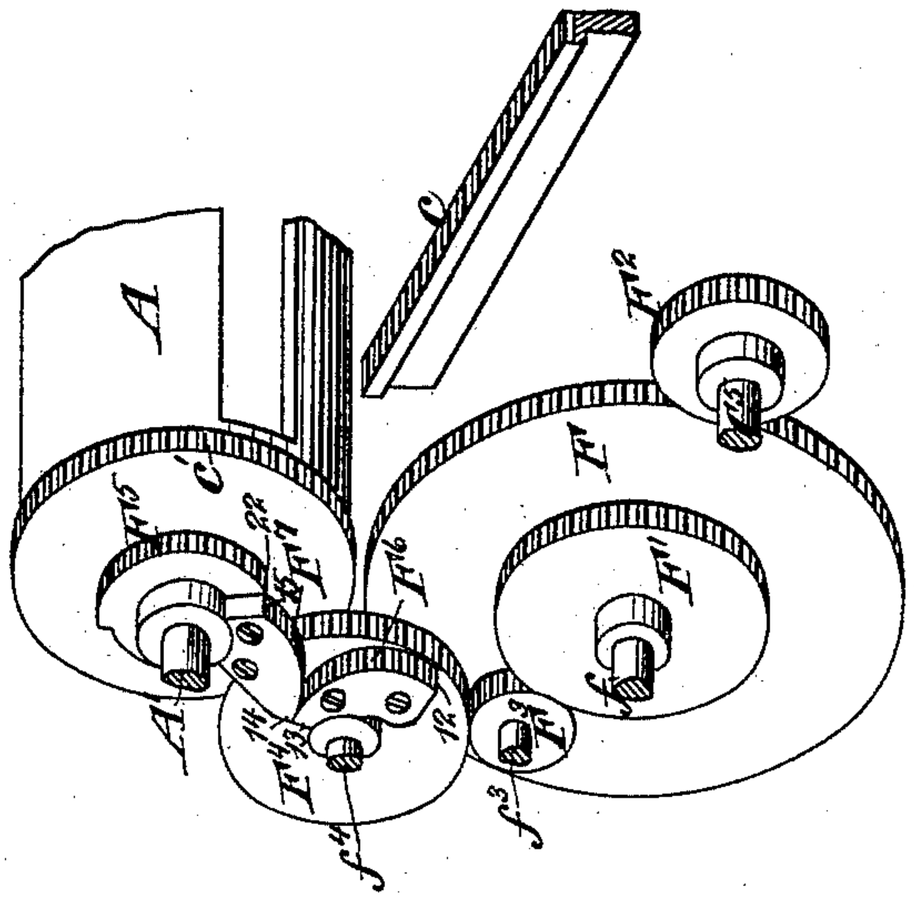


Fig. 7.



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UNITED STATES PATENT OFFICE.

CALVERT B. COTTRELL, OF STONINGTON, CONNECTICUT.

CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 412,877, dated October 15, 1889.

Application filed December 26, 1888. Serial No. 294,596. (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, reference being had to the accompanying drawings.

This invention is in part applicable to all stop-cylinder printing-machines, but is in its entirety applicable to those machines in which the impression-cylinder makes two complete revolutions and afterward stops during the time occupied by one reciprocating movement of the bed back and forth. In such a machine a toothed starting-lever engages a toothed sector or series of teeth upon the cylinder for the purposes of starting forward the cylinder at a slow speed and of afterward slowing up the cylinder and bringing it to a stop. During the direct or forward movement of the bed it gears with and rotates the cylinder to print and commences the delivery of the printed sheet, and then the cylinder is raised directly and entirely out of gear with the bed, and its revolution is continued to complete the delivery of the printed sheet and complete the two revolutions of the cylinder and bring the latter to the position in which it stops, with its receiving-edge in feeding position, while the bed makes its return movement.

The principal object of this invention is to provide for the starting of the cylinder with a very slow motion and to so gradually accelerate the velocity of its rotation that it is brought to printing speed before coming into gear with the bed-rack without any shock occurring either in the starting of the cylinder or in its coming into gear with the bed-rack or at any intermediate stage.

My improvement consists in certain means, hereinafter described and claimed, whereby the above-mentioned object is accomplished, and in the combination, with the impression-cylinder, as hereinafter described and claimed, of lift mechanism for raising and lowering the cylinder from and toward the bed, and a locking mechanism for holding the cylinder solidly down during the printing and liberating it to allow it to be lifted after printing.

The accompanying drawings represent so much of a printing-machine as is necessary to illustrate my improvement, only such parts as are not necessary to illustrate the invention being omitted.

Figure 1 represents a longitudinal vertical section of the machine, taken in the line *x x*, Fig. 2, which figure represents a horizontal section taken below the cylinder and bed, but showing the mangle-rack motion for driving the bed and the mechanism for operating the starting and stopping lever. Fig. 3 represents a longitudinal vertical section taken in the line *y y* of Fig. 2, showing the starting and stopping lever and its actuating mechanism and the lift and locking mechanism for the cylinder. Fig. 4 represents a transverse vertical section in the line *z z* of Fig. 3, showing part of the cylinder and its lift and locking mechanism. Fig. 5 represents a transverse vertical section of the machine in the line * * of Fig. 1, but showing the cylinder and its driving-gearing in full. Fig. 6 is a side view showing the lift and locking mechanism of the cylinder. Fig. 7 is a perspective view of the gearing shown in Fig. 1, but showing its members in a different position. Fig. 8 is a side view of the starting-lever and the toothed sector on the cylinder with which said lever gears, showing them in a position different from that shown in Fig. 3.

Similar letters of reference indicate corresponding parts in the several figures.

A designates an impression-cylinder, which is smaller than those usually employed in stop-cylinder presses, and which is mounted upon a shaft A′, as shown in Figs. 1, 3, and 5. This shaft A′ is journaled in boxes *a*, which are fitted to rise and fall a short distance in suitable guideways or housings *a′*, formed in the cylinder-frames B, which are mounted upon side frames B′ of the machine.

C designates a reciprocating bed, which is arranged to travel upon suitable bearers B^2, forming part of the fixed framing of the machine, and having provided upon it a bed-rack *c*, which is adapted to engage during printing with a gear-wheel *c′*, which is secured fast to the cylinder-shaft A′, and which may be considered as a fixed part of the cylinder. The reciprocating bed is to have imparted to

it a movement at a uniform speed as distinguished from a variable movement, such as is imparted by a crank, and, as here represented, a rack-and-pinion movement of the kind known as the "Napier" or "mangle" movement is employed. The bed C has depending from it a hanger C′, upon which the rack C^2 is carried, and with the rack there engages a mangle-pinion C^3 upon a knuckle-shaft C^4, which is jointed at c^2 to the main shaft C^5 of the machine, on which is usually placed a driving-pulley.

D designates the usual cam-shaft of the machine, which is driven from the main shaft C^5, as best shown in Fig. 2.

c^3 designates a fixed stud, upon which are mounted, so as to rotate as one, wheels c^4 and c^5. Upon the main shaft C^5 is a pinion c^6, which engages with the larger wheel c^4, and the smaller pinion c^5, rotating with the wheel c^4, engages with a larger wheel c^7 upon the cam-shaft D. By this arrangement of gear-wheels a speed very much slower than that of the main shaft C^5 is transmitted to the cam-shaft D, which may make one revolution during each complete movement of the bed C back and forth. For starting and stopping the cylinder A, I provide a starting-lever E, which is fulcrumed upon a pin e, secured in one of the side frames, and upon the upper end of this lever E is a toothed sector or series of teeth e^3 e^{3*}, which engage with a sector e^4 e^{4*} upon the cylinder, as best shown in Fig. 3. This starting-lever E is operated by a gab-hook E′, which is fulcrumed at e^5 upon a cam-actuated bar E^2 and engages a pin e^6 upon the starting-lever E. The cam-actuated bar E^2 is fitted to slide in suitable guides e^7 and has in it a slide or guide way e^8, which reciprocates upon a block e^9, fitted on the cam-shaft D.

The cam-shaft D takes the place of the cam-shaft commonly employed in stop-cylinder machines; but as it is desirable in carrying out this invention to impart more than the usual length of movement of the starting-lever I propose here to employ and have here represented upon the cam-shaft gear-wheels or toothed cams E^3 E^4, such as are shown in and constitute a part of the subject-matter of my application for United States Letters Patent, Serial No. 242,233, filed June 23, 1887. One of these cams E^3 is fastened upon the cam-shaft D and the other cam E^4 is pivoted upon the pin e^{10}, fast upon the bar E^2. The cams E^3 E^4 have plain bearing-surfaces e'', which are upon the pitch-line of their teeth, and inasmuch as the throw to be produced is divided between the two cams a very much smoother and easier cam motion can be obtained than would be possible with the large cam upon the shaft D—such as is usually employed—acting against a simple truck-roll in the bar E^2. The cams E^3 E^4 serve to move the bar E^2 toward the right hand in the drawings, Figs. 1, 2, and 3, and a return movement of said bar may be produced by another cam, as in my aforesaid application, or by a spring e^{12}, applied between the bar E^2 and a fixed part of the machine-framing, as shown in Figs. 1 and 3.

The toothed sector or series of teeth e^3 e^{3*}, hereinbefore mentioned, on the lever E is made in the form of an arc concentric with the fulcrum-pin e from the end e^3 about half-way to the other end, and thence the distance of the pitch-line of the teeth from the fulcrum e increases. The toothed sector or series of teeth e^4 e^{4*} on the cylinder is concentric with the cylinder from the end e^4 for a distance corresponding with the concentric portion of the teeth of the sector e^3 e^{3*}, and thence the pitch-line of the teeth approaches the center of the cylinder, so that it will continue in gear with the sector or series of teeth on the lever throughout the whole length of both. The effect of the form of the two sectors or series of teeth e^3 e^{3*} and e^4 e^{4*} will be hereinafter more fully explained.

Upon the side of the machine opposite the starting-lever E is a train of gearing, by which the revolution of the cylinder is continued after the latter has been started by the starting-lever and until it comes into gear with the bed. This train, which I will now proceed to describe, is shown in Figs. 1 and 5, but more plainly in Fig. 7.

Mounted upon a fixed stud or pin f there is a large gear-wheel F, which engages with a pinion F^2 on the main shaft C^5 of the machine. This pinion is of the same pitch diameter as the knuckle-gear or mangle-pinion C^3; hence its pitch-line has the same speed as the bed, and therefore the pitch-line of the large wheel F has the same speed as the bed, or the speed which the cylinder must have when the cylinder-gear c' meets the bed-rack c. Fast to the gear-wheel F is a gear-wheel F′, of half the pitch diameter of the large gear-wheel F. This gear-wheel F′ gears with a small gear-wheel F^3, turning loosely on a fixed stud f^3, and the said gear-wheel F^3 gears with another gear-wheel F^4, turning loosely upon a fixed stud f^4. Opposite this gear-wheel F^4 there is fast to the cylinder a concentric toothed sector F^5, which is capable of gearing with the said gear-wheel F^4. This sector has a pitch radius equal to one-half that of the cylinder-gear c'. Secured to the gear-wheel F^4 is an eccentric sector F^6, and secured to the sector F^5 or otherwise secured to the cylinder is an eccentric sector F^7, which is the counterpart of that F^6. These eccentric sectors are so arranged that they may gear with each other, as shown in Fig. 7. The gear-wheel F′ being one-half the diameter of the gear-wheel F, and being fast to it, its pitch-line will have one-half the speed of that of the gear F. The gear F^3, being but an intermediate gear for changing the direction of the gear-wheel F^4, will have the same pitch-line speed as that F′—that is, one-half the pitch-line speed required for the cylinder-gear c' when the latter meets the bed-rack c. The concentric sector F^5

having a pitch-line diameter equal to one-half that of the cylinder-gear c', it follows that when the teeth of the said sector are engaging in the teeth of the gear-wheel F^4 the cylinder will have the same speed as the bed. The end 12 of the pitch-line of the sector F^6 coincides with the pitch-line of the gear-wheel F^4, and the pitch-line of the other end 13 of the said sector has one-half of the radius of the said gear-wheel, and hence the end 13 will have half the velocity of the pitch-line of the gear-wheel F^4, or one-quarter of the velocity of the surface of the cylinder-gear c'. The pitch-line of the eccentric sector F^7 at the end 15 coincides with the pitch-line of the concentric sector F^5, and at the other end 14 has a radius corresponding with that of the pitch-line of the gear-wheel F^4.

I will next describe the mechanism for lifting and lowering the cylinder and for locking it in its lower position, and will afterward describe the operation of printing.

The lift mechanism itself does not differ essentially from that commonly employed in two-revolution presses. From the cylinder-boxes rods h extend downward, as best shown in Fig. 6, and have applied to them springs h', which bear at their lower ends upon a portion b of the main side frames B′ and at their upper ends upon shoulders h^2 upon said rods h. The pair of rods upon each side of the press extend directly downward through openings in the side frame, and are secured at their lower parts in a bearing-block h^5, which supports a rock-shaft h^6, as best shown in Figs. 5 and 6. This rock-shaft h^6 is cranked downward and extends across the machine, as shown in Fig. 5 at h^7, and between each end of the rock-shaft h^6 and the adjacent fixed portion b' of the side frames are a pair of toggle-levers h^8, one of which is formed upon the rock-shaft h^6, while the other is secured in the framing. The lifting is performed by a gab-hook H upon a bar or rod H′, which is operated by a cam d upon the cam-shaft D, as shown in Figs. 1 and 2. The cam d acts upon truck-rolls d' upon the hooked bar H′, and the gab-hook engages the cranked portion h^7 of the rock-shaft h^6. By this gab-hook the rock-shaft h^6 is rocked back and forth, alternately straightening and breaking down the pairs of toggle-levers h^8. When such toggle-levers are broken down, as shown by dotted lines in Fig. 3 and in full outlines in Fig. 6, the springs h', by their force exerted upon the rods h, lift the cylinder-boxes a sufficiently to carry the wheel c' entirely out of the bed-rack c; but when the toggle-levers h^8 are straightened or brought into line the force of said springs h' is overcome and the cylinder-boxes a are drawn down and held solidly down against stops, consisting of screws h^9, inserted in the bottom of the slideways a', to which the cylinder-boxes a are fitted.

When the cylinder-boxes a are drawn down, as just above described, it is desirable to lock them still more securely in their lowermost position, and to this end I apply to each cylinder-box a a lock consisting of toggle-levers i, jointed together and having a fixed joint i' upon the cylinder-frame B, and a movable joint j upon the adjacent box a, as best shown in Fig. 6. In front of the cylinder is a rock-shaft j', which extends across between the cylinder-frames B, and this rock-shaft has arms j^2, which are each connected by a rod j^3 with an arm j^4, extending from the fixed joint i' of the pair of toggles on each side of the machine. To one of the arms j^2 on the shaft j' is connected a rod j^5, which extends downward and has a truck-roll j^6, upon which acts a cam j^7, fixed upon a longitudinal shaft J, as best shown in Figs. 3 and 4. At the same instant that the rock-shaft h^6 straightens or brings into line the toggle-levers h^8, and thus brings down the cylinder-boxes a, the rod j^5 is drawn down by the cam j^7, and by the downward pull upon the rods j^3 the pairs of toggles i, which are applied to said cylinder-boxes a, are straightened and the boxes are held solidly down upon the stops h^9.

I will now describe the operation of printing. In the position of the parts shown in Figs. 1, 3, 4, 5, and 6 of the drawings the cylinder is raised out of gear from the bed-rack c and supposed to be at rest in the position in which it has just taken a sheet, and the bed is still continuing its return movement to the right—that is to say, in a direction the reverse of that in which it moves to print the sheet. The starting-lever E is in its central position, with its sector in gear with the sector e^4 e^{4*} of the cylinder at the point where their respective concentric and eccentric portions meet, and the cams E^3 E^4, by their rotation in the direction of the arrows shown in Fig. 3, are just about to move the starting-lever to the left and cause the concentric portions of the said sectors to move the cylinder forward in the direction of the arrow shown near it in Figs. 1 and 3, and the said movement increases gradually in speed by reason of the form of the cams. The speed to which the cylinder is thus brought depends on the form of the cams; but with such cams as are shown it will be about one-fourth the speed of the bed. Up to this time the eccentric sectors F^6 F^7 (shown in Figs. 1 and 7) are out of gear with each other; but they come into gear at their points 13 14, as shown in Fig. 7, just as the starting-lever is passing out of gear with its corresponding toothed sector on the cylinder. The radii of the pitch-lines of the sectors F^6 F^7 at the points 13 14 is, as hereinbefore described, such that the velocity of the movement then imparted to the cylinder through said sectors will also be one-quarter that of the printing speed, so that it corresponds with the velocity imparted through the starting-lever at the time the latter passes out of gear. After the sectors F^6 F^7 have become engaged the sector F^6 drives the cylinder at a constantly-increasing velocity till

the end 22 of the concentric sector F^5 comes into gear with the gear-wheel F^4 and brings the cylinder to the same surface speed as the movement of the bed, and its rotation at this speed is continued by the gear F^4 and concentric sector F^5. The cylinder having now been depressed by the action of the toggle-levers h^8 and locked down by the locks i, produced as hereinbefore described, and the movement of the bed having been reversed, the cylinder-gear c' then runs into gear with the bed-rack without shock or jar, and during the movement of the cylinder thus produced the printing takes place. After the cylinder has made somewhat more than a complete revolution in gear with the bed and the printing has been completed, the toggles h^8 are bent, and the cylinder is lifted to carry its gear c' out of gear with the bed-rack; but before this lifting takes place the starting-lever, which had been previously thrown over to the right beyond the cylinder, moves to the left, as indicated by the arrow in Fig. 8, and just as the cylinder is lifted completely out of gear with the bed-rack the said lever brings its sector into gear with the corresponding sector of the cylinder at the points e^{3*} e^{4*}, the lever-sector then moving in the same direction with the cylinder. The cylinder has up to this time been moving with a surface velocity equal to that of the bed; but the end e^{4*} of the cylinder-sector, being about half-way between the center and the surface of the cylinder, will have about half the velocity of the surface of the cylinder. Therefore the end e^3 of the starting-lever sector will have to move at about half the velocity of the surface of the cylinder in order to engage with the end e^{4*} of the cylinder-sector. Then as the cylinder and the starting-lever move to the positions shown in Figs. 1 and 3 the starting-lever can be holding back on the cylinder to bring the latter to rest in the last-mentioned position in which the lever stops. The stoppage of the cylinder may be assisted by a friction-brake, as in ordinary stop-cylinder presses.

It may be here stated that while in carrying out this invention I prefer to make the toothed sector on the starting-lever and the corresponding one on the cylinder with their pitch-lines of irregular or compound curvature, as herein described, the said sectors might have their curvatures regular or concentric, as in other stop-cylinder presses.

It will be obvious that in applying my invention to a stop-cylinder press in which the cylinder makes but one revolution to each complete movement of the bed back and forth and for each printing the lift and locking mechanism for the cylinder would be omitted.

I do not intend to claim herein, broadly, 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. Neither do I intend to claim herein, broadly, the combination, in a printing-machine, of a form-carrier and 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 said motion to the cylinder and for arresting its motion. Neither do I claim herein, broadly, the combination, in a printing-machine, 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 a cam-actuated starting-lever whereby the cylinder is slowed down after it has been so lifted while the bed is returning and is started forward to come again into gear with the bed-rack at its next direct movement; nor do I claim herein such combination of cylinder, bed, starting-lever, and lift mechanism when so organized that during each movement of the bed back and forth the cylinder is caused to make two revolutions to print and deliver the sheet and remains at rest to take a new sheet. Neither do I intend to claim herein the combination, with the 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 said cylinder and gearing for arresting the movement of the bed. Neither do I claim herein the combination, with the bed and cylinder of a printing-machine, of a starting-lever, a bar through which motion is imparted to the said lever, and a cam-shaft and two engaging cam-shaped gear-wheels, one upon the said shaft and the other pivoted upon said bar; nor do I claim the combination, with such bed, cylinder, starting-lever, bar, cam-shaft, and gear-wheels, of a resistance device applied to said bar for maintaining said cams in engagement, the above-specified combinations being all described in my application for Letters Patent No. 242,333, filed July 23, 1887, and hereby reserved as part of the subject-matter of that application.

What I claim as my invention is—

1. The combination, with the main shaft and impression-cylinder, the bed having a rack for gearing with and driving the cylinder during printing, and a cam-actuated starting-lever for starting and stopping the cylinder, of eccentric gearing between and geared with the main shaft and cylinder for driving the latter at a gradually-increasing speed after it has been started by the starting-lever, substantially as herein described.

2. The combination, with the main shaft and impression-cylinder, the bed having a rack for gearing with and driving the cylinder during printing, and lift mechanism for raising the cylinder after printing, of eccentric gearing between and geared with the main

shaft and cylinder for driving the latter at a gradually-increasing speed while out of gear with the bed, and a cam-actuated starting-lever for starting and stopping the cylinder, substantially as herein set forth.

3. The combination, with the main shaft and the impression-cylinder, of the concentric sector F^5, fast to the cylinder, a gear-wheel for gearing with said sector and geared with the main shaft to drive the cylinder at printing speed, and two eccentric sectors, one fast to the cylinder and the other carried by said gear-wheel for the purpose of driving the cylinder at a gradually-accelerated velocity, substantially as and for the purpose herein set forth.

4. The combination, with the impression-cylinder and its journal-boxes, and mechanism, substantially as herein described, for raising and depressing said boxes, of locking devices consisting of toggle-levers applied directly to said boxes independently of the said raising and depressing mechanism for holding the cylinder down during printing, substantially as herein set forth.

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Witnesses:
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