No. 622,125. Patented Mar. 28, 1899.

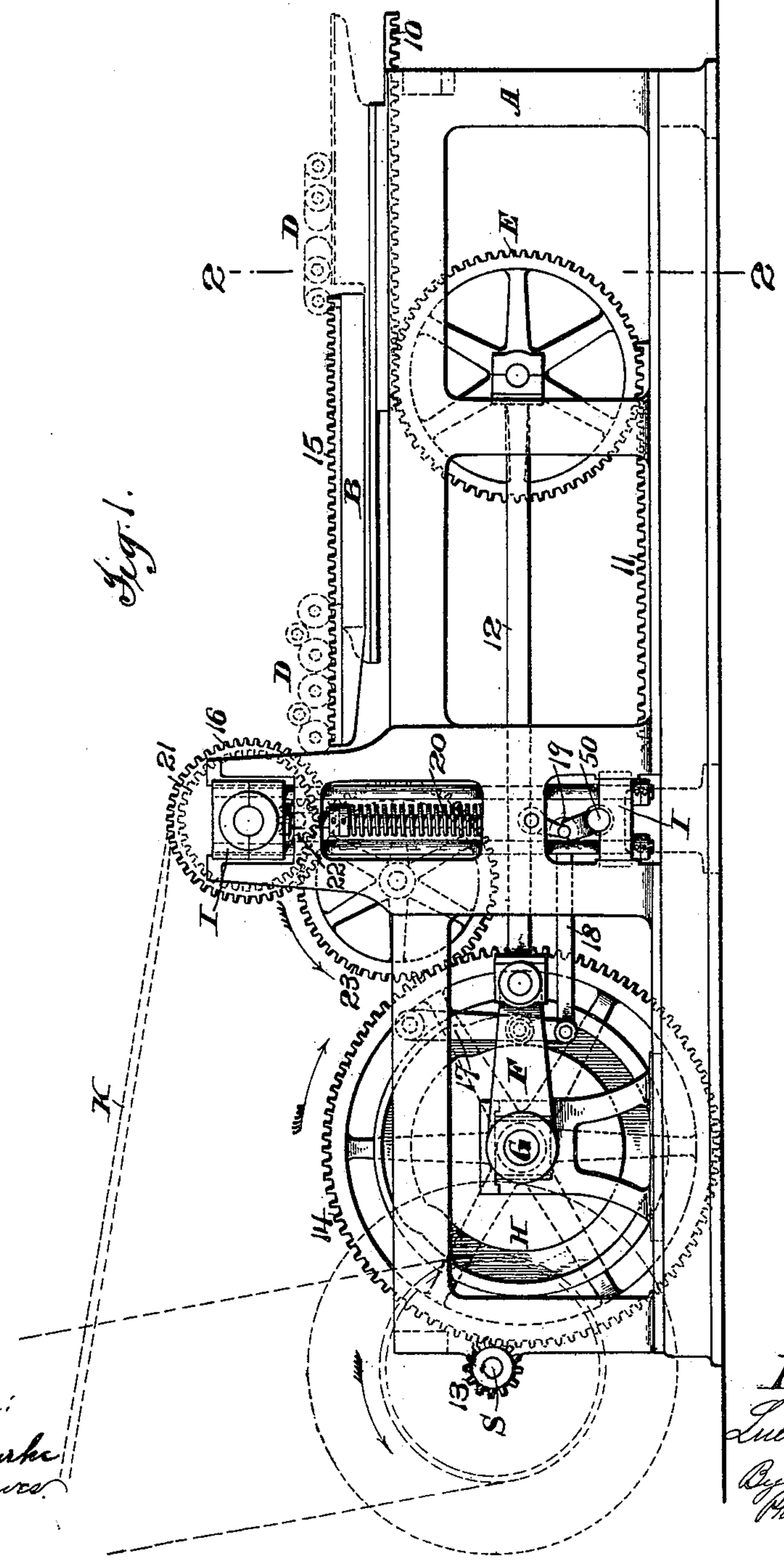
L. C. CROWELL.

BED AND CYLINDER PRINTING MACHINE.

(Application filed June 8, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

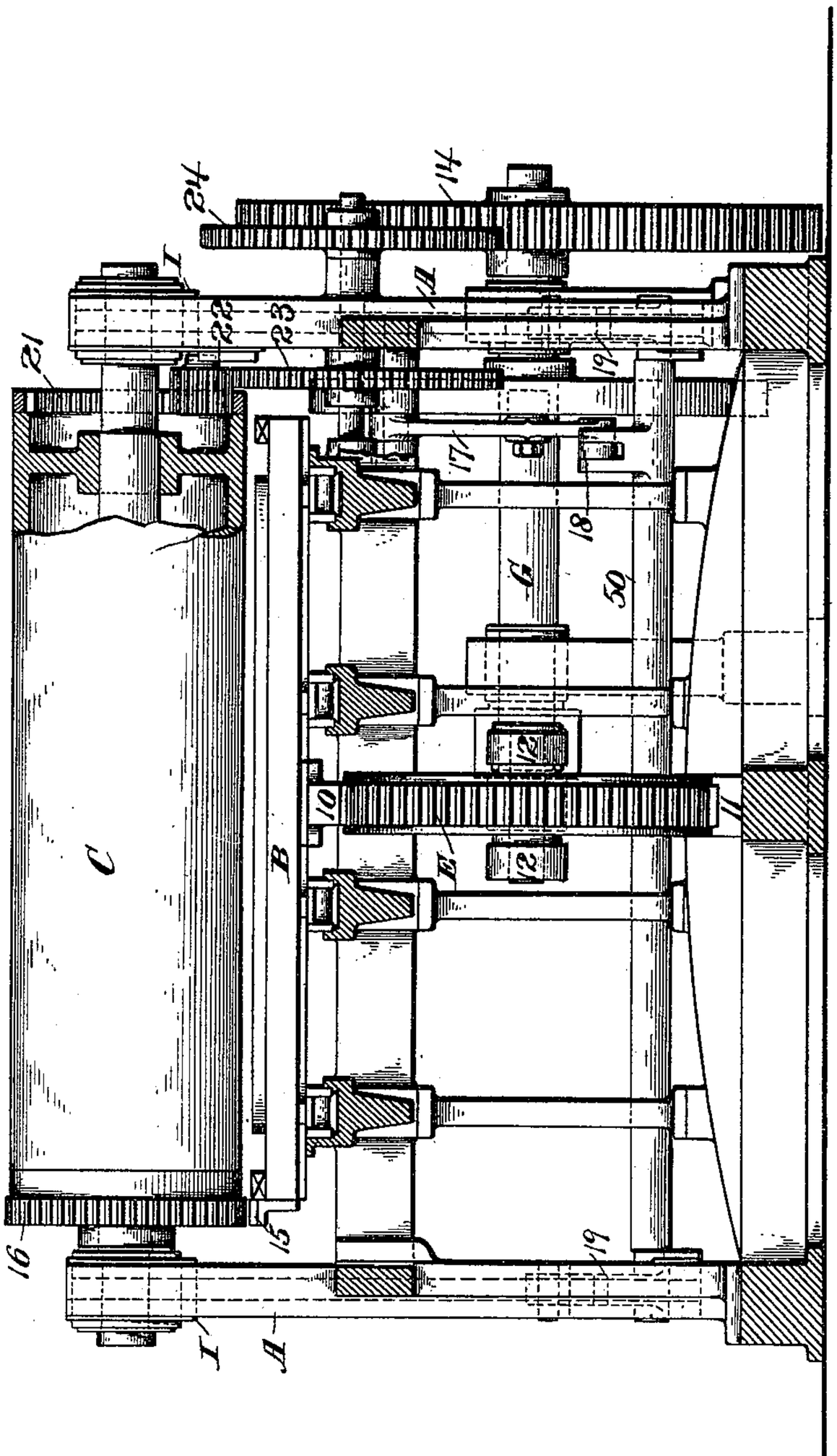

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

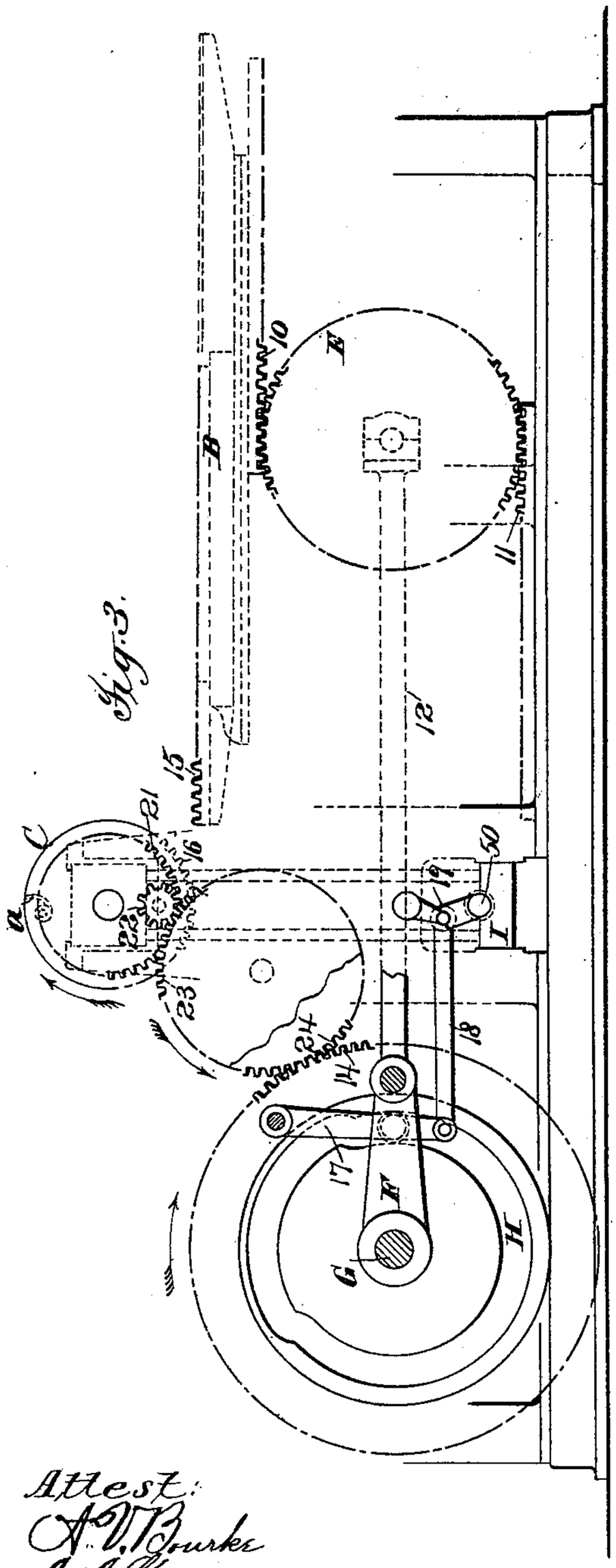
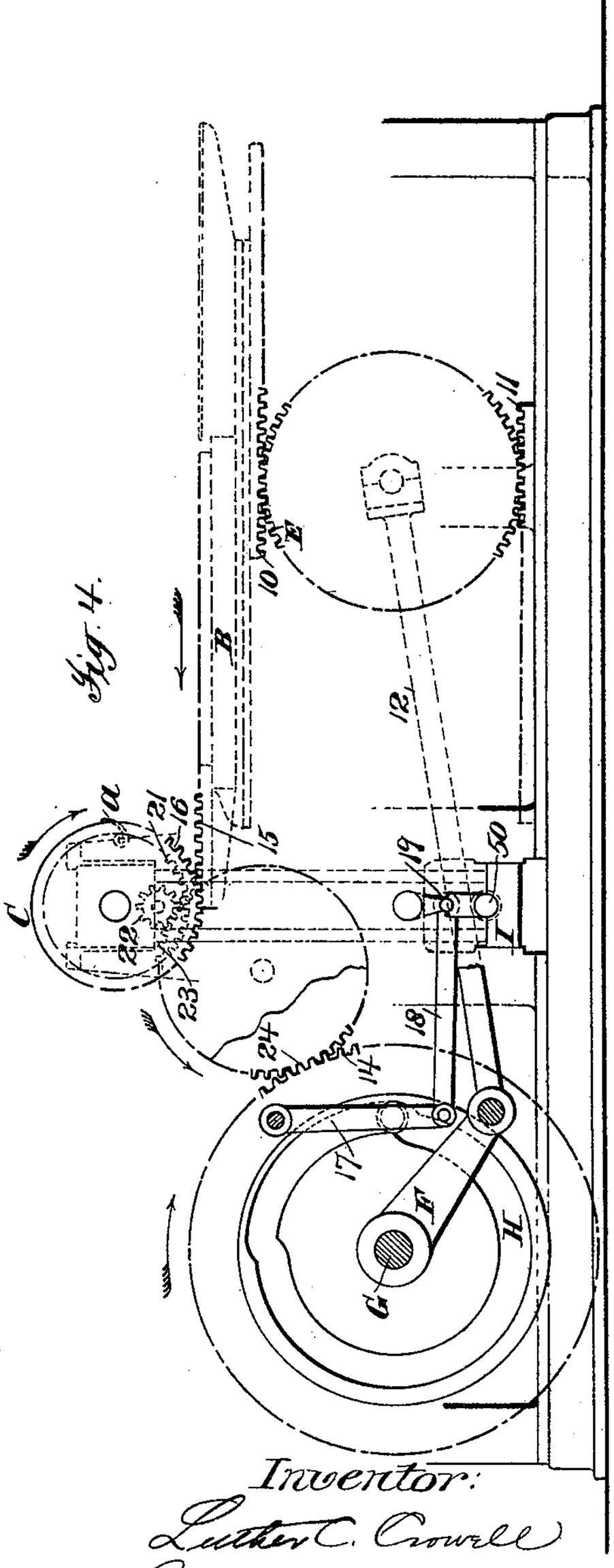


Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

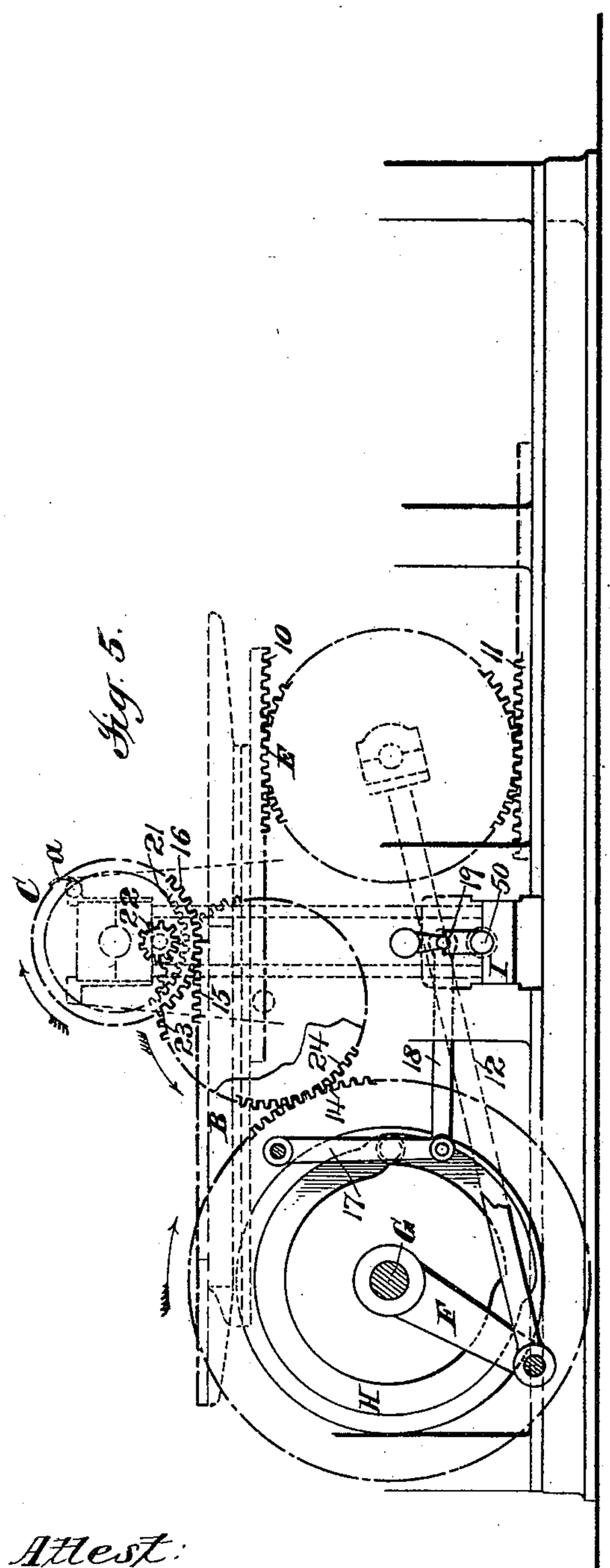

Fig. 5.

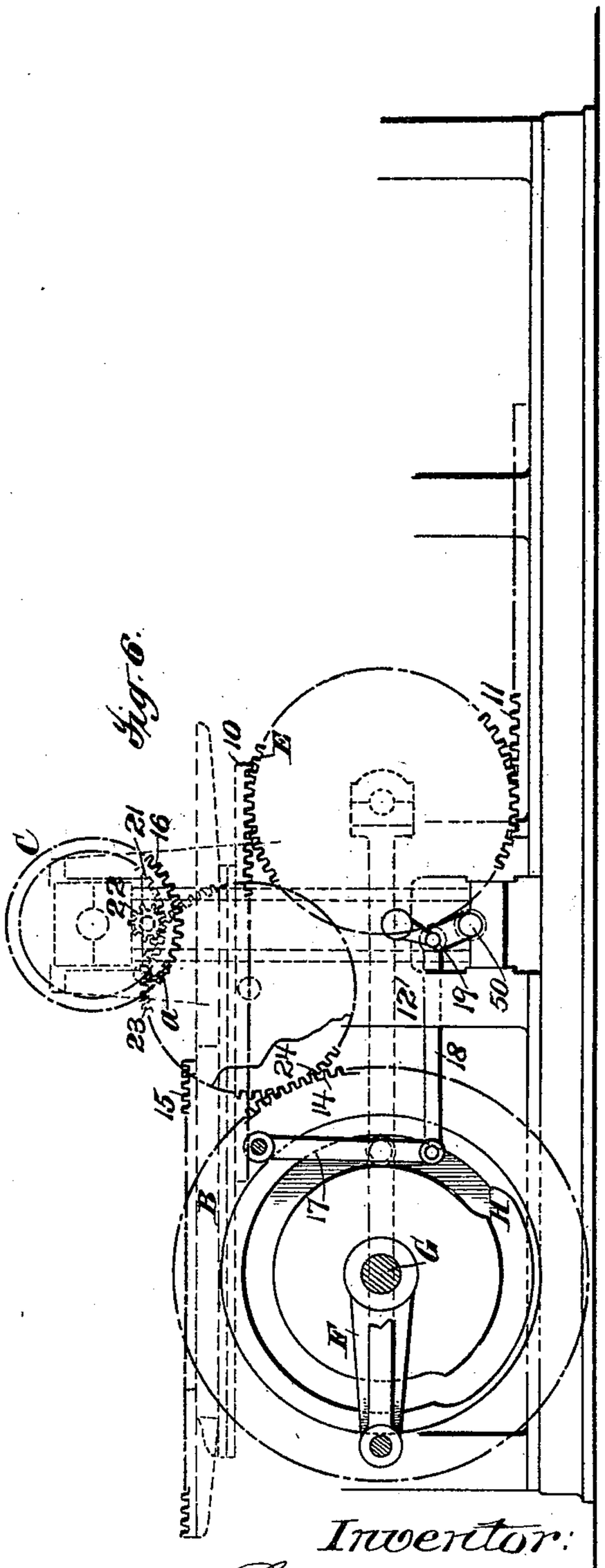

Fig. 6.

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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF NEW YORK, N. Y., ASSIGNOR TO ROBERT HOE, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF SAME PLACE.

BED-AND-CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 622,125, dated March 28, 1899.

Application filed June 8, 1897. Serial No. 639,816. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at New York, (Brooklyn,) county of Kings, and State of New York, have invented certain new and useful Improvements in Bed-and-Cylinder Printing-Presses, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to bed-and-cylinder printing-presses of those classes in which a reciprocating bed is used in combination with one or more continuously-rotating cylinders. There are many different classes of such presses employing one or more impression-cylinders and for printing a single side of one or more sheets or for perfecting and in which the cylinder or cylinders make one or more rotations during a complete reciprocation of the bed; but in all such presses it is requisite that the cylinder shall rotate in contact with the bed and move in exact synchronism therewith during the printing operation or period of impreasion and shall rotate with its surface out of contact with the bed during another part of the movement of the cylinder, so as to allow the return of the bed without printing contact between the bed and cylinder. This contact of the cylinder with the bed during one part of its movement and lack of contact during another part is usually obtained by raising and lowering the cylinder out of and into printing contact with the bed; but it may be obtained otherwise, as by the cylinder having a depressed part that allows the bed to return without printing contact.

Many different means have been used for reciprocating the bed with the object of attaining high speed without the shock and loss of power resulting from sudden stoppage and reversal of the bed. A most simple and efficient construction for this purpose is secured by driving the bed with a movement produced by or corresponding to that of a crank, so that the speed of the bed constantly varies, being at its maximum in the middle of the stroke of the bed and during the period of impression and at its minimum at the ends of its stroke or time of reversal. In this movement the bed will momentarily stop at the point of reversal as the crank is passing the dead-center and then move at a rapidly-accelerating speed until the maximum speed is nearly reached, then at a slowly-accelerating speed to the middle of the stroke and a slowly-decreasing speed after passing that point, and then at a more rapidly-decreasing speed to the stop at the point of reversal, this operation then being repeated with the crank on the opposite side of the center and the bed moving in the opposite direction. As the speed of movement of the bed in such construction will constantly change, although much less rapidly at some parts of its movement than at others, it is obviously important that the speed of the impression-cylinder during the printing operation or period of impression shall vary also, as it must be exactly synchronous with that of the bed in order to secure perfect impressions and the accurate registry of the sheets. If the heavy cylinder be driven throughout at a variable speed corresponding to that of the bed, there is great loss of power and strain upon the press resulting from the change of speed of the cylinder from a very slow to a very rapid movement, so that such presses, if good printing results are secured, must be run at a comparatively low rate of speed and with great waste of power.

The object of the present invention is to secure in such a crank-movement construction perfect synchronism of movement of the bed and cylinder during the printing operation without undue shock or strain upon the press or the loss of power resulting from large variation in the speed of the cylinder during different parts of its movement. This result is secured by actuating the cylinder by the bed during substantially the middle part or printing movement of the bed and actuating the cylinder during the rest of its movement by a separate driving mechanism which is out of operation during the time that the bed drives the cylinder. This separate driving mechanism for the cylinder is preferably a uniform-speed driving mechanism, so that the cylinder is driven at a uniform speed during the time that it is not driven by the bed, which uniform-speed is the speed at which the bed commences and ceases to drive the

cylinder, so that there is no shock as the change in driving of the cylinder is made. The bed preferably commences and ceases to drive the cylinder as nearly as possible at the beginning and end of the printing operation consistently with securing perfect synchronism of movement throughout the entire period of impression, so that the printing operation occurs during that part of the crank movement in which the speed of the bed varies but slightly, which extends for a considerable distance on each side of its highest-speed position, and the cylinder is out of contact with the bed and driven by the separate driving mechanism during that part of the crank movement in which the speed of the bed varies largely—that is, before and after the reversal at opposite ends of its movement. This permits the cylinder to be driven at a uniform rate of speed approximating the printing speed of the bed, the printing operation occurring, as has been before said, at the time when the speed of the cylinder is varied but slightly, at which time it is driven by the bed. It is to be understood that while the separate constant-speed driving mechanism begins to drive the bed as nearly as possible at the end of the printing operation and ceases to drive it as nearly as possible at substantially the beginning of the printing operation the exact points at which the constant-speed mechanism begins and ceases driving may not necessarily coincide with the exact points at which the printing begins and ends. The constant-speed driving mechanism must necessarily have a speed which is greater than the lowest speed of the bed produced by the crank mechanism by which it is driven and less than its greatest speed. There will be two points, therefore, in the printing stroke of the bed in which the two speeds coincide, and it is at these points that it is desirable to transfer the cylinder from one driving mechanism to the other. Wherever it is practicable these points will be made to correspond substantially with the beginning and ending of the printing operation; but constructions in which the cylinder is transferred from one driving mechanism to the other at points which do not coincide with the beginning and ending of the printing operation are within this invention, provided they employ a cylinder which rotates continuously in the same direction, the cylinder being driven part of the time by variable-speed mechanism and part of the time by constant-speed mechanism which has a speed which is greater than the lowest speed of the bed under the influence of the variable-speed mechanism and less than its greatest speed, the transfer from one driving mechanism to another being made at approximately the times when the two speeds coincide, the transfer being accomplished through devices which are made effective by the raising and lowering mechanism. While, however, it is preferable that the cylinder shall be driven by the separate driving mechanism at a uniform speed when not driven by the bed, and such a construction forms a part of the invention, as claimed, the invention, broadly considered, is not limited to such a movement, but includes also features of construction and combinations of parts in constructions in which the cylinder is not thus driven.

The invention is applicable generally to bed-and-cylinder printing-presses of all classes employing a continuously-rotating cylinder; but for simplicity of illustration and description it will be shown and described as applied in connection with what is known as a "two-revolution single-cylinder" press, in which the cylinder makes one rotation and prints during the movement of the bed in one direction and makes another rotation without printing during the return of the bed. From this illustration and description the application of the invention to printing-presses of other classes will be readily understood.

In the accompanying drawings, forming a part of this specification and showing the invention applied in its preferred form to a two-revolution single-cylinder press, Figure 1 is a diagrammatic side elevation of the press. Fig. 2 is a section on the line 2 of Fig. 1 with the cylinder partly broken away to show the driving-pinion. Figs. 3, 4, 5, and 6 are diagrammatic views similar to Fig. 1, showing the parts of the press in different positions during a complete movement of the bed in one direction.

Referring to said drawings, A is the frame of the press; B, the reciprocating type-bed; C, the impression-cylinder; D, the inking mechanism; E, the traveling gear, engaging the rack 10 on the bed and the stationary rack 11 on the frame; F, the crank, driving traveling gear E through connecting-rod 12, and G the crank-shaft, driven from the main driving-shaft S by pinion 13 and gear 14, the bed B, carrying the rack 15, meshing with gear 16 on the end of the cylinder C for driving the cylinder by the bed. In the construction shown the cylinder is raised and lowered to move it out of and into printing contact with the bed, and this movement may be obtained by any common or suitable means. As shown, the crank-shaft G carries a cam-disk H, in which runs a bowl on a lever 17, connected by a link 18 to a crank-arm on a rock-shaft 50, having the usual toggle-joints 19 at opposite ends, one arm of the toggle-joints being on the shaft and the other on the press-frame, the shaft 50 being mounted in the vertically-sliding cylinder-frame I, in which the cylinder is mounted. The straightening of the toggle-joints by the rocking of shaft 50 lowers the frame and cylinder for printing contact of the cylinder and bed, and the frame I and cylinder C are raised again by springs 20, when the toggles 19 are broken by the rocking of the shaft. The impression-cylinder C has the usual grippers *a*, to which sheets are fed over the feeding-board K.

All the parts above described may be of any common or suitable construction, so arranged as to secure the desired variable-speed movement of the bed, with the bed moving some distance before and after the printing operation and the cylinder thrown into and out of mesh with the bed as nearly as practicable at the commencement and end of the printing operation and while the bed is moving at a comparatively high rate of speed.

When the cylinder is raised so that its surface is out of contact with the form on the type-bed after the printing operation and during the time that it is not driven by the bed, the cylinder is driven by a separate driving mechanism which is inoperative to actuate the cylinder during the time that the cylinder is driven by the bed, the cylinder being driven, preferably, at a uniform rate of speed corresponding to the speed of the bed at the time when the bed commences and ceases to drive the cylinder. For this purpose any suitable mechanism may be used and arranged in any desired manner so as to secure the operation of the mechanism upon the cylinder at the desired time and its inoperativeness at other times. In this form of the invention the separate driving mechanism consists of gears 23 24, mounted on a suitably-located shaft which has its bearings in the frame of the machine, the gear 24 being constantly in mesh with the gear 14 on the crank-shaft G. These gears are so proportioned that when they are connected to the cylinder by the devices hereinafter described or by other suitable means they will cause the cylinder after it has ceased to be driven by the bed to be driven at a constant speed which will approximate the lowest speed which the bed had when the cylinder was transferred. The devices employed in this embodiment of the invention to connect the driving mechanism referred to with the cylinder consist of an internal gear 21, carried on the cylinder, and a pinion 22, this pinion 22, as hereinafter shown, being a broad-faced pinion and so located that one of its ends is in mesh with the gear 23 of the constant-speed driving mechanism before referred to. Its other end when the constant-speed mechanism is to drive the cylinder will be in mesh with the internal gear 21, carried by the cylinder. These intermediate devices for connecting the constant-speed driving mechanism to the cylinder are rendered operative by the raising and lowering devices which have been heretofore described. When the continuously-rotating cylinder is raised by the raising and lowering devices, the gear 21 is brought into mesh with the pinion 22, and it is obvious that the rotation of the cylinder will then be continued by the constant-speed mechanism and at the speed which the cylinder had when it was released from the bed.

The operation of the construction will be readily understood from the drawings and a brief description, referring especially to Figs. 3 to 6. As shown in Fig. 3, which corresponds in position of parts to Fig. 1, the bed is at the end of its movement to the right and is just about to be reversed and move to the left for the printing movement, and the cylinder C is in position for its grippers *a* to take a sheet from the feed-board K. As the operation proceeds from this position the crank F moves from its horizontal toward its vertical position, actuating the bed through the railroad-gear movement shown, and on account of the movement of the crank the speed of the bed is accelerated rapidly during the first part of the crank movement, during which time the bed moves out of contact with the cylinder, which is raised above the bed by the springs 20, and the cylinder is driven from the constant-speed mechanism which is connected by the intermediate connecting devices before described—namely, the gear 21 and the pinion 22, which are then in mesh. When the parts reach the position shown in Fig. 4, at which time the speed of the bed under the driving action of the crank mechanism is substantially equal to or approximates the speed of the cylinder, which is being operated, of course, by the constant-speed mechanism, the cam H actuates the shaft 50 through the lever 17 and link 18, so as to straighten the toggles 19, and thus force the cylinder-frame I and cylinder downward. This operation brings the cylinder-gear 16 into mesh with the bed-rack 15, so that the cylinder is therefore driven by the bed and at the same time releases the cylinder from the constant-speed mechanism by causing the intermediate connections—namely, the internal gear 21 and pinion 22—to pass out of mesh. From this point the bed continues its movement through the printing operation, driving the cylinder in exact synchronism with the bed, with the cylinder held positively by the bed against movement in either direction independent of the bed by the meshing of the gear 16 and rack 15, and during this printing operation or period of impression the crank moves to its vertical position and somewhat beyond the latter, during which movement the speed of the bed and cylinder as driven by the crank varies but slightly. The position of the parts at the end of this part of the movement is shown in Fig. 5. At this point the cam H releases the lever 17 and the toggle-joints 19 are broken again by the springs 20, forcing the cylinder-frame I and cylinder C upward, so as to move the cylinder out of printing contact with the bed, gear 16 on the cylinder at the same time being moved out of mesh with the rack 15 on the bed and the internal gear 21 being again brought into mesh with the pinion 22, after which the movement of the bed to the left is completed and the bed stopped as the crank reaches the horizontal position on the opposite side of the center from that at which we started at the commencement of this description, the speed of the bed decreasing rapidly during this part

of the movement of the crank and the cylinder being driven by the pinion 22 at a constant rate of speed equal to the speed of the bed at the time when it ceased to drive the cylinder. The operation above described is now repeated during the return of the bed, except that the cam H is formed to hold the bed out of contact with the cylinder during the entire return movement of the bed, during which the cylinder C is driven by the pinion 22, and the gear 16 and rack 15 are out of mesh.

It will be understood that my invention is not to be limited to the specific class of press shown, nor to the exact form or arrangement of the driving mechanism or any of the devices illustrated as embodying my invention, but that the invention is applicable in many classes of printing-presses and that mechanism of various forms may be used for carrying it out.

What I claim is—

1. In a bed-and-cylinder printing-machine, the combination with a reciprocating bed, of means for driving it at varying speeds, a cylinder continuously rotating in the same direction, means for driving the cylinder in synchronism with the bed during a part of one stroke, a constant-speed mechanism for driving the cylinder when it is not driven in synchronism with the bed, a raising and lowering mechanism and intermediate devices between the constant-speed mechanism and the cylinder acting to connect the cylinder to and disconnect it from the constant-speed mechanism at substantially the times when the two speeds coincide, said intermediate devices being rendered effective by the raising and lowering mechanism.

2. In a bed-and-cylinder printing-machine, the combination with the reciprocating bed, of means for driving it at varying speeds, means for driving the cylinder in synchronism with the bed during the printing period, means for driving the cylinder during the non-printing period at a constant speed which is approximately equal to the printing speed, raising and lowering mechanism, and devices between the cylinder the separate driving mechanism made effective by the raising and lowering devices, whereby the cylinder may be connected to and disconnected from the constant-speed mechanism, substantially as described.

3. In a bed-and-cylinder machine, the combination with a reciprocating bed driven at varying speeds, of a cylinder continuously rotating in the same direction, means whereby the cylinder is driven by the bed during a part of one stroke, a constant-speed mechanism for driving the cylinder when it is not driven by the bed, a raising and lowering mechanism and devices intermediate the constant-speed mechanism and the cylinder for connecting the cylinder to and disconnecting it from the constant-speed mechanism, said devices acting at substantially the times when the speeds of the bed and the constant-speed mechanism coincide, and being rendered effective by the raising and lowering devices.

4. The combination with a reciprocating bed driven at a varying speed, of a cylinder continuously rotating in the same direction, said cylinder being driven by the bed during the printing operation and held by the bed against movement in either direction independently of the bed during said operation, mechanism for rotating the cylinder at a constant speed, raising and lowering devices, and devices intermediate the bed and the cylinder made effective by the raising and lowering devices to connect the cylinder to and disconnect it from the constant-speed mechanism, substantially as described.

5. The combination with a reciprocating bed driven at varying speeds, of a continuously-rotating cylinder, means whereby it is driven from the bed during the printing period, means for driving the cylinder at a constant speed when it is not driven by the bed, means for raising and lowering the cylinder, and means brought into operation by the raising and lowering mechanism for connecting the cylinder to the constant-speed mechanism.

6. The combination with a reciprocating bed driven at a varying speed, of a cylinder continuously rotating in the same direction, said cylinder being driven by the bed substantially during the printing operation and disconnected therefrom during the rest of its movement, mechanism for rotating the cylinder when disconnected from the bed at a constant speed which is approximately that which the cylinder had under the influence of the bed at the beginning and end of the printing operation, raising and lowering devices, and devices intermediate the cylinder and the constant-speed mechanism made effective by the raising and lowering devices, substantially as described.

7. The combination with a reciprocating bed, of a crank-movement for driving the bed at a varying speed, a continuously-rotating cylinder driven from the bed during the printing operation and disconnected therefrom during the rest of its movement, said bed and cylinder being arranged with the printing operation occurring during that part of the movement of the bed in which the speed varies but slightly, a constant-speed mechanism for rotating the cylinder when disconnected from the bed, raising and lowering devices, and devices intermediate the cylinder and the constant-speed mechanism for connecting the cylinder to said mechanism made effective by the raising and lowering devices, substantially as described.

8. The combination with a reciprocating bed driven at a varying speed and carrying a rack, of a cylinder continuously rotating in the same direction and carrying a gear engaging said rack during a part of the movement of the bed, mechanism for rotating the cylinder independently of the bed and at a

constant speed when the gear is out of engagement with the rack, raising and lowering devices, and devices intermediate the cylinder and the constant-speed mechanism for connecting the cylinder to and disconnecting it from the constant-speed mechanism made effective by the raising and lowering devices, substantially as described.

9. The combination with a reciprocating bed driven at a varying speed and carrying a rack, a cylinder continuously rotating in the same direction, and carrying a gear that engages with the rack when the cylinder is in printing position, mechanism for rotating the cylinder at a constant speed when the gear and rack are disengaged, devices intermediate the cylinder and the constant-speed mechanism consisting of an internal gear on the cylinder and a pinion which meshes therewith and with the constant-speed mechanism, and raising and lowering devices, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
NATHANIEL ATWOOD,
G. R. STEDMAN.