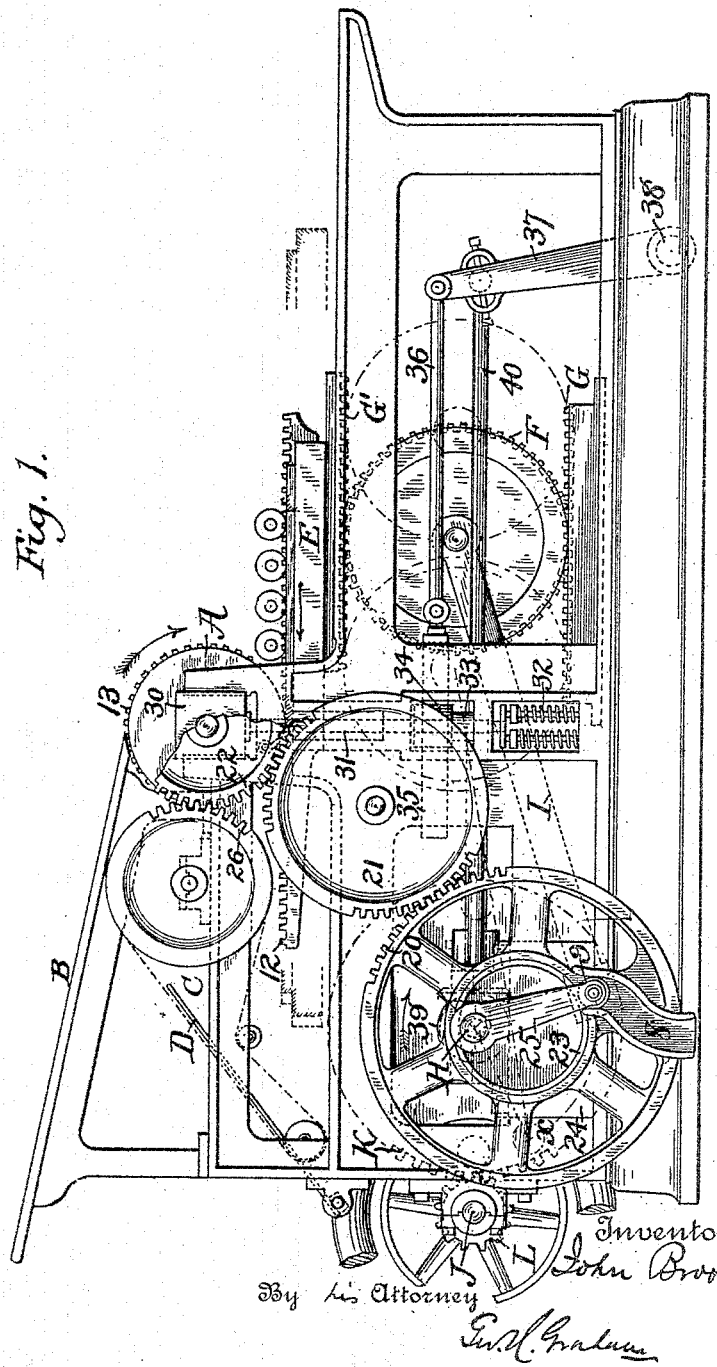
(No Model.) 7 Sheets—Sheet 1.

# J. BROOKS.

## BED AND CYLINDER PRINTING MACHINE.

No. 491,334. Patented Feb. 7, 1893.

Fig. 1.

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(No Model.) 7 Sheets—Sheet 2.

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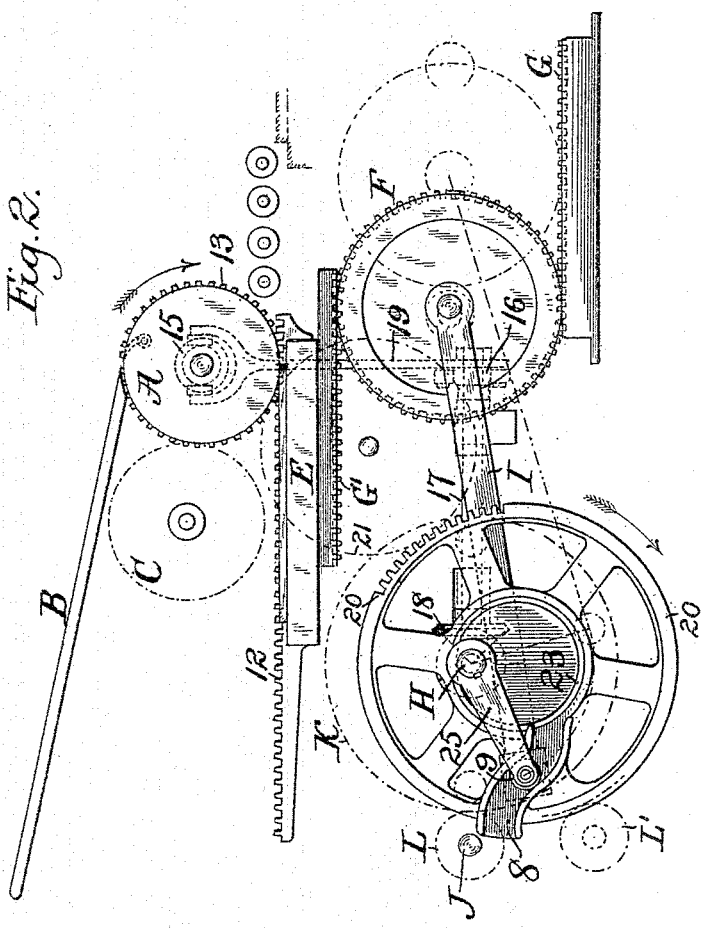
## BED AND CYLINDER PRINTING MACHINE.

No. 491,334. Patented Feb. 7, 1893.

Fig. 2.

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(No Model.) 7 Sheets—Sheet 3.

# J. BROOKS.

## BED AND CYLINDER PRINTING MACHINE.

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Fig. 3.

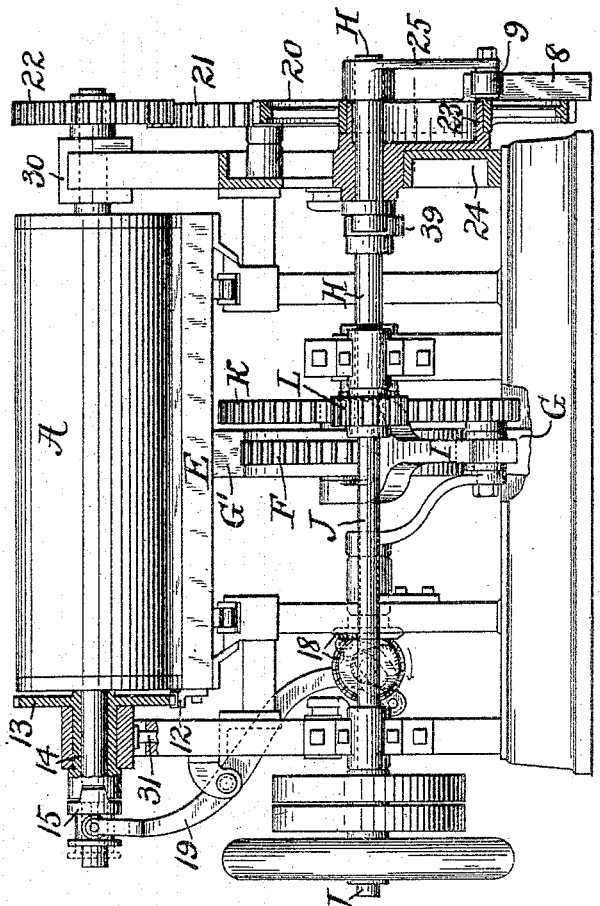
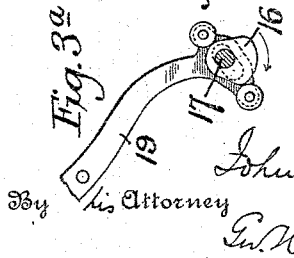



Fig. 3a.

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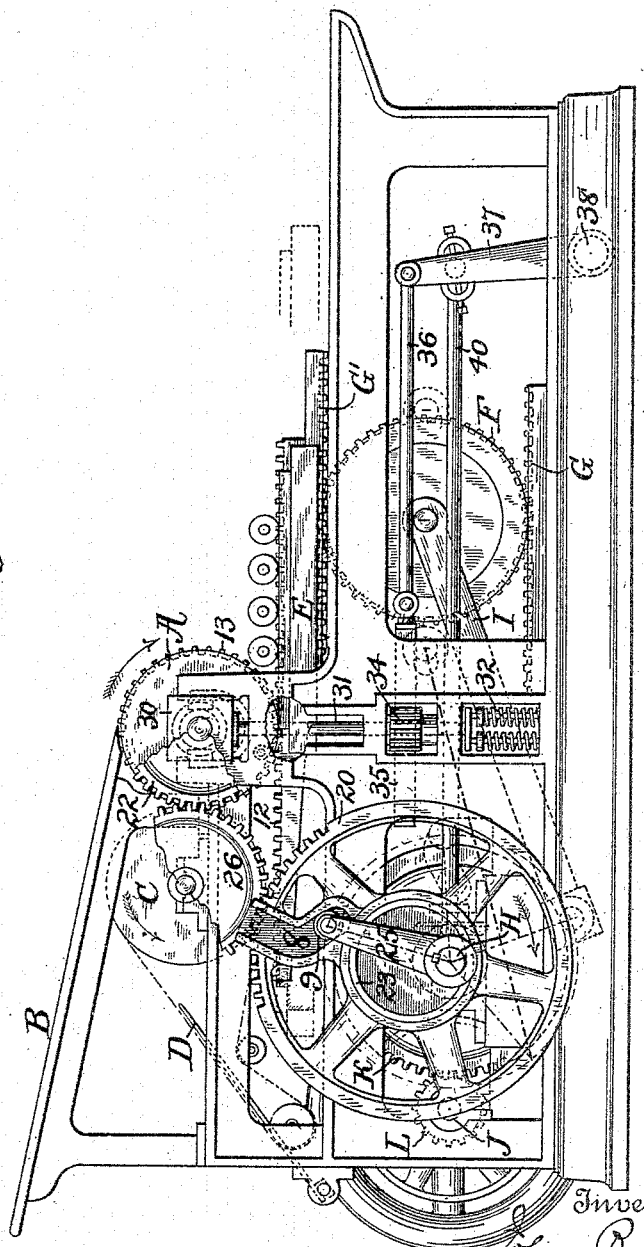
(No Model.) 7 Sheets—Sheet 4.

# J. BROOKS.

## BED AND CYLINDER PRINTING MACHINE.

No. 491,334. Patented Feb. 7, 1893.

Fig. 4.

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(No Model.) 7 Sheets—Sheet 5.

# J. BROOKS.

## BED AND CYLINDER PRINTING MACHINE.

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Fig. 6.

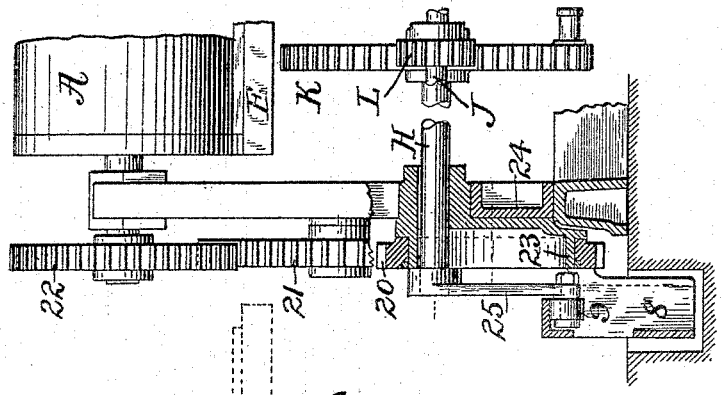
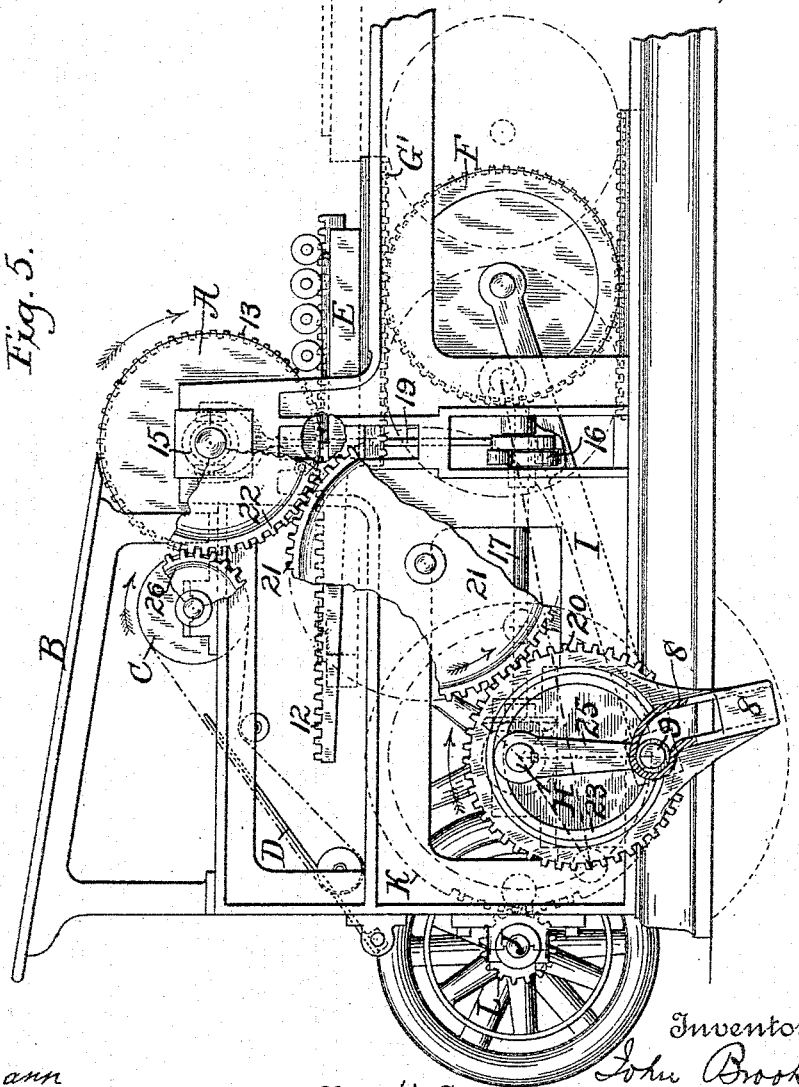



Fig. 5.

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(No Model.) 7 Sheets—Sheet 6.

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## BED AND CYLINDER PRINTING MACHINE.

No. 491,334. Patented Feb. 7, 1893.

Fig. 8.

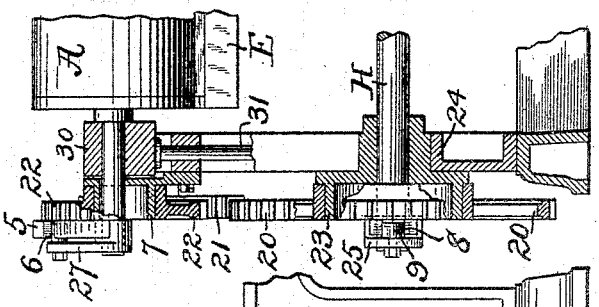
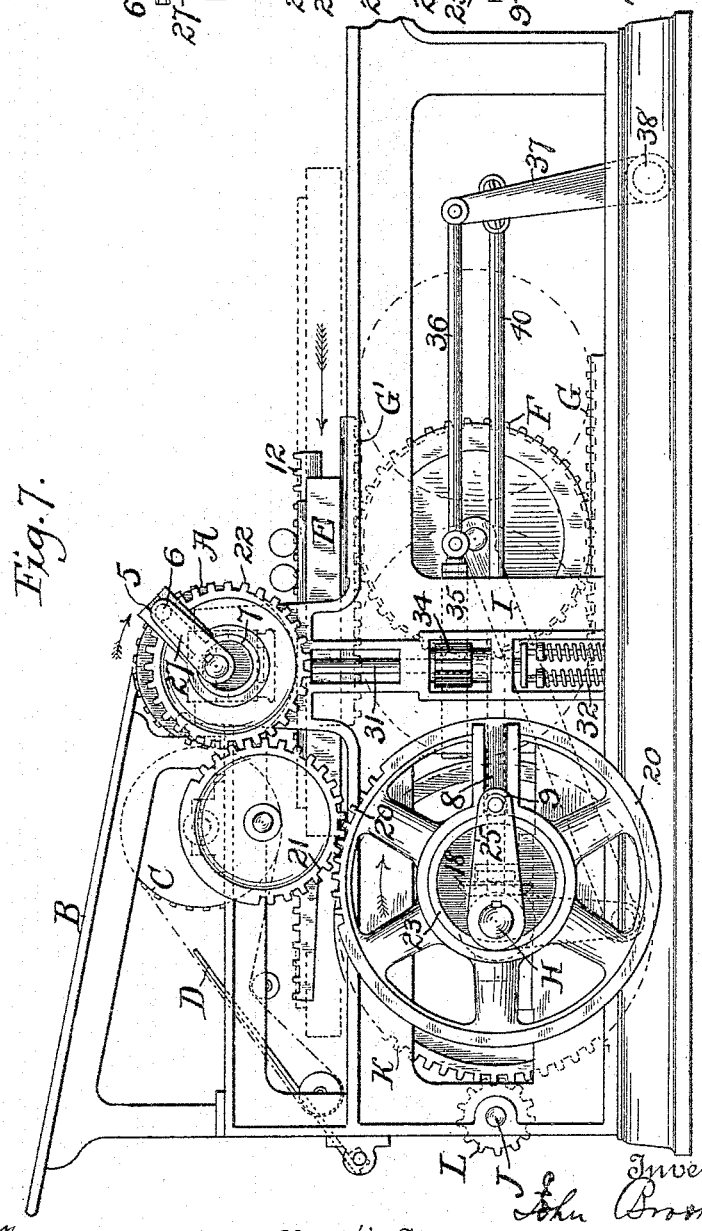



Fig. 7.

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(No Model.) 7 Sheets—Sheet 7.

# J. BROOKS.

## BED AND CYLINDER PRINTING MACHINE.

No. 491,334. Patented Feb. 7, 1893.

Fig. 10.

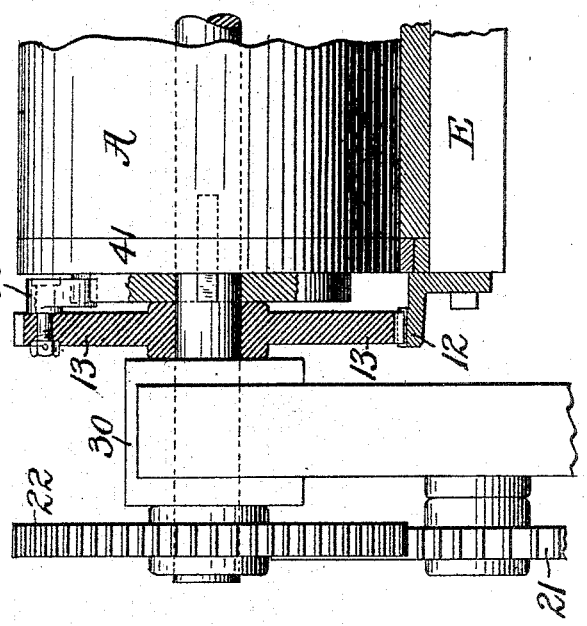
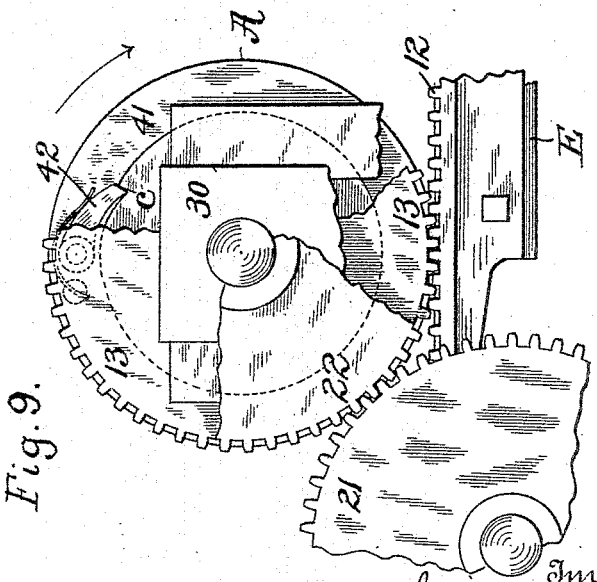



Fig. 9.

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# UNITED STATES PATENT OFFICE.

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## BED AND CYLINDER PRINTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 491,334, dated February 7, 1893.

Application filed December 31, 1891. Serial No. 416,652. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN BROOKS, of the city of Plainfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Bed and Cylinder Printing-Machines, fully set forth in the following description and represented in the accompanying drawings.

This invention relates generally to bed and cylinder printing machines, and more particularly to the means for operating and controlling the motion of certain parts of such machines.

It has for its object, among other things, to provide means whereby the impression cylinder and bed are caused to travel with the same surface speed during the time of impression and to otherwise control the movement of the cylinder so that efficient work and accurate register of the sheets are produced.

As a better understanding of the invention and its scope may be had from a detailed description of a practical embodiment thereof, such description will now be given, reference being had to the accompanying drawings.

In said drawings:—Figure 1, is a side elevation of a cylinder printing machine provided with the invention. Fig. 2, is a diagram of a similar machine showing a changed position of the parts. Fig. 3, is an end elevation partially in section of the machine shown in Fig. 1; and Fig. 3ª is a detached view of a cam and connections. Fig. 4, is a view similar to Fig. 1, a slightly modified form of the invention. Fig. 5, is a similar view of the invention applied to a single revolution cylinder machine; and Fig. 6, is a partial sectional elevation of the same. Fig. 7, is a similar view to Fig. 1, of another modified form of the invention; and Fig. 8, is a partial cross section of the same. Figs. 9 and 10 are respectively a partial side elevation and cross section of a modified form of the connection between the impression cylinder and bed.

In the several different embodiments of the invention, only such devices and details of well known forms of printing machines are represented as will aid a proper understanding of its function and operation. In each of these embodiments, the machine frame supports the usual impression cylinder A having grippers which take the sheets from the feed board B or other source of supply and after printing, as one mode of delivery, deliver them to the delivery cylinder C and from thence taken by tapes down in front of a fly D to be piled. With the impression cylinder there co-operates a reciprocating form bed E moved by a traveling gear F, which in turn is operated in the usual manner by the fixed rack G, the rack G′ on the under side of the bed, and the revolving crank shaft H through the connecting rod I. The crank shaft is rotated at proper speed in any proper manner, as from the driving shaft J through a gear wheel K fast to the crank shaft in mesh with the driving pinion L. The construction and arrangement of the parts thus far described may be of any of the usual and common forms and will be varied according as the style of the machine may vary. Other means of supplying sheets to the impression cylinder and for delivering them either flat or folded may be employed without effecting the improvements now to be described.

It will be understood that during the rotation of the crank shaft, the speed of the traveling gear F and hence that of the form bed will gradually change from its maximum to its minimum, then they will momentarily stop in the reversal of their direction of movement as the crank is passing the dead center, then move at its minimum speed gradually accelerating until the maximum speed is reached again, and so on during each reciprocation of the bed, and traveling gear. From which it will be seen that the speed of movement of the form bed will constantly change, so that it is important that the speed of the impression cylinder during the taking of the impression shall exactly correspond with that of the bed in order to obtain proper working, accurate register of the sheet and perfect impressions.

The present improvements consist essentially in the combination with the impression cylinder A, the form bed E, and the driving

crank shaft H, of connections between said crank shaft and the cylinder whereby during the taking of the impression the cylinder will have the same surface speed and move in unison with the form bed; or, in other words, whereby the crank movement of the bed is produced in the cylinder so that a constant movement of both the bed and cylinder during the impression at an irregular speed in unison is effected. These connections, broadly speaking, are such as to transmit a rotation or rotations to the impression cylinder in counterpart of that imparted to the form bed by the crank shaft, so that the same variation in speed of the bed may be duplicated in the speed of that cylinder, and so long as this is accomplished, it is immaterial whether the motion be taken from the crank shaft *per se* or from other moving part of the printing machine, as will hereinafter appear. In the present embodiments of the invention, the crank shaft is, however, utilized because it is not only preferable in practice to do so, but it obviates the necessity of providing additional devices; and the connections with the cylinder may consist wholly of gearing or partially of gearing with coacting devices.

Referring now to Figs. 1, 2 and 3, the invention is shown combined with a two revolution cylinder machine, the impression cylinder making two complete revolutions—it might be more according to the diameter of the cylinder and the gearing—to each revolution of the crank shaft and hence to each complete reciprocation of the form bed,—once forward and return. During the first revolution of the impression cylinder it may be supposed that the impression is taken in which case the grippers will have seized a sheet and in the rotation of the cylinder will carry it in contact with the form bed then moving in the same direction, the cylinder then being in what is termed its plane of impression; and as soon as the end of the sheet has left the bed and during the return or idle reciprocation of the form bed, the impression cylinder will have been raised out of its plane of impression and when in this position and during such return movement will make its second revolution, which is consequently an idle one. The timely lifting and lowering of the impression cylinder may be effected in any of the usual ways, that taken for illustration being substantially the same as that set forth in Letters Patent No. 274,558, granted to me, and consists in mounting the boxes 30 supporting the journals of the cylinder shaft so as to slide vertically in guideways in the frame work. Each box is seated on the end of a vertical rod 31, the lower end of which is in turn seated upon a pair of springs 32 and just above this end the rod is screw threaded and engaged by a nut 33 confined in an opening in the framework and bears a pinion 34. This pinion is engaged by a rack bar 35 that is connected by a link 36 with the upper end of a vibrating arm 37; and the arm is connected with a cross rock shaft 38, which at the opposite side of the frame bears a similar vibrating arm for operating in unison a duplicate of the raising and lowering devices on that side of the machine. The vibrating arm 37 is moved from a cam 39, see Fig. 3, on the crank shaft H by a connecting rod 40, one end connected with the vibrating arm and the other end slotted to embrace the crank shaft with rolls bearing against the cam as is usual in such constructions. The connections between the crank shaft H and the impression cylinder in this embodiment consist of the toothed wheel 20, intermediate toothed wheel 21, and toothed wheel 22. The latter wheel is fast to the cylinder shaft; the intermediate rotates on a stud projecting from the framework, and the wheel 20 rotates loosely on a hub 23 secured to and projecting outwardly from one of the crank shaft bearings 24. The hub is represented as a flange arranged eccentric to the axis of the crank shaft and hence supports the toothed wheel 20 in a like position with respect thereto. The end of the crank shaft projects through its bearings 24 and the hub 23 and carries at its outer end and fast thereto a driving arm 25 that bears a roll 9 engaging a co-operating guideway or slot 8 formed in or carried by the toothed wheel 20. The effect of these connections during the rotations of the crank shaft is to impart through the arm 25 rotations to the toothed wheel 20 and thence by the other intermeshing gears to the impression cylinder. The eccentric arrangement of the toothed wheel 20 with respect to the crank shaft and the intermediate sliding connections between said shaft and wheel are such as to impart to said toothed wheel 20 and hence to the impression cylinder an irregular speed corresponding to the speed of the crank movement of the bed during the impression or printing operation. The connections between the crank shaft and cylinder, like that between said shaft and the form-bed, being positive, a constant movement with irregular speed is imparted to said cylinder; and the toothed wheel 20 being twice the diameter of the cylinder toothed wheel 22, it results in the cylinder making two revolutions to each revolution of the wheel 20 and of the crank shaft.

In the position of the parts in full lines, Fig. 1, the form-bed is about in mid stroke moving in the direction of the arrow thereon, with the impression cylinder in the plane of impression with the forward edge of a sheet just taking the impression. Owing to the position of the crank of the crank shaft, the bed is moving at its maximum speed, and the outer end of the arm 25 being at its nearest point to the axis of rotation of the toothed wheel 20, said toothed wheel is likewise moving at its maximum speed, so that if the proportions of the parts be accurate, the cylinder and bed will be moving in unison at the same surface speed. As the crank of the crank shaft is passing the rearward dead

point, indicated by the dotted lines *x*, Fig. 1, and in full lines in Fig. 2, and has been gradually lessening the speed of the form-bed the outer end of the arm 25 has been approaching the periphery of the toothed wheel, and moving away from the axis of rotation of said wheel a similar lessening of speed of the toothed wheel 20 has occurred, so that the cylinder has been gradually increased in speed in unison with that of the form-bed; and thus throughout the time the impression is being taken, the bed and cylinder are moved in unison at the same surface speed. During the remainder of the movement of the crank and the arm 25, and until the bed again arrives substantially in the position shown in full lines in Fig. 1, it is immaterial whether the bed and cylinder travel in unison with the same surface speed or not, as no printing occurs, hence it is not deemed essential to follow the intermediate speeds of the bed and cylinder during the idle movements.

In practice, the guide way and slot 8, with which the end of the arm 25 engages, will have a slightly curved formation and extend slightly tangentially to the axis of the wheel 20 instead of radially therefrom. The precise form of the guideway, the shape of its curve and the general position of the guideway with respect to the axis of the wheel 20, will depend largely upon the degree of eccentricity of the wheel 20 with respect to the axis of the crank shaft; to the position of eccentricity with respect to said crank shaft; to the proportion of the parts, and as to whether the crank and arm 25 are set in the same radial plane or not with respect to the crank shaft, as will appear hereinafter.

It is to be remarked that it is immaterial what the diameter of the impression cylinder is to the rest of the mechanism within practical limits, because any difference may be wholly compensated for by the form or curve of the guideway 8, so that the cylinder during impression will have the same surface speed with that of the bed.

In the embodiment shown in Fig. 4, substantially the same style of press is shown as in Figs. 1 to 3, wherein the impression cylinder makes two revolutions to each complete reciprocation of the bed. In this case, however, instead of the eccentric wheel 20 meshing with an idle intermediate, it meshes with the delivery cylinder toothed wheel 26, fast to the shaft of said cylinder, or pulleys forming a delivery cylinder as the case may be, which toothed wheel 26 meshes with the impression cylinder toothed wheel 22; thus the impression cylinder is driven through the delivery cylinder gear. The eccentric arrangement of the toothed wheel 20, instead of being located below the axis of the crank shaft, as before, is arranged above and the driving arm 25 instead of being arranged in the same radial plane with the crank of the crank shaft, is set at an obtuse angle with respect to said crank and behind it. In this construction the form of the guide way or slot 8, will be slightly different from that shown in Fig. 1, rendered necessary by the difference in arrangements just enumerated. The parts are shown in the position when the bed is being moved at its maximum speed and the impression cylinder being similarly moved through the arm 25, and wheel 20. As the crank approaches its dead center, the arm 25 will have approached the periphery of the toothed wheel 20, and hence will have reduced the speed of the impression cylinder as the form bed has been reduced in speed; so that during the time the cylinder and bed are coacting for the impression or printing operation, their speeds are in unison, as before.

In the embodiment shown in Figs. 5 and 6, the impression cylinder makes turn for turn with the crank shaft, in which case the toothed wheel 20 is of the same pitch diameter as that of the impression cylinder toothed wheel 22. In this instance also, the arrangement of the parts is similar to those of Fig. 1. The toothed wheel 20 meshing with an intermediate 21 which in turn meshes with the impression cylinder wheel 22. The eccentric arrangement of the toothed wheel 20 is also arranged below the crank shaft and the driving arm 25 is arranged in the same radial plane with the crank of the crank shaft. The guideway or slot 8 is formed in an extension from the face of the toothed wheel, and varies in shape from each of the other two guideways previously described. The effect of the arrangement being precisely the same as in the other embodiments previously described, imparting to the impression cylinder a speed in unison with that of the bed during the taking of the impression. In this form of the invention, also, the guideway or slot 8 may be divided between the driving wheel 20 and the cylinder wheel 22, as in the construction presently to be described with respect to Figs. 7 and 8, one or both of the guideways being of curved formation.

In Figs. 7 and 8, a slight further change in the construction and arrangement of the parts is illustrated, in a two revolution cylinder printing machine. Herein, the guideway 8 is arranged radially with respect to the axis of the wheel 20 without the curve formation. The arm 25 is set substantially at right angles to and behind the crank of the crank shaft, and the eccentric arrangement of the wheel with respect to the crank shaft is disposed, instead of above or below as in the previous forms, is set to the right of the crank shaft in the same horizontal plane. The impression cylinder toothed wheel 22, instead of being fast to the cylinder shaft is mounted on a hub 7, set eccentric with the axis of the cylinder shaft projecting from the box 30 in which the cylinder shaft is journaled. The end of the cylinder shaft carries an arm 27 that has at its outer end a roll which engages with a radial guideway or slot 5, formed in or car-

ried on the toothed wheel 22. The arrangement of these parts is such that while the bed is traveling at its maximum speed, the end of the arm 27, engaging with the slot of the toothed wheel 22 further removed from the center of the wheel, drives the cylinder at a corresponding speed which gradually diminishes just as the speed of the bed diminishes as the crank approaches the dead center, so that the impression cylinder and bed are accurately in unison and with the same surface speed during the impression or printing operation.

Referring again to the other constructions herein illustrated, and particularly Figs. 1 and 2, it is not deemed essential that the crank shaft H be driven directly by the driving pinion L, through the toothed wheel K; but that said toothed wheel K may be entirely omitted and the main driving shaft J so arranged that its driving pinion L may gear directly with the toothed wheel 20, as indicated by the dotted lines L′ in Fig. 2. In such an arrangement of the main driving pinion, the impression cylinder instead of following the movements of the bed, the reverse will be the result,—the bed will follow the movements of the impression cylinder; the connection being direct from the driving pinion through the several toothed wheels 20, 21, and 22, to the impression cylinder, while the connection with the bed will be through the guideway 8, the driving arm 25, and the crank shaft and traveling gear F to the bed. The unison and speed of the impression cylinder and bed may be still further accurately imparted by providing for the coupling of the impression cylinder and bed together during the impression or printing operation. Thus in the arrangement shown in Figs. 1, 2 and 3, and seen partly in Fig. 3, the bed carries a registering rack 12, that is engaged by a toothed wheel 13, mounted loosely on the cylinder shaft at the inner end of a sleeve 14, the outer end of which has a hub provided with a single notch with which engages a single projection on a sliding clutch member 15, splined to the cylinder shaft; the single notch and projection insuring the coupling of the bed always in one position of the parts.

During the idle movements of the cylinder and bed, or at all other times than during the taking of the impression, the sliding clutch member will keep the dotted position shown in Fig. 3, with its tooth out of engagement with the notch, so that while the toothed wheel 13 and rack 12 may be in engagement, the toothed wheel will rotate and oscillate idly independent of the cylinder, which constantly rotates in one direction.

To effect the coupling operation, there is provided a cam 16, see Fig. 3ª, fast to a longitudinal shaft 17, mounted in suitable bearings in the machine to which continuous motion is imparted from the crank shaft by a pair of bevel gears 18, one fast on the shaft 17, and the other to the crank shaft, see Fig. 3. With this cam there co-operates a pair of rolls at the end of a pivoted arm 19, the opposite end of which is forked to loosely engage the groove of the sliding clutch member 15. The arrangement of these parts is such that immediately the bed and impression cylinder commence to coact for the printing operation and are moving at the same surface speed, the cam 16 will operate to rock the clutch arm 19 and thus slide the projection of the sliding clutch member 15 into the notch of the sleeve 14, which thus couples the cylinder with the bed through its shaft, sleeve 14, gear 13 and rack 12, so that during the further movement in unison of the bed and cylinder, they are coupled together; and as soon as the printing operation is completed, the cam will act to again rock the arm 19 and move the sliding clutch member back to its inoperative position, uncoupling the cylinder from the bed. The position of the parts are also such, there being a single notch in the hub of the sleeve 14, that as soon as said notch, in the rotation of the gear 13 with the bed, arrives in alignment with the projection of the sliding clutch member, the cam 16 will immediately act to move the projection freely into the notch; the projection and notch at this time traveling in unison at the same speed. Another form of this cylinder and bed coupling mechanism is shown in Figs. 9 and 10. In this case the loose oscillating toothed wheel 13 meshes with the rack 12, carried by the bed as before, and the coupling is effected by providing the toothed wheel 13 with a spring-pressed pawl 42 that is adapted to engage with a notch *c* in a disk 41, secured to the impression cylinder shaft or formed on the end of the cylinder. The arrangement of these parts is such that the impression cylinder A with the disk 41 constantly rotates in the direction of the arrow through the driving connections and in the manner heretofore described, while the toothed wheel 13 oscillates in the back and forth reciprocations of the bed. In the oscillation of the toothed wheel 13 in the direction the reverse of the movement of the impression cylinder, the pawl 40 moves back idly over the periphery of the disk 41, as will be apparent, and such oscillation carries the pawl 40 beyond the notch *c* of the disk before the direction of the toothed wheel 13 reverses. On the reversal of this direction of movement of the toothed wheel 13 in the same direction as the impression cylinder, the speed of the toothed wheel, being slightly in excess of that of the impression cylinder, the pawl will have caught up with the wall of the notch *c* simultaneous with the coaction of the impression cylinder and bed at the same surface speed, so that should there be any tendency of the cylinder to lag, the pawl will compel its continuous movement in unison with the speed of the bed until the time the bed arrives at the end of its reciprocation and starts to reverse its direction, when the toothed wheel 13

and pawl will simultaneously oscillate in the opposite direction and leave the cylinder and its disk 41 to continue their onward rotation.

What is claimed is:—

1. In a cylinder printing machine, the combination with the form bed and the impression cylinder, of a shaft bearing two cranks, one having connections with the form bed and the other having connections with the impression cylinder, whereby the cylinder and bed will move at the same surface speed during the impression, substantially as described.

2. In a cylinder printing machine in which the bed is driven from the crank-shaft, the combination with the impression cylinder, the form bed, and the crank-shaft, of a driving gear concentric with its axis of rotation and mounted eccentrically with respect to and connected with the crank shaft, and gearing between said driving gear and the impression cylinder, substantially as described.

3. The combination with the impression cylinder, its form bed, and crank-shaft for reciprocating the bed, of a driving gear geared with the impression cylinder, and sliding connections directly between the crank-shaft and the driving gear for moving the impression cylinder and bed in unison at the same surface speed during the printing operation, substantially as described.

4. The combination with the impression cylinder, its form bed, and crank-shaft for reciprocating the bed, of the driving gear geared with the impression cylinder, a guideway carried by the driving gear, and a driving arm fast to the crank-shaft and engaging with said guideway, substantially as described.

5. The combination with the impression cylinder, its form bed and a crank shaft for reciprocating the bed, of a driving toothed wheel eccentrically mounted to the crank shaft, and gearing between said wheel and the impression cylinder, a curved guideway carried by the driving toothed wheel, and a driving arm fast to the crank shaft and engaging with said curved guideway.

6. The combination with the cylinder revolving continuously at an irregular speed in one direction and a reciprocating bed, also moving at an irregular speed of an oscillating toothed wheel in gear with the bed, a coupling device for coupling the toothed wheel with the cylinder whereby the latter and the bed move in unison, and a driver for both the cylinder and the bed whereby both are moving at substantially the same surface speed at the time the coupling device couples said toothed wheel and cylinder together, substantially as described.

7. The combination with the impression cylinder revolving continuously in one direction, and a reciprocating bed, of an oscillating toothed wheel in gear with the bed, a clutch, one member on the toothed wheel and the other carried with the cylinder, and a revolving cam for moving the members into and out of engagement, substantially as described.

8. The combination with the impression cylinder, the form bed and a shaft bearing two cranks, one crank having connections with the form bed, and the other crank having connections with the impression cylinder; for driving the cylinder and bed during impression at the same surface speed, and a coupling device for coupling the bed and cylinder together during impression, substantially as described.

9. The combination with the impression cylinder, the form bed and crank-shaft for moving the bed, of gearing interposed between the crank-shaft and impression cylinder for driving the latter during impression at the same surface speed with the bed, and an oscillating toothed wheel in gear with the bed a clutch for coupling the cylinder to the toothed wheel during impression, and a revolving cam and connections for moving one clutch member into engagement with the other, substantially as described.

10. The combination with the impression cylinder, its form bed, and means for moving the bed at an irregular speed, of a driving toothed wheel geared with the impression cylinder, a driven shaft and sliding connections embracing a compensating guide between the shaft and driving toothed wheel for rotating the cylinder at an irregular speed in unison with the bed, substantially as described.

11. The combination with the impression cylinder, its form bed, and means for moving the bed at an irregular speed, of a driving toothed wheel geared with the impression cylinder, a driven shaft mounted eccentrically to the axis of said toothed wheel and sliding connections embracing a compensating guide between the shaft and toothed wheel, substantially as described.

12. The combination with the impression cylinder, its form bed, and a crank-shaft having connections with the bed for reciprocating it, of a driving toothed wheel mounted eccentrically to and independent of the crank-shaft, and geared with said cylinder, and sliding connections between the crank-shaft and toothed wheel, substantially as described.

In witness whereof I have signed my name, in the presence of two witnesses, this 26th day of December, 1891.

JOHN BROOKS.

Witnesses:
N. MARLER,
GEO. H. GRAHAM.