No. 688,689. Patented Dec. 10, 1901.

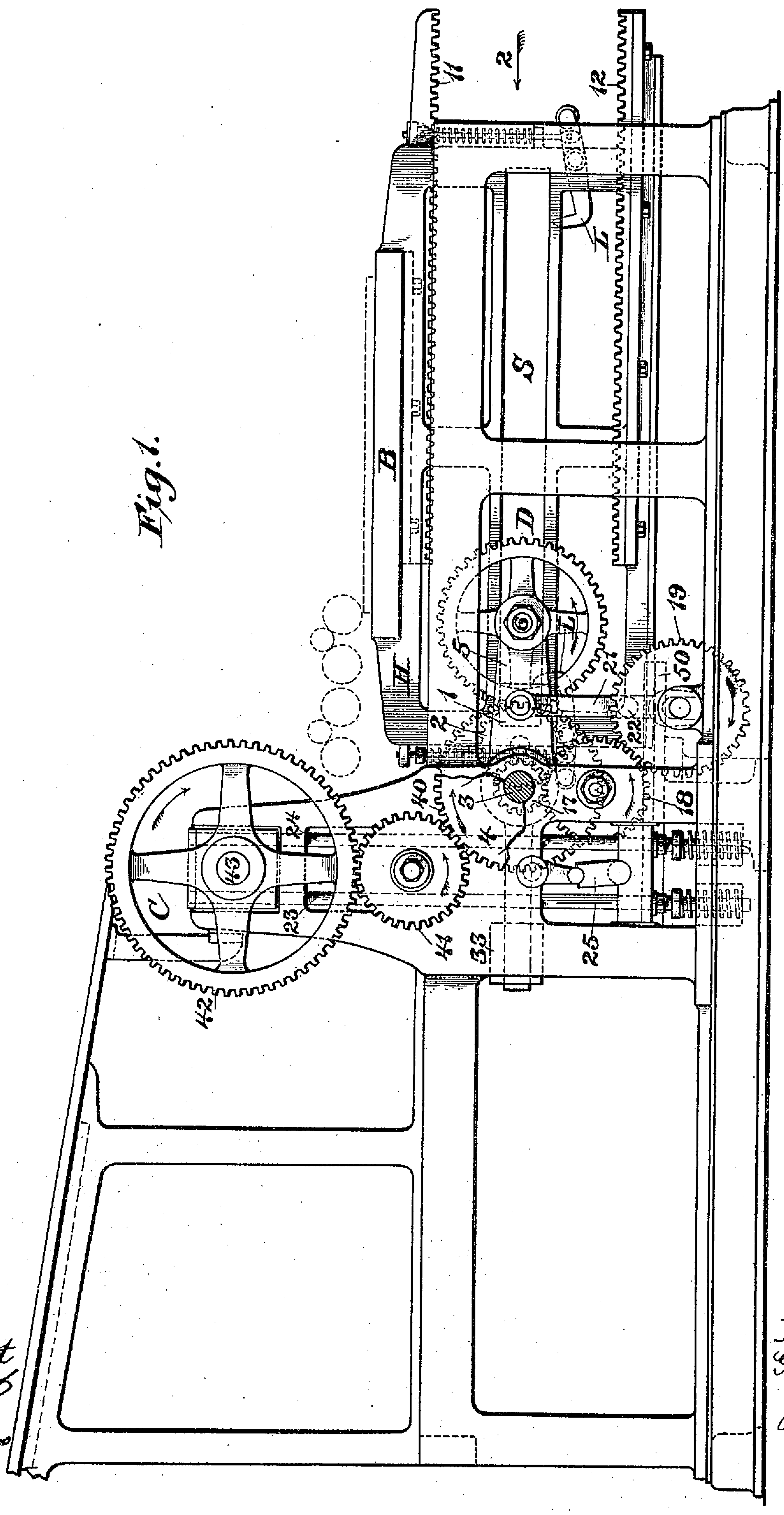
G. F. READ.

BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.



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No. 688,689. Patented Dec. 10, 1901

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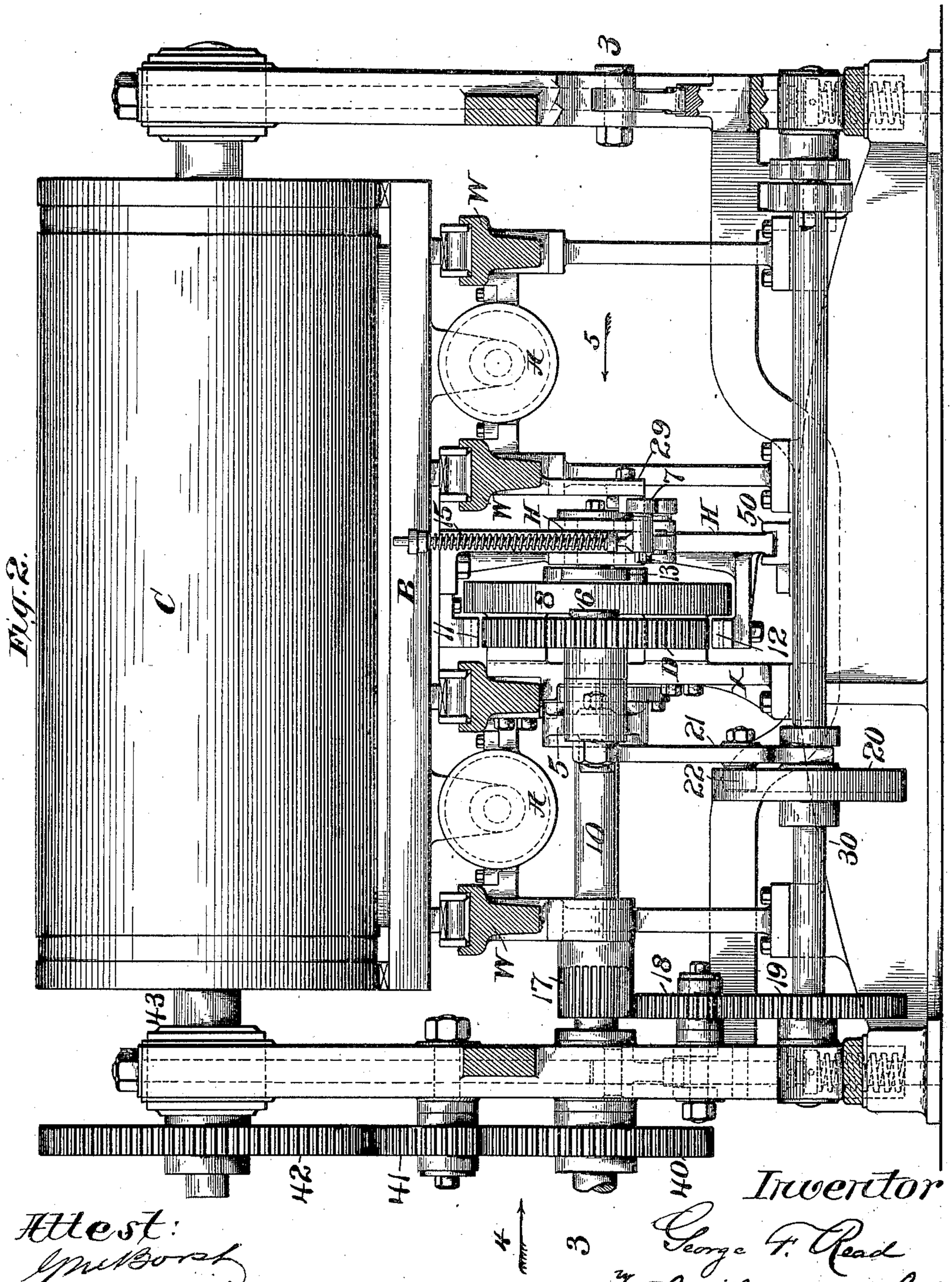
BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 2.



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BED MOTION FOR CYLINDER PRINTING MACHINES.

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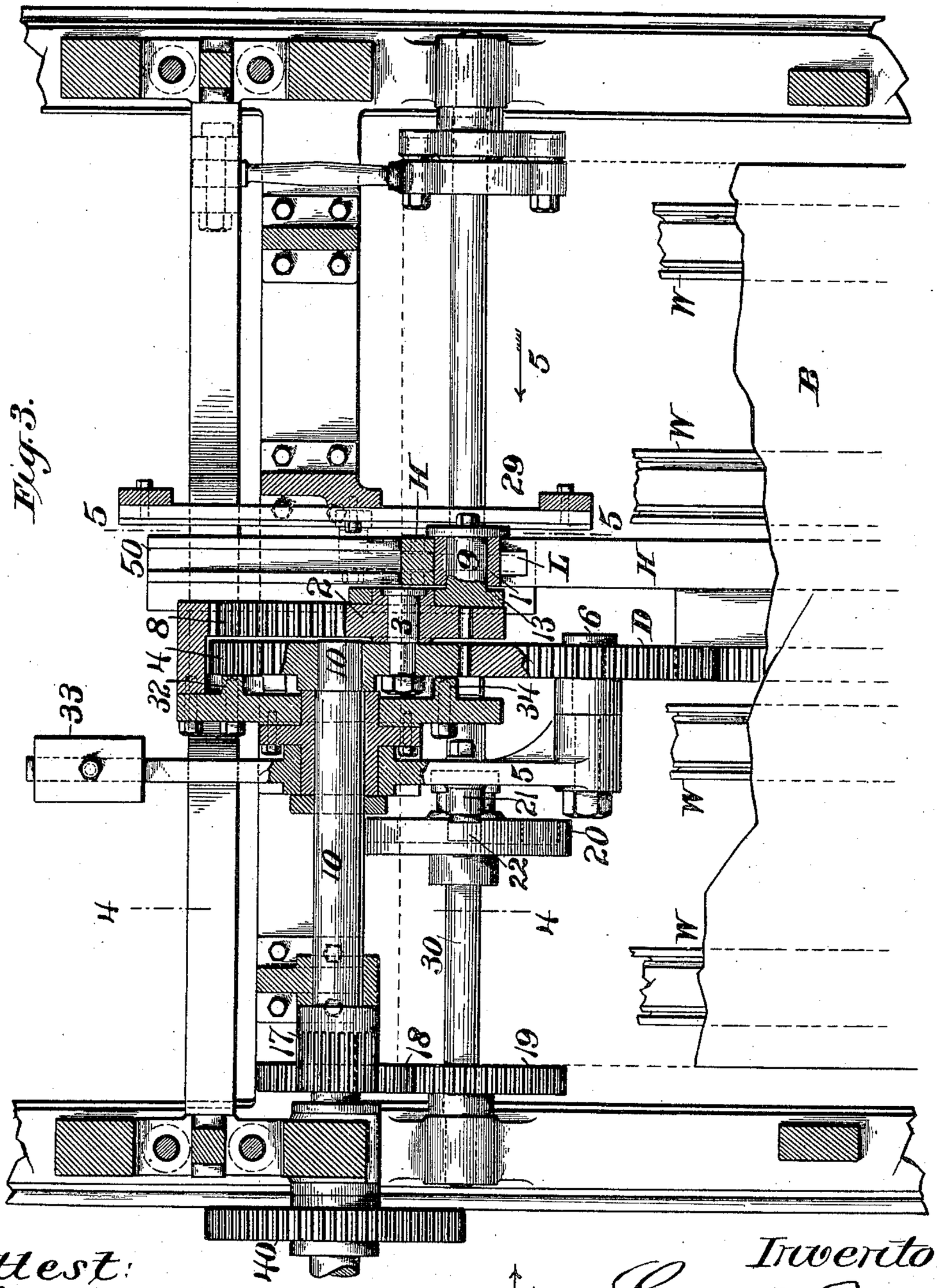
(No Model.) 7 Sheets—Sheet 3.

Fig. 3.



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BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 4.

Fig. 5.

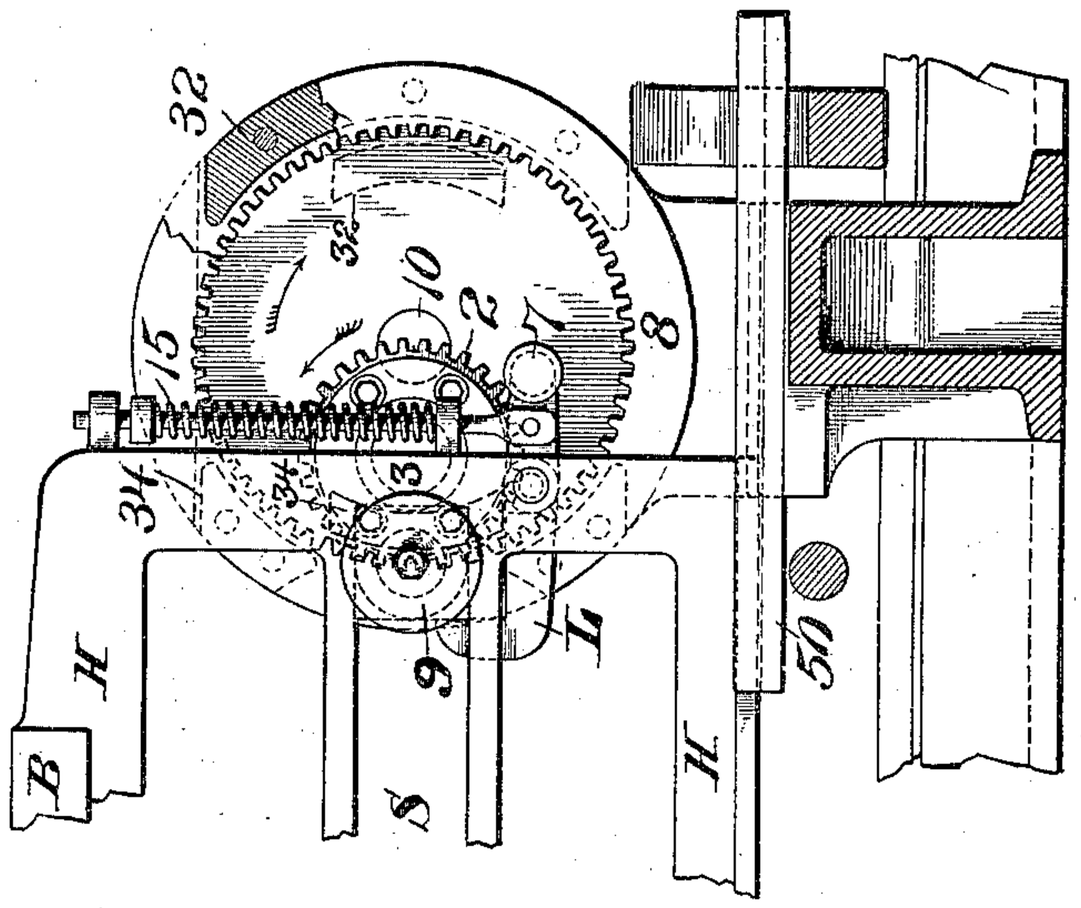
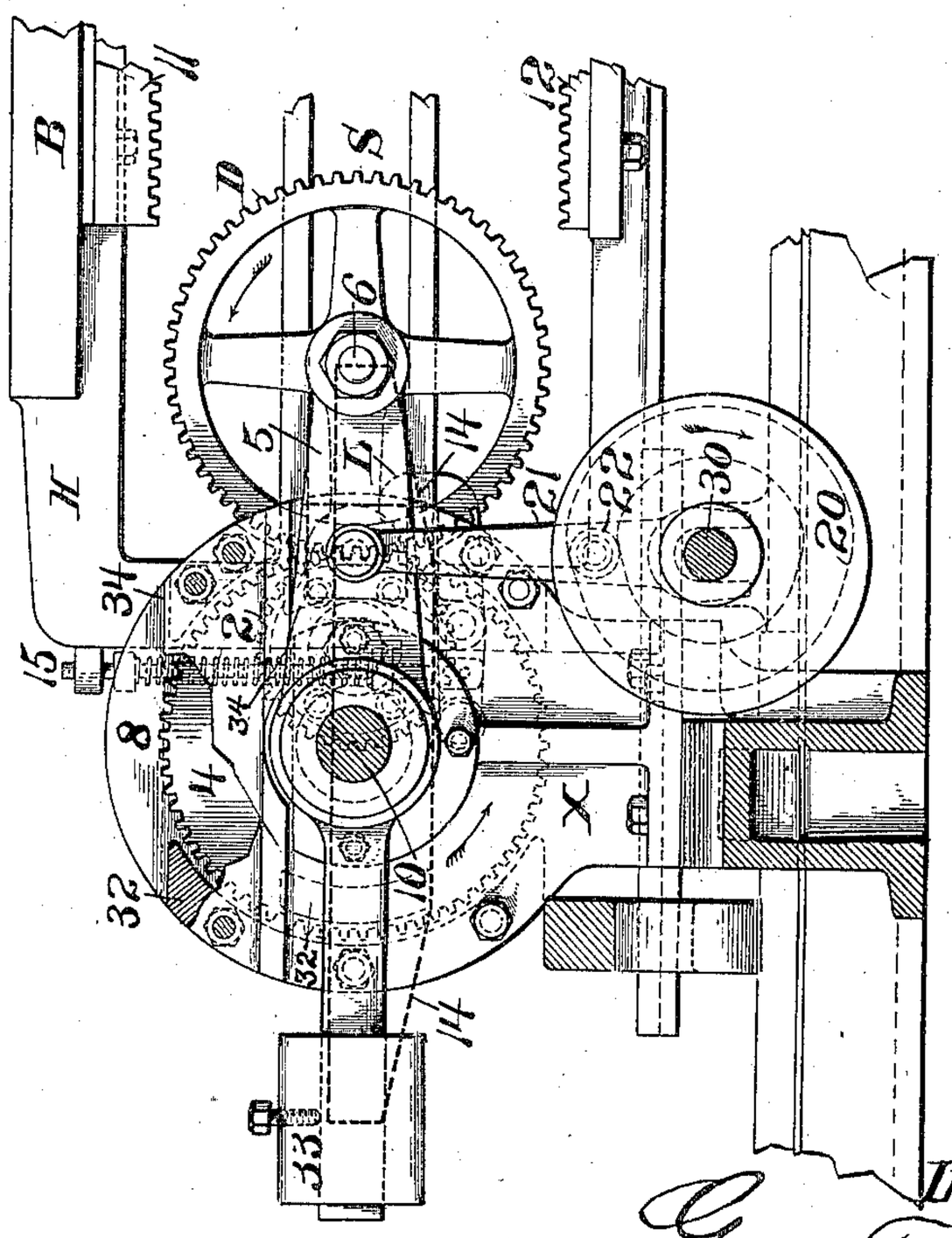


Fig. 4.



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BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 6.

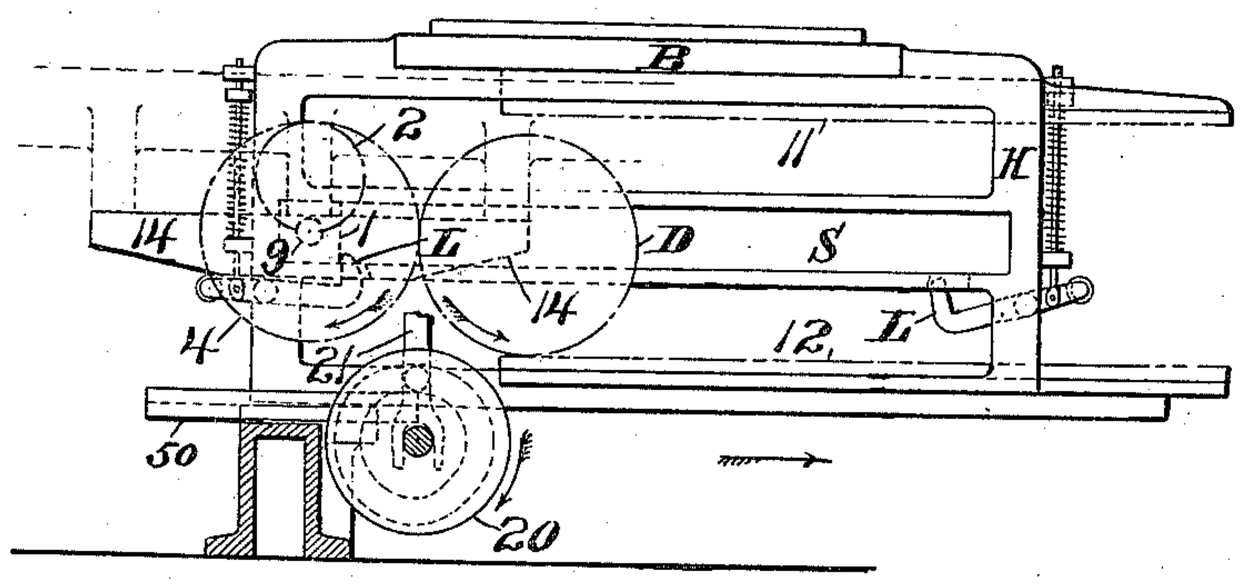


Fig. 7.

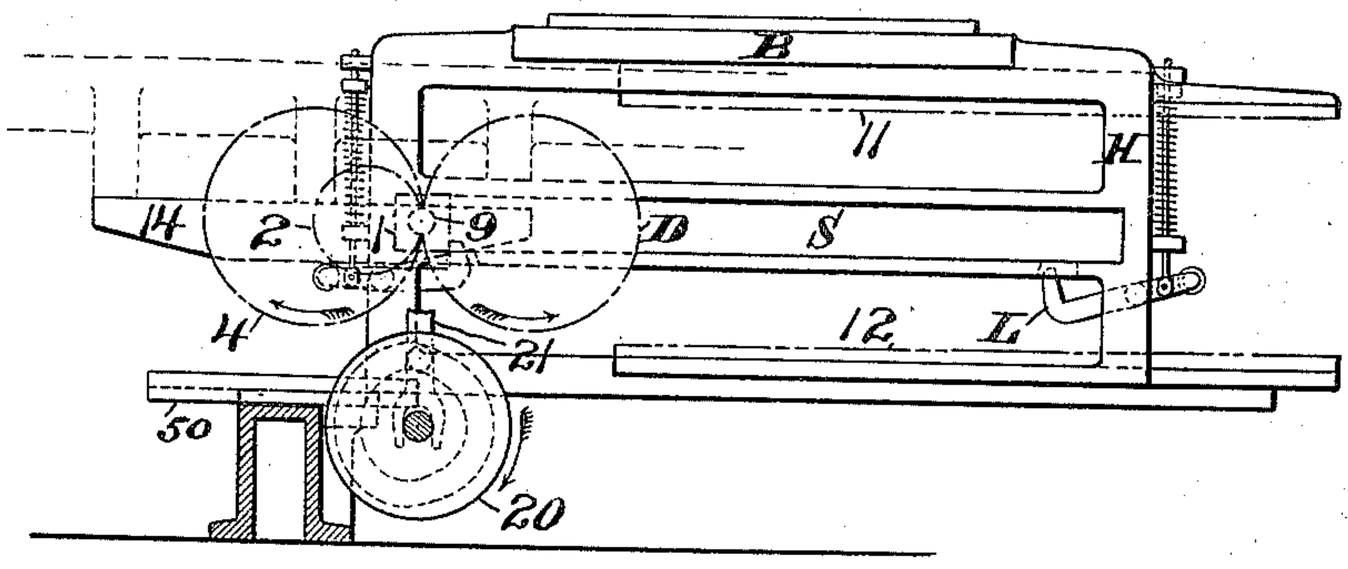


Fig. 8.

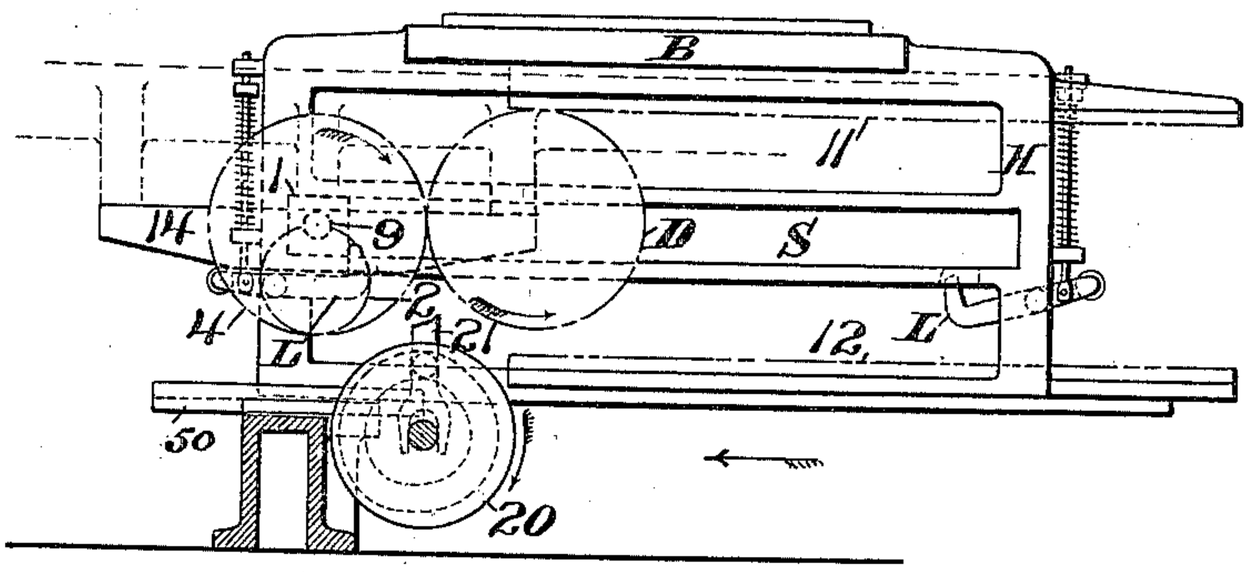
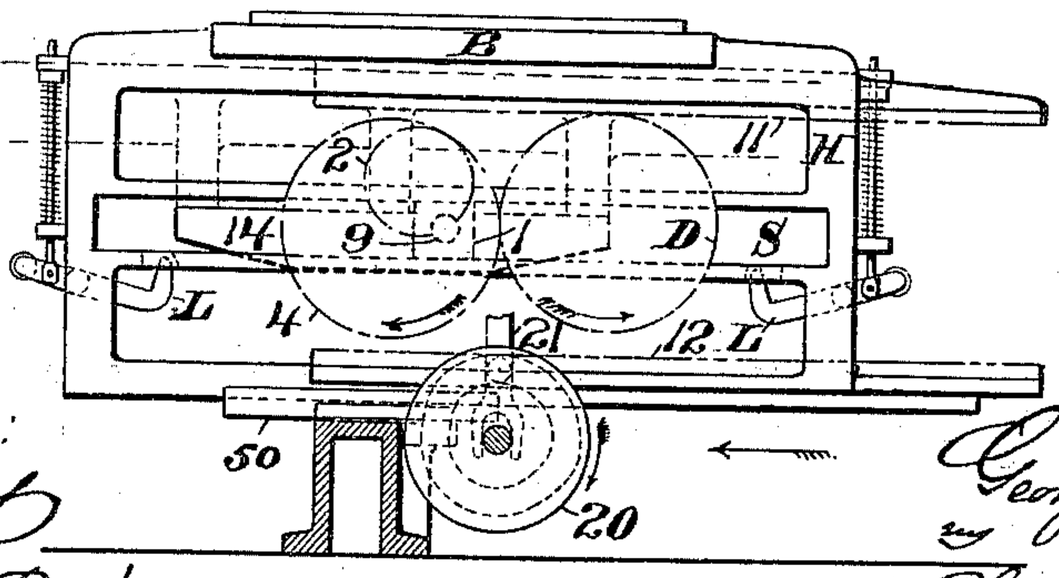


Fig. 9.



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BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 10.

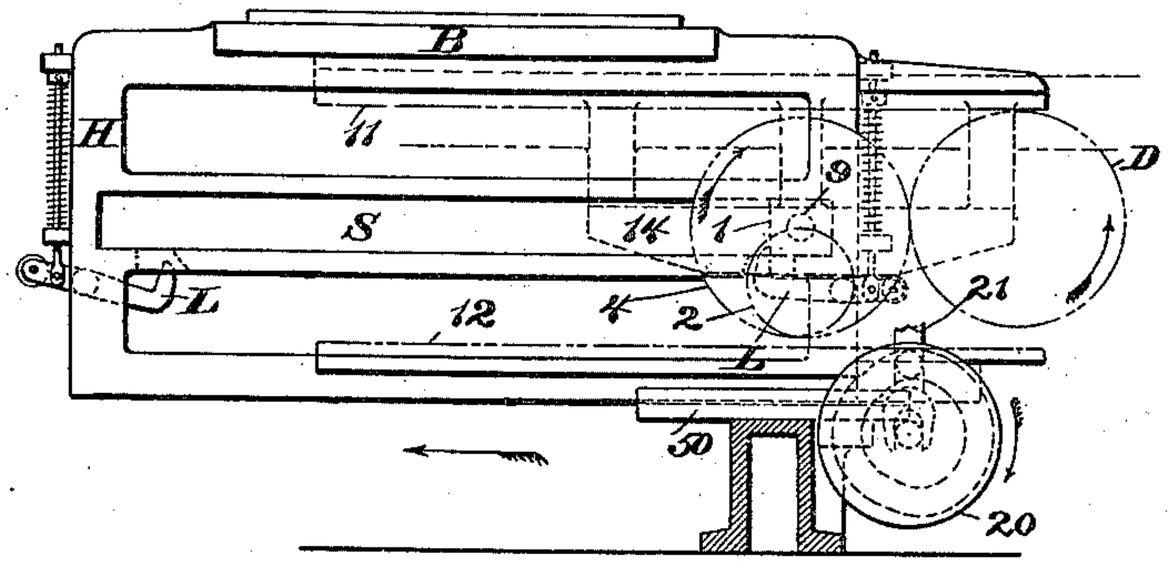


Fig. 11.

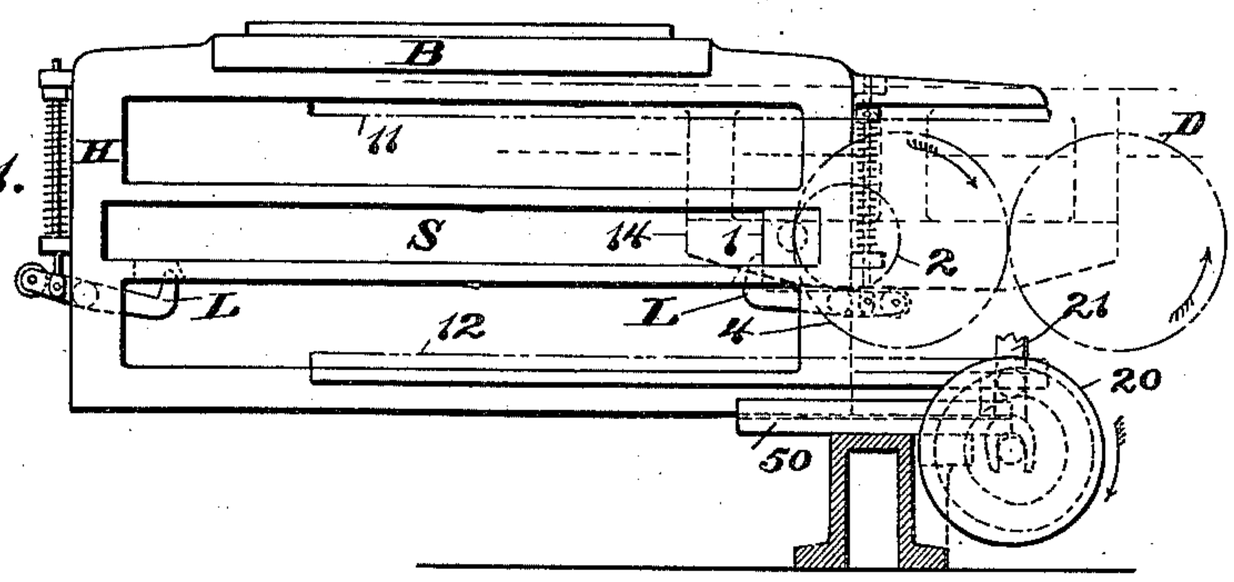
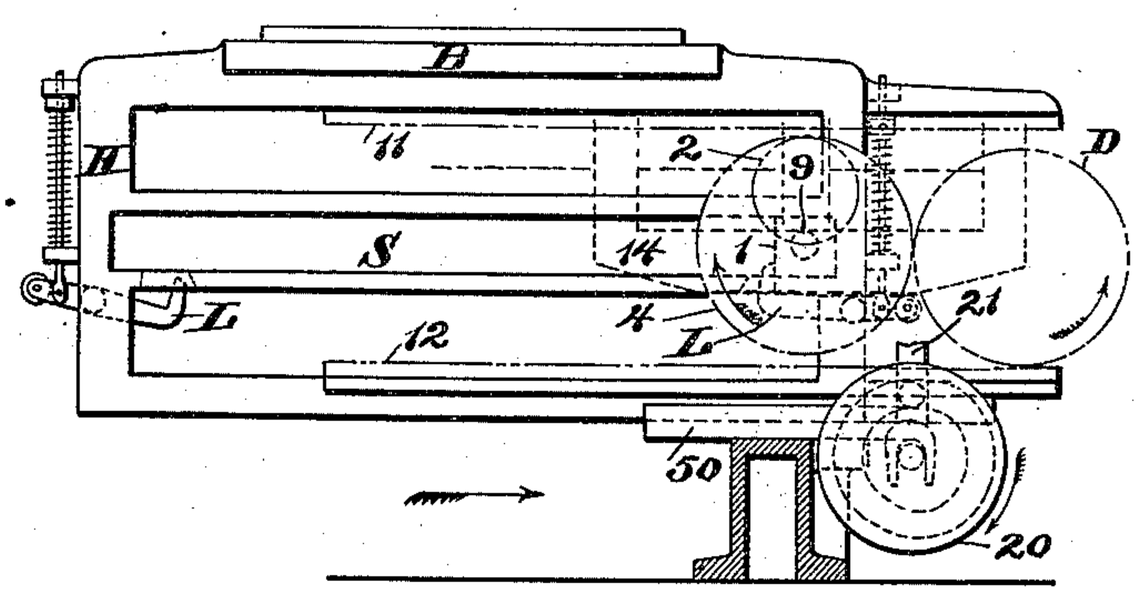


Fig. 12.



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BED MOTION FOR CYLINDER PRINTING MACHINES.

(Application filed Dec. 7, 1895.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 13.

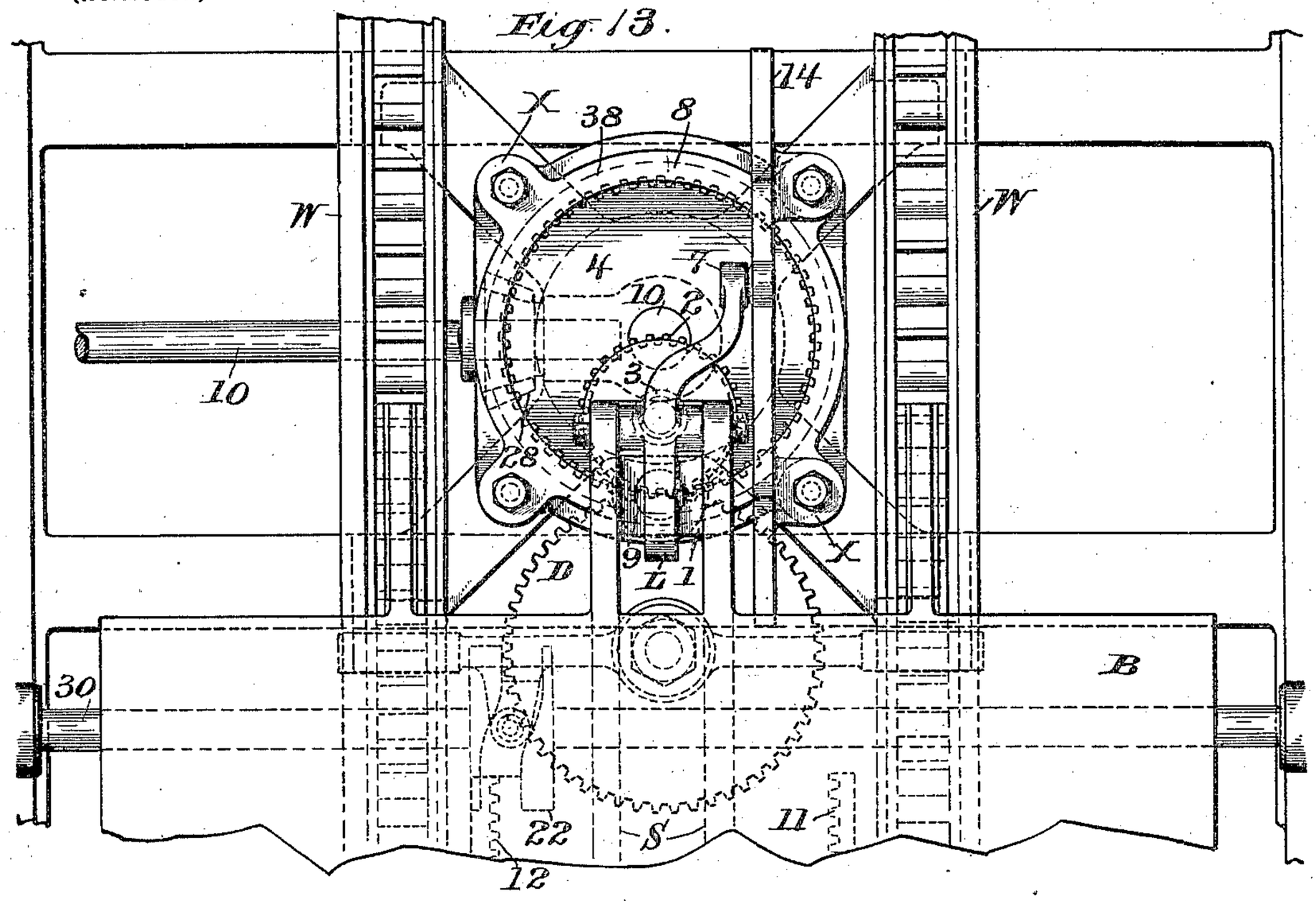
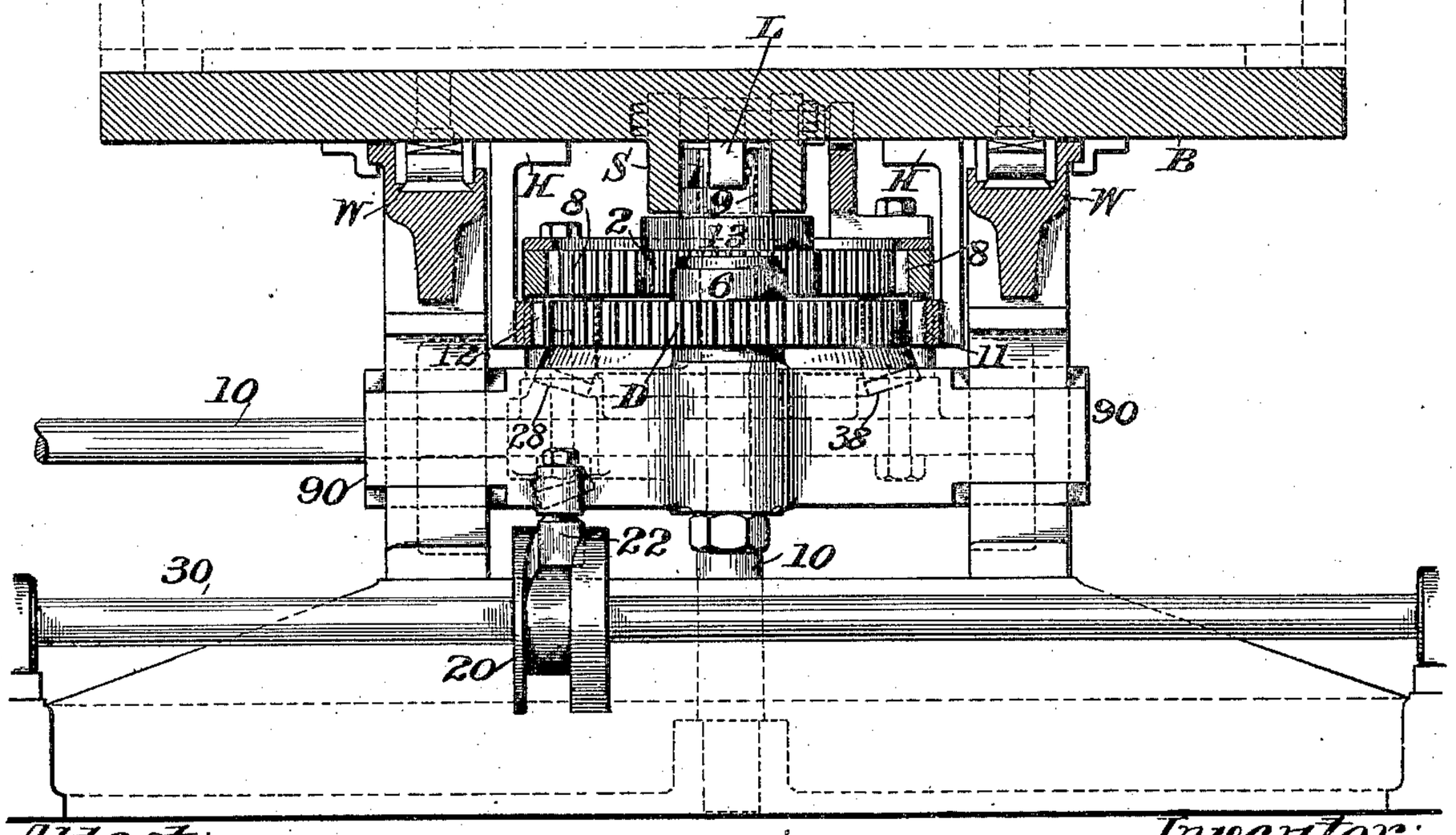


Fig. 14.



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by Church Duncan & Sheets
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UNITED STATES PATENT OFFICE.

GEORGE F. READ, OF BROOKLYN, NEW YORK, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE AND CHARLES W. CARPENTER, OF NEW YORK, N. Y., COPARTNERS DOING BUSINESS UNDER THE FIRM-NAME OF R. HOE AND COMPANY.

BED-MOTION FOR CYLINDER PRINTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 688,689, dated December 10, 1901.

Application filed December 7, 1895. Serial No. 571,328. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. READ, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Bed-Motions for Cylinder Printing-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an improved means of propelling the type-bed of a bed-and-cylinder press in its reciprocatory movement and of reversing its motion at the end of each stroke.

The invention consists in a novel means for reversing the movement of a reciprocating bed after it has made the greater extent of its travel in either direction, so that it may not only reciprocate in coöperation with an impression-cylinder revolving at a high velocity, but said reversal be quickly accomplished without strain or jar and a high maximum of speed of the operation of the machine be thus made attainable, said means consisting mainly in mechanisms whereby a member is caused to reciprocate in a horizontal path of travel with successively decreasing and increasing velocities and to coact with an abutment on the bed to slow down the bed from its high or normal velocity to a state of rest and start the same in the opposite direction and accelerate it to the normal velocity of the bed.

The invention further includes combinations and arrangements of parts, all of which are hereinafter fully explained and finally pointed out in the claims.

A practical embodiment in the preferred form of these improvements is illustrated by the accompanying drawings, in—

Figure 1, by a side elevation of a single-cylinder printing-machine embodying the same; Fig. 2, an enlarged end elevation thereof as seen looking in the direction of the arrow 2 in Fig. 1, the end of frame being removed; Fig. 3, an enlarged central sectional plan view taken on the horizontal sectional line 3 of Fig. 2, some of the parts being shown in plan; Fig. 4, an enlarged side elevation taken on the section-line 4 of Fig. 3 as seen looking in the direction of the arrow 4 in Figs. 2 and 3; Fig. 5, an enlarged opposite side elevation of the same, taken on the sectional line 5 of Fig. 3 as seen looking in the direction of the arrow 5 in Figs. 2 and 3. Figs. 6 to 12, inclusive, are diagrammatic illustrations of various positions which the bed-moving mechanism assumes during its reciprocation and reversing movements. Fig. 13 is a partial plan view, and Fig. 14 a partial elevation, portions of which are in section, illustrating a modification of the invention, in which the main parts of the driving-bed are arranged in a horizontal plane.

The printing-machine here illustrated consists of the ordinary impression-cylinder C, carried by a shaft 43 and provided with a lifting movement indicated by the rods 23 24 and toggle 25 in Fig. 1, and of the reciprocating bed B, traveling on roller frames and ways W and provided with ordinary air cylinders or buffers A, as usually employed at the end of the machine to reduce the shock and wear of parts incidental to the checking of the momentum which the bed attains.

Attached to the bottom of the type-bed B is a hanger H, upon which an upper rack 11 and a lower rack 12 are secured, said hanger, fixedly depending from the bed, being guided below in its horizontal movement in a groove or race 50, fixed to the bed-plate. A bed-driving wheel D, turning upon a stud 6, supported at the end of a rock-arm 5, that is journaled upon the inner bearing of the driving-shaft 10, is revolved continuously by the crank-wheel 4, which is fast to the main driving-shaft 10, and the arm 5 is rocked up or down near the end of each stroke of the bed by a cam 20 on a counter-shaft 30 through a rock-arm 21, pivoted to the rock-arm 5 at one end and pivoted on the shaft 30 at the other end, said arm 21 having a bowl 22 running in the slot of the cam 20. This cam-motion, aided, if preferred, by counterweights 33, operates to move the driving-wheel D alternately into gear with the top and bottom racks 11 12, so that it will produce the principal part of the reciprocating movement of

the type-bed at the high or normal speed of said wheel.

The driving-shaft 10 revolves in fixed bearings in the framework and carries a wheel 40 outside of the frame, which wheel 40 communicates motion through an intermediate wheel 41 to the wheel 42 on the outer end of the impression-cylinder shaft 43 and by means of a train of gears 17 18 19 inside the frame drives the counter-shaft 30. Said driving-shaft 10 has secured to its inner end a crank-wheel 4 of the same diameter as the bed-driving wheel D, with which it engages and which it drives, and consequently the crank-wheel 4 and bed-driving wheel D have the same peripheral speed as the surface of the impression-cylinder C, and they preferably are of a size to make three revolutions for each complete movement or reciprocation of the bed.

The crank-wheel 4 carries a stud 3, (see Figs. 3 and 5,) the center of which is exactly midway between the center of the driving-shaft 10 and the pitch-line of said crank-wheel 4, and upon this stud 3 revolves a pinion 2, whose pitch-circle diameter is one-half that of the crank-wheel 4 and whose teeth engage with those of an internal annular rack or gear 8 of the same pitch-circle diameter as the crank-wheel 4 and which internal gear is fixed securely to the framework by a bracket X. The pinion 2 will thus by the rotation of the crank-wheel 4 be caused to revolve bodily about the axis of the crank-wheel and through its engagement with the internal gear 8 will be caused to rotate about its own axis in the opposite direction to that of its revolution about the axis of the crank-wheel 4 or to that of the rotation of the crank-wheel 4, and its pitch-circle diameter being half that of the internal gear 8 it will be caused to make two such rotations about its own axis to one rotation of the crank-wheel 4. Any point on the pitch-circle of the pinion 2 will therefore be caused to move back and forth in a straight line a distance equal to the pitch-circle diameter of the crank-wheel 4 and at a speed equal to and varying as that which would be derived from a crank having a radius equal to the pitch-radius of the crank-wheel 4. A crank-pin 9 is therefore secured to the side of the pinion 2, with its center coincident with a point in the pitch-circle and in such a position that it will move in a central horizontal line back and forth. The pinion 2 and crank-pin 9 thus form a bodily-revolving lever, which also rotates in the opposite direction of its bodily travel on an axis independent from that about which it revolves. This crank-pin is secured by means of an arm 13, that carries it, and which arm is fast to the side of the pinion 2, said crank-pin being provided with a square journal-box 1.

The rack-hanger H is provided with a horizontal rectangular bearing-slot S in line with the course of travel of the crank-pin 9, it being of a width to receive and allow the box 1 to slide or travel free horizontally therein and of a sufficient length to allow the bed to travel a distance substantially equal to one circumference of the bed-driving wheel D. At each end of the slot S is provided a locking-latch L pivoted to the hanger H for locking the crank-pin journal-box 1, (which moves endwise in the slot S while the bed is being propelled by the driving-wheel D,) when it reaches the end of said slot S or contacts with the abutment at the end of said slot, and just before said wheel leaves each rack; each of said latches being drawn constantly downward or retained in its non-operative position by a spring 15, and being moved into its operative or locking position by inclined ways 14 carried by a fixed frame 29, over the faces of which ways travels a rock-arm 7 that projects from the heel of each latch. In its, say, first revolution, as in Fig. 6, the bed-driving wheel D is engaged with the lower rack 12 and propels the bed outward or during its non-printing movement at a uniform or the normal velocity during the greater extent of its outward stroke of longitudinal travel. In its next half-revolution, as in Fig. 7, said wheel is clear of both racks and the reversing movement of the bed takes place, and in its next revolution, as in Figs. 8 and 9, said wheel is engaged with the upper rack 11 and again propels the bed inward or during its printing movement at a uniform or the normal velocity during the greater extent of its inward stroke of longitudinal travel, and in its next half-revolution, as in Fig. 11, said wheel is clear of both racks and the reversing movement of the bed at the opposite end of its stroke takes place, the wheel D thus making three revolutions to a complete reciprocation of the bed. When the bed is approaching and reaches the extreme end of its movement in both directions, the strains are such that there may be a tendency to cause the inner end of the driving-shaft 10, together with the crank-wheel 4, which that end carries, to yield somewhat. In order to offset this and hold these parts rigidly, segmental facial bearing-seats 32 34 are provided. These are rigidly secured to the framework by the bracket X, (see Figs. 3, 4, and 5,) so as to bear against one side of the crank-wheel 4 near its periphery, and thus sustain it and said shaft against any tendency to yield at that time under the great strain the bed exerts upon them during the operation of arresting its movement. The arm 13, which carries the crank-pin 9, is also formed so as to run very close to or bear upon the outer face of the internal gear 8 for the same purpose—that is, providing it with a facial bearing against a fixed part at the time these great strains are exerted. Thus the parts which at the time of great strain might be thrown slightly out of place have such injurious movement of them provide against.

Having in mind that the bed-wheel D, running at the uniform speed of the cylinder C,

operates when geared with the rack 11 to drive the bed B throughout the greater portion of its inward run or during the printing operation and when it is geared with the rack 12 to drive the bed throughout the greater portion of its outward run or during its return and that after each such run or each end of the greater portions of both of its strokes of reciprocation not only must said driving-wheel D, which causes them, be moved out of engagement with the rack it then engages, but that the reversing mechanism must be simultaneously engaged with the bed as said wheel D is detached, and that thereafter the reversing mechanism must operate to gradually slow down the bed in one direction from its normal speed to a state of rest and then operate to start the bed in the opposite direction and accelerate it until the normal speed of the machine is again attained, when the bed will be released from the reversing mechanism and will be again driven by the wheel D, then geared with its appropriate rack, the following description of the operation of the mechanisms will be readily understood.

The diagram Fig. 6 illustrates the position of parts after the bed has made its greater movement of travel outward, in which direction it runs to ink its forms at the high or normal speed of travel. Having reached this position of outward movement, it requires to be reversed, so that it may make its return or inward movement at said high or normal speed. In this reversing movement it will be understood that the bed-driving wheel D must be simultaneously withdrawn from the rack 11, as the bed and the reversing mechanisms then come into coactive relation, and this is accomplished as follows: The bed having been rapidly moved through the greater part of its outward run at the normal speed of the press by the bed-driving wheel D, while engaged with the lower rack 12, as in Fig. 6, during which time the impression-cylinder is in this instance raised out of printing position and during which part of the outward movement the crank-pin 9 will have made an idle or non-operative reciprocation, as is shown in Fig. 9, at the completion of one revolution of the bed-driving wheel D this crank-pin 9 will be moving in the same direction as the type-bed is traveling and at the same velocity and will have been overtaken by the left-hand abutment or end of the slot S and contact with it, as in said Fig. 6. Simultaneously with the attaining of this position of the crank-pin 9 or thereabout the latch L will be raised to lock the box 1 to the said abutment and the cam 20 will rock the bed-driving wheel D out of engagement with the rack 12, as in Fig. 7. The bed will then be controlled by said crank-pin 9 and box 1, and its further outward movement will be gradually slowed down and cease, and the bed will be arrested or brought to a state of rest by the constantly-diminishing movement of said crank-pin 9, as the crank-wheel 4 makes that quarter-revolution which carries the crank-pin 9 in a horizontal path of movement from its position in Fig. 6 to its position in Fig. 7, during which the outward movement of the bed will have been gradually slowed down from its normal or high speed to a state of rest, as in Fig. 7. The next quarter-revolution of the crank-wheel 4 will carry the crank-pin 9 in a horizontal path of movement from its position in Fig. 7 to its position in Fig. 8, during which it will gradually start and accelerate the bed in the opposite direction or cause its inward movement to begin, during which movement the printing operation is performed, and when the crank-wheel has caused the crank-pin 9 to make its horizontal movement from its position in Fig. 7 to that shown in Fig. 8 the bed will have again attained its normal speed or the velocity at which the surface of the impression-cylinder is then revolving, at which time the bed-driving wheel D will have been rocked into engagement with the rack 11, the latch L will be released, and the bed will, driven solely by the bed-driving wheel D, make the greater part of its inward movement, during which the crank-pin 9 will make an idle or non-operative reciprocation, as shown in Fig. 9. At the end of this greater part of the return or printing movement of the bed the crank-pin 9 and box 1 will be overtaken by the opposite abutment or right-hand end of the slot S, as in Fig. 10, and simultaneously therewith the opposite locking-latch L will be locked against said box 1, the bed-driving wheel D will be rocked out of engagement with the rack 11, and the bed will again be wholly within the control of said crank-pin 9. During the next quarter-revolution of the crank-wheel 4 it will carry the crank-pin 9 in a horizontal path of movement from its position shown in Fig. 10 to that which it has in Fig. 11, in making which constantly-diminishing movement it will have gradually slowed the bed down from its normal speed to a state of rest, as in Fig. 11, and during the next quarter-revolution of the crank-wheel 4 it will have carried the crank-pin 9 in a horizontal path of movement from its position shown in Fig. 11 to that which it has reached in Fig. 12, in making which travel it will have gradually started the bed in the opposite or outward direction and accelerated it to the high or normal speed, whereupon the bed-driving pinion D will be rocked into engagement with the rack 12, the locking-latch will be released, and the bed will again make its outward movement or non-printing run, solely driven by the wheel D, during which the crank-pin 9 will make an idle reciprocation, as in Fig. 9, and the bed will be brought into the position shown in Fig. 6, when the described operations will be repeated.

The bars between which the way or slot S is formed, though preferable, are not essen-

tial, since the abutments which the ends of said way S form constitute the part coacting with the crank-pin 9, and hence said abutments might be simply vertically-projecting parts secured at appropriate points to the bed, the seating-surface of the crank-pin being either straight or curved, but for stability the hanger will preferably be constructed as shown. So, also, the box 1, in which the end of the crank-pin 9 is housed, is not essential, for the reason that the crank-pin itself is the controlling working member; yet it is desirable to provide this box, as it constitutes the appropriately-shaped piece, formed of a member contacting with an abutment having a vertical face, and, moreover, constitutes a sliding guide running in the way S, for which a friction-bowl on the crank-pin 9 may be substituted, as it will well serve the purpose, especially when the seat or bearing of the abutment is curved.

By this invention, in which a member (in the example shown the crank-pin) simply reciprocates in a right line and in a horizontal pathway of travel in performing the stopping and starting of the bed at each end of its stroke, great simplicity of parts is attained over former constructions wherein a crank-pin made to perform this operation rotates in a vertical plane, and thus requires a vertical guiding pathway and through the walls of which its power is exerted, thereby making it necessary that the point of greatest strain shall be a constant changing one with respect to the bed upon which it operates, and also that its vertical pathway shall be a member interposed between it and the bed, while in the present improvement the action of the crank-pin is directly upon the bed and always in the same vertically-distant relation thereto.

From a slight consideration of these improvements as embodied herein it will be apparent that the crank-wheel, bed-wheel, crank-carrying pinion, and the internal gear may be arranged to operate horizontally, in which case the abutments projecting from the bed will be quite short and the pathway, if one is used connecting them, be much nearer the under face of the bed. It is therefore to be understood that this horizontal arrangement is within the scope of the present claims, and it is accordingly illustrated herein as a modification, though the same is made the subject-matter of my application, Serial No. 584,045, filed March 20, 1896. As herein illustrated, the internal gear 8, crank-wheel 4, crank-pin 2 it carries, and the bed-driving wheel shown are horizontally positioned, which position, as shown, necessitates a slight change of other parts. Thus the crank-wheel is mounted upon a shaft 10, which is vertically stepped in a bottom support and journaled in a sliding frame 90, which supports the internal gear 8, while the driving-shaft 10 (which, with this wheel-shaft, becomes a compound shaft, and for that reason each retains the same letter of reference) is connected to the vertical shaft 10 by a beveled gear 28 through a beveled gear 38, fast on the under face of the crank-wheel 4. In this modification the way S, and consequently the abutments at each end thereof, extends but a short distance below the bed B, while the latches L are hung at each end of the way S, nearly over said abutments, the crank 7 of these latches riding on a rail 14, suitably provided with inclined surfaces to raise and lower these latches for locking the box 1 to the abutment. The rack-hangers in this instance are both short, for the reason that they are required only to extend the same distance, as each rack is in the same horizontal plane or that of the bed-driving wheel D. The bed-driving wheel in this modification is journaled upon a stud carried by a sliding frame 90, capable of transversely sliding in guides in the framework, its movements in opposite directions being accomplished by the cam 20, acting upon a lever 22, attached to said frame, which cam is so shaped as to cause said bed-driving wheel to appropriately engage the racks 11 12. In such a horizontal arrangement it is feasible in modification thereof to omit the bed-wheel D and gear the crank-wheel directly into moving racks that immediately underlie the bed, as is also shown in said application filed by me on the 20th day of March, Serial No. 584,045, in which application these modifications are claimed, although they are broadly embraced by the claims herein.

What is claimed is—

1. The combination with means for driving the bed throughout the greater extent of its movement in either direction, and an abutment on the bed, of a crank-pin engaging said abutment, and means for causing said crank-pin to travel horizontally at successively decreasing and increasing velocities, whereby it coacts with said abutment to slow down and arrest the movement of the bed in one direction and to start and accelerate it in the other direction, substantially as described.

2. The combination with means for driving the bed throughout the greater extent of its movement in either direction, and abutments at opposite ends of the bed, of a crank-pin engaging said abutments, and means for causing said crank-pin to travel horizontally at successively decreasing and increasing velocities, whereby it coacts with said abutments to slow down and arrest the movement of the bed in one direction and to start and accelerate it in the other direction at each end of its stroke, substantially as described.

3. The combination with a bed provided with a driving-rack, a bed-driving wheel and means for engaging it with and disengaging it from said rack, and an abutment on the bed, of a crank-pin engaging said abutment, and means for causing said crank-pin to travel horizontally at successively decreasing and increasing velocities, whereby it coacts with

said abutment to slow down and arrest the movement of the bed in one direction and to start and accelerate it in the other direction, substantially as described.

4. The combination with a bed provided with driving-racks, of a bed-driving wheel and means for alternately engaging it with and disengaging it from said racks, abutments on the bed separated a distance substantially equal to the extent of movement of the bed in each direction while driven by said wheel, a crank-pin engaging said abutments, and means for causing said crank-pin to reciprocate horizontally at successively decreasing and increasing velocities, whereby it coacts alternately with said abutments to slow down and arrest the movement of the bed in one direction and to start and accelerate it in the other direction at each end of its stroke, substantially as described.

5. The combination with means for driving the bed throughout the greater extent of its movement in either direction and an abutment on the bed, of a crank-pin, a pinion carrying said crank-pin, an internal gear with which said pinion gears, and a crank-wheel to which said pinion is pivoted, substantially as described.

6. The combination with means for driving the bed throughout the greater extent of its movement in both directions and abutments on the bed at each end thereof, of a crank-pin, a pinion carrying said crank-pin, an internal gear with which said pinion gears, and a crank-wheel to which said pinion is pivoted, substantially as described.

7. The combination with means for driving the bed throughout the greater extent of its movement in either direction, of a hanger depending rigidly from the bed and provided with a way S, a crank-pin and means causing it to travel horizontally in said way and abut alternately against the ends thereof and move at successively decreasing and increasing velocities whereby it coacts with the ends of said way to retard the movement of the bed in one direction and arrest it, and to start and accelerate the bed in the other direction, substantially as described.

8. The combination with a bed provided with a driving-rack and bed-driving wheel and means for engaging and disengaging the wheel from the rack, and a hanger depending rigidly from the bed and provided with a horizontal way, of a crank-pin, a pinion carrying said crank-pin, an internal gear with which said pinion gears, and a crank-wheel to which said pinion is pivoted, substantially as described.

9. The combination with a bed provided with driving-racks and bed-driving wheel and means for engaging and disengaging the wheel from said racks, and a hanger depending rigidly from the bed and provided with a horizontal way, of a crank-pin, a pinion carrying said crank-pin, an internal gear with which said pinion gears, and a crank-wheel to which said pinion is pivoted, substantially as described.

10. The combination with the bed B, racks 11, 12, hanger-abutments, wheel D carried by a counterbalanced lever 5, a cam for operating said lever to shift the wheel from rack to rack, crank-wheel 4 on the main shaft gearing with wheel D and carrying pivoted to it the pinion 2, internal gear 8 with which said pinion gears, and crank-pin 9 carried by said pinion, substantially as described.

11. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater part of its movement, of a bodily-revolving lever also rotating on an independent axis in the opposite direction of its bodily travel, and means in connection with said part to be reciprocated for engagement with said lever, substantially as described.

12. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revolving lever also rotating on an independent axis in the opposite direction of its bodily travel, and means at each end of said part to be reciprocated for engagement with said lever, substantially as described.

13. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revoluble lever rotatable on an independent axis and comprising a toothed portion forming a pinion, a second toothed portion engaging with said pinion and causing the same to rotate, and means in connection with said part to be reciprocated for engaging with said lever, substantially as described.

14. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revoluble lever rotatable on an independent axis and comprising a pinion, a non-rotative toothed portion engaging with said pinion and causing the latter to rotate and means in connection with said part to be reciprocated for engagement with said lever, substantially as described.

15. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revoluble lever rotatable on an independent axis and comprising a pinion, an internal gear surrounding said pinion and meshing therewith, whereby said lever is rotated in the opposite direction of its bodily travel, and means in connection with said part to be reciprocated for engagement with said lever, substantially as described.

16. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revoluble lever rotatable on an independent axis and comprising a pinion, an internal non-rotative gear sur-

rounding said pinion and causing said lever to rotate, and means in connection with said part to be reciprocated for engagement with said lever, substantially as described.

17. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a rotating member, a lever pivoted eccentrically to and carried by said member, a non-rotative gear, said lever comprising a pinion engaging with said gear and causing the rotation of said lever, and means in connection with said part to be reciprocated adapted to engage with said lever, substantially as described.

18. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a rotating member, a shaft secured eccentrially to and supported by said rotating member and a pinion and an actuating member mounted on said shaft and constituting a lever, a non-rotative gear engaging with said pinion, and means carried by said part to be reciprocated for engaging with said actuating member, substantially as described.

19. The combination with the part to be reciprocated and means for reciprocating said part throughout the greater portion of its movement, of a bodily-revolving lever also rotating on an independent axis in the opposite direction of its bodily travel, an abutment in connection with said part to be reciprocated for engagement with said lever, and means for holding said lever in engagement with said abutment, substantially as described.

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

GEORGE F. READ.

Witnesses:
F. W. H. CRANE,
E. L. SPEIR.