(No Model.) 8 Sheets—Sheet 1.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

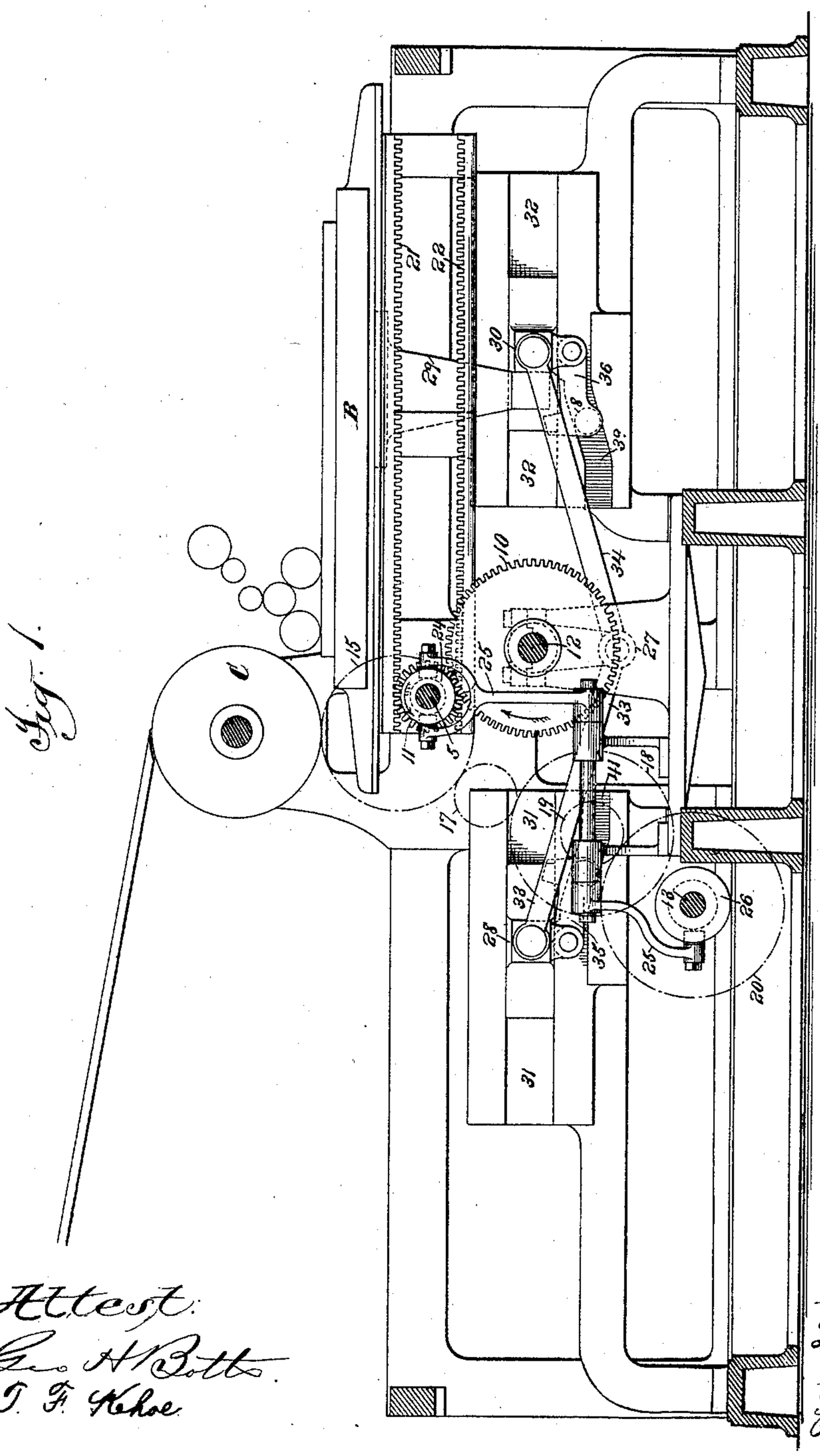

Fig. 1.

Attest:
Geo. H. Bott.
T. F. Kehoe

Inventor
Luther C. Crowell.
by
Philipp Munn and Philipp
Attys

(No Model.)

8 Sheets—Sheet 2.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

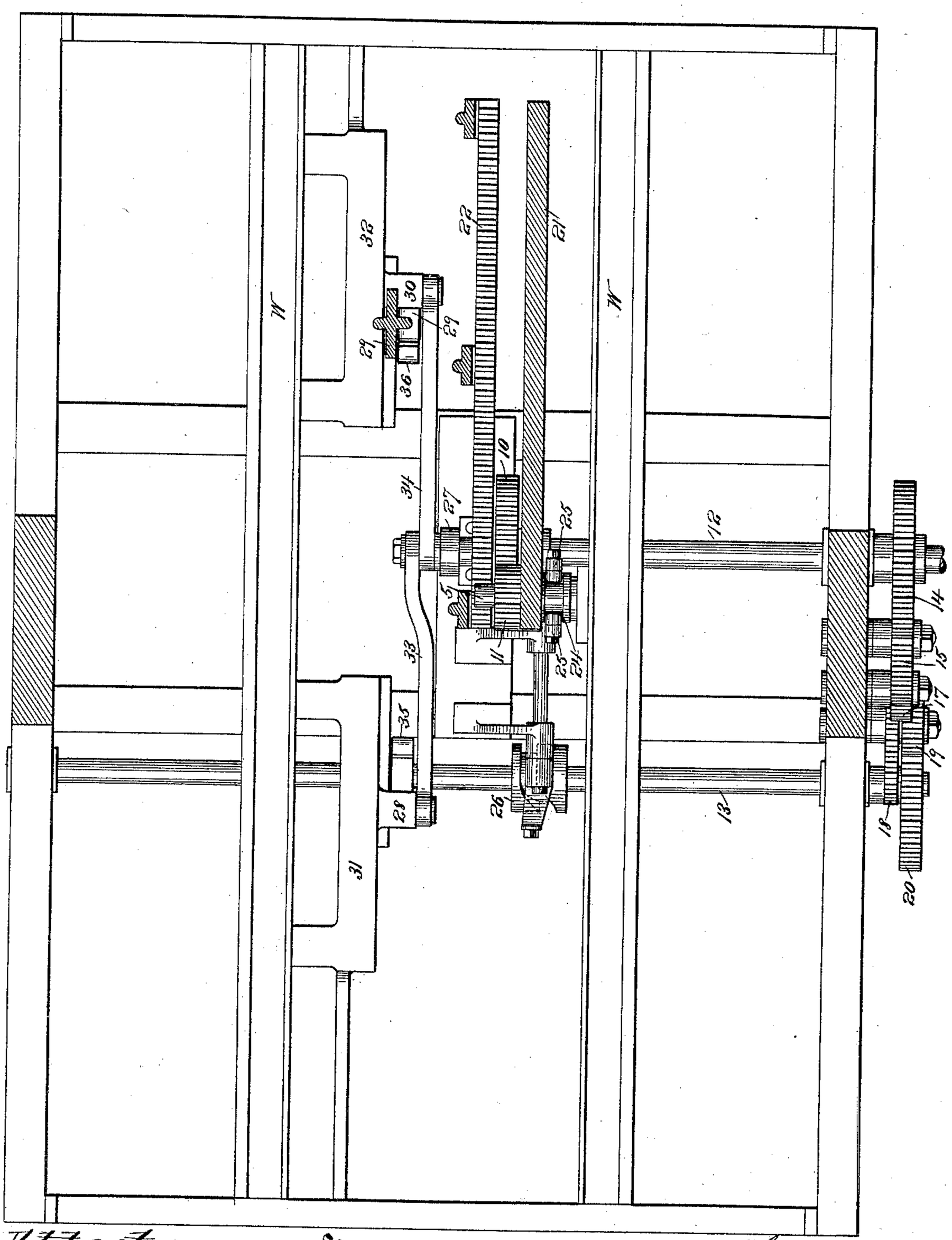

Fig. 2.

Attest:
Geo. H. Botts
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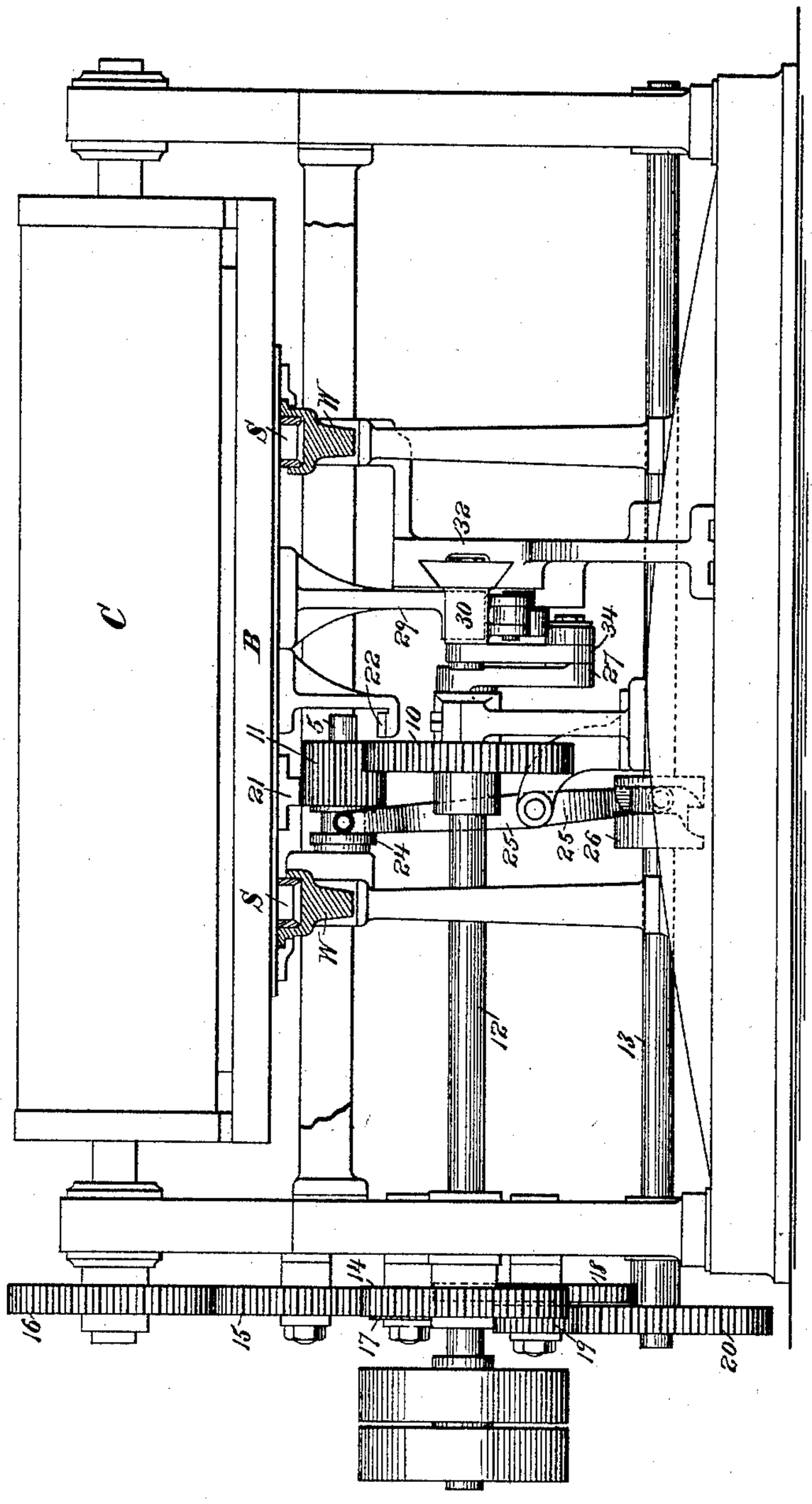
(No Model.) 8 Sheets—Sheet 3.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

Fig. 3.



Attest:
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(No Model.) 8 Sheets—Sheet 4.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

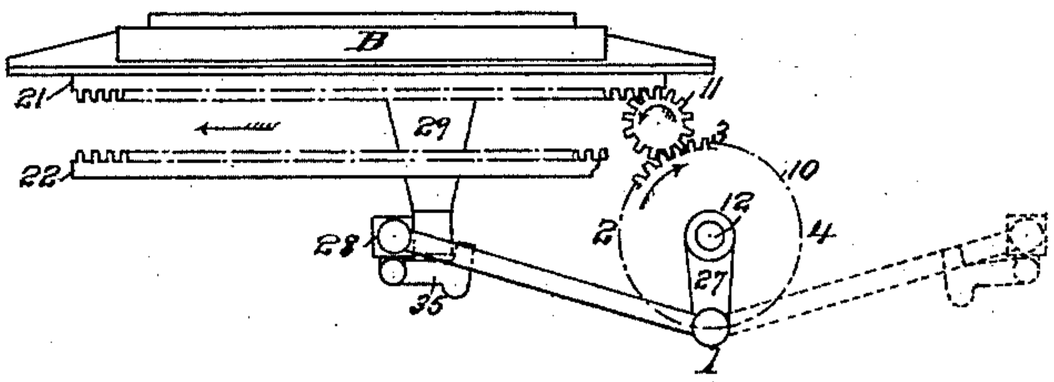

Fig. 4.

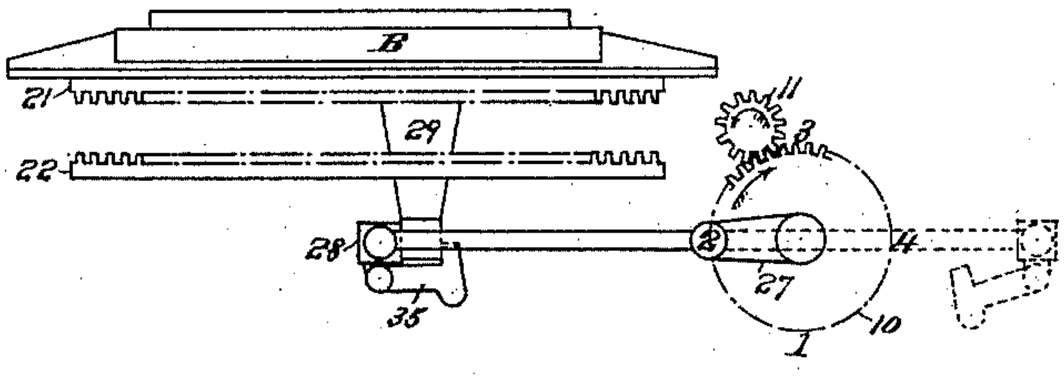

Fig. 5.

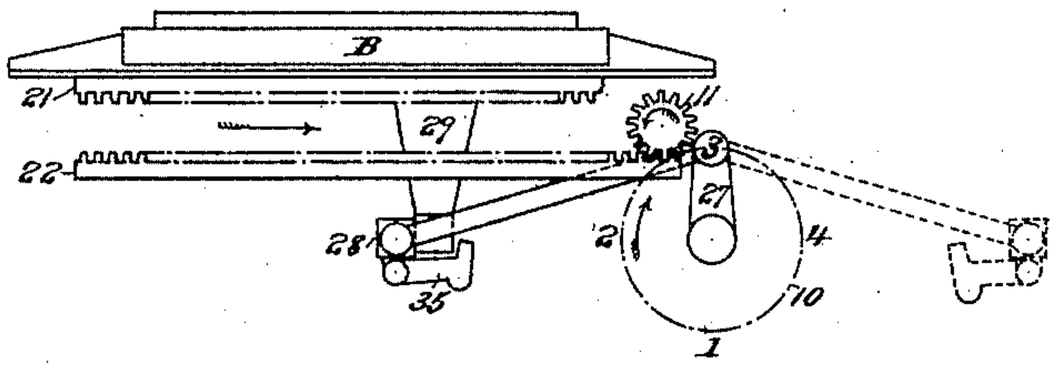

Fig. 6.

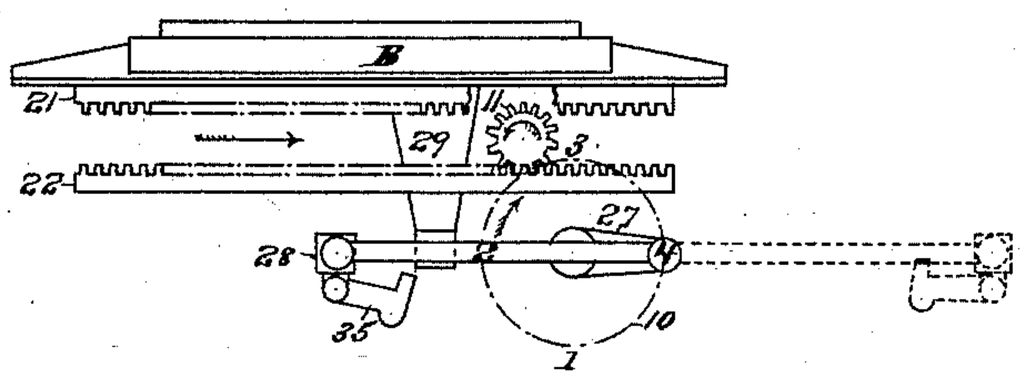

Fig. 7.

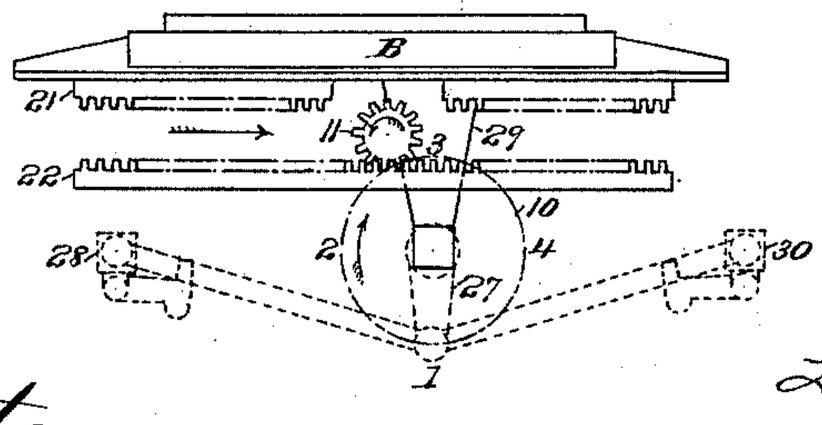

Fig. 8.

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(No Model.) 8 Sheets—Sheet 5.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

Fig. 9.

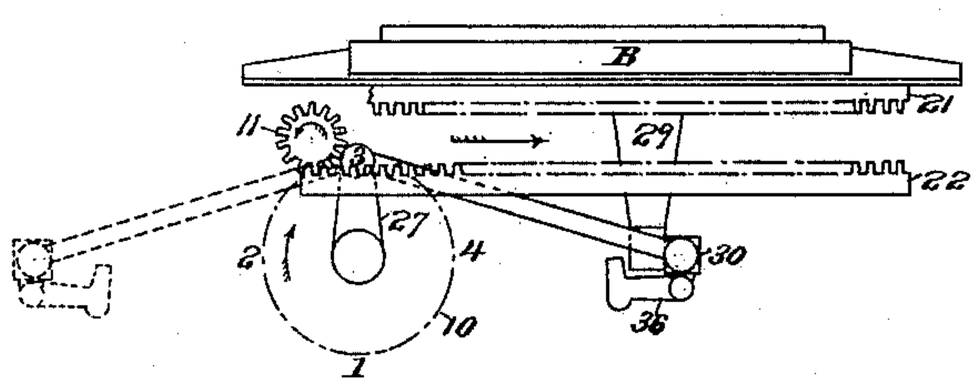


Fig. 10.

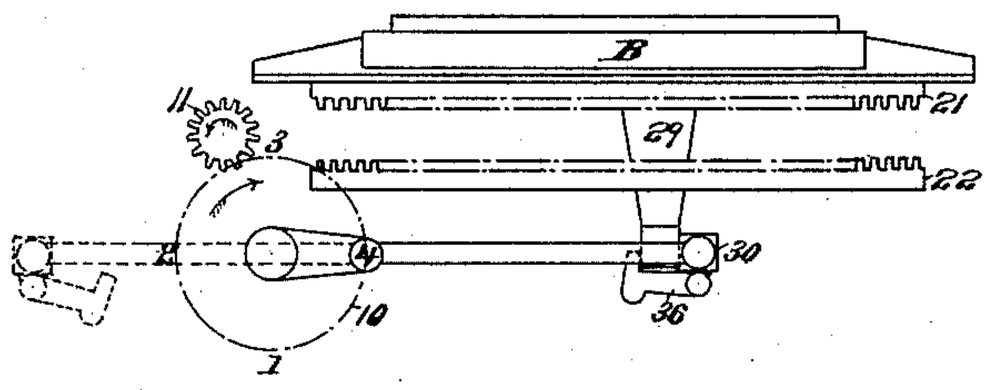


Fig. 11.

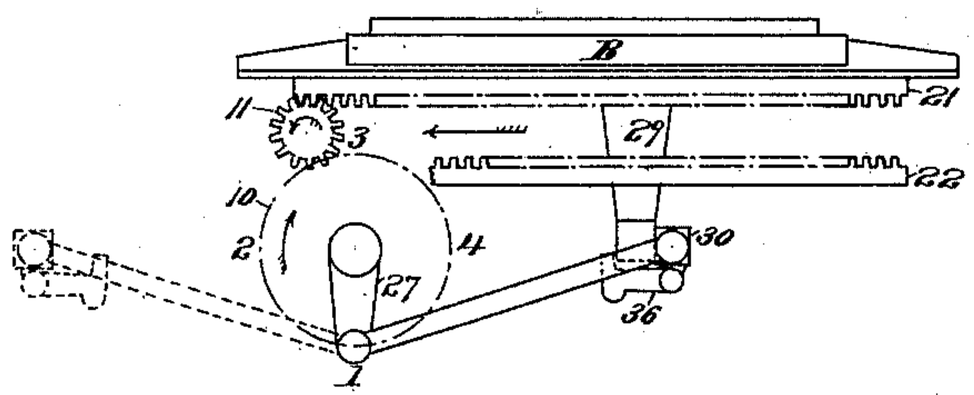


Fig. 12.

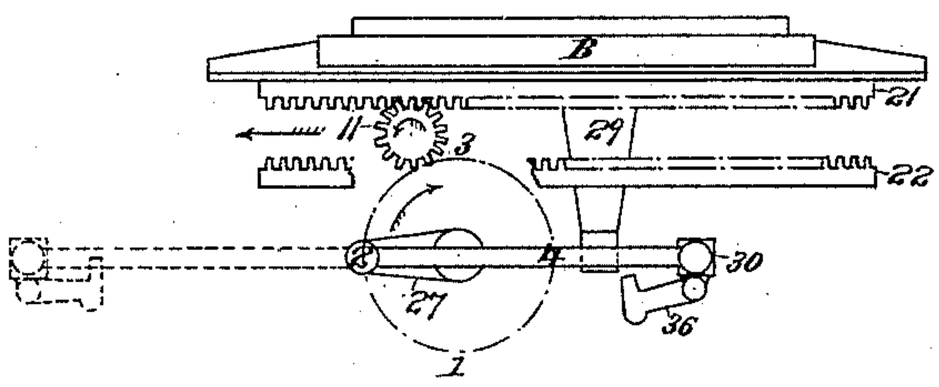
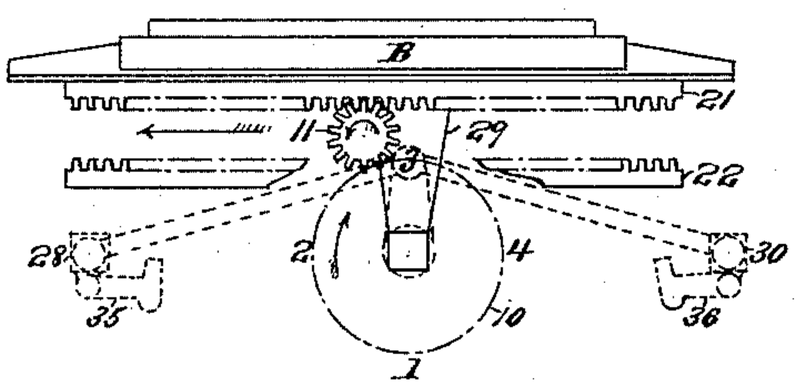


Fig. 13.



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(No Model.) 8 Sheets—Sheet 6.

L. C. CROWELL.

BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

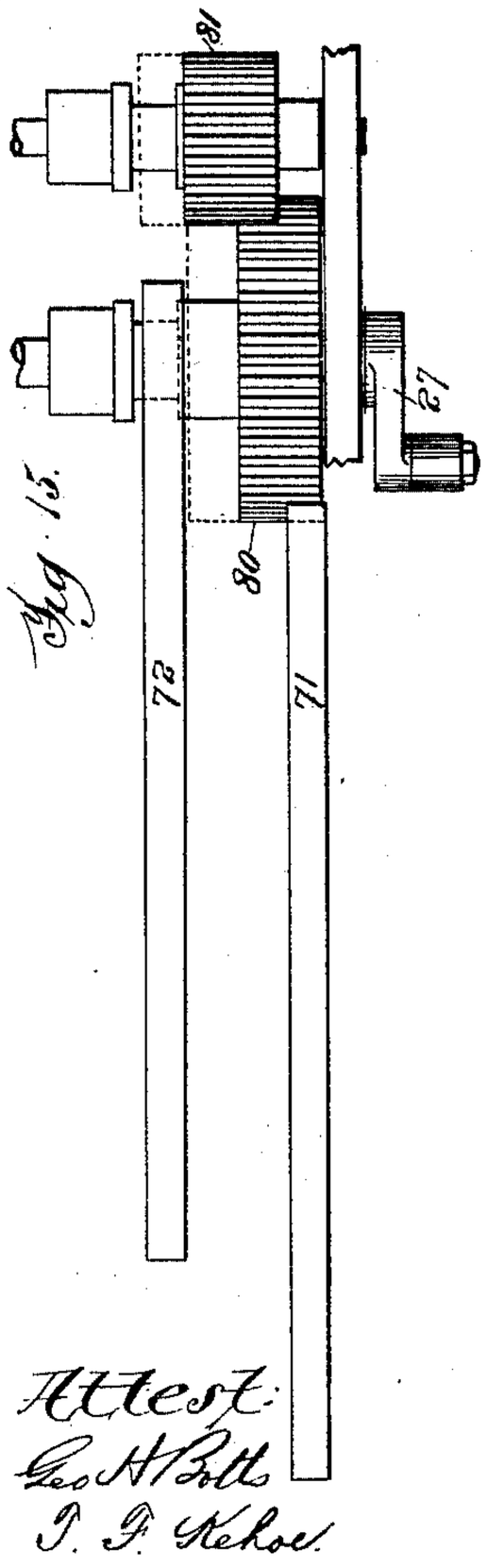

Fig. 15.

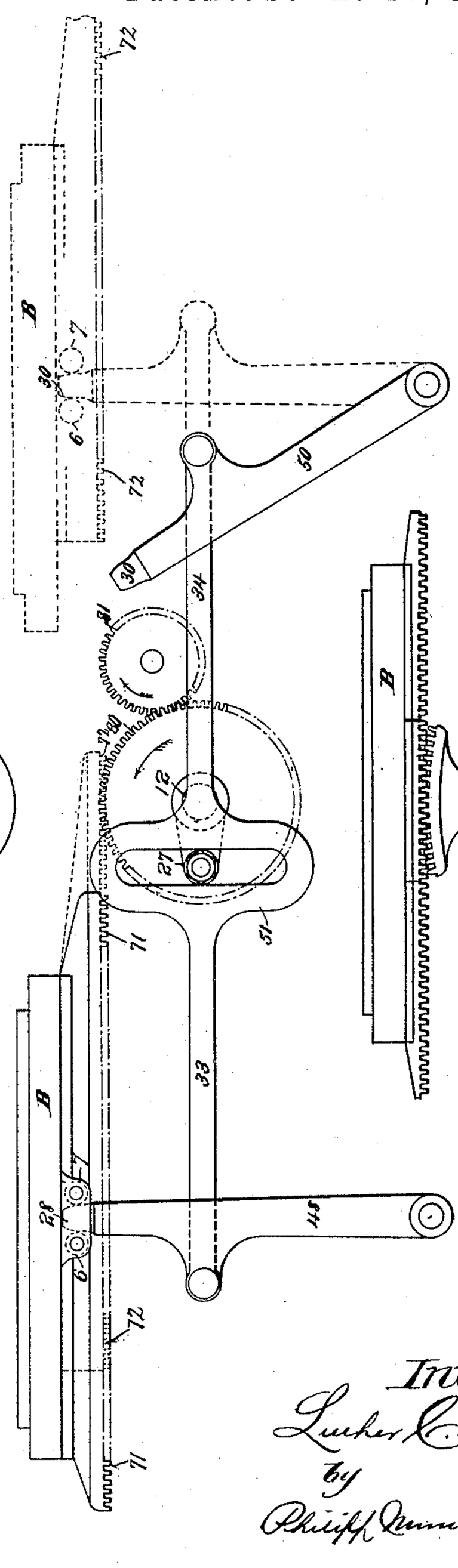

Fig. 14.

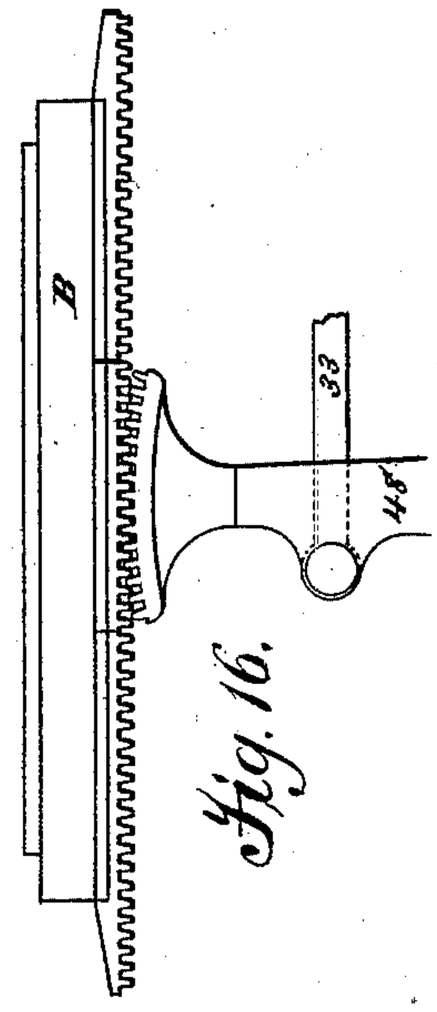

Fig. 16.

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(No Model.) 8 Sheets—Sheet 7.

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BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

Fig. 17.

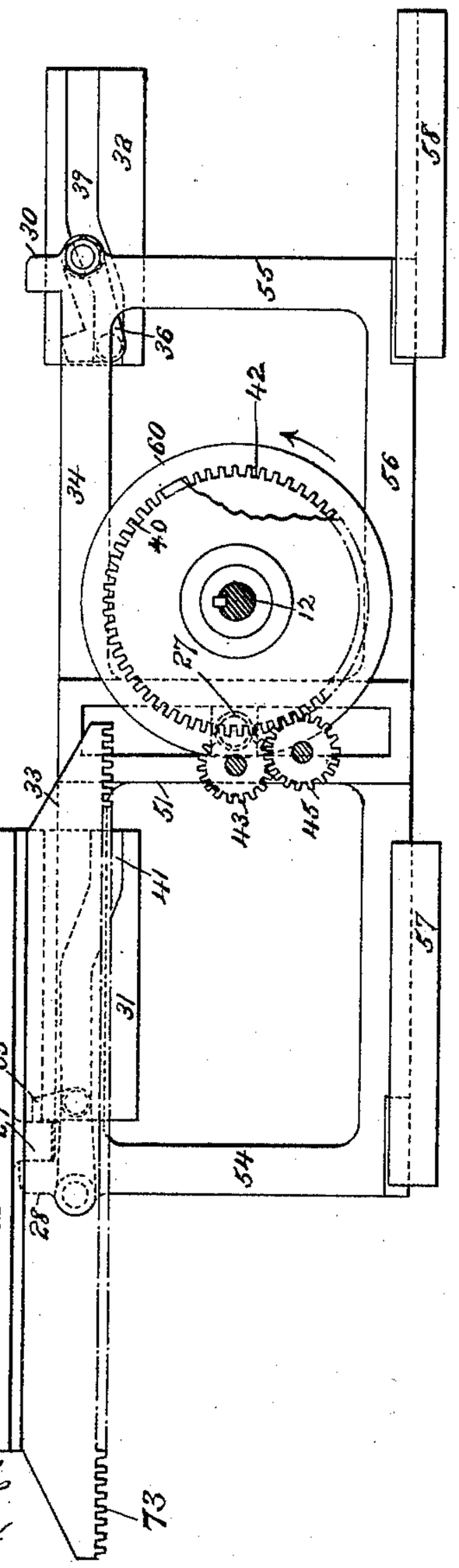

Fig. 18.

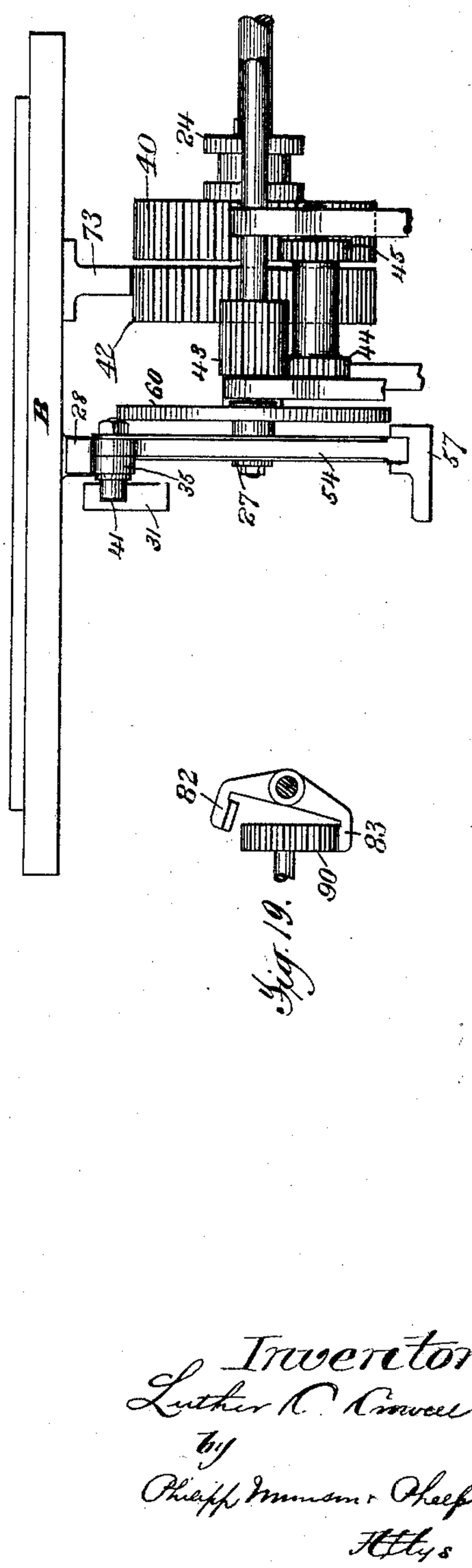

Fig. 19.

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by
Philipp Inman & Cheesbro.
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(No Model.) 8 Sheets—Sheet 8.

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BED MOTION FOR CYLINDER PRINTING MACHINES.

No. 477,045. Patented June 14, 1892.

Fig. 21.

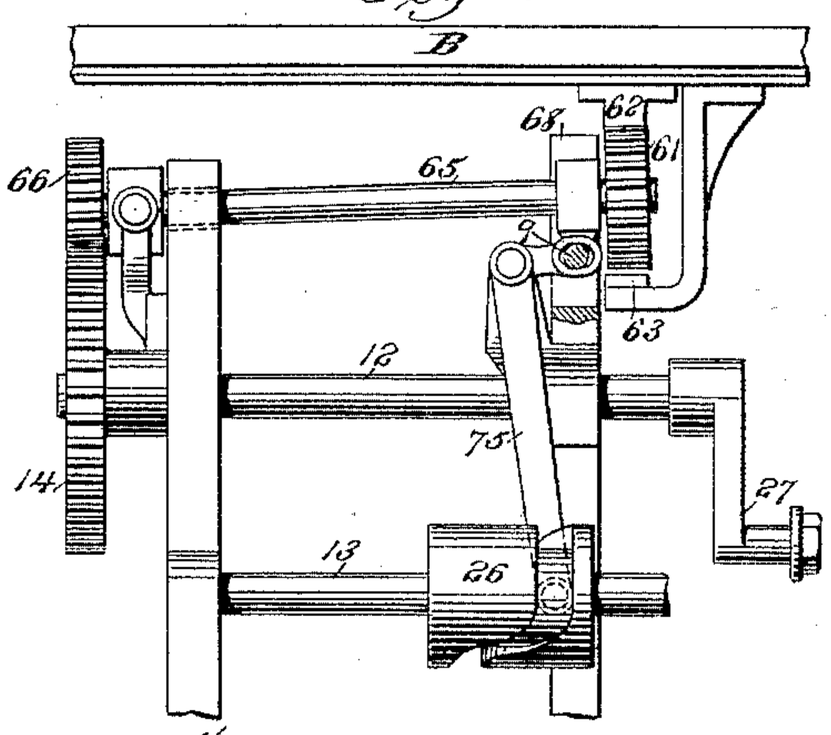


Fig. 20.

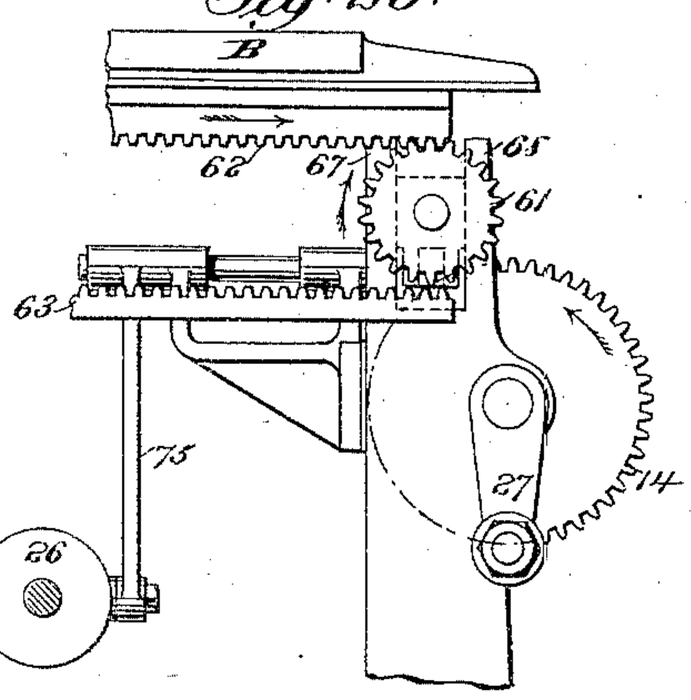


Fig. 22.

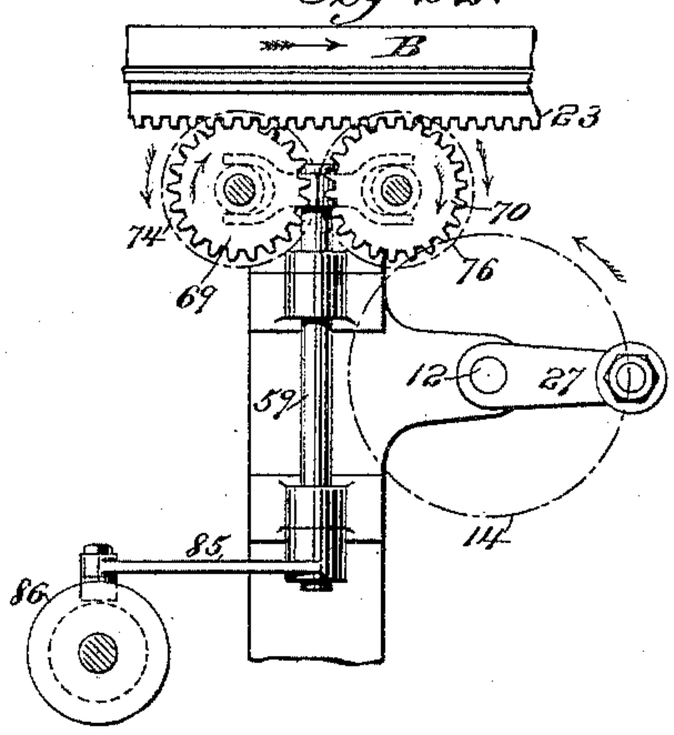


Fig. 23.

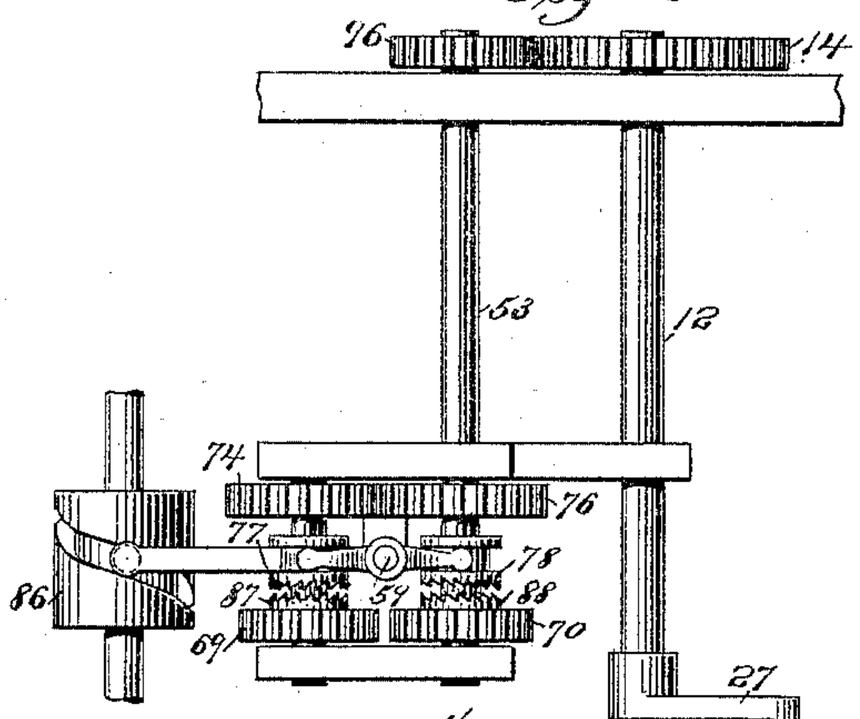


Fig. 24.

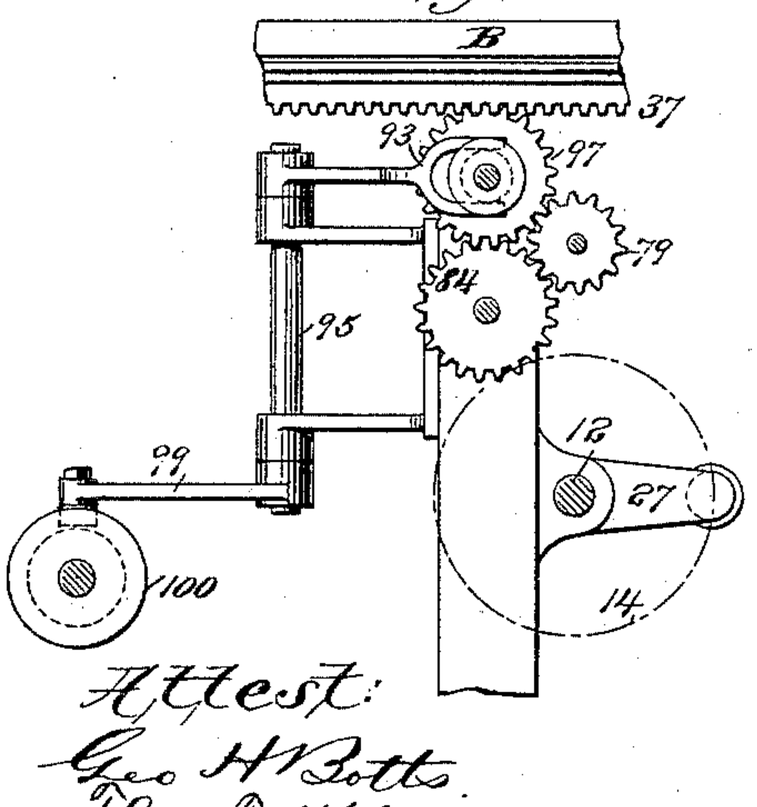
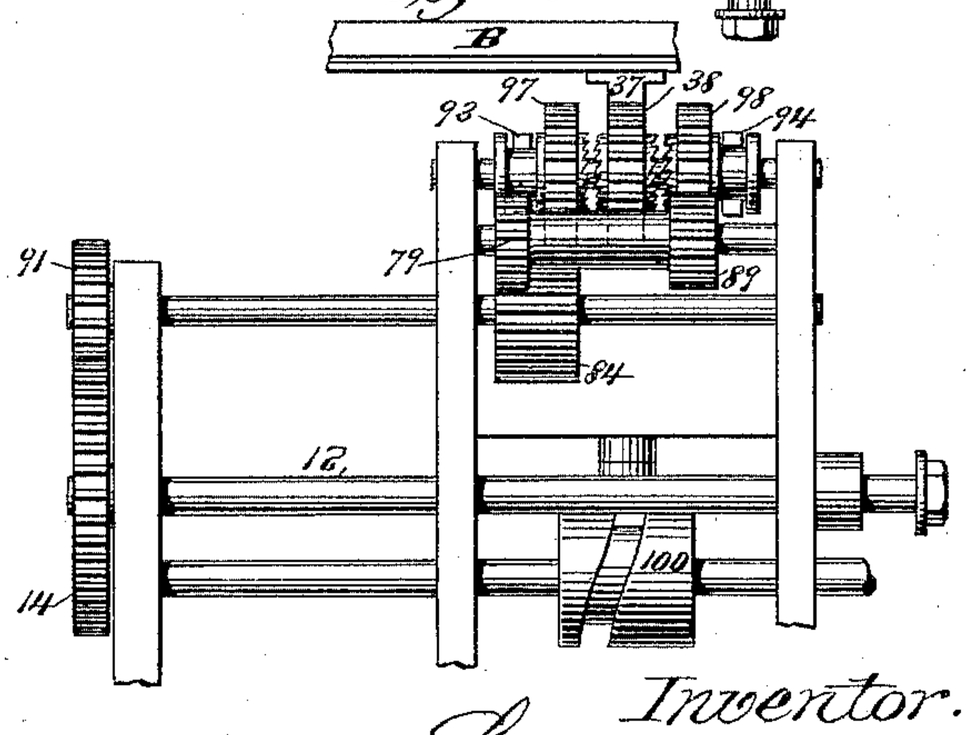


Fig. 25.



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Thos. P. Kehoe.

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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO ROBERT HOE, STEPHEN D. TUCKER, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

BED-MOTION FOR CYLINDER PRINTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 477,045, dated June 14, 1892.

Application filed February 18, 1892. Serial No. 421,914. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at the city of 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, primarily, to the means for imparting a reciprocating motion to the type-beds of cylinder printing-machines. One species of such printing-machines has an oscillating impression-cylinder that is driven by a top rack on the type-bed. In one such construction the cylinder prints while running in one direction, is then raised, and runs idly in the other direction during the return of the bed. In another such construction the cylinder, without rising and falling, prints while running in both directions and is provided with a returning-cylinder, so as to perfect the same sheet. In another such construction the cylinder, without rising and falling, prints while running in both directions and is provided with two feeds, so as to print two sheets upon one side. Another species of such printing-machines has an impression cylinder or cylinders that continuously revolve. One such construction has one cylinder with a depressed part that allows the returning bed to pass without making printing-contact. Another such construction, called "two-revolution," has the cylinder raised during its second revolution or while the bed is returning. In another such construction, called "three-revolution," the cylinder which runs in printing relation to the bed during one revolution is being raised during the next half-revolution, held in its raised position during the return of the bed, and being lowered during the next half-revolution. Another species of such printing-machines have two impression cylinders continuously revolving in opposite directions, each printing during its second revolution and so rising and falling that while one cylinder is down in printing relation to the passing bed its companion is up out of such position. In one such construction sheets may be fed to each cylinder and delivered printed upon one side only. In another such construction a sheet fed to one cylinder and printed upon one side is transferred to the other cylinder and printed upon its other side. In another such construction the cylinders have depressed portions for the non-printing passage of the bed and are connected by two transferring-cylinders, so that a sheet printed by one cylinder is transferred to and printed by the other cylinder. Another species of such printing-machines, called "stop-cylinder," has its cylinder driven during the printing operation by a top rack on the bed and stopped while the bed returns by running past a flat portion of the cylinder. In such printing-machines a perfect printing operation depends upon an exact unison of movement between the surfaces of the impression-cylinder and the type-form on the bed during the whole period of making the impression, and when this is accomplished the immediate necessity to the attaining of a maximum speed of operation is the rapid slowing down of the movement of the bed, stopping the same, starting the bed in the reverse direction, and reattaining said surface speed. This will be best performed when it is accomplished without jar and is attained by the present improvements.

The invention consists in the combining, with the reciprocating bed, of a crank-actuated controlling-arm, whereby the movement of the bed at either end of its run is gradually decreased to a state of rest and is then started and accelerated in the opposite direction; also, in the combination, with the reciprocating bed and a driving-pinion moving the same through a rack attached to the bed, of a crank-actuated controlling-arm that engages the bed as the driving-pinion ceases to be the driver and thereafter controls the movement of the bed and brings the same to a state of momentary rest, then starts the same and moves it in the reverse direction with an accelerating speed, and is then disengaged from the bed as the driving-pinion again becomes the driver, whereby the bed, driven at a maximum speed, is slowed down

in one direction, stopped, and started in the reverse direction by a powerful and efficient mechanism that produces a smooth and regular movement.

The invention embraces many forms of embodiment in printing-machines and may in any or all of them be applicable wherever in any machine it is desirable to quickly convert the movements of any reciprocating device without jar or undue strain. Many combinations of parts and details of construction are also included within the present improvements; but the same are so particularly hereinafter described as to need no further preliminary explanation.

In the accompanying drawings, illustrating the present improvements, Figure 1 is a side elevation taken just within the nearest side frame. Fig. 2 is a plan view taken on a line just above the bed-rack; and Fig. 3, an end elevation, partially in section, of so much of a cylinder printing-machine as is necessary to an illustration of the application of the present improvements thereto. Figs. 4 to 13 are diagrams illustrating the bed and its driving mechanism at different points and in different positions of their movements. Fig. 14 is a diagrammatic side elevation of a modified form of the improvements, in which the rack member 22 is shown in dotted lines to render the illustration clear. Fig. 15 is a plan view of the bed-racks and driving-pinions, and Fig. 16 is a side elevation of part of a controlling-arm of peculiar structure. Fig. 17 is a diagrammatic side elevation of a further modified form of the improvements, and Fig. 18 is an end elevation of the same. Fig. 19 illustrates a means of moving the rack, so that its opposite members shall alternately be carried into gear with the driving-pinion. Fig. 20 is a side elevation of a modification in which the driving-pinion is vertically moved to alternately engage the opposite members of the driving-rack, and Fig. 21 is an end elevation of the same. Fig 22 is a side elevation, and Fig. 23 a plan view, of a modification of rack-and-pinion driving mechanism in which the coupling or operative connection of the rack and pinion is controlled by clutches. Figs. 24 and 25 are respectively a side and a sectional end elevation of a further modification of rack-and-pinion driving mechanism, the operation of which is controlled by a clutch mechanism.

The elements of this slowing, stopping, and starting mechanism are a controlling-arm that engages with and determines the movement of the bed during the operation of reversing it at the end of its run in either direction and an actuating-crank that imparts the requisite movement to said arm, which arm is automatically connected with the bed while it is moving at its maximum speed, and thereafter operates to slow down its movement in one direction, arrest the same, and then to start and accelerate it in the contrary direction until the maximum speed is attained and then be disconnected therefrom.

The reciprocating bed is driven throughout the principal part of its run in either direction by a driving-pinion engaging its rack, and this pinion runs or should run at the highest attainable speed in order to render the printing-machine effective in the highest degree, and during one of these runs, which is that during which the impression is made, the member of the rack that is nearest to the bed will preferably be the one that is engaged by the pinion. When the said pinion is about to become inoperative as the means of driving the bed, the crank-operated controlling-arm will connect with the bed and control the movements thereof until the pinion again becomes its driver. This arm, owing to the peculiar movements imparted by the crank, will have the same surface speed as the bed at the time of its being connected therewith, which speed will immediately be progressively reduced until the bed is momentarily arrested while the crank is passing its center of motion, and thereupon said arm will impart a movement in the contrary direction, which will gradually increase until the maximum speed of the bed is again attained, at which time the bed will again be moved by the driving-pinion and solely driven thereby, while said controlling-arm will be disconnected from the bed, and hence cease to be its driver. Thus the bed will be driven at a maximum speed throughout its principal or working movement, which speed will be modified until it ceases, and then be reattained by a movement that is smooth, powerful, and rapid.

The transition of the driving means from the pinion to the controlling-arm, and vice versa, is progressively accomplished—that is to say, just before the pinion runs out of gear with the rack the arm as the bed is finishing its outward movements will have engaged the bed, so that both pinion and arm will be momentarily engaged with the bed, but while all are running at the same speed, which enables the pinion and rack to separate without strain or jar. This arm also continues to be momentarily engaged with the bed when it is making its inward or return movements until after the rack has engaged the pinion, but the parts are then concertedly moving, and hence coact smoothly. As the driving-pinion ordinarily turns in one direction it will of course be necessary for driving the bed in its reverse movement to provide either a companion wheel, turning appropriately in the opposite direction to cause the same driving-pinion to be moved into engagement with a companion rack, or to provide in some equivalent manner for driving the bed through a rack-and-pinion mechanism during the principal part of its reciprocating movement, all of which will be explained farther on. With this preliminary explanation the construction and operation of the mechanisms and devices illustrated herein will be readily understood, and a general description of those

illustrated by Figs. 1 to 13 will first be given and then modifications and amplifications of the invention will be set forth.

The type or form carrying bed B reciprocates, as is usual, upon wheeled sliders S, running in longitudinal ways W, fixedly supported by the frame-work and co-operates with the cylinder C in performing the printing operation. This bed is primarily moved by a driving-pinion 10, preferably of a size that makes three turns to one complete movement or reciprocation of the bed. Its rotative movement is transmitted herein through an intermediate 11, which, driven thereby and running at the same surface speed, will be referred to and is to be considered in a general sense as the bed-driving pinion, though it will be included as a distinct element in some claims specifically naming it.

The bed-driving pinion 10 is mounted upon a shaft 12, which may be the main or driving shaft that turns in fixed bearings and which will be provided with ordinary means for revolving it. This shaft carries outside of the frame a wheel 14, that meshes with an intermediate 15, from which the cylinder C is driven through a slotted toothed wheel 16, and which also drives a train consisting of intermediate pinion 17, wheel 18, pinion 19, and wheel 20 on shaft 13 for driving various mechanisms.

The intermediate bed-driving pinion 11 is made of double width, so that it may be caused to alternately engage the upper member 21 and the lower member 22 of the bed-rack. It is mounted to turn upon a shaft 5 and is caused to slide thereon, while constantly geared with the driving-pinion 10 by means of a collar 24, yoked to a swinging lever 25, that is vibrated by a cam 26 on the shaft 13, which is rotated by wheel 20 in unison with the bed-driving pinion 10. In such sliding movements this driving-pinion 11 will either be geared with the member 21 or the member 22 of the bed-rack and will be accurately guided from one to the other, as is apparent, and when this driving-pinion is geared with one or the other member of said rack it will drive the type-bed in one direction or the other at the highest maximum speed practically attainable. In order to secure this maximum speed during the greater part of the run of the bed in both directions, and yet quickly convert the same from one direction to the other at the end of the run of the bed in both directions, a crank-operated controlling-arm is automatically connected with the bed by means of a lug 29, depending therefrom at each end of its run at the same time when the bed-rack leaves the driving-pinion, which crank-operated bed-controlling arm operates to slow down and stop the bed, and also to start and accelerate it in its reverse movement, and then to be disconnected therefrom as the rack again engages the driving-pinion to receive motion therefrom.

The precise movements of the bed will now be described by aid of the diagrams Figs. 4 to 13, in which that member of the bed-rack which is inoperative in the position shown is, when it would obscure or mislead, broken away to the necessary extent to render the illustration clear. It may be premised that the actuating-crank 27 is carried by the shaft 12 of the bed-driving pinion 10, and hence that it makes concerted movements therewith. The controlling-arms 28 30 are of dimensions to adapt each to properly engage with one face of the lug 29, and each of said arms projects laterally from a head that slides in ways 31 32, that are fixedly supported by brackets from the frame-work. These arms 28 30 are each pivoted at one end to the actuating-crank 27 by means of rods, as 33 34, whose outer ends are pivoted, respectively, to the said arms 28 30, and hence all of the peculiar movements of the throw of the crank are imparted to said arms, and thence to the bed, when the same is within the range of action of either of said crank-actuated arms.

For the sake of perspicuity one controlling-arm 28 and its mode of operation will first be described, followed by a like description, referring to the controlling-arm 30. Assuming the bed B to have just finished its printing movement, made at a maximum speed while driven by the pinion 11 through the upper member 21 of the bed-rack, the end of said member of the rack will have arrived at the point where it is about to pass out of gear with said pinion, as in Fig. 4, and simultaneously therewith the crank-actuated arm 28, then traveling in the same direction with the bed and with like surface speed, will have been engaged by the lug 29, and thus control the further movement of the bed in that direction. This movement will, while the crank is making its quarter-turn from the point 1 to the quarter-point 2, be a progressively-decreasing one, causing the bed to come to a state of rest when the point 2 is reached, thus slowing down the movement of the bed in the direction of the arrow and stopping the same, as in Fig. 5, and while the crank is making its quarter-turn from the quarter-point 2 to the half-point 3 the controlling-arm 28 will start and move the bed in the reverse direction by a movement that is accelerated until the crank has reached the half-point 3, when the maximum speed of the bed will be attained, at which time the lower member 22 of the bed-rack will gear with the intermediate pinion 11, as in Fig. 6, which pinion will thereafter solely drive the bed in the direction of the arrow during one complete revolution of the pinion 10 or while the crank 27 is traveling from the half-point 3 and again reaches that point, the lug 29 then being disengaged from the arm 28 and moving out of its range of motion, as is shown by Figs. 7, 8, and 9. When, however, the crank has again reached the point 3, as in Fig. 9, the opposite end of the lower member 22 of the bed-rack

will have arrived at the point when it is about to pass out of gear with the pinion 11 and simultaneously the crank-actuated arm 30, then traveling in the same direction as is the bed and with like surface speed, will have been engaged by the lug 29, and thus control the further movement of the bed in that direction. This movement will, while the crank is making its quarter-turn from the half-point 3 to the quarter-point 4, be a progressively-decreasing one, causing a state of rest when the point 4 is reached, thus slowing down the movement of the bed in the direction of the arrow and stopping the same, as in Fig. 10. While the crank is making its quarter-turn from the point 4 to the point 1 the controlling-arm 30 will start and move the bed in the reverse or printing direction by a movement that is accelerated until when the crank has reached the point 1 the maximum speed of the bed will again be attained, at which time the upper member 21 of the bed-rack will again gear with the pinion 11, as in Fig. 11, which pinion will thereafter slowly drive the bed in the direction of the arrow during one complete revolution of the pinion 10 or while the crank is traveling from the point 1 and again reaches that point, which is the movement of the bed during which the impression is made, the lug 29 then being disengaged from the arm 30 and moving out of its range of motion, as is shown in Figs. 12, 13, and 4. When, however, the crank has reached the point 1, as in Fig. 4, the action of the controlling-arm 28 upon the bed will be repeated. Thus the reciprocating bed is driven by the pinion 11 at the highest maximum speed in each direction during one complete revolution of the pinion 10, and its movement in one direction is slowed down and stopped and is then taken up in the opposite direction at each end of its run by a crank-operated controlling-arm, which slowing, stopping, and starting are accomplished while said pinion 10 is free from the bed-rack, and make a half-revolution. In these driving or controlling movements of the bed it will be observed that its movement during the period of the impression is accomplished by a pinion geared with the member of the rack that is fixed directly to the under side of the bed, thus securing a regular and equal movement applied, as near as possible, to the point of contact of the impression-cylinder with the bed, and that the slowing, stopping, and starting at each end of the run of the bed are performed by a crank movement that is not only powerful, but a constantly-changing one that reduces the maximum speed to a state of rest and then reattains the same without producing any jar or necessitating auxiliary aid. When the member 21 of the rack has run out of gear with the pinion 11 and while the bed is completing its run in one direction and undergoing reversal said pinion makes its lateral movement by the action of the cam 26, whereby it is carried out of the path of travel of said rack member 21 and brought into the path of travel of the rack member 22, as in Fig. 3, and while the bed is completing its run in the opposite direction said pinion is again moved laterally, so as to carry it out of the path of travel of said rack member 22 and again bring it into the path of travel of the rack member 21, said rack members being for this purpose set at such a distance apart vertically as to have their pitch-lines correspond with that of the pinion 11, and horizontally separated so that said pinion, while constantly geared with the pinion 10, may be moved into gear with either of said racks.

It may now be remarked that the structure embodying the pinion 10, and with it the pinion 11 and the devices shown or equivalent means for moving the latter, constitutes an important improvement, as it enables the lateral shifting of the pinion 11 to be made upon its shaft without the use of a feather or spline, thus forming a structure of great strength and one that is subjected to a minimum amount of wear for the reason that it revolves freely upon its carrying-shaft.

In the preceding description the arms 28 and 30 have been alluded to as connected with and disconnected from the bed or its depending lug 29. Practically their work is performed by simple contact with said lug for the reason that the pressure during their working movement is opposed to the direction of their travel at the time such work is performed, and hence they are broadly to be considered as devices against which the lug 29 abuts. It is desirable, however, to prevent any false action, as jumping or any other unnecessary or improper movement which might result when the machine runs slowly, to provide means for coupling them to the lug 29 in their working position at the moment when it has been reached, and of uncoupling them when the time arrives for the lug 29 to move independently of them. Herein this is accomplished by means of a latch automatically moved upward and against the lug 29, so as to clutch the same between it and the co-operating arm. There is such a latch coacting with each arm, as the latch 35 with the arm 28 and the latch 36 with the arm 30. As the construction of both is the same, one only will be particularly described. This latch, as 36, is pivoted at the end of its long arm to a stud depending from the body of the said arm and at its bend or the junction of its two arms it is provided with a stud or bowl 8, that travels in a lateral camway 39, provided in the lower part of the body of the block, in which is formed the guideway 32. When the rack member 22 is about to leave the pinion 11, as in Fig. 9, and the lug 29 and arm 30 are making contact, the stud or bowl 8 of this lever will ride from the low to the high part of the camway 39, (see Fig. 1,) and the latch 36 thus be brought into a position to confine and hold said lug 29 between it and the arm 30, which coupled condition of these parts will be main-

tained during the slowing down, stopping, and starting of the bed, all while the crank is moving from the half-point 3 to and reaches the point 1, as is illustrated by Figs. 9, 10, and 11, at which latter time a reverse movement of the latch will be made to uncouple said lug and arm, while the rack member 21 is running into gear with the pinion 11, and thus permit the lug 29 to move free, as is shown in Figs. 12 and 13. The opposite latch 35 depends in like manner from the arm 28 and has a similar stud or bowl that runs in a similar camway 41, formed in the block having in it the guideway 31, and its complete movement, in connection with the lug 29, is performed when the rack member 21 is about to leave the pinion 11, as in Fig. 4, and the lug 29 and arm 28 are making contact, and its uncoupling movement is made when the rack member 22 is engaging with the pinion 11, as in Fig. 6, and the lug 29 moving away from it, as is shown in Figs. 7 and 8.

Many modifications of this invention may be made without departing from the generic character thereof. Some of them are herein illustrated and will now be described; but it is to be understood that they are herein contained only as they are embraced by the broad scope of the claims, and that in all other respects they form the subjects-matter of separate applications, serially numbered and dated, respectively, as follows: No. 422,835, filed February 26, 1892; No. 427,023, filed March 30, 1892; No. 427,162, filed March 31, 1892; No. 427,317, filed April 1, 1892, and No. 427,554, filed April 2, 1892.

The construction embodying the improvements shown in Figs. 14 and 15 will now be explained. The controlling-arms 28 30 are formed by the upper ends of rocking levers 48 50, which are pivoted at their lower ends to the frame-work. They are engaged with and disengaged from the bed B at appropriate times by means of a double lug constituted by two projections separated sufficiently to form a receiving-socket into which said arms may enter, which double lug thus forms a substitute for the lug 29 and provides bearings on opposite sides of the arms which removes the necessity for locking-latches and the means for operating the same, and this double lug may or may not have the friction-rolls 6 7, as shown. The pin of the actuating-crank 27 travels in a yoke 51, to the opposite sides of which the connecting-rods 33 34 are attached, which rods are pivoted at their outer ends, respectively, to the levers 48 50. The bed-rack consists of two members 71 72, both of which are in the same horizontal plane and fixed close to the under side of the bed, but at some distance apart. These racks co-operate, respectively, with a three-revolution pinion 80 and an intermediate 81, both of which are held in the relation shown and in meshing contact and provided with appropriate means, as that heretofore shown and described, for sliding them laterally on their shafts. This pinion and intermediate will turn in the direction of the arrows and their movement will, as is shown in Fig. 15, enable the pinion 80 to turn in the vertical plane occupied by the rack 71, and hence engage the same during the run of the bed when the impression is made, and when the bed is moving in the opposite direction enable the intermediate 81 to run in the vertical plane occupied by the rack member 72, and hence engage the same.

A modified structure of controlling-arm, suitable to be carried at the end of a rocking lever, is shown in Fig. 16. This consists in providing the free end of each of the arms with a segment-rack whose multiplex teeth will engage in an auxiliary rack secured to the center of the bed.

The construction embodying these improvements shown in Figs. 17 and 18 illustrates a modification of the yoke 51, in which a crank-pin 27 operates. Its connecting-rods 33 34 extend outwardly from its upper end, whereby the controlling-arms 28 30, which run in the guideways 31 32, are brought so near to the plane of travel of the bed as to enable the lug 29 to be short and the leverage to be much reduced, and in order to steady the reciprocations of these arms there are end plates 54 55, that are connected with the arms and provided with a lower member 56, that moves in guiding-slots provided in blocks 57 58, attached to the frame-work. These arms 28 30, their latches 35 36, and their mode of operation are precisely the same as has been heretofore described, and therefore need no additional description at this time. In this case there are two driving-pinions 40 42 of equal pitch and double width, which alternately mesh with the single rack 73, which is fixed in a horizontal plane close to the under surface of the bed. These pinions 40 42 revolve loosely upon the same shaft, which is mounted in fixed bearings, and are made to revolve constantly in opposite directions by the intermediates 43 44 45, which pinions 40 42 are so connected together as to slide bodily into position to bring the appropriate one of them into gear with the bed-rack and yet remain geared with their intermediates. Of these intermediates 43 is fixed to its shaft, which in this case is the driving-shaft, and it is wide enough to accommodate this sliding movement of the pinion 42 and yet remain geared with it, and the intermediate 44 will likewise remain in gear with the pinion 40 during such movement. In this form of the invention the crank-pin 27 is carried by a disk 60, and the path of movement of such crank-pin corresponds with the pitch-line of the driving-pinions 40 42. So, also, with the single pinion and a rack having upper and lower members, the pinion may be on a shaft revolving in fixed bearings and the two members of the bed-rack be so attached to the bed that by a rocking or sliding movement the appropriate member will be presented at the

proper time to gear with said pinion. This modification is shown in Fig. 19, wherein the bed-rack members, as 82 83, are carried by a swinging frame, which, rocked in one direction, will engage the rack, as 83, with the pinion, as 90, and rocked in the other direction will engage the rack, as 82, with the said pinion.

A single driving-pinion 61 and a bed-rack with upper and lower members 62 63, as in Figs. 20 and 21, may be employed, and the pinion may be provided with means for moving it automatically at appropriate times into a position to gear with the upper member 62 and lower member 63 of the bed-rack, as is required. In the construction shown this driving-pinion 61 is mounted upon one end of a shaft 65, whose opposite end is supported in a pivoted box, whereby said shaft is enabled to swing slightly and yet be rotated from the crank-shaft 12 through the wheel 14 and pinion 66. This shaft 65 is raised and lowered in its guides 67 68 by means of stud 9, that is embraced by the short arm of the rocking lever 75, which latter is moved by the cam 26 on the shaft 13. When the pinion is about to be engaged by the rack member 62, it is moved upward into the plane of its travel, as in Fig. 20, and when it is to engage the rack 63 it is moved downward into the plane of travel of that rack member.

From the foregoing specification it will have been understood that the office of the driving pinion or pinions, in co-operation with the bed-rack, whether single or double membered, is to drive the bed during the major part of its movement in both directions and then cease to drive the bed at the time when the crank-actuated controlling-arms come into operation to finish the bed movements at each end of its run and stop and start them in a reverse direction. In the constructions thus far shown and described this suspending of the driving action of the rack-and-pinion mechanism has been accomplished by a separation of the rack and pinion.

It will now be shown how the rack-and-pinion mechanism may remain constantly geared and yet have their driving action appropriately sustained for driving the bed during the principal extent of its reciprocating movements and yet be suspended at the time when the crank actuated controlling-arm is in active operation. This is illustrated in Figs. 22 and 23, which show one such means. In this construction there is but one bed-rack 23, and it has two equal-sized driving-pinions 69 and 70 constantly geared with it. The pinion 70 is mounted to run freely on a shaft 53, that is driven by a pinion 96 from the wheel 14 on the crank-shaft 12. These pinions 69 70 are not geared together, but are mounted to turn freely upon their shafts, which are driven in contrary directions by means of wheels 74 76, fixed thereon, meshing together, and consequently constantly revolved in the directions indicated by the outside arrows in Fig. 22, and the shafts carrying these wheels 74 76 are each provided with the moving member of a clutch, as 77 78, while the other member of each clutch, as 87 88, is secured, respectively, to the pinions 69 70. The moving members 77 78 of these clutches are splined upon the shaft, so as to slide thereon while being rotated thereby, and they are provided with collars, into which extend the branching arms of an oscillating yoke that is carried at the end of a shaft 59, that is rocked by a lever, as 85, from a cam, as 86. It should now be understood that both of these pinions 69 70 will at times be driven by the rack and at all times must turn in the direction in which the rack travels, and that when either of them is driving the rack it will be coupled by its clutch to its driving-shaft, and that at the same time its companion pinion will turn in a like direction, but be driven by the rack. With the bed B traveling in the direction of the arrow in Fig. 22 the driving-pinion 70 will be clutched to its shaft, be driven by the wheel 76 in the same direction with it, as indicated by the arrow in Fig. 22, and in turn it will drive the bed through the rack 23, at which time the pinion 69, running idly, will be turned in a like direction, as is indicated by the arrow. This movement will continue until that position of the bed is reached and the time for the action of the controlling-arm 28 or 30 has arrived, whereupon the clutches 77 87 and 78 88 will both be thrown out of operation and the movement of the bed be thus relegated solely to the controlling-arm, and both pinions 69 70 become inactive, although still in gear with the bed-rack, their movement following that of the bed and being reversed when the bed is reversed by the action of the actuating-crank through one controlling-arm or the other. When, however, the bed having been reversed and started in the direction contrary to that of the arrow in Fig. 22, the pinions 69 70 will turn idly, but in directions which are contrary to that indicated by the arrows upon them; but when the time is arriving when the controlling-arm 30 will cease to move the bed, which is when the pinions 69 70 have attained a speed of rotation equal to that of the pinions 74 and the clutch member 77, which it rotates, said clutch member 77 will begin to drive the bed, and the pinion 70 will continue its idle rotation in a like direction. So, also, when the time arrives for the controlling-arm 28 to act upon the bed, both pinions will again be put out of driving action, and when the bed has been reversed by the action of the controlling-arm 28 the pinion 70 will again become active, as at first described.

A further modification is shown in Figs. 24 and 25, wherein a single pinion constantly geared with a single rack is made periodically operative or inoperative by a clutch mechanism. In this construction a single rack 37 is constantly geared with a single driving-pinion 38, that turns freely between small collars on its shaft and it carries fast to each of its opposite faces one member of a clutch. The

opposite member of the clutch on one side of the pinion 38 is carried by a wheel 97, that runs freely on the shaft of the pinion 38, and the opposite member of the clutch on the other side of the said pinion is carried by a wheel 98, that also runs freely on the shaft of said pinion 38. The wheels 97 and 98 are driven constantly in opposite directions by means of a wheel 84, which is rotated by a pinion 91, gearing with the wheel 14 on the crank-shaft 12. This wheel 84 gears with the wheel 97 and with an intermediate 79, the latter being on a shaft which carries an intermediate 89, which gears with the wheel 98, and the intermediate 89 and wheel 84 are wide enough to remain in gear with the intermediate 79 and wheel 97, as the latter are caused to slide by means of yokes 93 94, which, resting in collars fixed to the wheel 97 98, are connected together, so as to be simultaneously moved by the action of a shaft 95 and lever 99 from the cam 100. Although the rack 37 and pinion 38 are constantly geared, it will now be understood that whenever the pinion 38 is clutched to either of the wheels 97 or 98, it, and through it the bed, will be driven in the direction of the rotation of said pinion, and that when neither of these wheels 97 or 98 is clutched to the pinion 38 it will be moved by the action upon it of the bed-rack, to which motion is then imparted by the action of one or the other of the crank-actuated controlling-arms.

In the example of printing-machine shown herein the impression-cylinder will be provided with means for raising it bodily out of printing-contact with the bed during the non-printing run of the latter by means of lifting devices preferably cam-moved, which act simultaneously upon its journal-boxes.

It has been intimated that these improvements may be applied to other machines, and it may now be stated that this is true of pumps, planers, and all other machines where there is a member making a rapid reciprocation, and requires to be reversed at each end of its stroke by a mechanism, which will accomplish the same smoothly and quickly without subjecting the parts to undue strain. The type-bed herein named is to be considered, therefore, as the reciprocating member of such machines.

What, therefore, is claimed herein is—

1. The combination, with the bed and a mechanism operating to drive it throughout the principal extent of its movement in either direction, of a controlling-arm moved to and fro, periodically engaged with the bed and operating to complete such movement and reverse the bed at the end of its run by rapidly retarding the same to a state of rest and then starting and accelerating its movement in the reverse direction, substantially as described.

2. The combination, with the bed and a mechanism operating to drive it throughout the principal extent of its movements of reciprocation, of controlling-arms moved to and fro, alternately engaged with the bed and operating to complete such movements at opposite ends of its run by rapidly retarding the same to a state of rest and then starting and accelerating its movement in the reverse direction, substantially as described.

3. The combination, with the moving bed, of a crank and a controlling-arm that is moved to and fro, automatically connected with the bed and disconnected therefrom and operates to slow down and arrest its movement in one direction and to start the same in the opposite direction, substantially as described.

4. The combination, with the reciprocating bed, of two crank-actuated controlling-arms that are automatically connected therewith and disconnected therefrom, one operating at each end of the run of the bed to slow down and arrest its movement in one direction and to start and accelerate the same in the opposite direction, substantially as described.

5. The combination, with the bed and a rack-and-pinion mechanism operating to drive it during the principal extent of its run in either direction, of a crank-actuated controlling-arm moved to and fro and periodically engaged with the bed while it is moving at its maximum speed and thereafter operating to slow down and arrest the same at the end of its run, then to start and accelerate it in the reverse direction and be disconnected from the bed when its maximum speed is again attained, substantially as described.

6. The combination, with the bed and a rack-and-pinion mechanism operating to drive it during the principal extent of its reciprocation, of two crank-actuated controlling-arms moved to and fro and periodically alternately engaged with the bed at each end of its run while it is moving at its maximum speed and thereafter operating to slow down and arrest the same and then to start and accelerate it in the reverse direction and be disconnected from the bed when its maximum speed is again attained, substantially as described.

7. The combination, with the bed and a rack-and-pinion mechanism operating to drive the bed during the principal extent only of its movement in either direction, of a crank-actuated controlling-arm moved to and fro, periodically engaged with and operating to rapidly diminish such movement of the bed, arrest the same, then start and accelerate its movement in the reverse direction, together with means acting to bring said controlling-arm into operative relation to the bed while the rack-and-pinion mechanism is becoming inoperative as the driver, substantially as described.

8. The combination, with the bed and a rack-and-pinion mechanism operating to drive the bed during the principal extent only of its reciprocation, of crank-actuated controlling-arms moved to and fro, periodically engaged with and operating to rapidly diminish such movement of the bed at each end of its run, arrest the same, then start and accelerate its movement in the reverse direction, together

with means acting to bring said controlling-arms alternately into operative relation to the bed while its rack-and-pinion mechanism is becoming inoperative, substantially as described.

9. The combination, with the bed, a mechanism to drive it throughout the principal extent of its movement in either direction, and a controlling-arm periodically engaged with the bed and operating to complete such movement and reverse the bed at the end of its run by retarding, arresting, starting, and accelerating the same, of a locking device coupling said arm to the bed, substantially as described.

10. The combination, with the bed and a mechanism operating to drive it throughout the principal extent of its reciprocation, and controlling-arms periodically engaged with the bed and operating to complete such movement and reverse the bed at each end of its run by retarding, stopping, starting, and accelerating the same, of locking devices coupling said arms to the the bed, substantially as described.

11. The combination, with a rack-and-pinion mechanism operating to drive the bed during the principal extent of its run, of a crank-actuated controlling-arm periodically engaged with the bed and operating to slow down and arrest the bed, then to start and accelerate it in the reverse direction, and a locking device for coupling said arm to the bed, substantially as described.

12. The combination, with a rack-and-pinion mechanism operating to drive the bed during the principal extent of its reciprocation, of two crank-actuated arms coacting with the bed to slow down, stop, start, and accelerate the same at each end of its run, and locking devices for coupling said arms to the bed, substantially as described.

13. The combination, with a driving-pinion and means for shifting the same laterally on a shaft mounted in fixed bearings and a bed-rack having two members that alternately engage opposite sides of said pinion, of a crank-actuated controlling-arm and means for engaging it with and disengaging it from the bed at the end of its run in one direction, substantially as described.

14. The combination, with a driving-pinion and means for shifting the same laterally on a shaft mounted in fixed bearings and a bed-rack having two members that alternately engage opposite sides of said pinion, of two crank-actuated controlling-arms and means for engaging one arm with and disengaging it from the bed at one end of its run and engaging and disengaging the other arm at the opposite end of the run of the bed, substantially as described.

15. The combination of the bed and its driving-rack whose members are separated vertically to suit the pitch-diameter of the driving-pinion with which they alternately engage, a driving-pinion whose axis is mounted in fixed bearings, means for shifting said pinion from the path of travel of one to that of the other member of said rack, and a driver with which said pinion remains constantly geared during all of its lateral movements, substantially as described.

16. The combination, with the moving bed and a crank-actuated controlling-arm that operates to slow down and arrest its movements in one direction and to start the same in the opposite direction, of a latch, as 36, and and a cam, as 39, whereby said latch is automatically connected to the bed and disconnected therefrom, substantially as described.

17. The combination, with the reciprocating bed and two crank-actuated controlling-arms, one operating at each end of the run of the bed to slow down and arrest its movement in one direction and to start the same in the opposite direction, of latches 35 36 and cams 41 39, whereby said latches are automatically connected therewith and disconnected therefrom, substantially as described.

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

LUTHER C. CROWELL.

Witnesses:
HENRY T. MUNSON,
C. J. SAWYER.