No. 680,433. Patented Aug. 13, 1901.

W. S. HUSON.

MECHANICAL MOVEMENT.

(Application filed Feb. 20, 1893. Renewed Mar. 10, 1897.)

(No Model.) 3 Sheets—Sheet 1.

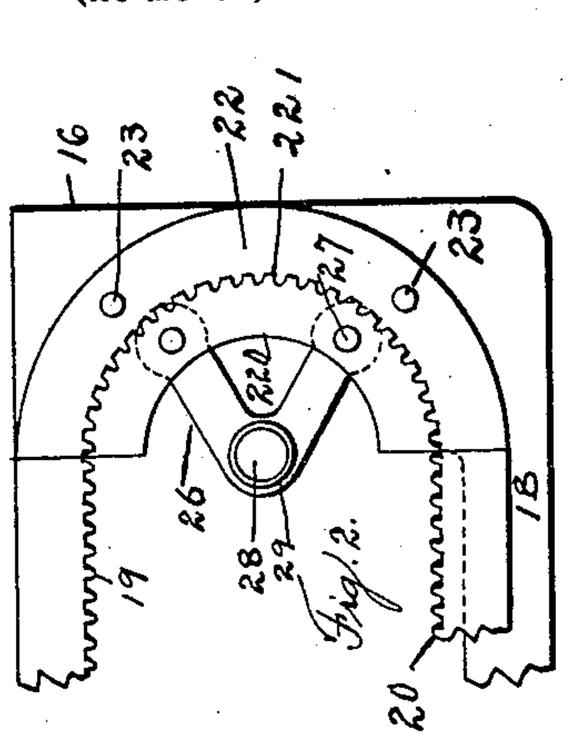

Fig. 2.

Fig. 1.

Witnesses
H. W. Tozzendorf
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W. S. Huson,
By his Attorney
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(No Model.) 3 Sheets—Sheet 2.

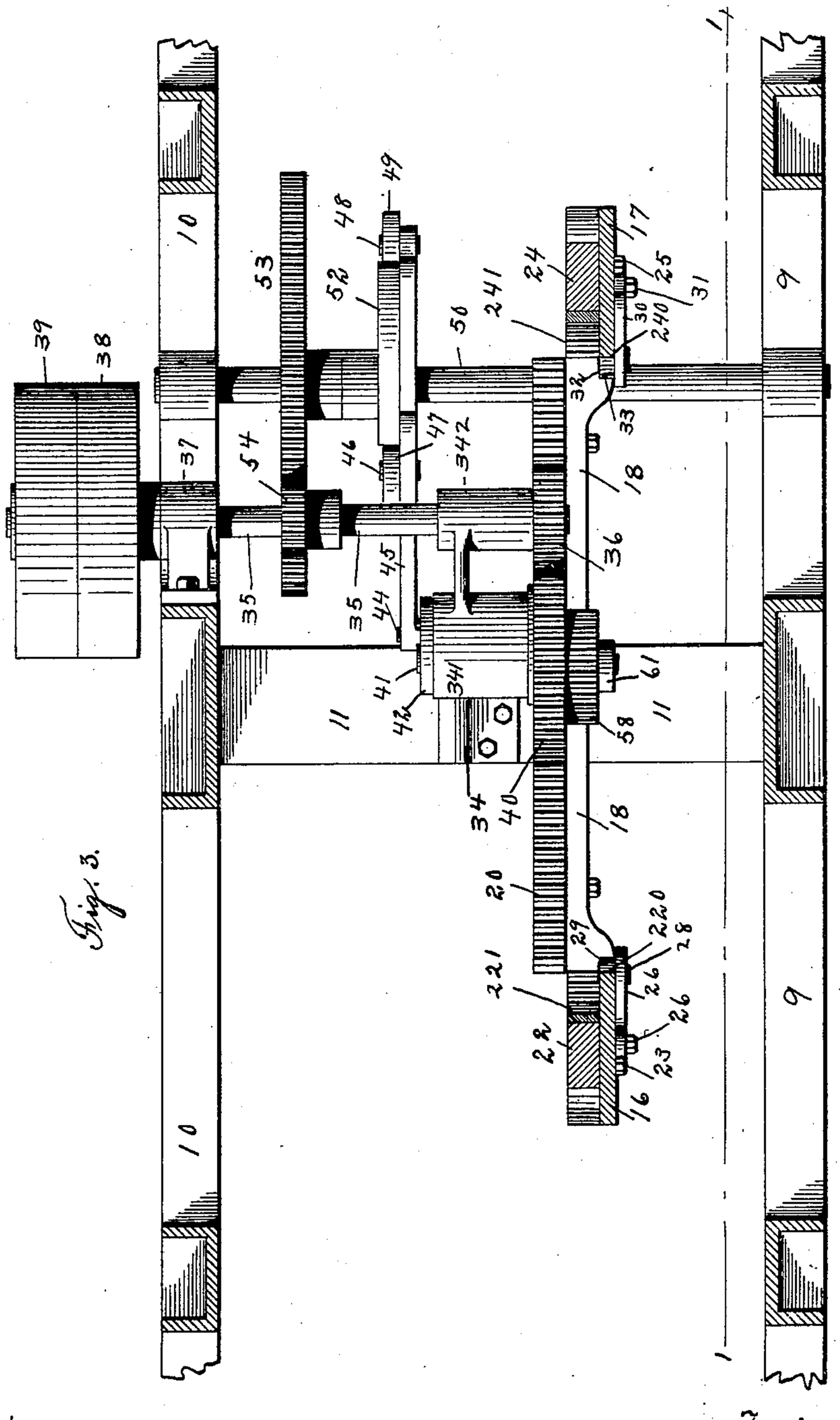

Fig. 3.

Witnesses
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(No Model.) 3 Sheets—Sheet 3.

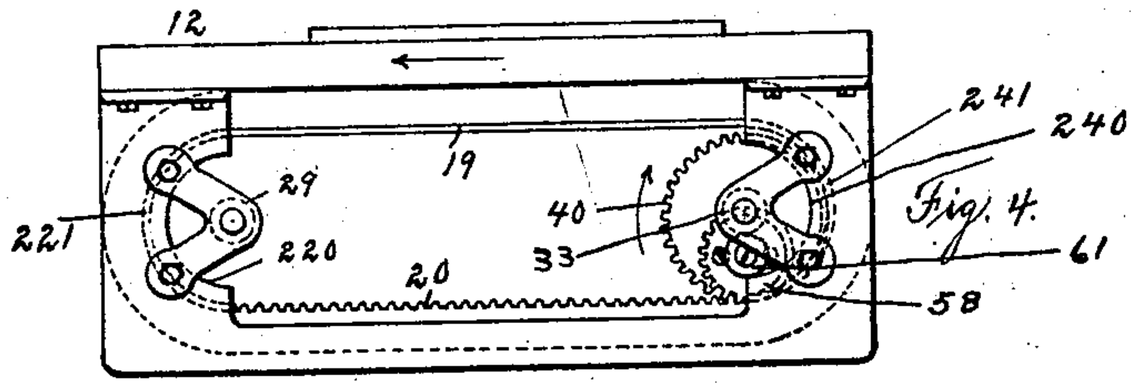

Fig. 4.

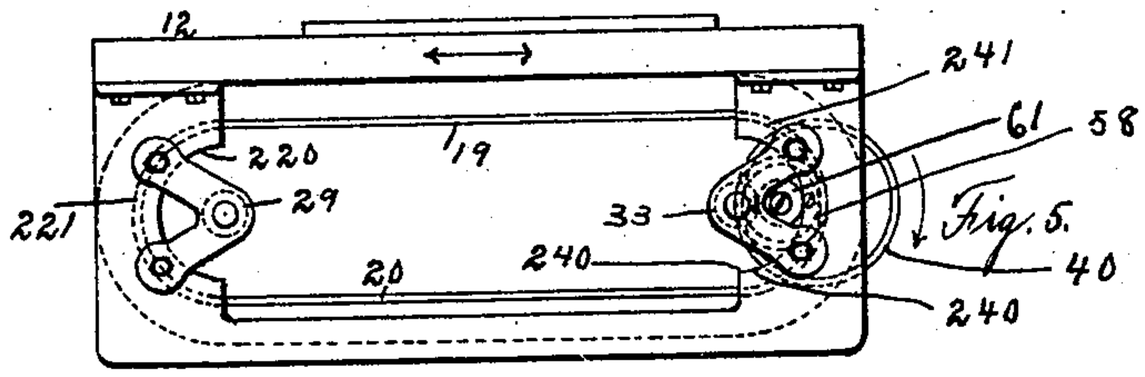

Fig. 5.

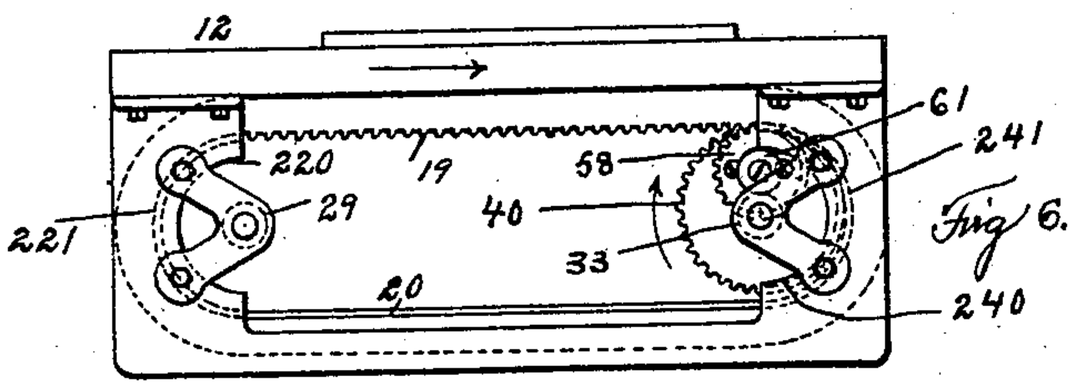

Fig 6.

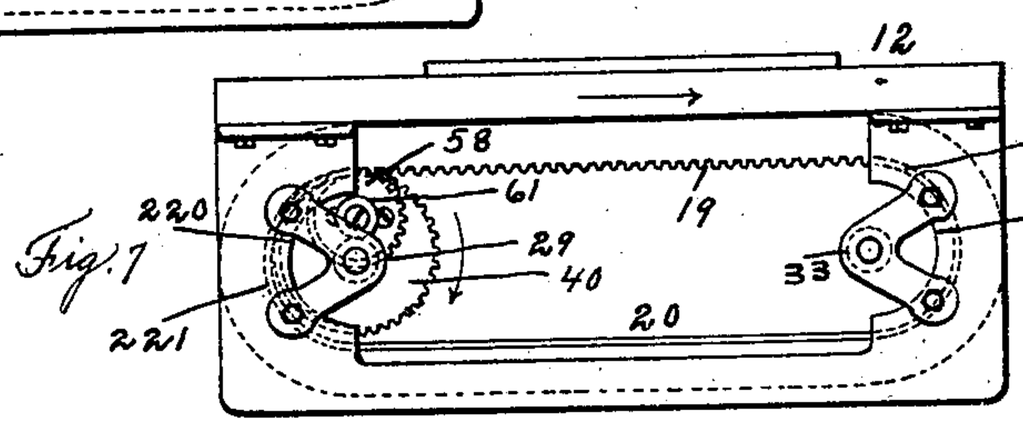

Fig. 7

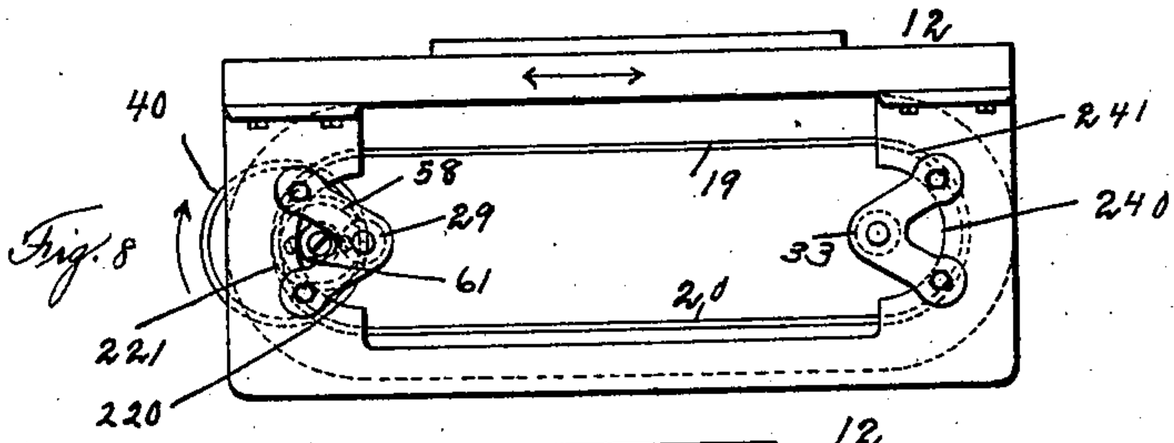

Fig. 8

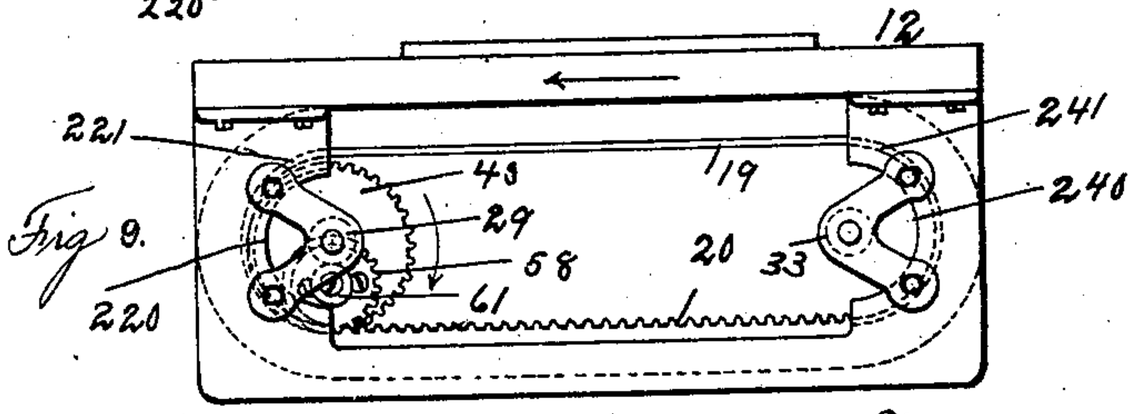

Fig 9.

Witnesses
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Inventor
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By his Attorney
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UNITED STATES PATENT OFFICE.

WINFIELD S. HUSON, OF TAUNTON, MASSACHUSETTS, ASSIGNOR TO THE CAMPBELL PRINTING PRESS & MANUFACTURING COMPANY, OF NEW YORK, N. Y.

MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 680,433, dated August 13, 1901.

Application filed February 20, 1893. Renewed March 10, 1897. Serial No. 626,893. (No model.)

To all whom it may concern:

Be it known that I, WINFIELD S. HUSON, a citizen of the United States, residing at Taunton, in the county of Bristol and State of Massachusetts, have invented a new and useful Improvement in Mechanical Movements, of which the following is a specification.

The aim of this invention is to improve the arrangement of parts in mechanical movements which are designed to transform rotary motion into rectilinearly-reciprocating motion; and to this end the invention consists of the device described and claimed in this specification and illustrated in the accompanying three sheets of drawings, in which—

Figure 1 is a sectional elevation on the line 1 1 of Fig. 3. Fig. 2 is a view of one end of the framing secured to the under side of the reciprocating member looking at the same from the opposite side to which the same is shown in Fig. 1. Fig. 3 is a sectional plan view taken on line 3 3 of Fig. 1; and Figs. 4 to 9, inclusive, are diagrammatic views of the actuating mechanisms, showing the positions that they assume in one complete forward and backward movement of the reciprocating member.

My invention, generally speaking, consists in a peculiar mechanical movement that is adapted to transform rotary movement into rectilinearly-reciprocating motion, and the same may be applied and adapted to any use or location where it is desired to use this movement.

My invention, however, has been principally devised for use in connection with the reciprocating beds of printing-presses, and I will further describe my invention as applied and used in connection with a printing-press.

A printing-press bed to secure the best results must be run, preferably, at an even speed during the forward and return strokes and must be gradually stopped and started again in the reverse direction without jar or vibration. There are many mechanisms well known for giving the bed or reciprocating member its main or direct forward or backward movement whether the same is at an even speed or not; and my invention consists in the combination, with a bed driven in this manner, of a peculiar reversing mechanism which consists of a rack, preferably curved, attached to the bed and a pinion mounted on a revolving crank, which pinion is adapted to engage said curved rack to reverse the movement of the bed. Two curved racks are preferably used, so that the same pinion can reverse the bed in either direction. The revolving crank in which this peculiar pinion is mounted, as hereinafter described, may be also the main driving-gear. A suitable guiding mechanism may also be used, if so desired, to keep the reversing-pinion in mesh with the curved rack or racks. By this mechanism there will be a constant mesh between the driving mechanism and the bed.

I preferably use for my main driving mechanism a gear rotating in one direction disposed between two racks placed on opposite sides of the gear and attached to the moving member and with which the gear alternately engages, and thereby gives a reciprocating movement to the moving member.

Referring now to the drawings and in detail, 9 and 10 represent the usual side frames of a printing-machine, and between these side frames may be secured a box beam or girder 11. A reciprocating bed or member 12, which is arranged to coact with any of the usual forms of impression-cylinders, as 13, (indicated in dotted lines,) is mounted on suitable guideways 14, formed on the frames of the machine, and the reciprocating member 12 may have suitable grooves 15 engaging these guides 14, if so desired.

It is understood, of course, that the invention is applicable to any form of printing-press, whether the same has one or more impression-cylinders and no matter how the impression cylinder or cylinders act in relation to the bed and no matter how the reciprocating member is mounted to slide on the frames, the invention being a mechanism for imparting a reciprocating movement to the bed.

Secured to the under side of the reciprocating bed or member 12 is a depending frame which consists of the brackets 16 and 17,

which are connected together by the tie 18, and secured to the under side of the bed is the rack 19, and secured to the tie 18 by means of bolts or screws 21 is the rack 20, these two racks 19 and 20 facing each other, as shown. Bolted to one side of the depending bracket 16 by means of screws 23 is the curved piece 22, which has teeth 221, as shown, and bolted to the depending bracket 17 by means of screws 25 is a similar curved piece 24, which has teeth 241. Secured to the front side of the bracket 16 by means of screws 27 is a frame 26, which carries a stud 28, on which stud is mounted a roller 29, and secured to the bracket 17 by means of screws 31 is a frame 30, which carries a stud 32, on which a roller 33 is mounted, these two constructions on opposite sides of the reciprocating member being similar.

The bracket 16 has a nicely-finished curved face 220, which is substantially formed on a circle struck about the center of the stud 28, and the bracket 17 has a similar curved face 240, which is substantially formed on a circle struck about the center of the stud 32, and the curved racks 221 and 241 are made substantially concentric with the curved faces 220 and 240, for a purpose hereinafter noted.

Secured on the box beam or girder 11 is the bracket 34, which carries the two journal-boxes 341 and 342. Journaled in the bearing 342 and in a bearing 37, secured to the frame 10, is a shaft 35, which may be the driving-shaft of the machine and which may carry the tight and loose pulleys 38 and 39. The shaft 35 carries at the inner end thereof a pinion 36, which engages a gear 40, which gear 40 is adapted by means hereinafter described to alternately engage the racks 19 and 20 and impart the main reciprocation to the reciprocating bed or member. This gear 40 is mounted on a shaft 41, which shaft 41 is journaled in an eccentric bushing 42, which eccentric bushing 42 is journaled in the bearing 341 of the bracket 340. This eccentric bushing has an extension 43, which carries a pin 44, and connected to this pin 44 is a yoke 45, in which yoke is secured a stud 46, carrying a roller 47, and a stud 48, carrying a roller 49, and the yoke has a slot, engaging which is a block 51, secured on a shaft 50, which shaft 50 is journaled in the frames 9 and 10, as shown. Secured on the shaft 50 is the cam 52, which is adapted to reciprocate the yoke 45. The shaft 50 is preferably driven by means of gear 53, secured on the same, which gear 53 is driven from a pinion 54, secured upon the shaft 35, as shown. The cam 52 has two surfaces—a high surface 55 and a low surface 56—and these two surfaces are connected by easy inclines 57.

As shown, the machine is designed to have what is known as a "three-revolution driving-gear"—that is, the gear 40, which is the driving-gear, makes one complete revolution to give the bed its forward movement, one complete revolution to give the bed its backward movement, and a half-revolution to reverse the movement of the bed in either direction. Then if the reduction between the gears 36 and 40 is two to one the shaft 35 will make six revolutions for each comple forward and backward movement of the bed. As the cam 52 must make one complete revolution for each forward and backward reciprocation of the bed in the specific device shown, the reduction between the gear 53 and pinion 54 must be six to one. The cam is so proportioned and designed that the gear 40 will be held in engagement with one rack, as 20, during one movement of the bed, and while the reversing mechanism is actuating the cam will actuate the gear, so that when the bed is given by the reversing mechanism back to the driving-gear the driving-gear will engage the other rack and make a complete revolution in engagement with the same.

Of course it is understood that I do not limit myself to the proportion of gearing herein described, as the same may be varied by the designer and the relative proportion and speed of the parts altered as desired for any location.

Secured to the side of the gear 40 by means of screws 59 is a pinion 58, which I term the "reversing-pinion." This pinion, as shown, is made a trifle larger than one-half of the driving-gear 40, and the periphery of the reversing-pinion is preferably set flush with the periphery of the driving-gear 40, as shown. In the center of this reversing-pinion 58 is secured a stud 60, on which stud 60 is mounted a roller 61, which roller 61 is adapted to fit between the roller 29 and the curved surface 220 or between the roller 33 and the curved surface 240.

It will be noted that the reversing-pinion and the curved racks are all disposed to one side of the main driving-gear, whereby but a single adjustment is necessary at each end of the bed and whereby the gearing is arranged very simply and efficiently. By this arrangement it will be seen that a certain portion of the reversing-pinion—namely, that at the center of rotation—is substantially at rest. This gives, in effect, a true crank reverse, as hereinafter described.

In actual practice the reversing-pinion is made slightly larger than one-half of the driving-gear 40, and this is for the reason that the main driving-gear is raised and lowered. The curved racks are made semicircular and of a diameter substantially equal to the distance between the racks 19 and 20 and are made, preferably, to have the same number of teeth as the reversing-pinion. It will be seen that by the reversal operation hereinafter described all of the teeth of the reversing-pinion will engage with one of the curved racks in one reversal and that all the teeth of the circular toothed reversing-pinion will thereby be used. This gives a continuous mesh between the driving-gear and bed at all times, the driving-gear meshing with either

one of the main racks during the forward or backward movement of the bed on its main stroke or meshing through the reversing-pinion, which is substantially part of the main driving-gear, with one of the curved racks during the entire reversal movement. This continuous mesh is an important point in practice, because, as is well known, a geared relation between two parts is the most positive and accurate that can be made mechanically. Another important point in practice is that the reversing-pinion running up or down one or the other curved racks tends to raise or lower, if not to entirely raise or lower, the main driving-gear, the cam simply following the action and preserving the main driving-gear in its highest or lowest potion during the main working stroke.

The operation of my improved device will now be described. Reference to follow this description should be had to the third sheet of the drawings.

In Fig. 4 the bed is shown as just completing its main movement to the left, the driving-gear 40 as just leaving the lower rack 20, and the reversing-pinion 58 as engaging the curved rack 241. If the bed has been running at full or printing speed on its main stroke to the left, the bed has now reached the point where its movement must be slowed down or retarded. The momentum of the bed will force the teeth of the curved rack 241, carried by the bed, against the teeth of the reversing-pinion 58, the force being transmitted in a line which at first will be substantially parallel to the movement of the bed or at right angles to the radius of the engaging teeth, or, in other words, tangential to the pitch-circle of the reversing-pinion. As the bed advances the reversing-pinion will run along up the curved rack, and the bed will be gradually retarded for a ninety-degree movement of the main driving-gear. During this action the force produced by the momentum of the bed acts less and less directly on the sides of the teeth of the reversing-pinion until the bed is brought to a state of rest in its extreme left-hand position, as shown in Fig. 5, at which point the force produced by the momentum of the bed acts in a direction which is radial to the pitch-circle of the reversing-pinion. During the next quarter-turn of the main driving-gear the reversing-pinion will run up the upper part of the curved rack 241 and will gradually start or accelerate the bed with a true crank motion from zero up to full working speed. During this acceleration the engaging teeth of the reversing-pinion first extend in the direction the force is applied, or, in other words, the thrust imparted by the reversing-pinion acts first in a direction radial to the pitch-circle of the reversing-pinion, and when the accelerating operation is completed it acts tangential to the pitch-circle of the pinion or directly against the sides of the teeth. This will bring the parts to the position shown in Fig. 6, where the bed is brought up to full working speed on its movement to the right and the main driving-gear brought into engagement with the upper rack 19. After the bed has been reversed at its left-hand extreme the same is moved to the right by a complete revolution of the main driving-gear 40 in engagement with the rack 19, when the parts are brought to the position shown in Fig. 7. The bed is then retarded and brought to rest by the next quarter-turn of the main driving-gear and the movement of the reversing-pinion 58 down the upper part of the curved rack 221, when the bed is brought to its extreme right-hand position, as shown in Fig. 8. During the next quarter-turn of the main driving-gear the bed is given its accelerating movement to the left by the reversing-pinion running down the lower part of the curved rack 221, and the parts are brought to the position shown in Fig. 9, where the bed is moving at full speed to the left and the main driving-gear 40 is just engaging the main driving-rack 20. During the next turn of the main driving-gear 40 the bed will be given its main working stroke to the left and the parts brought back to the position shown in Fig. 4. The reversal of the bed at the right-hand end of its movement is substantially the same as that previously described in detail at the left-hand end of its movement, except that the reversing-pinion runs from top to bottom of the curved rack 221 instead of from bottom to top, as is the case with the left-hand reverse when the reversing-pinion engages the curved rack 241. If the machine should be run slowly or turned over by hand, so that the bed does not acquire momentum, the reversing-pinion will pull the bed along from the position shown in Fig. 4 toward the position shown in Fig. 5 and from the position shown in Fig. 7 toward the position shown in Fig. 8 and will push the bed at the time when the same is approaching the position shown in Fig. 6 and at the time when the same is approaching the position shown in Fig. 9. It is desirable in practice to use some means to keep the reversing-pinion from disengaging the curved racks as it passes over the dead-centers, and this is the function of the guiding mechanism, consisting of the roller 61 on the main driving-gear and the truck-rolls 29 and 33. When the bed is running so as to acquire momentum, there will be very little, if any, bearing engagement between the crank-roll 61 and the truck-rolls 29 and 33; but if the bed should be turned over by hand or stopped at the dead-point of the reversal movement the truck-rolls and the crank-roll provide a means whereby the reversing-pinion cannot get out of mesh with the curved racks. It is also desirable in practice to use some means for preventing the teeth of the reversing-pinion from bottoming in the teeth of the curved racks, especially as the reversing-pinion passes over

the dead-centers, and this is the function of the curved guides 220 and 240. When the bed is running at full speed, the crank-roll bearing on either of the curved guides 220 or 240 will prevent the teeth of the reversing-pinion from bottoming in the curved racks, this function being of course most perfectly performed at the dead-centers of the reversal movement when the thrust is in line with the movement of the bed. The guiding mechanism is most efficient to preserve the proper mesh when the mesh of the gearing in the reversing mechanism is the least efficient. While this guiding mechanism is used in practice both to prevent disengagement and the teeth from bottoming, it is not always necessary to have it perform the latter function, for there are well-known forms of gear-teeth which have curved ends which allow a bottoming action. If this form of gear-teeth should be used for the reversing-pinion and the curved racks, the curved working shoulders 220 and 240 could be dispensed with. In practice, however, the involute or epicycloidal form of gear-teeth is preferred, and the curved working shoulders are used to keep the teeth of the reversing-pinion from bottoming in the curved racks. The complete movement of the bed in either direction is a pitch-circumference of the driving-gear 40 plus two pitch-diameters of the reversing-pinion 58, or a pitch-diameter of the driving-gear 40 if the invention is applied to a three-revolution machine. As before stated, this proportion between the parts can be varied, as desired.

When the invention is applied to a printing-machine which has but a single cylinder and in which the bed is in impression on but one of its movements, it is preferred to make the printing movement the movement before described to the right—that is, the movement when the main driving-gear is in engagement with the upper rack. As before described, it is evident, of course, that the reversing-pinion could be mounted on a crank independent of the gear 40, if so desired, and work in the same manner.

The advantages of my device are apparent. The bed is moved with even speed during its main forward and backward movement and is easily reversed, being retarded from full speed to a state of rest and gradually accelerated and brought back to full speed in the other direction without jar or vibration with what is the equivalent of a crank motion.

It will be seen that during the initial period of retardation and final period of acceleration a great many of the teeth of the reversing-pinion are in engagement with the curved rack, so that there will be a very strong connection between the parts, which will not develop wear under long use.

The continuous geared engagement between the main driving-pinion and the bed has been found in practice to give a very smooth and rapid motion to printing-press beds.

As has been before indicated, any other form of main driving mechanism, such as any of the ordinary rack-and-pinion mechanisms, can be used for giving the bed its main reciprocation. In this event the gear 40 becomes simply a crank for carrying the reversing-pinion, and it is immaterial whether or not this main driving mechanism imparts an even or uneven speed to the bed during its main direct movement, my invention embracing the combination, with any main driving mechanism for the bed, of my new and peculiar reversing mechanism.

As before stated, the invention is of general application and may be used to reciprocate printing-press beds, planer-tables, heavy pump-pistons, and other heavy members.

The details and arrangements of parts herein described may be greatly varied by a skilled mechanic without departing from the scope of my invention as expressed in the claims.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a mechanical movement, the combination of the bed, with mechanism for giving the same its main reciprocation, a rack secured to the bed, a pinion mounted on a revolving crank adapted to engage said rack to reverse the movement of the bed, and means for keeping the pinion in constant mesh with said rack during the reversing movement, substantially as described.

2. In a mechanical movement, the combination of the bed, with mechanism for giving the same its main reciprocation, a rack attached to each end of the reciprocating bed or member, a pinion mounted on a revolving crank adapted to engage alternately with said racks to reverse the movement of the bed in either direction, and means for keeping the pinion in constant mesh with one of said racks during the reversing movement, substantially as described.

3. In a mechanical movement, the combination of the reciprocating bed or member, a rack carried by the reciprocating bed or member, a pinion mounted on a revolving crank, and adapted to engage said rack to reverse the movement of the bed, and guiding mechanism arranged to keep said pinion constantly in mesh therewith during the reversing movement, substantially as described.

4. In a mechanical movement, the combination of a reciprocating bed or member, a rack mounted at each end of said bed or member, a pinion mounted on a revolving crank and adapted to engage said racks alternately to reverse the movement of the bed in either direction, and guiding mechanism arranged to keep said pinion in constant mesh with one of said racks during the reversing movement, substantially as described.

5. In a mechanical movement, the combina-

tion of the reciprocating bed or member, a curved rack carried by said bed or member, a pinion rigidly mounted on a revolving crank, and adapted to engage said curved rack to reverse the movement of the bed, a roller mounted concentrically with said pinion, and a guideway formed on the bed, which said roller is adapted to engage to keep said pinion properly in mesh with said curved rack, substantially as described.

6. In a mechanical movement, the combination of the reciprocating bed or member, curved racks mounted at each end of said bed, a pinion rigidly mounted on a revolving crank, and adapted to alternately engage said curved racks to reverse the movement of the bed in either direction, a roller concentrically mounted with said pinion, and guideways formed on the bed with which said roller is adapted to engage to keep said pinion properly in mesh with said curved racks, substantially as described.

7. In a mechanical movement, the combination of the reciprocating bed or member, a curved rack mounted on said bed, a pinion rigidly mounted on a revolving crank and adapted to engage said curved rack, a roller concentrically mounted with said pinion, and a guideway for said roller, consisting of a curved face, substantially concentric with said curved rack, and a roller mounted on the bed at the center of said curved face and rack, substantially as described.

8. In a mechanical movement, the combination of a reciprocating bed or member, curved racks secured to the ends of said bed, a pinion rigidly mounted on a revolving crank, and adapted to alternately engage said curved racks to reverse the movement of the bed in either direction, a roller concentrically mounted with said pinion, and guideways for said roller consisting of curved faces, substantially concentric to said curved racks, and rollers mounted at the centers of said curved racks and faces, whereby a guideway is formed for said roller concentric with each of said racks, and whereby said roller will, when in said guideways, keep said pinion properly in mesh with said curved racks, substantially as described.

9. In a mechanical movement, the combination of the reciprocating bed or member having two oppositely-disposed racks, the driving-gear adapted to alternately engage said racks to give the bed its main forward and backward reciprocation, curved racks mounted at the ends of said bed, and a pinion mounted entirely on one side of said driving-gear adapted to alternately engage said curved racks to reverse the movement of the bed in either direction, substantially as described.

10. In a mechanical movement, the combination of the reciprocating bed or member having two racks, the driving-gear adapted to alternately engage these racks to give the bed its main forward and backward reciprocation, curved racks secured to the ends of said bed, guideways formed substantially concentric with said racks, a pinion mounted on said driving-gear and adapted to alternately engage said curved racks to reverse the movement of the bed in either direction, and a roller, also, mounted on said main driving-gear adapted to engage said curved guideways, and to keep the pinion properly in mesh with the curved racks, substantially as described.

11. In a mechanical movement, the combination with the bed, a mechanism for giving the same its main reciprocation, a semicircular rack secured to the bed, and a pinion mounted on a revolving crank adapted to engage said rack to reverse the movement of the bed, substantially as described.

12. In a mechanical movement, the combination of the bed, with mechanism for giving the same its main reciprocation, a semicircular rack attached to each end of the reciprocating bed, and a pinion mounted on a revolving crank adapted to alternately engage with said racks to reverse the movement of the bed in either direction, substantially as described.

13. In a mechanical movement, the combination of the bed, with mechanism for giving the same its main reciprocation, a semicircular rack secured to the bed, and a pinion of substantially half the diameter of said semicircular rack mounted on a revolving crank adapted to engage said semicircular rack to reverse the movement of the bed, substantially as described.

14. In a mechanical movement, the combination of the bed, with mechanism for giving the same its main reciprocation, a semicircular rack attached to each end of the reciprocating bed, and a pinion of half the diameter of said semicircular racks mounted on a revolving crank, and adapted to engage with said racks to reverse the movement of the bed in either direction, substantially as described.

15. In a mechanical movement, the combination of the reciprocating bed or member with a rack-and-pinion mechanism for giving the same its main reciprocation, curved racks carried by the bed, and a reversing-pinion mounted on a revolving crank adapted to alternately engage said curved racks to reverse the movement of the bed in either direction, the parts being so arranged that there will be a continuous mesh either between the rack-and-pinion mechanism giving the bed its main reciprocation, or between said reversing-pinion and one of the curved racks, substantially as described.

16. In a mechanical movement, the combination of the bed, a mechanism for giving the same its main reciprocation, a rack secured to the bed, and a circular toothed pinion mounted on a revolving crank adapted to engage said rack to reverse the movement of the bed, substantially as described.

17. In a mechanical movement, the combi-

nation with the bed, a mechanism for giving the same its main reciprocation, racks secured to each end of the reciprocating bed, and a circular toothed pinion mounted on a revolving crank adapted to alternately engage with said racks to reverse the movement of the bed in either direction, substantially as described.

18. In a mechanical movement, the combination with the bed, a mechanism for giving the same its main reciprocation, a pinion mounted on a revolving crank, and a curved rack secured to each end of the bed, said pinion and said curved racks being all disposed to one side of said revolving crank, substantially as described.

19. In a mechanical movement, the combination with the bed, racks carried thereby, a driving-gear alternately engaging said racks to give the bed its main reciprocation, a pinion mounted on one side of said gear, and a curved rack secured to each end of the bed, said pinion and said curved racks being all disposed to one side of said driving-gear, substantially as described.

20. In a mechanical movement, a reversing mechanism, comprising a reversing-pinion secured to a revolving crank, and a semicircular rack carried by the moving member, having a radius substantially equal to the diameter of the reversing-pinion, substantially as described.

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

WINFIELD S. HUSON.

Witnesses:
J. F. HALEY,
WM. A. DAVOL.