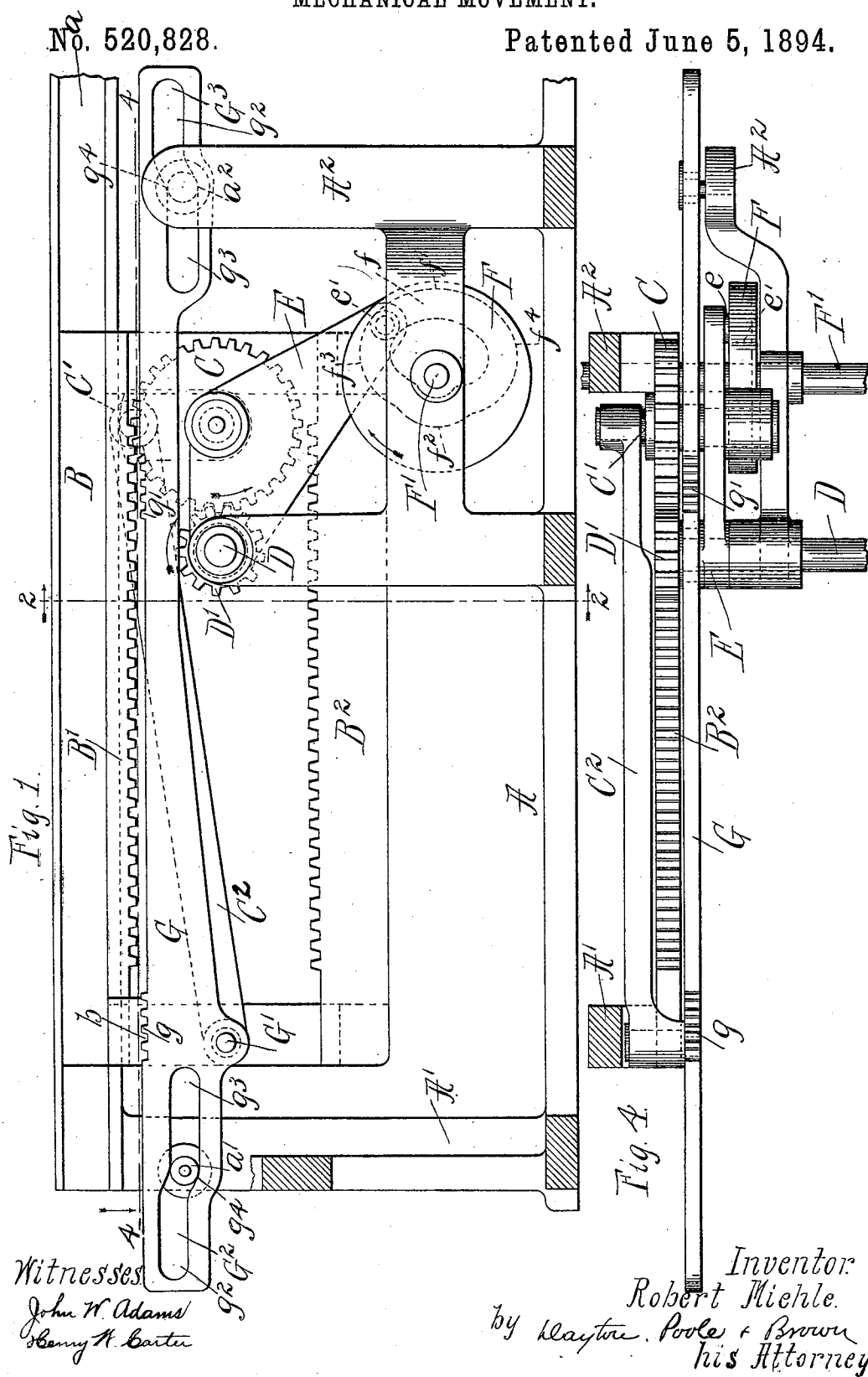


R. MIEHLE.  
MECHANICAL MOVEMENT.

No. 520,828.

Patented June 5, 1894.



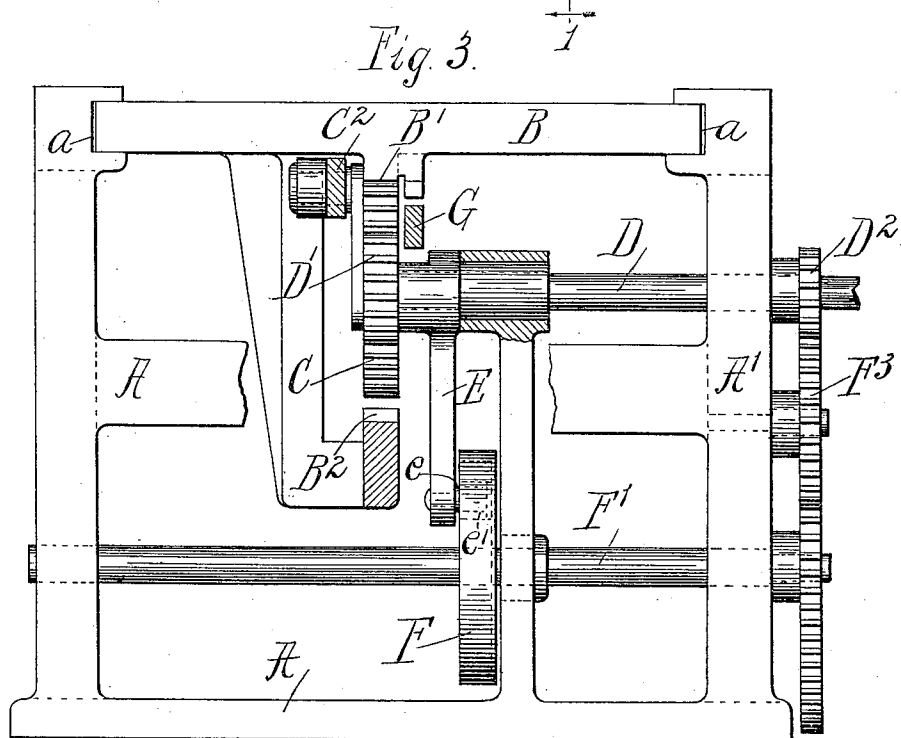
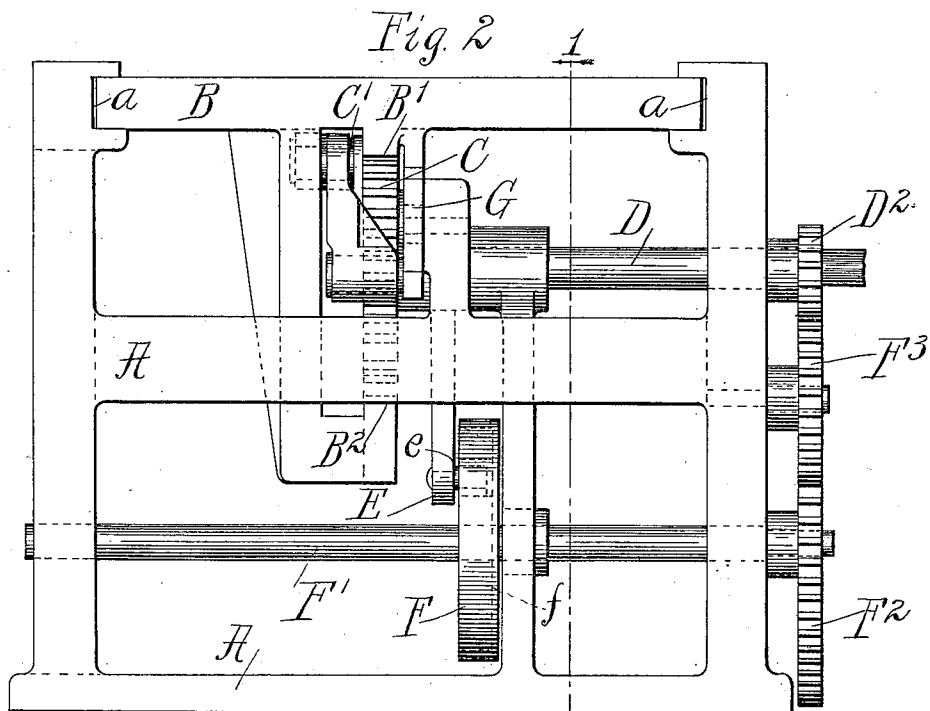
Witnesses  
John W. Adams  
Henry H. Carter

Inventor  
Robert Miehle.  
by Clayton, Poole & Brown  
his Attorneys.

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Witnesses  
John W. Adams  
Henry Carter

Inventor  
Robert Miehle  
by Wayton Poole & Brown,  
his Attorneys.

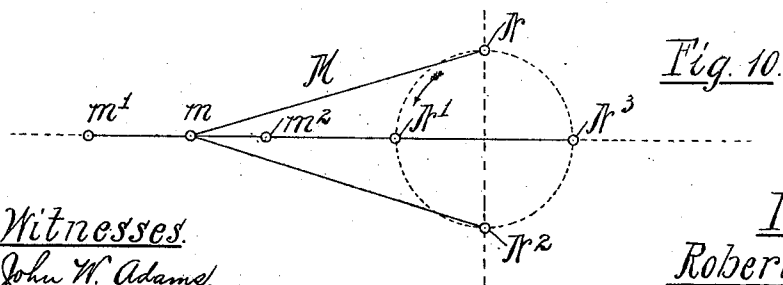
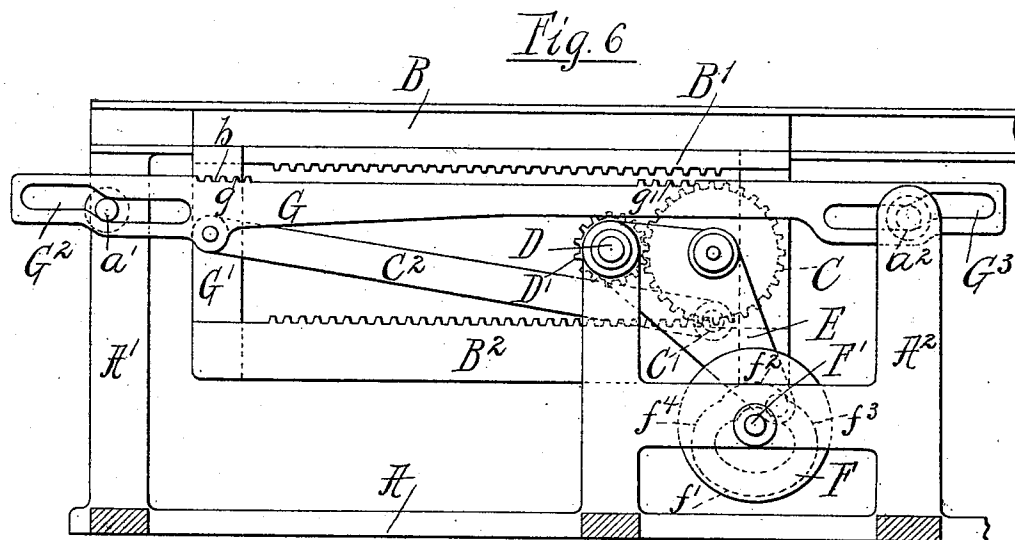
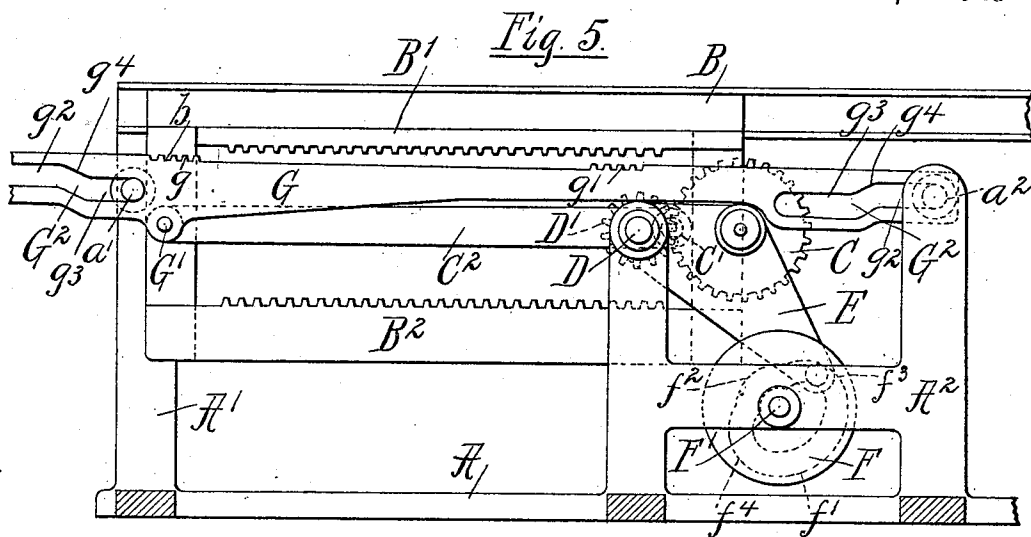
(No Model.)

4 Sheets—Sheet 3.

R. MIEHLE.  
MECHANICAL MOVEMENT.

No. 520,828.

Patented June 5, 1894.



Witnesses.  
John W. Adams.  
Henry Baxter

Inventor  
Robert Miehle.  
by Leighton, Poole & Brown,  
his Attorneys.

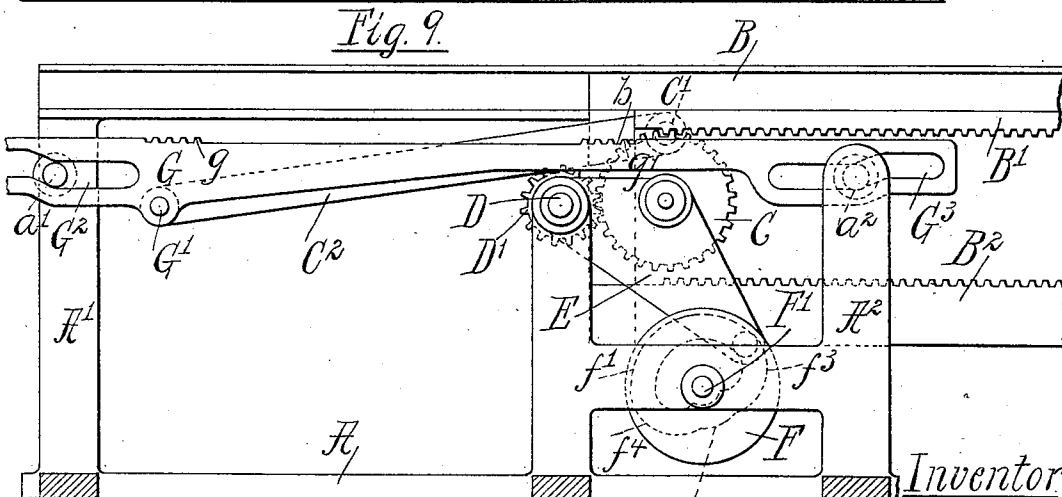
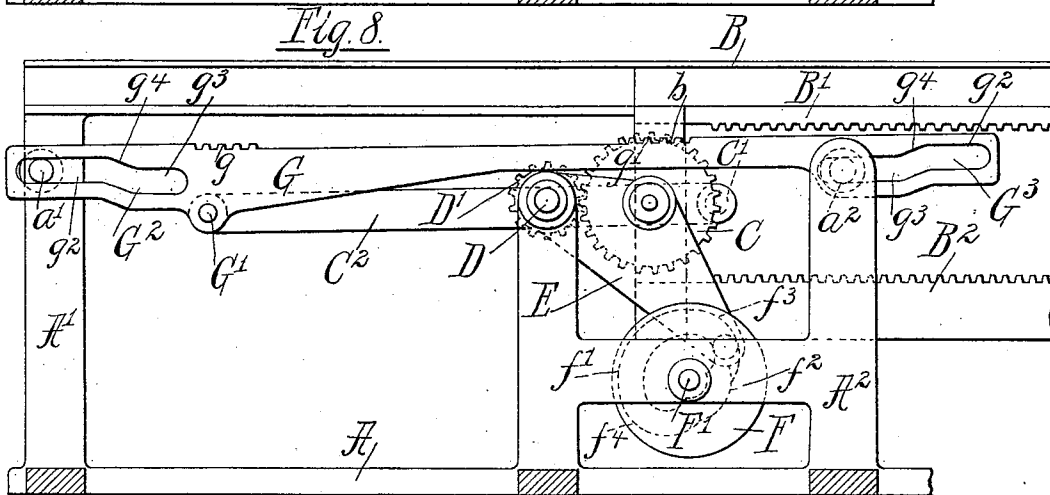
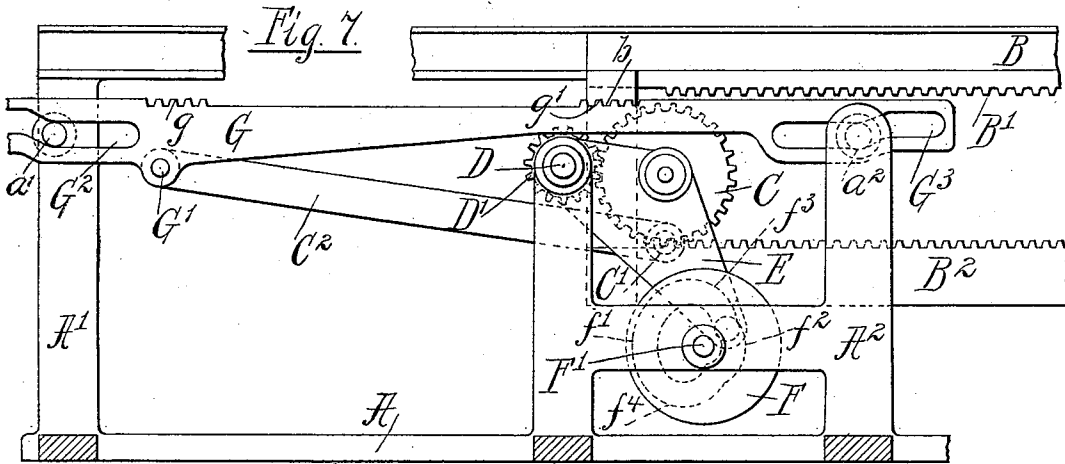
(No Model.)

4 Sheets—Sheet 4.

R. MIEHLE.  
MECHANICAL MOVEMENT.

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Witnesses.  
John W. Adams.  
Henry H. Carter.

Inventor  
fr Robert Michle  
by Clayton, Poole & Brown.  
his Attorneys.

# UNITED STATES PATENT OFFICE.

ROBERT MIEHLE, OF CHICAGO, ILLINOIS.

## MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 520,828, dated June 5, 1894.

Application filed July 14, 1893. Serial No. 480,508. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT MIEHLE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Mechanical Movements; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in mechanical movements for transforming rotary into reciprocatory motion, and more particularly to mechanism for reciprocating the beds of printing presses or similar reciprocating parts.

The object of the invention is to provide an improved construction in mechanical movements of the character referred to and to this end it consists in the matters hereinafter set forth and particularly pointed out in the appended claims.

A device embodying my invention embraces means for giving motion to the reciprocating part throughout the greater portion of its movement, together with auxiliary means acting at each end of the throw of said reciprocating part to gradually bring it to a state of rest and to start it on its return movement with a velocity which is gradually accelerated until it equals that due to the main driving mechanism to which the driving function is thereupon transferred; as will be clearly understood from the following description of a machine which practically embodies my invention in one form, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional side elevation of a printing press embodying my invention, taken on line 1—1 of Fig. 2. Fig. 2 is an end elevation of the same. Fig. 3 is a similar view, but with parts in section. Fig. 4 is a plan section of a portion of the machine, taken on line 4—4 of Fig. 1. Figs. 5, 6, 7, 8 and 9 are sectional side elevations similar to Fig. 1, but showing the operative parts in different positions. Fig. 10 is a diagrammatic view illustrative of the variable action inherent in a crank and connecting rod movement.

A designates the supporting framework of the press and B the bed of the same, said bed

being adapted to reciprocate in any suitable way *a* provided on said framework.

Rigidly secured to the bed B, and in this instance depending from the under side of the same, are two parallel rack bars  $B'$   $B^2$  of equal length, which are arranged with their toothed sides facing each other. Extending transversely of the frame A and journaled in suitable bearings therein is a main driving shaft D upon which, at a point adjacent to the racks  $B'$   $B^2$ , a vibrating lever E is pivotally mounted. A gear wheel C is journaled upon the lever E in such position as to stand between and in the plane of the racks  $B'$   $B^2$ , said gear wheel serving to engage and drive the racks  $B'$   $B^2$  alternately as the vibrating arm E is raised and lowered. Rotary motion is imparted to said gear wheel C by an intermeshing driving pinion  $D'$  provided on the inner end of the main driving shaft D, and since said shaft is the pivotal center of the arm E it is obvious that the vibrating movement of said arm will not interfere with the driving of the former by the latter. Suitable vibratory motion of the lever E, operating to throw the wheel C into mesh with the racks  $B'$   $B^2$  alternately and at the desired intervals, is provided by means of a cam wheel F which is rotatively mounted in the frame A at a point adjacent to the downward projecting end of the lever E. Said cam F has a cam groove *f* in its lateral face adjacent to the lever E and the latter is provided with a laterally projecting stud *e* carrying a friction roller *e'* which engages said cam slot *f*. As herein shown the latter comprises two concentric portions  $f'$  and  $f^2$  of larger or smaller radius respectively, the adjacent ends of which are joined by eccentric portions  $f^3$  and  $f^4$ . When the friction roller *e'* is in engagement with the larger concentric portion  $f'$  the lever E is raised, bringing the wheel C into position to mesh with the upper rack  $B'$ . When said friction roller is engaging the smaller concentric portion  $f^2$  the lever E is lowered, bringing the wheel C into position to engage the lower rack  $B^2$ . Said cam F is herein shown fixed to a transverse shaft  $F'$  which is journaled in suitable bearings in the frame A and is driven from the main driving shaft D by means of gears  $D^2$  and  $F^2$  provided

on the outer ends of the shafts D and F' respectively, and operatively connected by an intermediate intermeshing gear wheel F<sup>3</sup>.

In the operation of the mechanism thus far described the reciprocating part or bed B is, by the engagement of the wheel C with one of the racks B' B<sup>2</sup>, driven in the one direction or the other until the end of the engaged rack arrives at a point directly above or below the axis of said wheel C. When such point is reached said wheel C is by the action of the cam slot *f* on the roller *e*<sup>2</sup>, withdrawn from engagement with said rack and during its next half revolution is swung into position to engage the other rack and drive said bed in the reverse direction. Such mechanism constitutes the means hereinbefore referred to for driving the reciprocating part or bed throughout the greater portion of its movement. For controlling the motion of and reversing said part at each end of its throw and during the half revolution of the wheel C occurring, as above stated, while said gear wheel is being shifted from its engagement with one of the racks B' B<sup>2</sup> into engagement with the other, devices are provided as follows:

G designates an elongated frame or bar mounted on the frame A to reciprocate longitudinally thereof and adapted to be engaged or interlocked with the bed B to control the movement of the same at each end of its throw, during the half revolution of the wheel C occurring while said wheel is being oscillated between the racks B' B<sup>2</sup> as hereinbefore described. Reciprocatory motion is imparted to said bar G by a connecting rod C<sup>2</sup> which is journaled at one end upon the crank pin C' and at the other end pivotally engages a laterally projecting wrist pin G' located on the bar G at a point on the opposite side of the driving pinion D' from said wheel C. This location of the wrist pin G' brings the point of connection of the connecting rod with the bar G at the same side of the gear wheel C as that at which the driving pinion is located, this construction being employed for a purpose hereinafter pointed out.

To provide for the engaging or interlocking of the bar G and bed B the latter is, in this instance, mounted upon the frame A in such manner as to have a rising and falling as well as a longitudinally reciprocating motion, by means of which engaging surfaces *g g'* on said bar are alternately lifted into engagement with a corresponding engaging part *b* on the bed B. To this end said bar is herein shown as provided at its ends with oppositely arranged cam slots G<sup>2</sup> G<sup>3</sup> which are engaged by friction wheels *a' a*<sup>2</sup> respectively journaled on suitable studs projecting laterally from up-rights A' A<sup>2</sup> of the frame A. Said cam slots are exactly similar in shape, each consisting of two portions *g*<sup>2</sup> and *g*<sup>3</sup> lying parallel to the axis of the bar, with the former portion nearer its upper edge, and connected by a short intermediate inclined portion *g*<sup>4</sup>, and said slots

are so located that the wheels *a' a*<sup>2</sup> engage the inclined portions of the same at substantially the middle point of the travel of the bar G. By the engagement of each friction wheel *a' a*<sup>2</sup> with its cam slot G<sup>2</sup> or G<sup>3</sup> the adjacent end of the bar G is, therefore, maintained in raised position throughout one half of each revolution of the wheel C, and, owing to the opposite arrangement of said slots G<sup>2</sup> G<sup>3</sup>, the raising of one end of the bar will in this instance occur simultaneously with the lowering of its other end, and vice versa. Obviously the limits of each of such half revolutions of the wheel C will be the uppermost and lowermost positions of the crank pin C', each end of the bar G being herein shown as raised during the passage of said crank pin C' through that half of its orbit adjacent to such end.

The engaging surfaces *g g'* hereinbefore referred to are located upon the bar G at a distance apart equal to the length of the racks B' B<sup>2</sup> and the length of said racks is made an equal multiple of the pitch circumference of the driving wheel C, said length being, in this instance, exactly equal to said circumference. The engaging surface *b* of the bed B is located on said bed so as to stand opposite the engaging surface *g* when the end of the racks remote from said surface *b* arrives in the same vertical plane with the axis of the wheel C. Obviously, therefore, when the bed is reciprocated to bring the other end of said racks in the same vertical plane with the axis of said wheel the surface *b* will stand opposite the other engaging surface *g'* and in position to interlock therewith. The wrist pin C' is located in the wheel C at a distance from the axis of the same equal to the pitch radius thereof, and is arranged to stand in the same vertical plane with said axis simultaneously with the arrival of the ends of the racks in said plane, and to further stand adjacent to that one of the racks B' B<sup>2</sup> with which said gear is then intermeshing.

The construction of the machine being as described and the directions of rotation of the gears being as indicated by the arrows on the several figures of the drawings, the operation is as follows; starting with the parts in the position shown in Fig. 9: The friction roller *e'* has, as therein shown, just entered the larger concentric portion *f'* of the cam groove *f* and lifted the wheel C into mesh with the rack B'. The next revolution of said wheel C moves the bed B to the left a distance equal to the length of said rack B', bringing the right hand end of the same directly over the axis of said wheel, as shown in Fig. 1. Just as the parts arrive in this position the inclined portion *g*<sup>4</sup> of the cam slot G<sup>2</sup> passes over the friction wheel *a'*; causing the engaging surface *g* of the bar G to interlock with the surface *b* of the bed B. Obviously the said bar G is at this moment moving in the same direction and at the same velocity as the bed B so that no jar or shock occurs by the interlocking of the bar and bed.

During the next half revolution of the wheel C the bed B moves in unison with the bar G by reason of its connection therewith. The velocity of said parts is gradually reduced until, as the crank pin C' passes its dead center, they become stationary, standing in the position in Fig. 5. They are then started in the reverse direction with a velocity which is gradually accelerated until, at the end of said half revolution of said wheel C, it equals the pitch peripheral velocity of said wheel, the bed and bar arriving at this moment exactly in the position occupied in the beginning of said half revolution, *i. e.* with the ends of the racks B' B<sup>2</sup> in the same vertical plane with the axis of the wheel C.

At the beginning of the half revolution above referred to the friction roller *e'* has reached the end of the larger concentric portion of the groove *f*, and during said half revolution said roller passes through the eccentric portion *f*<sup>3</sup> and enters the smaller concentric portion *f*<sup>2</sup> of said slot, drawing the wheel C down into position to intermesh with the rack B<sup>2</sup>. Such intermeshing obviously occurs simultaneously with the arrival of the end of the racks in the same vertical plane with the axis of the wheel C at the end of said half revolution, said wheel acting immediately thereupon to continue the reverse movement of the bed. As said wheel thus resumes its operative connection with the bed, the bar G is disengaged from said bed by the passage of the inclined portion *g*<sup>4</sup> of the cam slot G<sup>2</sup> of the bar back over the friction wheel, whereby the surface is withdrawn from its engagement with the surface *b*. The succeeding revolution of the wheel C drives the bed to the right the full length of the racks B' B<sup>2</sup>, bringing the left end of said racks in the same vertical plane with the axis of said wheel, as shown in Fig. 7. As the bed reaches this position the inclined portion *g*<sup>4</sup> of the slot G<sup>2</sup> passes over the friction wheel *a*<sup>2</sup> and lifts the surface *g'* of the bar G into engagement with the surface *b* of the bed B, said surface *b* having arrived at this instant directly opposite said surface *g'*. The movement of the bed B is then continued under the control of the bar G during the next half revolution of the wheel C, said bed and bar being gradually brought to a standstill in the position shown in Fig. 9 and then started in the reverse direction with a gradually accelerated velocity, reaching its maximum at the moment the ends of the racks arrive again in the same plane with the axis of the wheel C, as shown in Fig. 1. During such half revolution the friction wheel *f'* will have passed through the eccentric portion *f*<sup>4</sup> of the cam groove *f*, raising the wheel C into position to mesh with the rack B' so that at the end of said half revolution said wheel resumes its operative connection with said rack to drive the bed to the left once more. At the same time the inclined portion *g*<sup>4</sup> of the slot G<sup>2</sup> passes back over the friction roller *a*<sup>2</sup>, bringing the

portion *g*<sup>3</sup> of said slot into engagement with said friction roller and lowering the adjacent end of the bar G sufficiently to disengage the surface *g'* from the surface *b*. The engaging surfaces *g g'* and *b* of the bar and bed, respectively, are herein shown provided with a plurality of interlocking teeth made of sufficient length to insure a firm connection between the parts when the bar is raised to engage the bed, but not too long to be completely cleared when the bar is lowered again to disengage the bed at the end of the reversing movement.

The object of employing a connecting rod as the means of operatively connecting the crank-pin C' of the gear wheel C with the reciprocating bar, and of locating the wrist pin G' of the bar G on the opposite side of the driving pinion D' from the gear C, as hereinbefore set forth, may be explained as follows: A gear wheel mounted to oscillate between parallel racks and alternately engaging said racks to drive them in opposite directions is an exceedingly effective and convenient form of main driving mechanism. The oscillation of such gear wheel about the shaft of its driving pinion operates, however, to interfere with the uniformity of the rotary velocity of said wheel, it being obvious that when said wheel is oscillated about the shaft of its driving pinion in the direction in which said pinion normally turns, the rotary velocity of the wheel will be momentarily checked during such oscillatory movement; and that, on the other hand, when said wheel is oscillated in a direction opposite to the direction of rotation of the driving pinion the rotary velocity of said wheel will be accelerated. Inasmuch, therefore, as the oscillatory movement in one direction occurs at that time at which the crank-pin of the wheel is operating, through the medium of the reciprocating bar, to reverse the motion of the bed at one end of its throw, and the oscillatory movement in the other direction occurs during the time at which said crank-pin is operating to reverse the movement of the bed at the other end of its throw, it is obvious that the reversal at one end will be more sudden than the reversal at the other end, and that consequently the movement of the bed will be to this extent uneven, unless means are employed to counteract the variable rotary speed of the wheel due to its oscillatory movement.

Such correcting means is found in that form of connection described, as will be understood from a consideration of the diagram in Fig. 10 illustrating in detail the action of the connecting rod and crank as a means of transforming rotary into reciprocatory motion. In said diagram N N' N<sup>2</sup> N<sup>3</sup> designate a crank-pin at the four quarters of its stroke, and M a connecting rod. *m* designates the mean point of the reciprocating end of the connecting rod, and *m' m*<sup>2</sup> its extreme points. The distance *m' m* is obviously equal to the

radius of the crank-arm plus the increased effective length of the connecting rod due to its assuming a horizontal instead of an oblique position. The distance  $m m^2$ , on the other hand, is equal to the radius of the crank-arm minus said increased effective length of the connecting rod. Obviously, therefore, if the crank-pin revolves at uniform speed the reciprocating end of the connecting rod will occupy the same time in traveling through the lateral distance  $m m'$  that it does in passing through the distance  $m m^2$ , and consequently, the speed of the reversing motion in one direction will be greater than in the other. If, however, the rotary velocity of the crank-pin be decreased during that half of its revolution adjacent to the reciprocating end of the rod and increased during that half of its revolution remote from said reciprocating end, the velocity of reversal at each end of the stroke will be more nearly uniform.

In the case in hand we have seen that the rotary velocity of the wheel C is decreased during that half of its revolution adjacent to the crank-pin G' and is increased during the other half of its revolution, owing to the oscillatory movement of the said wheel about its driving pinion. The variations in velocity of the two mechanisms, therefore, tend to correct each other, with the result of an increased smoothness in the running of the machine. If, however, the wrist pin G' were placed on the same side of the driving shaft D as the gear C, the variations in velocity of the two mechanisms would co-operate to still further increase the difference in the speeds of the reversing actions.

As a means for connecting the bar G with the bed, interlocking projections on the bed and bar may be engaged with and disengaged from each other by devices operating otherwise than by a bodily movement of the bar itself, but the construction described and shown, wherein the bar is bodily moved for the purpose stated, has advantages in point of simplicity of construction and certainty of operation, and is herein in itself claimed as part of my invention.

I claim as my invention—

1. The combination with a reciprocating bed provided with parallel racks and a driving gear wheel mounted to oscillate between said racks and engage the same alternately to drive the reciprocating bed in opposite directions, of means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar adapted to be periodically interlocked with the reciprocating bed, a crank pin on said driving gear, and a connecting rod operatively connecting said crank pin with said bar to reciprocate the latter, substantially as described.

2. The combination with a reciprocating bed provided with parallel racks, of a gear-wheel, a driving pinion for actuating said gear-wheel, means for controlling the movement of the bed at each end of its throw com-

prising a reciprocatory bar adapted to be periodically interlocked with the reciprocatory bed, a crank pin on said gear-wheel, and a connecting rod connecting said crank pin with said bar to reciprocate the latter, and means for oscillating the gear wheel about the axis of rotation of the driving pinion so as to engage said gear wheel alternately with the racks, the movement of the gear wheel about this axis in the direction of rotation of the driving pinion occurring during the movement of the connection between the connecting rod and the reciprocatory bar from the gear wheel, and the movement of the gear wheel in the opposite direction occurring during the movement of said connection in the opposite direction, substantially as described.

3. The combination, with a reciprocating bed provided with parallel racks, of a gear wheel mounted to oscillate between said racks and engage the same alternately to drive the reciprocating bed in opposite directions, a driving pinion for actuating said gear, the axis of rotation of which is coincident with the axis of oscillation of the gear wheel, and means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar adapted to be periodically interlocked with the reciprocating bed, a crank-pin on said gear wheel, and a connecting rod connecting said crank-pin with said bar to reciprocate the latter, the said connecting rod being connected with the bar at a point at the side of the driving pinion opposite the gear wheel, substantially as described.

4. The combination with a reciprocating bed provided with two racks, of a gear wheel mounted between said racks, an oscillating lever supporting said gear wheel, a cam engaging said lever to actuate the same, and means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar adapted to be periodically interlocked with the reciprocating bed, a crank-pin on said gear wheel, and a connecting rod connecting said crank-pin with said bar to reciprocate the latter, substantially as described.

5. The combination with a reciprocating bed provided with racks, of a gear wheel engaging the same and acting to drive the reciprocating bed alternately in opposite directions, and means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar extending longitudinally of the bed and having near the opposite ends thereof projecting parts to engage the bed, and a crank-pin operatively connected with the said bar to reciprocate the same, said reciprocating bed being provided with parts adapted to alternately interlock with said projecting parts of the bar, substantially as described.

6. The combination with a reciprocating bed provided with racks, of a gear wheel engaging the same and acting to drive the reciprocating part alternately in opposite direc-

tions, of means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar extending longitudinally of the bed and adapted to be periodically raised to interlock with said bed, and a crank-pin operatively connected with said bar to reciprocate the same, substantially as described.

7. The combination with a main frame, of a reciprocating bed provided with racks, a gear wheel engaging the same and acting to drive the reciprocating bed alternately in opposite directions, and means for controlling the movement of said bed at each end of its throw comprising a reciprocatory bar provided at its ends with cam slots, lateral projections on the main frame engaging said cam slots, and a crank-pin operatively connected with said bar to reciprocate the same whereby the latter will be moved periodically to interlock with said reciprocating bed, substantially as described.

8. The combination with a main frame, of a reciprocating bed provided with racks, of a gear wheel engaging the same and acting to drive the reciprocating bed alternately in opposite directions, and means for controlling the movement of said bed at each end of its throw comprising a reciprocatory bar provided at its ends with oppositely arranged cam slots, lateral projections on the main frame engaging said cam slots, and a crank-pin operatively connected with said bar to reciprocate the same, whereby the opposite ends of said bar will be alternately raised to interlock with said reciprocating bed, substantially as described.

9. The combination with a main frame, of a reciprocating bed provided with a double rack, a driving shaft mounted in said frame, an oscillating lever pivotally mounted on said driving shaft, means acting on said lever to oscillate the same, a gear wheel journaled upon said lever and adapted to alternately engage said racks, a driving pinion upon said driving shaft intermeshing with the gear wheel, and means for controlling the movement of said reciprocating bed at each end of its throw comprising a reciprocatory bar provided at its ends with cam slots, lateral projections on the main frame engaging said

cam slots, a crank-pin on said gear wheel located at a distance from the axis of the same equal to its pitch radius, and a connecting rod between said crank-pin and bar, substantially as described.

10. The combination with a main frame, of a reciprocating bed provided with racks, a gear wheel engaging the same and acting to drive the reciprocating bed alternately in opposite directions, and means for controlling the movement of said bed at each end of its throw, comprising a reciprocatory bar provided at its ends with cam slots, each formed of two end portions lying parallel to the upper surface of the bar at different distances therefrom and connected by an inclined middle portion, lateral projections on the main frame engaging said cam slots, and a crank-pin operatively connected with said bar to reciprocate the same, substantially as described.

11. The combination with a main frame, of a reciprocating bed provided with a double rack, a driving shaft mounted in said frame, an oscillating lever pivotally mounted on said driving shaft, a cam-wheel provided with a slot having concentric portions of unequal radii connected by eccentric portions, a lateral projection on said oscillating lever engaging the slot of said cam, a gear wheel journaled upon said lever and adapted to alternately engage said racks, a driving pinion upon the driving shaft, intermeshing with said gear wheel, means for rotating said cam-wheel from said driving shaft, and means for controlling the movement of the reciprocating bed at each end of its throw, comprising a reciprocatory bar adapted to be periodically interlocked with the reciprocating bed, and a crank-pin on said driving gear, operatively connected with the said bar to reciprocate the same, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

ROBERT MIEHLE.

Witnesses:

C. CLARENCE POOLE,  
G. W. HIGGINS, Jr.