C. J. ROBERTSON.

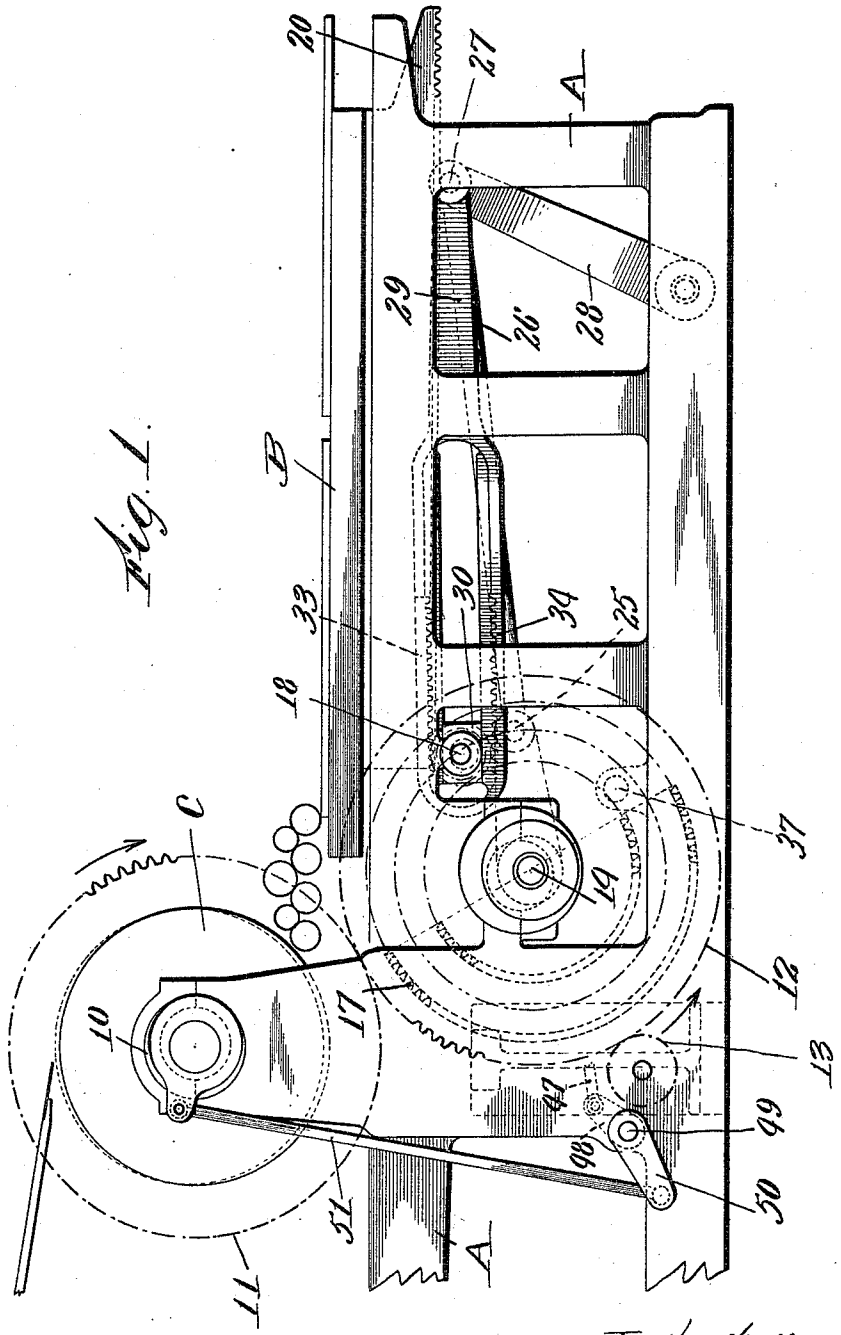
MECHANICAL MOVEMENT.

APPLICATION FILED OCT. 6, 1904. RENEWED DEC. 6, 1910.

998,859. **Patented July 25, 1911.**

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
C. F. Wesson.
A. M. Goddard.

Inventor:
C. J. Robertson.
By his Attorneys.
Southgate & Southgate

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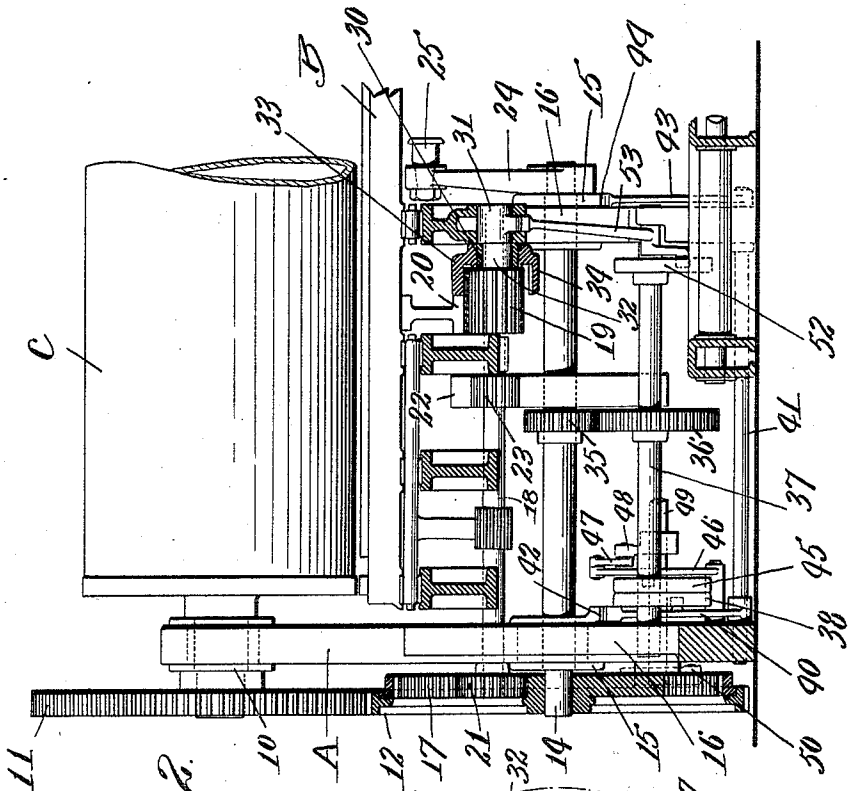

Fig. 2.

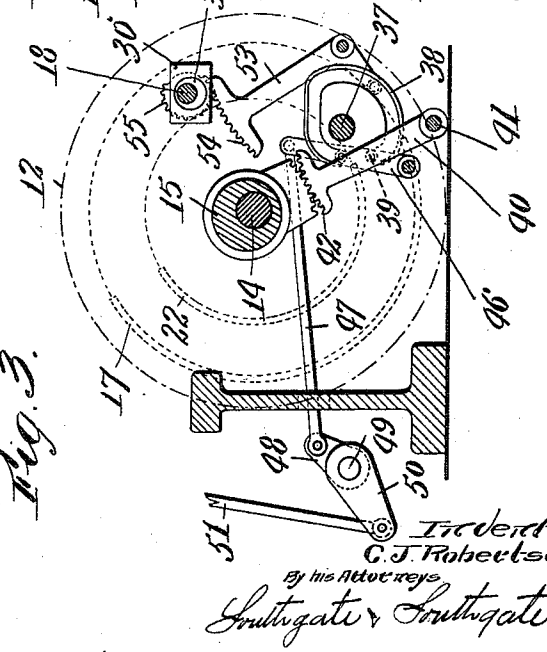

Fig. 3.

Witnesses:
C. A. Wesson.
A. M. Goddard

Inventor:
C. J. Robertson.
By his Attorneys
Southgate & Southgate

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

C. J. ROBERTSON.

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4 SHEETS—SHEET 3.

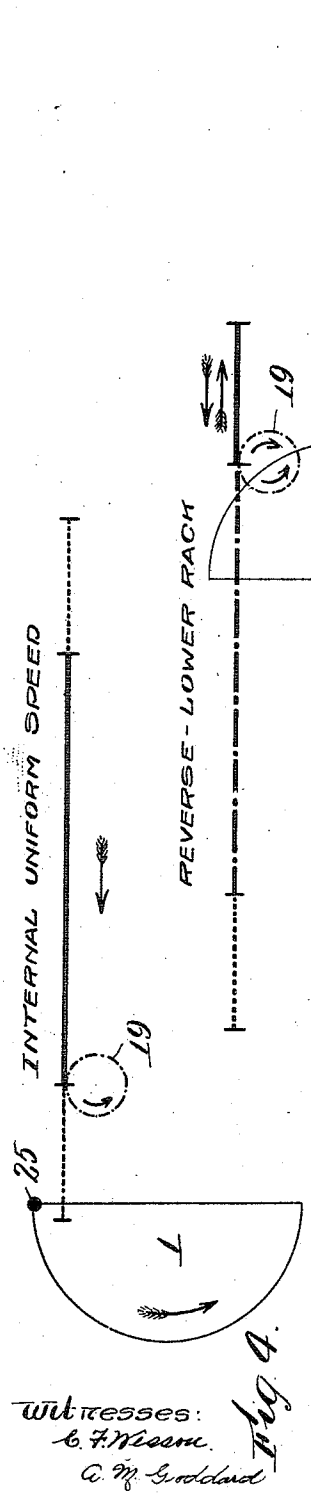

Fig. 4.

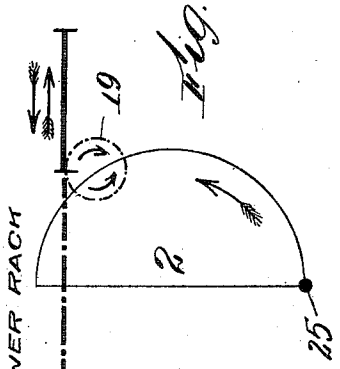

Fig. 5.

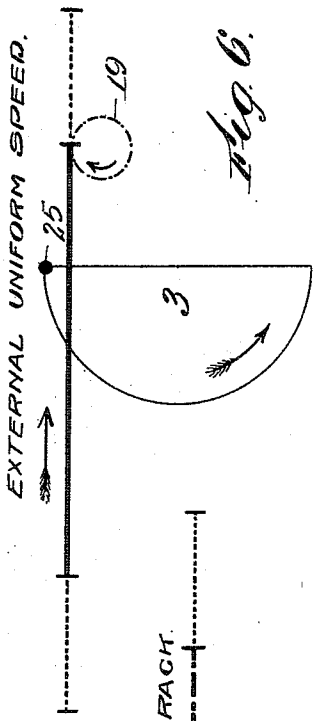

Fig. 6.

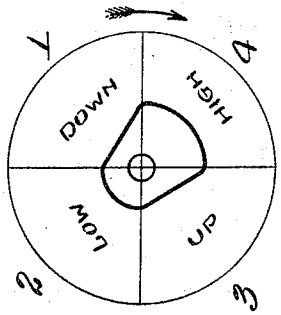

Fig. 8.

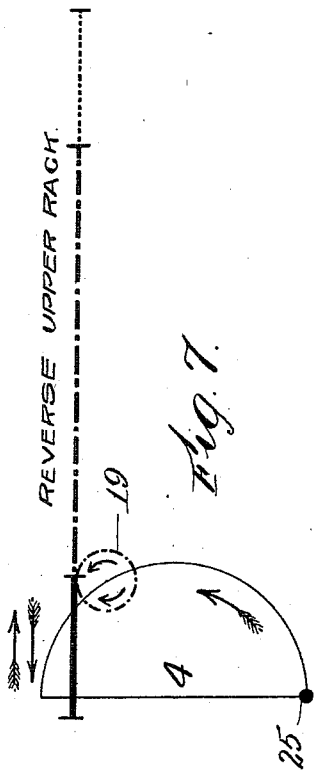

Fig. 7.

Witnesses:
C. F. Wesson.
C. M. Goddard

Inventor:
C. J. Robertson.
By his Attorneys
Southgate & Southgate

C. J. ROBERTSON.

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4 SHEETS—SHEET 4.

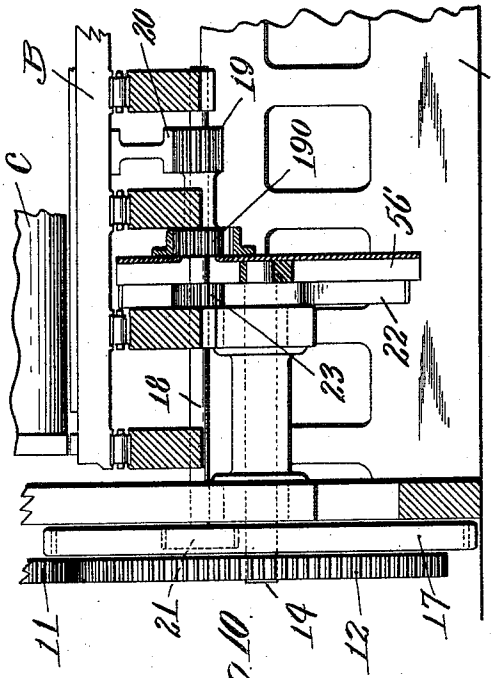

Fig. 10.

Fig. 9.

Witnesses:
C. F. Wesson.
A. M. Goddard

Inventor:
C. J. Robertson
By his Attorneys.
Southgate & Southgate

UNITED STATES PATENT OFFICE.

CHARLES J. ROBERTSON, OF TAUNTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AUTOPLATE COMPANY OF AMERICA, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MECHANICAL MOVEMENT.

998,859. Specification of Letters Patent. **Patented July 25, 1911.**

Application filed October 6, 1904, Serial No. 227,344. Renewed December 6, 1910. Serial No. 595,944.

To all whom it may concern:

Be it known that I, CHARLES J. ROBERTSON, a subject of Great Britain, residing at Taunton, in the county of Bristol and State of Massachusetts, have invented a new and useful Mechanical Movement, of which the following is a specification.

The object of this invention is to provide a new and improved mechanical movement for converting rotary motion into reciprocating motion.

The movement has been particularly designed for reciprocating the beds of printing machines, although it may be applied to other machines.

A printing press bed should be run at a uniform speed during its printing movement or movements, and should be reversed; that is, gradually retarded, stopped and gradually started in the opposite direction up to full uniform speed with what is known as a crank-reverse. As printing presses have been made larger and have been made to run at higher speeds, it has been found desirable to give more time, relatively speaking, to the crank-reverse. This has lead to the development of the well-known "three-revolution" movement. I have shown my invention as applied to a still further carrying out of this idea, that is, to a "two-revolution" movement, although, in its broad sense, the invention is not limited to any particular number of revolutions. So far as I have now developed the invention, however, I believe its best form can be worked out in connection with the two-revolution movement. In a two-revolution movement a half revolution is alternately given to the uniform movement of the bed, and to a reversing movement thereof, two revolutions thus imparting a full reciprocation to the bed. I have discovered that the speed of printing press-beds can be further increased if the parts carried by the bed are reduced to a minimum.

It is customary with the movements before used to attach top and bottom racks and hangers carrying parts of the reversing mechanism to the bed. This has greatly increased the weight of the bed and hence the momentum which has to be overcome in the reversing movements.

The principal object of my invention is to design a movement by which the bed shall be made as light as possible, and by the invention as hereinafter described it will be seen that I have most advantageously worked out this principle, and that the only part that need be attached to the bed is a single rack. By this arrangement the reciprocating parts are very materially decreased in weight and hence the speed of the machine can be materially increased without straining the mechanism.

The invention can best be understood by describing the same in detail.

Two modified ways of practicing the invention are shown in the accompanying four sheets of drawings.

Referring to the drawings, Figure 1 is a side elevation of the principal parts of a printing press with my invention applied thereto. Fig. 2 is an end view partly in section illustrating the mechanism. Fig. 3 is a partial sectional elevation illustrating the cam mechanism used to actuate the various parts. Figs. 4 to 7 are diagrams illustrating the action. Fig. 8 is a diagram illustrating the cam, and Figs. 9 and 10 are views similar to Figs. 1 and 2 illustrating a modification.

Referring to the drawings and in detail, A designates the usual framework, mounted to reciprocate on which is the usual bed or form carrier B.

C designates the impression cylinder, the shaft of which is journaled eccentrically in bushings 10 fitted in the frame. This arrangement is common in two-revolution impression cylinder printing presses, and the parts operate so that the impression cylinder is lowered and is in impression while the bed makes its forward uniform speed movement, and so that it is raised to clear the forms as the bed makes its retrograde or return movement.

The invention can be applied to any form of printing machine having a reciprocating bed, the two-revolution form being chosen merely to show one advantageous use of the same.

Mounted on the end of the impression cylinder shaft is a gear 11, which meshes with a driving gear 12 to which power is applied in any suitable way as by a pinion 13 arranged on a shaft to which power is ap-

plied. The driving gear 12 is mounted on a main shaft 14 which is eccentrically journaled in bushings 15 fitted in the framework A and in an interior strut or bearing 16. A half internal gear 17 is secured to the driving gear 12.

A driving shaft 18 is journaled in the framework A and in a bushing hereinafter referred to fitted in strut 16. This driving shaft carries a large wide-faced or double driving pinion 19 which meshes with a rack 20 secured to the bed. The driving pinion 19 and the rack 20 are always in mesh and constitute the only means by which the various movements are imparted to the bed. A pinion 21 is arranged on the outer end of the said driving shaft 18 in position to engage the half internal gear 17. Also arranged on the shaft 14 is a half external or spur gear 22, and the driving shaft 18 carries a pinion 23 in position to engage the half spur gear 22. The said half external and internal gears occupy similar angular positions on the main shaft.

The mechanism hereinbefore described constitutes an efficient main driving mechanism which operates as follows: When the main shaft 14 is lowered by its eccentric bushings 15, the half internal gear 17 will engage the pinion 21 on the shaft 18, and hence the bed will be moved by the pinion 19 and rack 20. On the inner end of the main shaft 14 is arranged a crank-arm 24 which carries a wrist-pin 25 or crank-element which actuates the reversing mechanism as hereinafter described. The relation between the internal gear 17, the pinion 21, the driving pinion 19, and rack 20 is such that the uniform speed thus imparted to the bed is the same as the circumferential speed of the crank-element or wrist-pin 25, and hence as the internal gear 17 is only a half gear this uniform movement will occupy one-half of the turn of the shaft 14, and will move the bed a distance equal to one-half of the circumferential travel of the crank-element. This movement is utilized to impart the forward or printing stroke to the bed and forms a desirable mechanism for this purpose, as the mesh of the half internal gear 17 with its pinion 21 is a strong and long mesh which imparts a smooth movement. During the reversing movement which takes place during the next half revolution of the crank-element, and which will be hereinafter described, the eccentric bushings 15 are oscillated to lower the shaft 14. It will now be seen that a return movement is imparted to the bed by the half spur gear 22 engaging the pinion 23, and thus actuating the driving pinion 19 in the opposite direction, but at the same speed, which movement imparts the uniform speed return movement to the bed, and which movement is a half circumference of the crank-element. The ratio between the half internal gear 17 and the pinion 21 is the same as the ratio between the half spur gear 22 and the pinion 23; for example, suppose the half internal gear for its engagement with the pinion 21, should give the same and thus the driving shaft 18, four and one-half turns, the half spur gear 22 for its engagement for a half revolution with the pinion 23 should give the latter and thereby the driving shaft 18, four and one-half turns in the opposite direction. Of course the reduction between the gears and the pinions can be varied, the only essential being that the same ratio is preserved between the half internal gear and its pinion and the half spur gear and its pinion. The next reversing movement now takes place, and the main shaft 14 is raised for the next forward movement.

The bushings 10 which carry the shaft of the impression cylinder are operated by mechanism hereinafter described in unison with the bushings 15 which carry the main shaft 14, hence the mesh of gearing between the gears 11 and 12 is not disturbed. This is an important point in practice, as it is desirable to have the gearing to the cylinder work always under the same conditions.

The rising and falling of the shaft 14 does not break the mesh between the driving gear 12 and its pinion 13, and the disturbance in this mesh may be completely neglected as it does not affect or modify the gearing between any of the parts of the printing machine. This advantageous result follows from the fact that the main shaft 14 can be moved up and down in unison with the shaft of the impression cylinder, both being down for the forward or printing movement of the bed, and both being up for the return stroke of the bed, and the change of positions taking place during the reversing movements.

The reversing mechanism will now be described.

A pitman 26 is connected to the crank element or wrist pin 25 and also to a pin 27 carried by a lever 28 pivoted in the framing. A connecting piece 29 is also journaled or attached to the wrist-pin 27 preferably on the other side of the lever 28. This connecting piece is slotted at its forward end, and the walls of the slot are accurately finished. Fitted into the slot is a steel block 30 which forms a guiding and supporting means for the inner end of this connecting piece. A bushing 31 is journaled in the strut 16, and the driving shaft 18 is journaled in the end thereof. This bushing 31 has a hub 32 which is eccentrically arranged and which carries said block 30. Formed or secured to the connecting piece 29 are upper and lower racks 33 and 34 which are arranged in position to engage the upper and lower sides of

the driving pinion 19, said driving pinion being made wide-faced for this purpose. The racks 33 and 34 are arranged a little farther apart than the diameter of said driving pinion 19. When the bushing 31 is held in the position shown in Fig. 3, the eccentric hub 32 will be in its lowest position, and the block 30 will thus guide the connecting piece 29 so that the upper rack 33 will engage the driving pinion 19. When the bushing 31 is turned, which is done by the mechanism hereinafter described, the guiding block 30 will be held in a lifted position, so that the lower rack 34 will engage the driving pinion 19. It will be seen that the connecting piece 29 is crank actuated and reciprocates back and forward on the block 30 with a crank motion, and this alternate engagement of the racks 33 and 34 with the driving pinion 19 constitutes a reversing mechanism which operates as hereinafter described. The cam mechanism for operating these parts will now be described.

Arranged on the main shaft 14 is a pinion 35 which meshes with a gear 36 secured on a cam shaft 37 journaled in the framing and in the strut 16. The relation between the gear 35 and gear 36 is one to two, so that the cam shaft makes one complete turn for each two turns of the main shaft, or one complete turn for each complete reciprocation of the bed. The gear 36 is made of irregular outline, or substantially with one-half thereof higher than the other, so that as the main shaft raises and lowers, the pinion 35 will still be accurately in mesh with said gear 36. Arranged on said cam shaft is a cam 38 engaging which is a roller 39 mounted on a lever 40 secured on a shaft 41 journaled in the framing and the strut. This lever is provided with teeth 42 at its upper end which engage teeth projecting from the bushing 15 which is journaled in the framing. On the inner end of the shaft 41 is arranged a similar toothed lever 43 which engages teeth 44 formed on the bushing 15 which is journaled in the strut 16. By this mechanism the bushings 15 will be oscillated and the main shaft 14 raised and lowered as hereinbefore described. Also arranged on said cam shaft is a cam 45 engaging which is a roller mounted on a pivoted lever 46 which connects by link 47 to a short lever 48 mounted on a cross-shaft 49 journaled in the framing. On the outer ends of this cross-shaft are arranged levers 50 which connect by links 51 to the eccentric bushings 10 which carry the impression cylinder. By this mechanism the impression cylinder will be raised and lowered. The cams 38 and 45 are made of a shape to operate the impression cylinder and main shaft in unison as before described. Near the inner end of said cam shaft 37 is arranged a cam 52, engaging the groove of which is a roller mounted on one end of a pivoted rocking lever 53 which has teeth 54 which engage teeth 55 formed on the bushing 31. This cam 52 is of substantially the same contour as the cams previously described, and operates to raise and lower the guide-block 30 for the connecting piece 29.

The racks 33 and 34 are made of a length about equal to the radius of the crank-element, whereby they will only operate for the left-hand half turn of the crank-element relatively to a vertical line through the main shaft 14.

It will be seen that the reversing mechanism acts through the driving pinion 19, and that as before stated, the only connection to the bed is the driving pinion 19 and the rack 20 which is made long enough both for the uniform movements and the reversing movements.

The operation can be followed from the diagrams. In Fig. 4, the parts are shown with the bed as just starting on its uniform forward or printing movement, and the half internal gear as coming into operation. Now during the next half revolution of the crank-element the bed will be moved on its printing stroke a distance equal to one-half of the circumference of the travel of the crank-element. During this movement the reversing racks are not in operation, as the crank-element is on the left-hand half of its turn. This will bring the crank-element to the position shown in Fig. 5. During this last described movement, the cam 52 will have turned so that the low part of its groove will now come into operation, the cam 52 being set a quarter revolution ahead, so to speak, relatively to the cams 38 and 45. When the low portion of the cam 52 comes into operation the bushing 31 will be turned so that the block 30 will be lifted to its highest position. This will bring the lower rack 34 in position to engage the driving pinion 19. Now during the next half turn of the crank-element the connecting piece 29 will be moved with a gradually decreasing speed to the right, stopped and started with a gradually accelerated speed to the left, or will have a crank reverse, and this motion by means of said lower rack 34 and pinion 19 will be oppositely imparted to the bed; that is, the bed will be moved to the left with a gradually diminishing movement, stopped at its left-hand extreme, and then started on its right-hand movement with a speed gradually increasing from zero up to the uniform speed. This reverse movement will give a travel to the bed equal to the radius of the crank-element. During this reversing movement, the shaft 14 and also the impression cylinder will be raised so that the half external gear 22 will come into operation. Now during the next half turn of the crank-element the bed will be given

its uniform retrograde stroke which will be a movement equal to one-half of the circumference of the crank-element. During this movement the cam 52 will have operated so that its high portion will now come into operation. This will lower the guiding block 30 so that the upper rack 33 will now engage the driving pinion 19. This will bring the parts to the position shown in Fig. 7. During the next half turn of the crank-element this upper rack will impart a direct crank reverse to the bed, the movement of this reverse equaling in its travel the radius of the crank-element. The parts are shown in Figs. 1, 2 and 3 in the same position with the bed at the extreme of its travel to the right, or at its center of reversal during this last described operation. Thus the total travel of the bed will be a half of the circumference of the crank-element plus two radii thereof. By the means described the proper crank reverse will be imparted to the bed, and the mesh between the driving pinion and its rack utilized for every movement.

While the invention is not limited to the application of a two-revolution movement, still this is a desirable development of the same.

A further advantageous point of this new movement is that the work of driving the form-inking rollers can be taken off of the bed and put directly on the driving shaft by gearing the driving shaft to the form inking rollers as the driving shaft turns forward and backward at the proper speed to allow this to be done. This will tend also to help the speed of the machine, as the less the bed, which is a reciprocating part, has to do, the greater speed can be obtained. Additionally any duty taken off the gearing which drives the bed lessens the wear of these parts and consequently increases the life of good register in the machine. The anti-friction bed-roll frames may be also driven from the driving shaft by a pinion exactly half the size of the bed rack pinion meshing into a rack on the bed-roll frame as indicated in Fig. 2. I intend to claim these points of printing press construction in a further application for patent.

In Figs. 9 and 10 a modification is shown. In this modification the pitman-actuated connecting piece 29 is omitted, and in its place a yoke 56 is used. This yoke has a slot 57 engaging which is a block 58 mounted on the crank-element. The gearing for this modification is somewhat modified as shown in Fig. 10, a supplemental pinion 190 being used to engage the reversing racks which are carried by said yoke.

The left-hand part of the slot of the yoke is mounted on a block 59 which is arranged on a pin 60 secured to the framing. The right-hand slot of the yoke is arranged on a block 61 which is carried by the eccentric hub of a bushing which is operated as before described. By this arrangement the yoke will be pivoted on the pin 60 and raised and lowered so that the reversing racks will operate as before described. In other respects this modification operates as hereinbefore described.

The movement hereinbefore described particularly allows a strong construction in printing press movements as the elimination of the lower bed rack allows the cross-girth under the line of impression to be made high and strong, and also allows the driving shaft to be rigidly and well supported in the fixed bearings.

As I believe this construction covers a radical departure in this class of apparatus, I do not wish the claims that I make to be construed or limited to details of construction as the invention may be worked out in other ways without departing therefrom.

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

1. In a mechanical movement, the combination of a moving member or bed, a rack carried by the same, a driving pinion engaging said rack, and means for rotating said pinion alternately in opposite directions so that the bed will have uniform speed equal forward and backward main movements, and a crank reverse at each end of its uniform movements effected through the driving pinion.

2. In a mechanical movement, the combination of the moving member or bed, a rack carried by the same, a driving pinion engaging said rack, an internal gear and pinion for turning the driving pinion in one direction, and an external gear and pinion for turning the driving pinion in the opposite direction, this gearing being proportioned so that the movements thus imparted to the bed will be equal in speed.

3. In a mechanical movement, the combination of the moving member or bed, a rack carried by the same, a driving pinion engaging said rack, a half internal gear and pinion for turning the driving pinion in one direction, and a half external gear and pinion for turning the driving pinion in the opposite direction, this gearing being proportioned so that the movements thus imparted to the bed will be equal in speed.

4. In a mechanical movement, the combination of the moving member or bed, a rack carried by the same, a driving pinion engaging said rack, a half internal gear and pinion for turning the driving pinion in one direction, a half external gear and pinion for turning the driving pinion in the opposite direction, said external and internal gears occupying similar angular positions to form a main driving mechanism, and a re-

versing mechanism operating alternately with the main driving mechanism.

5. In a mechanical movement, the combination of the moving member or bed, a rack carried by the same, a driving pinion engaging said rack, a main shaft carrying an internal and an external gear, a pinion actuated by each gear and connected to actuate the driving pinion, and means for moving the main shaft to mesh each gear alternately with its pinion.

6. In a mechanical movement, the combination of the moving member or bed, a rack carried by the same, a driving pinion engaging said rack, a main shaft, a half internal and a half external gear carried thereby, a pinion actuated by each gear and connected to the driving pinion, and means for moving the main shaft to mesh each gear alternately with its pinion.

7. In a mechanical movement, the combination of the moving member or bed, a rack carried thereby, a shaft carrying a driving pinion engaging said rack, two pinions mounted on said driving shaft, a main shaft, a half internal and a half external gear carried by said main shaft, and means for moving said main shaft to mesh each half gear alternately with its respective pinion.

8. In a mechanical movement, the combination of the moving member or bed, a rack carried thereby, a driving shaft carrying a driving pinion engaging said rack, two pinions mounted on said driving shaft, a main shaft, a half internal and a half external gear carried by said main shaft, the half gears occupying similar angular positions on said shaft, means for moving said shaft to bring each half gear alternately into operation to thereby form a main driving mechanism, and a reversing mechanism operating alternately with the main driving mechanism.

9. In a mechanical movement, the combination of the reciprocating member or bed, a main driving mechanism therefor, and a reversing mechanism comprising crank actuated racks, a pinion connected to actuate the bed disposed between said racks, and means for alternately engaging each of said racks with said pinion.

10. In a mechanical movement, the combination of the reciprocating member or bed, a main driving mechanism therefor, and a reversing mechanism comprising crank-actuated racks, a pinion disposed between said racks, a guiding means for said racks, and means for operating said guiding means so that each of said racks will alternately engage said pinion.

11. In a mechanical movement, the combination of the reciprocating member or bed, a main driving mechanism therefor, and a reversing mechanism, comprising crank-actuated racks, a pinion disposed between said racks, a bushing eccentrically carrying a block for guiding said racks, and means for oscillating said bushing.

12. In a mechanical movement, the combination of the reciprocating member or bed, a main driving mechanism for imparting the uniform movements thereto, and a reversing mechanism comprising a revolving crank, racks of a length substantially equal to the radius of said crank and actuated thereby, a pinion disposed between said racks, and means whereby each of the racks is alternately engaged with the pinion.

13. In a mechanical movement, the combination of the reciprocating member or bed, a main driving mechanism for imparting the uniform speed movements thereto, and a reversing mechanism comprising a revolving crank, a pitman connected thereto, a lever vibrated by the pitman, a connecting piece actuated by said lever, racks carried by said connecting piece, a pinion disposed between said racks, and means for alternately engaging each rack with said pinion.

14. In a mechanical movement, the combination of the member or bed, a rack attached to the same, a driving pinion in constant mesh with said rack, means for rotating said pinion forward and backward to give the bed its uniform movements, a crank-actuated reversing mechanism, and means whereby the same is periodically connected to actuate said driving pinion.

15. In a mechanical movement, the combination of the reciprocating member or bed, a rack carried thereby, a driving pinion in constant mesh with said rack, a crank-element making two revolutions for each complete reciprocation of the bed, a main driving mechanism for imparting uniform forward and backward movements to the bed, means whereby the same is connected to actuate said driving pinion for alternate half turns of said crank element, a reversing mechanism actuated by said crank element, and connections whereby the same actuates said driving pinion alternately with the main driving mechanism.

16. In a mechanical movement, the combination of the reciprocating member or bed carrying a rack, a driving shaft carrying a pinion in constant mesh with said rack, pinions on said driving shaft, a main shaft carrying an internal and an external gear, eccentric bushings carrying said main shaft, and means for oscillating said bushings to bring the internal and external gears alternately into operation.

17. The combination of a bed, a main driving shaft, gearing therefrom for reciprocating said bed, an impression cylinder geared to said main shaft independently of the gearing which reciprocates the bed, and means for raising and lowering said main

driving shaft and impression cylinder synchronously.

18. The combination of the reciprocating bed, a main driving shaft for imparting the movements thereto, eccentric bushings carrying said main shaft, an impression cylinder coöperating with said bed and geared to said main shaft, eccentric bushings carrying said impression cylinder, and means for operating all said eccentric bushings so that the shaft and cylinder will rise and fall together.

19. The combination of the reciprocating bed carrying a rack, a driving pinion in mesh therewith, a shaft carrying an internal and an external gear, pinions for connecting the gears to the driving pinion, an impression cylinder coöperating with said bed, gearing between said shaft and impression cylinder, and means for raising and lowering said shaft and impression cylinder synchronously.

20. The combination of the reciprocating bed carrying a rack, a driving pinion in mesh therewith, a shaft carrying an internal and an external gear, pinions for connecting the gears to the driving pinion, an impression cylinder coöperating with said bed, gearing between said shaft and impression cylinder, eccentric bushings in which said shaft and impression cylinder are mounted, and means for operating said eccentric bushings synchronously.

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

C. J. ROBERTSON.

Witnesses:
ROBERT T. JOHNSTON,
HENRY P. COPELAND.