C. J. ROBERTSON.

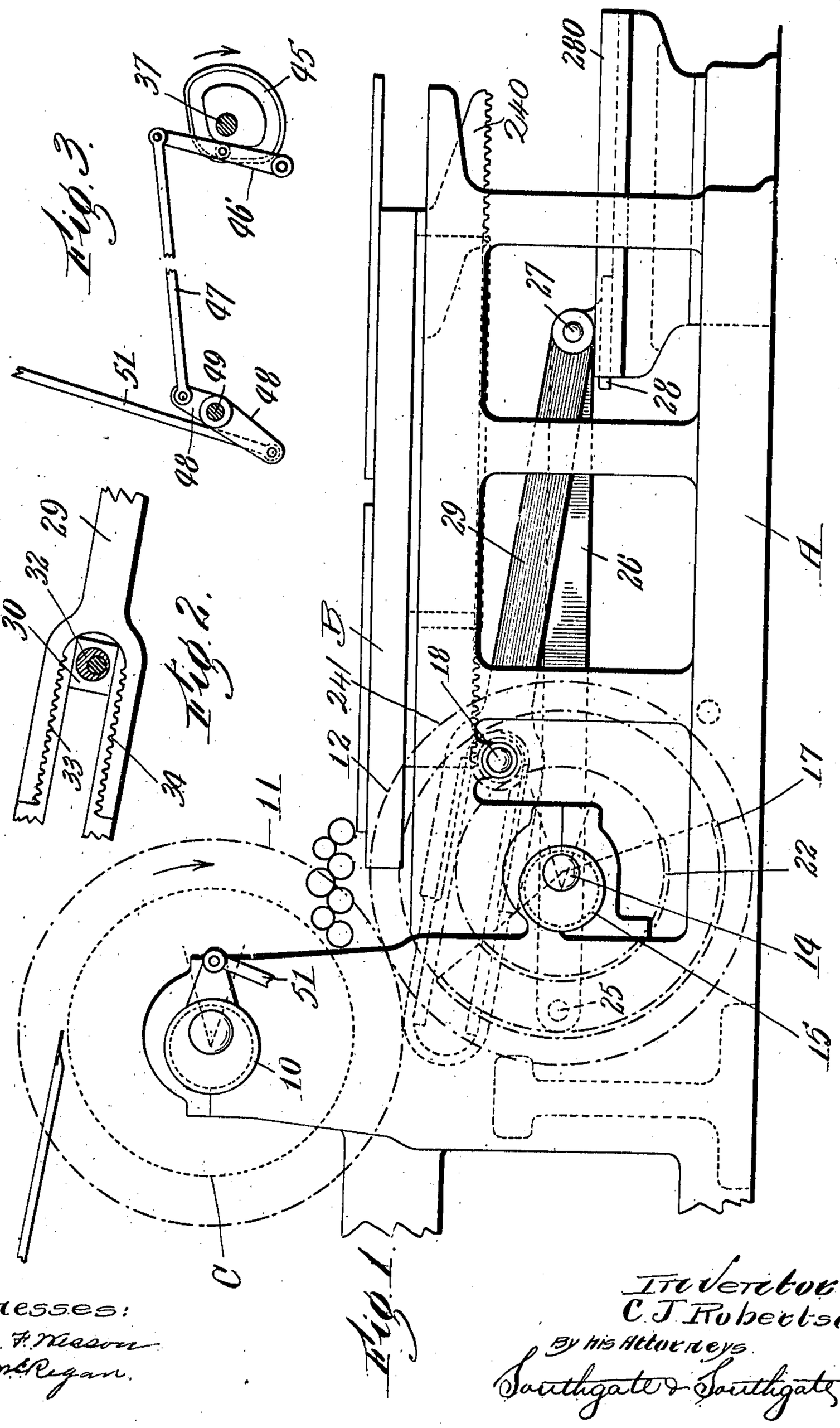
MECHANICAL MOVEMENT.

APPLICATION FILED MAR. 21, 1905. RENEWED JUNE 4, 1909.

945,197.

Patented Jan. 4, 1910.

4 SHEETS—SHEET 1.



Witnesses:
C. F. Mason
M. C. Regan.

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

C. J. ROBERTSON.

MECHANICAL MOVEMENT.

APPLICATION FILED MAR. 21, 1905. RENEWED JUNE 4, 1909.

945,197.

Patented Jan. 4, 1910.

4 SHEETS—SHEET 2.

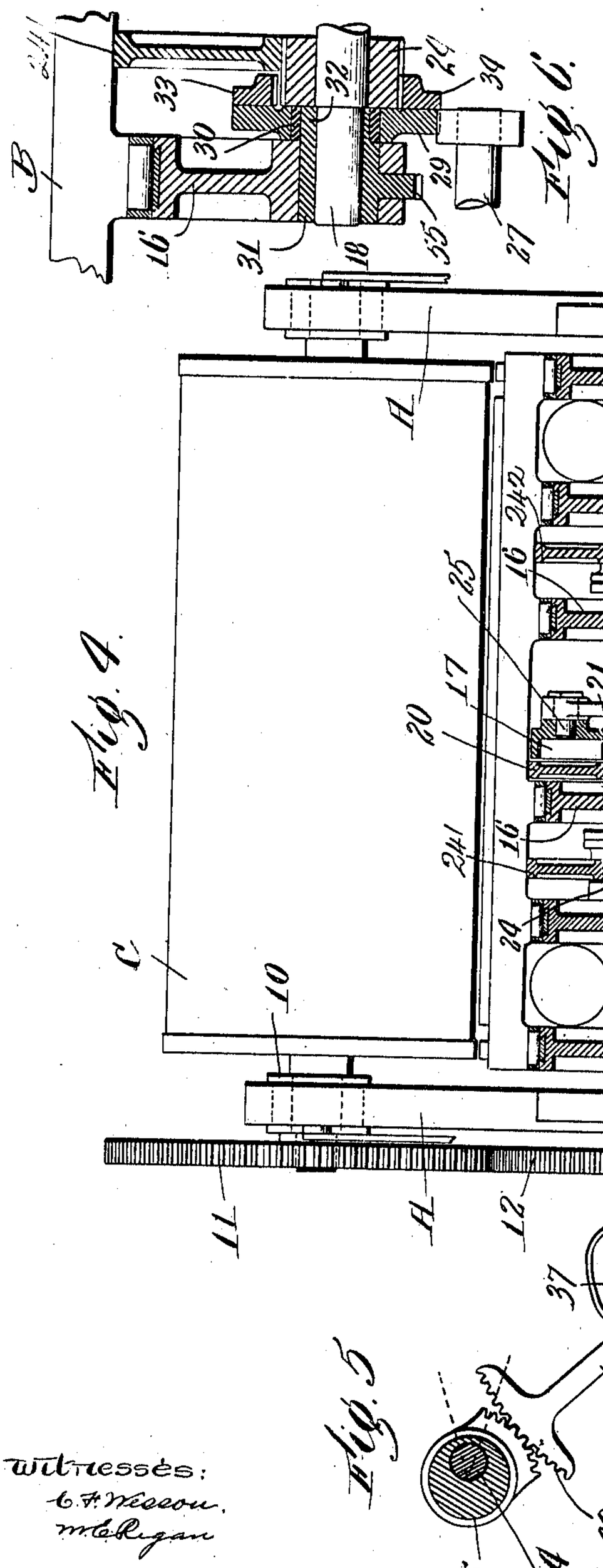


Fig. 4.

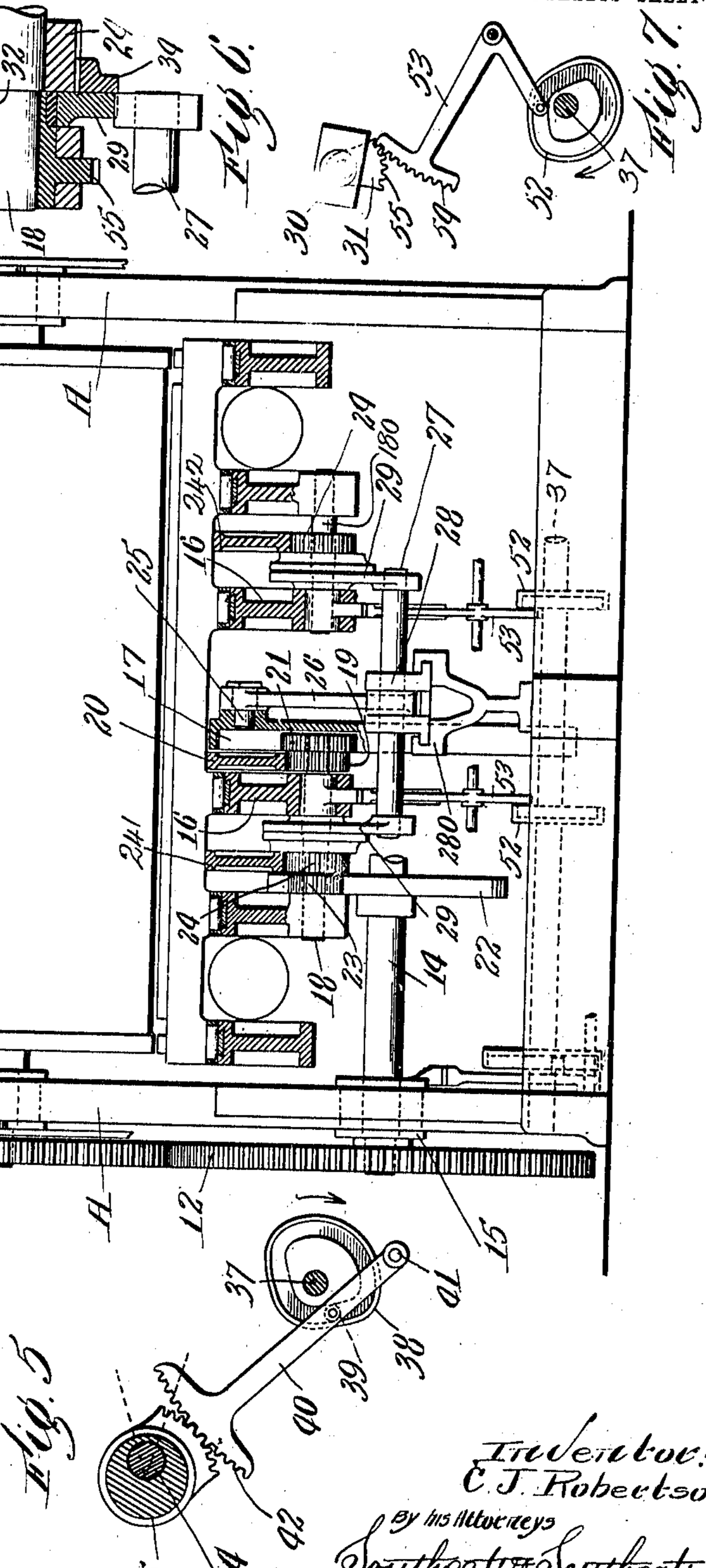


Fig. 7.

Fig. 5

Witnesses:
C. F. Wesson.
M. C. Regan

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

C. J. ROBERTSON.

MECHANICAL MOVEMENT.

APPLICATION FILED MAR. 21, 1905. RENEWED JUNE 4, 1909.

945,197. Patented Jan. 4, 1910.

4 SHEETS—SHEET 3.

Fig. 8.

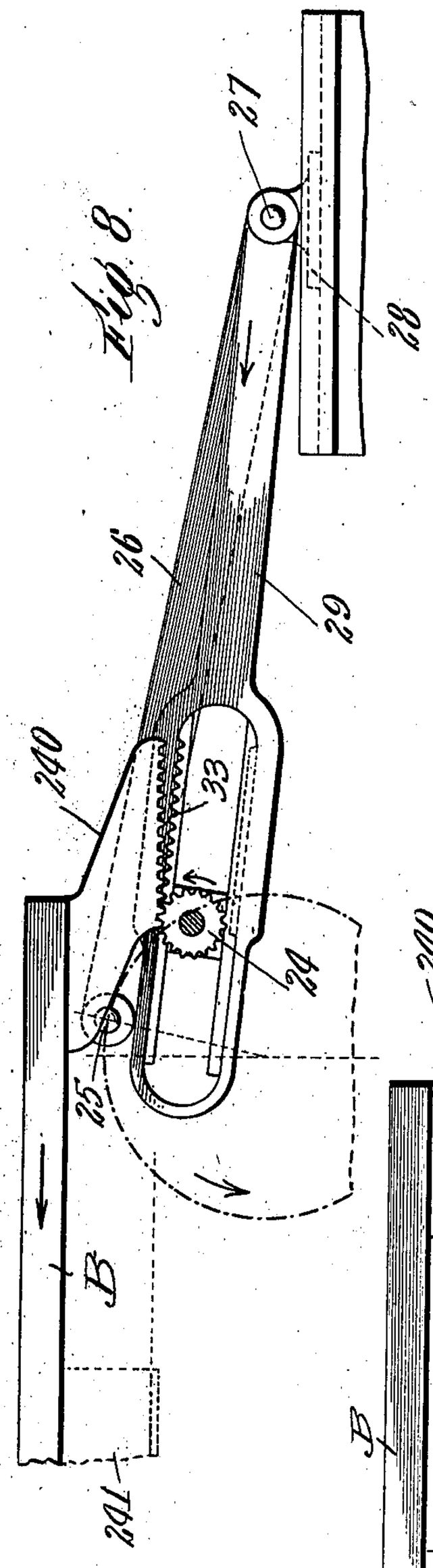


Fig. 9.

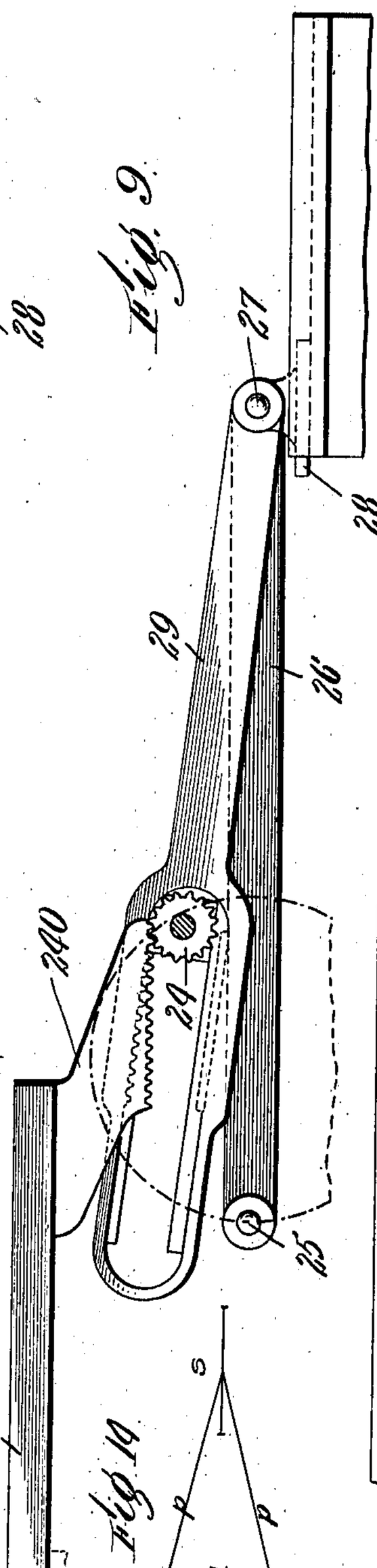


Fig. 10.

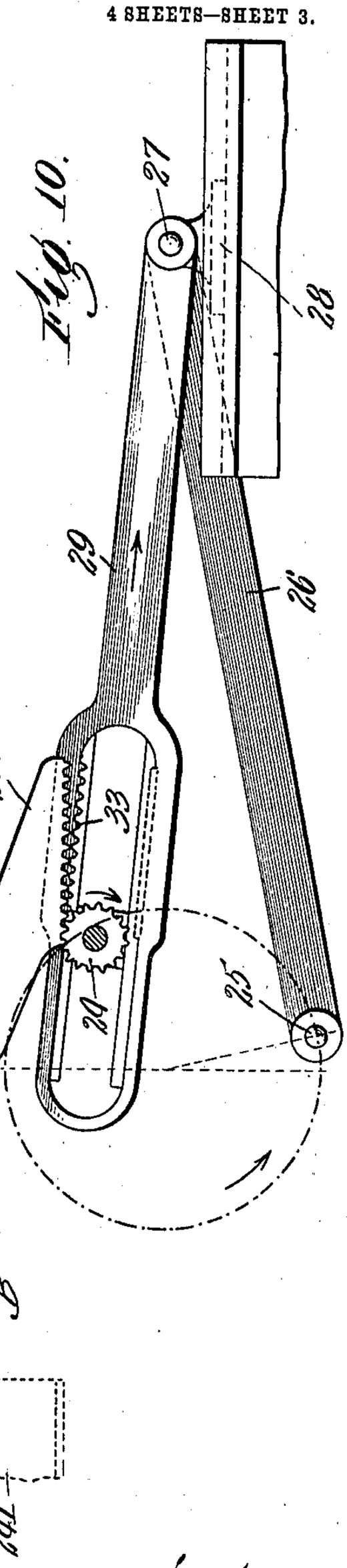


Fig. 11.

Witnesses:

C. F. Wesson.

M. C. Regan.

Inventor:

C. J. Robertson.

By his Attorneys

Southgate & Southgate

C. J. ROBERTSON.

MECHANICAL MOVEMENT.

APPLICATION FILED MAR. 21, 1905. RENEWED JUNE 4, 1909.

945,197.

Patented Jan. 4, 1910.

4 SHEETS—SHEET 4.

Fig. 11.

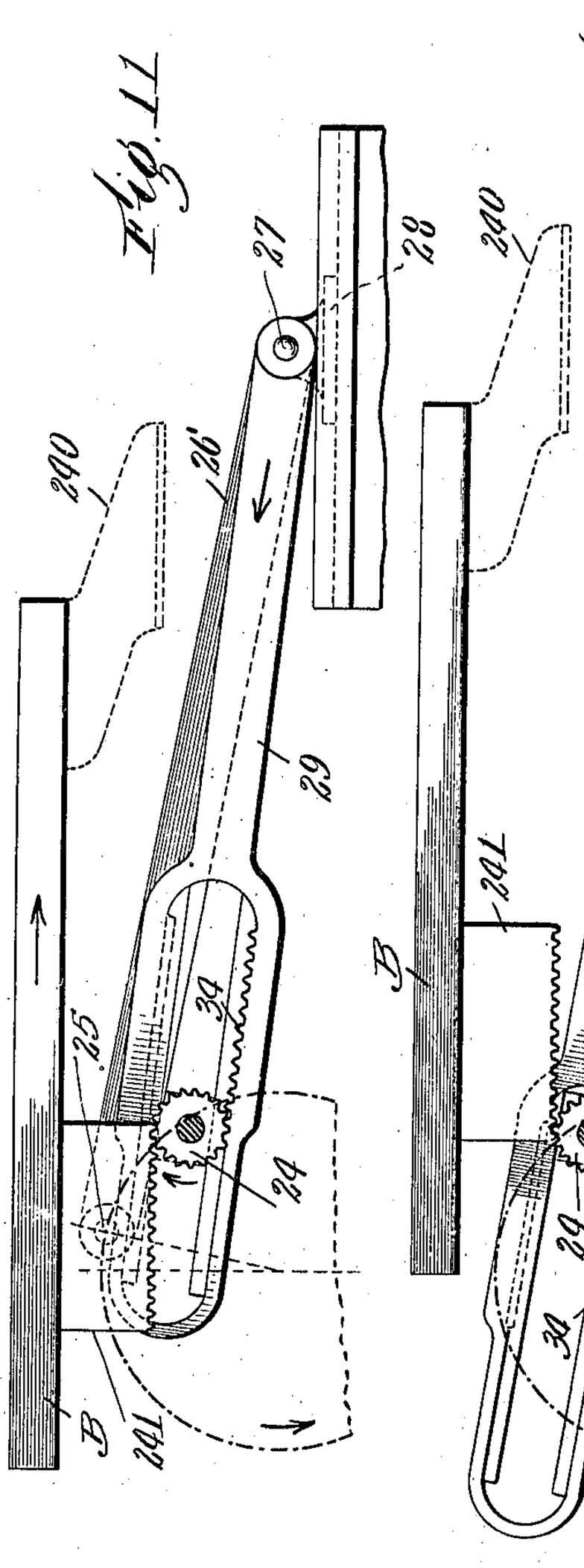


Fig. 12.

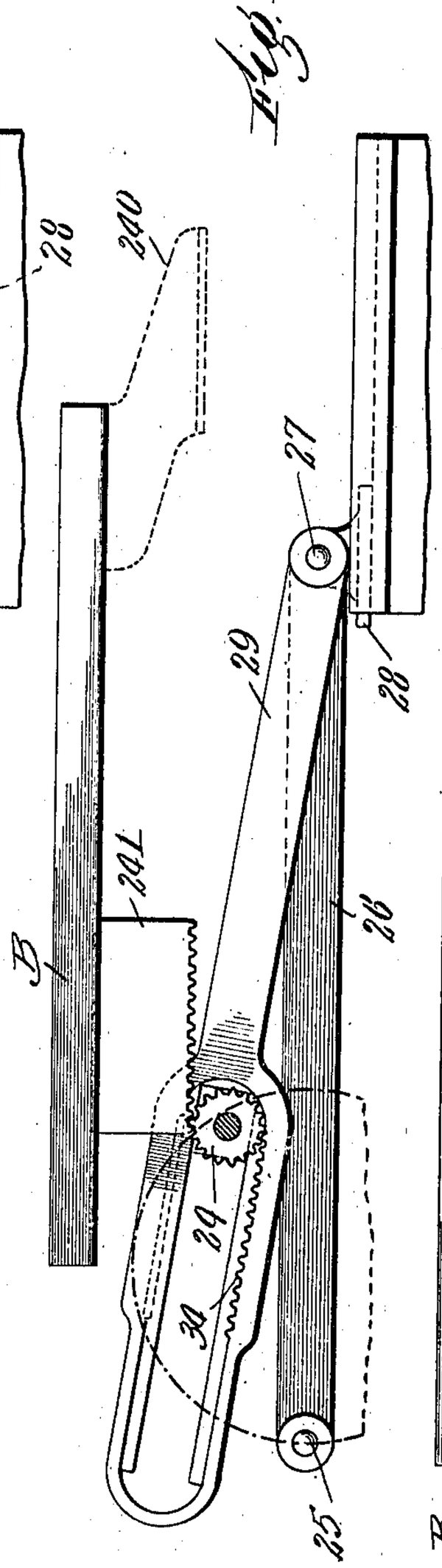
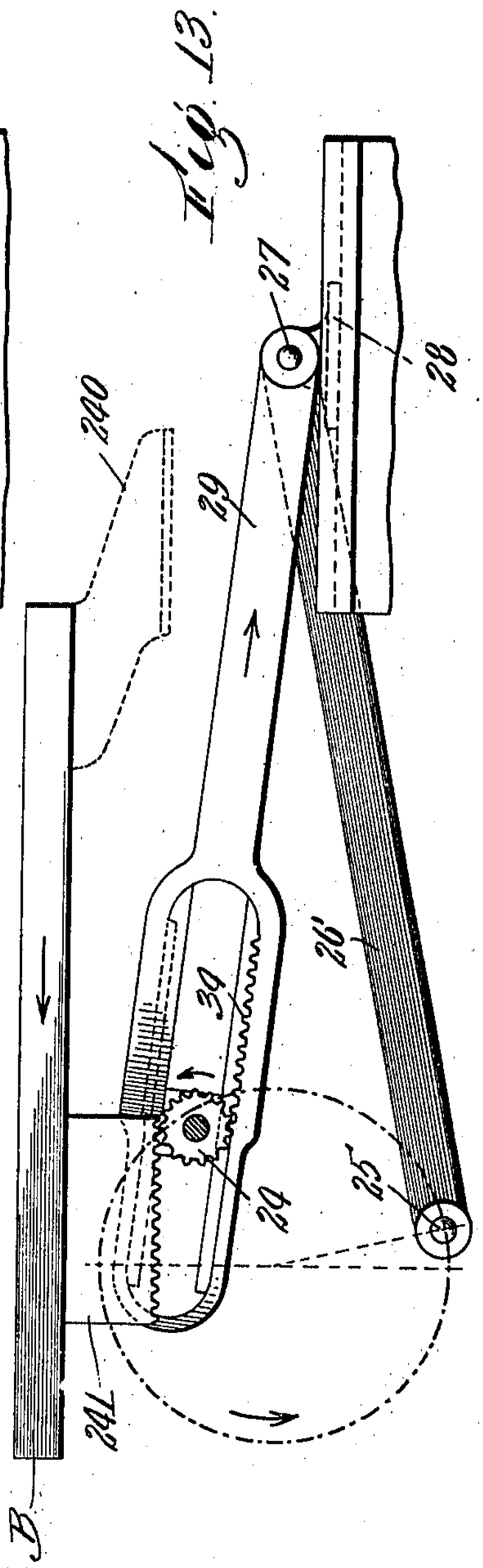


Fig. 13.



Witnesses:

C. F. Keenan

M. E. Regan

Inventor:

C. J. Robertson.

By his Attorneys

Southgate & Southgate

UNITED STATES PATENT OFFICE.

CHARLES J. ROBERTSON, OF TAUNTON, MASSACHUSETTS, ASSIGNOR TO THE CAMPBELL PRINTING PRESS & MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MECHANICAL MOVEMENT.

945,197. Specification of Letters Patent. Patented Jan. 4, 1910.

Application filed March 21, 1905, Serial No. 251,205. Renewed June 4, 1909. Serial No. 500,120.

To all whom it may concern:

Be it known that I, CHARLES J. ROBERTSON, a subject of the King of England, 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.

In developing the mechanical movement shown, described, and claimed in my application for patent filed October 6, 1904, Serial No. 227,344, I have found that the mechanism is capable of certain modifications and improvements which are of advantage in certain kinds of printing presses. The first important point wherein I have modified and improved the apparatus, consists in arranging the mechanism so that each reverse will take more than 180 degrees or a half turn. By this modification, a still easier reverse can be obtained which is of advantage on large size machies. If a pitman be employed, this increase in the reversing movement can be obtained advantageously by employing what is sometimes spoken of by engineers as the "sweet side" of the pitman.

It is well known in mechanics that if a revolving crank-pin be connected by a pitman to a horizontal sliding member that the movement imparted to that member will be different in each direction from central position, which difference arises from the angular deflection of the pitman or the "pitman error" as it is sometimes called.

Referring to Figure 14 for illustration, *r* designates a radius, *c* a crank-pin, *p* a pitman and *s* a sliding member. Suppose the crank or wrist-pin to move from position #1 to position #2, where the pitman and crank-arm are at such an angle, less than 90 degrees, that the plus acceleration from the angular deflection of the pitman imparted to the slider will change to a minus acceleration or retardation. During this movement of the crank-pin, the movement of the sliding member is an accelerating movement both from the wrist-pin and from the deflection of the pitman. From this point on in the revolution, the movement imparted by the deflection of the pitman is a retarding movement first acting in opposition to the accelerating movement imparted by the wrist-pin during angle *a*, that is while the crank-pin moves from position #2 to position #3, and then a retarding movement acting in conjunction with the retarding movement imparted by the movement of the crank-pin while the latter moves from position #3 to position #4. The result of this action is that the movement imparted to the sliding member from position #2 to position #4 is a movement which first approximates, or is almost a constant speed movement while the wrist-pin moves from position #2 to position #3, and then is a gradual decreasing or retarding movement to rest from position #3 to position #4. By using this principle in a reversing mechanism and commencing the reversing action substantially at position #2, a much easier translation from the constant speed drive to the reversing action is accomplished; and a longer reverse is obtained, both angularly and in direct travel. Therefore, an easier reverse can be obtained from a wrist-pin.

The particular object of this invention is to modify the mechanism of said previous application to utilize this "sweet side" of the pitman reverse. In developing the same, certain modifications and changes in the mechanism have been made, the principal one of which is the use of a reversing pinion or pinions separate from the main driving mechanism.

The apparatus is illustrated in the accompanying four sheets of drawings, referring to which,

Fig. 1 is a side elevation of the mechanism. Fig. 2 is a detail view of one of the parts used in the reversing mechanism. Fig. 3 is a detail view of the cam mechanism used to actuate the impression cylinder. Fig. 4 is a cross sectional view of the mechanism. Fig. 5 is a detail view of the mechanism employed to raise and lower the main shaft. Fig. 6 is a detail view of the connecting gearing for the reversing mechanism. Fig. 7 is a detail view of part of the reversing mechanism. Figs. 8 to 13 inclusive, are diagrams illustrating the action of the reversing mechanism, and Fig. 14 is the diagram herein before described.

Referring to the drawings and in detain, A designates the usual frame work 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.

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. The driving gear is mounted on a main shaft 14, which is journaled in eccentric bushings 15 fitted in the frame work A and in an interior strut or bearing 16. A partial internal gear 17 is secured on the end of the main shaft 14.

A driving shaft 18 is journaled in one of the struts of the machine and in a bushing hereinafter referred to fitted in strut 16. This driving shaft 18 carries a driving pinion 19, which meshes with a rack 20 secured to the bed. A pinion 21 is arranged on the end of said driving shaft 18 in position to engage the partial internal gear 17. Arranged on the main shaft 14 is a partial external or spur gear 22 and the driving shaft 18 carries a pinion 23 in position to engage the partial spur gear 22. The said partial external and internal gears occupy substantially similar angular positions on the main shaft 14.

The mechanism hereinbefore described constitutes the main driving mechanism for imparting the constant speed movements and operates as follows: When the main shaft 14 is lowered by its eccentric bushings 15, the partial internal gear 17 will engage the pinion 21 on the driving shaft 18 and will turn the driving pinion 19 to move the bed through the rack 20. When the main shaft 14 is raised by its eccentric bushings 15, the partial external gear 22 will engage the pinion 23 and hence will turn the driving pinion 19 to actuate the bed through the rack 20 in a reverse direction from the movement obtained from the internal gear 17. This mechanism is so designed that these movements will take place at the same speed and for the same distance. Except for the angular section of the partial internal gear 17 and the partial external gear 22, this mechanism is in substance the main driving mechanism shown, described and claimed in my application for patent Serial No. 227,344, previously referred to. On the face or inside of the internal gear 17 is arranged 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 external gear 22, and pinion 23 is such that the uniform speed imparted to the bed forward and backward is the same as the speed of the bed as given to it by crank-pin 25, connecting rod 26, rack-rod 29, pinion 24 and rack 20 at the instant of greatest deflection. The main driving mechanism will impart a constant speed forward and backward motion to the bed for less than a half turn of the main shaft 14, as the partial gears 17 and 22 are made less than 180 degrees in operative circumference.

The reversing mechanism will now be described.

A pitman 26 is connected to the crank-element or wrist-pin 25 and also to a shaft 27 fitted in a sliding block 28, which is free to reciprocate horizontally in a guide-way 280, attached to the frame. Connecting pieces 29 are journaled or attached to the ends of the shaft 27, two connecting pieces being preferably used and being practically similarly arranged.

The left hand connecting piece, looking at Fig. 4 will be first described see Figs. 2, 6 and 7. This connecting piece is slotted at its forward end and the sides of the slot are accurately finished. Fitted into the slot is a block 30 which forms a supporting and guiding 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 said bushing, as previously stated. 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 a gear 24 secured on the driving shaft 18. This gear is made wide faced and is arranged to engage short racks 240 and 241 attached to the bed, as shown to best advantage in Figs. 1, 4 and 6 of the drawings. The right hand connecting piece 29 is similarly connected except that the parts which connect the same are arranged on a shaft 180 which is journaled in the frame-work in line with the driving shaft 18. The rack 242 which the reversing gear 24 of this arrangement engages, is made of a single piece and of a length so that the right-hand gear 24 will remain constantly in mesh therewith. This right-hand connecting piece 29 acts as a squaring mechanism, or is a complement of the left-hand reversing mechanism aiding in taking the heavy strain of reverse. The same will be neglected for further discussion until hereinafter referred to as the details of its operation, except as hereinafter indicated, are identical with the left-hand connecting piece 29. The racks 33 and 34 of the connecting piece are arranged a little farther apart than the diameter of the reversing pinion 24. When the bushing 31 is held in position as shown in Fig. 6, the eccentric hub 32 will be at its highest position and the block 30 will thus guide the connecting piece 29 so that the lower rack 34 will engage the reversing pinion 24. When the

bushing 31 is turned, which is done by the mechanism hereinafter described, the guiding block 30 will be held at its lowest position so that the upper rack 33 will engage the reversing pinion 24.

The cam mechanism for operating these parts will now be described.

A cam shaft 37 is journaled in the machine and is driven by any suitable gearing so as to turn twice for each two-revolutions of the main shaft 14 or twice for each cycle of operation. Arranged on said cam shaft is a cam 38, engaging which is a roller 39 arranged on a lever 40 secured on a shaft 41 journaled in the machine. This lever 40 is provided with teeth 42 at its upper end which engage teeth projecting from the bushing 15 which is journaled in the frame. On the inner end of the shaft 41 is arranged a similar mechanism as shown in detail in my prior application. By this mechanism, the main shaft 14 will be raised and lowered. Also arranged on said cam shaft is a cam 45 engaging which is a roller mounted on a pivoted lever 46 which connects by a link 47 to a short lever 48 mounted on a cross-shaft 49 journaled in the frame-work. 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 in unison with the shaft 14, the advantages of which operation are pointed out and claimed in my prior application for patent referred to. Also arranged on said cam-shaft are cams 52, engaging the grooves of which are rollers mounted on the ends of pivoted rocking levers 53 which have teeth 54 which engage teeth 55 formed on the bushings 31. These cams 52 are of substantially the same contour as the cams previously described and they operate to raise and lower the guide blocks 30 for the connecting pieces 29.

The operation can be followed by the diagrams. In Fig. 8 the bed is shown as just completing its uniform forward speed movement obtained from the internal gear 17. The reversing pinion 24 is just engaging into the reversing rack 240. It will be noted that this engagement takes place before the crank-pin 25 has reached its highest position by the angular difference *a* hereinbefore pointed out. Now, as the wrist-pin travels from this position to its dead center at the left, shown in Fig. 9, the speed of the bed will be retarded and the bed brought to a state of rest at its left hand extreme by the action of the pitman and its connecting piece previously referred to actuating the reversing gear 24 which is engaged with the upper rack 33 of said connecting piece. The reversing movement will take longer than 90 degrees or a quarter turn by the amount of the angle *a*, and hence the time and movement of this retardation will be greater than that obtained with the usual true or half-turn crank reverse. Now, as the wrist-pin moves from its left-hand dead center, shown in Fig. 9, to the position shown in Fig. 10, the bed will be started on its movement to the right at a speed gradually commenced at zero and increasing up to full speed. Thus from passing from position shown in Fig. 8 to position shown in Fig. 10 the reversal of the bed at its left-hand or forward position is obtained. This reversing movement is greater angularly than that usually obtained from a taue crank reverse by twice the angle *a* and the travel is correspondingly greater than the usual radius of reverse. The external gear 22 now comes into operation and gives the bed its return movement. During this return movement, the bushing 31 will be oscillated so that the lower racks 34 will next engage the reversing pinions 24. The same reversal now takes place with the bed at its right-hand end of travel as indicated in Figs. 11, 12, and 13 through rack 241. The changed relation between the connecting pieces 29 and the reversing gears 24 gives the change motion necessary to this reverse. The partial internal gear 17 now comes into operation giving the bed its constant speed forward movement, returning the bed to the position shown in Fig. 8 and completing the cycle.

The partial internal gear 17 and the partial spur gear 22 are made less than half gears angularly by twice the angle *a*. By this arrangement the time and travel of the reversing movements are increased relatively to the constant speed movement, and hence an easier action is obtained.

The mechanism as shown is applied to a two-revolution movement in such way that each reverse takes more than a half turn and each constant speed movement takes correspondingly less than a half turn. When the constant speed movements are taking place, the connecting pieces 29 run out of engagement with the reversing gears 24, the right end reversing gear being turned idly by its bed rack 242 so as to keep the same in proper time relation until the right hand connecting piece again engages the same. Thus a smooth acting mechanism is provided by which a very heavy bed can be reciprocated at high speed and reversed without jar.

By using reversing gears and reversing racks the strain and wear of the reversing movements is taken entirely off of the driving pinion 19 and rack 20 which is employed for the constant speed movements, and hence wear on these parts is saved so that they will work accurately when called into action, which is necessary, as the constant

speed movement or movements are the operative movements of the bed, and should be extremely accurate.

By supplementing or doubling the reversing mechanism, as shown and described, a very strong arrangement is provided to take the jars and strains and as the two mechanisms are arranged at equal distances from the center, the bed is kept from twisting. The right-hand pinion 24 can be kept constantly in mesh with the rack 242.

The details herein shown and described may be greatly varied by a skilled mechanic without departing from the scope of my invention.

Having fully described my invention, what I claim and desire to secure by Letters-Patent of the United States is,—

1. A mechanical movement comprising a main driving mechanism and a crank actuated reversing mechanism connected to operate for more than a half turn for a reverse.

2. A mechanical movement comprising a main driving mechanism, a crank actuated reversing mechanism connected to reverse the bed at the extremes of its travel in either direction and to act for more than a half turn for each reversing movement.

3. In a mechanical movement the combination of a reciprocating member, a main driving mechanism therefor for imparting a constant speed movement thereto, and a reversing mechanism for slowing down, stopping and starting the member in the opposite direction, the time of the uniform speed movements being less than the time of the reversing movements.

4. A two-revolution mechanical movement for converting rotary into reciprocating movement, comprising a main driving mechanism for imparting uniform forward and backward movements to a reciprocating member, a crank reversing mechanism, and means for connecting the crank reversing mechansim to a reciprocating member for more than a half revolution of the crank between each of the uniform movements.

5. A mechanical movement comprising a main driving mechanism, a revolving crank, a pitman connected thereto and connections therefrom to the bed arranged so that the "sweet side" of the pitman will be employed for the reversing movement for more than a half turn of the revolving crank.

6. A mechanism comprising a main driving mechanism, a revolving crank, a pitman connected thereto and connections therefrom to the bed arranged so that the "sweet side" of the pitman will be employed for each reversing movement and so that the same will be connected to the bed for more than a half turn for each reversing movement.

7. In a mechanical movement the combination of the moving member, a rack carried by the same, a driving pinion engaging said rack, an internal gear having less than half a circumference and a pinion for turning the driving pinion in the opposite direction, and a reversing mechanism operating alternately with the main driving mechanism.

8. In a mechanical movement, the combination of a main driving mechanism connected to actuate the bed and a reversing mechanism for reversing its movements, said reversing mechanism being connected to the bed for each reverse by two separate sets of connections which operate together and square the bed.

9. A reversing mechanism comprising a crank actuated sliding member and two sets of connections therefrom to the bed acting at each reverse to square the bed.

10. A reversing mechanism for a mechanical movement, comprising a revolving wrist-pin, a sliding member, a pitman connection between the sliding member and a wrist-pin, two connecting pieces attached to the sliding member, and connections whereby both connecting pieces will be geared to the bed for each reverse.

11. A mechanical movement comprising a main shaft, a partial internal and a partial external gear carried thereby, a driving pinion and rack, pinions with which said partial gears engage to make up a main driving mechanism, a wrist-pin carried by the internal gear, a pitman connection between the wrist-pin and sliding member, connecting pieces carried by the sliding member, and means whereby they are geared to the bed for each reversing action.

12. A mechanical movement comprising a main shaft, a partial internal and a partial external gear carried thereby, a driving pinion and rack, pinions connected to the driving pinion and arranged to coöperate with the partial gears to form a main driving mechanism, a wrist-pin carried by the internal gear, a sliding member, a pitman connection between the sliding member and wrist-pin, two connecting pieces carried by the sliding member, a reversing gear and rack for each connecting piece, and means for oppositely gearing the connecting pieces to the reversing pinions for alternate reverses.

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

C. J. ROBERTSON.

Witnesses:
ROBERT T. JOHNSTON,
FRED J. VIEWEG.