F. T. LEILICH.

BED MOTION FOR CYLINDER PRINTING PRESSES.

APPLICATION FILED MAY 27, 1909. RENEWED MAR. 27, 1916.

1,200,956.

Patented Oct. 10, 1916.

3 SHEETS—SHEET 1.

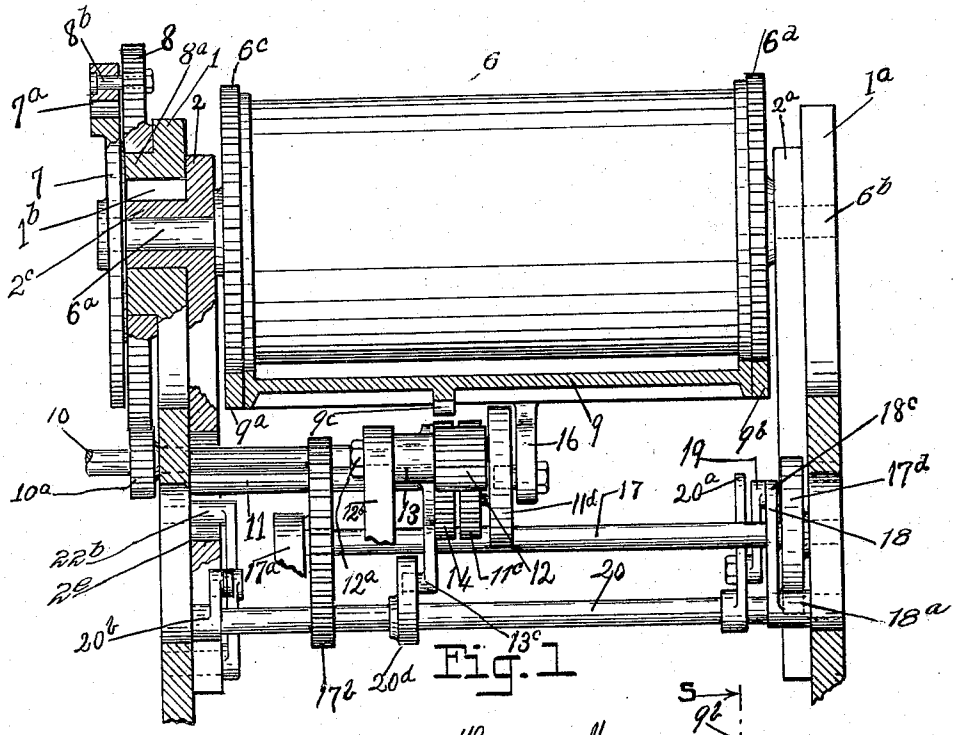


Fig. 1

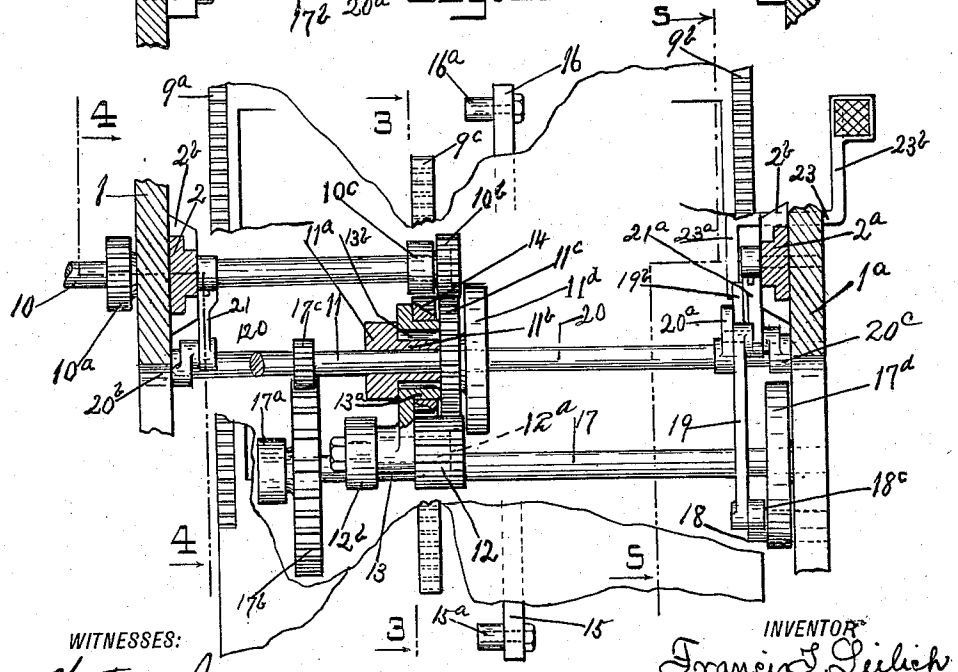


Fig. 2

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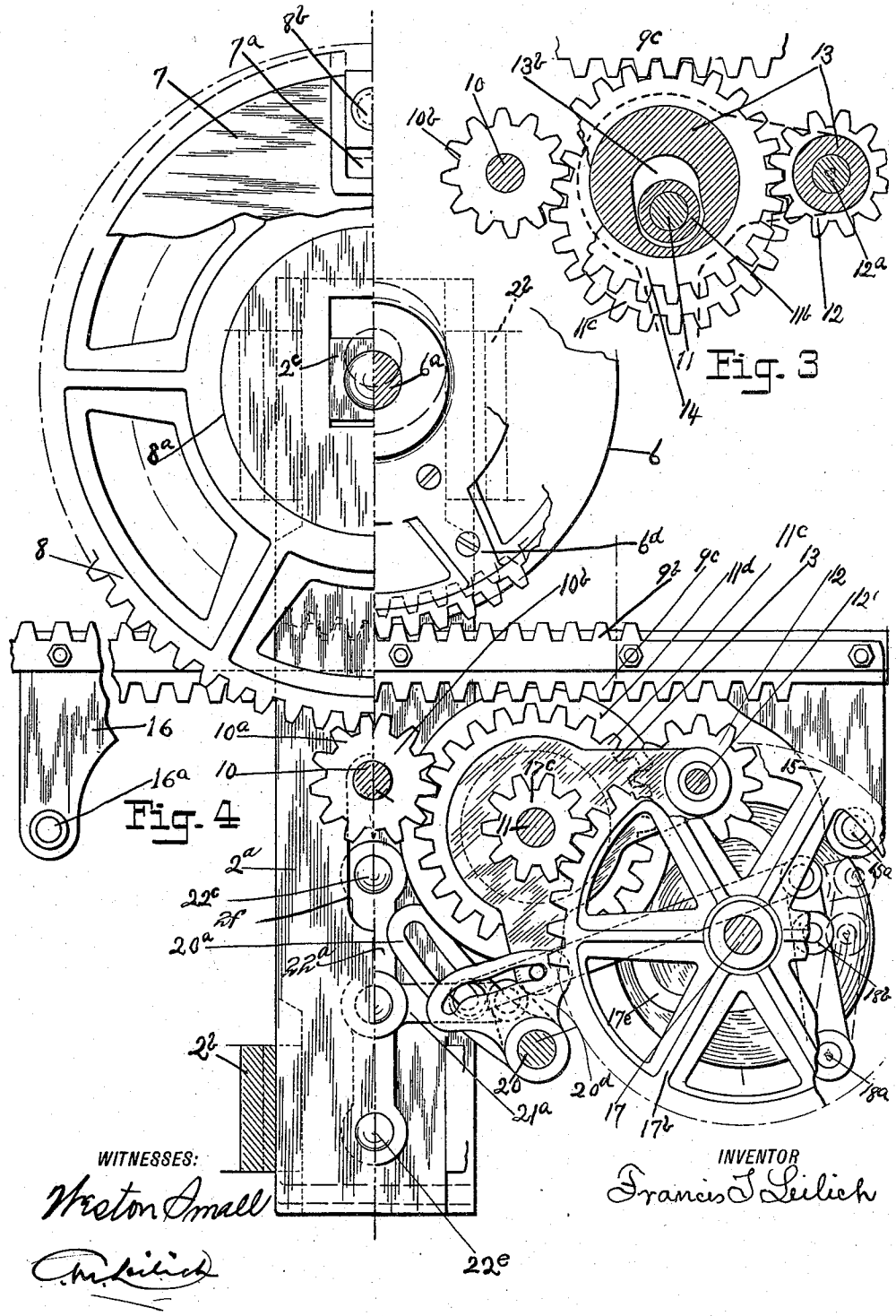
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

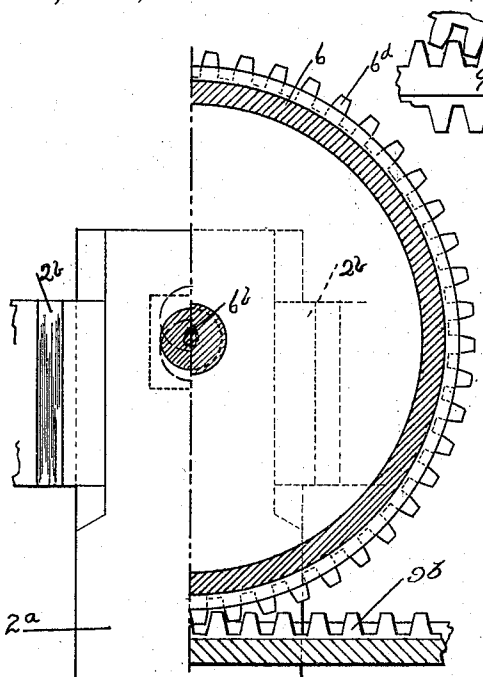


Fig. 5

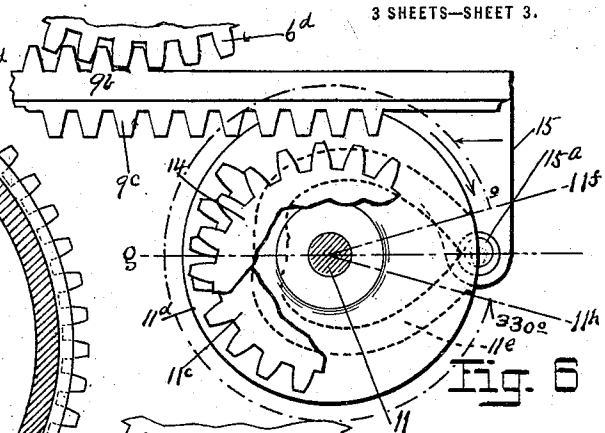


Fig. 6

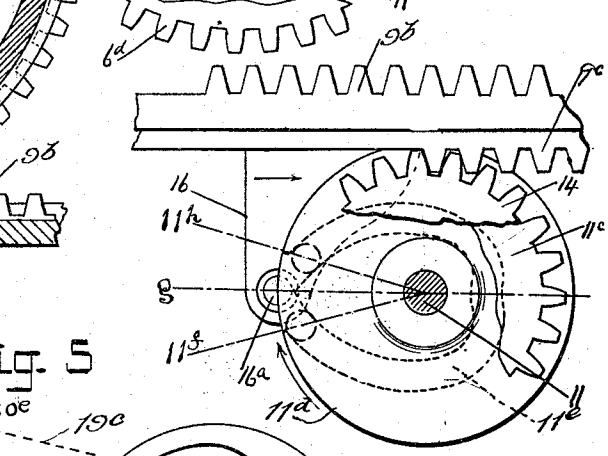
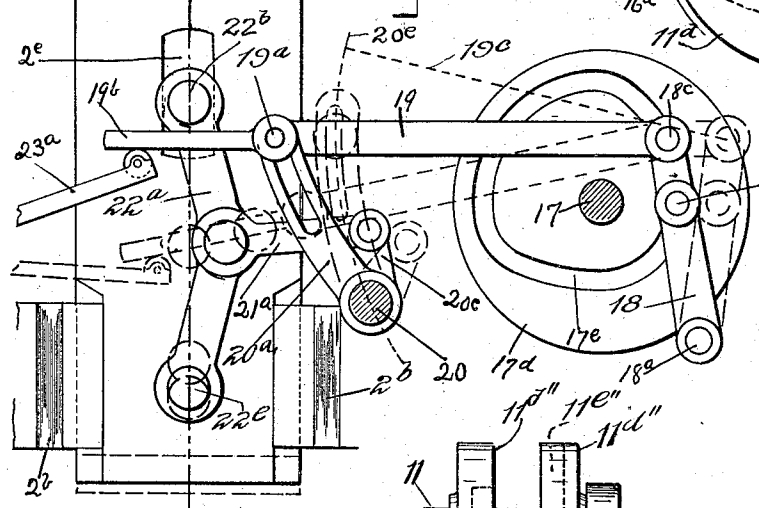


Fig. 7



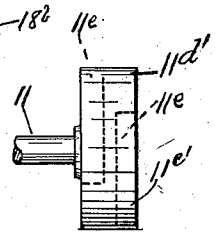


Fig. 8

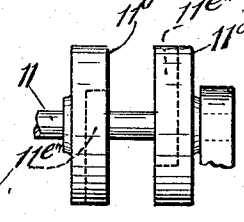


Fig. 9

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UNITED STATES PATENT OFFICE.

FRANCIS T. LEILICH, OF SAN FRANCISCO, CALIFORNIA.

BED-MOTION FOR CYLINDER PRINTING-PRESSES.

1,200,956. Specification of Letters Patent. **Patented Oct. 10, 1916.**

Application filed May 27, 1909, Serial No. 498,614. Renewed March 27, 1916. Serial No. 87,106.

To all whom it may concern:

Be it known that I, FRANCIS T. LEILICH, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Bed-Motions for Cylinder Printing-Presses, of which the following is a specification.

In the particular form in which I have embodied my invention the cylinder is rotated twice during each complete reciprocation of the flat bed and type form, and my objects are the attainment of a more perfect bed register, a more direct application of the driving power to the parts to be moved, to avoid the torsion occurring when the power is transmitted through relatively slower running shafts rotated from outside the frame, a reduction in the number of gear wheels usually employed in presses of like character, a simple and powerful means for reversing the bed at each end of its to and fro movement, and by which the relative time of said movement with respect to the reversing means, may be varied, a reduction of the weight of the parts usually carried on the bed and consequently of the momentum to be arrested at each end of the to and fro movement, and a lessening of the cost of construction, all of which objects I secure by the means, mechanism and devices hereinafter described, illustrated in the drawings and pointed out in the claims.

Referring to the drawings Figure 1 is an end elevation the frame and certain parts being shown in vertical broken cross section with the gear side of the frame to the left. Fig. 2 is a plan view, with the means for moving the bed in one direction removed, certain parts being shown in horizontal broken cross section. Fig. 3 is a vertical detailed section of the means for moving the bed in the opposite direction, on the line 3—3 Fig. 2, viewed in the direction of the arrows. Fig. 4. is a sectional side elevation on the broken line 4—4 in Fig. 2, looking in the direction of the arrows, all parts to the left of the vertical dotted line are on the outside of the frame and to the left side of Fig. 1, parts to the right of said line are located to the right of the gear side of the frame, which is removed. Fig. 5. is a sectional detailed elevation on the broken line 5—5 Fig. 2, looking in the direction of the arrows and illustrating the mechanism for reciprocating the cylinder and a part of the manually operated devices for limiting the reciprocation, the frame being removed and the bed and cylinder in cross section. Fig. 6. is a detailed sectional elevation of the means for reversing the bed, the reversing cam path being shown in dotted outline with the cam roll about entering the cam path, the bed moving in the direction of the arrows and the bed rack about moving out of engagement with the gear wheels attached to the cylinder. Fig. 7. is a detailed sectional elevation of the reversing means, the cam path being shown in dotted outline with the cam roll, secured to the hanger attached to the opposite end of the bed, about entering the cam path in the opposite position to that shown in Fig. 6 with the bed moving in the direction of the arrow and the lower rack about moving out of engagement with the gear wheel by which it is moved. Figs. 8 and 9. are modifications of the means for reversing the bed.

In order that the specification and claims may be more clearly understood I will state, 1st, that the driving shaft, the geared pinions secured thereon, and the racks secured to the type bed are recited in the claims as separate elements from those of the means which engage with said racks for moving the bed to and fro. 2nd. that the hangers attached to the bed, to each of which is secured a stud and roller, are not included among the elements of the means for reversing the direction of the movement of the bed. 3rd. that the supports for the cylinder are not included among the elements of the mechanism for vertically reciprocating the cylinder.

In the drawings 1. 1^a, are the sides of a frame to which two supports 2. 2^a, are movably secured and arranged to be reciprocated vertically between several guides 2^b, firmly secured to, or integral with, the frame. From the upper ends of each of these supports hubs 2^c. 2^d, extend, through apertures or gaps 1^b. 1^c, in the frame, for the purpose of a clearer illustration only I have placed the supports 2. 2^a, inside, or between the sides, of the frame and not because anything in the construction requires them to be so placed. In the hubs 2^c. 2^d, are formed bearings for the reception of the journals

6^a. 6^b, of an impression cylinder 6. The hub 2^d is not separately shown being similar in construction to that of 2^c. On the end of the journal 6^a is secured a flange, arm or part 7 having in it a gap or opening 7^a. Surrounding the gap or aperture 1^b, in the gear side of the frame and projected outwardly, or to the left in Fig. 1, is a fixed circular bearing 8^a, secured to, or integral with, the frame, on which is rotatably mounted a gear wheel 8, the center of this bearing and gear wheel is co-incident with the center of the cylinder when the latter is in its lowest position. Secured to the gear wheel 8, is a stud and block 8^b, extending within the gap 7^a, in the flange 7, by which the rotation of the gear wheel is communicated to the flange 7 and thereby to the cylinder 6, the gear wheel 8 being rotated as is hereinafter described. To the respective ends of the cylinder 6, gear wheels 6^c. 6^d are rigidly attached. The foregoing is a description of the means for moving the bed in one direction, preferably that during which the printing is being done and which I have designated in the claims as the first means. To a type bed 9, two racks 9^a 9^b, are rigidly secured, the teeth of which project upwardly and are of the same pitch as those of the cylinder gear wheels 6^c. 6^d.

In the operation of all printing presses of like character, known to me, the bed is moved to and fro by means which engage with it below its under surface, the cylinder being rotated by a member of the same gear train, during the operation of printing it becomes necessary at times to stop the cylinder from descending to its lowest, or printing, position, to prevent the impression from being made, which is done, in such presses, by detaching one part of the cylinder reciprocating mechanism from another part, by which the reciprocation is interrupted, the cylinder remaining in its upward position, the bed meanwhile moving uninterruptedly to and fro. It is obvious, however, that such an arrangement would fail to answer the requirements of my invention in which, because of the fact that the cylinder and its attached gear wheels are a part of the means by which the bed is moved in one direction, their vertical reciprocation cannot be interrupted at any time without at the same time interrupting the reciprocation of the bed. The constant reciprocation of the cylinder and gear wheels, in my invention, therefore being necessary, a mechanism for reciprocating them is required all the elements of which are undetachable from each other, but which is so constructed that it can be controlled or modified in its action by devices manually operated at will, and the desired result of preventing the cylinder from descending to its lowest point and thereby the making of an impression on the type form secured. The arrangement of racks secured to the bed, with which the gear wheels attached to the cylinder are caused to engage, is not new, being in common use for the purpose of compelling the cylinder to follow the bed, to effect a better bed register than when not so geared. The bed therefore being moved in one direction by means of which the cylinder and attached gear wheels are elements I have provided separate means for moving the bed in the opposite direction, as is hereinafter described.

A main driving shaft 10 is supported toward one end in the frame 1 and at the other in an upright 10^c, below the bed, Fig. 2. On this shaft and outside the frame Fig. 1, is secured a driving pinion 10^a, engaging with the gear wheel 8, to rotate the flange 7 and cylinder 6 through the stud and block 8^b, and on the opposite end of the shaft 10 is secured a pinion 10^b. While I have shown the gear wheel 8 as supported around the cylinder journal 6^a, and its bearing in the hub 2^c independently of both, said gear wheel can be secured directly to the cylinder journal in the usual manner, but as the teeth of the gear wheels 6^c, 6^d, attached to the cylinder and those of the bed racks 9^a, 9^b, must be of comparatively large pitch, for better wearing purposes, there would be required, in such a case, a still larger pitch and consequently fewer teeth in the driving pinion 10^a than is desirable, in order to maintain it in constant engagement with the gear wheel 8. A reversing shaft 11 is supported in the frame 1 and a bearing 11^a, broken off in Fig. 2, to show a shaft below it, from one side of which bearing projects an extension 11^b, whereby a longer support is obtained for the shaft 11. On the shaft 11 is secured a gear wheel 11^c engaging with the driving pinion 10^b by which it is rotated, the completed description of the reversing means will be found farther on. The means for moving the bed in the opposite direction are separately and independently, with respect to the first means described for moving the bed in one direction, connected with the driving shaft and rotated thereby through the driving pinion 10^b and gear wheel 11^c. A broad pinion 12 rotatably mounted on a stud 12^a engages with the gear wheel 11^c, movably mounted on the stud 12^a is a support 13, from one side of which projects a circular bearing 13^a, in which an opening 13^b Figs. 2 and 3 is made and through which the extension 11^b projects, the opening 13^b being large enough to permit the support 13 to surround the extension 11^b and to be moved transversely thereof without contacting therewith in any of its hereinafter described positions. To an extension 13^c of the support 13 is secured a stud and roller by which the support is reciprocated vertically by mechanism hereinafter described. Mounted on the circular bearing 13^a is a

gear wheel 14 engaged with and rotated by the broad pinion 12.

The foregoing elements 12 to 14 inclusive comprise the separate means by which the bed is moved in the opposite direction by the engagement of the gear wheel 14 with a rack 9^e secured to the underside of the type bed 9, and which I have designated in the claims as the second means.

The mechanism by which the gear wheels 6^c, 6^d and 14, of the means for moving the bed to and fro, are alternately moved in and out of the paths of the racks secured to the bed comprises the following elements. On a shaft 17, supported at one end in the frame 1^a and at the other in an upright 17^a, is secured a gear wheel 17^b engaged with a driving pinion 17^c secured to the reversing shaft 11, by which the shaft 17 is rotated once during each complete reciprocation of the type bed. To the shaft 17 is secured a body 17^d in which is formed a cam path 17^e. A lever 18 movable on a fulcrum 18^a in the side of the frame 1^a has secured to it a stud and roller 18^b extending within the cam path 17^e and pivotally secured at one end 18^c to a connection 19. On a rock shaft 20 supported at each end in the frame a curvilinearly slotted lever 20^a, is secured to which the connection 19 is slidably attached at 19^a, near the respective ends of the rock shaft 20 are secured arms 20^b, 20^c, to which are connected the respective ends of the links 21, 21^a, they in turn being secured at their respective opposite ends to two toggle levers 22, 22^a of similar construction, the upper members of which are fulcrumed at 22^b to the frame sides 1, 1^a, through the gaps 2^e, 2^f, in the cylinder supports 2, 2^a, their respective lower members are secured at 22^e to the respective lower ends of the said supports. To the shaft 20 is secured a rocking cam 20^d in the path of which a stud and roller secured to the extension 13^c is engaged. This mechanism will be better understood from Figs. 4 and 5, they being on a larger scale and more clearly illustrated than in Figs. 1 and 2, in which the foreshortening and number of lines required made it impracticable to show all the parts plainly. In Fig. 5 the support 2^a the connected toggle lever 22^a link 21^a and arm 20^c shown are those on the right hand side of Figs. 1 and 2 and are duplicates of similar parts on the left side of the same figures.

The devices by which the mechanism for reciprocating the cylinder is manually controlled or modified to prevent the cylinder from descending to the impression point without interrupting either its reciprocation or that of the type bed is as follows: Suitably fulcrumed in the side of the frame 1^a is a lever 23, one of the arms of which 23^a projects under an extension 19^b of the connection 19 and is preferably provided with a stud and roller as shown, the other arm 23^b extends along the outside of the frame 1^a in a position where it can be manually operated when desired. In Fig. 1 the cylinder is seen fully engaged with the bed and moving it in one direction while the means for moving it in the opposite direction are out of engagement with the bed, at or about the time the upper racks 9^a, 9^b move out of engagement with the cylinder gear wheels 6^c, 6^d the rotation of the cam 17^d actuates the parts described and shown in Fig. 5, to move them to their extreme position, to the right hand, the positions of the cam lever 18 and curvilinearly slotted lever 20^a being indicated by dotted lines, the normal position of the connection 19 in which the slidable attachment 19^a is at the end of the curvilinear slot nearest the fulcrum is indicated in dotted outlines. During the movement of these several parts to the positions indicated, the cylinder has been lifted to its highest position in which the teeth of the gear wheels 6^c 6^d will safely clear the teeth of the bed racks 9^a, 9^b as illustrated by the dotted teeth of the gear wheel 6^d in Fig. 4 when they are moved in the opposite direction and the bed has been reversed in its direction, by means hereinafter described, and the support 13 on which the gear wheel 14 is rotatably mounted moved vertically by the engagement of the cam roll secured to the extension 13^c with the cam path of the rocking cam 20^d, lifting the gear wheel 14 thereon into the path of the under rack 9^c which is moved into engagement therewith by the said reversing means which then release the control of the bed.

It being necessary in the practical operation of a printing press of this character that the impression cylinder must be prevented, at will, from descending to the impression point and, as has been stated, the bed being moved in one direction by the gear wheels 6^c, 6^d when engaged with the bed racks 9^a, 9^b it is obvious that the mechanism heretofore described must be of such a construction that while the cylinder 6 and gear wheels 6^c, 6^d are constantly reciprocated between two positions, in the lower of which the pitch line of said gear wheels corresponds with those of the bed racks 9^a, 9^b, the devices for manually controlling said mechanism must so affect its action as to change the position of the lowest point of reciprocation to an intermediate one, in which the cylinder does not descend to the lowest or point of impression, but does descend far enough to permit the teeth of the gear wheels 6^c, 6^d to engage with those of the bed racks 9^a 9^b less than the normal depth, but which still is enough to move the bed as before, because of the necessity for the teeth of the gear wheels

6^c, 6^d to lift high enough to always clear those of the bed racks 9^a, 9^b when the bed is moving in the opposite direction, the cylinder reciprocation must be controlled or limited at its lowest point only. To secure these results, the curvilinear slot in the lever 20^a is struck, with a radius equaling the distance between the center of the point of attachment of the connection 19 with the cam lever 18 at 18^c, and the center of the slidable attachment point of the lever 19 at 19^a. With this radius indicated by the dotted line 19^c and with the connection 19 and lever 20^a in their extreme right hand positions, which correspond to those in which they are placed with the cylinder in its highest position, as indicated by the dotted lines in Fig. 5, the dotted curved line 20^e passing through the center of the rock shaft 20 is struck, the slot being formed of a desired width each side of the curved line. It is therefore obvious that with the cylinder in its highest position and with the co-acting parts in their respective related positions that the cylinder reciprocation can be decreased at will at its lowest point, by the use of the devices before described, without changing the highest position of the cylinder. The means for reversing the bed at each end of the to and fro movement and which I have designated in the claims as the third means comprise the rotated reversing shaft 11, the gear wheel 11^e, and body 11^d, secured thereon, in the latter of which is formed a cam path 11^e extended throughout an arc of more than one hundred and eighty degrees and which is illustrated approximately, in dotted lines in Figs. 6 and 7.

In the operation of my invention and starting from the position shown in Fig. 1 with the cylinder down and the gear wheels 6^c, 6^d fully engaged with the bed racks 9^a, 9^b, power being applied in any suitable manner to rotate the driving shaft 10 and pinions 10^a 10^b thereon, the type bed 9 is moved under the cylinder to impress a sheet which may be held on it upon a type form secured to the bed. The bed and racks 9^a, 9^b have now been moved in the direction of the arrow in Fig. 6 and are just about to pass out of the control of the gear wheels 6^c, 6^d by which time the cam roll and stud 15^a on the hanger 15 has moved up to, and about contacts with the inside wall of the cam path 11^e, the cam rotating in the direction of the curved arrow. In this cam the ordinal lines 11^f, 11^h, Fig. 6 show the path as extended throughout an arc of three hundred and thirty degrees. The cam roll 15^a moves along the inside wall of the cam path 11^e at about the same speed as that of the bed racks 9^a, 9^b until the said racks are about out of control of the said gear wheels, by which time the cam has rotated far enough for the roller 15^a to have fully entered the path entrance on the ordinal line 11^f. The bed is now under the sole control of the reversing cam which continuing its rotation moves the cam roll 15^a toward the center, gradually arresting the bed movement and then reversing its direction with a gradually accelerated motion, the reverse of that just described, until the cam roller 15^a emerges from the exit of the cam path and the gear wheel 14 engages with the bed rack 9^e secured to the under side of the bed, to move it in the opposite direction. About, or during, the time the reversing cam has control of the bed, as described, the cylinder 6 and gear wheels 6^c, 6^d have been moved, by the mechanism described to the highest point of their reciprocation and out of the path of the bed rack 9^a, 9^b and the gear wheel 14 likewise moved to the highest point in its reciprocation and into the path of the under bed rack 9^e, the gear wheel 14 rotating in a direction opposite to that of the gear wheels 6^c, 6^d, the bed is thereby moved in the opposite, or non-printing, direction, this movement of the bed continues to the right, as indicated by the arrow in Fig. 7, which shows the under bed rack 9^e as about moving out of engagement with the gear wheel 14 and the cam roll 16^a about in contact with the inside wall of the cam path 11^e, as the bed is reversed at the end of the non-printing stroke Fig. 7 in the same manner as at the end of the printing stroke in Fig. 6, the same description will apply to both, it will be noted, however, that the respective hangers 15, 16 are attached to the opposite ends of the bed on opposite sides of the reversing shaft 11 and consequently that the respective studs and rollers 15^a, 16^a must enter and leave the cam path 11^e from diametrically opposite sides. In Fig. 6 the path entrance for the roller 15^a is above the horizontal diametral line 11^g and in Fig. 7 the path entrance for the roller 16^a is below said line, this therefore in this instance, requires a fractional number of revolutions of the body 11^d, during the time the bed is being moved in either direction in order to bring the entrance of the cam path 11^e alternately to the respective positions shown in Figs. 6 and 7 to engage with the studs and rollers 15^a, 16^a. In the structure illustrated the reversing cam is rotated five revolutions during one complete reciprocation of the bed and the cylinder is rotated twice.

As it may be desirable in presses of a large size to allow a longer relative time for reversing the heavy bed and type form used therewith I have illustrated, in Figs. 8 and 9, modifications of the reversing means, Fig. 8 showing a body $11^{d'}$ secured to the shaft 11, and having a cam path $11^{e'}$, similar to those illustrated in Figs. 6 and 7, formed in each side of it with the respective entrances and exits of each path diametrically opposite, whereby, in conjunction with the pre-

viously described reversing means, a wide variation in the time of the reversing periods relative to the time of the to and fro movements of the bed may be obtained.

In Fig. 9 is illustrated two bodies $11^{d''}$ $11^{d''}$ independently secured to the shaft 11, in the opposing faces of which are formed cam paths $11^{e''}$, $11^{e''}$ similar to those in Figs. 6 and 7, with their respective entrances and exits also diametrically opposite, the use of either of these modifications requires a different positioning of the hangers 15, 16 on the bed in order that the cam rollers 15^a, 16^a may alternately enter and leave each cam path, which is obvious and need not be further illustrated. Thus by the use of a single cam body with a single cam path formed therein, the body, which always rotates once during each reversal period, can be made to rotate any desired odd number of revolutions, as three, five, seven, etc., during the to and fro movements of the bed, while the two cam paths formed in one body, or one in each of two bodies, with their respective entrances and exits placed relatively opposite each other on the same diametrical line, the said body, or bodies, may be rotated any desired even number of revolutions, as two, four, six, etc., during the to and fro movements of the bed.

While I have illustrated and described my invention in a preferred form of construction, I do not limit myself thereto, as many modifications not illustrated or described may be made within its scope, and without departing from its spirit. My invention lies therefore not only in the novel construction, combination and arrangement of the parts shown and described and their equivalents, but broadly and more particularly as follows: First, in moving the bed of a printing press to and fro by two relatively distinct and separate means, which act alternately upon its respective opposite surfaces. Second, in means for moving the bed of a printing press in one direction which include an impression cylinder, having gear wheels attached to its respective ends adapted to be engaged with the bed at predetermined times by suitable mechanism. Third, in which the gear wheel surrounding one of the journals of the cylinder is geared directly to a pinion on the shaft to which the motive power is applied. Fourth, in a mechanism for constantly reciprocating the cylinder which is constructed to permit the reciprocation of the cylinder to be decreased at its lower end and the gear wheels attached to the cylinder ends to be engaged with the upper bed rack less than the normal depth by devices manually operated at will. Fifth, in means for reversing the movement of the bed by which the retardation and acceleration may be varied and also by which the time occupied in the reversal periods may be varied with respect to the time required for the to and fro movement of the bed.

I therefore claim:

1. A type bed, racks secured thereon, a driving shaft, means, connected therewith, for moving the bed in one direction, which include a cylinder, two gear wheels rigidly attached thereto, one at each end thereof, the cylinder and gear wheels being located above the bed, a gear wheel operatively engaged with the cylinder, a fixed bearing for said gear wheel, supports for the cylinder, and mechanism for moving the supports and thereby the cylinder and gear wheels rigidly attached thereto, into engagement with the racks, and which when so engaged are the sole means through which power may be transmitted to move the bed in one direction.

2. A type bed, two racks secured thereon, a driving shaft having a fixed center of rotation, a cylinder operatively engaged with the driving shaft and provided with two journals, two supports, in the respective ends of which are formed bearings for the journals, suitable framework in which the supports are fitted to move, two gear wheels rigidly attached to the cylinder, one at each end thereof, and mechanism for moving the supports and thereby the gear wheels into and out of the path of the racks, by which the bed is moved in one direction.

3. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, means for moving the bed to and fro which include among the elements for moving it in one direction, a cylinder, two gear wheels rigidly attached thereto, one at each end thereof, the cylinder and gear wheels being located above the type bed, supports for the cylinder, mechanism for moving the supports and thereby the cylinder and gear wheels attached thereto into and out of engagement with two of the racks, and which when so engaged is the sole means through which power may be transmitted to move the bed in one direction, and a second means, operatively engaged with the driving shaft independently of the first means, for moving the bed in the opposite direction, which include a gear wheel supported below the bed and connected with said mechanism and thereby alternately moved into and out of engagement with one of the racks and which when so engaged is the sole means through which power may be transmitted to move the bed in the opposite direction.

4. A type bed, two racks secured to the upper and one to the under side thereof, a driving shaft having a fixed center of rotation, means for moving the bed in one direction, a second means for moving the bed in the opposite direction, and mechanism for engaging and disengaging each of said means alternately with and from the bed, each of said

means being separately and independently, relatively to each other, connected with the driving shaft and alternately coöperating with the racks secured to the bed to move it to and fro.

5. A type bed, a rack secured thereon, a cylinder, a support therefor, a gear wheel, rigidly attached to the cylinder, a driving shaft having a fixed center of rotation operatively connected with said cylinder and gear wheel, and mechanism for moving the support and thereby the cylinder and gear wheel into and out of the path of the rack, to move the bed in one direction, and separate means for moving the bed in the opposite direction.

6. A type bed, two racks secured to the upper and one to the under side thereof, a driving shaft having a fixed center of rotation, and means, connected therewith, for moving the bed to and fro, including among the elements for moving it in one direction a gear wheel supported beneath the bed, a support having a bearing on which the gear wheel is mounted, an operative connection between the driving shaft and gear wheel, by which the latter is rotated, and mechanism for reciprocating the support vertically, and thereby moving the gear wheel into and out of the path of one of the racks, said gear wheel being out of all operative engagement with the bed when it is moved in the opposite direction by the other elements of said means engaging with the racks secured to the upper side of the bed.

7. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, and means, connected therewith, for moving the bed to and fro which include a cylinder, a gear wheel rigidly attached thereto, a support for the cylinder, and mechanism for moving the support and thereby operatively engaging the cylinder and gear wheel with one of the racks secured to the bed, to move the latter in one direction and disconnecting them therefrom when the bed is moved in the opposite direction by the other elements of said means engaging with another of said racks.

8. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, two gear wheels operatively and separately engaged with the driving shaft and rotated thereby, a support for each of the gear wheels, one of the gear wheels and supports being located above and one below the bed, and mechanism for moving the supports and thereby the gear wheels alternately into and out of engagement with the racks, one of said gear wheels being engaged with one of the racks during the time the other gear wheel is disengaged from the other rack.

9. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, a cylinder operatively connected therewith and located above the bed, supports for the cylinder, two gear wheels rigidly attached to the cylinder, one at each end thereof, and mechanism for moving the supports and thereby the cylinder and gear wheels into and out of the path of the racks, to move the bed in one direction.

10. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, means connected therewith for moving the bed to and fro, which include among the elements for moving it in one direction a cylinder, two gear wheels rigidly attached to the cylinder, one at each end thereof, supports for the cylinder, and mechanism for moving the supports and thereby the cylinder into and out of operative engagement with two of the racks secured to the bed.

11. A type bed, racks secured thereon, a gear wheel supported above the type bed, a movable support for the gear wheel, a second gear wheel supported below the type bed, a movable support for the second gear wheel, a common driving shaft having a fixed center of rotation with which each of said gear wheels is operatively engaged, and mechanism for moving said supports and thereby each of the gear wheels alternately into and out of the path of the racks.

12. A type bed, two racks secured to the upper and one to the under side of the bed, a driving shaft having a fixed center of rotation, means, connected therewith, for moving the bed to and fro, which include as elements for moving it in one direction a gear wheel supported below the bed, a support for the gear wheel, and mechanism for moving the support and thereby the gear wheel into and out of engagement with the rack secured to the underside of the bed, said gear wheel being out of all engagement with the bed when the latter is being moved in the opposite direction by the other elements of said means engaging with the racks secured to the upper side of the bed.

13. A type bed, racks secured thereon, a gear wheel supported above the bed, a gear wheel supported below the bed, supports for the gear wheels, a common driving shaft having a fixed center of rotation with which each of the gear wheels is operatively engaged and by which they are rotated, and mechanism for moving each of the gear wheels into and out of alternate engagement with the racks.

14. A type bed, racks secured thereon, a driving shaft having a fixed center of rotation, a cylinder operatively engaged with and rotated by the driving shaft, a support for the cylinder located above the type bed, two gear wheels rigidly attached to the cylinder, one at each end thereof, a gear wheel located below the type bed and operatively engaged with and rotated by the driving shaft, a support for the latter gear wheel,

and mechanism for moving said supports and thereby said gear wheels into and out of alternate engagement with the racks secured to the bed.

15. A type bed, and means for moving it to and fro, which include a cylinder located above the bed, two gear wheels rigidly attached to the cylinder one at each end thereof, supports for the cylinder, a gear wheel located below the bed, a support for the latter gear wheel, a common driving shaft having a fixed center of rotation with which said gear wheels are operatively connected, racks with teeth projecting upwardly secured to the bed, a rack secured to the under surface of the bed, and mechanism for vertically moving said supports and thereby the gear wheels alternately into and out of the paths of the racks.

16. A type bed, and means for moving it to and fro, which include a cylinder located above the bed, two gear wheels rigidly attached to the cylinder, one at each end thereof, supports for the cylinder, a gear wheel located below the bed, a support for the latter gear wheel, a common driving shaft having a fixed center of rotation with which said gear wheels are operatively connected, racks with teeth projecting upwardly secured to the bed, a single rack secured to the under surface of the bed, and mechanism for moving said supports and thereby the gear wheels alternately into and out of the paths of the racks.

17. A type bed, and means for moving it to and fro, which include two gear wheels, a cylinder located above the bed to which the gear wheels are rigidly attached, supports for the cylinder, a gear wheel supported below the bed, a support for the latter gear wheel, a common driving shaft having a fixed center of rotation with which said gear wheels are operatively connected, racks with teeth projecting upwardly, secured to the bed, a single rack secured to the under surface of the bed, and mechanism for moving said supports and thereby the gear wheels alternately into and out of the paths of the racks.

18. A type bed, a rack secured thereon, a driving shaft, a pinion thereon, a reversing shaft, a gear wheel secured thereto engaging with the driving pinion, a second gear wheel located beneath the bed and supported around the reversing shaft independently thereof, a support for the second gear wheel surrounding the reversing shaft independently thereof, an intermediate gear wheel between the first and second gear wheels, by which the motion of the first gear wheel is transmitted to the second gear wheel, and mechanism for moving the support and thereby said second gear wheel into and out of the path of the rack.

19. A type bed, two racks, with teeth projecting upwardly, secured thereon, a driving shaft having a fixed center of rotation, a cylinder operatively engaged therewith, two gear wheels rigidly attached to the cylinder, one at each end thereof, and adapted to be engaged with the two racks, supports for the cylinder, a single rack, with teeth projecting downwardly, secured to the under side of the bed, a gear wheel operatively engaged with the driving shaft, supported below the type bed and adapted to be engaged with the single rack, a support for the gear wheel, and connected mechanism for moving said gear wheels into and out of the paths of said racks.

20. A driving shaft, having a fixed center of rotation, a cylinder operatively engaged therewith, supports for the cylinder, mechanism for constantly reciprocating the supports and thereby the cylinder, and manually operated devices for controlling said mechanism, whereby the extent of the reciprocation may be decreased without suspending it, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

21. A driving shaft, having a fixed center of rotation, a cylinder operatively engaged therewith, supports for the cylinder, undetachable mechanism for constantly reciprocating the supports and thereby the cylinder, and manually operated devices for controlling said mechanism, whereby the extent of the reciprocation may be decreased without suspending it, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

22. A driving shaft, having a fixed center of rotation, a cylinder operatively engaged therewith, supports for the cylinder, mechanism for vertically and constantly reciprocating the supports and thereby the cylinder, and devices, manually operated, for controlling said mechanism to limit, without suspending, the reciprocation at the lowest point only, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

23. A driving shaft, a gear wheel operatively engaged therewith, a support on which the gear wheel is carried, mechanism for reciprocating the support and thereby the gear wheel between two positions and devices, manually operated, for controlling the mechanism and thereby changing the location of the lowest position without suspending the reciprocation, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

24. A driving shaft, a gear wheel operatively engaged therewith, a support for the gear wheel, mechanism for constantly reciprocating the support and thereby the gear wheel between two positions, and devices,

manually operated, for controlling the mechanism and thereby changing the location of one of the positions without suspending the reciprocation, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

25. A driving shaft, a gear wheel operatively engaged therewith, a support on which the gear wheel is carried, mechanism for constantly reciprocating the support and thereby the gear wheel, and devices, manually operated, for controlling said mechanism, whereby said gear wheel may be moved to three different positions, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

26. A type bed, two racks secured thereon, a driving shaft, a cylinder, supports therefor, two gear wheels rigidly attached to the cylinder, automatic mechanism for constantly moving the supports and thereby the gear wheels into and out of the path of the racks, and devices manually operated, for modifying the action of the automatic mechanism to limit the engagement of the teeth of the gear wheels with those of the racks to less than the normal depth.

27. A type bed, a rack secured thereon, a driving shaft, a cylinder, a gear wheel attached thereto, supports for the cylinder, mechanism for constantly moving the supports and thereby the cylinder and gear wheel between two positions, in the lowest of which the teeth of the gear wheel engage with the teeth of the rack to a normal depth, and devices, manually actuated during the operation of the mechanism, for modifying the action of said mechanism and thereby moving the gear wheel to a position in which its teeth are engaged with those of the rack, a less depth than normal.

28. A driving shaft, a cylinder operatively engaged therewith, a rock shaft, mechanism between the cylinder and rock shaft including elements for rocking the shaft, and thereby constantly reciprocating the cylinder, and devices, manually operated, for controlling said mechanism to decrease the extent of the reciprocation of the cylinder at the lowest point only, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

29. A driving shaft, a cylinder operatively engaged therewith, supports for the cylinder, mechanism for reciprocating the supports and thereby the cylinder which includes a rock shaft, connections between the cylinder and rock shaft and elements for rocking it, and devices for modifying the action of the mechanism at will, whereby the latter shaft may be rocked a lesser degree of arc without interrupting its rocking motion, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

30. A driving shaft, a cylinder operatively engaged therewith, supports for the cylinder, mechanism, all of whose elements are undetachable from each other, for reciprocating the supports and thereby the cylinder, and devices manually operated, for moving one of said elements upon another whereby the extent of the reciprocation of the cylinder may be decreased, said devices, when not in operation, being unconnected with said mechanism, or with any element reciprocated by it.

31. A driving shaft, a cylinder operatively engaged therewith, supports for the cylinder, mechanism for reciprocating the supports and thereby the cylinder which includes a rock shaft, connections between the cylinder and rock shaft, a slotted lever rigidly secured to the rock shaft, a rotating body, operatively engaged with the driving shaft, having formed therein a cam path, a cam lever provided with a stud and roller engaging with the cam path, a connection movably secured at one end to the cam lever and at the other end slidably secured to the slotted lever, and devices manually operated for moving the slidable end of the connection along the slotted lever.

32. A driving shaft, a cylinder operatively engaged therewith, supports for the cylinder, and undetachable mechanism for reciprocating the supports and thereby the cylinder which includes among its elements a rock shaft, a curvilinearly slotted lever rigidly secured thereon, a rotating body operatively engaged with the driving shaft, having a cam path formed therein, a cam lever provided with a stud and roller engaging with the cam path, a connection movably secured to one end of the cam lever, and at the other end slidably, but undetachably secured to the curvilinearly slotted lever, the curve being struck from the center of the point where the connection is movably secured to the cam lever and when the latter and all connected parts, including the cylinder, are in their respective positions at the highest point of the reciprocation of the cylinder and with a radius equal to the distance between the centers of the points where the connection is secured to the cam lever and curvilinearly slotted lever, respectively, whereby the connection may be moved along the latter lever and the reciprocating movement decreased at the lowest point only, and devices, manually operated, for moving the slidable end of the connection along the slotted lever.

33. A driving shaft, two pinions rigidly secured to the shaft one at each end thereof, a cylinder driving gear wheel directly en-

gaged with and rotated by one of the pinions, a reversing shaft, a second gear wheel secured to the latter shaft and engaging directly with another of the pinions, by which it is rotated, and a third gear wheel operatively engaged with and rotated by the second gear wheel.

34. A type bed, racks secured thereon, two hangers rigidly attached to the bed, and each provided with a stud and roller, a driving shaft, means for reciprocating the bed including a reversing shaft operatively connected with the driving shaft, a single gear wheel located beneath the bed, and supported around the reversing shaft independently thereof, a support for the gear wheel, an operative connection between the reversing shaft and gear wheel, by which the latter is rotated, and mechanism for reciprocating the support and gear wheel thereon transversely to the reversing shaft, to engage with and disengage from one of said racks secured to the underside of the bed.

35. A type bed, two racks, with teeth projecting upwardly and, one rack with teeth projecting downwardly, secured thereon, two hangers rigidly attached to the bed and each provided with a stud and roller, a driving shaft, means for moving the bed in one direction, a second means, separate from the first means, for moving the bed in the opposite direction, and a third means, coacting with said studs and rollers, for reversing the direction of the movement of the bed, the first and third means being independently, relatively to each other, engaged with the driving shaft, and the second means being directly engaged with and actuated by the third means, and mechanism for engaging the first and second means alternately with the racks secured to the bed to move it to and fro, the first means engaging with the two racks with teeth projecting upwardly and the second means engaging with the rack with teeth projecting downwardly.

36. A type bed, two racks, with teeth projecting upwardly and, one rack with teeth projecting downwardly, secured thereon, two hangers rigidly attached to the bed, and each provided with a stud and roller, a driving shaft, means for moving the bed in one direction, a second means for moving the bed in the opposite direction, and a third means, coacting with said studs and rollers, for reversing the direction of the movement of the bed, the first and third of said means being independently connected with, and actuated by, the driving shaft, and the second means being directly connected with and actuated by the third means, and undetachable mechanism for moving said first and second means alternately into and out of operative engagement with the racks secured to the bed, the first means engaging with the two racks with teeth projecting upwardly and the second means engaging with the rack with teeth projecting downwardly.

37. A type bed, two racks with teeth projecting downwardly and one rack with teeth projecting upwardly, secured thereon, two hangers rigidly attached to the bed, and each provided with a stud and roller, a driving shaft, means connected therewith, for moving the bed to and fro, which include as elements for moving it in one direction, a single gear wheel located below the bed, a support for the gear wheel, and mechanism for moving the support and thereby said gear wheel into and out of engagement with the rack secured to the underside of the bed, said gear wheel being out of all engagement with the bed when the latter is being moved in the opposite direction by the other elements of said means, and further means, coacting with said studs and rollers, for reversing the direction of the movement of the type bed at each end of its to and fro movement.

38. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, means, connected therewith, for moving the bed to and fro, and reversing means therefor, including a body rotated in a fixed position and once during each reversal of the bed and having formed therein a cam path, with which said rollers alternately engage, the arc throughout which the path extends being greater than one hundred and eighty degrees.

39. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, means, connected therewith, for moving the bed to and fro, and reversing means therefor, including a body rotated in a fixed position and once during each reversal of the bed and having formed therein a cam path, with which said rollers alternately engage, extending throughout an arc of three hundred and thirty degrees.

40. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, and means for moving the bed to and fro, and reversing its direction of movement which include a body having a cam path formed therein with which said rollers alternately engage, said body being rotated in a fixed position and more than one hundred and eighty degrees during the reversal of the bed.

41. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, means for reciprocating the bed which include a body rotated in a

fixed position and once during each reversal of the bed and having formed in it a cam path, with which said rollers alternately engage, extending throughout an arc greater than one hundred and eighty degrees.

42. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, means for reciprocating the bed which include a body rotated in a fixed position and once during each reversal of the bed and having formed in it a cam path, with which said rollers alternately engage, extending throughout an arc of three hundred and thirty degrees.

43. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a single stud and roller, a driving shaft, means for moving the bed to and fro and reversing its direction of movement which include a body rotated in a fixed position and once during each reversal of the bed and having formed in it one or more cam paths, with which said rollers alternately engage, extending throughout an arc, or arcs, greater than one hundred and eighty degrees.

44. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a single stud and roller, a driving shaft, means for moving the bed to and fro and reversing its direction of movement, which include a body rotated in a fixed position and once during each reversal of the bed and having formed in it one or more cam paths, with which said rollers alternately engage, extending throughout an arc, or arcs, of three hundred and thirty degrees.

45. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving shaft, a body rotated in a fixed position and once during each reversal of the bed and having formed in it one or more cam paths, and means for moving the type bed and attached studs and rollers to and fro and thereby engaging the latter with said one or more cam paths.

46. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving pinion, means operatively engaged therewith, for moving the type bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with said studs and rollers for reversing the direction of movement of the bed which include a body, rotated in a fixed position and once during each reversal period, having formed therein a cam path, the part on which the inner wall is formed being integral with, or rigidly attached to, the part on which the outer wall is formed, the outer wall being open at one point to permit the entrance and exit of said studs and rollers, the included angle of the opening in the outer wall being less than one hundred and eighty degrees.

47. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving pinion, means, operatively engaged therewith, for moving the type bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with said studs and rollers for reversing the direction of movement of the bed which include a body, rotated in a fixed position and once during each reversal period, having formed therein a cam path open at one point in its outer wall, and having the interior part, on which the inner wall is formed, rigidly attached to, or integral with, the body, the included angle of the opening in the outer wall being less than one hundred and eighty degrees.

48. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving pinion, means, operatively engaged therewith, for moving the type bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with said studs and rollers for reversing the direction of movement of the bed which include a body, rotated in a fixed position and once during each reversal period, and having formed therein a cam path, open at one point in its outer wall, each of the walls of which are rigidly attached to, or integral with, the body, the included angle of the opening in the outer wall being less than one hundred and eighty degrees.

49. A type bed, racks secured thereon, two hangers rigidly attached to the bed and each provided with a single stud and roller, a driving pinion, means, operatively engaged therewith, for moving the type bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with said studs and rollers, for reversing the direction of the movement of the bed which include a body confined to rotation in a fixed position and once during each reversal period and provided with a cam path, the inner wall of which is continuous and formed integrally upon the body, or upon a part rigidly attached thereto, the outer wall being open at one point to permit the entrance and exit of the said studs and rollers.

50. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a stud and roller, a driving pinion, means engaged therewith for moving the bed to and fro, mechanism

for engaging and disengaging said means with and from said racks, and further means coacting with said studs and rollers for reversing the direction of movement of the bed, which include a body rotated in a fixed position and once during each reversal period and having formed therein a cam path extending throughout an arc of more than one hundred and eighty degrees.

51. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a stud and roller, a driving pinion, means engaged therewith for moving the bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with the studs and rollers, for reversing the direction of movement of the bed which include a body rotated in a fixed position and once during each reversal period and having formed therein a cam path, the inner wall of which has an operative surface of more than one hundred and eighty degrees.

52. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a stud and roller, a driving pinion, means engaging therewith for moving the bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with the studs and rollers, for reversing the direction of the movement of the bed which include a body rotated in a fixed position and once during each reversal period and having formed therein a cam path, the part on which the inner wall is formed being integral with, or rigidly attached to, the part on which the outer wall is formed, the outer wall being open at one point, to permit the entrance and exit of said studs and rollers.

53. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a stud and roller, a driving pinion, means engaged therewith for moving the bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means coacting with said studs and rollers, for reversing the direction of movement of the bed, which include a body rotated in a fixed position and once during each reversal period and having formed therein a cam path, each of the walls of which are rigidly attached to, or integral with, the body, the outer wall being open at one point to permit the entrance and exit of said studs and rollers.

54. A type bed, racks secured thereon, two hangers rigidly attached thereto and each provided with a stud and roller, a driving pinion, means engaged therewith for moving the bed to and fro, mechanism for engaging and disengaging said means with and from said racks, and further means, coacting with said studs and rollers, for reversing the direction of movement of the bed, which include a body rotated in a fixed position and once during each reversal period and having formed therein a cam path, each of the walls of which are rigidly attached to, or integral with, the body, the inner wall being continuous, and the outer wall being open at one point to permit the entrance and exit of said studs and rollers.

55. A type bed, or driving shaft, pinions rigidly secured thereon, a cylinder provided with two journals, a gear wheel surrounding one of the journals and operatively engaged therewith, said gear wheel being directly engaged with one of the driving pinions, and a second gear wheel operatively engaged with another of said pinions, by which it is rotated, for moving the type bed in one direction.

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Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."