Aug. 7, 1923. 1,463,839

O. L. RAABE

MECHANICAL MOVEMENT

Filed Sept. 20, 1921 3 Sheets-Sheet 1

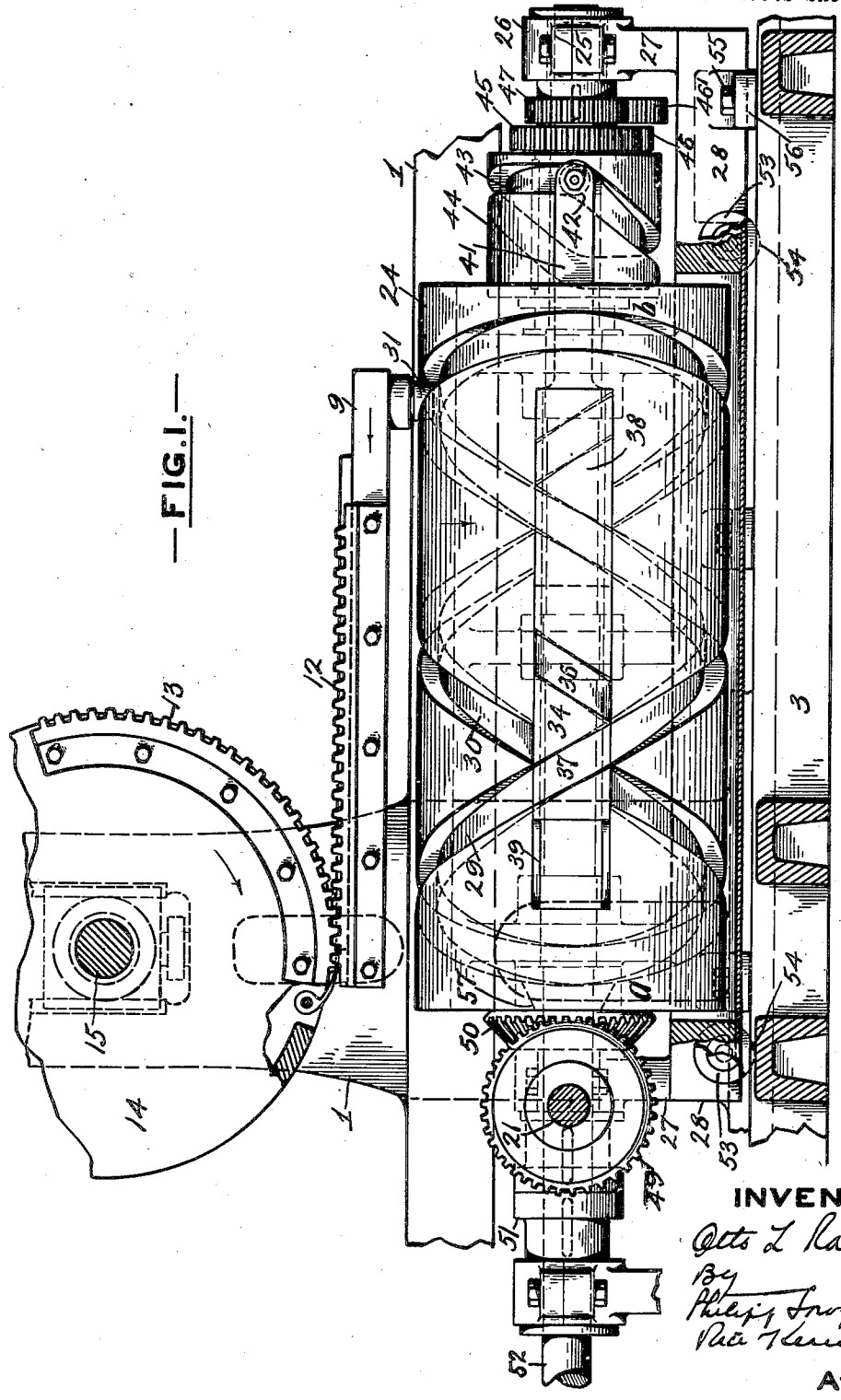


FIG. I.

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MECHANICAL MOVEMENT

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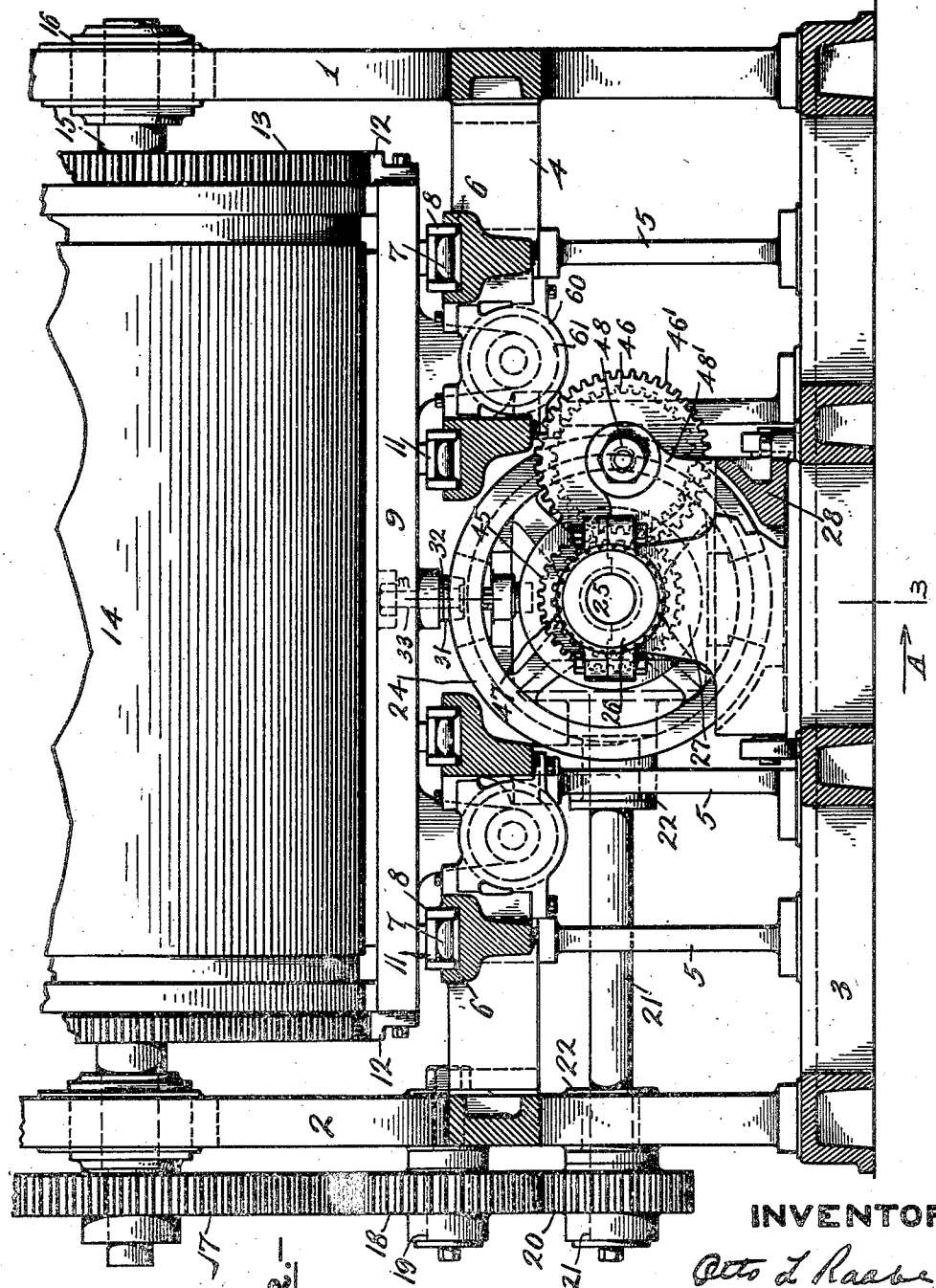


FIG. 2.

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MECHANICAL MOVEMENT

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FIG. 4.

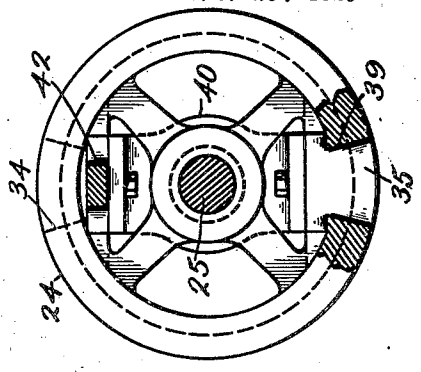


FIG. 3.

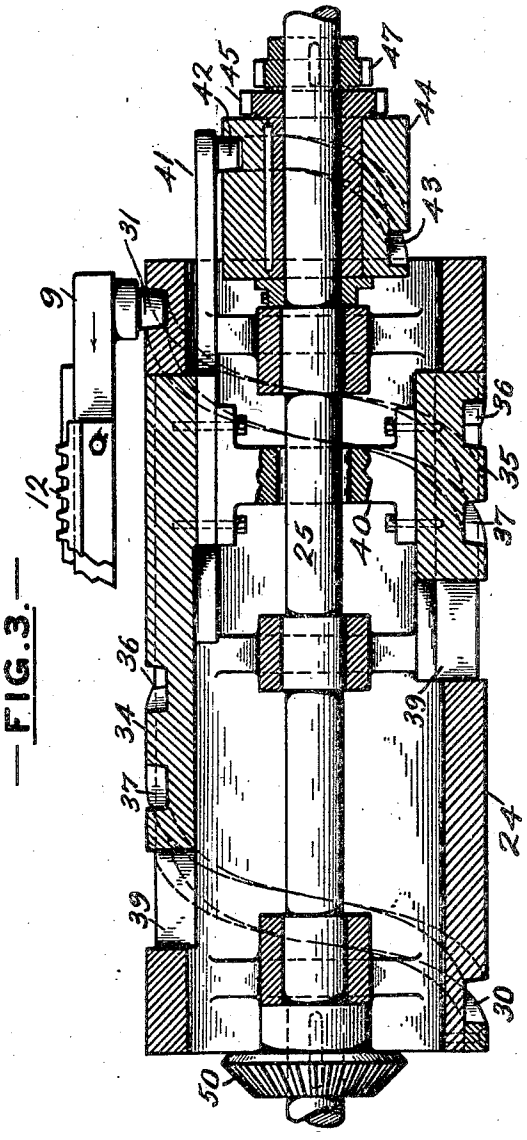
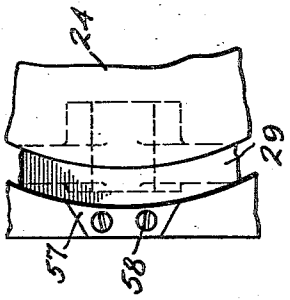


FIG. 5.



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UNITED STATES PATENT OFFICE.

OTTO L. RAABE, OF JERSEY CITY, NEW JERSEY; MINNIE C. MOOG, RUTH A. SMITH, AND ARTHUR E. RAABE EXECUTORS OF SAID OTTO L. RAABE, DECEASED.

MECHANICAL MOVEMENT.

Application filed September 20, 1921. Serial No. 501,662.

To all whom it may concern:

Be it known that I, OTTO L. RAABE, a citizen of the United States, residing at Jersey City, county of Hudson, and State of New Jersey, have invented certain new and useful Improvements in Mechanical Movements, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain improvements in mechanical movements for reciprocating a flat table or bed and has been designed particularly for reciprocating the bed of a bed and cylinder printing machine, though it is applicable to other types of machines in which it is desirable to effect a reciprocating movement of a flat bed or table.

In certain types of machines embodying a reciprocating bed and particularly in bed and cylinder printing machines, the impression cylinder, when the machine is in operation, rotates continuously at a uniform speed and while the bed is in printing relation with the cylinder, the bed is given a movement at a uniform speed in unison with the cylinder. After the printing operation the bed moves out of contact or printing relation with the cylinder and the bed is given a return movement at a uniform speed, this movement corresponding to the movement given it for the printing operation, or the forward printing movement. At both ends of travel of the bed, the bed has to be stopped and then brought up to speed. The uniform travelling motion of the bed, in constructions as now generally produced, is imparted to the bed by means of racks attached to the bed by a hanger suspended from the bed, these racks being in mesh with a gear or gears on the main driven shaft or a shaft driven therefrom. The reversal of the motion of the bed is accomplished by means of shoes attached to the bed or hanger, and in machines as ordinarily constructed during reversal the driving gears and the racks which control the forward and backward motions of the bed are out of engagement. There is thus a transfer from the mechanism which drives the bed at its uniform speed to the reversing mechanism and back from the reversing mechanism to the uniform speed mechanism.

In bed and cylinder press constructions the beds are very heavy and have to move at a high speed to effect the required rapidity of printing, and the stopping of these heavy beds at the end of their forward and rearward movements throws a great strain on the parts which, in prior constructions, has necessitated a very heavy driving and reversing gear and heavy connecting parts which are expensive and which are liable to break even when made of great weight. Furthermore, in bed motion as heretofore generally constructed the power employed for effecting the movement and stopping of the bed has been delivered from a driving shaft extending across the machine, the axis of the shaft being parallel to the axis of the cylinder. In these constructions as most generally used, a gear on the end of the driving shaft carries at one side near its periphery a roller which engages shoes at both ends of a hanger suspended from the bed, to effect reversal of the bed motion, and this reversal subjects the driving mechanism to a great strain, and in this construction there are many frictional points of contact with the rolls, bearings, gears and the reversing mechanisms, and the strength of these members is limited by the weight of the parts which can be used within practical limits.

It is the especial object of the present invention to provide a mechanism for driving and reversing reciprocating beds, tables and the like, particularly where such beds are heavy and have to move at high speed, which mechanism will have uninterrupted control of the bed both in its forward and backward reciprocating movements and in the slowing down and stopping movements at each end of the cycle or reversal movements, so that the bed is in the continuous, uninterrupted control of one member of the bed driving mechanism.

A further object of the invention is to minimize the weight of the bed and parts as compared with usual constructions by providing a driving mechanism which will dispense with the hangers and racks ordinarily carried by the bed for cooperating with the driving and reversing gearing.

A further object of the invention is to minimize as compared with usual constructions, the friction between the bed driving mechanism and bed.

A further object of the invention is to arrange the driving shaft for reciprocating the bed so that the shaft extends lengthwise of the machine and in the direction of the motion of the bed.

A further object of the invention is to provide a bed driving mechanism which will form a complete unit and which may be constructed independently of the press and set into place or removed in its entirety so that the cylinder and bed part of the machines and the driving mechanism may be constructed independently and then readily assembled.

With these and other objects not specifically referred to in view, the invention consists in certain novel parts and combinations, a preferred form of which is shown in the accompanying drawings, in connection with which a preferred detail construction and arrangement of parts will now be described in detail, and the novel features pointed out in the claims annexed hereto.

Referring now to these drawings,—

Fig. 1 is a side view, partly in section and partly broken away, of the invention as employed with a bed and cylinder press, so much of the latter being shown as is necessary for an understanding of the invention;

Fig. 2 is an end view looking to the right of Fig. 1, the view being partly in section and partly broken away;

Fig. 3 is a detail, partly broken, longitudinal sectional view of the driving worm for operating the bed, the section being taken on line 3—3 of Fig. 2, looking in the direction of the arrow A of that Figure;

Fig. 4 is an end view, partly in section, of one end of the bed driving worm; and

Fig. 5 is a detail plan view showing a means by which the bed may be disconnected from the bed driving worm when it is desired to remove the driving mechanism as a unit.

Referring now to these drawings, the invention has been illustrated as used with a single cylinder bed and cylinder printing machine, in which the cylinder makes one revolution to one reciprocation of the bed. It will be understood, however, that the invention is not limited to a printing press of this type, but may also be used in machines in which the cylinder makes two or more revolutions to one reciprocation of the bed, and also may be used with machines having a pair of impression cylinders. As illustrated, the various parts of the mechanism are supported in side frames 1, 2 arising from a base 3, these frames and the base being of any usual or desired construction. These side frames are braced together by a brace or rib 4 supported from standards 5 rising from the base of the machine.

The rib or base 4 is provided with flanged beams or tracks 6, two pair of these tracks being provided in the construction illustrated, on each side of the machine and extending longitudinally the length thereof. These tracks support a series of anti-friction rolls 7 held in place by the usual roller frames 8 secured between the flanges of the tracks.

The bed which in the particular construction illustrated carries a printing form and is marked 9, is provided on its under side with connections such as shoes 11 which run on the rollers 7 and support the bed in its backward or forward movement with a minimum amount of friction.

Secured to each side of the bed 9 are racks 12 which engage segments 13 secured on the ends of the impression cylinder 14. This impression cylinder is supported and driven by a shaft 15 mounted in bearings as journal boxes 16, secured in the side frames 1, 2, before referred to.

The shaft 15 at one side of the machine has secured thereto a gear 17 which meshes with an intermediate gear 18 carried on a stud 19 mounted in the side frame 2, and this gear 18 is in mesh with a gear 20 carried at one end of a cross shaft 21 which is supported in bearings 22 suitably supported in the frame 2 and one of the standards 5 before referred to.

In accordance with the invention, means will be provided for reciprocating this bed, which will be of such character preferably that the bed is in continuous and uninterrupted control of one member of the driving mechanism, so that a shift from a mechanism by which the bed is given its uniform reciprocating motion to a separate mechanism whereby the reversal of the bed takes place, is eliminated. Furthermore, these driving means will be preferably of such character that the member of the driving mechanism which actuates the bed will extend in the direction of the movement of the bed so as to eliminate as far as possible friction points and increase the strength and rigidity of the drive. While this driving mechanism may be somewhat varied, in the particular construction illustrated, there is provided a worm 24 in the form of a cylinder or roll mounted on a shaft 25 suitably secured by bearings 26 supported on standards 27 which form part of a carriage 28 hereinafter referred to. This worm is provided with right and left hand driving threads, 29, 30.

Cooperating with these threads is a connection between the worm and the bed. In the construction illustrated, this connection is in the form of an anti-friction roll 31, which freely rotates on a stud (see Fig. 2) 32 secured to the bottom of the bed, as by a bolt 33. The sides of this bed roller 31 are preferably downwardly tapered radially to the shaft 26 and the sides or walls of the

threads 29, 30 are preferably similarly tapered or inclined, so that the full width of the operating face of the bed roller 31 bears upon the sides of the threads, so that an effective connection is made between the bed and the worm and lost motion is avoided, whereby the bed can be given its reciprocating movements with a minimum amount of power.

In constructions embodying a worm having right and left hand threads for effecting reciprocating movement of the bed, means will be provided whereby the walls of the threads at the points of cross-over may be made continuous. This construction permits the use of the anti-friction roll and does away with the shoes heretofore used in constructions where worms have been used for reciprocating beds, which shoes, on account of the necessity of their being long enough to lap over the cross-over points, cause considerable friction and render the structure unsatisfactory in practice. While various means may be employed for closing the gaps of cross-over points of the threads and making the threads continuous, in the particular construction illustrated, there is provided a pair of switches 34, 35, one of these switches being provided on each side of the worm roll. Each of these switches is provided with a right and left hand groove or recess 36, 37, which correspond in width, depth and pitch to the right and left hand threads of the worm before referred to. These switches carrying the recesses may be of various forms, but in the particular construction shown, they are in the form of bars 38, which slide in recesses 39 formed in the side surfaces of the worm roll 24.

These switches are manipulated so as to close the gaps in the right and left hand threads as the roller passes across these gaps. While various means may be employed for manipulating these switch bars, in the particular construction illustrated (see Fig. 3) the bars are joined together so as to operate simultaneously, by a web 40 shown in Figs. 3 and 4, and secured to one of the bars is a connecting rod or bar 41 which carries at one end a cam roll 42 which works in the continuous cam groove 43 on a cam block 44 loosely mounted on the shaft 26 before referred to. This cam groove has, as shown, angular or eccentric portions, and concentric portions therebetween. This cam block is driven in the particular construction illustrated by being secured to the hub of a gear 45 also loosely mounted on the shaft 25, and this gear is connected through intermediate gears 46, 46′ with a gear 47, fast on the shaft 25 before referred to, the gears 46, 46′ being secured on stud 48 (see Fig. 2) mounted in a bracket 48′ carried in the frame 28 before referred to. In the particular construction here illustrated these gears are so proportioned that the cam block 44 will make two revolutions while the worm 24 is making three revolutions. With this construction, as the worm rotates and the bed roller is moved backward and forward the gaps on the cross-overs of the threads of the worm are closed and form a continuous bearing for the roll so that the roll is at all times in close driving contact with the worm and the bed is under control of the worm during a complete reciprocating cycle.

The shaft 25 may be driven in any suitable manner, but the connections will be such in the preferred construction that the shaft, worm, carriage and all may be readily positioned in the machine as a unit for convenience in construction and assembly. In the particular construction illustrated the cross shaft 21 before referred to carries at its inner end a mitre gear 49 which meshes with a mitre gear 50 secured to the shaft 25. The shaft 25 is connected by means of a coupling 51 with a main power shaft 52 of the machine which may be driven by an electric motor or from any other suitable source of power not illustrated.

As before stated, in the best constructions the driving mechanism will be so arranged that it may be removed as a unit from the machine. In the particular construction illustrated, therefore, the carriage 24, on which the shaft, worm, and gearing are mounted, is provided with rollers 53 running on the bed plate 3 before referred to. This bed plate is provided with slight recesses 54 into which the rollers 53 slide. When the carriage is drawn forward on the plate to free it from the machine, the rollers 53 ride out of the recess and lift the carriage sufficiently to clear the bed plate. At the same time the gear 50 is disengaged from the gear 49 and the shaft 25 uncoupled from the shaft 52, whereupon the whole driving mechanism may be removed as a unit from the machine. The carriage may be secured to the bed plate by bolts 55 passing through suitable cooperating lugs 56, which bolts are loosened when it is desired to remove the carriage. To permit the bed roll 31 to be removed from the threads when the carriage is to be withdrawn, the worm cylinder at one end is provided with a removable wall 57 (see Fig. 5) this being held in place by screws or in any other suitable way, the removable piece 57 being wide enough to permit the roll to pass through the opening and out of the thread at the end of the wall of the worm.

In constructing the driving mechanism, the worm 24 will be of sufficiently large diameter and heavy construction, so as to have the right and left hand threads sufficiently wide and deep to permit the bed roller 31 to engage the thread in its entire

course with a good driving fit. Furthermore, the thread is cut so as to gradually continue from the pitch by which the uniform reciprocating motion has given the bed to a pitch which will decelerate and accelerate the reversal movement gradually, the thread running from a uniform pitch into a decelerating pitch, continuing to an accelerating pitch, and back to a uniform pitch so as to cause a gradual and easy stop and reversal of the bed, and this changing pitch is indicated at the points *a*, *b* (Fig. 1) of the drawings. With this construction sudden stoppage and consequent strain on the mechanism due to the necessary heavy weight of the bed is eliminated and a quick, easy transition from forward to backward movement of the bed is obtained. In the construction illustrated in the drawings the parts are so geared that the worm 24 makes three revolutions to one revolution of the impression cylinder 14 and the gear 20 on the cross shaft 21 is one third the diameter of the gear 17 on the cylinder shaft 15, the mitre gears 49, 50, being the same size. In a two revolution press the cylinder 14 would be approximately only one half as large in diameter as in the one revolution press shown, and the worm 24 would then make three revolutions to two revolutions of the cylinder. The worm 24 is preferably designed to make three revolutions to one revolution of a one-revolution cylinder press or two revolutions of a two-revolution cylinder press so that but two switches are necessary for use in closing the thread gaps. It will be understood, however, that the mechanism can be designed to have the worm make four or more revolutions instead of three, and the number of switches correspondingly increased.

In order that a firm, rigid structure may be provided when the bed roller 31 is passing through the switches and so that the walls of the recesses in the switches will give the same driving power to the bed roll as is given by the thread of the worm, the ends of the switches are arranged to abut against the ends of the recesses in which the switches slide, and if desired the recess ends at this point may be provided with an adjustable block or the like so as to insure accurate alignment of the grooves in the cylinders with the threads in the worm, any usual construction for effecting this being provided.

In some instances, particularly where very heavy beds are being reciprocated, it may be desirable to employ air cushioning devices for assisting the worm in controlling the bed for checking the momentum of the bed at both ends of the reciprocation, and these may be in the form of air cylinders 60 attached to the rib or brace 4, in which cylinders work pistons 61, secured to the bottom of the bed as usually employed in flat bed cylinder presses, and it will be understood that these air cushioning devices may be employed if desired.

The operation of the movement as applied to a one revolution bed and cylinder press such as shown in Figs. 1 and 2, it is believed, will be clear from the above description, but may be amplified somewhat for the sake of entire clarity, as follows:

In the position shown in Fig. 1, the rack 12 on the bed 9 is just entering into engagement with the segments 13 on the cylinder 14 at the start of the printing operation, the direction of movement of the bed and cylinder being indicated by the arrows and the direction of rotation of the worm 24 being indicated by the arrow thereon. At the point shown in Fig. 1, the bed roll 31 is in that part of the right hand thread 29 where the change from the accelerated motion to the uniform motion has taken place. The pitch of the thread 29 is such that when the worm 24 makes one revolution the roller 31 will have moved the bed 9 in a uniform movement to a point where the uniform pitch of the thread changes to a decelerating or speed lowering pitch. During this movement the gear 50 on the shaft 25 will have imparted one revolution to the gear 49 on the shaft 21 and the gear 20; this gear 20 being one third the diameter of the gear 17 on the cylinder shaft 15 the cylinder will have moved one third of the revolution. As shown the impression surface of the cylinder extends around approximately one third of the circumference and the segments 13 on the cylinder also extend about one third around the cylinder. As the cylinder continues to rotate at a uniform speed through the action of the driving gears, the segments pass out of engagement with the racks 12 at the completion of the printing stroke. During this one revolution of the worm 24 the bed roller 31 will have passed through the gaps 37 of the two switches, the cam block 44 having manipulated the switch bar to properly position the recesses. The cam block 44 rotating in the same direction as the worm 24 will have made two thirds of a revolution during the one revolution of the worm and during this two thirds of the revolution of the cam block, the switches will have remained stationary owing to the shape of the cam groove 43 in the cam block 44. When the racks 12 on the bed 9 have passed out of engagement with the segments 13 at the end of the printing movement, the roller 31 will have arrived at the point in the thread 29 of the worm where the transition occurs from uniform pitch to decelerating pitch. As the worm continues to revolve at a uniform speed one fourth of a revolution of the worm will gradually have brought the bed roll 31 to the furthermost point in the direction of movement of the bed 9 as in-

dicated by the arrow. In a further one quarter revolution of the worm the roller 31 will, by the accelerating pitch of the thread have been caused to move gradually from a state of rest to a point in the thread where the pitch changes from accelerating to uniform. Thus during one half a revolution of the worm the motion of the bed will have been gradually slowed down to a stop and then gradually accelerated in a direction reverse to that indicated by the arrow. At the end of the decelerating pitch of the thread where the roller brings the bed to a stop, the thread changes from right hand to lefthand, that is, the thread 29 changes to the thread 30. During a further revolution of the worm the motion of the bed is continuous at a uniform speed, and during this one revolution the roller will pass through the switches which have been moved to bring the other annular recesses 36 in the switches in line with the thread so as to form a continuation thereof. Nearly a whole revolution of the worm thus takes place while the switches are shifted from one position to the other and during this time the cam block 44 will have made approximately two thirds of a revolution, the cam roll 42, during this movement of the switches, having passed through one of the eccentric parts of the groove in the cam block 44. After the roller 31 by its reversed movement has passed through the uniform pitch of the thread, it will have arrived at a point where the uniform pitch of the thread again changes to a decelerating pitch and when the roller arrives at this point the worm 24 will have made approximately two and a half revolutions. During a further one quarter revolution of the worm 24 the roller 31 will have passed through the decelerating pitch part of the thread and have brought the reversed motion of the bed gradually to a stop at the point where the left hand thread changes to the right hand thread. In a further one quarter revolution of the worm the roller will pass through the accelerating part of the thread up to the point where the accelerating pitch part of the thread again merges into the uniform right hand thread, at which point one complete reciprocation of the bed will have been completed and the racks are again in position to enter into engagement with the segments on the cylinder.

It is possible, of course, to extend the uniform pitch of the thread to somewhat more than one revolution of the worm and to lessen the reversing pitch to correspond so as to insure the bed moving at a uniform speed a little before and after as well as during the actual printing and return movements.

With the construction as described, a very simple, strong and durable bed motion has been provided, one in which the parts are arranged so as to dispense with many of the elements now used in such bed motions and in which the bed is positively controlled by one member of the driving mechanism through an entire reciprocating cycle. The construction disclosed permits the use of a roller as distinguished from the shoes heretofore employed in these bed motions, thus eliminating friction and providing an accurate reciprocating movement with little wear of the parts. Furthermore, as the driving shaft is arranged longitudinally of the machine, the thrust of the reversal of the bed is in this direction, and a bed motion of great strength and power is provided, and the power is applied in a direct manner to a bed greatly reduced in weight.

While the invention has been shown in its preferred form as employed with a bed and cylinder printing machine, it will be understood that it may be used in other devices and that various changes may be made in the specific construction and arrangements of parts without departing from the invention as defined in the claims annexed hereto.

What is claimed is:

1. The combination of a bed, a driver having a right and left hand thread crossing each other, means for making the threads continuous at the cross over points, and connections from the bed working in the threads.

2. The combination of a bed, a driver having right and left hand threads crossing each other, switches having right and left hand recesses corresponding in pitch to the threads, means for intermittently operating the switches to bring the recesses in line with the threads at the cross over points, and connections from the bed working in the threads and recesses.

3. The combination of a bed, a rotary driver having right and left hand threads crossing each other, switches having right and left hand recesses corresponding in pitch to the threads, a cam for intermittently operating the switches to bring the recesses in line with the threads at the crossover points, means for giving the cam a different number of revolutions than the driver, and connections from the bed working in the threads and recesses.

4. The combination of a bed, a rotary driver having right and left hand threads crossing each other, a shaft therefor, switches having right and left hand recesses on each side of the driver corresponding in pitch to the threads, connections between the switches for causing them to move together, a cam on the driver shaft for intermittently operating the switches to bring the recesses in line with the threads at the cross over-points, means for giving the cam a differ-

ent number of revolutions than the driver, and a roll on the bed working in the threads and recesses.

5. The combination of a reciprocating bed and a frame therefor, and driving mechanism for reciprocating the bed and removable from the bed and its frame as a unit.

6. The combination with a reciprocating bed, of a frame for the bed, a base for the frame, a carriage movable on the base into and out of operative relation with the bed, a driver having a worm and a shaft for the driver mounted on the carriage, a power shaft, a coupling between the power shaft and the driver shaft, and connections between the bed and the driver.

7. The combination with a reciprocating bed, a driver having a worm, a roll on the bed working in the threads of the worm, and a removable part in the worm through which the roll may pass to free it from the worm.

8. The combination with a reciprocating bed, a driver having a worm, a roll on the bed working in the threads of the worm, and means whereby the roll may be freed sidewise from the worm to permit the worm to be moved away from the bed.

In testimony whereof, I have hereunto set my hand.

OTTO L. RAABE.