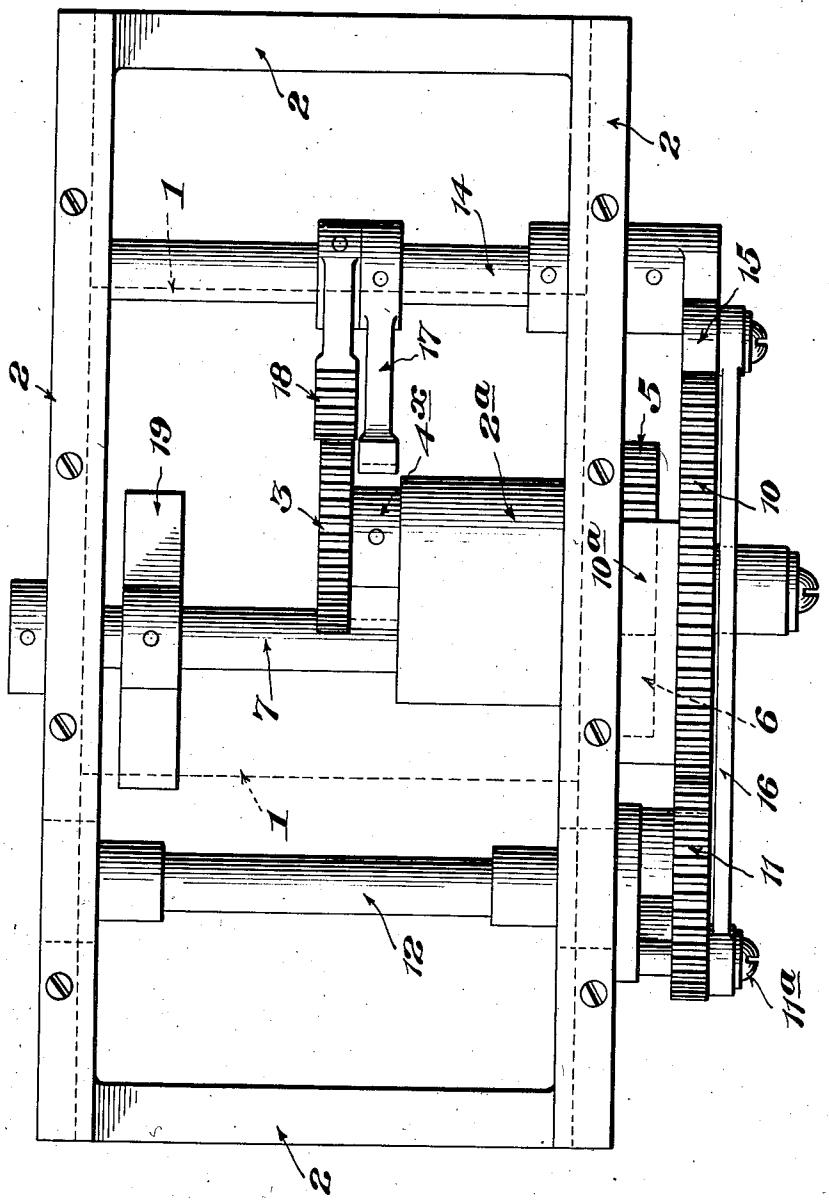
March 30, 1943. B. F. UPHAM 2,315,142

BED MOTION FOR PRINTING PRESSES

Filed Sept. 9, 1940 4 Sheets-Sheet 1

Fig. 1.



Inventor

Burt F. Upham

By Alexander Powell

Attorneys

March 30, 1943. B. F. UPHAM 2,315,142

BED MOTION FOR PRINTING PRESSES

Filed Sept. 9, 1940 4 Sheets-Sheet 2

Fig. 2.

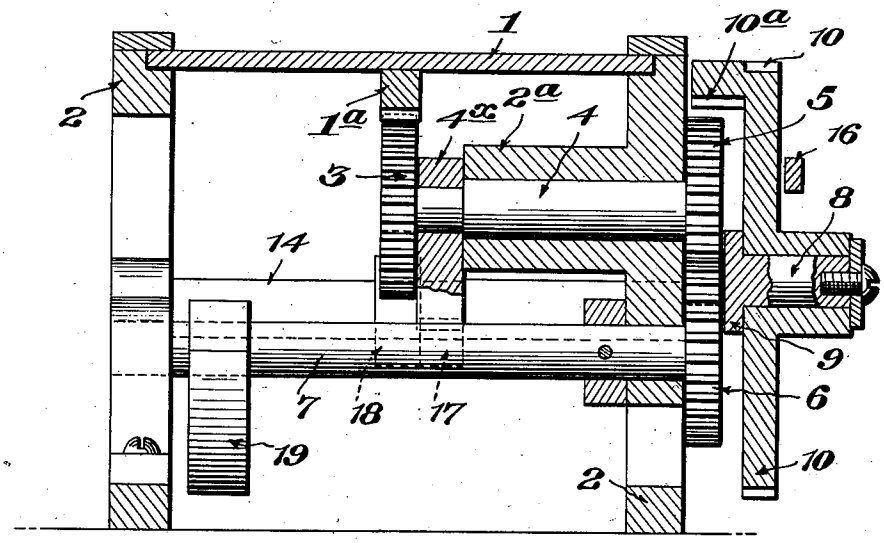
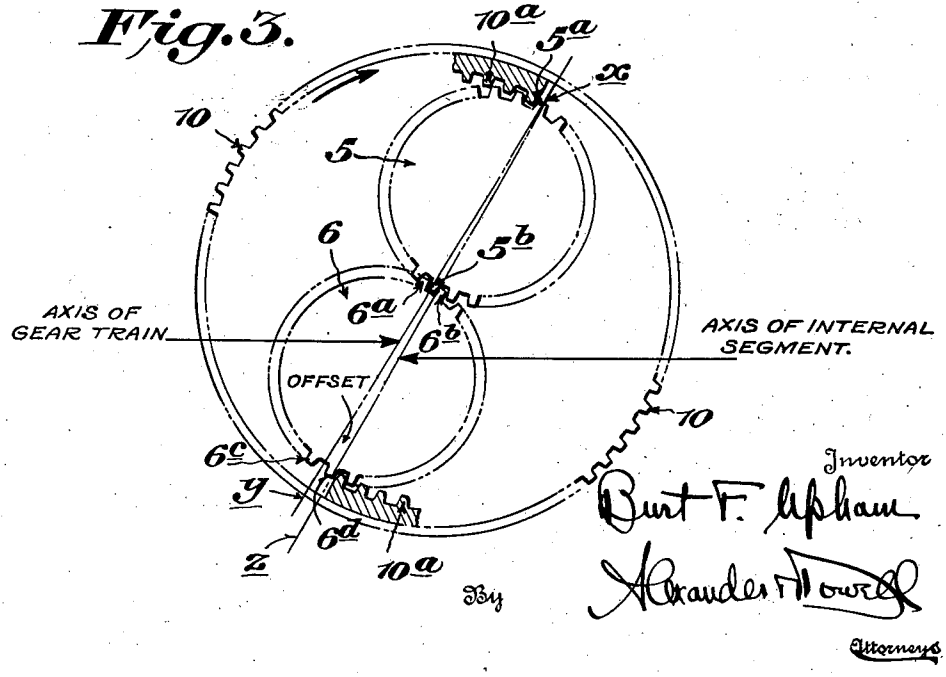


Fig. 3.



Inventor
Burt F. Upham
By Alexander Mowell
Attorneys

March 30, 1943. B. F. UPHAM 2,315,142

BED MOTION FOR PRINTING PRESSES

Filed Sept. 9, 1940 4 Sheets-Sheet 3

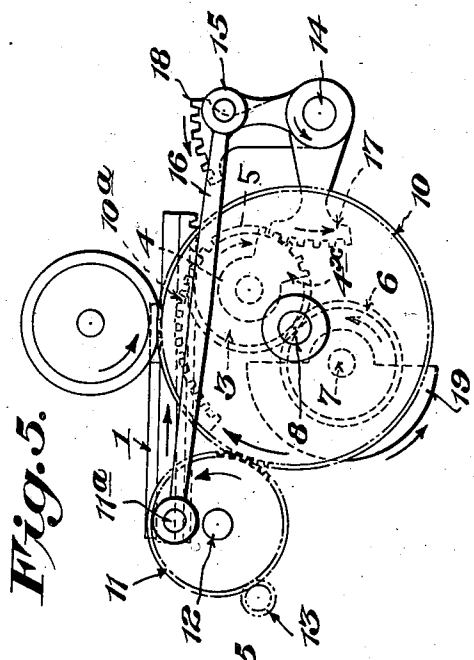


Fig. 5.

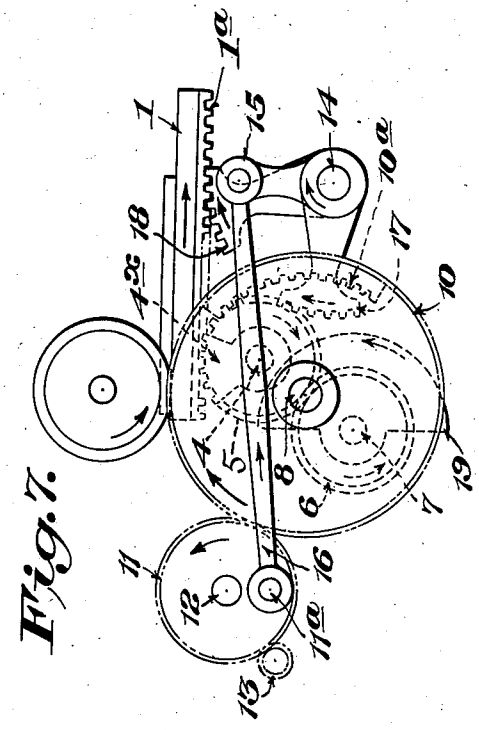


Fig. 7.

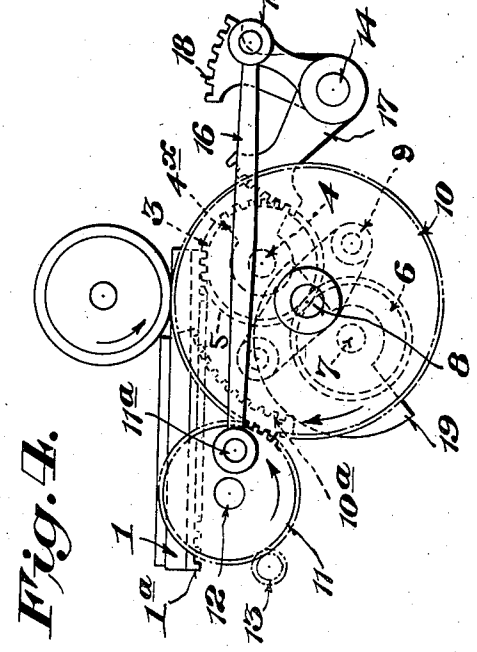


Fig. 4.

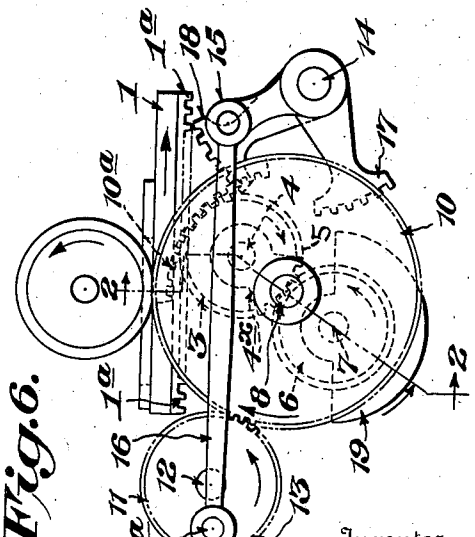


Fig. 6.

Inventor

Burt F. Upham

By Alexander Powell

Attorneys

March 30, 1943. B. F. UPHAM 2,315,142

BED MOTION FOR PRINTING PRESSES

Filed Sept. 9, 1940 4 Sheets-Sheet 4

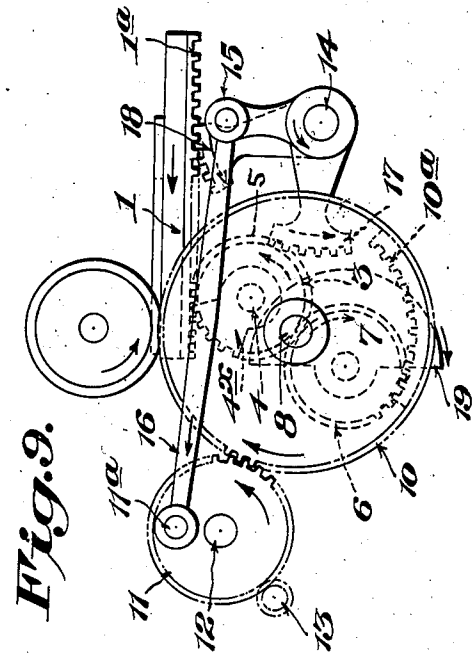


Fig. 9.

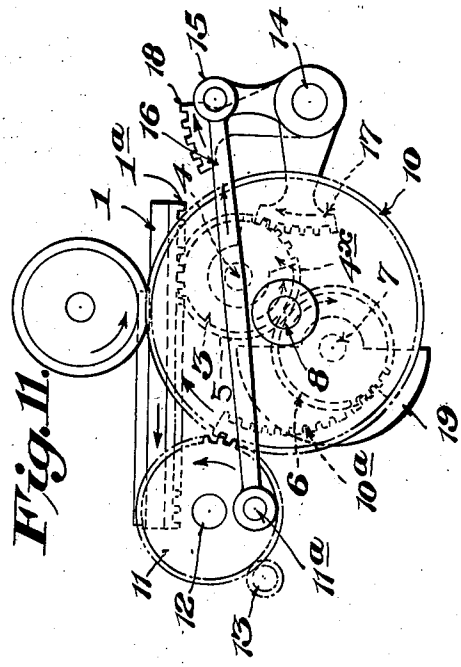


Fig. 11.

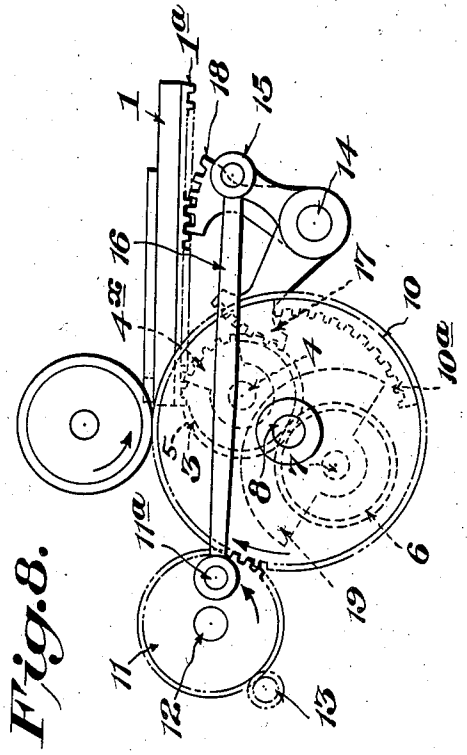


Fig. 8.

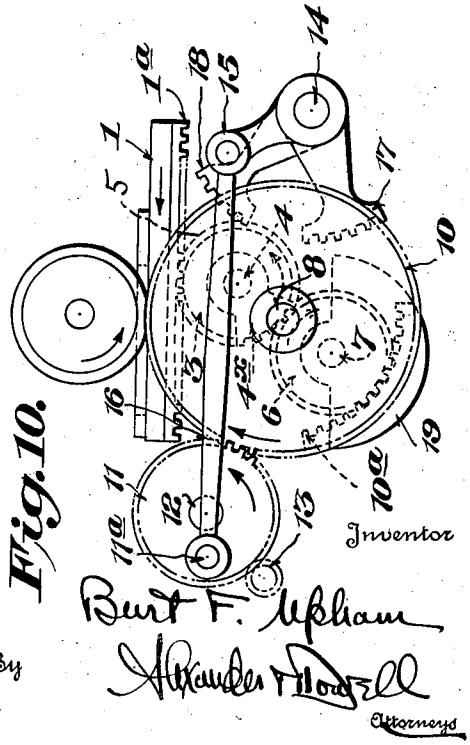


Fig. 10.

Inventor

Burt F. Upham

By Alexander Woodell

Attorneys

Patented Mar. 30, 1943

2,315,142

UNITED STATES PATENT OFFICE

2,315,142

BED MOTION FOR PRINTING PRESSES

Burt F. Upham, Grimsby, Ontario, Canada

Application September 9, 1940, Serial No. 356,074

19 Claims. (Cl. 74—27)

This invention is an improvement in "two-to-one" bed motions for printing presses and other machines having reciprocating beds, and the principal object thereof is to provide a simple novel, and efficient high speed bed motion in which the bed is provided with a rack driven by a pinion which is rotated to drive the bed at uniform speed during the major portion of each stroke, the bed being reversed at the ends of each stroke by novel means whereby the bed is gradually decelerated until stopped, and then the bed is accelerated in the opposite direction until the pinion imparts to the bed the uniform part of its movement on such stroke.

My invention provides novel means for actuating the bed driving pinion to drive and reverse same at proper times; novel means, including oscillatory segments, for reversing the bed; and novel means for actuating said segments. The invention further provides a novel oscillating weight for assisting in the deceleration, stoppage and acceleration of the bed during the reversals thereof, whereby the strains on the bed motion during reversal are materially lessened; said weight also counterbalancing the movement of the bed.

I will explain the invention with reference to the accompanying drawings which illustrate one practical embodiment thereof to enable others familiar with the art to adopt and use the same; and will summarize in the claims, the novel features of construction, and novel combinations of parts, for which protection is desired.

In said drawings:

Fig. 1 is a top plan view, with bed removed, showing one practical embodiment of my invention as applied to a printing press.

Fig. 2 is a vertical section on the line 2—2, Fig. 6.

Fig. 3 is a diagrammatic view illustrating the angular offset of the axis of the internal gear segment from the axis of the gear train.

Figs. 4–11 inclusive are diagrammatic views illustrating various positions of the bed driving and reversing elements during one complete cycle of operations of the press.

The bed motion illustrated in the drawings is of the type commonly known as "two-to-one," in which the bed moves in one direction at a uniform speed for approximately 25½% of a complete cycle of operation of the press, is then reversed during approximately 24½% of such cycle, and is then moved in the opposite direction at uniform speed during approximately 25½% of such cycle, and is then again reversed during the remaining approximate 24½% of such cycle.

As shown in Figs. 1 and 2 the press bed 1 is reciprocably mounted in a frame 2, preferably on the customary sliders guided in ways formed in the sides of the frame in the usual manner. The bed has a rack 1a on its underside preferably disposed on the axis thereof, said rack meshing with a pinion 3 mounted on a shaft 4 journaled in a boss 2a of frame 2 extending inwardly towards the center of the frame. On one end of shaft 4 is a gear 5 disposed at the outside of the frame and in constant mesh with a gear 6 on a shaft 7 journaled in the frames below but parallel with shaft 4, the gears 5 and 6 being preferably but not necessarily of the same size.

Mounted on a stub shaft 8 carried by a bracket 9 (Figs. 2 and 4) mounted on the side of the press frame directly overlying gears 5 and 6, is a larger gear 10, said stub shaft being disposed substantially at the center of a line drawn through the gears 5 and 6 and through the axis of said gears 5 and 6, larger gear 10 meshing with a driving gear 11 of half the diameter of gear 10, said gear 11 being mounted on a shaft or stub 12 journaled in the frame, gear 11 being driven in any desired manner such as by drive pinion 13 (Figs. 4–11) or by a belt pulley or the like mounted on shaft 12.

Gear 10 is spaced from the side of the press frame and overlies intermeshing gears 5 and 6. On the inner face of gear 10 is an internal gear segment 10a of arcuate length approximately 90°, which segment 10a is adapted to alternately mesh with intermeshing gears 5 and 6 as gear 10 is rotated by driving gear 11. When segment 10a is in mesh with gear 5, pinion 3 which constantly meshes with rack 1a of bed 1 will drive the bed in one direction at constant speed. The rotating segment 10a will then pass out of mesh with gear 5 and after a brief interval will mesh with gear 6; and since gear 6 is in constant mesh with gear 5, pinion 3 or shaft 4 will be caused to rotate in the opposite direction thereby causing bed 1 to travel at uniform speed in said opposite direction. During the interval that segment 10a is out of mesh with both gears 5 and 6, pinion 3 is merely rotated by and with the movement of the rack 1a on bed 1 thereby imparting corresponding rotation to shaft 7 through shaft 4 and intermeshing gears 5 and 6; and during said interval the bed is decelerated, stopped, and accelerated in the opposite direction as hereinafter described.

Preferably the axis of gear 10 which carries internal gear segment 10a is offset slightly from

the line passing through the axes of gears 5 and 6 for the purpose of permitting the teeth of internal gear 10a to properly engage the teeth of both gears 5 and 6 as gear 10 is rotated. As shown in Fig. 3, the diametrical line x—y through gear 5 bisects diametrically oppositely teeth 5a and 5b, and the lower tooth 5b which engages gear 6 enters a space between teeth 6a and 6b in gear 6, and the same diametrical line x—y therefore bisects the space between diametrically opposite teeth 6c, 6d of gear 6. Therefore while the advancing segment 10a (Fig. 3) would mesh properly with the teeth at the top of gear 5, the segment would not properly mesh with the teeth at the bottom of gear 6 unless the axis of gear 10 was offset slightly from the diametrical line x—y, as shown in Fig. 3, by such amount that the diametrical line x—z of gear 10 would also bisect a tooth 6d (or 6c) of gear 6 in the same manner that line x—z bisects tooth 5a of gear 5, the angular offset between lines x—y and x—z being therefore equal to half the pitch of the teeth of gears 5 and 6. Similarly the axis of the gear 6 might be offset from the diametrical line x—z of gear 10, an equal angular amount to accomplish the same result, i. e., to prevent the segment 10a when approaching gear 6 from riding on the tops of the teeth of said gear.

Journaled in frame 2 parallel with and spaced from shaft 4 is a rock shaft 14 carrying a crank arm 15 extending outwardly slightly beyond the face of gear 10, the outer end of arm 15 being connected by connecting rod 16 to a pin 11a projecting from the face of driving gear 11, whereby as the gear 9 is rotated shaft 14 will be oscillated. Gears 10 and 11 are of ratio 2:1 so that gear 11 will make one complete revolution while the bed is moving between the extreme limits of its stroke in either direction. Pin 11a is so disposed on gear 11 that when the bed 1 is in either extreme limit of its stroke, the pin 11a will be at the end of its dead center, i. e., the horizontal diameter of gear 11, adjacent the gear 10 as shown in Figs. 4 and 8, so that the reversal of the direction of movement of bed 1 will be effected by a pull on connecting rod 16 rather than a push on said rod, thereby eliminating any tendency to bend or buckle rod 16.

On shaft 4 between pinion 3 and the inner face of boss 2a, is a gear segment 4x adapted to mesh with a gear segment 17 mounted upon the shaft 14 during a portion of the cycle of operations of the bed motion. Gear segment 4x is so disposed on shaft 4 that as the bed nears one end of its stroke and as the internal gear segment 10a of gear 10 passes out of mesh with the gear 6, the pinion segment 4x will come into mesh with the oscillating segment 17 on shaft 14, and as the shaft 14 is oscillated by the connecting rod 16 the segments 17 and 4x will cause the bed to decelerate, come to rest, and then accelerate in the opposite direction of movement, whereupon the internal gear segment 10a of gear 10 will come into mesh with gear 5 as segments 17 and 4x roll out of mesh so that continued movement of the bed in such direction will be effected directly by gear 5 which drives the bed 1 at constant speed until it approaches the opposite end of its stroke.

As the bed approaches the opposite end of its stroke, the segments 17 and 4x remain out of mesh, and a second segment 18 also mounted on shaft 14 directly below rack 1a of bed 1, will by oscillation of shaft 14 roll into mesh with said rack just as the internal gear segment 10a is moving out of mesh with gear 5, and the bed will be decelerated, come to rest, and then accelerated in the opposite direction until the segment 10a of gear 10 moves into mesh with gear 6, which imparts movement to the bed at uniform speed on said return stroke, whereupon oscillation of shaft 14 will move segment 18 out of mesh with rack 1a.

When presses as heretofore made are operated at high speed, the momentum of the bed tends to cause the press to slide along the floor in the direction of movement of the bed; also severe strains during reversal are produced on the bed motion and other parts of the press mechanism. In my invention, in order to prevent sliding of the press, and to lessen strains and assist in reversals of the bed, I provide an eccentric weight which is oscillated on its axis in opposite directions to the travel of the bed, which weight acts as a counterbalance to the bed during reversals thereof, and assists in the deceleration of the bed before the completion of the stroke in either direction, and also assists in acceleration of the bed in the reverse direction at the beginning of the return stroke. Shaft 7 of gear 6 in my bed motion will make less than one complete revolution during each stroke of the bed 1, since gear 6 is approximately one-half the diameter of the gear 10 and since segment 10a is approximately 90° in arcuate length; and therefore an eccentric semi-cylindrical weight 19 is applied to shaft 7 which always rotates in a direction opposite to the direction of movement of bed 1, said weight being of sufficiently small radius that it may oscillate below bed 1. Weight 19 is conveniently adjustably clamped or otherwise secured to shaft 7 adjacent one side of the frame 2, and is so mounted on shaft 7 that same is suspended directly below shaft 7 when bed 1 is at approximately the mid-point of its stroke whereby when the bed approaches either end of its stroke the weight 7 will be rotating in an upwardly direction to assist in decelerating the bed; and after the bed and weight have been stopped and reversed the weight will be rotating downwardly to assist in accelerating the movement of the bed in the opposite direction.

The use of the weight 19 in addition to the above function also serves to counterbalance the frame, i. e., the weight 19 provides a heavy mass always moving in a direction at all times opposite to the movement of the bed so as to offset any tendency of the frame 2 to slide along the floor due to the inertia of the bed and other moving parts, which is a valuable feature in that it permits the press to be operated at substantially higher speeds without any tendency to creep along the floor, which tendency even when a press is anchored, eventually causes the anchorage to break down.

Operation

Figs. 4 to 11 illustrate the relative positions assumed by the parts of the bed motion during a complete cycle of operations. In Fig. 4 the bed 1 has stopped at its extreme left-hand limit. Gear 11 is, however, rotating in the direction of the arrow and hence the meshing gear 10 is carrying internal gear 10a towards the top of gear 5 but is out of mesh with either gear 6 and gear 5. Rock shaft 14 is at its extreme right-hand limit and has come to rest, but segment 4x on shaft 4 is shown in mesh with segment 17 of rock shaft 14 and hence the bed has just come to rest and is on the point of being reversed by the move-

ment of connecting rod 16 after gear 11 has rotated pin 11a upwardly past its dead center position. The weight 19 on shaft 7 is also at rest in its raised position; but just previous to stopping the bed said weight had been swinging upwardly and assisting in decelerating of the bed, said weight moving in the opposite direction from the movement of the bed during deceleration.

When pivot 11a of connecting rod 16 starts to rise, the segment 17 will start to rock downwardly from the position shown in Fig. 4 thereby accelerating the gear 3 in the same direction of rotation as gear 10, the weight 19 swinging downwardly thus assisting in accelerating the bed, and said weight rotating in the opposite direction from the movement of the bed. When the internal segment 10a is advanced by rotation of gear 11 into mesh with the gear 5 as shown in Fig. 5 the bed 1 will be moved at uniform speed on its stroke to a point adjacent the opposite end of said stroke, but as the segment 10a meshes with gear 5, the segments 4x and 17 will have rocked out of mesh as shown in Fig. 5 and same will remain out of mesh until the bed is returned to the same position near the end of its return stroke.

In Fig. 6 the parts are shown in the positions assumed when the bed is at the approximate center of its stroke, the rock shaft 14 now being at rest and the weight 19 in its lowermost position but rotating in a direction opposite to the movement of the bed.

Fig. 7 shows the bed approaching the opposite end of its stroke, the segment 10a being on the point of passing out of mesh with the gear 5. Connecting rod 16 has moved the segment 18 upwardly so as to just mesh with rack 1a on the bed, and the weight 19 is swinging upwardly to assist in deceleration of the bed, the weight moving in a direction opposite to the movement of the bed.

Further rotation of gear 11 will bring the parts into position shown in Fig. 8 wherein the bed is in its extreme right hand limit of movement, and the bed 1, gear 3, rock shaft 14, and weight 19 are at rest; and segment 10a is out of mesh with either gear 5 and 6, but is moving towards gear 6. Further rotation of gear 11 will cause rock shaft 14 to swing downwardly thus reversing the bed, the weight 19 also starting to swing downwardly to assist in accelerating the bed, but said weight 19 rotating in a direction opposite from the movement of the bed to counterbalance the momentum thereof.

In Fig. 9 the bed is shown moving on its return stroke, the segment 18 is moving downwardly in the direction of the arrow and being just on the point of disengaging from rack 1a; while the segment 10a is now just meshing with gear 6.

In Fig. 10 the bed has reached its approximately mid-position, being moved at constant speed by gear 6 through gear 5, shaft 4, and pinion 3.

In Fig. 11 the bed is nearing completion of its return stroke. Segment 17 is just on the point of meshing with segment 4x on shaft 4, and the internal gear segment 10a is just on the point of becoming disengaged from gear 6. Further rotation of gear 11 will again bring the parts into their respective positions shown in Fig. 4, whereupon the cycle of operations will be repeated.

I have thus provided a "two-to-one" bed motion in which the crank pin 11a makes two complete revolutions during each press cycle, and wherein the reversal of the bed is effected at each end of the stroke while the crank pin 11a is travelling through the same identical arcuate limits at the same side of shaft 12. This feature is important since it results in a bed motion in which both reversals are alike and identically the same, thus eliminating the so-called "sweet and sour" strokes required for reversing the bed in a "three-to-one" bed motion, such as shown in my copending application Serial No. 283,906, filed July 11, 1939, (now U. S. Letters Patent No. 2,244,979) also obviating the necessity of providing a so-called "straight-line motion" for the connecting rod which serves to swing the reversing segments such as disclosed in my aforesaid application.

I do not limit my invention to the exact form shown in the drawings, for obviously changes may be made therein within the scope of the claims.

I claim:

1. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; means for alternately rotating said pinion at uniform speed in opposite directions; a segment rotatable with said pinion; a pair of oscillatory segments; and means for oscillating said pair whereby one segment of the pair will engage the pinion segment and cause reversal of the bed at one end of said uniform bed movement, and the other segment will engage the rack and cause reversal of the bed at the other end of said uniform bed movement; said oscillatory segments engaging the pinion segment and rack respectively while the pinion is disengaged from the said rotating means.

2. In a bed motion as set forth in claim 1, said pinion rotating means comprising a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears; and means for rotating said internal gear segment.

3. In a bed motion as set forth in claim 1, said pinion rotating means comprising a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment having its axis of rotation disposed substantially at the mid-point of the line passing through the gears and through the centers thereof, said internal gear segment alternately meshing with said first and second gears; and means for rotating said internal gear segment.

4. In a bed motion as set forth in claim 1, said pinion rotating means comprising a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears; the axis of said internal gear segment crossing the axis passing through the centers of said first and second gears at one end of the latter, and being offset at the other end an amount equal to half the tooth pitch of said gears; and means for rotating said internal gear segment.

5. In a bed motion as set forth in claim 1, said pinion rotating means including a gear rotating constantly in the same direction; a second gear meshing with said first gear and of half the diameter thereof; a rock shaft carrying said pair of oscillating segments; an arm on said rock shaft; and a connecting rod connecting said arm with a pin on said second gear whereby the pin will make one complete revolution for each stroke of the bed.

6. In a bed motion as set forth in claim 1, said pinion rotating means including a gear rotating constantly in the same direction; a second gear meshing with said first gear and of half the diameter thereof; a rock shaft carrying said pair of oscillating segments; an arm on said rock shaft; and a connecting rod connecting said arm with a pin on said second gear so disposed that when the bed is at either extreme limit of its stroke the pin will be at such dead end that reversal of the bed will be effected by a pull on the connecting rod.

7. In a bed motion as set forth in claim 1, a shaft constantly rotating at the same angular speed but in the opposite direction from the pinion; and an oscillating weight on said shaft adapted to assist in deceleration of the bed during reversals thereof, and to assist in acceleration of the bed during the beginning of each stroke, and to counterbalance the momentum of the bed.

8. In a bed motion, a reciprocating bed, a bed driving gear, a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears for alternately rotating said first gear at uniform speed in opposite directions; a crank driven connecting rod making two complete identical movements for each cycle of the bed; and a pair of reversing members actuated by the connecting rod for causing reversals of the bed at each end of said uniform bed movement and while the crank is travelling through the same identical arcuate limits.

9. In a bed motion as set forth in claim 8, said internal gear segment having its axis disposed substantially at the mid-point of the line passing through the gears and through the centers thereof; and a driven gear for rotating said internal gear segment and carrying the said crank, said driven gear making two revolutions for each revolution of the internal gear segment.

10. In a bed motion as set forth in claim 8, the axis of said internal gear segment crossing the axis passing through the centers of said first and second gears at one end of the latter, and being offset at the other end an amount equal to half the tooth pitch of said gears.

11. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears for alternately rotating said pinion at uniform speed in opposite directions; and means for causing reversals of the bed at each end of said uniform bed movement, said means being operative while the internal gear segment is disengaged from the first and second gears; said pinion having a segment; and said bed reversing means comprising a relatively fixed pair of oscillatory segments adjacent the pinion and adapted to engage the pinion segment and rack respectively near their respective ends of the bed strokes; and means for oscillating the pair of segments.

12. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears for alternately rotating said pinion at uniform speed in opposite directions; and means for causing reversals of the bed at each end of said uniform bed movement, said means being operative while the internal gear segment is disengaged from the first and second gears; said pinion rotating means including a gear; and said bed reversing means comprising a segment on the pinion; a relatively fixed pair of oscillating segments; and a connecting rod connecting said pair of segments with a pin on said pinion rotating gear.

13. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears for alternately rotating said pinion at uniform speed in opposite directions; and means for causing reversals of the bed at each end of said uniform bed movement, said means being operative while the internal gear segment is disengaged from the first and second gears; a continuously rotated gear carrying said internal gear segment; a second gear meshing with said first gear and of half the diameter thereof; and said bed reversing means comprising a segment on the pinion; a relatively fixed pair of oscillating segments adapted to engage the rack and pinion segment respectively; and a connecting rod connecting said pair of segments with a pin on said second gear so disposed that when the bed is at either extreme limit of its stroke the pin will be at such dead end that reversal of the bed will be effected by a pull on the connecting rod.

14. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; a gear rotatable with said pinion; a second gear meshing with said first gear; an internal gear segment adapted to alternately mesh with said first and second gears for alternately rotating said pinion at uniform speed in opposite directions; and means for causing reversals of the bed at each end of said uniform bed movement, said means being operative while the internal gear segment is disengaged from the first and second gears; a shaft carrying said second gear and constantly rotating at the same angular speed but in the opposite direction from the pinion; and an oscillating weight on said shaft adapted to assist in deceleration of the bed during reversals thereof, and to assist in acceleration of the bed during the beginning of each stroke, and to counterbalance momentum of the bed.

15. In combination, a driving pinion; a shaft carrying said pinion; a gear on said shaft; a second gear meshing with said first gear; an internal gear segment having its axis of rotation disposed substantially at the mid-point of the line passing through the gears and through the centers thereof adapted to alternately mesh with said first and second gears; means for rotating said internal gear segment; the axis of said internal gear segment crossing the axis passing through the centers of said first and second gears at one end of the latter, and being offset at the other end an amount equal to half the tooth pitch of said gears.

16. In a bed motion, a bed rack, a bed driving pinion meshing with said rack; means for alternately rotating said pinion at uniform speed in opposite directions; a segment carried by said pinion; a pair of relatively fixed oscillating segments, one segment being adapted to engage said pinion segment and cause reversal of the bed at one end of said uniform movement, and the other segment being adapted to engage the rack and cause reversal of the bed at the other end of said uniform movement; said pinion rotating

means including a constantly rotating gear adapted to make one revolution for each stroke of the bed; and a connecting rod connecting said pair of segments with a pin on said gear so disposed that when the bed is at either extreme limit of its stroke the pin will be at such dead end that reversal of the bed will be effected by a pull on the connecting rod.

17. In a bed motion as set forth in claim 16, said pinion rotating means including a shaft constantly rotating at the same angular speed but in the opposite direction from the pinion; and an oscillating weight on said shaft adapted to assist in deceleration of the bed during reversals thereof, and to assist in acceleration of the bed during the beginning of each stroke, and to counterbalance momentum of the bed.

18. In combination, a reciprocating bed, means for moving the bed at uniform speed on each stroke; a crank making two complete rotations for each cycle of the bed; and means actuated by the crank for reversing the bed at the ends of each stroke, whereby the reversals will be effected at each end of the stroke while the crank is travelling through the same identical arcuate limits.

19. In combination, a reciprocating bed; means for moving the bed at uniform speed on each stroke; a crank making two complete rotations for each cycle of the bed; a pair of reversing members actuated by the crank for reversing the bed at the end of each stroke, whereby the reversals will be effected at each end of the stroke while the crank is travelling through the same identical arcuate limits.

BURT F. UPHAM.