Jan. 23, 1940. F. W. SEYBOLD 2,187,758

BED MOTION

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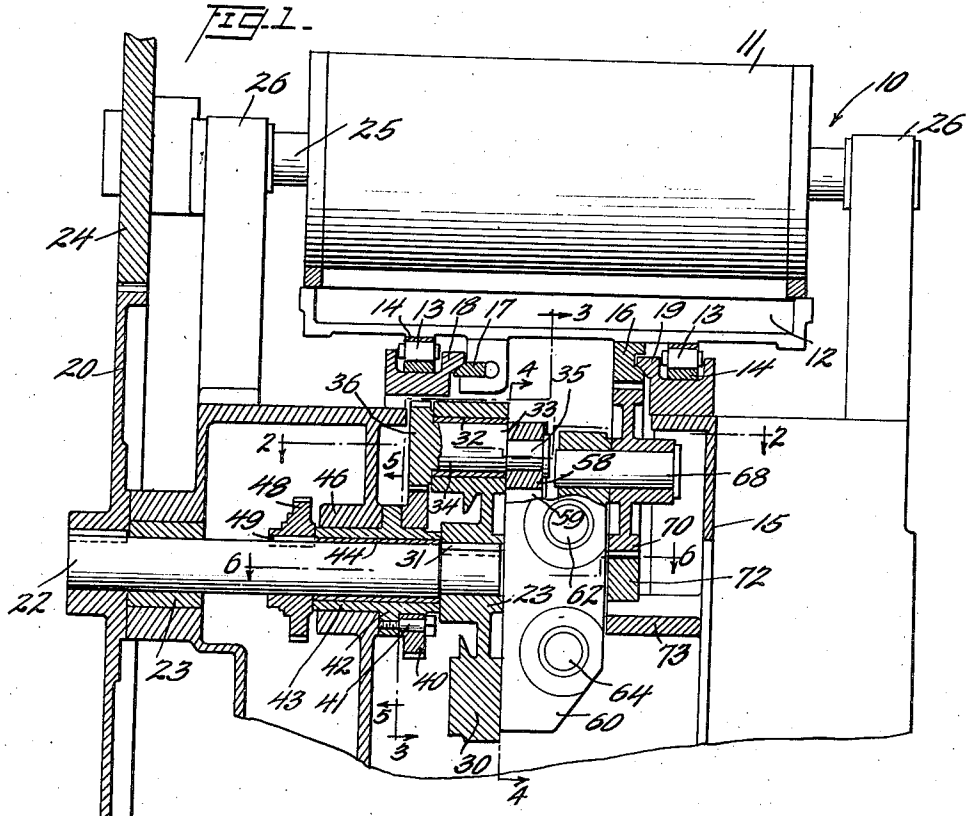
FIG. 1.



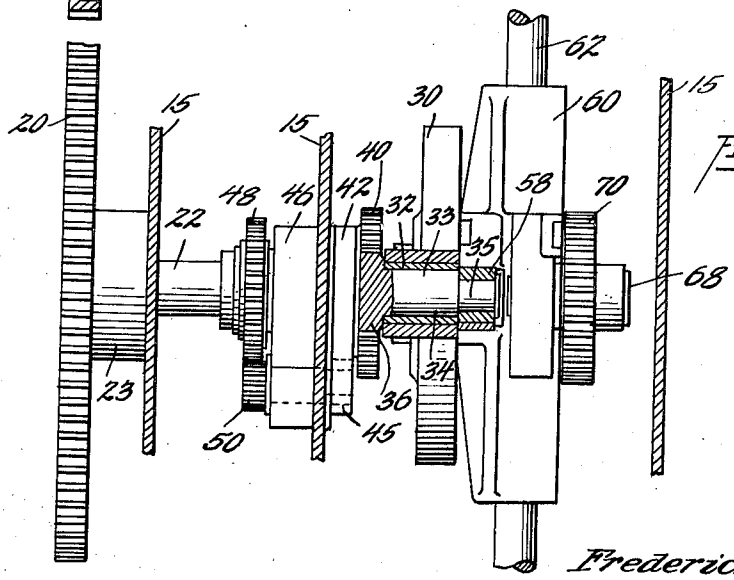


FIG. 2.

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BED MOTION

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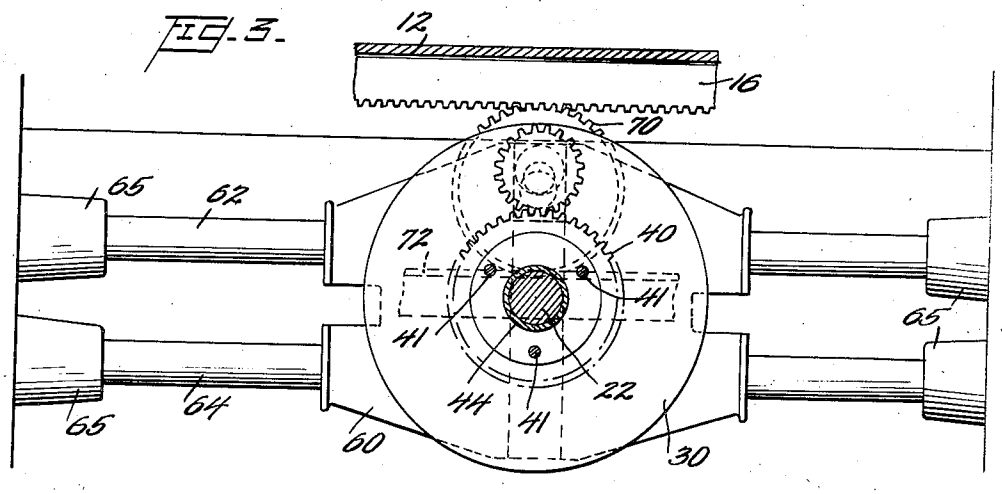
FIG. 3.



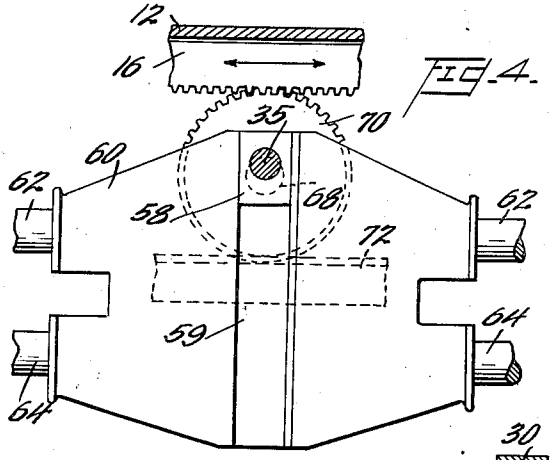


FIG. 4.

FIG. 5.

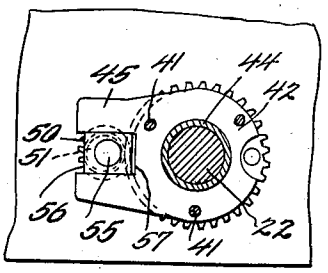
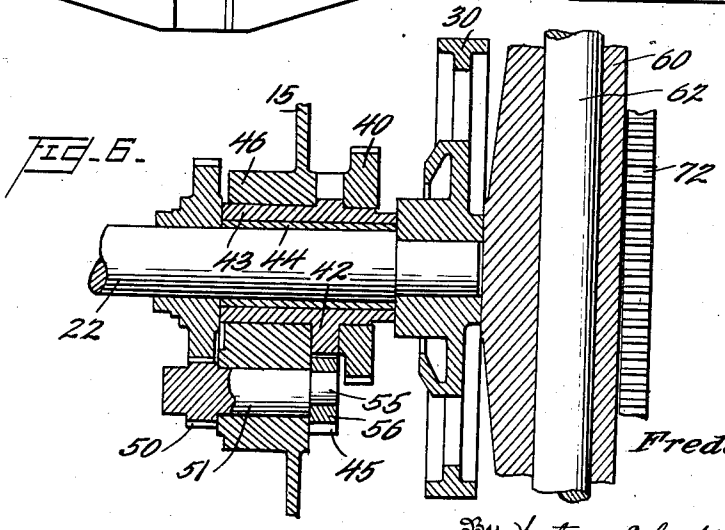


FIG. 6.



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BED MOTION

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FIG. 7.

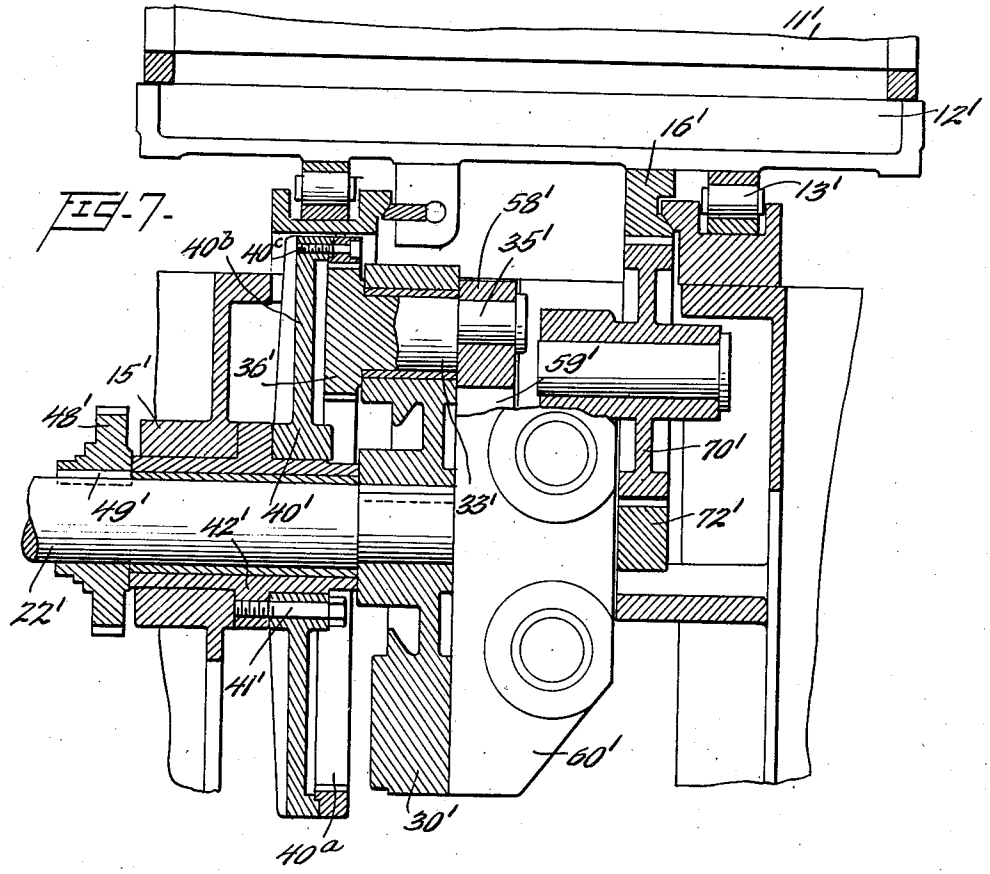
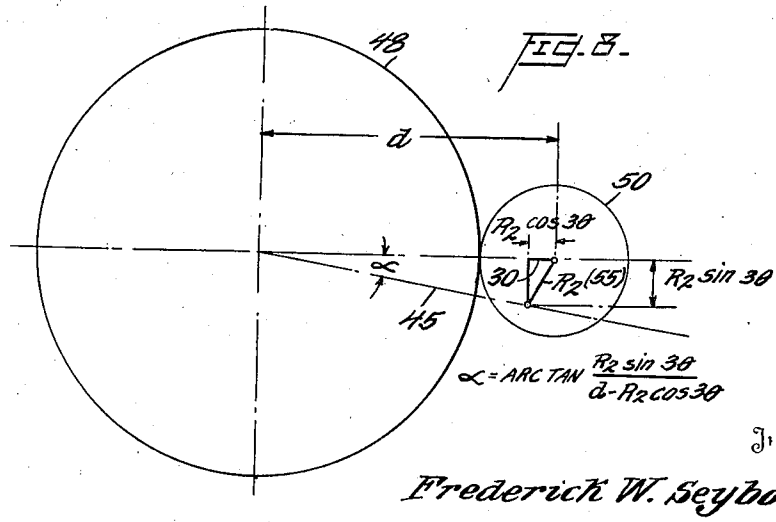


FIG. 8.



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BED MOTION

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FIG. 9.

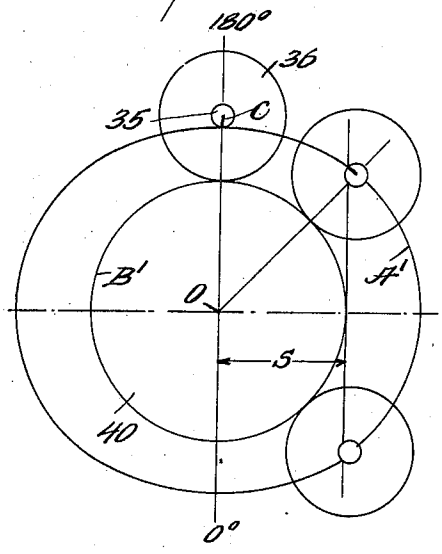


FIG. 10.

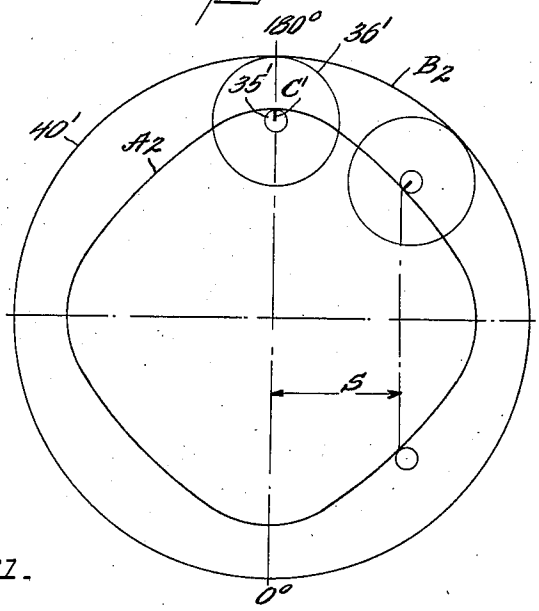
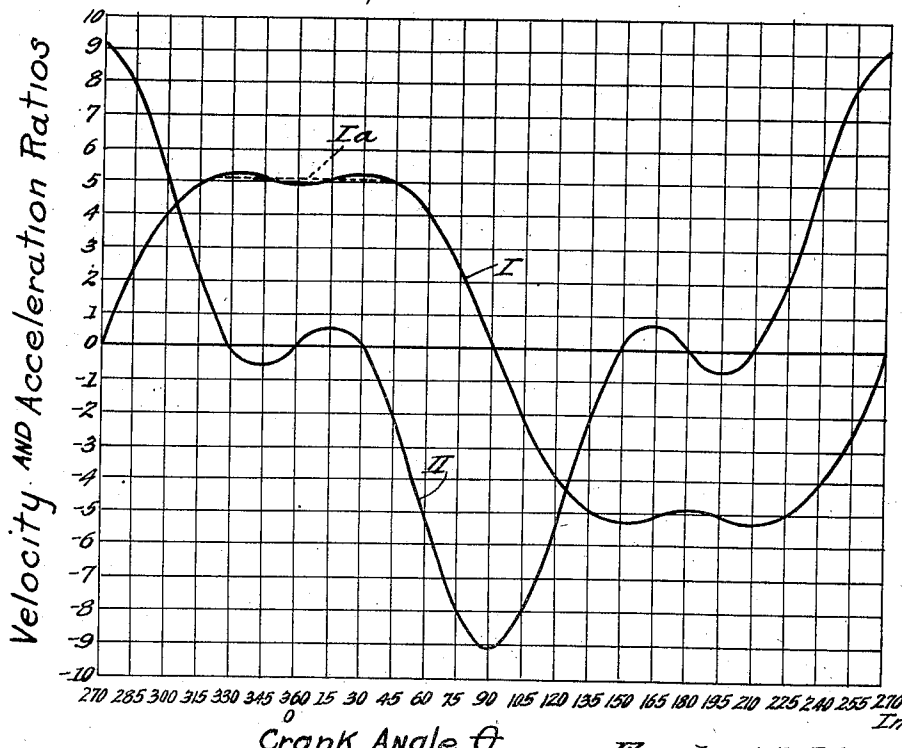


FIG. 11.



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Jan. 23, 1940. F. W. SEYBOLD 2,187,758

BED MOTION

Filed July 7, 1938 5 Sheets-Sheet 5

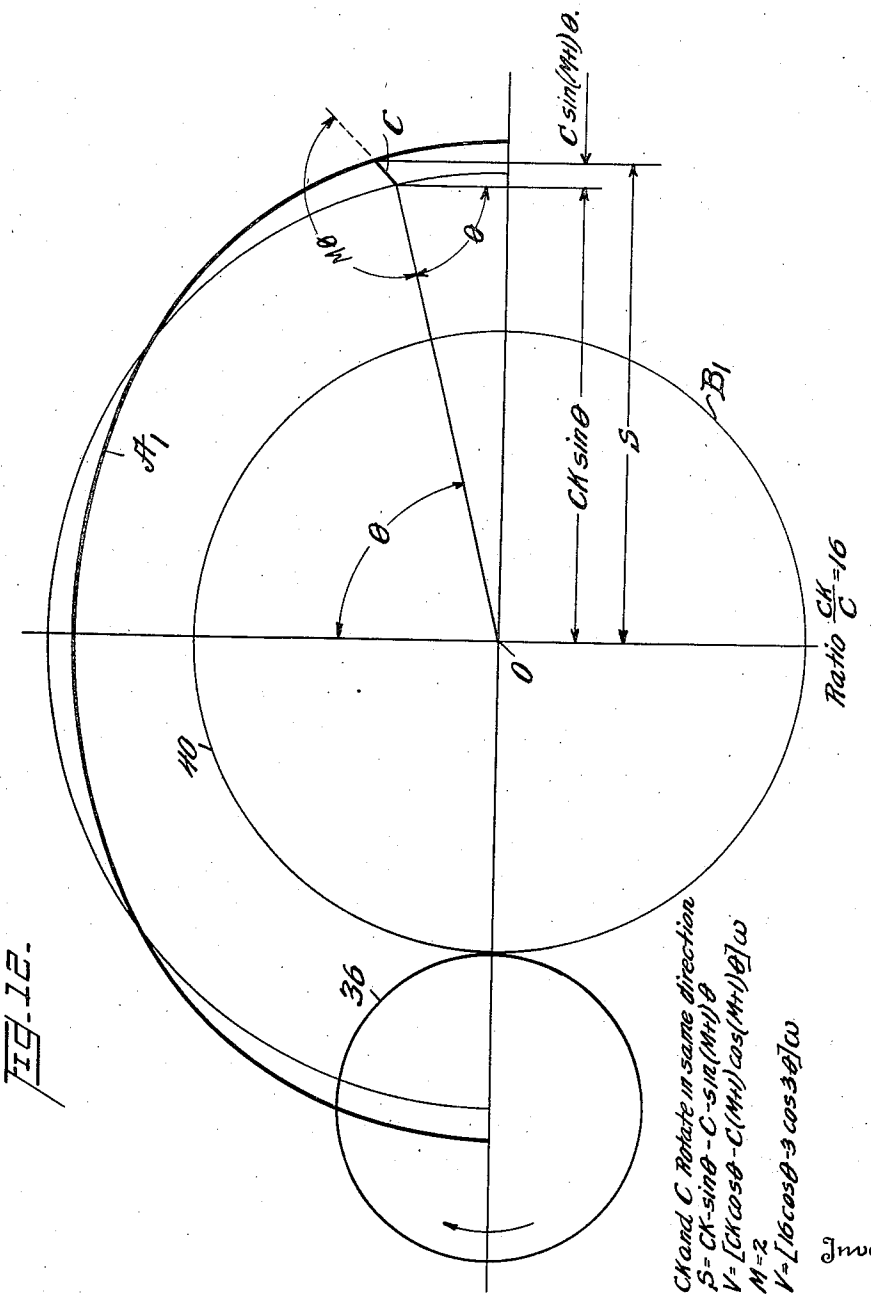

FIG. 12.

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Patented Jan. 23, 1940

2,187,758

UNITED STATES PATENT OFFICE

2,187,758

BED MOTION

Frederick W. Seybold, Westfield, N. J., assignor to American Type Founders, Inc., Elizabeth, N. J., a corporation of New Jersey

Application July 7, 1938, Serial No. 217,994

19 Claims. (Cl. 74—25)

This invention relates to reciprocating bed motions or the like, and more particularly to mechanisms of this character especially adapted to be embodied in printing presses of the flat bed and cylinder type.

The general object of the invention is to provide a novel and improved reciprocating bed motion by means of which a bed or similar carriage member may be oscillated through a complete cycle, the greater portion of the movement in at least one direction being at substantially constant speed.

In attaining this object, there is employed a train of driving gearing which connects the bed with a suitable source of power, and which is constantly in mesh, thus insuring a positive driving connection at all times. This arrangement makes possible the elimination of all cams, gates, latches, locks or any intermittently operating reversing gear; only such parts being used in the construction of the device which can be readily produced on standard machine tools at low cost.

It is a more particular object of the invention to provide a reciprocating bed motion which comprises a system of planetary gearing including a driving element carried by a planet gear and given a cyclic movement during operation, which by suitable means is transformed into oscillatory rectilinear motion and applied to the bed. The arrangement and proportions of the parts are so selected as to produce a cyclic movement of the driving element which will yield as long a period as possible of nearly constant velocity in the stroke of the bed, and further novel means are provided for applying an oscillatory movement to the sun gear at certain points during the cycle of movement of the driving gearing whereby a longer period of more nearly uniform speed will be produced.

In its preferred forms, the invention contemplates the provision of planetary gearing which will develop, in a crank pin or other intermediate driving element, a cyclic movement having the general characteristics of either a hypotrochoid or an apitrochoid, but both the orbit and angular velocity of the crank element are modified by means of a novel arrangement of gearing which rocks or oscillates the otherwise stationary sun gear about its axis, this serving to prolong the period of substantially constant velocity of the bed and to render it more uniform.

As previously pointed out, the present invention has particular adaptation to the printing art. It has long been recognized as desirable, during the printing period of a press of the type described, when the reciprocating type bed and the rotary impression cylinder are in rolling contact, to have these members of the printing couple move at a uniform linear velocity so as to aid in securing the proper registry and prevent the marring of the impression. This desired condition also renders unnecessary the awkward and difficult alternative of rotating the impression cylinder at an irregular rate to adapt it to any non-uniform motion of the bed.

A reciprocating bed actuated by a sliding crosshead or yoke driven by a simple crank arm, as in the case of the familiar Scotch yoke, would have a linear velocity which varies continually, attaining a maximum at mid-stroke and equalling zero at points of reversal at the ends of the printing and return strokes. This movement is one of simple harmonic motion, the general velocity equation of which is

$$V=\omega R \cos \theta$$

where θ is the angle the driving crank makes with the horizontal. The velocity ratio curve representing the relation of the velocity of the bed and the constant linear velocity of the crank pin would be, in that case, of course, the familiar sinusoid or sine curve. The problem, therefore, is to produce a modified harmonic motion, which may be represented by a curve having a flatter loop than the sinusoid, indicating a more nearly constant speed during at least the greater portion of the printing stroke.

Numerous expedients for attaining this condition of uniform speed have been proposed and put into practice, but these for the most part have involved the employment of a plurality of separate driving mechanisms for alternately driving the bed during different portions of its printing and return strokes and also for effecting the reversal of the bed at the ends of the strokes; others have used grooved cam members or similar difficultly machinable elements in the driving train; and still others have approximated the attainment of the desired conditions by the development in the bed of a motion which is the projection upon a straight line of the cyclic movement of a drive element developed by an ordinary planetary system.

The expedient last cited has the advantage of eliminating certain of the irregular parts to which reference has been made, but it falls quite short of providing a uniform velocity period of any considerable duration or accuracy during the cycle.

All of these irregularities and deficiencies are

eliminated by the various provisions of the present invention, as will be set forth in greater detail in the following specification, which together with the accompanying drawings disclose two embodiments of the invention which are exemplary only and not to be interpreted as limiting the scope of the invention which is defined in the subjoined claims.

In the instant specification, the two species of the invention disclosed provide the constant velocity periods in both the printing and return portions of the cycle. Two other species within the generic scope of the invention are disclosed in my copending application Serial No. 217,995 filed July 7, 1938, contemporaneously with this one; those species providing the constant velocity period only during the printing stroke.

In the drawings:

Figure 1 is a vertical transverse sectional view through a bed and cylinder printing press embodying the principles of the invention;

Figure 2 is a fragmentary horizontal sectional view taken on line 2—2 of Figure 1;

Figures 3, 4 and 5 are fragmentary longitudinal vertical sectional views taken on lines 3—3, 4—4, and 5—5 respectively of Figure 1;

Figure 6 is a fragmentary view in horizontal section taken on line 6—6 of Figure 1;

Figure 7 is a view similar to Figure 1 but illustrating an alternative embodiment of the invention;

Figure 8 is a diagram illustrating the movement and relationship of certain parts of the mechanism for oscillating the sun gear of either of the illustrated embodiments;

Figure 9 is a diagram of the movement and relationship of the essential elements of the planetary system in the embodiment illustrated in Figures 1–6 inclusive;

Figure 10 is a similar diagram based on the embodiment shown in Figure 7;

Figure 11 is a graphical representation of the velocity ratios during the cycle of movement of the driving crank element; and

Figure 12 is a diagram of the planetary system of the first described embodiment on an enlarged scale, furnishing a graphic explanation of the elements of the velocity and displacement equations involved.

In presenting the detailed specification of the invention, the mechanical structure and its operation will be described and then the underlying theoretical considerations will be explained and their mathematical basis set forth.

In Figures 1–6 inclusive of the drawings, a printing press of the two-revolution, flat bed and cylinder type is indicated generally by the reference numeral 10. As to be inferred from the designation of the press, the impression cylinder 11 makes two revolutions while the type bed 12 is making one oscillation.

The bed 12 is of course mounted for rolling contact with the impression cylinder 11 during the printing stroke. The means for supporting the bed during its oscillatory movement comprises the conventional rollers 13 which are disposed between the tracks 14 carried respectively by the bed and portions of the press frame 15. The bed is guided by means of the bed rack 16 and the gibs 17 which are suitably supported from the bed, and which are arranged for sliding contact with the guideways 18 and 19 provided on the press frame.

The impression cylinder 11 is driven from the large main driving gear 20 which is rotated from any suitable source of power, this gear 20 being keyed to the main drive shaft 22 which is rotatably mounted in the bearings 23 provided in the frame 15. The means for rotatably supporting the inner portion of this shaft will be described in connection with the bed driving mechanism. The large gear 20 meshes with the impression cylinder gear 24 which is carried upon the end of the impression cylinder shaft 25 which is suitably supported in the bearings 26 carried by the press frame.

The mechanism for driving the bed 12 will now be described; this mechanism being arranged to oscillate the bed through a complete cycle while the impression cylinder is making two revolutions, and also being adapted to move the bed at the same constant linear speed as the impression cylinder during the printing stroke. Upon the inner end of the main drive shaft 22 there is keyed as at 31 the crank disc 30 which is provided with the bearing bushing 32 in which the crank member 33 is rotatably mounted. The crank member 33 comprises the intermediate shaft portion 34 upon one end of which is formed the eccentric crank pin portion 35 which through certain operative connections transmits the driving force to the bed. Upon the opposite end of the crank member 33 there is provided the planet pinion 36, all of these portions of the member 33 being formed integral if desired. The planet pinion 36 meshes with, and is adapted to roll about the oscillatable sun gear 40, this sun gear being secured as by means of bolts 41 to the member 42. This member is provided with a tubular portion 43 freely rotatable upon the shaft 22 and separated therefrom by means of the bearing bushing 44. The portion 43 also serves to support and guide the shaft 22 for rotation within the bearing boss 46 formed on a portion of the frame 15. The member 42 is provided with a slotted arm 45 as very clearly shown in Figure 5 of the drawings.

A gear 48 is keyed as at 49 to an intermediate portion of the main shaft 22 and meshes with a smaller gear 50 carried by the stub shaft 51 rotatably carried in the boss or enlargement 46 of the frame 15. Upon the inner end of the stub shaft 51 there is formed the eccentric crank pin 55 which carries a block 56 adapted to move within the slot 57 of the slotted arm 45 of the member 42. It will thus be seen that as the crank pin 55 rotates it imparts an oscillatory movement to the member 42 which as described is rigidly secured to the sun gear 40, and this oscillation is transmitted to the sun gear and thus modifies the cycle of movement of the main driving crank pin 35 and alters the ultimate effect on the bed.

The means for transmitting the movement of the driving crank pin 35 to the bed 12 includes the following mechanism. The pin 35 carries a block 58 which is adapted to slide within the vertical slot 59 formed in the horizontally sliding cross-head member 60. The member 60 is provided with suitable bores adapted to receive the two horizontal shafts 62 and 64 by which the cross-head is guided; these shafts being mounted at their ends in the portions 65 formed on the frame 15. A stub shaft 68 is carried upon the upper central portion of the cross-head 60 and upon its projecting end a traveling gear 70 is rotatably mounted, this gear meshing with the bed rack 16 and also with the stationary rack 72 which is secured to and is supported by the bracket portion 73 of the frame 15. It will be readily seen from this arrangement that the trav-

elling gear serves to double the movement of the cross-head as it is applied to the bed 12.

The sun gear 40 has twice as many teeth as the planet gear 36 and the gear 48 of the sun gear oscillating train has three times the number of teeth as the pinion 50. Also, in the initial setting of the planetary and modifying systems, when the gear 36 is vertically above the gear 40, the crank 35 extends downwardly, and the modifying crank 55 is horizontal and extends inwardly toward the center of the shaft 22.

Reference may now be had to Figures 9 and 12 of the drawings which comprise diagrams of the planetary system and its movements without benefit of the rectifying or modifying gearing 48, 50. The center of the shaft 22 is indicated at O and the periphery of the sun gear 40 about which the pinion 36 rolls is indicated at B'. The length of the crank arm of the crank pin 35 is designated C. Under these conditions, as the planet pinion 36 rolls about the sun gear 40, the crank pin 35 generates a prolate epitrochoid indicated at A'. By means of the pin and slot connection with the cross-head 60 the motion transmitted to the cross-head by the crank pin 35 is the projection of the motion of the crank pin upon the horizontal line passing through the center O, the displacement of this motion being indicated by S.

The displacement equation for this motion may be expressed as follows:

$$S=CK \sin \theta - C \sin (M \pm 1)\theta \qquad (1)$$

this equation expressing the ordinate of the epitrochoid which, of course, is the path generated by a point on the radius of a circle rolling upon the exterior periphery of a base circle.

In Equation (1):

S=the displacement of the cross-head 60.

C=the length of the crank arm of the crank pin 35.

CK=the length of the crank disc arm 30.

M=the gear ratio between the sun gear 40 and the planet pinion 36.

θ=the angle of rotation of the crank disc 30, measured from the vertical.

Substituting the proper proportions and gear ratios to provide the desired conditions in the present case gives the following equation:

$$S=100 \sin \theta - 5.7 \sin 3\theta \qquad (2)$$

the length of the crank arm 35 being 5 7/100 or 5.7% of the length of the crank disc 30.

The velocity ratio equation is obtained by differentiating the displacement equation with respect to time and is found to be

$$V=(100 \cos \theta - 17.1 \cos 3\theta)\omega \qquad (3)$$

where ω is the angular velocity of the crank disc 30.

This equation is represented graphically by the solid line curve I in Figure 11 in which the velocity ratios of the disc 30 to the crank pin 35 are plotted against the angular displacements of the crank disc. The acceleration ratio equation is represented by the curve II.

It will be seen that the velocity ratio curve yields two portions which are nearly level but which do not represent a velocity which is constant enough for the purpose during the printing stroke. However, by means of the rectifying gearing 45—55 which applies three small oscillations to the sun gear 40 during a given cycle, the velocity ratio curve may be leveled as indicated by the dotted line Ia, thus providing a relatively prolonged period of substantially uniform velocity which is applied to the bed 12 during the printing stroke. It will be noted also that this curve is symmetrical and that the same uniform motion is applied during the return stroke.

Referring now to Figure 8 of the drawings the effect of the rectifying gear train upon the motion of the crank pin 35 will be described. In this figure d is the distance between the centers of the gears 48 and 50; R_2 equals the length of the crank 55; α equals the angle the slotted arm 45 makes with the line connecting the centers of gears 48 and 50 or as developed graphically in the diagram of Figure 8, the angle α may be expressed by

$$\alpha = \arctan \frac{R_2 \sin 3\theta}{d - R_2 \cos 3\theta} \qquad (4)$$

which is the angle the sun gear is being oscillated by the crank pin 55. Since the sun gear 40 is twice the size of the planet pinion 36, the crank 35 will turn through an angle 2α, and the displacement of the cross-head in the final mechanism can be expressed by

$$S=100 \sin \theta - 5.7 \sin (3\theta - 2\alpha) \qquad (5)$$

or

$$S=100 \sin \theta - 5.7 \sin \left(3\theta - 2 \arctan \frac{R_2 \sin 3\theta}{d - R_2 \cos 3\theta}\right) \qquad (6)$$

By making the compensating crank arm R_2 of suitable length, the velocity of the type bed can be made practically uniform during approximately 58% of the stroke of the bed which is quite adequate and practical for the operation of a two-revolution, flat bed printing press.

Referring now to Figure 7 of the drawings in which a modification of the previously described arrangement is shown, the same reference characters are applied as in the prior construction with the addition of primes. Thus, the impression cylinder 11' rolls upon the oscillating bed 12' which is supported upon suitable rollers 13' and carries the bed rack 16'. The main driving shaft 22' is carried in bearings in the frame 15' and has the crank disc 30' keyed thereto at its inner end. The crank disc rotatably carries the crank assembly 33' which includes the driving crank pin 35' and the planet pinion 36', the latter meshing with the internal sun gear 40' which comprises the ring gear portion 40a secured to the periphery of the wheel or disc 40b as by means of the bolts 40c. The internal sun gear 40' is secured to the oscillating member 42' as by means of the bolts 41'. The member 42' is provided with a slotted arm just as in the case previously described and is oscillated by exactly similar means which includes the gear 48' keyed as at 49' to the shaft 22'.

The crank pin 35' carries the block 58' which moves in the vertical slots 59' formed in the cross-head 60' which is mounted for horizontal oscillation in the same way as described in the previous embodiment. The cross-head 60' also carries the gear 70' which meshes with the bed rack 16' and the stationary rack 72'.

The motions developed in this embodiment are depicted in the diagram of Figure 10 of the drawings in which the periphery of the internal sun gear 40' is represented by the reference character B_2 upon which the planet pinion 36' rolls. The path described by the crank pin 35' is in this case, however, a prolate hypotrochoid indicated at A_2. The crank arm of the crank 35' is indicated at C'.

In this embodiment, since the rotation of the planet pinion in the case of the internal gear construction is opposite in direction to that of the external gear construction, the expression M±1 of the general Equation (1) becomes M−1 under these circumstances and the gear ratio being 4:1 the displacement equation as modified by the compensating gearing becomes

$$S=100 \sin \theta-5.7 \sin (3\theta-4\alpha) \quad (7)$$

$$S=100 \sin \theta-5.7 \sin \left(3\theta-4 \arctan \frac{R_2 \sin 3\theta}{d-R_2 \cos 3\theta}\right) \quad (8)$$

However, since M=4 in the case of the internal gear and M=2 in the case of the external gear, the final values of the equations in the two cases are the same, and thus both constructions yield the same motion in the type bed. The curves Iα and II in Figure 11 represent the velocity and acceleration ratios in this embodiment also.

It will thus be seen that there has been provided by the present invention novel mechanism for developing a projected motion in the bed of a printing press of the type described which is derived from the cyclic motion of a crank element appropriately modified or rectified by oscillation of the sun gear to yield the desired period of uniform velocity during the greater portion of the printing stroke.

It is understood that various changes and modifications may be made in the embodiments illustrated and described herein without departing from the scope of the invention as defined by the following claims.

The phrase "without retracement" as employed in certain of the claims is used, as in my prior Patents Nos. 2,082,183 and 2,082,184, to indicate that the driving element moves continuously in one direction along its closed orbit and never retraces its path therealong during any single cycle of movement.

Having thus described my invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, a member rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path, transmission means for maintaining a constant operative connection between said driving element and said bed, and means operatively associated with said member for introducing certain variations in the angular velocity of said driving element, whereby said bed is caused to move at a substantially uniform linear velocity during portions of its cycle of reciprocation.

2. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, transmission means for maintaining a constant operative connection between said driving element and said bed, and means driven by said second named means and operatively connected with said driving element for introducing certain variations in the angular velocity and cyclic path of said driving element, whereby said bed is caused to move at a substantially uniform linear velocity during substantial portions of its working stroke.

3. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, transmission means for maintaining a constant operative connection between said driving element and said bed, and means driven by said second named means and operatively connected with said driving element for introducing certain variations in the angular velocity and cyclic path of said driving element, whereby said bed is caused to move at a substantially uniform linear velocity during substantial portions of its working stroke, the path of said element being a prolate epi-trochoid modified by said last named means.

4. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, transmission means for maintaining a constant operative connection between said driving element and said bed, and means driven by said second named means and operatively connected with said driving element for introducing certain variations in the angular velocity and cyclic path of said driving element, whereby said bed is caused to move at a substantially uniform linear velocity during substantial portions of its working stroke, the path of said element being a prolate hypotrochoid modified by said last named means.

5. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, means driven by said second named means and operatively connected with said driving element for introducing certain variations in the angular velocity and the cyclic path of said element, transmission means maintaining a constant operative connection between said element and the bed, said transmission means adapted to develop a projection of the modified cyclic motion of said element upon a line extending longitudinally of said bed and transmit it to the bed, the motion imparted to the bed having a period at substantially uniform velocity, which period comprises the greater portion of one stroke of the bed.

6. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a con-

stant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, means driven by said second named means and operatively connected with said driving element for introducing certain regularly recurring variations in the angular velocity and the cyclic path of said element, transmission means maintaining a constant operative connection between said element and the bed, said transmission means adapted to develop an oscillatory motion which is a projection of the modified cyclic motion of said element upon a diameter of the cyclic path of said element, to amplify said projected motion, and to apply the resultant oscillatory motion to said bed, the motion imparted to the bed having a period at substantially uniform velocity, which period comprises the greater portion of one stroke of the bed.

7. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, means operatively connecting said driving element with said first named means and comprising a planetary system including a sun gear and a planet gear, means actuated by said second named means for oscillating said sun gear during the cycle of movement whereby the angular velocity of said driving element is varied during its cycle to introduce corresponding variations in the motion of the bed, and transmission means maintaining a constant operative connection between said element and said bed.

8. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a driving element, means rotatable at a constant angular velocity for moving said driving element without retracement along a cyclic path which is symmetrical about the center of rotation of said means, means operatively connecting said driving element with said second named means and comprising a planetary system including a sun gear and a planet gear, means actuated by said second named means for oscillating said sun gear during the cycle of movement whereby the angular velocity of said driving element is varied during its cycle to introduce corresponding variations in the motion of the bed, and transmission means maintaining a constant operative connection between said elements and said bed, said transmission means comprising a sliding cross-head having a pin and slot connection with said driving element and carrying a travelling gear, which meshes with a rack on said bed and with a fixed rack on said supporting means.

9. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of driving means rotatable at a uniform angular velocity, a planetary system including a sun gear mounted for limited oscillation about its axis, and a planet gear adapted to be rolled about said sun gear by said driving means, a crank pin carried by said planet gear and means operatively connecting said crank pin with said bed and including a pin and slot connection, means also actuated by said driving means for periodically oscillating said sun gear, whereby certain variations are introduced in the normal angular velocity and cyclic orbit of the crank pin produced by said planetary system, so that a prolonged period of motion of substantially uniform linear velocity is produced in the movement of said bed.

10. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a rack carried by said bed, a stationary rack carried by said supporting means, a cross-head mounted on said supporting means for oscillating movement longitudinally of said bed, a travelling gear rotatably mounted on said cross-head and meshing with both said bed rack and said stationary rack, a slot formed in said cross-head, a crank pin adapted to move along a closed cyclic orbit and, by engagement within said slot, to produce in said cross-head a rectilinear oscillation which is the projection of said cyclic motion upon one of the diameters of its closed orbit, means for generating said cyclic movement in said crank pin comprising a planetary system which includes a sun gear and a planet gear adapted to roll about said sun gear, said crank pin being carried by said planet gear at a point spaced from its center, means for rolling said planet gear at a uniform angular velocity and means for periodically oscillating said sun gear about its axis during the cycle of movement.

11. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, a sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

12. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, a sun gear concentric with said shaft about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means including a sliding cross-head having a pin and slot

connection with the crank pin for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, a crank pin carried by said last named gear, a carrier for oscillatably supporting said sun gear, and a connection between said last named crank pin and said carrier for oscillating the same, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

13. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, a sun gear concentric with said shaft about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means including a sliding cross-head having a pin and slot connection with the crank pin for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, a crank pin carried by said last named gear, an annular gear carrier surrounding a portion of said drive shaft, relatively rotatable therewith, and rigidly secured to said sun gear, a slotted arm on said carrier, within the slot of which said last named crank pin is engaged, whereby said sun gear is periodically oscillated during the cycle of movement of the bed motion, and whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

14. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, an externally toothed sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

15. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, an internally toothed sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for appplying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

16. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, an externally toothed sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes, the ratio of the sun gear to the planet pinion being 2:1 and the ratio of the gear carried by the drive shaft to the gear rotatably carried by the supporting means being 3:1.

17. A bed movement of the type described in which the bed during its working and return strokes is reciprocated in a plane, comprising the combination with the bed and means for supporting the same for planar movement, of a main drive shaft adapted to be rotated at a uniform angular velocity from a suitable source of power, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, an externally toothed sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes, the ratio of the sun gear to the planet pinion being 2:1 and the ratio of the gear carried by the drive shaft to the gear rotatably carried by the supporting means being 3:1, and the length of the crank arm of the first named crank pin is 5.7% of the length of the arm of the first named crank.

18. In a bed motion of the class described, in combination, a supporting frame, a main drive shaft extending through portions of said frame,

a planetary system actuated by said drive shaft and including a sun gear concentric with and surrounding said drive shaft, an annular hub on said sun gear within which said drive shaft bears and which in turn has a bearing in said frame, and gearing driven by said shaft and operatively connected with said sun gear for applying periodic oscillations thereto to modify the motion developed by said planetary system.

19. In a printing press of the reciprocating bed and rotary impression cylinder type, in combination, a supporting frame, a type bed mounted in said frame for rectilinear reciprocation, means for driving said bed through successive cycles of variable linear speeds, the greater portion of the printing stroke of the bed being at a uniform velocity corresponding with that of the impression cylinder, said means comprising a main drive shaft adapted to be driven at a uniform angular velocity, a train of gears operatively interposed between said shaft and said impression cylinder, a crank on said drive shaft, a planet pinion rotatably carried by the free end of said crank, a sun gear about which said planet pinion is adapted to roll, a crank pin carried by said pinion at a point spaced from its center, and transmission means for applying the movement of said crank pin to the bed, a gear secured to said drive shaft, another gear rotatably mounted in said supporting means, and a crank connection between said last named gear and the sun gear whereby the latter may be oscillated periodically during the cycle of movement of the bed motion to modify the motion developed by the crank pin and transmitted to the bed, whereby the bed is caused to move at a substantially constant linear velocity during the greater portion of at least one of its strokes.

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