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W. F. HUCK ET AL.
DOCTOR BLADE RECIPROCATING MECHANISM
FOR INTAGLIO PRINTING MACHINES

2,548,217

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3 Sheets-Sheet 1

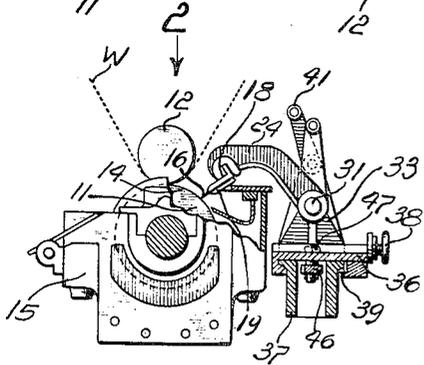
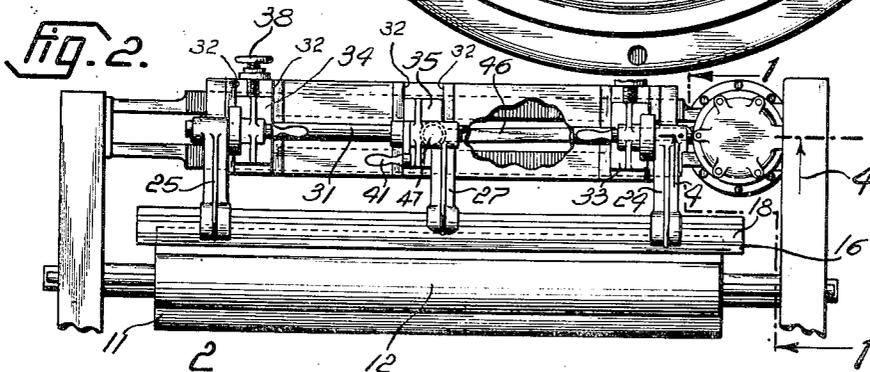
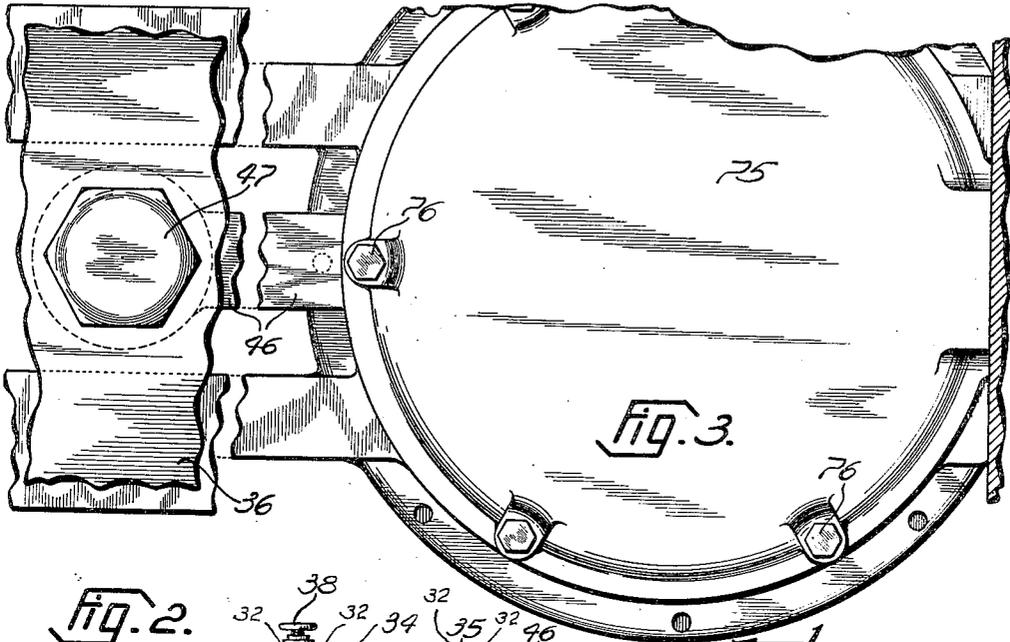


fig. 1.

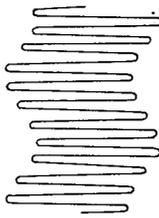


fig. 6

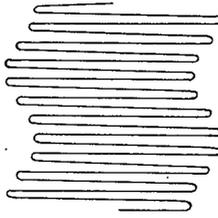


fig. 8

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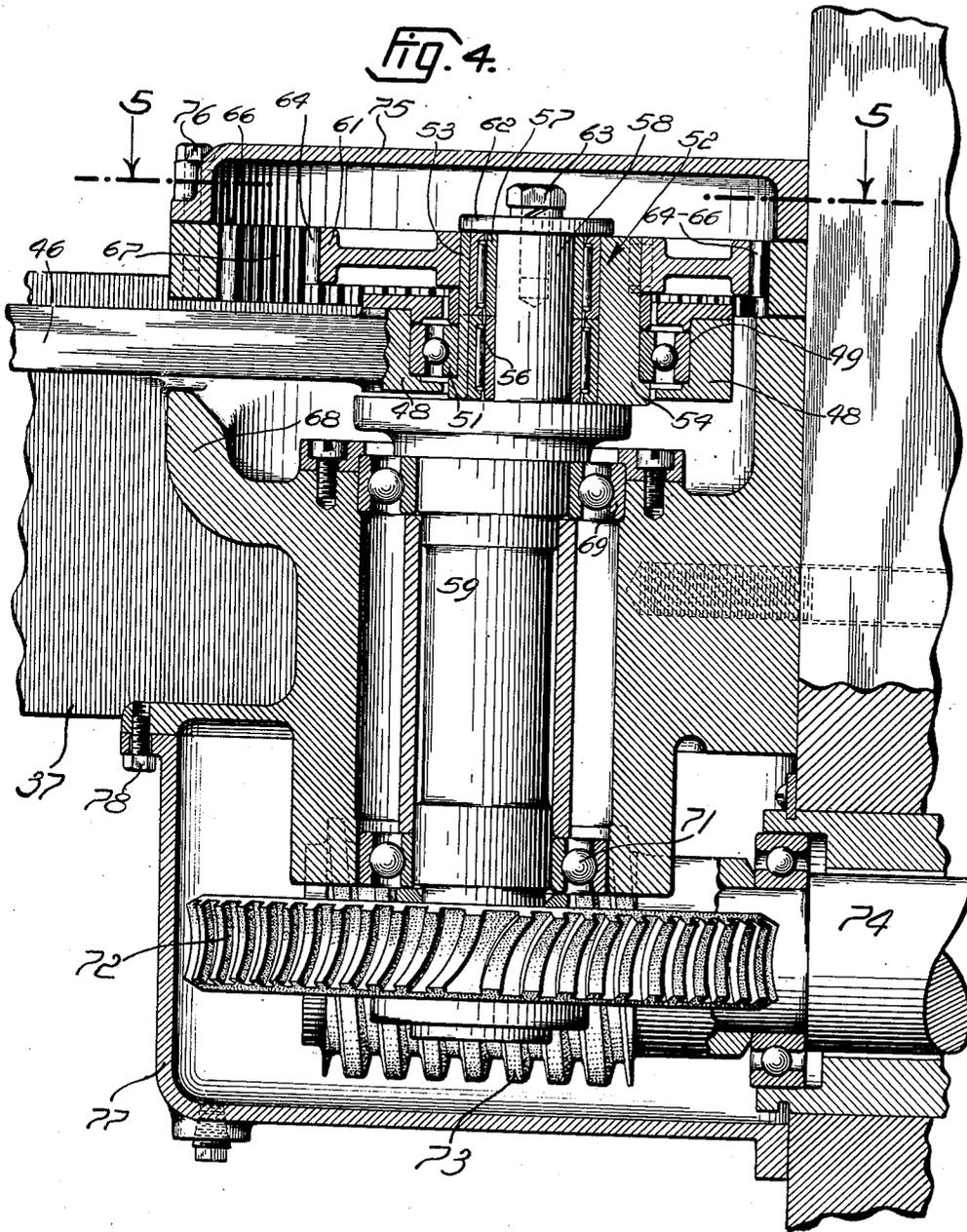
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3 Sheets-Sheet 2



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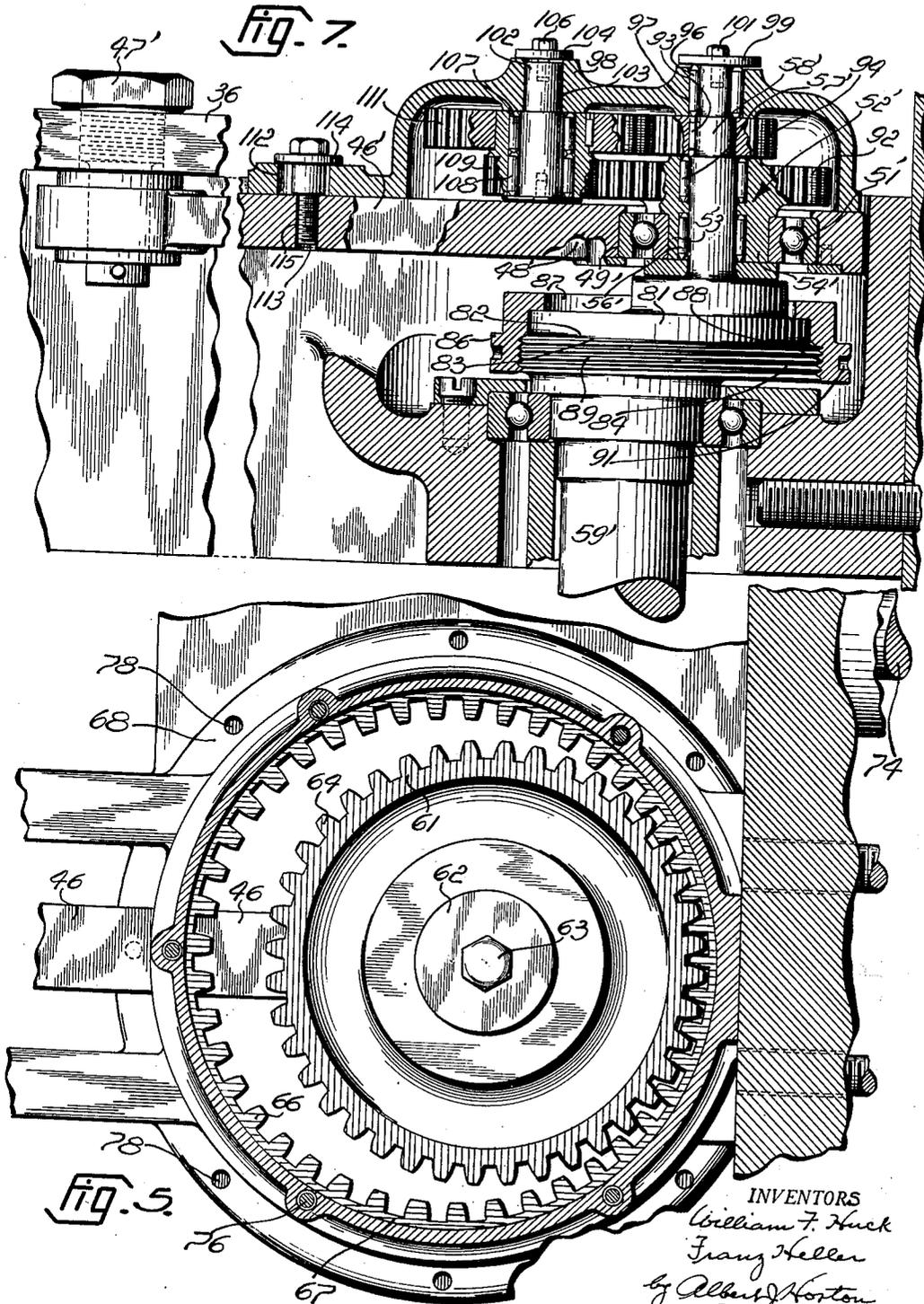
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3 Sheets-Sheet 3



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2,548,217

DOCTOR BLADE RECIPROCATING MECHANISM FOR INTAGLIO PRINTING MACHINES

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3 Claims. (Cl. 101—157)

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This invention relates to rotary intaglio printing machines and more particularly to an improved doctor blade mechanism for use with such machines.

Each printing cylinder of an intaglio printing machine is commonly mounted to rotate in an ink fountain from which the rotating cylinder picks up a quantity of ink and a doctor blade is arranged to engage the surface of the printing cylinder and remove excess ink therefrom. In order that injury to the printing cylinder, due to minor irregularities in the doctor blade or to the abrasive effect of any impurities present in the ink, may be avoided, it is customary to reciprocate the doctor blade longitudinally of the cylinder, and it is now found desirable to vary the length of successive strokes of the blade in order that the reversal between such strokes will not occur at the same place. Hence, an object of the invention is to provide a new and improved mechanism for reciprocating the doctor blade of an intaglio printing machine, which mechanism will automatically vary the position at which the motion of the blade is reversed at the end of each stroke.

Another object of the invention is to provide a doctor blade reciprocating mechanism whereby the length of the stroke of the doctor blade is alternately increased and decreased automatically within a certain range and in cycles, while the machine is running.

A further object of the invention is to provide a doctor blade reciprocating mechanism having means for alternately increasing and decreasing the stroke of the blade within a certain range and in cycles, and means for varying the range of the cyclic increase and decrease and the positions where the stroke is reversed.

Other objects of the invention will be apparent from the following specification:

Figure 1 of the accompanying drawings is a view partly in section of a portion of an intaglio printing machine as seen on the broken line 1—1 of Figure 2;

Figure 2 is a top view of the main portions of an intaglio printing machine in which the invention is incorporated, as seen in the direction of the arrow 2 of Figure 1;

Figure 3 is an enlarged plan view of a portion of the machine shown in Figure 2;

Figure 4 is a sectional view as seen on the line 4—4 of Figure 2 and looking in the direction of the arrows;

Figure 5 is a sectional view showing the parts seen on the line 5—5 of Figure 4 when looking in the direction of the arrows;

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Figure 6 diagrammatically depicts somewhat more than one complete cycle of variation in the reciprocatory movement of any chosen point on the doctor blade;

Figure 7 is a sectional view, similar to Figure 4, showing a modified form of the invention, in which the average length of stroke of the doctor blade may be adjusted; and

Figure 8 is a diagram, similar to Figure 6, showing the movement of a chosen point on the doctor blade when it is controlled by the mechanism of Figure 7, and adjustment has been made to increase the average length of stroke.

As shown in Figures 1 to 6 of the drawings, a printing cylinder 11 and an impression cylinder 12 cooperate to print a web W. The printing cylinder is provided with the usual etched printing surface 14 and is rotatably supported in an ink fountain 15 so the peripheral surface 14 picks up ink, a portion of which is subsequently transferred to the web W. A doctor blade 16, made of comparatively thin flexible metal, is supported between bars 18 and 19 that in turn are supported by arms 24, 25 and 27, in a manner similar to that shown in U. S. Patent 2,292,344. The blade 16 is disposed in engagement with the surface 14 of the cylinder 11 and removes surplus ink therefrom.

The arms 24 and 25 are rotatable on a shaft 31, whereas the arm 27 is releasably clamped to the shaft which is journaled at each end in bearing supports 33 and 34, and intermediate its ends in a bearing support 35. The bearing supports 33, 34 and 35 are mounted to slide in ways 32 on a reciprocable slide plate or base 36, which in turn is supported on stationary ways 37 secured to the machine frame. The bearing supports 33 and 34 are provided with screws having hand wheels 38, whereby the bearing supports may be adjusted transversely of the slide plate 36.

The shaft 31 is adapted to be turned manually by a handle 41 secured thereto near the intermediate bearing support 35, and thus the doctor blade 16 can be moved toward or away from the engraved surface 14. Other means for adjusting the pressure and position of the doctor blade 16 against the surface 14 are not shown in the drawings, but may be constructed in accordance with the arrangement disclosed in Patent 2,292,344.

The mechanism for reciprocating the slide plate 36 with the doctor blade 16, includes a connecting rod 46, one end of which is pivotally supported at the center of the slide plate 36 by a bolt 47, and the other end of the rod 46 is formed with a head 48 (Figure 4) having a bore 49 that supports the outer race of a ball bearing 51. The

inner race of the ball bearing 51 is secured to an eccentric sleeve 52, that has a thin wall portion 53 and a thick wall portion 54. The bore of the sleeve 52 supports the outer race of a pair of roller bearings 56 and 57 and the inner race of the roller bearings is carried on a crank pin 58 that is eccentrically formed on the end of a vertical shaft 59. The bearings 56 and 57 are held in place by a washer 62 and a screw 63. A spur gear 61 is secured to the outer surface of the upper portion of the eccentric sleeve 52 and the teeth 64 of this gear mesh with the internal teeth 66 of a gear ring 67 secured to the ways 37. The shaft 59 is rotatably supported by a pair of ball bearings 69 and 71, in a housing 68 formed integral with the ways 37. The lower end of the shaft 59 carries a worm wheel 72 that meshes with a worm 73 supported on the end of a rotatable shaft 74 that may be driven in any suitable manner. The gears 61 and 67 are covered by a cap 75 that is secured by screws 76, and the worm 73 and worm wheel 72 are enclosed by a cover 77 secured to the housing 68 by screws 78.

In operation, the mechanism shown in Figures 1 to 5 reciprocates the doctor blade 16 in a manner shown diagrammatically in Figure 6. When the shaft 74 (Figure 4) is rotated the worm 73 drives worm wheel 72 and shaft 59, which causes the eccentric crank pin 58 to revolve in a circular path around the axis of the shaft 59. This imparts one component of reciprocatory motion to the connecting rod 46 and the doctor blade 16, and at the same time the motion of the crank pin 58 causes the teeth of the spur gear 61 to roll on the internal teeth 66 of the gear 67, thus rotating the eccentric sleeve 52 about the crank pin 58. The effect of this action is to alternately increase and decrease the eccentricity of the outer surface of the sleeve 52 with respect to the axis of the shaft 59, thereby imparting a second component of reciprocatory motion to the connecting rod 46 and continuously changing the length of stroke of the doctor blade 16.

In the preferred embodiment of the invention shown, the ratio of the gears driving the eccentric bushing 52 is such that the drive shaft 59 makes approximately seven revolutions for every rotation of the eccentric bushing 52 on the crank pin 58 and the two components of motions combine to move the doctor blade in a manner similar to that indicated by the diagram of Figure 6.

A modified form of mechanism for reciprocating the doctor blade 16, is shown in Figure 7. In this form the connecting rod 46', one end of which is pivotally secured to the plate 36 by the bolt 47', has in its opposite end 48', a bore 49' that supports the outer race of a ball bearing 51'. The inner race of the ball bearing 51' is secured to the outer surface of an eccentric sleeve 52' that has a thin wall portion 53' and a thick wall portion 54'. The bore of the eccentric sleeve 52' forms the outer race for a pair of roller bearings 56' and 57', and the inner races of the roller bearings are formed on a crank pin 58' that is eccentrically formed on a disk 81 having a lower machined surface 82. The disk 81 is adjustably clamped to the upper surface 83 of an eccentric head 84 secured to a vertical shaft 59' that corresponds to the shaft 59 shown in Figure 4. The means for adjustably securing the disk 81 to the head 84 includes a bushing 86 having a bore 87, and an internally threaded portion 88, which is screwed on external threads 89 of the eccentric head 84. Recesses 91 are provided on the external periph-

ery of the bushing 86 for engagement by a spanner wrench (not shown) whereby the bushing can be loosened in order to make adjustments to vary the eccentricity of the eccentric crank pin 58' with respect to the shaft 59' and then lock them together.

A spur gear 92 is formed integral with the eccentric bushing 52'. The upper end of the crank pin 58' is secured by means of a key 93 to a gear 94 and the extreme upper end of the crank pin 58' is rotatable in a roller bearing 96 that is positioned in a bore 97 of a cap 98. A washer 99 is secured to the crank pin by a screw 101 and functions to hold the cap and roller bearing 96 in position. A stub shaft 102 is secured in a second bore 103 in the cap 98, by means of a washer 104 and a screw 106. Roller bearings 107 and 108 on the shaft 103, rotatably support an intermediate gear 109 that is in mesh with the gear 92. A second intermediate gear 111 is secured to the first intermediate gear 109 and meshes with the gear 94. An extended portion of the cap 98 is provided with an elongated hole 112 which receives a screw 113 having a washer 114. The screw is threaded into a hole 115 provided in the connecting rod 46' and prevents the cap 98 from turning but permits it to slide longitudinally of the connecting rod 46'.

In operation, the mechanism shown in Figure 7 reciprocates the doctor blade 16 with a short stroke as shown diagrammatically in Figure 6, with a long stroke as shown in Figure 8, or with a stroke of any intermediate length. When the shaft 59' is rotated, the crank pin 58' revolves about the axis of the shaft 59'. The diameter of this circular path can be adjusted by loosening the bushing 86, rotating the disk 81 so that its surface 82 turns with respect to the surface 83 and then tightening the bushing 86. When the shaft 59' is rotated the connecting rod 46' and the doctor blade 16 are reciprocated in a manner similar to that previously described. The eccentric sleeve 52' also rotates as in the form shown in Figure 4; however, the means for rotating the sleeve shown in Figure 7, includes the gears 92, 109, 111 and 94. As the crank pin 58' describes its circular path, it rotates the gear 94 which in turn causes the gears 111 and 109 to drive the gear 92 and thereby rotate the eccentric sleeve 52'. Rotation of the eccentric sleeve causes a relative motion between the cap 98 and the connecting rod 46', this motion being permitted by the elongated hole 112.

As in the previously described embodiment, the pin 58' imparts a first component of reciprocating motion to the doctor blade 16, and at the same time rotation of the eccentric bushing 52' imparts a second component of motion, but by adjusting the position of the disc 81 with respect to the head 84, it is possible to change the eccentricity of the pin 58' and thus to change the length of the first component strokes given to the doctor blade. Thus with the mechanism shown in Figure 7, it is possible to obtain a variable length of stroke ranging from the short stroke of Figure 6 to the long stroke shown in Figure 8.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being made to the claims rather than to the foregoing description for an indication of the scope of the invention.

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What we claim is:

1. In a rotary intaglio printing machine having a printing cylinder and drive therefor, a support for holding a doctor blade against the cylinder, a reciprocable slide for reciprocating the support, and a crank shaft driven by the printing cylinder drive for driving the slide; the combination with the reciprocable slide and crank shaft pin of a connecting rod pivotally connected to the slide at one end, an eccentric sleeve rotatably carried in the other end of the rod and rotatably mounted on the crank pin, and an epicyclic gear train driven by the crank pin and driving the eccentric sleeve, the gear train ratios being such that the eccentric sleeve rotates a fraction of a turn with respect to the crank pin during each stroke thereof, whereby the connecting rod reciprocates the slide between varying limits of reciprocation.

2. The combination according to claim 1, in which the epicyclic gear train comprises an external spur gear fixed to the eccentric sleeve and

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an internal stationary gear meshing therewith.

3. The combination according to claim 1, in which the epicyclic gear train comprises a driving gear fixed to the crank pin, a driven gear fixed to the eccentric sleeve, and an intermediate gear pair rotatable on a shaft carried by the connecting rod.

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