Oct. 2, 1934. R. F. MORRISON 1,975,369

ENGINE FOR OPERATING PRESSES

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Fig. 1.

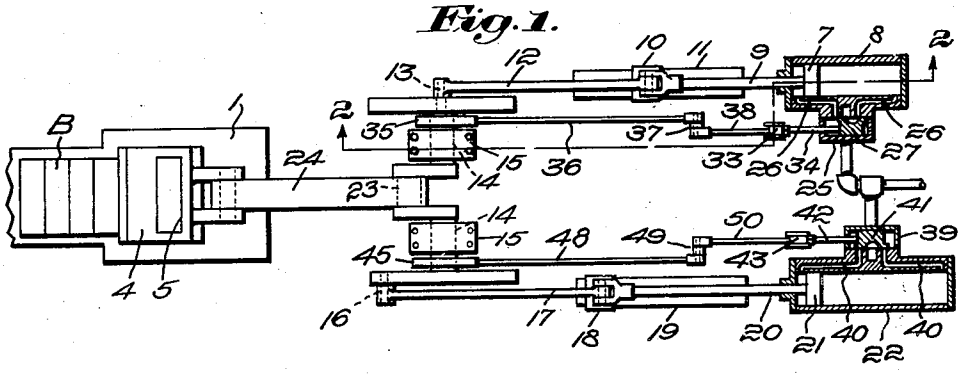


Fig. 2

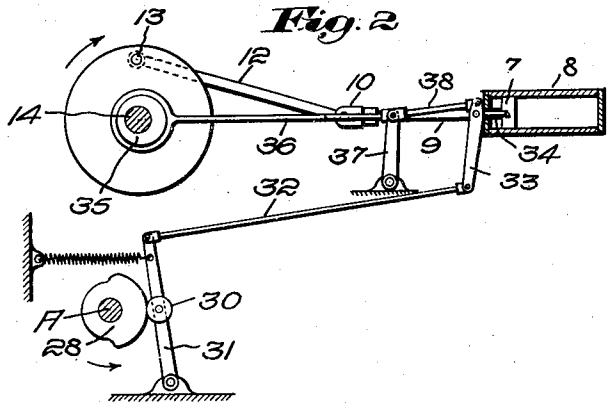
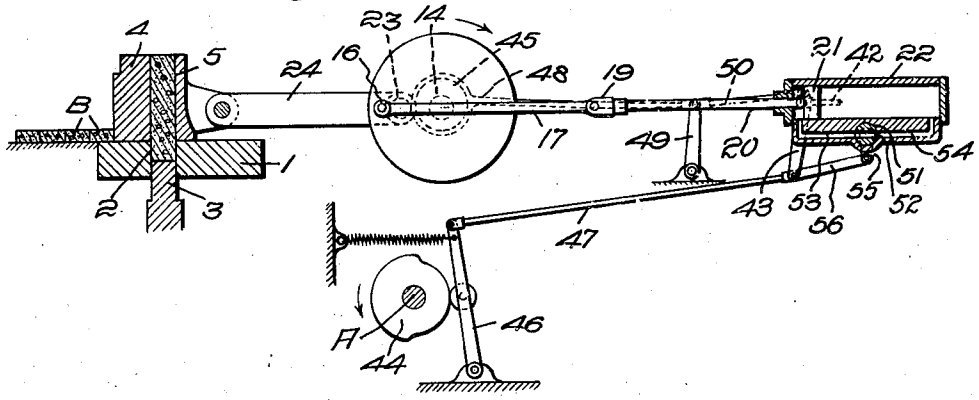


Fig. 3.



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Fig. 4

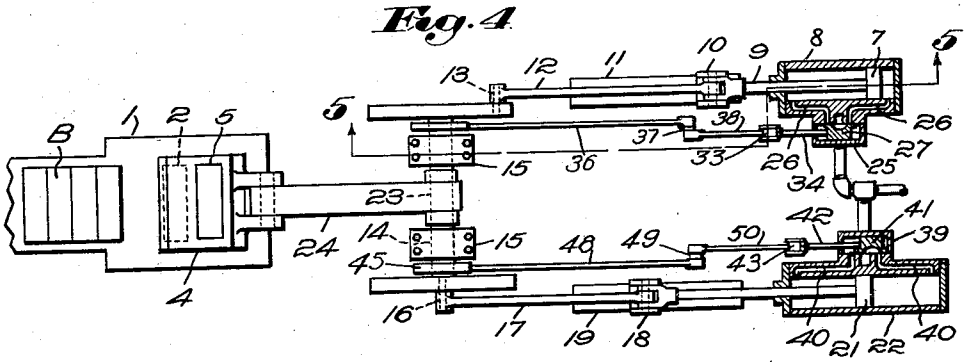


Fig. 5.

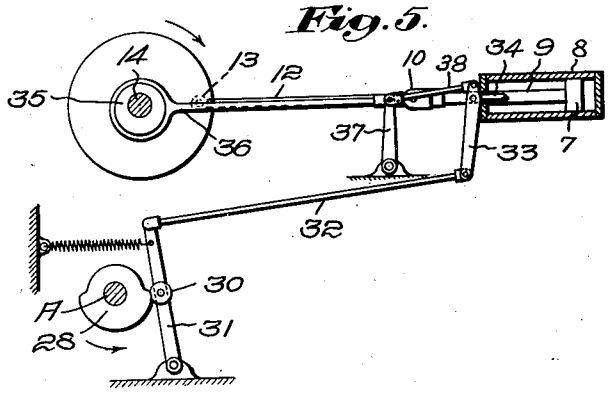
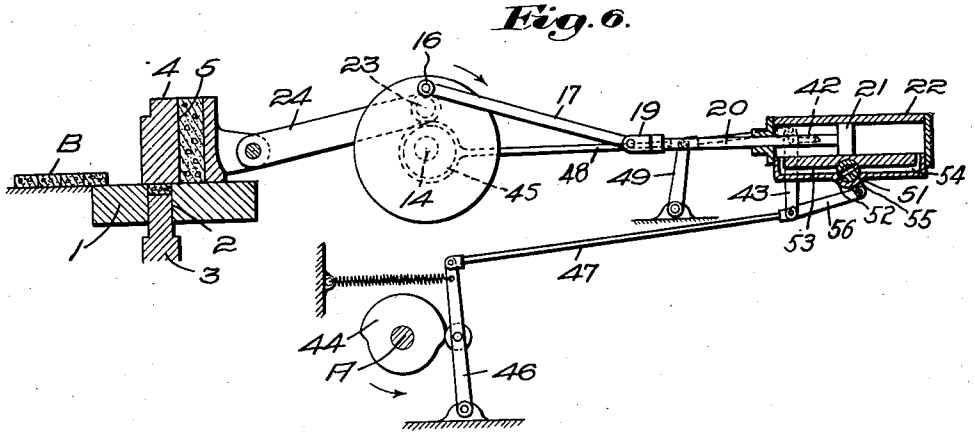


Fig. 6.



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Fig. 7.

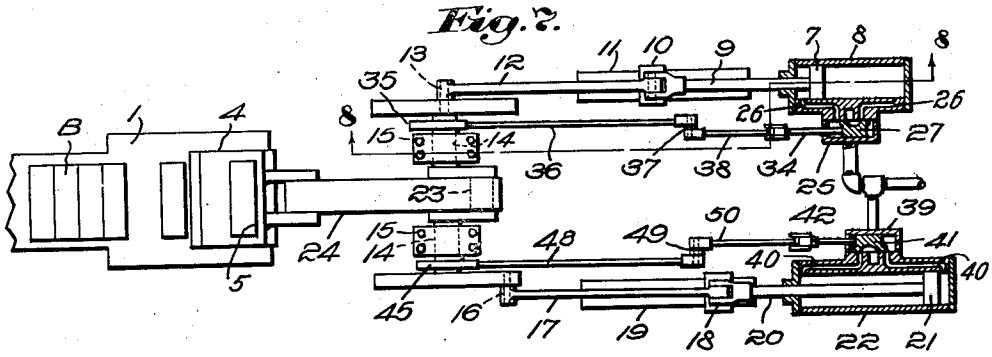


Fig. 8.

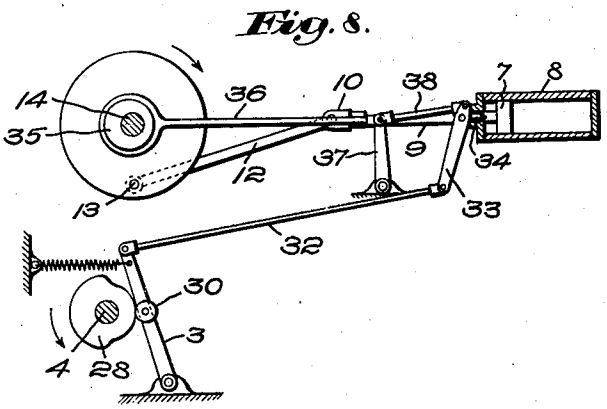
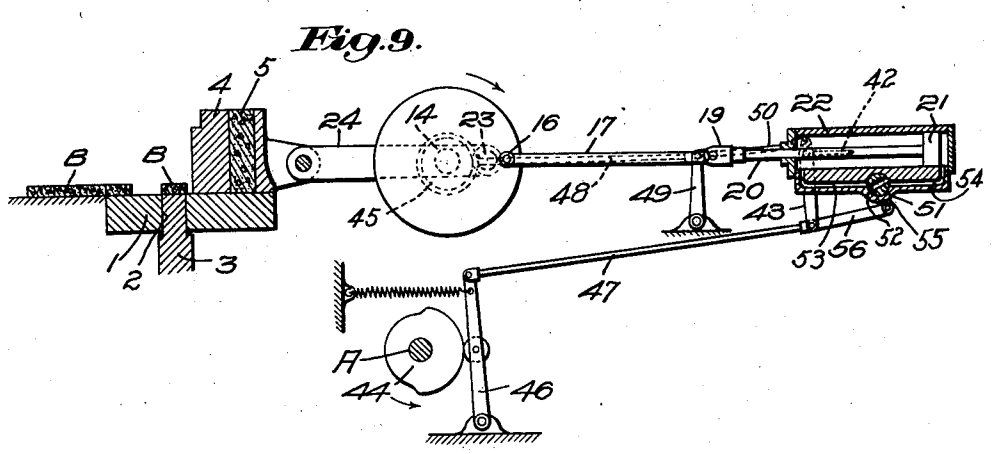


Fig. 9.



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Patented Oct. 2, 1934

1,975,369

UNITED STATES PATENT OFFICE

1,975,369

ENGINE FOR OPERATING PRESSES

Robert F. Morrison, Yonkers, N. Y., assignor to The International Pavement Company, New York, N. Y., a corporation of Connecticut

Application August 2, 1930, Serial No. 472,664

17 Claims. (Cl. 121—1)

My invention relates to mechanism for and methods of operating heavy machine parts, as, for example, the sliding head of a press for forming asphalt paving blocks and the like.

The invention will be best understood from the following description when read in the light of the accompanying drawings of one embodiment of the invention, the scope of which latter will be more particularly pointed out in the appended claims.

In the drawings:—

Fig. 1 is a more or less diagrammatic plan view, with parts in section, of one form of apparatus constructed according to the invention for moving the sliding head of a paving block press, said head in the position of parts illustrated being in filling position;

Fig. 2 is a section on the line 2—2 of Fig. 1 with parts omitted;

Fig. 3 is a more or less diagrammatic elevation, with parts in section, of the apparatus shown in Fig. 1;

Figs. 4, 5 and 6 are more or less diagrammatic views of the apparatus constructed according to Figs. 1, 2 and 3 showing the position of parts when the sliding head is in block pressing position. Figs. 4, 5 and 6 otherwise corresponding to Figs. 1, 2 and 3 respectively; and

Figs. 7, 8 and 9 are more or less diagrammatic views corresponding to Figs. 1, 2 and 3 showing the position of parts when the sliding head is in block ejecting position.

Herein, the heavy machine part to be moved is exemplified by the sliding head of a press of the type disclosed in United States patent to Whitney No. 1,003,561, issued September 19, 1911.

Referring to the drawings, the press includes an appropriately supported stationary mold block 1 having a mold chamber 2 in which is a vertically reciprocatory mold plunger 3. On the mold block is mounted a reciprocatory sliding head 4 having a passage 5 adapted to be brought into registry with the mold chamber for filling the latter with asphaltic or other material, which material is compressed by the mold plunger to form the blocks B.

In the preferred operation of the machine, when the parts are in the positions shown by Figs. 1, 2 and 3 the mold plunger 3 is at the lower end of its stroke, and the sliding head is at the left hand end of its stroke. In this position of parts, herein referred to as the "mold filling position", the mold chamber 2 is in registry with the passage 5 in the sliding head, so that the mold chamber will be filled with asphaltic material. The sliding head is then moved to the left, through part of its stroke in that direction, to cover the mold as shown by Figs. 4, 5 and 6, the parts being then in what is herein termed "block pressing position", whereupon the plunger 3 is raised by a hydraulic ram (not shown) for compressing the material to form the block. The sliding head, after the block is formed, is moved through the remainder of its stroke to the left, into the position of parts shown by Figs. 7, 8 and 9, herein termed "block ejecting position", whereupon the plunger 3 is raised to eject the block from the mold chamber, and the sliding head then is moved through a full stroke to the right to return the parts to the positions shown by Figs. 1, 2 and 3, which movement of the sliding head pushes the block B across the mold block away from the mold chamber.

As economic considerations make it necessary to fabricate from 15 to 50 blocks per minute, it will be observed that the sliding head must in consequence be moved and brought to rest with great rapidity, and, as said head in practice weighs in the order of several thousand pounds, exceedingly great destructive forces are set up due to the inertia of said head, which inertia must be overcome in accelerating and decelerating said head to cause it to come to rest in its several positions of operation and to move it from these positions.

The present invention is concerned more particularly with the instrumentalities for reciprocating the sliding head. The instrumentalities for moving the mold plunger 3 form no part of the present invention and therefore are not described. The latter, however, may be those described in the Whitney patent above referred to, which patent discloses a power actuated cam shaft, herein designated at A, for coordinating and controlling the operation of the sliding head and mold plunger. In the practice of the present invention this cam shaft may likewise be utilized for coordinating and controlling both the sliding head and plunger.

In the present embodiment of the invention, for effecting the above described reciprocatory step-by-step movements of the sliding head, the latter is moved from "mold filling position", Figs. 1, 2 and 3, to "block pressing position", Figs. 4, 5 and 6, by the action of a fluid pressure actuated piston connected to the sliding head through a crank, which crank, generally speaking, is in its most favorable position in respect to leverage when said sliding head is to be accelerated, and is in dead center position when said sliding head

comes to rest in block pressing position, the latter so that said head will be accurately positioned as its movement ceases. The sliding head is then moved from "block pressing position" to "block ejecting position", that is to say, through the remainder of its stroke to the left, as viewed in the drawings, by a second fluid pressure actuated piston acting on said head through a second crank, the latter, generally speaking, being in its most favorable position in respect to leverage when said head is to be accelerated from block pressing position, and being on dead center position when said head is brought to rest in block ejecting position. The return stroke to the right, that is to say, from block ejecting position to mold filling position, preferably is by the action of both pistons.

As above described, it will be observed that, in each instance of movement, one crank, at least, is in a favorable position in respect to leverage, when movement of the sliding head from any of its operative positions is to be initiated, and that one crank, at least, is on dead center position when said sliding head is in any of its operative positions.

As illustrated, the means for producing the reciprocatory step-by-step movement of the sliding head 4 includes a steam actuated piston 7 which is arranged to reciprocate in a cylinder 8, said piston being connected by a piston rod 9 with a cross head 10 which moves along suitably supported guides 11. Herein, the cross head 10 is operatively connected by a connecting rod 12 with a crank 13, the latter carried at one end of a shaft 14 journalled to rotate in suitably supported bearings 15. Secured to the opposite end of the shaft 14 is a second crank 16, the crank pin of which is angularly positioned, herein substantially 90°, from the crank pin of the crank 13. The crank 16 is operatively connected by a connecting rod 17 with a cross head 18 slidable on suitably supported guides 19, said cross head being connected by a piston rod 20 with a steam actuated piston 21 arranged to reciprocate in a cylinder 22, the latter herein being about twice as long as the cylinder 8.

As shown, the shaft 14 is operatively connected with the sliding head 4 by a crank 23, formed as part of said shaft, and connecting rod 24, the throw of the crank 23 being equal to the length of stroke of the sliding head, whereby, when said crank is in one or the other of its dead center positions, the extremes of the stroke of said head will be definitely determined.

Desirably the shaft 14 is oscillated from one dead center position of the crank 23 to the other, and does not make a complete rotation. Hence in order to facilitate the starting of the head, the pins of the cranks 13 and 16 are desirably positioned in different radial planes, one of said cranks, herein the crank 13, being arranged substantially 90° from the crank 23, while the other crank 16 is desirably in the same plane as the crank 23.

Upon movement of the piston 7 toward the right from its position shown by Fig. 1, in which position the pin of its associated crank 13 is substantially at right angles to the crank 23, the latter will be moved from its dead center position. The stroke of the piston 7 need be sufficient to move its crank 13 only a quarter turn of the shaft 14, or from the position shown in Figs. 1 and 2 to that shown in Figs. 4 and 5, moving the crank 13 to its interior dead center position, assuming, however, that the crank 23 in its starting position is in its exterior dead center position. This quarter turn of the shaft 14 is completed upon the completion of the stroke of said piston 7 to the right, and, as at the end of said stroke the crank 13 is in dead center position, the position of the crank 23 at mid stroke is accurately determined.

The mid stroke position of said crank 23 herein corresponds with the block pressing position of the sliding head 4, as is illustrated most clearly in said Figs. 4 and 6. When moved to this position, the sliding head remains at rest until the block compressing operation is completed, whereupon the steam actuated piston 21, which then is at mid stroke, is caused to effect the movement of the sliding head 4 through the remainder of its stroke to the right, that is to say, from its block pressing position to its block ejecting position, Figs. 7 and 9. At the beginning of this movement the crank 16 will be in position to exert a favorable leverage, as likewise will be the crank 23, and, as a result of this, a favorable force will be available for accelerating the sliding head, while at the end portion of this movement said cranks both will approach dead center positions so as to decrease the force applied to said head when it is decelerating.

From the foregoing description it will be obvious that the pistons 7 and 21 will function alternately during the stroke of the sliding head to the right, as viewed in the drawings, the functioning piston moving its crank from a position of favorable leverage to dead center position and, at the same time, moving the crank of the other piston from its dead center to a position of favorable leverage. During the left hand stroke of the sliding head, that is to say, its movement from its position in Fig. 9 to its position in Fig. 3, the piston 7 preferably operates to effect the initial starting movement, moving its crank 13 from its lower dotted line position of Fig. 8 and causing said head to move through part of its stroke, but before the piston 7 reaches the end of its stroke to place the crank 13 on dead center, the piston 21 is actuated to cooperate with or supplement the action of the piston 7 and cause the sliding head to make its stroke in one continuous movement. To insure this continuous movement of the sliding head, pressure fluid preferably is admitted to the head end of the cylinder 22 immediately upon removal of the crank 16 from dead center position, said fluid pressure acting upon said piston substantially throughout its entire stroke.

From the foregoing description it will be observed that by interposing the cranks 13, 16 and 23 between the several pistons and the sliding head 4, a succession of distinct movements of said head will be effected, and the end of each movement will be definitely determined by the dead centering of the crank responsible for the completion of that movement. Furthermore, it will be observed that, because the position of most favorable leverage exists when the crank is at about right angles to its associated connecting rod, and this condition does not exist until after the sliding head has been moved an appreciable distance from any of its operative positions, said cranks produce an increasing mechanical advantage as the sliding head begins to move, as a result of which there will be a slow starting motion under a relatively large force to overcome the inertia of the sliding head and gradual increase in this force for accelerating said head, said force increasing until a maximum speed is reached, the force then decreasing as the sliding head is de-

celerated and brought to rest with the crank on dead center.

It is desirable that the alternate operations of the pistons 7 and 21 be automatically controlled so that each step of the head 4 will follow its preceding step at regular intervals, allowing only sufficient time to elapse between the movements for performing intervening operations of the press.

Any appropriate instrumentalities may be employed for this purpose, and to this end, as herein illustrated, the cylinder 8 is provided with a steam chest 25 connected by suitable ports 26 with opposite ends of said cylinder, said ports controlled by a reciprocatory distributing valve 27 for admitting steam to and exhausting it from the ends of said cylinder alternately at proper times. Herein the valve 27 is actuated by a cam 28 mounted upon the timing shaft A of the press, said timing shaft driven by any suitable source of power. As shown, the cam acts on a cam follower roller 30 carried by a lever 31, the latter at its lower end, as viewed in the drawings, being pivoted to any suitable stationary support, and at its upper end being connected by a link 32 with the lower end of a floating lever 33, to which latter the stem 34 for the valve 27 is attached. Cooperating with the cam 28 is an eccentric 35 which herein is mounted upon the shaft 14 to turn with the crank 13, said eccentric being connected by an eccentric rod 36, rocker arm 37, and link 38 with the upper end of the floating lever 33.

The piston 21 may be, and preferably is, controlled in a manner similar to that in which the piston 7 is controlled. As illustrated, the cylinder 22 has a steam chest 39 communicating through ports 40 with the interior of said cylinder, control of the steam to the ports 40 being effected by a reciprocatory distributing valve 41 connected by a valve stem 42 with a floating lever 43, the latter having connection at opposite ends respectively with a suitable timing cam 44 upon the shaft A and an eccentric 45 secured to said shaft 14. As shown, the cam 44 is operatively connected through a cam lever 46 and link 47 with the lower end of the floating lever 43, while the eccentric 45 is connected through an eccentric rod 48, rocker arm 49, and link 50 with the upper end of said floating lever, thus insuring the cooperative action of said cam and eccentric in operating the valve 41 alternately to admit steam to and exhaust it from opposite ends of the cylinder 22 at the proper times.

Herein, to supplement the action of the sliding valve 41 which, owing to its operative means, is not at all times in the proper position to relieve the pressure within the cylinder 22 when the piston thereof is idling, I provide an oscillatory bypass valve 51 in the under side of the cylinder 22 (see Figs. 3, 6 and 9). As shown, this valve has a passage 52 which is adapted to align with ports 53 and 54 leading respectively to the crank and head ends of the cylinder 22. An arm 55 upon the stem of said valve 52 is operatively connected by a link 56 with the lower end of the floating lever 43, the latter actuated by the cam 44. At the proper times in the operation of the press, the passage 52 will be moved to connect the ports 53 and 54 and permit fluid to pass freely from one end of the cylinder to the other, while at other times the valve will be closed to effect a cushioning of the piston 21 at one end or the other of the cylinder and aid in decelerating the sliding head and bringing it to rest.

In the operation of the press, assuming the parts are in the positions shown by Figs. 1, 2 and 3, the cam 28 on the timing shaft 29 will move the valve 27 to connect the crank end of the cylinder 8 to the steam chest 25, so as to admit steam to said end, and to connect the head end to the exhaust. As a consequence the piston 7 will move to the right. During this motion the eccentric 35, acting on the floating lever 33, will move the valve 27 to mid travel as the piston reaches the end of its stroke, causing compression of trapped residual steam or air in the head end of the cylinder 8, which compression acts to cushion the sliding head. During the major part of this stroke of the piston 7 the by-pass valve 51 of the cylinder 22 is open, so as not to interfere with the operation of the press. Just before the end of the stroke, the action of the eccentric 45 and cam 44 closes the by-pass valve, so as to aid in cushioning the sliding head, and, at the completion of the block pressing operation, the cam 44, acting upon the floating lever 43, moves the valve 41 to its position shown by Fig. 4, while maintaining said valve 51 closed. In the position of parts shown by Figs. 4, 5 and 6, the crank end of the cylinder 22 is connected to the steam chest, and the head end thereof to exhaust, and, as a consequence, the piston 22 is moved to the head end of its cylinder so as to move the sliding head into block ejecting position as shown by Fig. 9. In the positions of parts shown by Figs. 7, 8 and 9, the valve 27 admits steam to the crank end of the cylinder 8, and connects the head end thereof to exhaust, while the valve 41, at that time or shortly thereafter, admits steam to the head end of the cylinder 22, and connects the crank end thereof to exhaust, and, as a consequence, the sliding head is moved to the left, as viewed in the drawings, toward its mold filling position. During this last mentioned movement, the piston 7 makes two successive strokes, the valve 27 reversing when the piston reaches the head end of its cylinder so as to drive it back toward the crank end thereof. Steam is admitted to the cylinder 22 until it is well past mid stroke, and, as it approaches the crank end of its cylinder, the valves 27 and 41 will have been actuated to cause steam to be trapped and compressed in the crank ends of both cylinders so as to cushion the sliding head.

It will be understood that wide deviations may be made from the embodiment of the invention herein described without departing from the spirit of the invention.

I claim:

1. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, a crank means for reciprocating said part, a pair of fluid actuated pistons, separate crank means operatively connecting said pistons to said first mentioned crank means, said separate crank means collectively providing dead center positions for determining the ends of all the strokes of said part and most favorable leverage positions for accelerating and decelerating said part at the ends of all its strokes.

2. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, a crank means for reciprocating said part having dead center positions corresponding to the ends of the strokes of said part, a pair of fluid actuated pis-

tons, separate crank means operatively connecting said pistons to said first mentioned crank means, said separate crank means collectively providing dead center positions for determining the ends of all the strokes of said part and most favorable leverage positions for accelerating and decelerating said part at the ends of all its strokes.

3. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, oscillatory means immediately associated with said part for reciprocating it, a pair of fluid actuated pistons, separate crank means operatively connecting said pistons to said angularly moving means, said separate crank means collectively providing dead center positions for determining the ends of the strokes of said part and most favorable leverage positions for accelerating and decelerating said part at the ends of its strokes.

4. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, oscillatory means immediately associated with said part for reciprocating it having favorable leverage positions for moving said part at the ends of its strokes, a pair of fluid actuated pistons, separate crank means operatively connecting said pistons to said angularly moving means, said separate crank means collectively providing dead center positions for determining the ends of the strokes of said part and most favorable leverage positions for accelerating and decelerating said part at the ends of its strokes.

5. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, an oscillatory crank means for operating said part having dead center positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a second crank means operatively connecting said piston to said first mentioned crank means, said second crank means being in favorable leverage positions when said part is at the ends of its strokes.

6. Operating means for a heavy reciprocatory machine part having stationary operating positions at the ends of its stroke comprising, in combination, crank means for reciprocating said part, a pair of fluid actuated pistons one having a longer stroke than the other, separate crank means connecting said pistons to said first mentioned crank means, said crank means for the piston with the longer stroke providing dead center positions for determining the ends of the strokes of said part, and said crank means for the piston with the shorter stroke providing favorable leverage positions for accelerating and decelerating said part at the ends of its stroke.

7. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, a crank means for operating said part having dead center positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a second crank means operatively connecting said piston to said first mentioned crank means, said piston being at the ends of its strokes and said second crank means being in favorable leverage positions when said part is at the ends of its strokes.

8. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, a crank means for operating said part having dead center positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a second crank means operatively connecting said piston to said first mentioned crank means, said second crank means being in favorable leverage positions when said part is at the ends of its strokes, a second fluid actuated piston, a third crank means operatively connecting said second piston to said first mentioned crank means, said third crank means being in dead center positions when said part is at the ends of its strokes.

9. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it having favorable leverage positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a crank means operatively connecting said piston to said angularly moving means, said crank means being in favorable leverage positions when said part is at the ends of all its strokes.

10. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it having favorable leverage positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a crank means operatively connecting said piston to said angularly moving means, said piston being at the ends of its strokes and said crank means being in favorable leverage positions when said part is at the ends of its strokes.

11. Operating means for a heavy reciprocatory machine part having stationary operating positions for finite periods of time at the ends of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it having favorable leverage positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a crank means operatively connecting said piston to said angularly moving means, said crank means being in favorable leverage positions when said part is at the ends of its strokes, a second fluid actuated piston, a second crank means operatively connecting said second piston to said angularly moving means, said second crank means being in dead center positions when said part is at the ends of its strokes.

12. Operating means for a heavy reciprocatory machine part having a stationary operating position at an intermediate portion of one of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it, a fluid actuated piston, crank means operatively connecting the latter to said angularly moving means having a dead center position corresponding to said operating position of said part.

13. Operating means for a heavy reciprocatory machine part having a stationary operating position at an intermediate portion of one of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it, a fluid actuated piston, crank means operatively connecting the latter to said angularly moving means having a dead

center position corresponding to said operating position of said part, a second fluid actuated piston, and a second crank means connecting the latter to said angularly moving means, having a favorable leverage position corresponding to said operating position.

14. Operating means for a heavy reciprocatory machine part having stationary operating positions at an end of one of its strokes and at an intermediate portion of one of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it, a fluid actuated piston, crank means operatively connecting the latter to said angularly moving means having a dead center position corresponding to said operating position of said part, a second fluid actuated piston, and a second crank means connecting the latter to said angularly moving means having a dead center position corresponding to the operating position of said part at the end of its stroke.

15. Operating means for a heavy reciprocatory machine part having stationary operating positions at and between the ends of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it, a plurality of pistons, separate crank means connecting said pistons to said angularly moving means, said crank means collectively providing a dead center position for each operating position of said part.

16. Operating means for a heavy reciprocatory machine part having stationary operating positions at and between the ends of its strokes comprising, in combination, angularly moving means immediately associated with said part for reciprocating it, a plurality of pistons, separate crank means connecting said pistons to said angularly moving means, said crank means collectively providing a dead center position and a favorable leverage position for each operating position of said part.

17. Operating means for a heavy reciprocatory machine part having stationary operating positions at each end of its stroke and a stationary operating position during one of its strokes comprising, in combination, crank means for reciprocating said part having dead center positions corresponding to the ends of the strokes of said part, a fluid actuated piston, a second crank means operatively connecting said piston to said first mentioned crank means, said second crank means being in favorable force applying position when said piston and said part at the ends of their strokes and being in a dead center position when said part is at said operating position during one of its strokes, a second fluid actuated piston, a third crank means operatively connecting said second piston to said first mentioned crank means, said third crank means being in favorable force applying position when said part is at said operating position during one of its strokes and being in dead center positions with said second piston when said part is at the ends of its strokes.

ROBERT F. MORRISON.

CERTIFICATE OF CORRECTION.

Patent No. 1,975,369. October 2, 1934.

ROBERT F. MORRISON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 96, claim 17, after "part" insert the word are; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of October, A. D. 1934.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)