

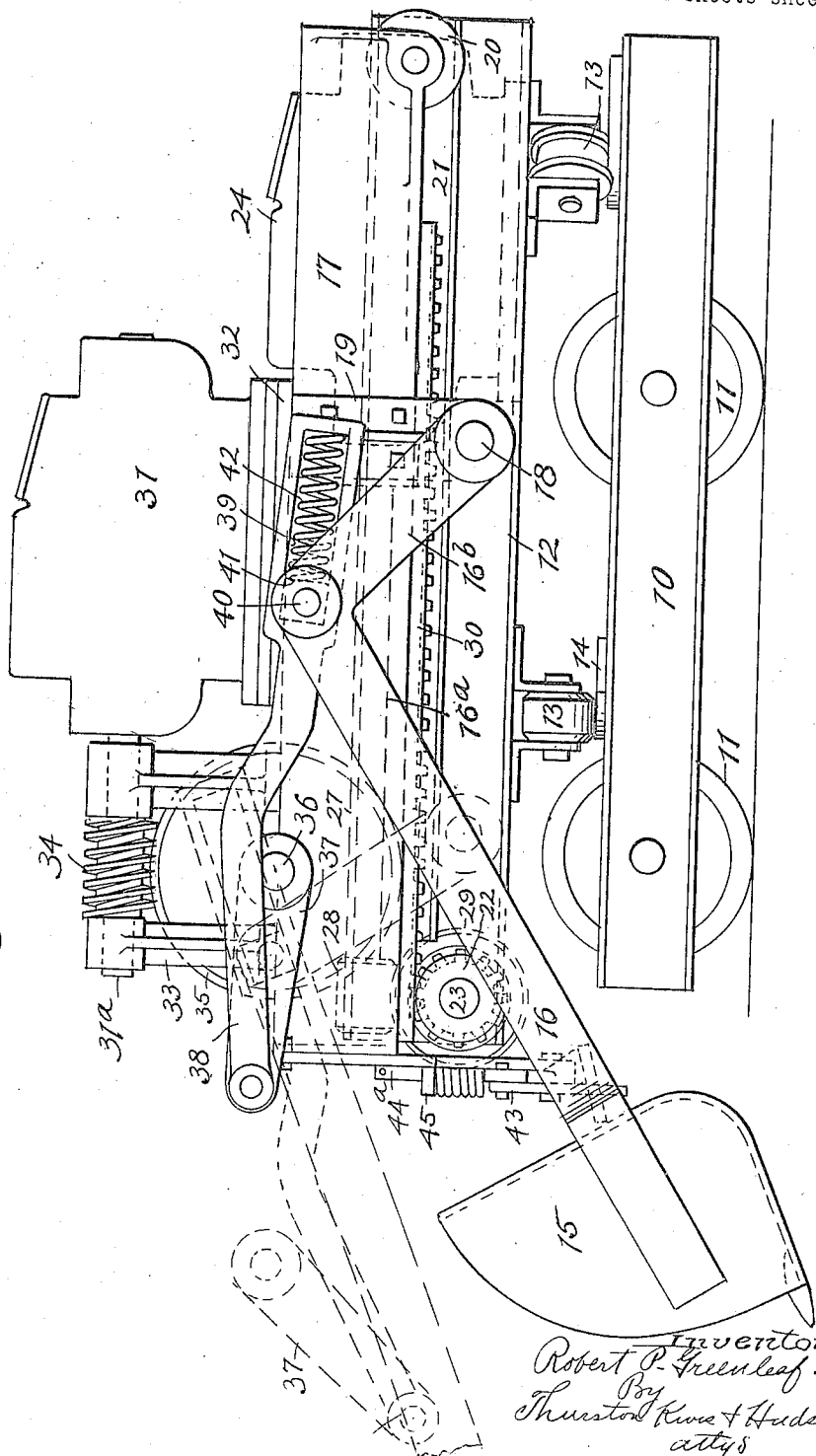
Apr. 10, 1923.

R. P. GREENLEAF
LOADING MACHINE

1,451,020

Original Filed July 17, 1919 4 sheets-sheet 1

Fig 1.



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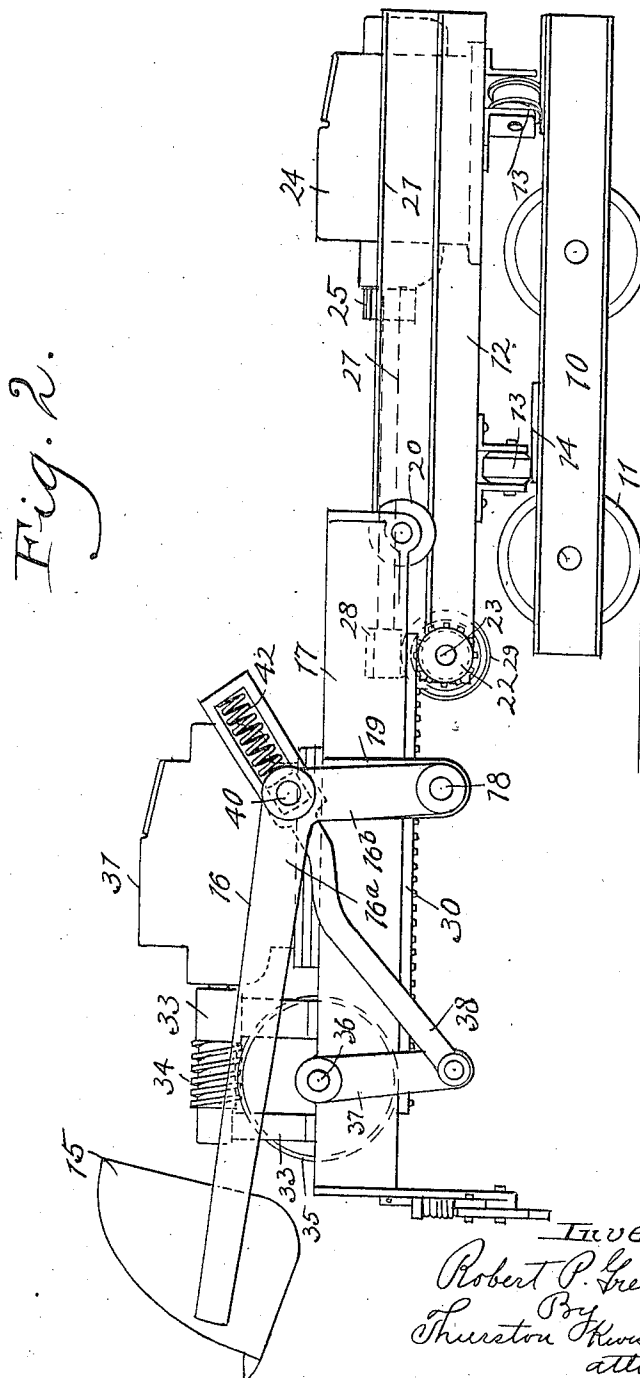
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4 sheets-sheet 2



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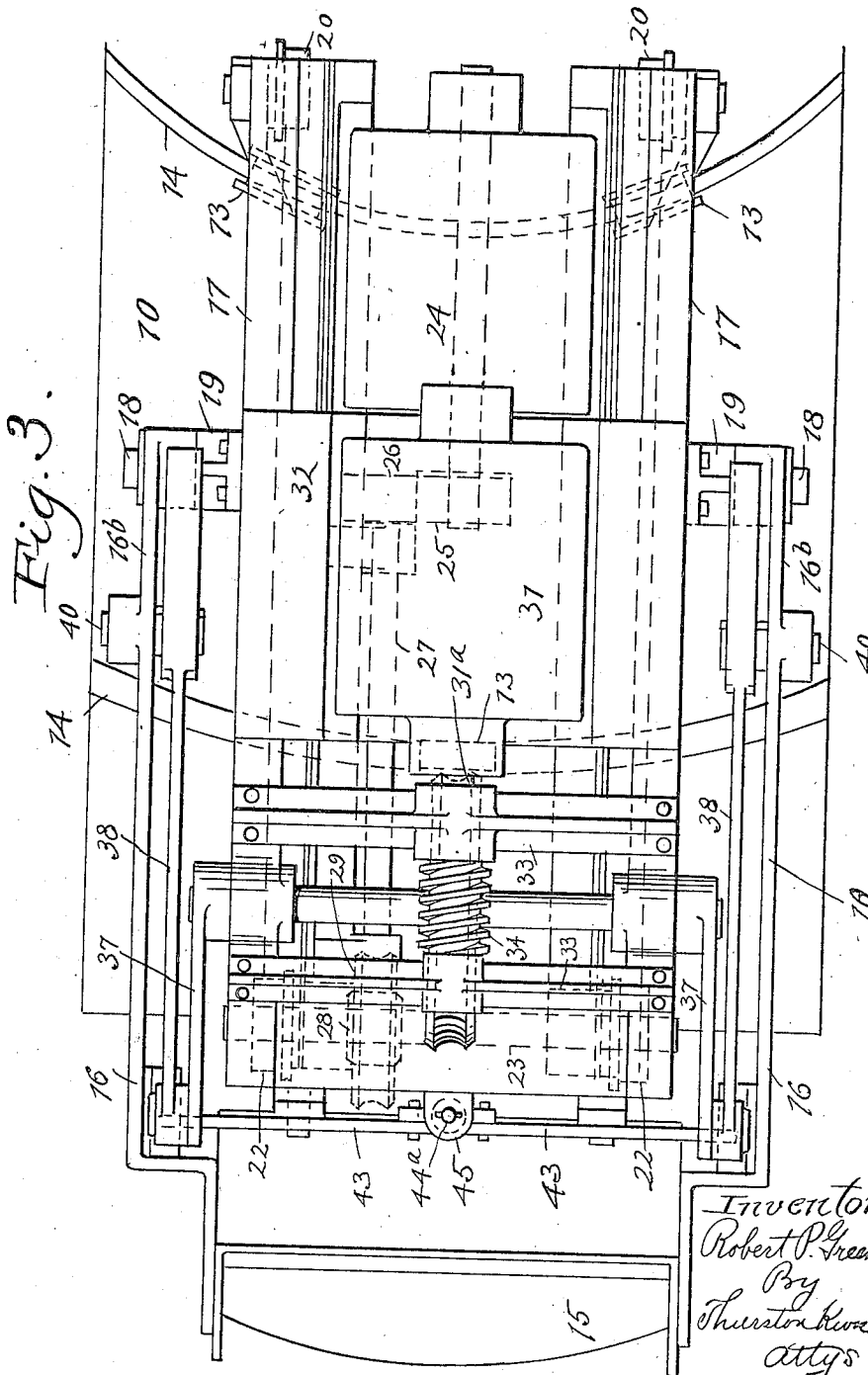
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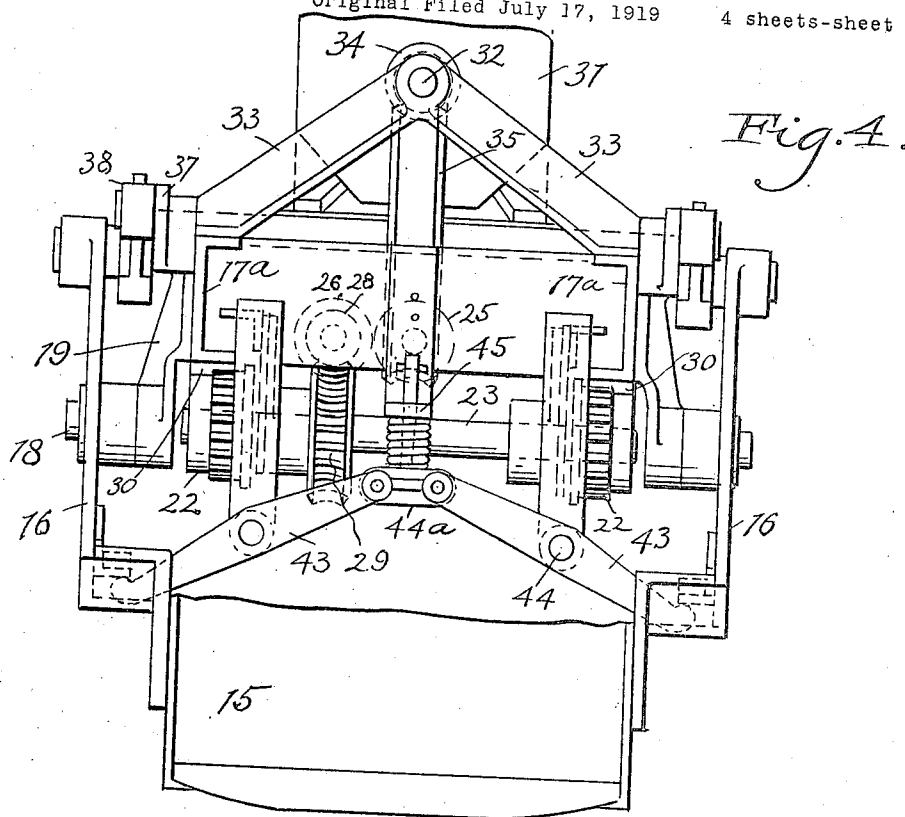
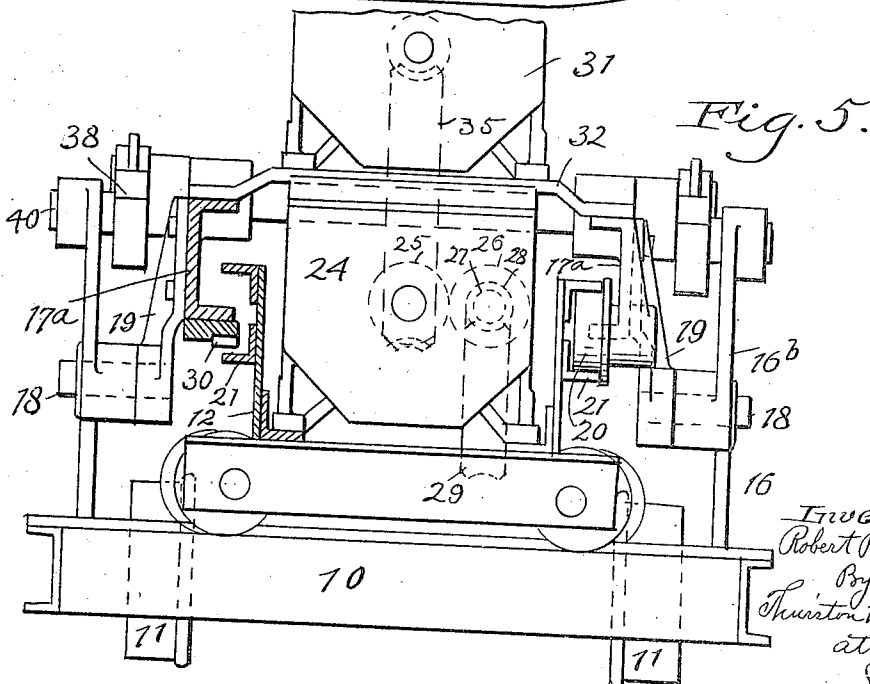
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4 sheets-sheet 4



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UNITED STATES PATENT OFFICE.

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LOADING MACHINE.

Application filed July 17, 1919, Serial No. 311,592. Renewed September 6, 1921. Serial No. 498,935.

To all whom it may concern:

Be it known that I, ROBERT P. GREENLEAF, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Loading Machines, of which the following is a full, clear, and exact description.

This invention relates to a loading machine of the type wherein material is transferred from in front of the machine to the rear thereof by means of a swinging shovel adapted to be thrust forward to receive a load, and then to be swung rearwardly to dumping position.

The principal object of the invention is to provide an efficient and practical machine, wherein the shovel is directly connected by swinging arms to a forwardly and rearwardly movable ram or equivalent reciprocating member, the machine having a moderate forward and rearward range of movement through the actuation of the reciprocating member, and a moderate height of swinging movement in passing over the machine. Further the invention aims to provide a machine of this character with shovel actuating mechanism which positively actuates the shovel at all parts of its cycle of movement, provision being made for adjustments necessary to meet various conditions such as varying depth of cut. Still further the invention aims to provide in a machine of this type, shovel actuating mechanism of such form that the torque or lifting moment exerted on the shovel as it is being turned or swung to dumping position is substantially proportional to the resistance to movement set up by the shovel, the turning effort or torque being greatest at and about the time the resistance to movement is greatest, due to the leverage through which the loaded shovel acts, and being gradually reduced as the leverage of the shovel is reduced while being swung over the machine to dumping position.

The invention may be briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings, Fig. 1 is a side view of the machine with

the ram retracted; Fig. 2 is a similar view with the ram extended and the shovel partly elevated; Fig. 3 is a top plan view of the machine with the ram retracted; Fig. 4 is a front view of the machine; and Fig. 5 is a view partly in rear elevation and partly in vertical section.

The machine as here shown, includes a sub-base in the form of a truck 10, having wheels 11, designed to run on a track which may be a mine track, the present machine being especially adapted for use in mines to scoop up material at the front of the machine and to load the same in mine cars run up to the rear of the machine. On this truck is mounted a superstructure including a frame or intermediate base 12, which in this instance is designed to be swung about a vertical axis to adapt the shovel of the machine to reach material at the sides as well as directly in front of the machine. To this end the frame 12 has wheels 13 which engage arc-shaped tracks 14 carried by the truck 10.

The material moving and conveying element is in the form of a shovel 15, open at the front and provided with a digging edge at its lower front part, which digging edge may be provided with teeth if desired. The shovel 15 is supported by, and direct connected by arms 16, to a forwardly and rearwardly movable member 17 in the form of a carriage or so-called ram, composed chiefly of two spaced parallel channel-shaped members 17^a, (see Figs. 4 and 5) suitably connected so that they will move back and forth in unison. The arms 16 which connect the shovel to this ram are in this instance in the form of bell-cranks, these arms having main portions 16^a which at their forward free ends are connected to the sides of the shovel, and having relatively short extensions 16^b which at their free ends are pivotally mounted on studs 18, at the lower ends of brackets 19, which extend upwardly to, and are secured to the channel-shaped side members of the ram 17.

The ram 17 is supported for reciprocating movement forwardly and rearwardly with respect to the frame 12, the supporting means consisting in this case of a pair of rear rollers 20, which are carried by the rear ends of the ram and travel along stationary outwardly facing channel-shaped guide-

ways 21, (see Fig. 5) supported in fixed position by the frame 12, and the supporting means further includes a pair of shrouded pinions 22 on which the ram runs, these shrouded pinions being secured to a cross-shaft 23, mounted in the front part of the frame 12. The ram may be actuated, i. e., reciprocated forwardly and rearwardly by various types or forms of motors. In this instance I show a rotary ram actuating motor 24, this motor being supported on the rear part of the frame 12. It is immaterial by what motive power this motor is actuated, but the motor here shown is designed to be an electric reversing motor.

The shaft of this motor has at its forward end, just beyond the motor housing, a pinion 25 (see Fig. 3) which drives a pinion 26, secured to a forwardly extending shaft 27 which is laterally displaced from the center line of the frame 12, this shaft having near its forward end a worm 28 which drives a worm-wheel 29 secured to the shaft 23 on which the shrouded pinions 22 already referred to are mounted. The rotation of the front shaft 23 carrying the shrouded pinions 22, transmits reciprocating movement to the ram through two racks 30 which are secured to the bottom of the side members 17^a of the ram. Side portions of these racks or rack bars ride over the shrouded portions of the pinions 22, whereby the front part of the ram is supported more or less independently of the racks as is obvious from a consideration of Fig. 4 which shows the ends of the rack 30 and their relation to the toothed and plain portions of the shrouded pinions 22. Thus it will be seen that when the motor is actuated, the ram as a whole, including all parts supported by it, is moved forwardly or rearwardly, depending upon the direction in which the motor 24 is actuated.

The ram carries in addition to the shovel, a motor actuated mechanism for turning or rotating the shovel separately or simultaneously with the reciprocation thereof, and this mechanism constitutes an important part of the improvement. This mechanism includes a motor which moves with the ram, a part which is moved back and forth either with a straight reciprocating movement or a rotary movement, and an arm or pair of arms which transmit movement from the forwardly and rearwardly movable part to the shovel supporting and actuating arms. This mechanism may assume different forms, and the motor for actuating it may be of any suitable form or type, the rotary type of motor being herein illustrated at 31. This motor is supported above and on the ram through the medium of a base 32 secured to the side members of the ram, and the motor shaft 31^a which projects forwardly from the motor housing is sup-

ported from and above the front part of the ram by bearings having diverging legs 33 which extend to and are secured to the side members of the ram. The motor shaft 31^a in this instance is provided with a worm 34, which drives a worm-wheel 35 secured to a shaft 36 rotatably supported at the front part of the ram. At the ends of this shaft are a pair of cranks 37, each having its plane of rotation just outside of the adjacent side member of the ram. It is the horizontal component of the rotary movements of these cranks which is effective for swinging the shovel and the shovel supporting arms 16 back and forth over the machine through devices which positively actuate the shovel supporting arms as they swing upwardly and rearwardly, or forwardly and downwardly. In this instance the free ends of these cranks are connected by links or arms 38 to the shovel supporting and actuating arms 16, the connections of the links being made to the arms at the junction of the portions 16^a and 16^b thereof. The rear portions of the links 38 have slots 39, the slotted portions of the links projecting beyond the points of attachment to the arms 16. The pins 40 connecting the arms and the links have squared portions or members 41, which may slide in the slots 39, but these members are pressed forwardly and held against the forward ends of the slots by a stiff coil spring 42, seated in the slots of the links as shown in Fig. 1.

As the cranks are rotated from the position shown in Fig. 1, to a position 180° from that shown, they swing the shovel from in front of the machine upwardly and rearwardly to dumping position at the rear of the latter, and as they return to the positions shown in Fig. 1, the shovel is positively returned to digging position. As the loaded shovel is swung from its lowermost position upwardly in front of the machine, the leverage through which the loaded shovel acts is at a maximum, but at this time the links are at right angles, or substantially at right angles to the short portions 16^b of the shovel supporting arms 16, and hence the conditions are such that during this time maximum turning effort or torque is exerted on the rotating arms 16, and as the shovel swings toward the vertical position the leverage through which the shovel acts is gradually reduced, but as this takes place the effective leverage through which the links transmit turning effort to the arms is gradually reduced, the torque or turning effort increasing and decreasing substantially as the effective leverage of the shovel increases and decreases. This is a condition that is highly desirable in a machine of this kind to obtain efficiency and smoothness of operation.

The cranks may be rotated, and prefer-

ably are rotated in the same direction to swing the shovel and shovel arms both rearwardly and forwardly, although by employing a reversing motor the cranks could be swung in one direction to bring the shovel to dumping position, and the cranks could be swung in the opposite direction to return the shovel to digging position. The continuous movement is preferable since the shovel could be started on its return movement at the end of the rearward swinging movement without either stopping or reversing the motor.

At the front of the ram I provide stops 43, which the shovel arms 16 are adapted to engage to limit the downward movement of the shovel and to determine the digging depth. These stops 43 are in the form of arms pivoted intermediate their ends at 44, the outer free ends of these arms being adapted to be engaged by the shovel arms 16. The inner ends of the stop arms 43 are connected to a spring restrained plunger 44^a carried by a bracket 45 adjustably secured to the front cross member of the ram. By adjusting the position of the bracket 45, the downward movement of the shovel can be terminated at any desired position, depending upon the depth which it is desired that the shovel dig. As the shovel arms on swinging downwardly engage the outer free ends of the arms 43, the spring surrounding the stem of the plunger 44 yields so as to absorb the shock incident to the stopping of the swinging movement. When the shovel reaches digging position, the motor 31 is usually stopped. If the stop arms are so positioned that the downward movement of the shovel is terminated before the crank arms reach the horizontal position shown in Fig. 1, it is obvious that when the motor is started and the arms are swung through the horizontal or dead center position, since the arms 16 are restrained against further downward movement, there is a sliding action between the links and the pins 40 which connect the links to the arms, the springs 43 then being slightly compressed.

It will be apparent that both the reciprocating and the swinging movements may be imparted to the shovel simultaneously or successively. In filling the shovel simply the ram actuating motor may be operated, or if desired, both motors may be operated at the same time, in which event the shovel will have a combined forward and upward swinging movement, and in moving the shovel to dumping position the ram may be first retracted and then the shovel may be swung over the machine, or both movements may be imparted simultaneously. The operation of the machine is thought to be obvious without further explanation. It will be apparent that the machine embodies to a high degree the features of efficiency and

simplicity, the efficiency being due in large part to the fact that the torque imparted to the shovel supporting arms increases and decreases substantially proportionately to the leverage through which the shovel is being swung, while the principal factor in the attainment of the advantage of the simplicity resides in the fact that the shovel is direct connected to the ram, and not to a part which moves forwardly and rearwardly with respect thereto, and also to the fact that the turning movement is imparted to the shovel arms through a straight link connection through the motor operated actuating parts, in this instance the cranks, which move forwardly and rearwardly with reference to the ram.

Another feature to be noted is the fact that gravity is not relied on to return the parts to normal position, but the shovel and its supporting arms are positively actuated at all times while being swung from either extreme position to the other. Furthermore the construction I have herein illustrated is conducive to smoothness of operation not only because of the graduated or varying character of the turning effort exerted on the shovel supporting arms, but also to the fact that the actuating mechanism is such that it is not liable to get out of order or to be clogged or choked by dirt or other foreign matter which may drop from the shovel.

While I have shown only one embodiment of my invention it is obvious that certain changes may be made in details of the parts, such as the type and manner of connecting the motors to the parts which they actuate, straight line or reciprocating motors being well adapted for use in the machine, and I therefore aim in my claims to cover all modifications which do not involve a departure from the spirit and scope of my invention in its broadest aspects.

Having described my invention, I claim:

1. In a loading machine, a frame, a shovel actuating member supported by the frame and movable forwardly and rearwardly, a shovel adapted to be filled at the front of the machine and to be swung upwardly and rearwardly over the same to dumping position, an arm connecting the shovel to said member, a link connected to said arm for swinging the same relative to said member, and means for actuating the link.

2. In a loading machine of the type having a shovel adapted to be filled with material at the front of the machine and to be swung over the machine to dumping position, a frame, a motor operated ram movable forwardly and rearwardly with respect to the frame, shovel supporting arms connecting the shovel and the ram, actuating links connected to the arms to turn the same relative to the ram, and means carried by

the ram for moving the links forwardly and rearwardly.

3. In a loading machine of the type having a shovel adapted to be filled with material at the front of the machine and to be swung over the machine to dumping position, a frame, a reciprocating ram movable forwardly and rearwardly with respect to the frame, a shovel, arms connecting the shovel to the ram, links for turning the arms connected to the latter, and means for actuating the links to impart turning movement to the arms, the connections between the links and the arms being at points displaced from a straight line extending between the points of attachment of the arms to the ram and shovel.

4. In a loading machine of the type having a shovel adapted to be filled with material at the front of the machine and to be swung over the machine to dumping position, a frame, a ram movable forwardly and rearwardly with respect to the frame, a shovel, arms pivoted to the ram and connected to the shovel, links connected to the arms, means for actuating the links to swing the arms on their pivoted points, said arms having angularly disposed portions, and the links being connected to the arms between their ends.

5. In a loading machine of the type having a shovel adapted to be filled with material at the front of the machine and to be swung over the machine to dumping position, a frame, a ram movable forwardly and rearwardly with respect to the frame, a shovel, arms pivoted to the ram and connected to the shovel, links connected to the arms, means for actuating the links to swing the arms on their pivoted points, said arms being substantially L-shaped, and the links being connected thereto between the ends of the latter.

6. In a loading machine of the type having a shovel adapted to be filled with material at the front of the machine and to be swung over the machine to dumping position, a frame, a ram movable forwardly and rearwardly with respect to the frame, a shovel, arms pivoted to the ram and connected to the shovel, links connected to the arms, means for actuating the links to swing the arms on their pivoted points, said arms being composed of angularly disposed portions, and the links being connected to the

arms at substantially the junction of said portions.

7. In a loading machine, a frame, a carriage movable back and forth along the frame, a shovel, a shovel supporting arm pivotally connected to the carriage and attached to the shovel, and means carried by the carriage for moving the shovel back and forth from filling to dumping position and comprising an actuating arm connected to the shovel supporting arm.

8. In a loading machine, a reciprocable carriage, a shovel supporting arm pivotally connected to the carriage, a shovel attached to the arm, means for actuating the carriage to impart a filling stroke to the shovel, and means for moving the shovel to dumping position and returning the shovel to filling position comprising a rotatable crank arm having a link connection with said shovel supporting arm.

9. In a loading machine, a carriage, a substantially L-shaped shovel supporting arm pivotally connected to the carriage at one end, a shovel attached to the free end of the arm, a link attached to the L-shaped shovel supporting arm substantially at the bend thereof, and means for actuating said link to swing said arm about its pivot.

10. In a loading machine, a carriage, a shovel, a shovel supporting arm pivoted at one end to the carriage and attached at its free end to the shovel, said arm being movable about its pivot to carry the shovel from filling to dumping position and having a part thereof at all times above the pivot, an actuating arm pivoted on the carriage, and a link connecting said actuating arm to the part of the shovel supporting arm above the pivot.

11. In a loading machine, a carriage, means for moving the carriage back and forth, a shovel supporting arm pivoted to the carriage, a shovel connected to the free end of the arm and adapted to be swung over the carriage to dumping position, and actuating means on the carriage for swinging the shovel supporting arm about its pivot, said actuating means having a yieldable connection with said shovel supporting arm.

In testimony whereof, I hereunto affix my signature.

ROBERT P. GREENLEAF.