F. H. ARMSTRONG.

SHOVELING MACHINE.

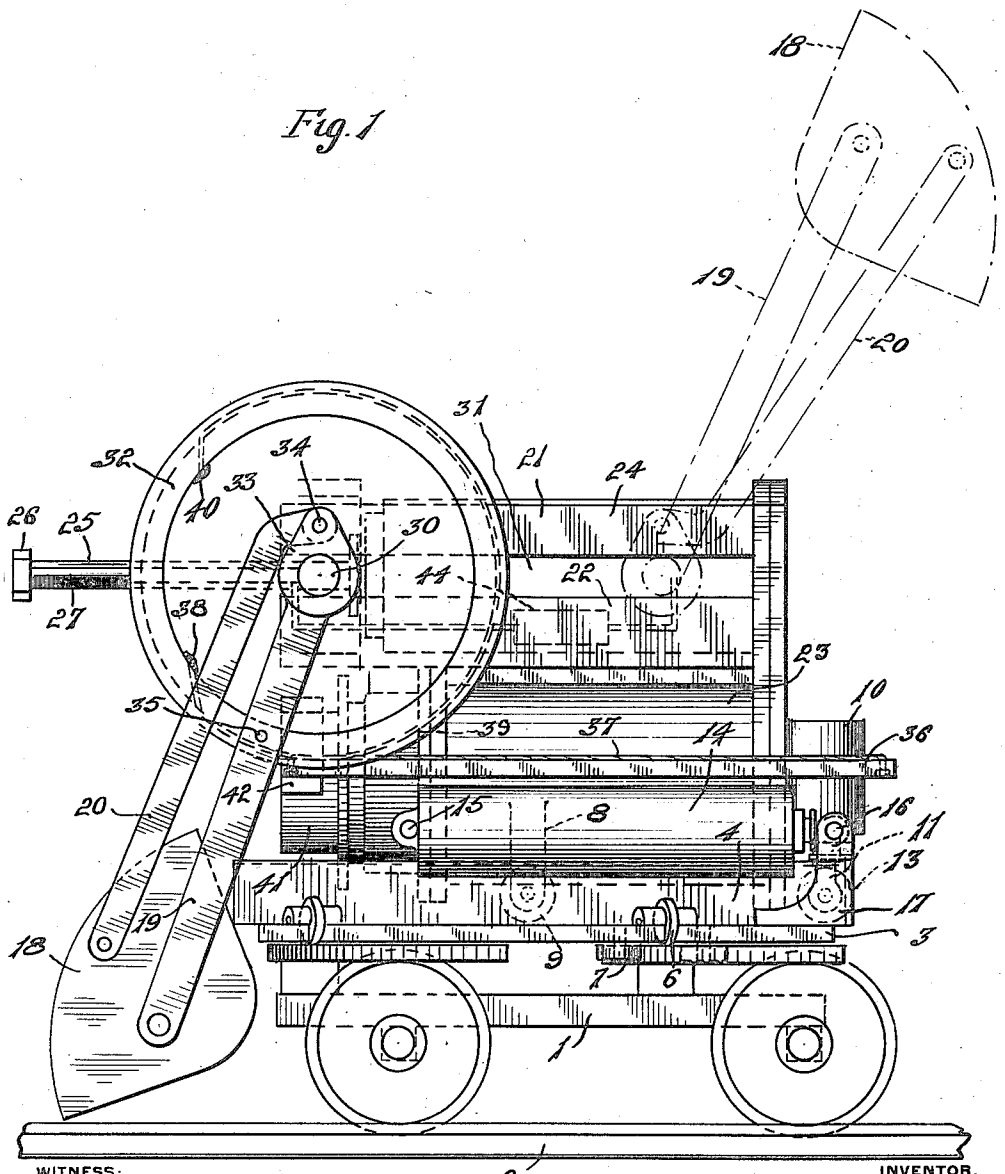
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1,234,115.

Patented July 24, 1917.

4 SHEETS—SHEET 1.

Fig. 1



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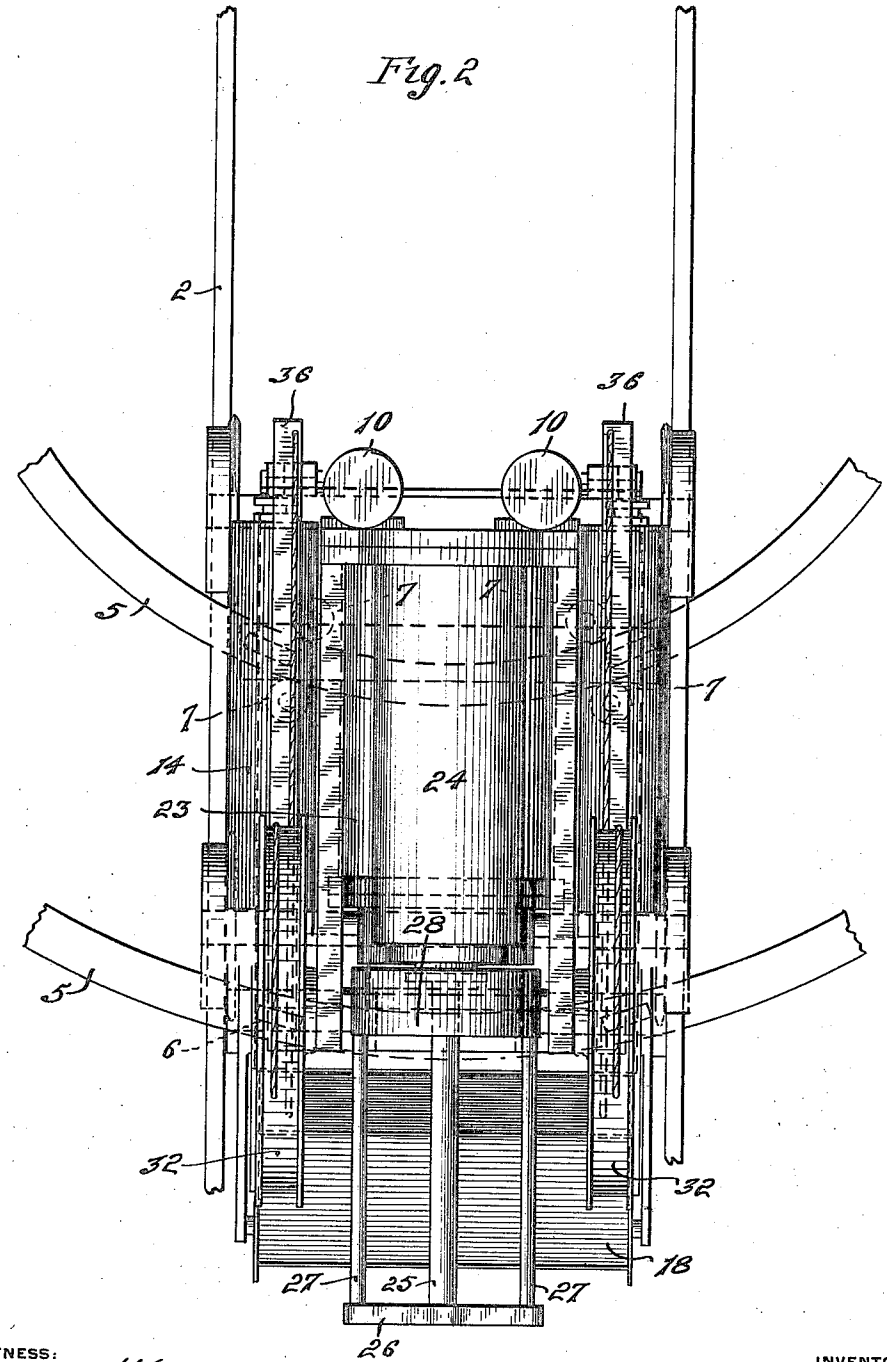
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4 SHEETS—SHEET 2.

Fig. 2



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4 SHEETS—SHEET 3.

Fig. 3

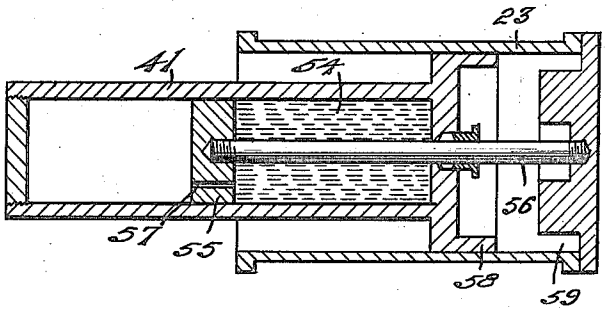
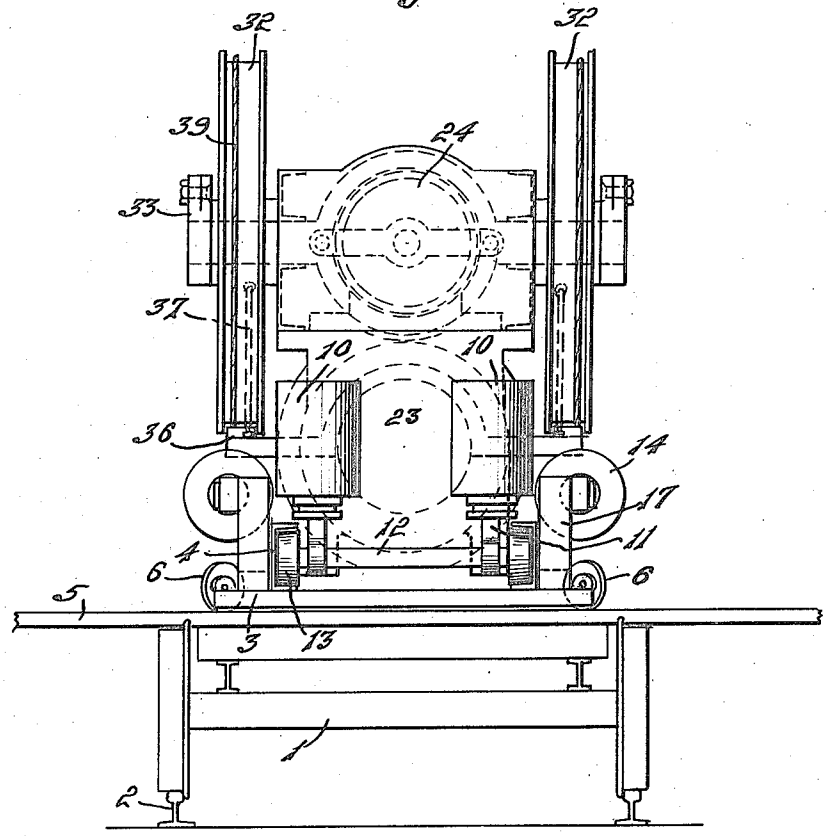


Fig. 4



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4 SHEETS—SHEET 4.

Fig. 5

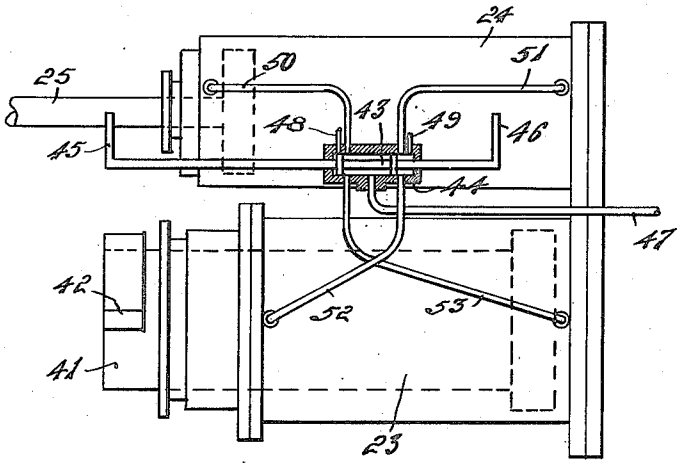
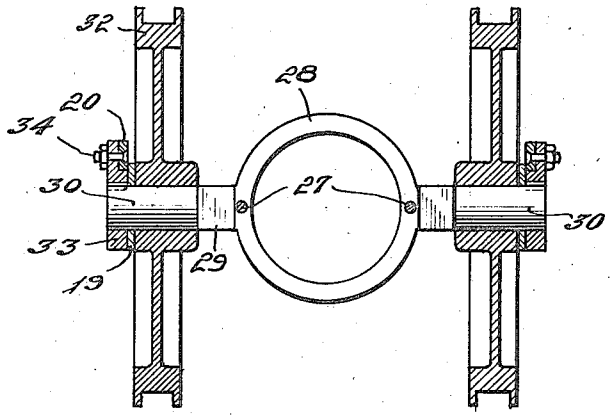


Fig. 6



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UNITED STATES PATENT OFFICE.

FRANK H. ARMSTRONG, OF VULCAN, MICHIGAN.

SHOVELING-MACHINE.

1,234,115. Specification of Letters Patent. Patented July 24, 1917.

Application filed October 21, 1916. Serial No. 126,860.

To all whom it may concern:

Be it known that I, FRANK H. ARMSTRONG, a citizen of the United States, residing at Vulcan, in the county of Dickinson and State of Michigan, have invented certain new and useful Improvements in Shoveling-Machines, of which the following is a specification.

The invention relates to shoveling machines, and is particularly designed for use in mines where it is desired to shovel up loose material or muck and transfer it to a car. The invention has for its primary objects, the provision of an improved power shoveling machine, (1) which will work in a restricted space and which itself requires a minimum amount of space to permit its introduction into a mine; (2) which is light in weight and of simple construction; (3) which will always discharge into the car regardless of the angle of the machine with respect to the car; (4) in which provision is made for clearance by the shovel of the pile of material being shoveled on the return of the shovel to its starting position; (5) in which the elevation of the forward edge of the dipper at the beginning of the shoveling stroke may be easily and conveniently adjusted to suit conditions; (6) in which the interference with the return of the shovel to its initial position by large lumps of material is avoided; and (7) in which the operation is in a large measure automatic, so that a single operator can easily attend to the manipulation of the machine. Other objects and advantages incident to the small size of the apparatus as compared with its capacity, its simplicity, cheapness and lack of complicated parts liable to get out of order will be apparent to those skilled in the art. One embodiment of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of the machine, the shovel being shown in starting position in full lines and in discharge position in dotted lines; Fig. 2 is a plan view of the machine; Fig. 3 is a detail section through the large cylinder and piston; Fig. 4 is a rear elevation of the machine; Fig. 5 is a diagrammatic view showing the valve arrangement and piping for the two cylinders; and Fig. 6 is a vertical section taken through the cross-head of the apparatus.

The apparatus is mounted upon a truck 1 resting upon a track 2, and means (not shown) are provided for clamping the truck to the rails during the operation of the shovel. Mounted above the truck is a framework including a base plate 3 and a pair of channel irons 4 (Fig. 4). The truck is provided with curved track members 5 (Fig. 2) and the framework is provided with sets of rollers for coöperating with these track members, so that the framework and the parts carried thereby may swing laterally in a curved path. The framework is provided with four rollers 6 which rest on the top of the rails 5, and four rollers 7 which engage the edges of the rear rail (see Figs. 1 and 2). The framework is in this manner supported and guided on rollers in such manner that it can be swung back and forth as desired depending upon the location of the material which is to be shoveled.

Mounted upon the framework is what may be termed the body portion of the machine, such body portion comprising the various operating cylinders and the mechanism for actuating the shovel. This body portion is provided on each side with a bracket 8 carrying a wheel 9 fitting between the flanges of the channel irons 4. The body portion also carries a pair of vertical cylinders 10 having piston rods 11 with their ends formed so as to receive an axle 12 (Fig. 4), and this axle carries a second pair of wheels 13 also fitting inside the flanges of the channels 4. In this manner the body portion comprising the main part of the machine is mounted for movement longitudinally of the framework and of the truck, the wheels 9 and 13 riding in the channels 4 which act as a track. This arrangement involving the use of the cylinders 10 also provides for giving the body portion a tilting movement about the wheels 9 as an axis. That is, the front end of the machine may be tilted up and down by actuating the cylinders 10, the body portion pivoting at such time about the wheels 9. Power means are provided for giving the body portion its back and forth movement in the form of a pair of horizontal cylinders 14, such cylinders being pivoted to the body portion, as indicated at 15, and having their piston rods pivoted at 16 to brackets 17 secured to the framework. The cylinders 14 thus provide for moving the body portion longitudinally of the framework while the cylinders 10 provide for tilting or oscillating the body portion with respect to the framework.

The digging or shoveling is accomplished by means of a shovel 18 operated by two pairs of arms 19 and 20, the shovel being adapted to be moved from the position illustrated in full lines at which time the digging operation is just started to the position indicated in dotted lines, at which time the shovel is discharging to a car (not shown) at the rear of the machine, the shovel digging from one side and discharging from the other. In the movement from the position of full lines to that of dotted lines the arms or levers 19 provide the power for moving the shovel, while the arms 20 perform the function of tilting the shovel so that it may be at the proper angle when in both extreme positions. The upper ends of the arms are secured to a cross-head which moves back and forth between the guides 21 and 22, such cross-head being governed by the operating cylinders, as hereinafter set forth.

The operating means for the shovel comprises two cylinders, the lower of which 23 may be termed the main cylinder, and the upper of which 24 may be termed the secondary cylinder. The secondary cylinder is provided with a forwardly projecting piston rod 25 (Figs. 1 and 2) which rod carries at its forward end a cross-bar 26. This cross-bar is provided with two rearwardly extending rods 27 which rods are secured in the circular portion 28 (Fig. 6) of the cross-head, this portion 28 being made in this form so as to encircle the secondary cylinder when the cross-head is moved to its extreme rear position, as indicated in part in dotted lines in Fig. 1. The circular portion 28 of the cross-head is provided with lateral extensions having their inner portions 29 square and their outer portions 30 circular in cross-section. The portions 29 ride in the slots 31 between the guides 21 and 22 (Fig. 1).

Mounted rotatably upon the extensions 30 are the wheels 32 and the upper ends of the operating levers 19 (Fig. 6), while the extreme ends of such extensions 30 carry the crank arms 33 keyed thereto, to which the upper ends of the tilting levers 20 are pivoted at 34. The levers 19 are secured to the rims of the wheels 32 by means of the pins 35 (Fig. 1) so that the rotation of the wheels causes the swinging of the levers 19 about the extensions 30 of the cross-head, as an axis. The rotation of the wheels 32 is accomplished by means of a pair of bars 36, one on each side of the machine, guided for longitudinal movement on the body portion, and each provided with a pair of ropes engaging the wheel. The first rope 37 (Fig. 1) is secured to the right-hand end of the bar, extends along the groove in the wheel 32, passing through such rim and being secured at 38. The other rope 39, shown in dotted lines on Fig. 1, is secured to the left-hand end of the bar 36, and passes in a counter-clockwise direction around the rim of the wheel, extending through such rim and being secured at 40. It will be seen that when the bar 36 is moved to the left the wheel 32 will be rotated in a clockwise direction by the rope 39, and that when the bar is moved to the right the wheel will be rotated in a counter-clockwise direction by the rope 37. Also that when the bar 36 is held against movement in either direction and the axle of the wheel is moved to the right, the wheel will be rotated by the rope 39 in a clockwise direction, such movement of the wheel being reversed when the axle is moved to the left. The main and secondary cylinders are so arranged as to give the bars 36 and the axle of the wheels 32 the movement necessary to cause the rotation of the wheels in such way as to swing the levers 19 and move the shovel from starting position to discharge position and back again.

The first movement of the shovel from the position shown in full lines in Fig. 1, is accomplished by means of the piston 41 of the main cylinder 23. This piston is provided at its front end (Fig. 1) with a yoke 42 having laterally extending ends to which the forward ends of the bars 36 are secured, so that the forward movement of the piston 41 causes a forward movement of the bars 36. The forward movement of the bars 36 places tension upon the ropes 39 causing the wheels 32 to rotate in a clockwise direction, which movement swings the levers 19 and the shovel carried thereby forward. This forward movement of the bars continues until the levers 19 about pass the horizontal, at which time the piston 41 arrives at the end of its stroke. The piston in the secondary cylinder 24 then moves to the rear causing the rearward movement of the cross-head and the wheels 32. The bars 36 are at this time maintained in their forward position so that the rearward movement of the wheels 32 causes such wheels to rotate still further in a clockwise direction, swinging the levers 19 and the shovel to the position indicated in dotted lines. The cross-head and its extensions 30 at this time occupy the position at the right-hand end of the guideway 31. The action of the pistons of the two operating cylinders is reversed on the return movement of the shovel, such pistons acting simultaneously to move the bars 36 to the right and the cross-head to the left, the parts finally arriving at the position indicated in full lines in Fig. 1.

In order to make the operation of the two pistons in a measure automatic, the valve and piping arrangement, illustrated diagrammatically in Fig. 5, is preferably employed, the valve 43 working in a casing 44 and being operated by the stem having the

upturned ends 45 and 46 adapted to be struck by the cross-head of the secondary cylinder, which moves back and forth between the ends 45 and 46. 47 is the pipe for supplying air under pressure; 48 and 49 are exhaust pipes; and 50, 51, 52 and 53 are supply pipes leading to the ends of the two cylinders. When the parts are in the position shown, pressure is being admitted to the rear end of the main cylinder and the forward end of the secondary cylinder, and the pipes 51 and 52 leading from the other ends of these cylinders are open to the exhaust 49, the shovel approaching its right-hand position at such time. The cross-head now reaches its extreme right-hand (discharge) position striking the end 46 and shifting the valve to the right. This movement of the valve connects the pipe 47 with the pipes 51 and 52, cuts off the connection with the pipes 50 and 53, and places such pipes 50 and 53 in communication with the exhaust 48 so that the piston in the upper cylinder is moved to the left and the piston in the lower cylinder is moved to the right, bringing the parts to the position shown in Fig. 1. The cross-head then strikes the end 45 moving the valve to the position shown in Fig. 5. At this time fluid pressure is applied to the left of the secondary piston and to the right of the main piston, but only the main piston moves at this time, since the resistance of the shovel to passage through the pile of material prevents the movement of the secondary piston, this piston being very much smaller than the main piston. As soon as the shovel clears the material the secondary piston moves to the right. The foregoing series of movements whereby the secondary piston does not move during the filling of the shoveling is advantageous since, by reason of this action, the cross-head is maintained in its forward position and the shovel moves through the material further to the left than would be the case if the cross-head started its withdrawing movement to the right as soon as the shovel started filling. On the return movement of the shovel the two pistons act simultaneously and as a result the shovel moves back to its starting position on an arc whose lower portion is further to the right than the corresponding portion of the arc of ascent. This is advantageous since it permits the shovel, on its downward movement, to clear the pile of material and there is no tendency to drag the material beneath the shovel and thus interfere with its downward movement.

The main cylinder and piston are preferably constructed as illustrated in Fig. 3. The piston 41 is hollow and provided with a body of liquid 54 and carries the piston 55. This piston is connected to the rear head of the cylinder by means of the rod 56, and is provided with a relatively small passage 57 whereby communication is established between its two sides. This arrangement serves to avoid a sudden forward jerk of the piston just as the shovel leaves the material and the resistance to filling is removed. The resistance to the passage of the liquid through the opening 57 prevents any sudden speeding up of the piston when the resistance is removed. The piston is preferably filled about half full of oil as this permits the starting of the digging stroke without any resistance due to the oil and still checks the speed at the latter part of the stroke. In order to cushion the piston 51 on its rearward stroke a flange 58 is provided adapted to fit into the annular recess 59, thus providing a yielding check.

The parts are preferably so arranged that when the shovel is in starting position the digging side of the shovel is inclined, as illustrated in Fig. 1. Interference to the movement of the shovel to the position illustrated is thus reduced to a minimum, since blocks or lumps of material to the right of the forward edge of the shovel will not prevent its movement to this position, such as would be the case if the lower side of the shovel were horizontal when in its starting position. The height of the digging edge of the shovel may be regulated and adjusted by means of the cylinders 10 which tilt the body portion of the machine around the wheels 9. The shovel can thus be started at various levels depending upon whether it is working over the rails or between them and upon the depth to which it is desired to dig.

The filling movement of the shovel is also facilitated by reason of mounting the body portion so that it may be moved back and forth by means of the cylinders 14. By this arrangement the shovel 18 can be moved ahead in a horizontal direction a considerable distance before the operating cylinders 23 and 24 come into play. Furthermore, on the return stroke of the shovel the body portion may be moved to the rear by the cylinders 14, thus providing still greater clearance between the shovel and the pile of material. This feature would of course have still greater utility in a construction in which the return path of the shovel was coincident with that of the filling operation. The operation of the valve 43 may be modified to suit requirements. For instance, such valve may be operated manually instead of automatically which operation is sometimes advisable for securing the movement of the valve to the left as this permits more time for the operation of the cylinders 14 before the digging operation commences, the valve being moved to the left after the cylinders 14 have moved the machine to the left. My invention contemplates the operating of the

controlling valves throughout to suit requirements. The rope connections for securing relative movement between the bars 36 and wheels 32 is the preferred means because of its simplicity and lack of interference by dirt, but other means might be used at this point, if desired.

The arrangement illustrated in Fig. 2 involving the curved tracks, permits the framework to be shifted on a relatively large arc, the center of such arc lying somewhere beneath the car which is being filled by the machine. As a result the shovel will always discharge into the car regardless of the shifting of the machine upon the tracks. This would not be the case if the center of adjustment were located on the truck itself, in which case the machine would swing on a sharp arc and in its extreme positions of adjustment would be inclined to discharge part of the material outside of the car.

What I claim is:

1. In combination in a shoveling machine, a shovel having side walls and also opposite inclined digging and discharge walls, a support movable back and forth on the machine in the plane of operation of the shovel, a pair of substantially parallel arms pivoted at their outer ends to the side of the shovel at separated points on such side and pivoted at their inner ends to said support, and means for swinging one of the arms forwardly and upwardly about its pivotal connection with said support and for moving said support to the rear, whereby the shovel moves forwardly and upwardly cutting into the material to be shoveled with its digging wall and is then carried bodily to the rear over the machine and tilted so as to discharge from its discharge wall to the rear of the machine.

2. In combination in a shoveling machine, a shovel having opposing digging and discharge walls, and side walls, a support on the machine movable back and forth in the plane of operation of the shovel, a pair of substantially parallel operating arms pivoted to each side of the shovel and to the support, and means for swinging the arms forwardly and upwardly about their pivotal connections with the support and for moving the support to the rear, whereby the shovel moves forwardly and upwardly cutting into the material to be shoveled with its digging wall and is then carried bodily to the rear over the machine and tilted so as to discharge from its discharge wall to the rear of the machine.

3. In combination in a shoveling machine, a shovel having a digging wall and an opposing discharge wall from which to discharge when the shovel is tilted to the rear, a support mounted for movement back and forth on the machine in the plane of operation of the shovel, operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, means for tilting the shovel about its pivotal connection with the arms and means for swinging the arms forwardly and upwardly about their pivotal connections with the support to substantially an upright position and for moving the support to the rear, whereby the shovel moves forwardly and upwardly cutting into the material to be shoveled with its digging wall and is then carried bodily to the rear over the machine and tilted so as to discharge from its discharge wall to the rear of the machine.

4. In combination in a shoveling machine, a shovel having a digging wall and an opposing discharge wall from which to discharge when the shovel is tilted to the rear, a support mounted for movement back and forth on the machine in the plane of operation of the shovel, operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, means for tilting the shovel about its pivotal connection with the arms, means for swinging the arms forwardly and upwardly about their pivotal connections with the support whereby the digging wall of the shovel is carried through the material to be shoveled and carried upwardly, and means for moving the support to the rear and causing the arms to continue their swinging movement about the support upward and to the rear whereby the shovel is carried bodily over the machine and the support and caused to discharge from its discharge wall to the rear of the machine.

5. In combination in a shoveling machine, a shovel having digging and discharge walls, a support mounted for movement back and forth on the machine in the plane of operation of the shovel, main operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, a tilting arm also pivoted to the shovel and to said support and adapted to cause the shovel to tilt forward as the main operating arms are moved upwardly, and means for swinging the main arms forwardly and upwardly about their pivotal connections with the support and for moving the support to the rear thereby moving the shovel forwardly and upwardly to fill it and then carrying such filled shovel bodily to the rear over the machine and discharging it over its discharge wall to the rear of the machine.

6. In combination in a shoveling machine, a shovel having digging and discharge walls, a support mounted for movement back and forth on the machine in the plane of operation of the shovel, main operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, a tilting arm also pivoted to the shovel and to said support and adapted to cause

the shovel to tilt forward as the main operating arms are moved upwardly, means for swinging the main arms forwardly and upwardly about their pivotal connections with the support, and means for then moving the support to the rear and continuing the swinging movement of the main arms bringing the shovel to a position to discharge to the rear of the machine.

7. In combination in a shoveling machine, a truck, a shovel having digging and discharge walls, a framework mounted for movement back and forth on the truck in the plane of operation of the shovel, a support mounted on the framework for back and forth movement in the same direction as the framework, power means for giving the framework its back and forth movement, main operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, a tilting arm also pivoted to the shovel and to said support and adapted to cause the shovel to tilt forward as the main operating arms are moved upwardly, and means for swinging the main arms forwardly and upwardly about their pivotal connections with the support and for moving the support to the rear thereby moving the shovel forwardly and upwardly to fill it and then carrying such filled shovel bodily to the rear over the machine and discharging it over its discharge wall to the rear of the machine.

8. In combination in a shoveling machine, a truck, a shovel having digging and discharge walls, a framework mounted for movement back and forth on the truck in the plane of operation of the shovel, a support mounted on the framework for back and forth movement in the same direction as the framework, power means for giving the framework its back and forth movement, power means for moving the forward end of the framework vertically, main operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, a tilting arm also pivoted to the shovel and to said support and adapted to cause the shovel to tilt forward as the main operating arms are moved upwardly, and means for swinging the main arms forwardly and upwardly about their pivotal connections with the support and for moving the support to the rear thereby moving the shovel forwardly and upwardly to fill it and then carrying such filled shovel bodily to the rear over the machine and discharging it over its discharge wall to the rear of the machine.

9. In combination in a shoveling machine, a shovel having front and rear walls at approximately right angles, a support movable back and forth on the machine in the plane of operation of the shovel, lever means pivoted at their outer ends to the shovel and at their inner ends to the support, means for swinging the lever means forwardly and upwardly about their pivotal connection with the support and for moving the support to the rear, and means for tilting the shovel forwardly during the swinging movement of the lever means, said lever means being arranged to cause the shovel to dig with its front wall and then move bodily to the rear over the machine and discharge over its rear wall to the rear of the machine.

10. In combination in a shoveling machine, a shovel, an air cylinder, a piston working in the cylinder and adapted to move the shovel forwardly, and yielding retarding means uniformly resisting the forward movement of the piston during a portion of its stroke and adapted to prevent the sudden forward movement of the shovel when the resistance of the material being shoveled is reduced.

11. In combination in a shoveling machine, a shovel, an air cylinder, a piston working in the cylinder and adapted to move the shovel forwardly, and retarding means in the piston uniformly resisting the forward movement of the piston during the latter part of its stroke and adapted to prevent the sudden forward movement of the shovel when the resistance of the material being shoveled is reduced.

12. In combination in a shoveling machine, a shovel, an air cylinder, a piston working in the cylinder and adapted to move the shovel forwardly, and a body of liquid displaced by the movement of the piston, a chamber for receiving the liquid, and a throttling passage through which the liquid is forced on the forward movement of the piston.

13. In combination in a shoveling machine, a shovel having a digging side and an opposing side from which to discharge when the shovel is tilted to the rear, a pair of levers attached at their ends to the shovel at separated points, a support for the other ends of the levers movable back and forth in a horizontal direction, operating means for the levers adapted to swing the levers forward and upward while the said support is maintained in forward position, then swing the levers to the rear to discharge the shovel while the said support is moved to the rear, then swing the shovel back to starting position while the said support is moving back to its forward position, and means for tilting the shovel forwardly as it moves upwardly and to the rear.

14. In combination in a shoveling machine, a shovel having a digging side and an opposing side from which to discharge when the shovel is tilted to the rear, and means for swinging the shovel on an arc from a starting position in front of the machine to a discharge position above and to the rear of

the machine, and for returning it to a starting position on an arc whose lower portion lies to the rear of the corresponding arc of ascent, so that clearance is provided for the shovel with respect to the material being shoveled on the return movement of the shovel, and means for tilting the shovel forwardly as it moves upwardly and to the rear.

15. In combination in a shoveling machine, a shovel having a digging side and an opposing side from which to discharge when the shovel is tilted to the rear, a rotary member movable bodily back and forth, reciprocating means coöperating with such member for causing its rotation when relative movement between the said means and member occurs, power means for reciprocating said member, power means for reciprocating said means and connections between said rotary member and the shovel whereby the shovel is moved forwardly and upwardly when the said means moves forward and causes the rotation of said member and then to the rear to discharge position above the machine upon the movement of said member to the rear.

16. In combination in a shoveling machine, a shovel having a digging side and an opposing side from which to discharge when the shovel is tilted to the rear, a rotary member movable bodily back and forth, connections between said rotary member and the shovel, reciprocating means coöperating with said member for causing its rotation when relative movement between said means and member occurs, power means for moving the said means forward to give the said member a rotary movement and cause the shovel to start forward and other power means for giving the said member a movement to the rear to cause the continued rotary movement of said member and the further upward and rearward movement of the shovel.

17. In combination in a shoveling machine, a shovel having a digging side and an opposing side from which to discharge when the shovel is tilted to the rear, a rotary member movable bodily back and forth, connections between said rotary member and the shovel, a reciprocatory bar, flexible connections between the bar and rotary member whereby relative bodily movement in either direction causes a rotation of the member, a cylinder and piston for moving the bar forward to give the member a rotary movement and cause the shovel to start forward, and a cylinder and piston for giving the said member a movement to the rear to cause its continued rotary movement and the further upward and rearward movement of the shovel.

18. In combination in a shoveling machine, a shovel, an air cylinder, a hollow piston member working in the cylinder and adapted to move the shovel ahead, a second piston carried in the first piston but fixed against movement therewith, a fluid in the hollow piston member partially filling it, and means permitting a relatively slow flow of liquid from one side of the second piston to the other side thereof as the first piston moves back and forth.

19. In combination in a shoveling machine, a shovel having opposing front and rear walls, a support movable back and forth on the machine in the plane of operation of the shovel, operating arms pivoted at their outer ends to the shovel and at their inner ends to the support, means for swinging the operating arms forwardly and upwardly about their pivotal connection with the support and for moving the support to the rear, and means for tilting the shovel forwardly during the swinging movement of the operating arms, said operating arms being arranged to cause the shovel to dig with its front wall and then move bodily to the rear over the machine and discharge over its rear wall to the rear of the machine.

FRANK H. ARMSTRONG.