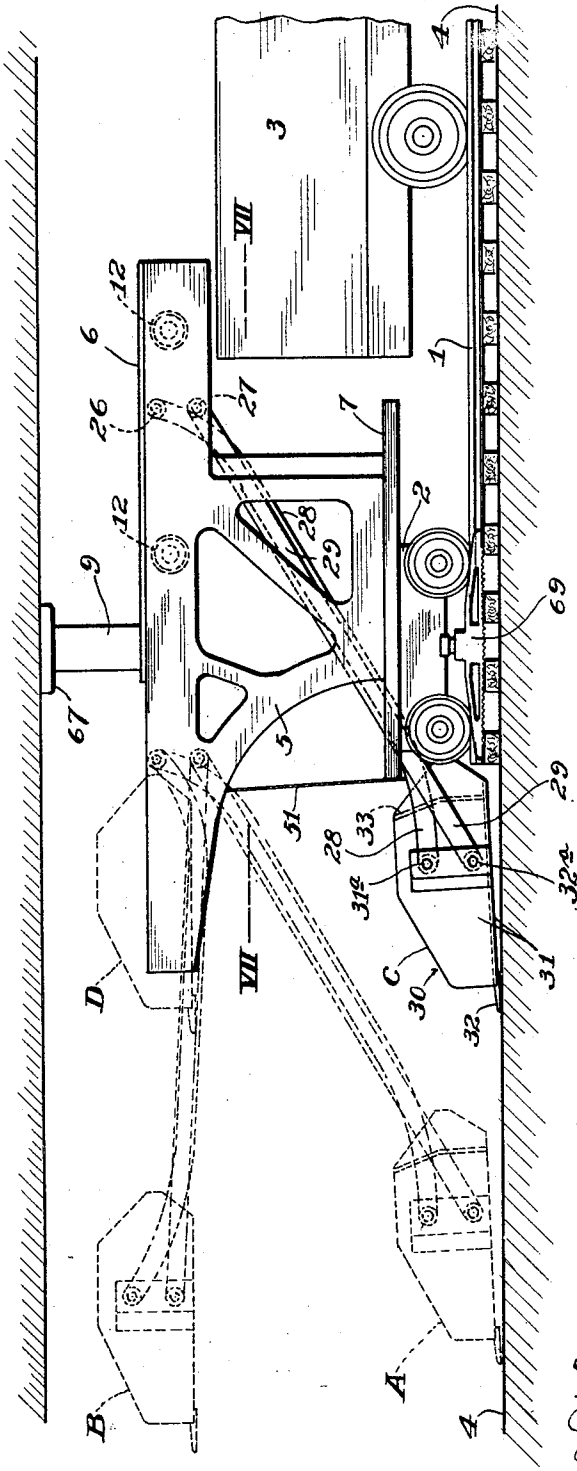
May 15, 1928. 1,669,688

F. H. ARMSTRONG

SHOVELING MACHINE

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Fig. 1.



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Fig. 2.

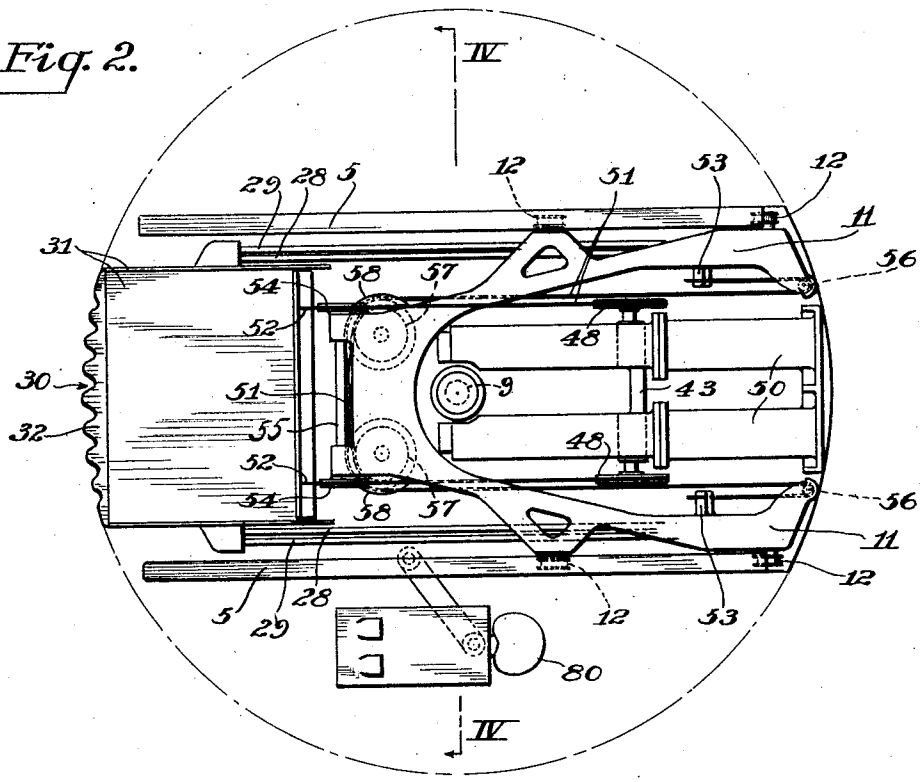
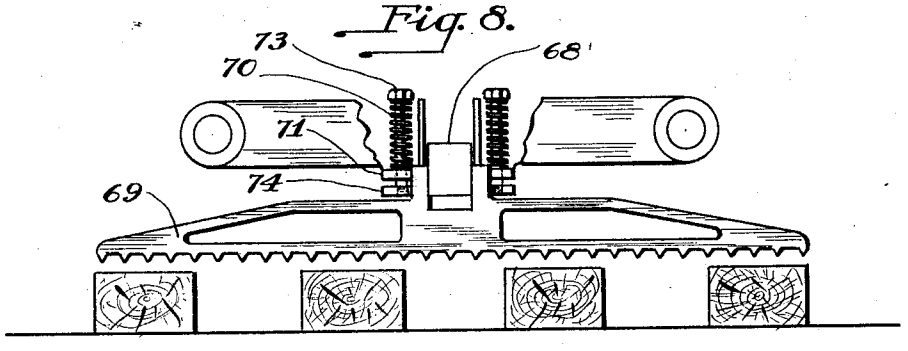


Fig. 8.



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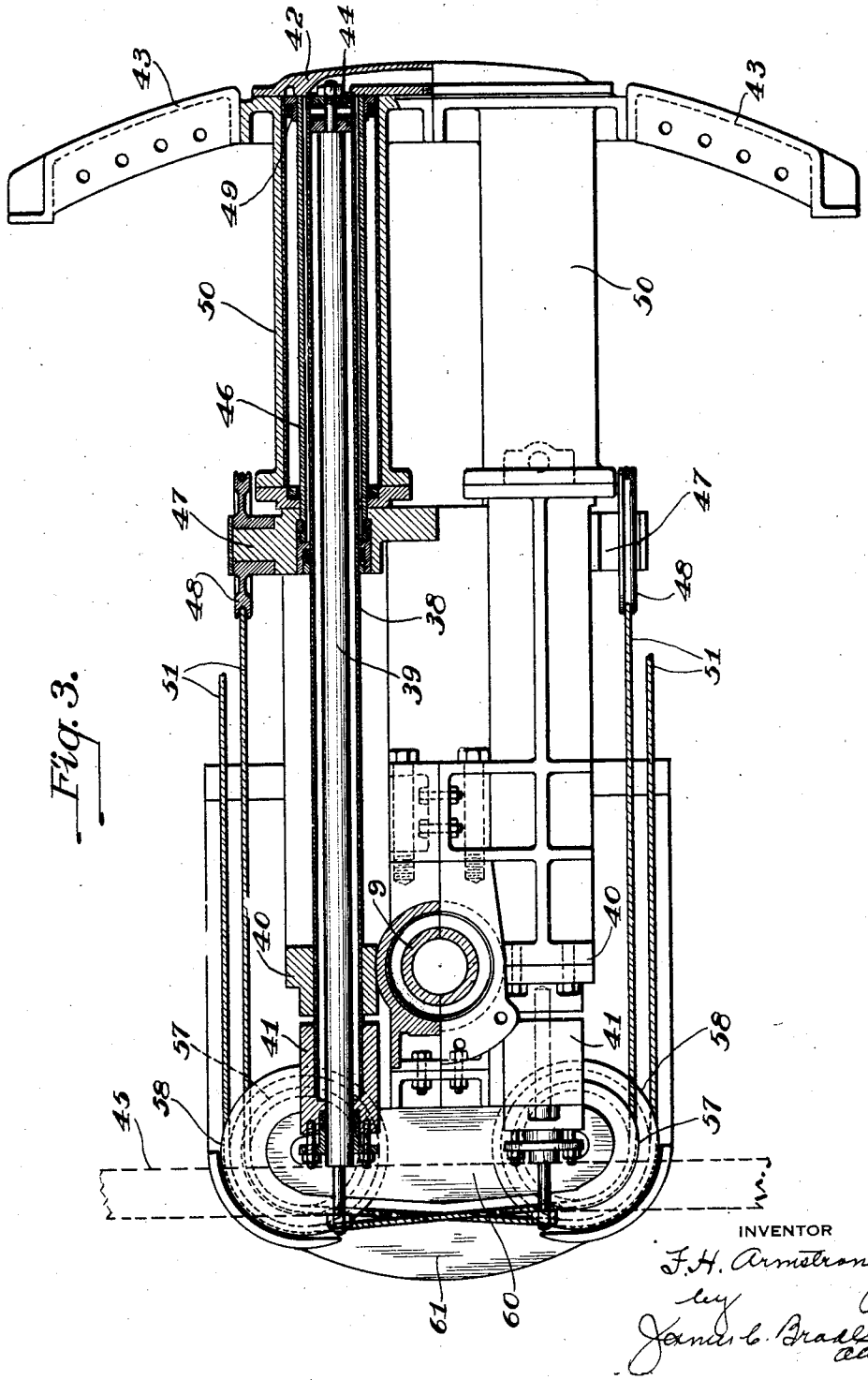


Fig. 3.

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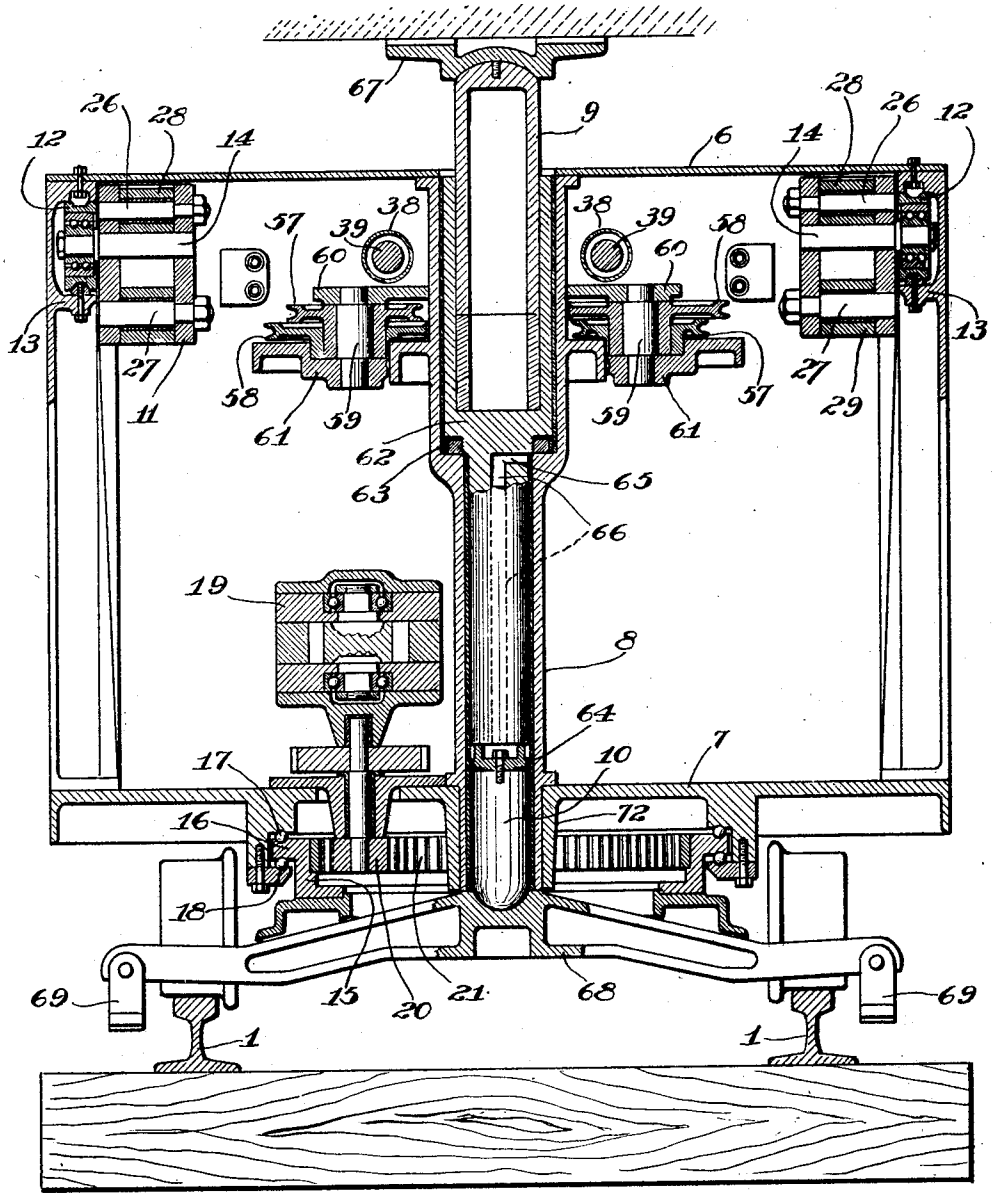
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Fig. 4.



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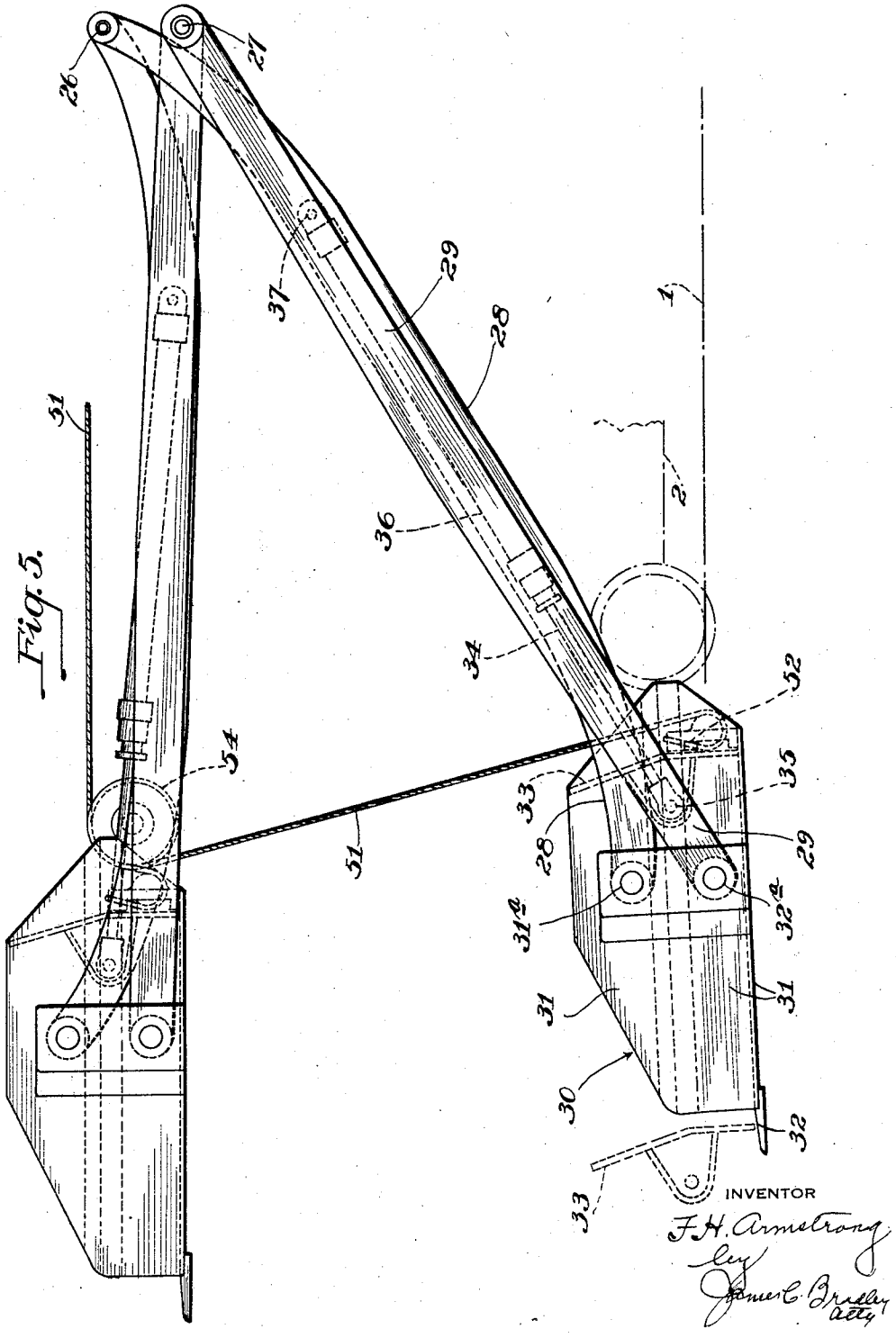


Fig. 5.

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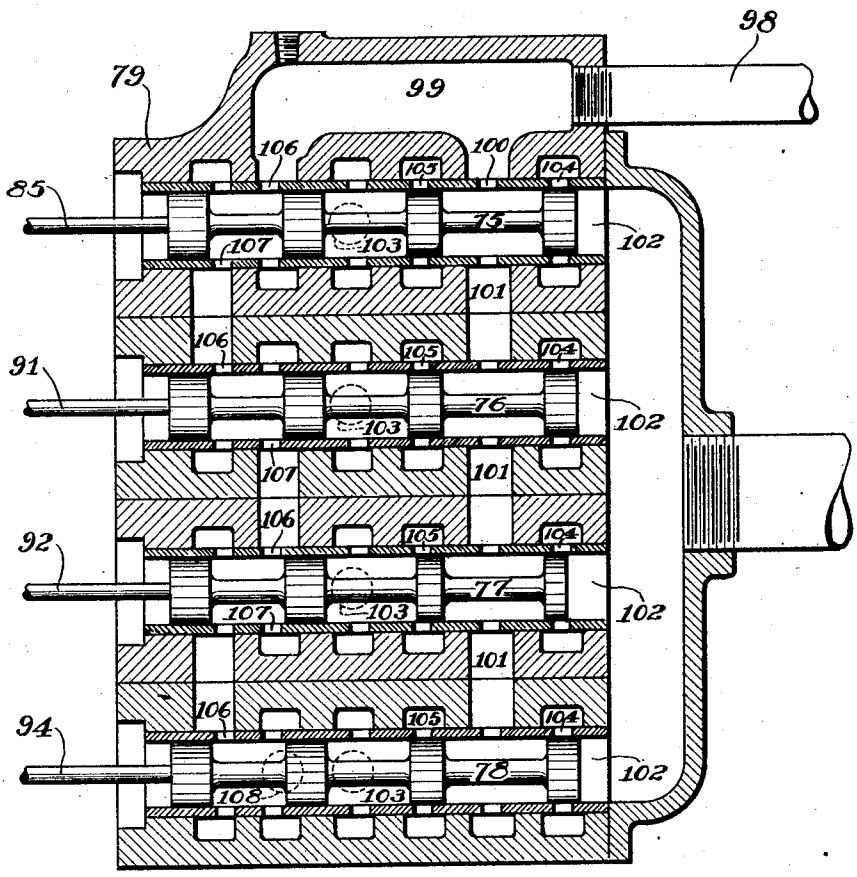
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Fig. 6.



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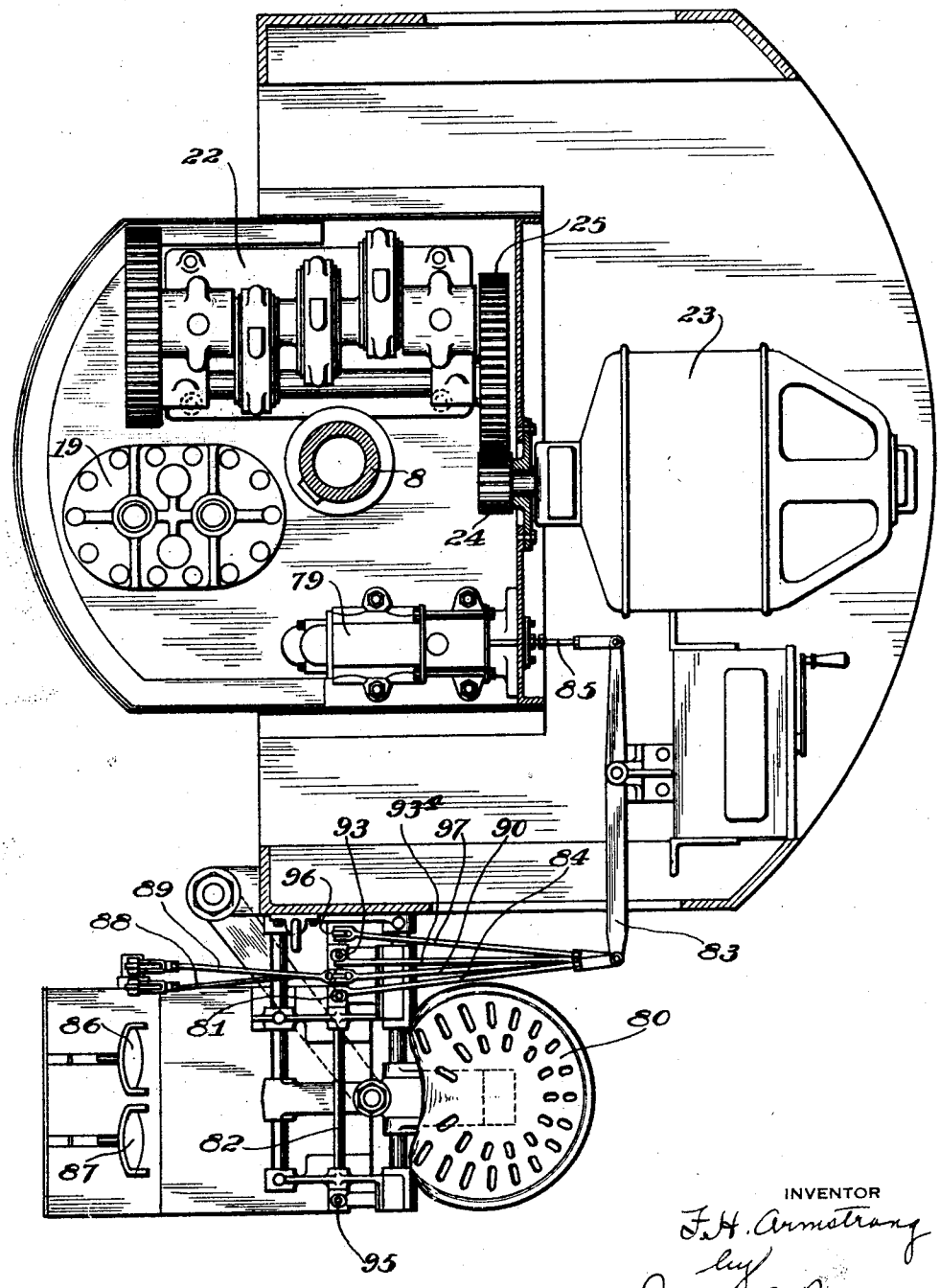
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Fig. 7.



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UNITED STATES PATENT OFFICE.

FRANK H. ARMSTRONG, OF GREEN BAY, WISCONSIN.

SHOVELING MACHINE.

Application filed December 21, 1925. Serial No. 76,716.

The invention relates to shoveling machines, or loaders, designed to shovel loose material, such as coal, ore and the like from a pile and transfer it to cars. It constitutes an improvement over the machine of my Patent No. 1,360,997, of December 7, 1920. The structure is in a general way similar to that of my patent, and like the machine of the patent, comprises a truck carrying a turntable which in turn supports a framework having a track. Upon the track is mounted a carriage, which moves back and forth with a shovel secured thereto by depending arms. The present machine differs from the machine of the patent in a number of details, among which are the shovel construction, and the means for discharging it; the means for supporting the shovel including the pairs of arms; the means for anchoring the machine securely in position; and the valve control.

The invention has for some of its principal objects; (1) the provision of improved means for anchoring the machine, so that it may be instantly anchored or released; (2) the provision of improved control for the hydro-electric operating means so arranged that the pump may be kept running at no load when none of the hydraulic power rams or cylinders are in use, thus insuring instant and powerful application of the power of the rams or cylinders when the valves are moved to service position; (3) the provision of a simplified and compact arrangement of the two sets of cylinders for operating the reciprocating carriage of the machine and the swinging arm carrying the shovel; and (4) the provision of an improved arm or link supporting means for the shovel so that the shovel operates at an advantageous, slightly inclined position, when digging, and at a horizontal position when discharging, so that a minimum of head room is required. One embodiment of the invention is illustrated in the accompanying drawings wherein:

Figure 1 is a diagrammatic side elevation of the complete machine, the dotted lines showing a number of positions of the shovel in addition to the one shown in full lines. Fig. 2 is a diagrammatic plan view of the machine of Fig. 1. Fig. 3 is a partial plan view and partial horizontal section through the carriage at the level of the carriage and shovel operating rams. Fig. 4 is a vertical section through the machine on the line IV—IV of Fig. 2. Fig. 5 is a diagrammatic side elevation view of the shovel and its supporting arms or links, Fig. 6 is a vertical section through the valve casing. Fig. 7 is a partial horizontal section on the line VII—VII of Fig. 1, and Fig. 8 is a detail of the jack foot.

Referring to the general arrangement of Figs. 1 and 2, 1 is a track, upon which is mounted the truck 2, and one of the cars 3 which is to be loaded with the material shoveled from the floor 4. The truck carries the framework of the machine comprising the side members 5, 5 (Figs. 1 and 2), the top and bottom plates 6 and 7 (Fig. 4) and the column or cylinder 8 (Fig. 4) carrying the anchoring plungers 9 and 10, later described.

Mounted for movement in a horizontal plane longitudinally of the upper portion of the frame members 5, 5 is a carriage 11 (Fig. 2) provided with four rollers 12, 12, 12, 12 working in the guideways 13, 13 shown in Fig. 4, such rollers being mounted on the axles 14 secured in the carriage framework.

In order to provide for the rotation of the machine framework to permit the shovel to work on any side of the track, and to discharge into cars located at the sides of the track or beyond it, the truck is provided with an annular supporting casting 15 (Fig. 4) provided with the flange 16 lying in an annular recess in the bottom plate 7 of the framework between the antifriction bearings 17 and 18. The rotation of the framework is accomplished by the hydraulic motor 19, operating through suitable reduction gearing (shown only in part) to rotate the pinion 20 engaging a gear 21 secured to the casting 15. The motor is driven by water pressure supplied from a triplex pump 22 (Fig. 7) driven from the electric motor 23 through the intermediary of the gears 24 and 25. The pump 22 is also employed to operate the various hydraulic rams employed upon the machine as later described, all the hydraulic power required for the functioning of the machine being supplied from the one pump 22 actuated from the electric motor.

The carriage 11 has adjacent its rear end on each side a pair of pivots 26 and 27 (Figs. 1 and 4), arranged one above the other, upon which are mounted for swinging movement, the rear ends of the arms or links 28 and

29 which carry the shovel 30, the forward ends of the arms being pivoted to the sides of the shovel at 31ª and 32ª. This provides for the maintenance of the shovel in an approximately horizontal position, as it swings from the dotted line position A of Fig. 1 to the dotted line position B. However, the shovel loads better in its forward gathering movement, when inclined slightly downward from the horizontal, as indicated at A, and in order to provide this inclination, the pivots 31ª and 32ª are spaced slightly farther apart than the pivots 26 and 27. When the shovel reaches the position B, it lies in a true horizontal position, and this is desirable, as compared with an inclined position at this point, since more clearance between the top of the car body (into which the shovel discharges) and the roof of the chamber for the shovel and its load, is provided with the shovel in a horizontal position than in an inclined position, and even a slight amount of additional clearance is an important consideration in a machine designed primarily for mine work where the overhead is always limited. The dotted line positions of Fig. 1 serve to indicate the range of movement of the carriage in gathering the load and of the arms 28 and 29 in swinging the shovel vertically. The full line position C shows the shovel in starting position, with the carriage at extreme rear position; A indicates the shovel after loading the carriage in extreme forward position; B shows the position of the shovel when swung upward to a height where it can pass over the side of a car to be loaded; and D shows the position of the shovel when the framework of the machine is retracted so as to bring the shovel as near the center of the machine as possible to permit it to revolve in narrow places.

The shovel 30 (Fig. 5) consists of side plates and a bottom plate 31 provided with the usual serrated end piece 32. The discharging plate 33 is mounted for movement longitudinally of the shovel between the side plates and is operated by a plunger 34 pivoted at 35 and working in the cylinder 36. This cylinder is pivoted at 37 to the arms 28, 28 and is supplied with fluid pressure from the pump 22. The plate 33 occupies its position at the rear end of the shovel during the gathering operation, and is moved to forward position, as indicated by the dotted lines at the left hand end of the shovel in Fig. 5, when it is desired to discharge the contents to the car.

The carriage 11 is reciprocated to move the shovel from position C to position A (Fig. 1), in the gathering operation, and to return it again to starting position, by means of a pair of hydraulic rams consisting of the cylinders 38, 38 also supplied with fluid pressure from the pump 22 and carrying a pair of plungers 39, 39 (Fig. 3). The cylinders are secured at their forward ends in the blocks 40, 41 carried by the fixed framework of the machine and at their rear ends in the castings 42 supported in the fixed framework of the machine. The plungers carry the pistons 44 at their rear ends, and at their front ends are bolted to the frame member 45 forming a part of the carriage.

Slidably mounted on the cylinders 38 as guides are a pair of hollow plungers 46, these plungers being secured at their left hand ends to the cross head 47 carrying the pulleys 48. The other ends of the plungers are provided with piston heads 49 working in the cylinders 50 secured to the brackets 43, mounted on, or forming, a part of the fixed carriage of the machine.

The reciprocation of the cross head 47 by the hollow plungers 46 secures the swinging of the arms 28 and 29 and the movement of the shovel from its gathering position A to its dumping position B and then back to its lower position after the dumping operation, the plungers being operated by fluid pressure supplied from the pump and controlled as later described.

The means whereby the reciprocation of the hollow plunger and the crosshead 47 causes the lifting and lowering of the shovel will be seen by reference to Figs. 2 and 3. This means includes the cables 51, 51, secured at their forward ends to the shovel, as indicated at 52 in Fig. 5, and at their rear ends to the lugs 53, 53 on the carriage (Fig. 2). The machine is provided with eight idler pulleys, over which the cables 51, 51 pass, namely; the pulleys 54, 54 at the front end of the carriage upon the shaft 55, the pulleys 48 on the cross head 47, and the pulleys 57, 57 and 58, 58, journaled, as indicated in Fig. 4, upon the pins 59, 59 mounted in suitable brackets 60, 61 carried by the framework of the carriage. The courses of the two cables 51, 51 are similar, so that a statement as to one only is sufficient. Starting with the rear end of the cable 51 attached to the lug 53, such cable passes to the rear around the lug 56, then forward to the pulley 58, then laterally to the pulley 57, then to the rear and up over the pulley 48, then forwardly over the pulley 54 and down to the shovel. The movement of the cross head 47 carrying the pulleys 48, 48 and operated by the hollow plungers 46, 46 causes the raising and lowering of the shovel, since the loops of cable passing around such pulleys 48 are lengthened and shortened in this way, the shovel being raised when the cross head moves to the right (Fig. 2) and lowered when it moves to the left. It will be observed that the telescopic arrangement of the cylinders 38 and 50 gives a very compact and effective arrangement and that the cylinder 38 is made to act as a guide for the

hollow plunger 46 and for the cross head 47.

The means for anchoring the machine from the roof above and the floor beneath, will be seen by reference to Fig. 4 in connection with Fig. 1. The column 8, which is secured rigidly to the rest of the framework of the machine, is made to act as a cylinder for the plungers 9 and 10, the plunger 10 being provided intermediate its ends with the shoulder 62 and packing 63, while the plunger 10 is provided at its upper end with the packing 64. Fluid pressure is supplied from the pump 22 through a pipe leading to the passages 65 and 66 at a point in the cylinder 8 between the plunger 10 just above the packing 64. The plunger 9 has secured to its upper end the cap 67, while the plunger 10 engages the center of the foot 68 with a socket joint, so as to permit the foot to adjust itself to any equalities which may be encountered. The foot 68 is provided at its ends with the pair of feet 69 (Fig. 8) with serrated lower faces for engaging the ties which support the track 1. The feet also have pivoted connection with the ends of the foot 68 to permit the feet to adjust themselves to any unevenness of the ties. The foot 68 is normally held in upper position, as indicated in Fig. 8, so that the feet 69 do not engage the ties, by means of the springs 70. These springs are supported upon lugs 71 projecting from the truck frame 2 and engaging the heads of the stud bolts 73, which are screwed at their lower ends into the lugs 74 projecting laterally from the jack foot 68. These springs are of such strength that when the hydraulic pressure between the ends of the plungers 8 and 9 is released, the jack foot 68 is raised and with it the plunger 10 and the feet 69. At the same time, the upper plunger 9 is moved down by the force of gravity, so that the machine is completely released from its anchorage and free to be moved to a new position.

The control of the fluid from the pump 22 (Fig. 7) to the four different hydraulic motors or rams is afforded by means of four valves 75, 76, 77 and 78 (Fig. 6) in the valve casing (79), and these valves are in turn under the control of an operator who occupies the seat 80 (Fig. 7) and moves the valves in and out through the intermediary of certain hand levers and foot pedals. For instance the rams operating the cables 51 for swinging the shovel up and down, are controlled from the hand lever 81 pivoted on the shaft 82, which lever has a crank arm connected to the horizontal lever 83 by means of the link 84. The lever 83 is pivoted at its end to the stem 85 of the valve 75 (Fig. 6). The valve 76 is operated from the pedals connected by the links 88 and 89 to a double crank member pivoted on the shaft 80 and having one arm above the shaft and one below, and this crank member in turn operates the link 90 which moves the stem 91 (Fig. 6) in and out through the intermediary of a horizontal link similar to the link 83 and lying beneath it. This valve 76 controls the motor 19 (Fig. 4) which swings the turntable. The valve 77 controls the ram for operating the scraper 33 (Fig. 5) and dumping the shovel. This valve is operated by the stem 92, which is moved from the hand lever 93 through mechanism, including the link 93ª, which is the duplicate of that described in connection with the operation of the valve 75. The fourth valve 78, having a stem 94, controls the operation of the rams 38, which move the carriage 11 back and forth. This valve is controlled from the hand lever 95, which is keyed to the shaft 82. The other end of this shaft swings a lever 96, which is connected to the stem 94 through the intermediary of a link 97 and a horizontal lever lying below the lever 83 and similar thereto.

The valve control will be understood by reference to Fig. 6. Fluid pressure for operating all of the power members is supplied through the pipes 98 to the chamber 99, and thence downward through the ports 100 to the three cavities 101. Exhaust occurs from one side of each ram plunger through the end openings 102, and from the other sides of the ram plungers through the side openings 103. Admission occurs to one side of the ram plungers through the ports 104 and to the other side of such plungers through the ports 105.

The valves are all illustrated as in neutral position. The two sets of admission ports 104 and 105 are blanked. When a valve, such as 78, is moved to the right, the port 104 is uncovered, so that fluid pressure is admitted to one end of the carriage reciprocating cylinders, the other end of such cylinders being opened to the exhaust by reason of the communication between the port 105 and the exhaust port 103. If the valve is moved to the left from the position illustrated, admission occurs to the other end of the cylinder, via the ports 101 and 105, while exhaust occurs from the opposite end of the cylinder, via the ports 104 and 102.

In order to permit the pump to run continuously when the valves are all in neutral position, a by-pass arrangement is provided, so that a prompt and powerful action is secured when any valve is moved to operative position, such as would not be possible if the pump were brought to a stop with the valves in neutral position. This by-pass is provided by the circulation ports 106 and 107 in conjunction with the exhaust port 108 from the bottom valve cavity and leading back to the supply tank of the pump. It will be seen that with the valves all in the neutral positions illustrated, a continuous

by-pass circulation is permitted from the pump to the chamber 99 and thence back to the supply tank via the ports 106, 107 and 108, which circulation is interrupted when any one of the valves 75, 76, 77 or 78 is moved in either direction from neutral position to operative position.

Briefly stated, the operation of the shovel, starting with the parts in the full line position of Figs. 1 and 2 is as follows: Fluid pressure being admitted to the rear or right hand end of the cylinders 38 (Fig. 3), the plungers 39, 39 are moved to the left, thus moving the carriage to the left, and with it the shovel 30 from position C of Fig. 1 to position A. During this movement, the shovel is filled. The next movement is the swinging of the shovel from position A to position B, which is accomplished by the plungers 46 which move the cross head 47 from a point adjacent the block 40 (Fig. 3) to the right of such position and to the position illustrated in Fig. 3, thus lengthening the loops of the cables 51, 51 passing around the pulley 48, 48, and raising the shovel to position B. During or after this raising operation, the turntable motor 19 is operated to swing the framework of the machine with the shovel laterally so as to bring it to position over a receiving car (not shown). The last operation is the actuation of the dumping plunger 34 to move the scraper 33 and push the contents of the shovel over its forward end and into the car. The series of operations is now reversed to bring the shovel back to starting position C, thus completing the cycle.

What I claim is:

1. In combination in a shoveling machine comprising a truck, a framework thereon, a carriage mounted for reciprocation thereon in a horizontal plane, a shovel, supporting arms for the shovel, and a plurality of hydraulic rams for operating the carriage and shovel, a pump for supplying fluid under pressure to operate each of said rams, a motor for driving the pump, a manually operable valve for controlling the supply of fluid to each end of each ram, and its return to the pump, and a by-pass extending past all of the valves and returning to the pump for permitting a continuous circulation of fluid to the valves and back to the pump when the valves are all in neutral position, the valves being positioned with respect to the by-pass so as to close it when any one of the valves is moved from neutral to operative position.

2. In combination in a shoveling machine comprising a truck, a framework thereon, a carriage mounted for reciprocation thereon in a horizontal plane, a shovel, and supporting arms for the shovel pivoted thereto and to the carriage, a cylinder secured to the framework and extending longitudinally of the carriage, a plunger in the cylinder secured at one of its ends to the carriage for reciprocating it, a second cylinder surrounding the first cylinder and also secured to the framework, a hollow plunger lying between the two cylinders and guided on the inner one, a flexible member guided upon the carriage and connected so as to raise and lower the shovel, and means carried by said hollow plunger and having operative connection with said flexible member, so as to raise and lower the shovel when said hollow plunger is reciprocated.

3. In combination in a shoveling machine comprising a truck, a framework thereon, a carriage mounted for reciprocation thereon in a horizontal plane, a shovel, and supporting arms for the shovel pivoted thereto and to the carriage, a cylinder secured to the framework and extending longitudinally of the carriage, a plunger in the cylinder secured at one of its ends to the carriage for reciprocating it, a second cylinder surrounding the first cylinder and also secured to the framework, a hollow plunger lying between the two cylinders and guided on the inner one, a flexible member guided upon the carriage and connected at one end to a part moving with the shovel for raising and lowering it, and connected at its other end to said carriage, and a pulley carried by said hollow plunger, over which said flexible member is looped, the arrangement of the flexible member and pulley being such that the movement of the hollow plunger in one direction causes the end of the flexible member connected to said part moving with the shovel to lift such shovel.

In testimony whereof, I have hereunto subscribed my name this 16th day of December, 1925.

FRANK H. ARMSTRONG.