

Sept. 27, 1932.

C. R. HUGHES

1,880,091

MINING MACHINE

Filed Sept. 11, 1931

5 Sheets-Sheet 1

Fig. 1.

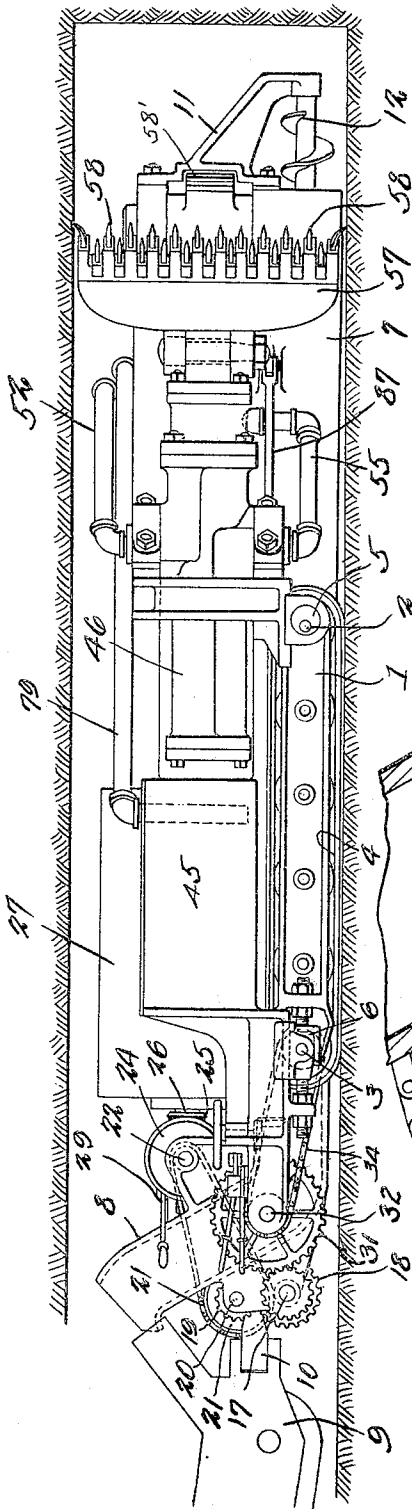
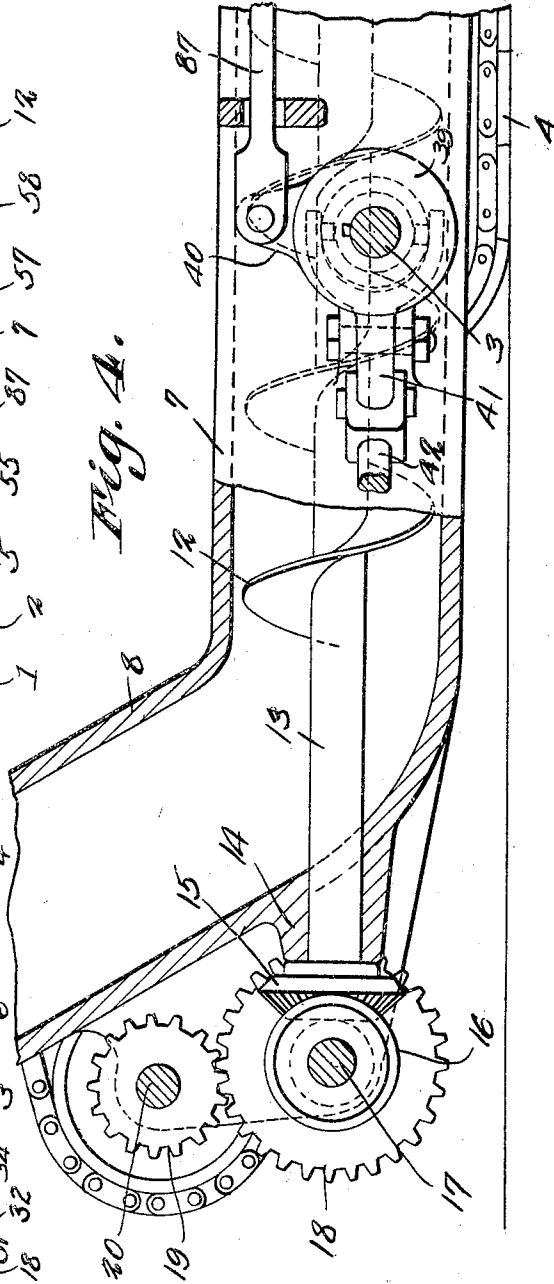


Fig. 4.



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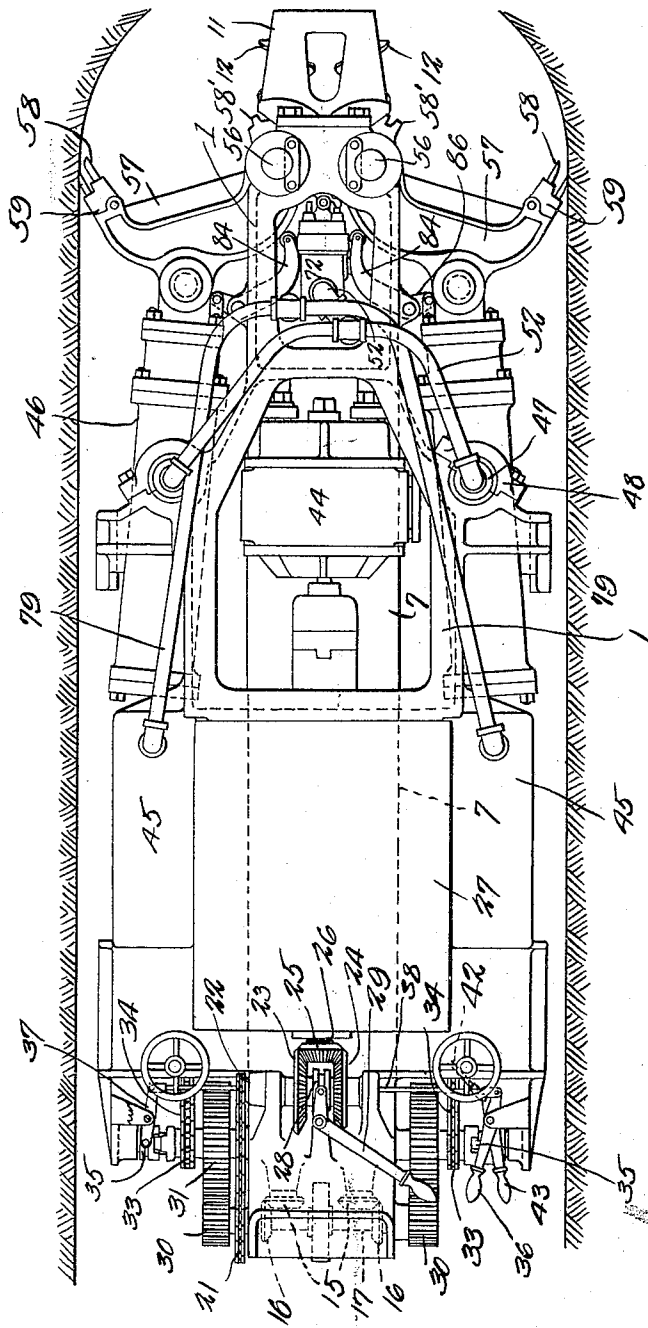


Fig. 2.

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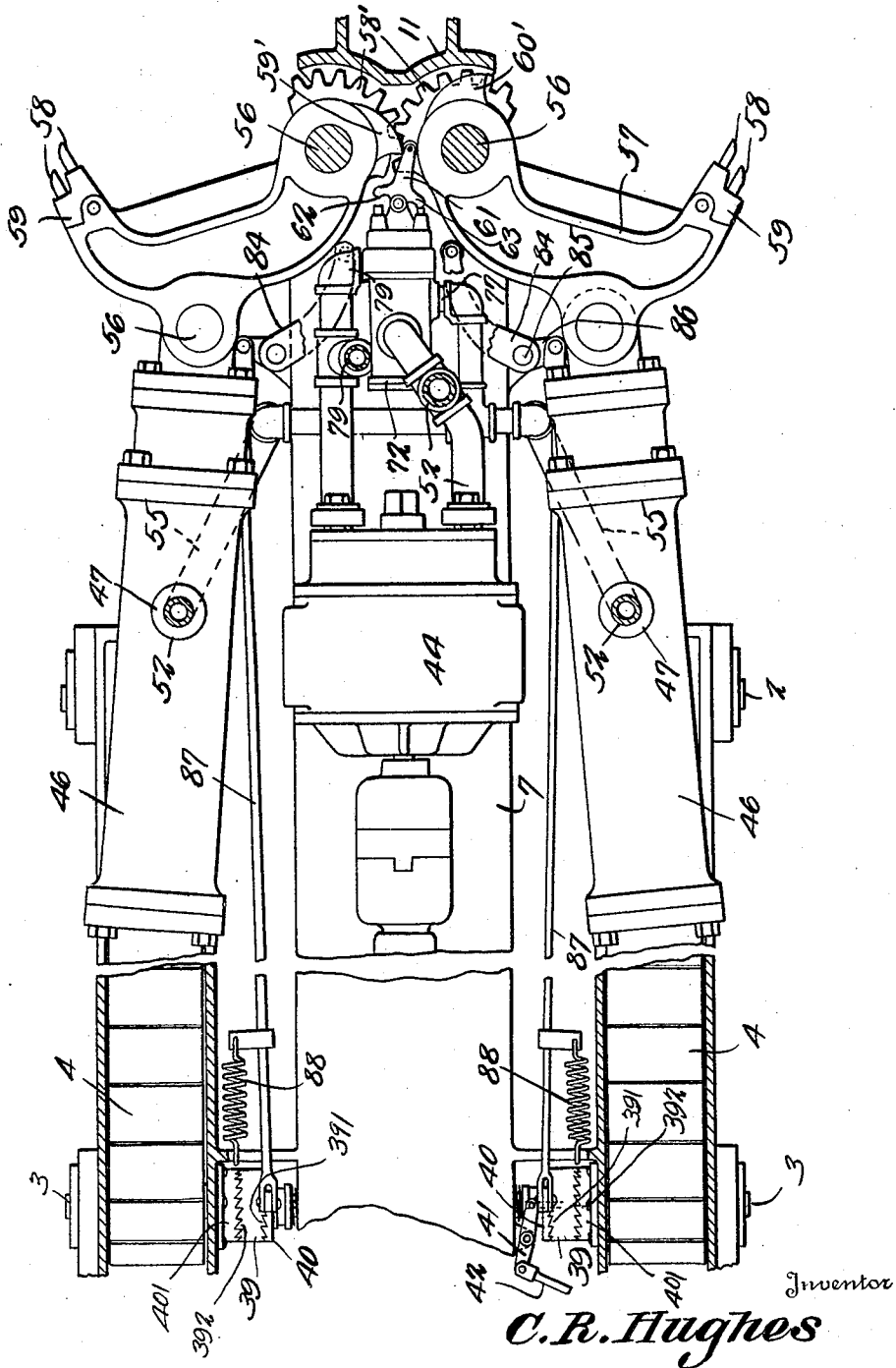
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Fig. 3.



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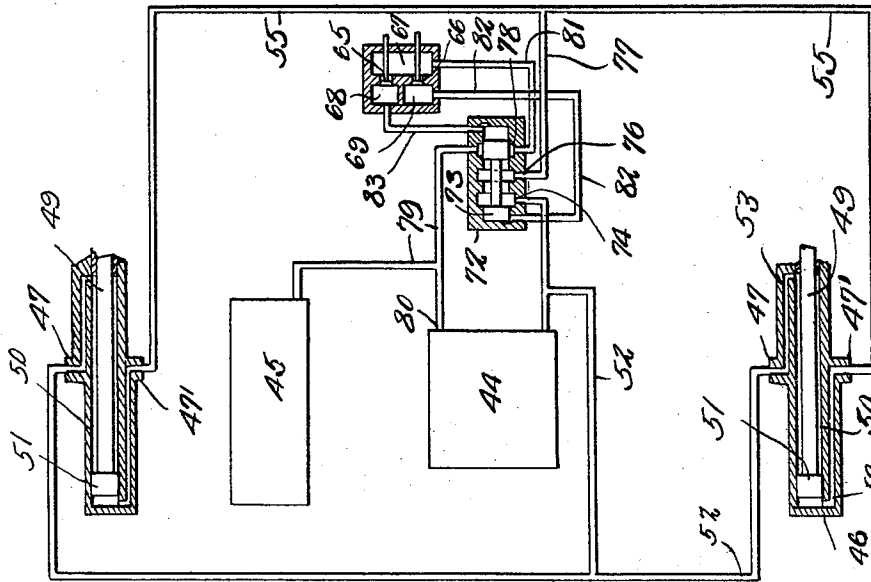


Fig. 7.

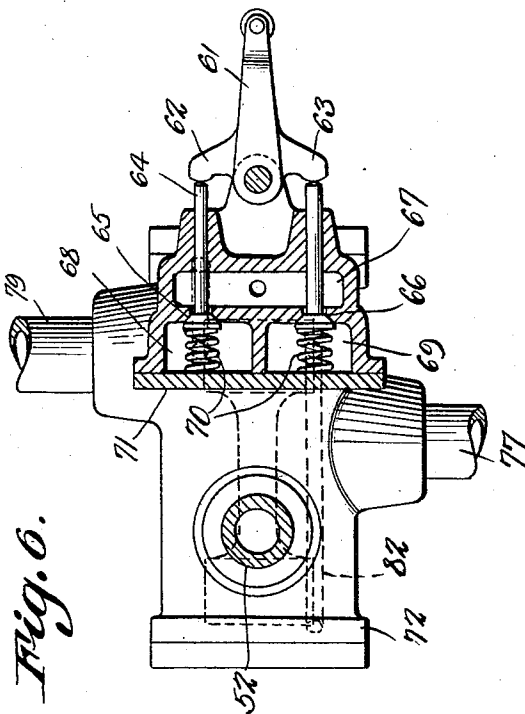
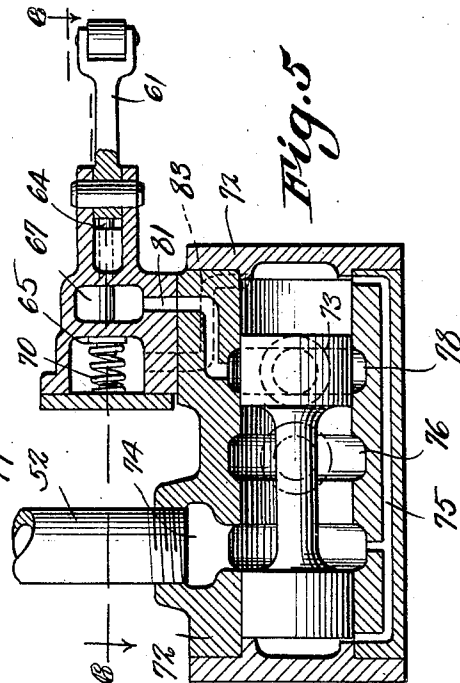


Fig. 6.



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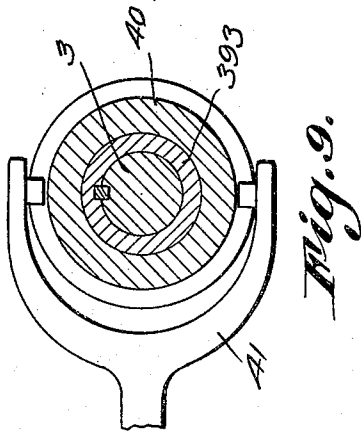


Fig. 9.

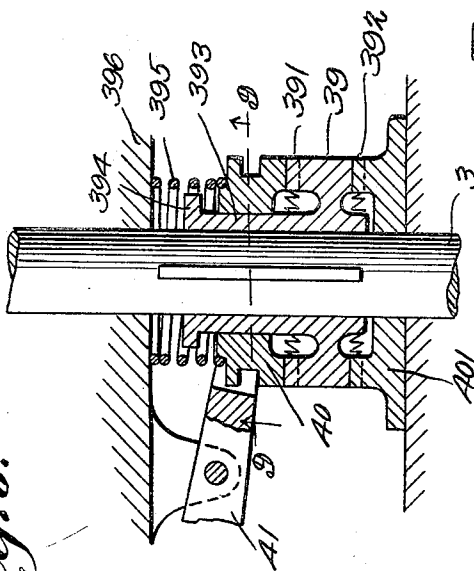


Fig. 8.

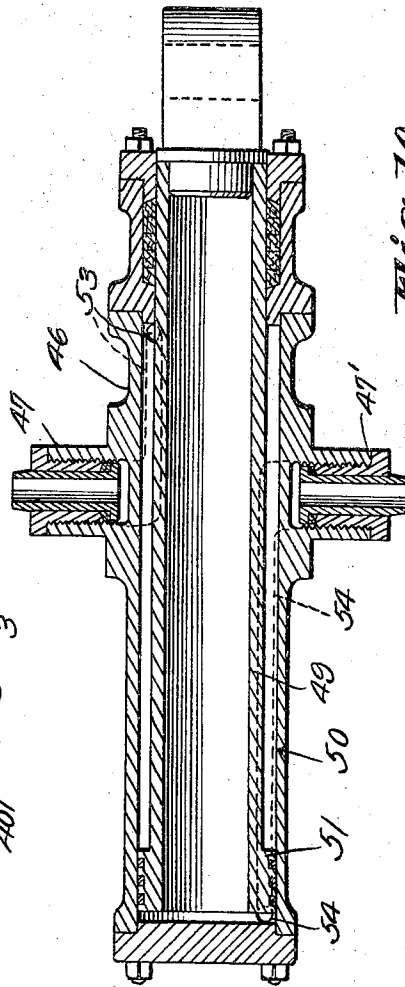


Fig. 10.

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UNITED STATES PATENT OFFICE

CHARLES R. HUGHES, OF ALTOONA, PENNSYLVANIA

MINING MACHINE

Application filed September 11, 1931. Serial No. 562,396.

This invention relates to a mining machine designed primarily for use in opening new rooms, headings and air courses, one of the objects being to provide a machine of the "crawler" type which will tunnel into a wall, means being provided for intermittently digging and feeding automatically so that after the machine has been set in its proper course it will act to dig out a path and deliver the loose material rearwardly therefrom.

A further object is to provide improved digging means having new and novel means for operating the same.

Another object is to employ a propelling mechanism receiving its motion from the digging means during the tunneling operations.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings:

Figure 1 is a side elevation of the machine.

Figure 2 is a plan view thereof.

Figure 3 is an enlarged plan view of a portion of the machine, parts being broken away and in section.

Figure 4 is a vertical longitudinal section through the rear portion of the delivery mechanism.

Figure 5 is a vertical longitudinal section through the valve housing.

Figure 6 is a section on line 6—6, Figure 5.

Figure 7 is a diagram of the valve controlled hydraulic system forming a part of the invention.

Figure 8 is a plan view of a portion of the mechanism used for advancing the machine while mining.

Figure 9 is a section on line 9—9, Figure 8.

Figure 10 is a longitudinal section through one of the differential cylinders.

Referring to the figures by characters of

reference, 1 designates a frame having transverse axles 2 and 3 supported by belt treads 4. The axle 2 is mounted in cams 5 whereby the frame can be raised or lowered relative to the axle, and the rear axles 3 are journaled in boxes 6 adjustable longitudinally to regulate the tension of the treads 4.

A delivery trough 7 is extended longitudinally in the frame 1 and forwardly therebeyond and the rear end portion 8 thereof is inclined upwardly and rearwardly so as to discharge bulk material onto a conveyor mechanism, indicated generally at 9, which is connected to the back end of the frame 1, as at 10.

Secured to the front end of the top of frame 1 is a bracket 11 which extends downwardly and forwardly. In this bracket are journaled the front ends of worm conveyors 12 which are parallel and extended longitudinally within the trough 7. The rear ends of the shafts 13 of these conveyors are extended through bearings 14 on the inclined rear end 8 of trough 7 and are provided with gears 15 meshing with gears 16 on a transverse shaft 17. This shaft is driven through gears 18 and 19, from a shaft 20.

A chain and sprocket drive 21 connects shaft 20 to a shaft 22 provided with opposed gears 23 and 24 meshing with a drive gear 25 on one end of the shaft 26 of an electric motor 27. A clutch 28 is slidable on shaft 22 and can be shifted by lever 29 so as to uncouple both or either gear 23 or 24 from its shaft. Thus the shaft 17 can be driven either forwardly or rearwardly or can be disconnected from the motor.

Gears 30 are secured to the ends of the shaft 17 and mesh with gears 31 keyed on separate shafts 32. Sprockets 33 are mounted loosely on shafts 32 and are adapted to engage with clutches 35 which are also keyed on shafts 32. One clutch 35 is shifted by lever 37 and handle 36 connected by rod 38, while the other clutch 35 is shifted by handle 43. Thus sprockets 33 can be simultaneously coupled to or uncoupled from axles 3, or either side may be coupled to or uncoupled from axles 3.

Obviously by providing the mechanism

described the machine can be driven forwardly or rearwardly and by uncoupling the axles 3 from the sprockets 33 the machine can be kept stationary while the motor is driving the worm conveyors, or either side may be driven independently of the other side, thus providing a means for steering or turning.

Axle 3 has a disk 39 feathered on each end portion thereof and provided with toothed ratchet faces as shown on 391 and 392. A tubular stem 393 extends from one toothed face of the disk and has a head 394.

Mounted to slide and rotate on the stem 393 is a pawl member 40 and adapted to engage the teeth 391 to rotate the disk 39 in one direction only. A spring 395 extends round the head 394 and bears at one end against a portion of the supporting structure 396 of the motor 27, while its other end bears against pawl member 40 thereby holding said member normally in engagement with disk 39 and spaced from head 394.

A stationary pawl member 401 is secured to the frame or other fixed part of the machine and the pressure of spring 395 against member 40 and disk 39 serves to hold the teeth 392 normally in engagement with the teeth on member 401. Thus when each pawl member 40 is oscillated it will, during one stroke, rotate disk 39 therewith and teeth 392 past the teeth on member 401, while during the opposite stroke each disk 39 will be held against retrograde movement and member 40 will slip over teeth 391. Oscillation of the members 40 thus produces an intermittent rotation of axles 3 in one direction, said axles being held against rotation in the opposite direction by the members 401.

Each pawl member 40 is shiftable by lever 41 connected by rods 42 to levers 43 and 37. Only one lever 41 and its operating members has been shown. By shifting lever 41 in one direction against spring 395 it will pull the member 40 out of engagement with disk 39 and by pulling further on the lever the member 40 will push against head 394 and pull disk 39 out of engagement with member 401. When the parts are in this latter position axle 3 can rotate without restriction by the members 40, 401, and 39.

When the pawl members are swung forwardly they will normally engage the teeth 39 and give a short rotative motion to the disks 39 and the axles 3 and advance the machine by driving the treads a short distance. When the pawl members are disengaged from the disks however there will be no feeding action.

Thus when clutches 35 are engaged by shifting handles 36 and 43 for driving axles 3 by chain sprockets 33, the ratchet device just described will be disengaged.

Located in front of the motor 27 is a pump 44 adapted to be driven by said motor and at the sides of the motor are provided one or more reservoirs 45. Differential cylinders

46 are mounted adjacent to their centers to swing about vertical axes and two trunnions 47 and 47' are journaled in bearings 48 extending from the sides of frame 1. The cylinder plungers are directly connected through pin 56 to digging arms 57 which are journaled in the front end of frame 1 back of bracket 11 and are adapted to swing toward and from each other. Teeth 58 are mounted in blocks 59 pivotally connected to the outer ends of the arms in such a manner as to slide freely over an engaged wall surface when the jaws are swung apart, but to be held rigidly while the jaws are moving towards each other and the teeth are cutting.

Each cylinder 46 has a bore 50 in which is fitted a plunger 49 having a head 51 at one end. Ports 53 and 54 lead from the cylinder ends through the center of rotation to pipes 52 and 55 respectively. Pipe 52 and hence port 53 is always subjected to pump pressure while liquid is alternately admitted to and discharged from the other end through port 54 by the action of the operating valve hereafter described. It is, therefore, obvious that the net area of the forward or working stroke is that of the plunger 49 while the area on the return stroke is the difference between the effective areas of plunger 49 and head 51. Therefore with a constant pump displacement and the proper ratio of areas it is possible to get any desired ratio of time of the forward to the return strokes.

The operating valve is essentially a three-way piston valve hydraulically operated by means of auxiliary valves 65 and 66. In the position shown in Figure 5 the main valve 73 permits the flow of liquid from pipe 52 through port 74 to port 76 and thence through pipes 77 and 55 to the large ends of the cylinders, and when the piston valve 73 is moved to the other extreme position it closes port 74 and opens port 78 thus permitting the discharge of liquid through port 76 and 78 to pipe 79 leading to the oil reservoirs and to the pump inlet. From port 74 is a small port 75 which leads to the two ends of the main valve housing 72. Additional ports 83 and 82 lead from these two ends to the auxiliary valve chambers 68 and 69.

In operating this machine it is brought to position by driving the treads 4 through the gearing described and when the digging operation is to commence, the operator uncouples the treads from the gears, couples the pawls 40 to the disks 39 and starts the pump 44. Oil under pressure will be forced from the pump through pipe 52 and valve casing 72 to pipe 77 and thence against the large ends of pistons 51 which will be overbalanced and forced forwardly from the positions shown in Figures 2 and 7. This will cause the jaws 57 to swing toward each other and the teeth 58 will bite into and cut down the

adjacent wall surfaces. The loosened bulk material will be gathered by the jaws in front of the trough 7 where the oppositely rotating worms or screws 12 will engage it and carry it rearwardly so as to force the material out from the inclined portion 8 onto the conveyor mechanism 9.

As the jaws operate in the manner stated the cam 60' will thrust the tappet 61 laterally and cause finger 62 to push the stem of valve 65 while the stem of valve 66 is released. Thus pressure is released from back of valve 73 through passage 83 and chambers 68 and 67 and said valve caused to shift to its other extreme position. This closes inlet 74 and opens pipe 55 and chamber 67 to pipe 79 so that oil can return to the pump. At the same time pressure from the pump through pipe 52 will come against the small ends of pistons 51, forcing them backwardly and returning them to the positions shown in Figure 7 and the jaws to the positions shown in Figures 2 and 3.

As the jaws move to open position they thrust against levers 84 which are fulcrumed at 85 and have short arms 86 connected by rods 87 to the pawl members 40. Springs 88 pull on the rods and hold levers 84 and the pawl members normally pressed forwardly. Each time the levers 84 are pressed back by the jaws the pawl members 40 are turned or pulled forwardly to impart a slight rotation to disks 39 and axle 3 and, consequently, the treads 4 are actuated to advance the entire machine a short distance. Thus when the jaws again swing toward each other the teeth will be advanced to dig into the wall in front thereof.

When the jaws reach their open positions the cam 59' shifts tappet 61 to open valve 66 and close valve 65. Thus the position of valve 73 will become reversed and the jaws will again be moved toward each other.

What is claimed is:

1. A machine of the class described including opposed digging jaws, means for swinging the jaws forwardly toward each other and rearwardly from each other, and means operated by the rearward movement of the jaws for advancing the machine.

2. A machine of the class described including opposed digging jaws, means for swinging the jaws forwardly toward each other and rearwardly from each other, material conveying means, said jaws constituting means for simultaneously cutting into a wall in the path of the machine and gathering the loosened material into position for engagement by the conveying means.

3. A machine of the class described including means for conveying loose material, opposed digging and gathering elements, and means for moving said elements toward each other to simultaneously dig material and direct it to the conveying means.

4. A machine of the class described including means for conveying loose material, opposed digging and gathering elements, and hydraulic means controlled by said elements for moving them toward each other to dig material and direct it to the conveying means and subsequently return said elements to their points of starting.

5. A machine of the class described including means for conveying loose material, opposed digging and gathering elements, and hydraulic means controlled by said elements for oscillating them toward and from each other.

6. A machine of the class described including means for conveying loose material, opposed digging and gathering elements, hydraulic means controlled by said elements for oscillating them toward and from each other, and means actuated by the oscillation of said elements for intermittently advancing the machine.

7. A machine of the class described including means for conveying loose material, opposed digging and gathering elements, hydraulic means controlled by said elements for oscillating them toward and from each other, means actuated by the oscillation of said elements for intermittently advancing the machine, said means including an endless tread, pawl and ratchet means for moving the tread in one direction, a lever in the path of one of said elements for actuation thereby, and means for transmitting motion from said lever to the pawl and ratchet means.

8. A machine of the class described including opposed digging jaws mounted to swing about parallel axes, gears connecting the jaws for movement toward and from each other, and hydraulic means connected to each jaw for actuating both jaws.

9. A machine of the class described including opposed digging jaws mounted for movement about parallel axes, gears connecting the jaws for simultaneous movement toward or from each other, hydraulic means for actuating the jaws, a valve mechanism for controlling the action of the hydraulic means and the direction of movement of the jaws, and means operated by the jaws for actuating the valve mechanism to oscillate the jaws.

10. A machine of the class described including opposed digging jaws mounted for movement about parallel axes, gears connecting the jaws for simultaneous movement toward or from each other, hydraulic means for actuating the jaws, a valve mechanism for controlling the action of the hydraulic means and the direction of movement of the jaws, means operated by the jaws for actuating the valve mechanism to oscillate the jaws, said means including separate relief valves, a tappet for alternately operating the same, and cams movable with the respective jaws for actuating the tappet at the comple-

tion of each movement of the jaws thereby to open the respective relief valves successively.

11. A machine of the class described including oscillating jaws, means for swinging
5 them toward and from each other, a series of teeth on each jaw, and means connecting the teeth to the jaws for wiping action over a surface while the jaws are moving apart, and means for holding the teeth in digging
10 positions while the jaws are moving toward each other.

12. A machine of the class described including oscillating digging jaws, means for moving them toward and from each other, a
15 motor, a pump driven thereby, pistons connected to the jaws, valve controlled means for directing fluid under pressure against the pistons to actuate the jaws, and means controlled by the jaws for reversing pressure
20 upon the pistons as the jaws reach each limit of their movement, thereby to oscillate the jaws.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

25 CHARLES R. HUGHES.

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