N. EBBLEY.

MUCK SHOVEL.

APPLICATION FILED JULY 8, 1910.

1,029,799.

Patented June 18, 1912.

4 SHEETS—SHEET 1.

Fig. 1.

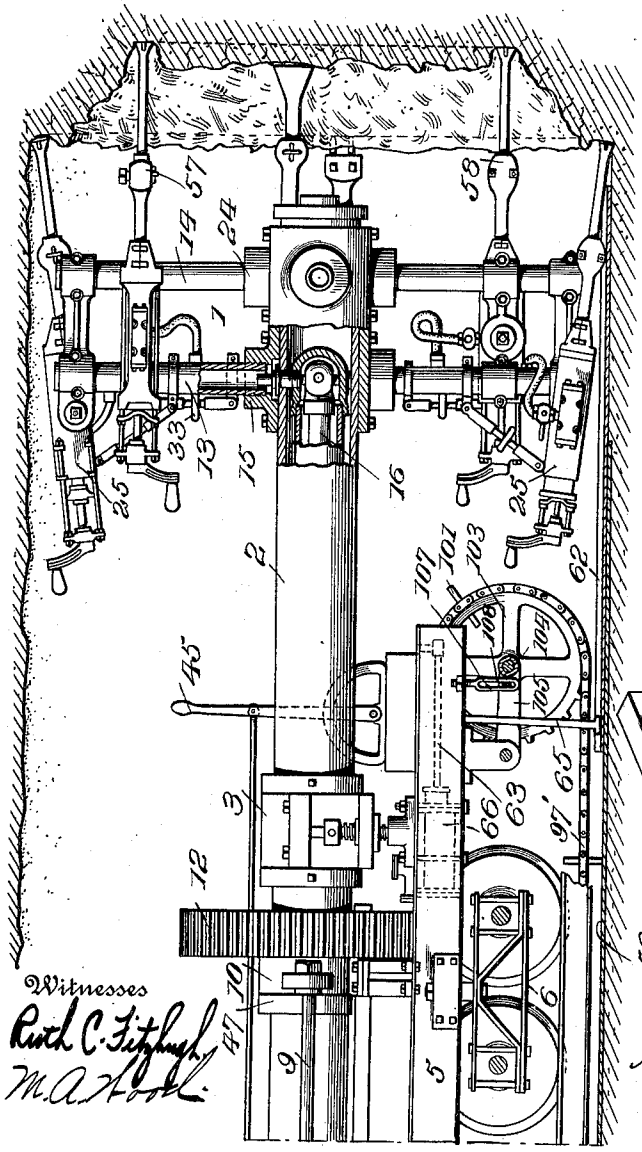
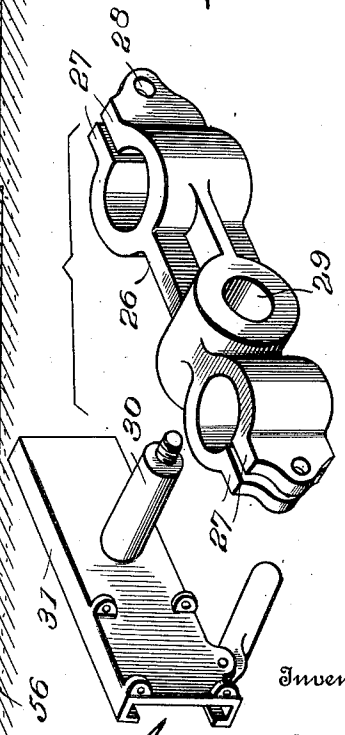


Fig. 2.



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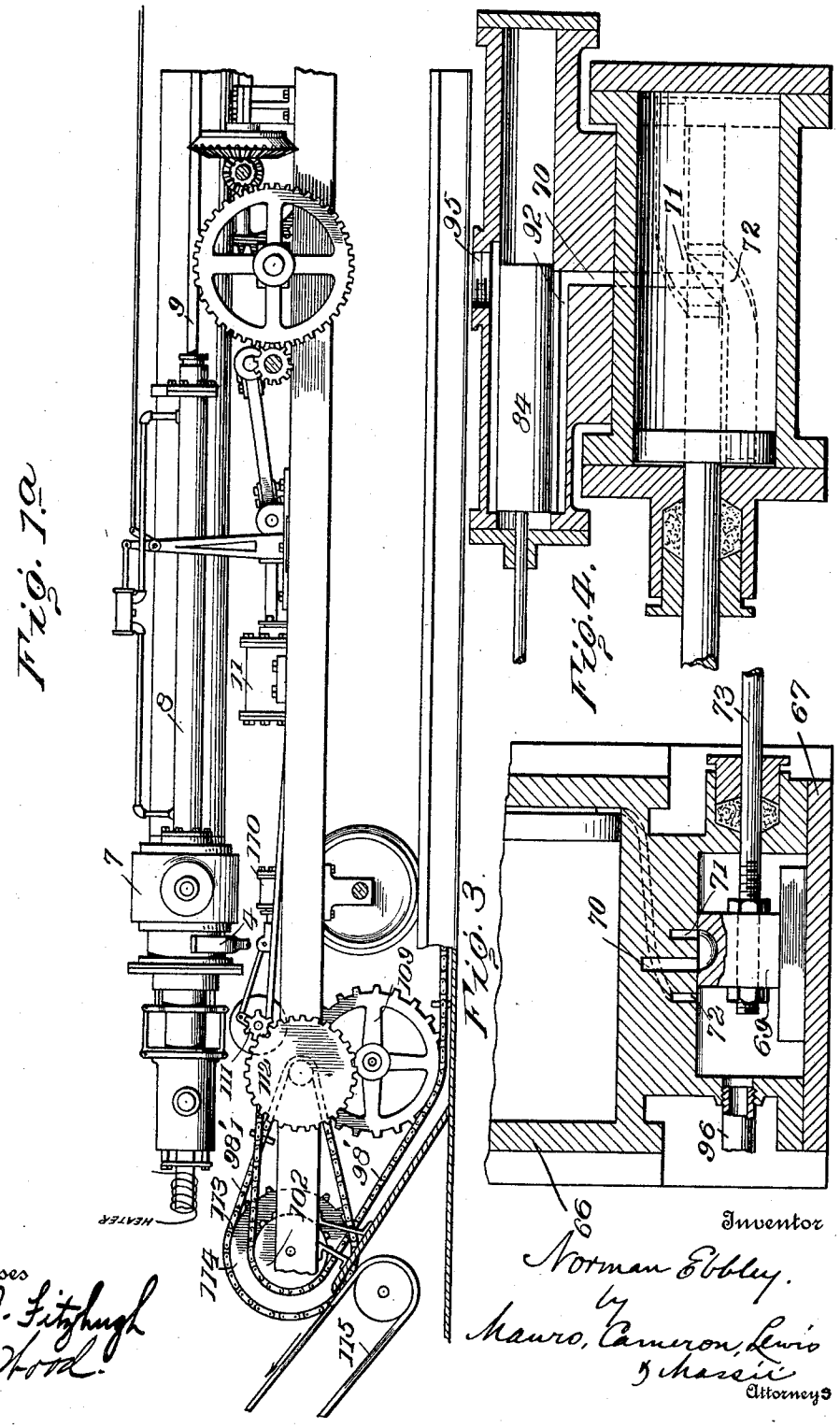

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4 SHEETS—SHEET 3.

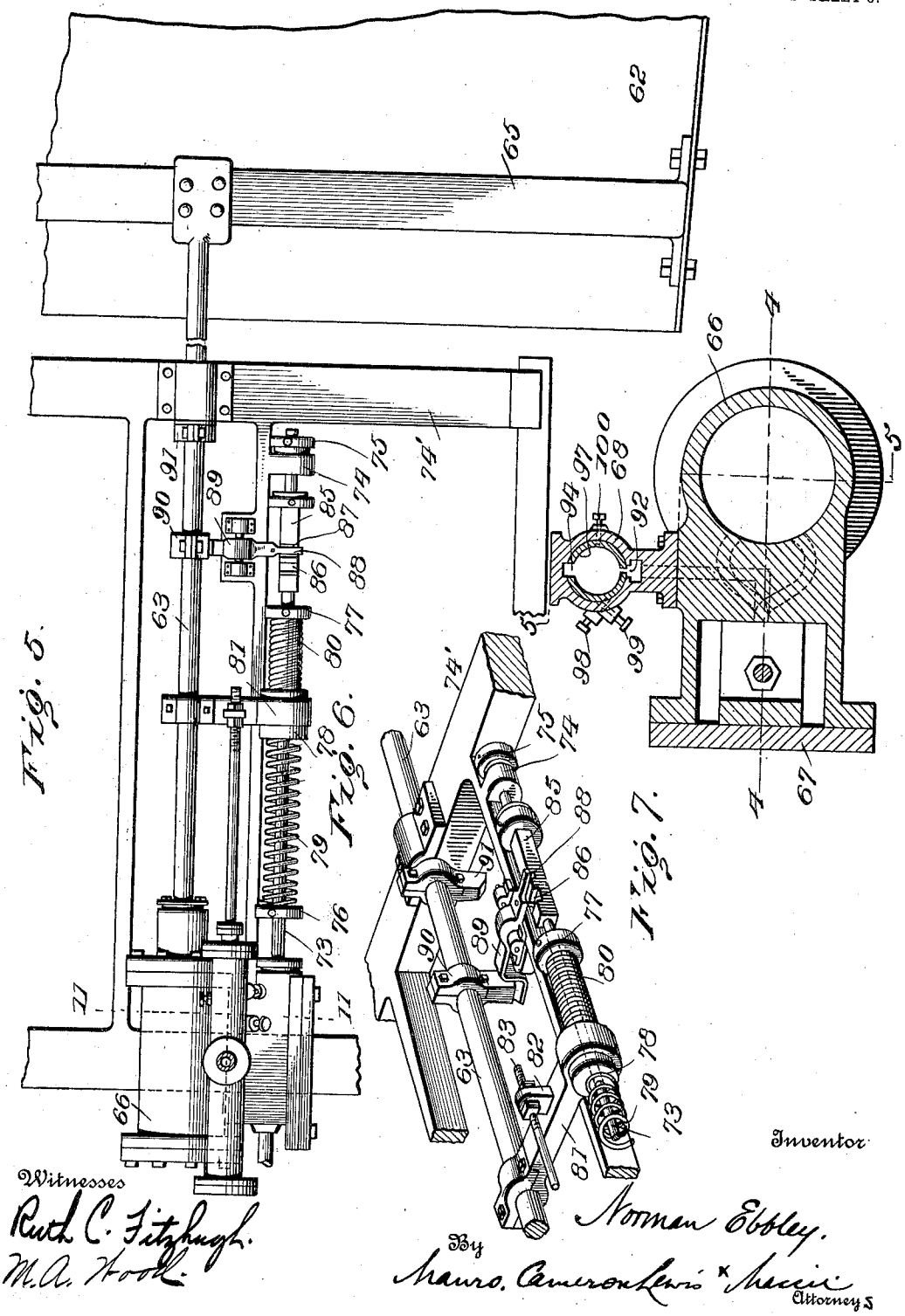

Fig. 5.

Fig. 6.

Fig. 7.

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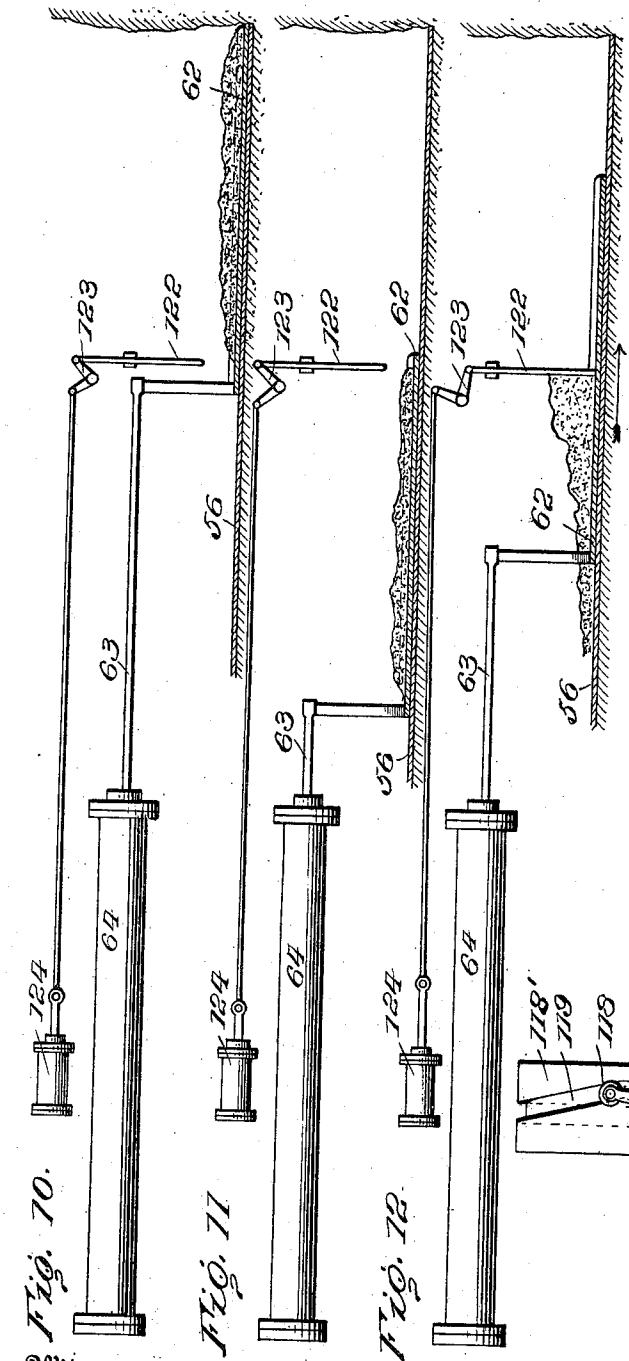

Fig. 10.

Fig. 11.

Fig. 12.

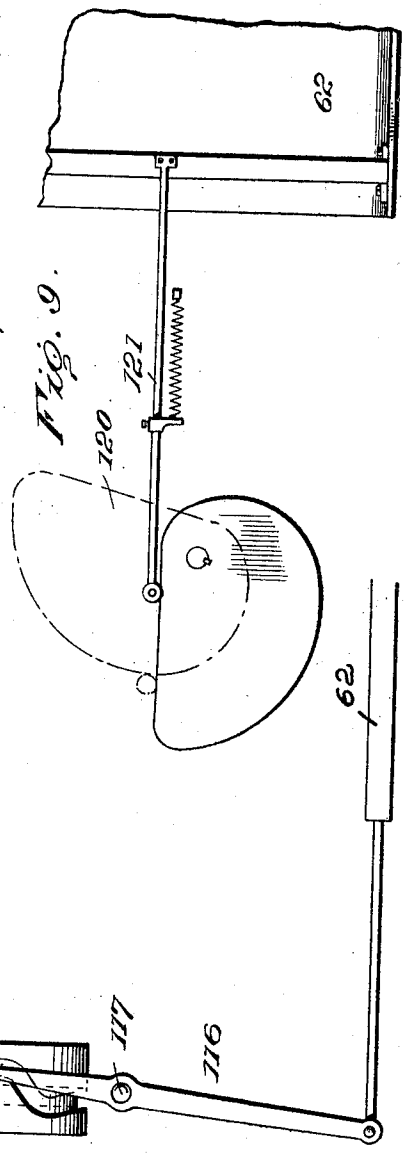

Fig. 9.

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MUCK-SHOVEL.

1,029,799. Specification of Letters Patent. Patented June 18, 1912.

Original application filed April 26, 1910, Serial No. 557,667. Divided and this application filed July 8, 1910. Serial No. 571,062.

To all whom it may concern:

Be it known that I, NORMAN EBBLEY, of Wallace, Idaho, have invented a new and useful Improvement in Muck-Shovels, which invention is fully set forth in the following specification.

This invention relates to mechanically operated shoveling devices, and particularly to that class of devices known as muck shovels used in connection with rock-drilling machines, and to the means for continuously operating the same.

In my copending application filed April 26th, 1910, Serial No. 557,667, of which the present application is a division, I have shown, described and claimed the tunneling machine herein described and have also claimed the combination of the same and the shoveling device, of the present application, and I therefore do not claim said subject-matter herein, reserving for this application claims to the shoveling device alone.

While my present invention may be used in various relations, I have by way of example described it in connection with my aforesaid tunneling machine, so much only of which is herein described as is necessary to properly understand its construction in relation to the present invention.

For the purpose of removing the "muck", I provide at the bottom of the tunnel or excavation a continuously operating muck remover of peculiar and novel construction, which acts to withdraw the muck from the foremost part of the tunnel or excavation and beneath the operating head back to a point where the same is taken up by a suitable endless carrier by which it is removed to the rear.

The device for removing the muck from the forward portion of the tunnel or excavation will hereinafter be referred to as the "mucker", and in its construction and operation advantage is taken of the inertia of the muck to facilitate the removal of the latter. The mucker shovel may assume any suitable form, but as herein specifically shown, it consists of a long shovel-like structure, preferably composed of sheet steel, which is capable of a to-and-fro motion in line with the tunnel. In advancing the mucker shovel, the same is given a quick forward movement by means of suitable connections with the engine or other mechanical means, said movement being very much in the nature of a man using an ordinary shovel to insert the shovel under the material. The mucker shovel is then withdrawn rearward, the movement at first being a slow movement, which movement, however, is constantly accelerated, to the end that the muck on the shovel may partake of the movement of said shovel. The mucker shovel having acquired a rapid rearward movement, it is brought to a sudden stop, and the inertia of the material thereon causes the same to continue the backward movement after the shovel has stopped, thus advancing the material toward the rear of the shovel, that is, the muck slides rearward on the shovel after the latter has been brought to a stop. At the next forward movement of the shovel, it is given a sudden or quick impulse forward, and the muck resting thereon, by reason of its inertia, fails to move forward with the shovel, thus advancing the muck further to the rear on the shovel. This operation is continually repeated until the muck is brought within the sphere of action of any suitable endless carrier operating at the bottom of the tunnel for withdrawing the muck beyond the rear of the tunneling machine, when it may be removed from the tunnel in any suitable manner.

The invention is capable of receiving a variety of mechanical expressions, some of which, for the purpose of illustrating the invention, are shown in the accompanying drawings, but it is to be expressly understood that the specific construction illustrated in the drawings is shown for the purpose of illustration only, and is not to be taken as defining the limits of the invention, reference being had to the appended claims for that purpose.

Referring to the drawings, Figures 1, 1ª, are separated views principally in elevation and part in broken section, showing a tunneling machine embodying my improvements; Fig. 2 is a perspective detail view of a drill support; Fig. 3 is a horizontal sectional view on the line 4—4 of Fig. 7, showing the inlet valve and ports in the engine for operating the muck shovel; Fig. 4 is a vertical sectional view on the broken line 5—5, Fig. 7, showing means for controlling the exhaust of said engine; Fig. 5 is an enlarged detail plan view of the muck-shovel operating engine, showing a portion of the shovel attached thereto; Fig. 6 is a perspec-

tive detail of the controlling means for the inlet and exhaust valve of the muck-shovel engine; Fig. 7 is a vertical transverse sectional view on the line 11—11 of Fig. 5; Figs. 8 and 9 are diagrammatic views illustrating cam means embodying my principle of imparting to-and-fro accelerated movement to the muck-shovel; and Figs. 10, 11 and 12 are diagrammatic views of means for operating the muck-shovel in connection with a scraping device.

Referring to Figs. 1 and 1ª of the drawings, I have therein illustrated one form of my muck shovel in connection with my improved tunneling machine. The tunneling machine comprises a tool-supporting head 1 mounted on a revoluble and extensible tubular shaft 2 which is supported in front in a bearing 3, and at the rear in a supporting-saddle 4, both of which supports are mounted on wheeled trucks 6 running on rails. The rear of shaft 2 is guided in a block 7 which is mounted thereon and made fast to the walls of the tunnel by means of jacks. This block also serves as an abutment for supporting driving cylinders 8, which impart longitudinal movement to shaft 2 by means of a pair of pistons therein, which are driven by compressed air or other fluid. These piston rods 9, are made fast at their outer ends to a collar 10 which permits rotation of shaft 2, but is fast against longitudinal movement thereon. Rotation of the main shaft 2 is effected by means of an engine 11 acting through a train of gearing on the large drive gear 12 fast on said shaft.

The drill-head includes a plurality of tubular arms 13, 14, which serve the double purpose of drill-supports and fluid-conduits, and are arranged radially around the forward end of the drive-shaft 2. These arms are preferably grouped in pairs, each pair lying in the same radial plane. Each of the arms 13, 14, is made fast to the wall of the shaft 2 by securing means such as by a step 15 bolted to the wall of the shaft and having a threaded opening into which the end of the arm may be screwed. Each tubular arm 13 is in open communication with an air pipe 16 located in the axis of the drive-shaft and is supplied with air from an air pressure reservoir not shown. Tubular arms 14 are provided in front with perforations, and are in open communication with the tubular shaft, and are secured therein by steps 24 into which they are screwed. Upon the radial arms 13, 14, I support the pneumatic cylinders 25 for driving the tools against the face of the rock. The supporting means which I have shown and which I prefer to use comprise a bar 26, Fig. 2, having tubular spring jaws 27 adapted to engage arms 13 and 14 and be clamped thereon in any desired position along the arms by suitable bolts engaging the openings 28. Each drill-cylinder is supported in a bracket 31 having an arbor 30 having a bearing in socket 29 in bar 26, whereby the cylinder may be given a movement in a radial plane through the axis of shaft 2, by manipulating an adjusting screw 33.

The boring-head of the machine, as stated above, is adapted to rotate and also to advance as the rock is removed from the breast of the tunnel. In the tunneling machine illustrated, this is effected by a prime mover 11 mounted on the frame 5 which transmits its power to the large gear 12 fast on shaft 2 through a suitable train of drive gears, in a manner well understood. The head of the machine is advanced as work progresses by manipulating valves not shown controlling the air inlet and exhaust ports to compressed air-cylinders 8, by means of lever 45, whereby piston rods 9, 9, acting through collar 10, which is loose on shaft 2, but held from slipping thereon by collar 47 and gear 12, pushes the shaft with its drill-head forward. It may here be stated that the pistons 9, which advance the shaft 2, react through pneumatic cylinders 8, bearing 7 and means not herein illustrated for jacking the latter against the walls of the tunnel. Drilling tools 57, 58, mounted on the drill cylinders 25 are adapted to operate on the face of the rock while the head rotates, thereby cutting channels in the same, enabling the intervening circular ridges to be broken down by other tools carried by the head. The rock or muck falls to the floor of the tunnel, where it is taken care of by my improved muck shovel, which I will now describe in detail.

Referring to Fig. 1, the rails of the track on which the wheels of trucks 6 run, I preferably secure to a portable floor 56, made of heavy iron plates bent to conform with the curved shape of the tunnel. This floor extends as far as possible to the front of the tunneling machine when the work of drilling is begun, and on this forward portion of the floor I place a muck-shovel 62, preferably of heavy steel and curved to conform to the floor 56. The length of this shovel is sufficient to extend from the front end of the carriage frame 5 to near the breast of the tunnel when the machine is in operative position. For the purpose of reciprocating the shovel 62, and to give it the desired acceleration in its to-and-fro movements, it is connected to driving means such as the piston 63 of an engine 66, by a rigid bail 65 which is bolted or otherwise secured to the shovel. The character of the reciprocating movements imparted to this shovel determine primarily its peculiar advantages.

In Figs. 3, 4, 5, 6, and 7, I have illustrated pneumatic means for securing the movement referred to, but other means may be employed such as cam-actuating means. 66 is

a power cylinder provided with a piston, the movement of which is transmitted to shovel 62 by means of a power-transmitting rod 63. The cylinder 66 is provided with a fluid inlet chest 67 and an exhaust chest 68. Within chest 67 is a quick acting valve 69 adapted to alternately bring into communication an exhaust port 70 in cylinder 66 with ports 71 and 72 therein. To secure rapid shifting of valve 69 its valve rod 73 is made of considerable length with its outer end supported in a lug or projection 74 on a bar forming a part of a frame 74′ for supporting the various parts of the shovel driving mechanism. The end of valve-rod 73 is provided with a stop-member 75 limiting the inward traverse of the valve. Fast to rod 73 are two abutment rings 76, 77, secured thereon in adjustable position by clamping screws. A sleeve 78 loose on rod 73 separates two springs 79 and 80 and is provided with an arm 81 adapted to be clamped fast to the piston-rod 63. This arm is provided with a lug 82 in which the end of a second valve stem 83 is secured and operates exhaust valve 84 in chest 68. Valve stem 73 is also provided with a locking means such as plate 85 having thereon two notches 86 and 87 for receiving a spring-latch 88 having a rearwardly extending arm 89 adapted to be tripped by a tappet 90 mounted on piston rod 63. A second tappet 91 is also mounted on piston rod 63 to trip latch arm 89 on the return stroke of the piston. The spaces on the opposite side of the piston in cylinder 66 communicate by passages 71 and 72 in the walls of the casing with the valve chest 67, and by means of valve 69 with exhaust passage 70 leading into the exhaust chest 68. The outlet opening of exhaust passage 70 is in the form of a narrow slot 92, Figs. 4 and 7. Diametrically opposite slot 92 is a narrow passage 94 either in the wall of casing 68 or in a sleeve 97 communicating with the exhaust port 95, said passage being opened and closed by the reciprocating movement of solid piston 84.

The operation of the mucker thus far described is as follows: With the parts in position shown in Fig. 5, the shovel 62 has been sent into advanced position by a previous forward movement of piston rod 63, and it is on the point of starting back, at which time the shovel has imparted to it a slowly accelerating rearward movement for the purpose of permitting the muck on the shovel taking up the motion of the latter. As the shovel retreats its movement is accelerated and then suddenly stopped, permitting the muck load to continue rearward by its own momentum and then removed by a traveling carrier while the shovel is given a sudden impetus forward into the pile of muck and shoved down near the end of its advance by action of the driving means. As piston rod 63 reaches the end of its outward stroke tappet 90 engages and raises latch 88, thereby releasing previously compressed spring 80 which shoots valve stem 73 forward into position for notch 86 to receive latch 88 and lock valve stem 73 in advanced position during the rearward stroke of piston rod 63. Valve 69 in valve chest 67 will then have the position shown in Fig. 3 during the time the piston in power cylinder 66 is moving from right to left in the figure. Compressed air entering chest 67 through supply pipe 96 passes by way of passage 72 to the right side of the piston Fig. 3, or the left side as viewed from the rear, as shown in Fig. 4. As the piston retreats it expels the exhaust air through passage 71 into passage 70 and by way of the gradually opening slit 92 into the chest 68 and thence through slit 94 and port 95. The rapidity of movement of the piston rod 63 and muck-shovel 62 is therefore governed by the exhaust valve 84 which controls the exhaust from cylinder 66. The piston begins its return movement slowly because the exhaust valve 84 nearly closes the exhaust port 92. Further movement of the piston in cylinder 66, together with that of exhaust valve 84, gradually uncovers the exhaust port 92, permitting more rapid escape of air in the power cylinder and effecting increased speed of the piston rod 63 with its shovel 62. The speed of the shovel on its rearward trip is accelerated up to the end of the back stroke. During this period spring 79 has been compressed by the rearward movement of collar 81 while the valve rod 73 has been held stationary by engagement of latch 88 in notch 86. This spring is next released by engagement of tappet 91 with latch arm 89, thereby releasing valve rod 73 which is shot rearward by spring 79 and held in this position by latch 88 dropping into depression 87 till another piston stroke is effected. At the moment the piston rod 63 reaches its maximum speed it stops for reversal. The muck on the shovel, however continues by its own momentum to slide rearward to a sufficient extent to come within the action of blades on a continuous carrier 97′. The shovel next starts forward the moment valve 69 is reversed to admit compressed air into port 71. The exhaust valve 84 is now in position to completely uncover the exhaust passages 92 and 94 and permit rapid escape of air from cylinder 66. The piston rod 63 therefore starts with a rapid movement forward and the shovel 62 is forced under the muck in a manner similar to the operation of a hand-shovel. The shovel is slowed down as it nears the end of its travel by cutting down the size of the exhaust port 92, by valve 84. This valve, however, at no time completely cuts off the exhaust, but leaves a small opening which

facilitates reversing the piston. The shovel is now in position to move rearward with its load and repeat the cycle of operations above described.

In Fig. 7 I have shown means for regulating the size of the exhaust port 92, for further varying the character of the movement of the muck shovel. 97 is a sleeve fitting within the exhaust casing 68 and provided with two diametrically positioned slots registering with slots 92 and 94. By means of screws 98, 99, turning in threaded openings in the wall of the valve-casing, and having their ends resting in tangential shoulders cut in the wall of sleeve 97, the latter can be given a slight rotation in opposite directions to regulate the size of the exhaust port 92. The sleeve is locked in any desired position by means of a set screw 100. The muck shovel 62 brings the muck well to the rear of the drill-head where it is scraped off by a traveling conveyer 97′ provided with blades 101. This conveyer may be of any approved form, though I prefer the one herein shown and described, which consists of two parallel endless sprocket chains 98′ only one of which appears in Figs. 1 and 1ª. Each chain runs over a sprocket wheel 102 mounted near the rear end of the carriage frame 5 and over a similar wheel 103 at the forward end of the frame. Wheel 103 is mounted on an axle 104 having bearings in a pair of parallel arms 105 normally held in horizontal position by retaining means, such as links 107 engaging projections 108 on the arms 105. Scraper blades 101 are secured between the chains, and one or more guide wheels 109 are mounted on the frame to direct the chains. Movement is given the endless chains by means of an engine 110 which drives a gear 111 meshing with a large gear 112, which latter drives sprocket-wheel 102 through a chain 113 and sprocket-wheel 114 fast to the shaft carrying sprocket-wheel 102. As the blades 101 are carried by the chains down and around the forward sprocket wheels 103 they scrape the muck from shovel 62 onto floor 56 on which also the rear portion of the shovel 62 slides. Each mass of muck delivered thus to the carrier is worked back on the smooth iron floor 56 and delivered to a belt 115 or other means whereby it may be delivered out of the tunnel. Should perchance the blade of the traveling conveyer meet an obstruction in the shovel too large for it to readily pass under the front sprocket wheels 103, the latter will be lifted to clear the obstruction, since the shaft 104 on which these wheels are mounted has bearings in arms 105 hinged to a fixed part of the carriage frame. Stoppage of the conveyer is thus prevented.

The operation of removing the muck debris will be readily understood from what has preceded. The shovel 62 mainly rests on the smooth iron floor of the tunnel and therefore is readily slid back and forth while its forward part hugs the ground or rock-bottom of the tunnel. The outward stroke of the drive rod 63 advances the shovel to its work with first a rapid movement in the nature of a quick shove which causes it to enter the muck and then the drive-rod rapidly slows down its movement and stops the shovel. On reverse movement of the drive-rod 63 the shovel is slowly withdrawn from the pile for a fraction of the piston stroke and as the load of muck takes up the movement of the shovel the momentum of the whole is increased to its maximum at the end of the traverse of the shovel where the latter is brought to a sharp stand-still and again shot forward. The muck, however, by reason of its own momentum, continues to the rear, more readily sliding over the shovel as the latter moves in the opposite direction, and is caught under the blades 101 of the conveyer which force it to the rear on the smooth iron floor 56. This operation of muck removal is continuous and effective. The parts of the device are readily assembled for purposes of cleaning, removal of obstructions, and of making repairs, while it is simple and cheap in construction.

While I have described in detail one form of means and the one I prefer for imparting to the shovel the movements described, I do not desire to limit myself to this particular means, as it is obvious that other devices may be employed for the purpose, as, for example, the shovel 62 (Fig. 8) is shown connected with a lever 116 fulcrumed at 117 and having on its outer end a roller 118 which runs in a cam groove 119 formed in the periphery of a wheel 118′, the rotation of which imparts a reciprocatory movement of the character described to the shovel. In Fig. 9 is shown another means for effecting the described movement of the shovel and consists of a cam 120 having a contour as shown. As the cam rotates, its engagement with the spring retracts rod 121 and causes the latter to reciprocate and with it the shovel 62.

Instead of a chain conveyer for removing the muck delivered thereto by the shovel, other removing means may be employed, one of which I have illustrated diagrammatically in Figs. 10, 11 and 12, wherein 62, 63 and 64 designate the shovel and its operating means as described. A scraper bar 122 is mounted over the shovel, and by means of a bell-crank lever 123 operated by a power device, such as compressed air-cylinder and piston 124, is given an up-and-down movement, such that when the shovel is in retracted position the scraper rod 122 is dropped in front of the muck and remains in depressed position while the shovel

advances thereunder and unloads the shovel. The bar is raised to clear the load when the shovel is moved in reverse direction. This operation will be apparent from an inspection of the drawings.

What is claimed is:—

1. In combination, a shovel, means for reciprocating the same, and means controlling the first-named means for imparting increased acceleration in one direction and decreased acceleration in the opposite direction, and a conveyer in operative relation to the shovel for removing material from the shovel.

2. In combination, a shovel, a power cylinder provided with a reciprocating piston for reciprocating said shovel, and means controlling the exhaust port of said cylinder for enabling said piston to move faster on one stroke than on the opposite stroke.

3. In combination, a shovel, a power cylinder provided with a reciprocating piston for reciprocating said shovel, inlet and exhaust ports in said cylinder, valves controlling said ports, and spring-pressed means for throwing the inlet valve in either direction, power being stored in said springs by movement of said piston.

4. In combination, a shovel, a power cylinder provided with a reciprocating piston for reciprocating said shovel, inlet ports opening on opposite sides of said piston, an exhaust passage, a valve for alternately placing one of said inlet ports in communication with the said exhaust passage and the other with said cylinder, and a valve working with said piston to open and close said exhaust and thereby effect increased or decreased acceleration of said piston and of said shovel.

5. In combination, a shovel, a power cylinder provided with a piston for reciprocating said shovel, inlet ports opening on opposite sides of said piston, an exhaust passage and means for placing the same in communication with one or the other of said inlet ports, means for adjusting the size of the opening at the end of the exhaust passage, and a valve working with said piston to open and close said exhaust passage and thereby effect increased and decreased acceleration of said piston and of said shovel.

6. In combination, a shovel, means for reciprocating the same, and means controlling the first-named means for imparting increased acceleration in one direction and decreased acceleration in the opposite direction.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

NORMAN EBBLEY.

Witnesses:
E. W. GIBSON,
E. L. FURST.