June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

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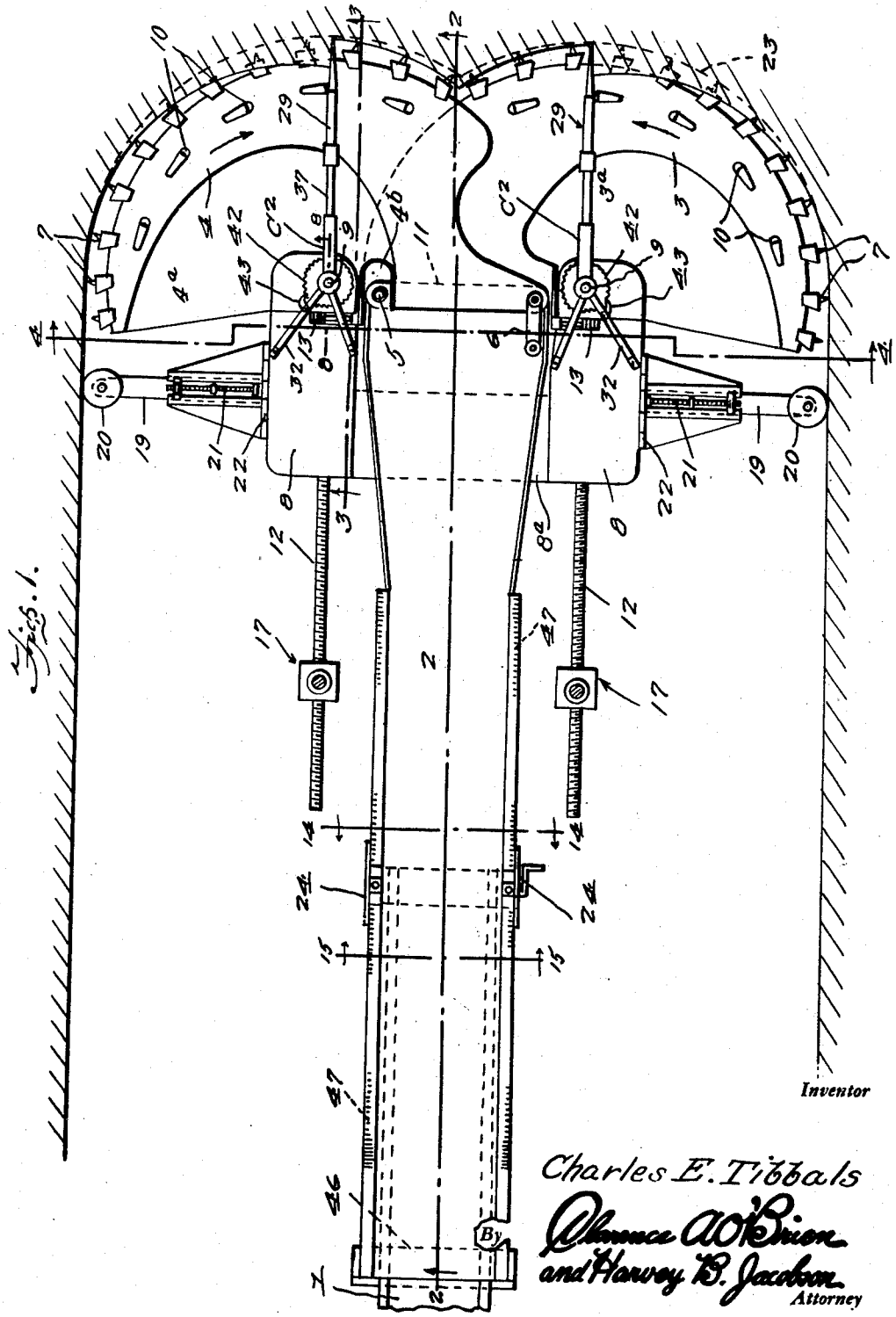


Fig. 1.

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June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 2

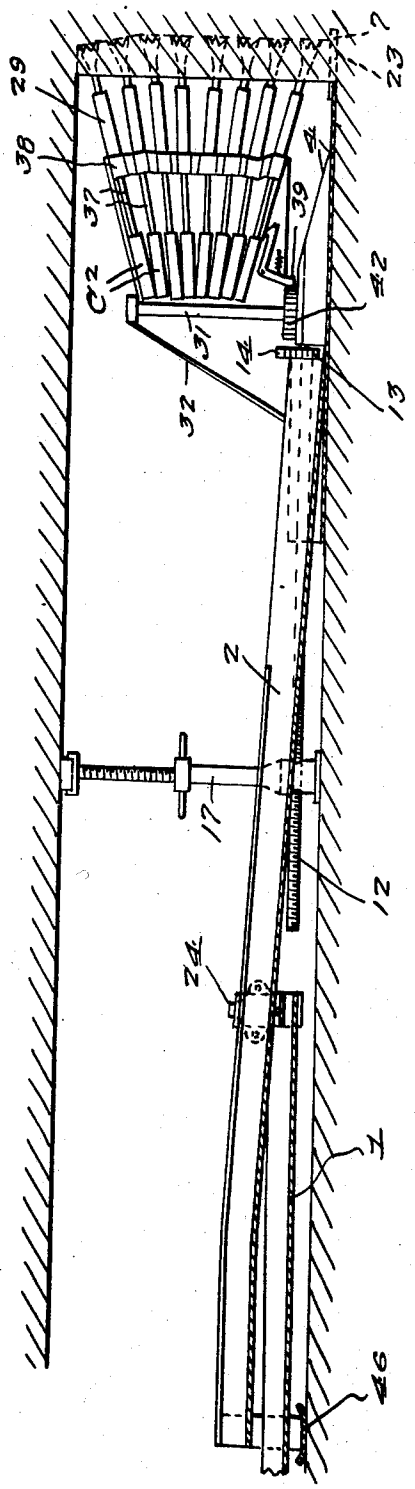


Fig. 2.

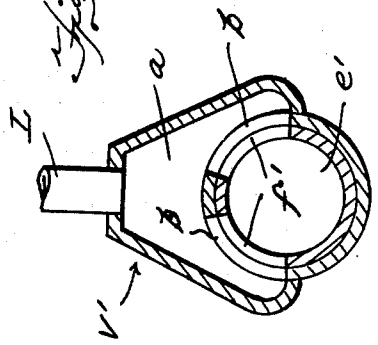


Fig. 12.

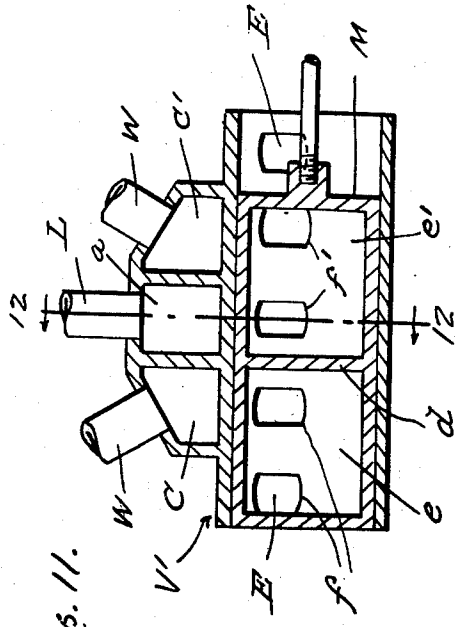


Fig. 11.

Inventor

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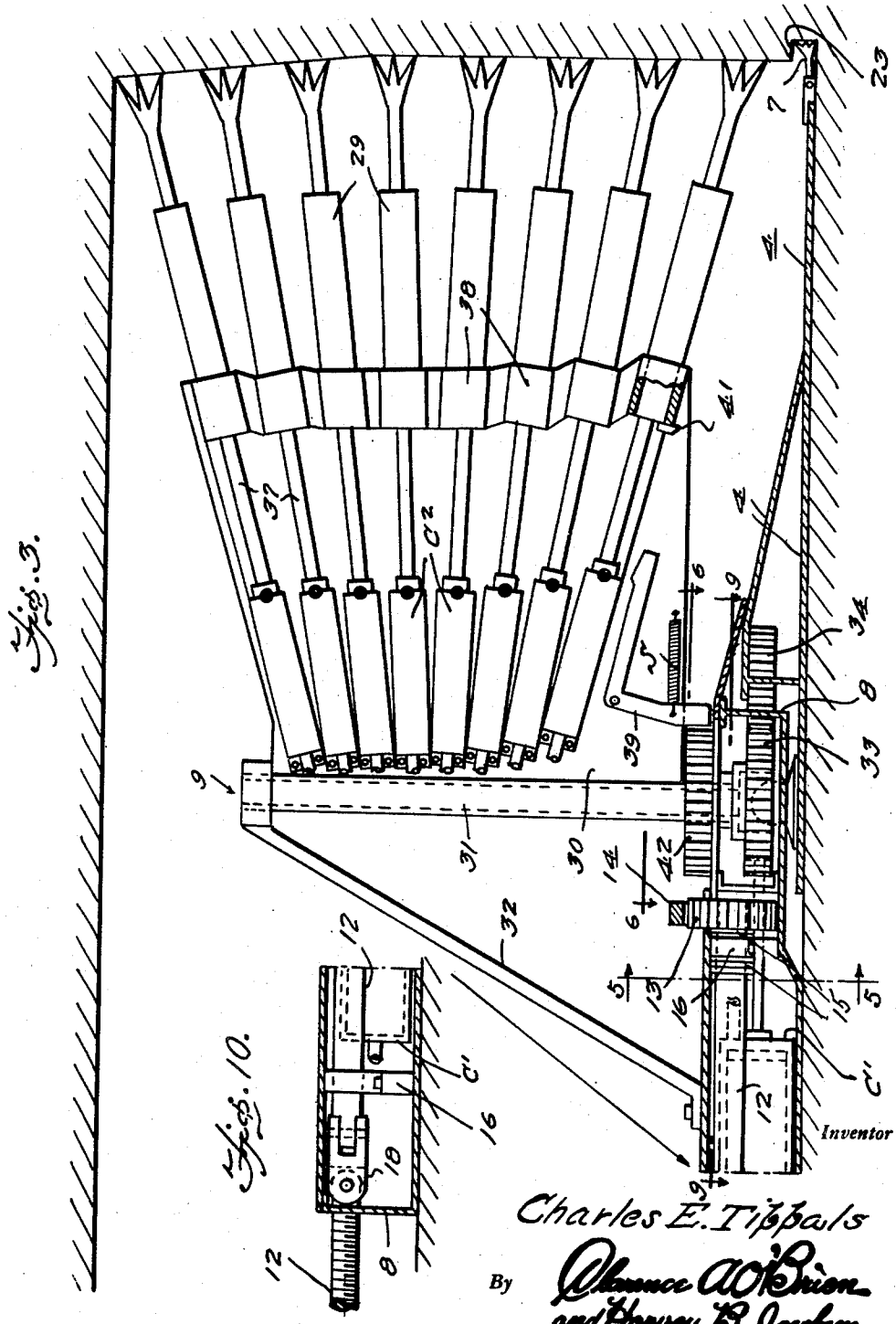
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June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 3



June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 4

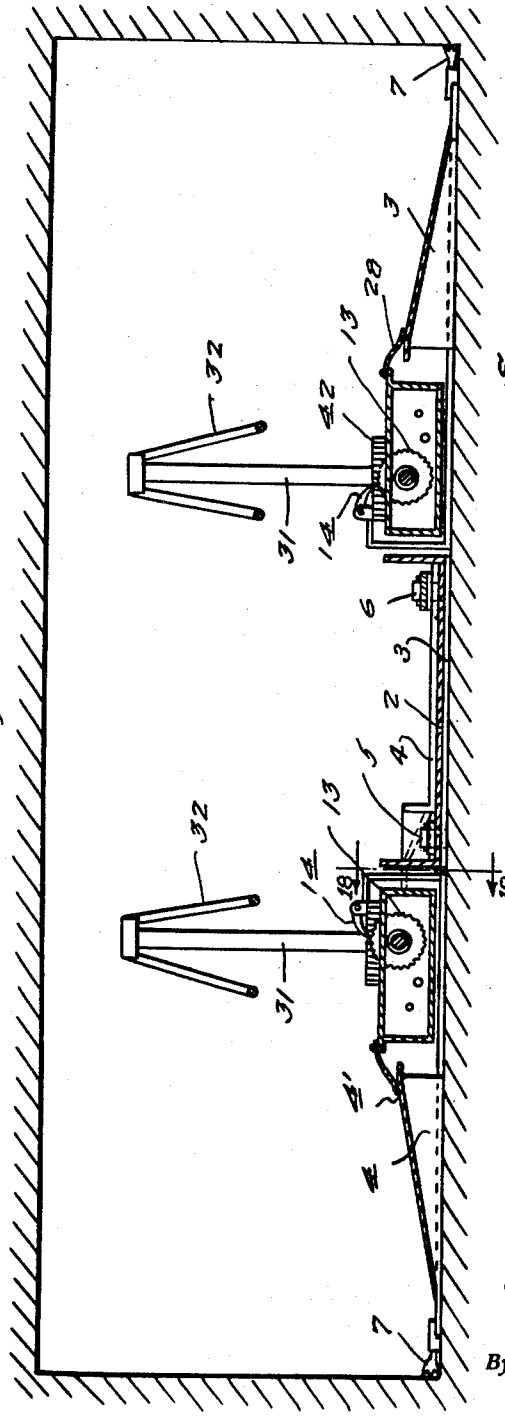


Fig. 4.

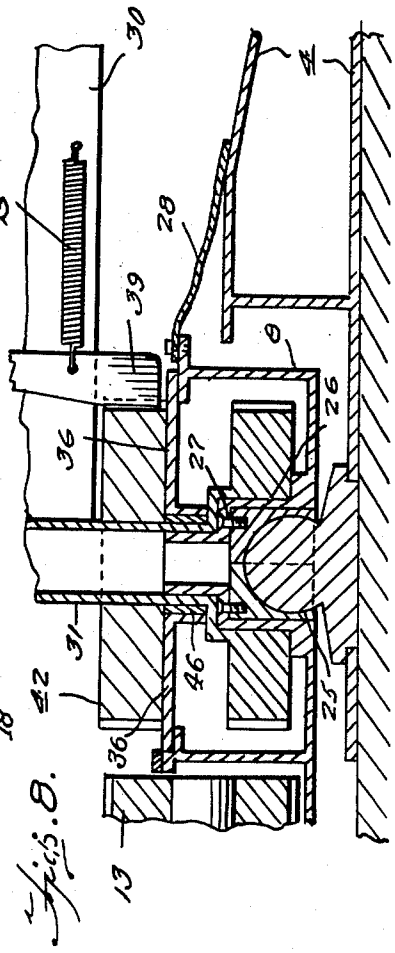


Fig. 8.

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June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

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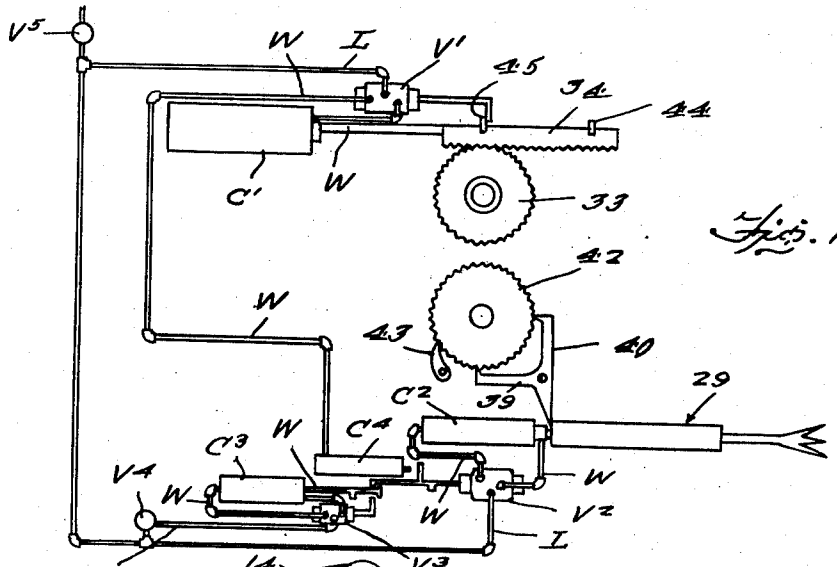


Fig. 13.

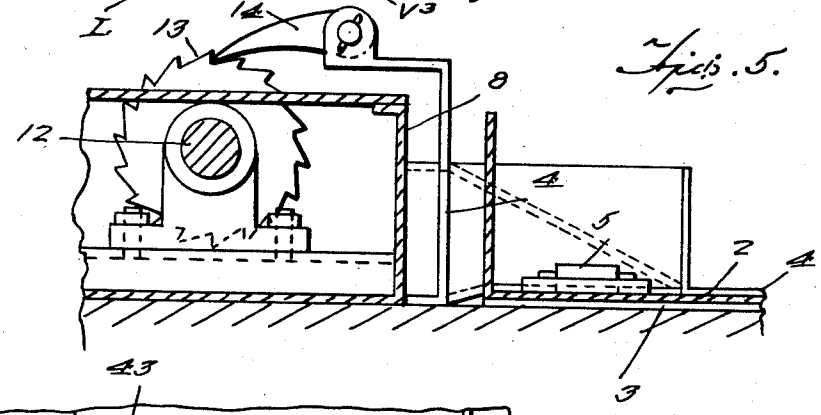


Fig. 5.

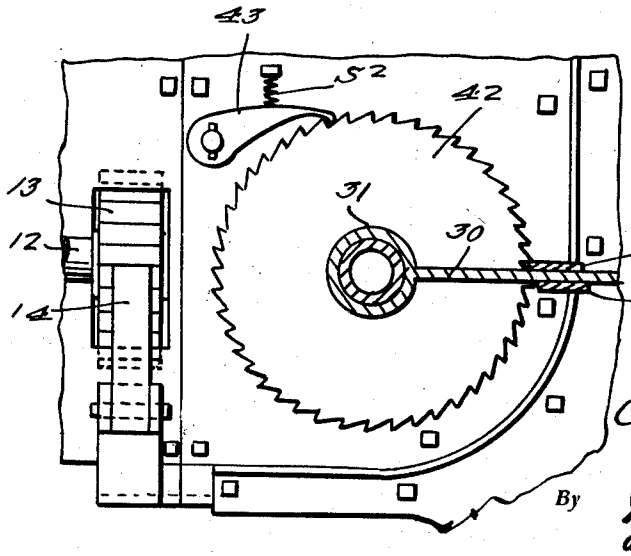


Fig. 6.

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June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 6

Fig. 9.

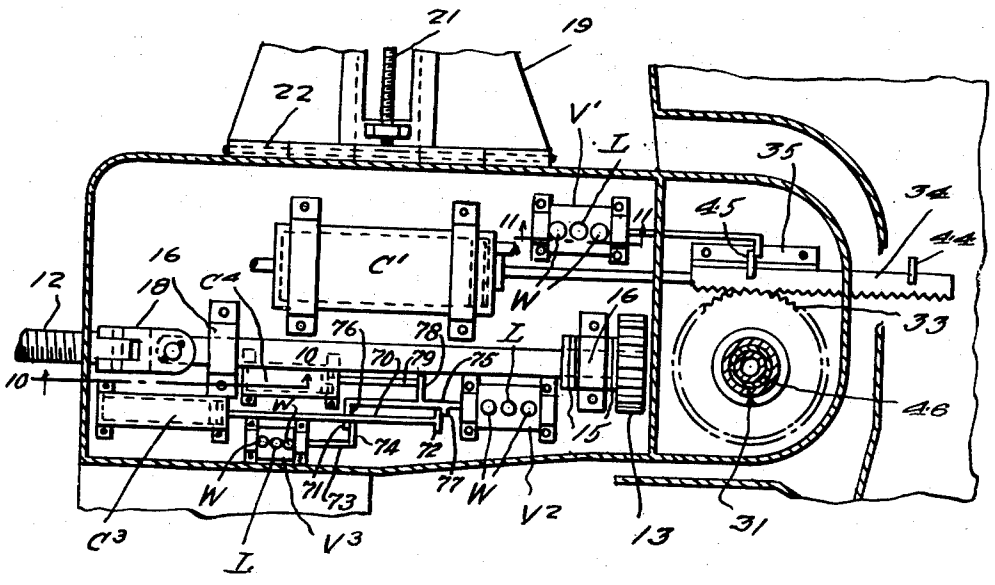
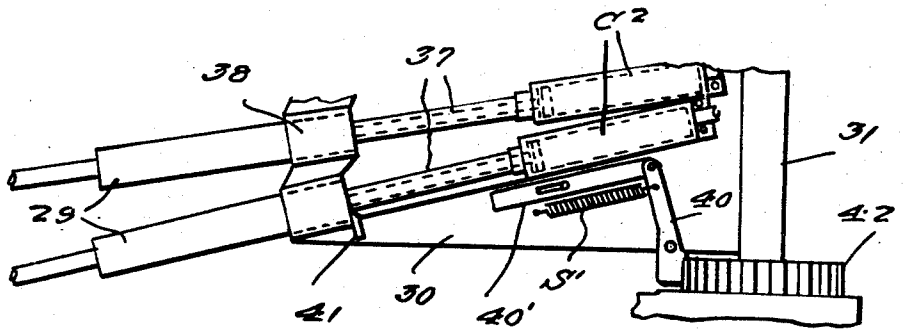


Fig. 7.



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June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

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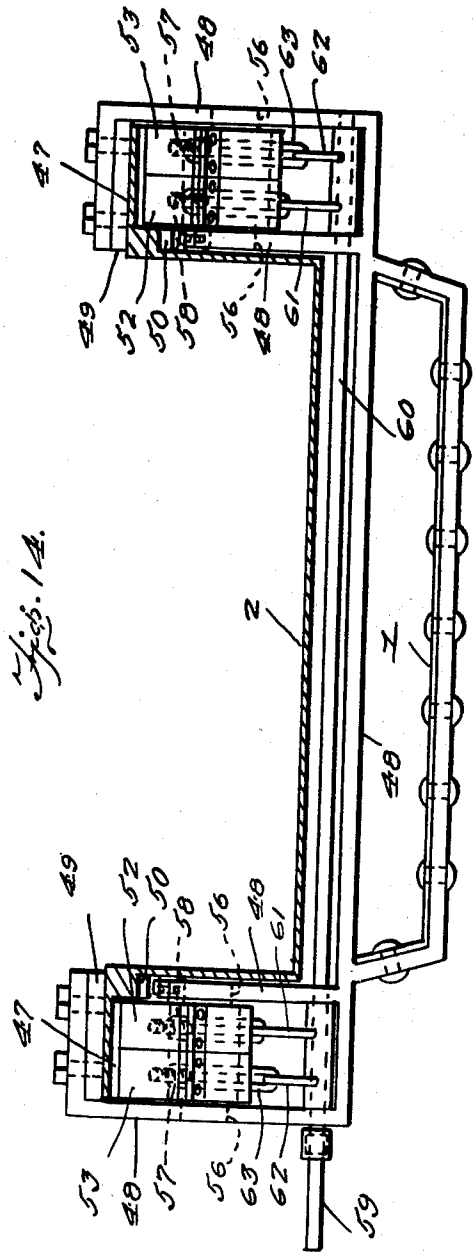


Fig. 14.

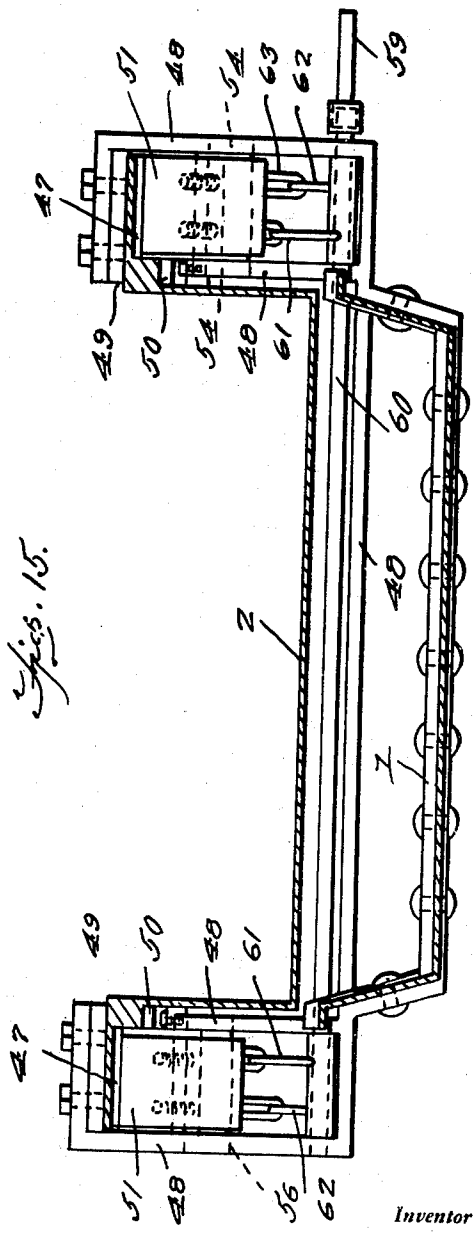


Fig. 15.

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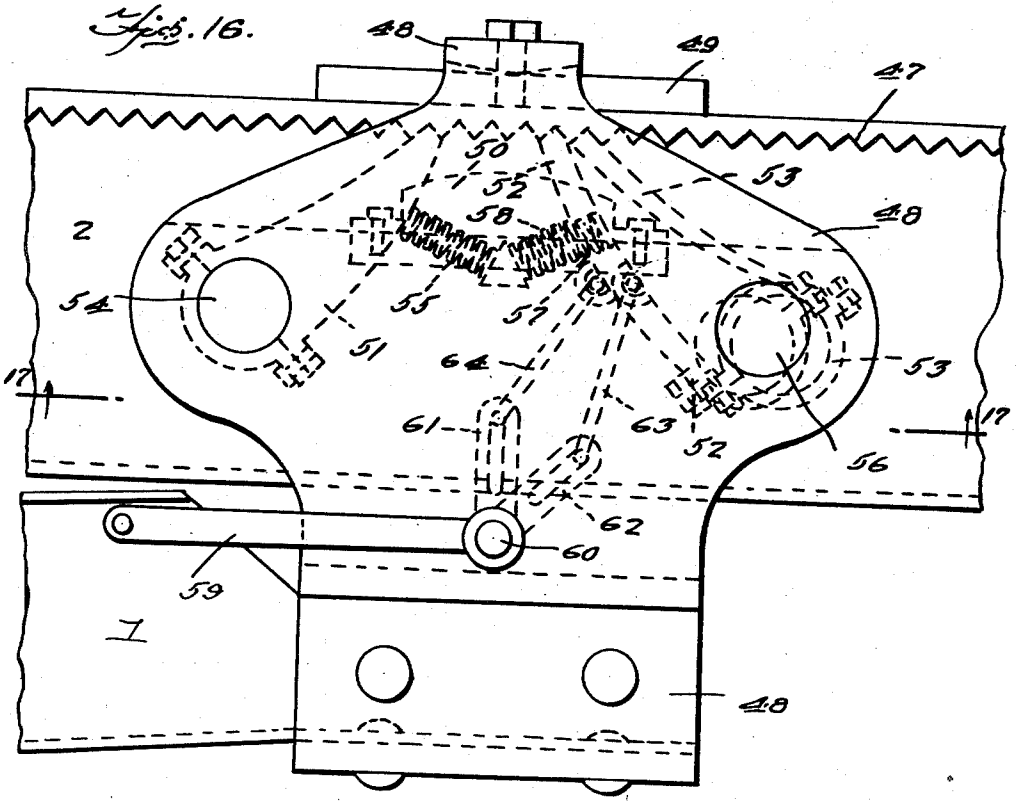
Attorneys

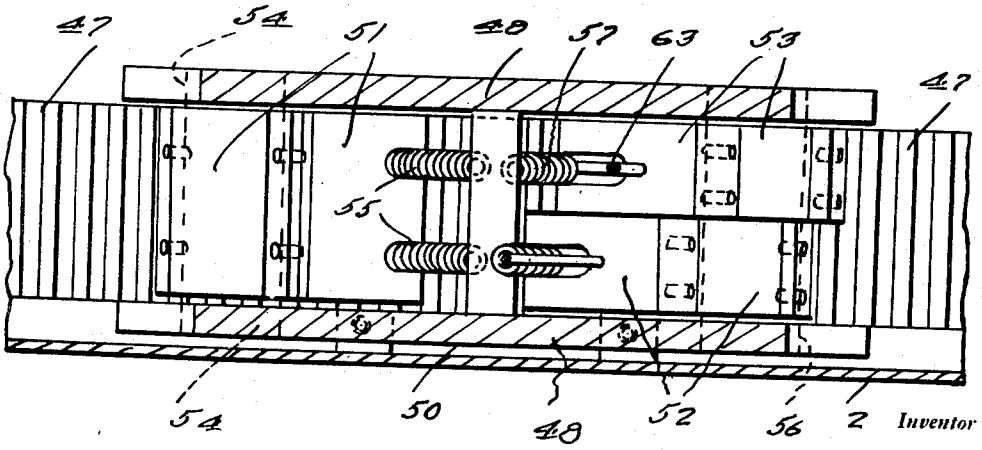
June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 8

Fig. 16.





Inventor

Fig. 17.

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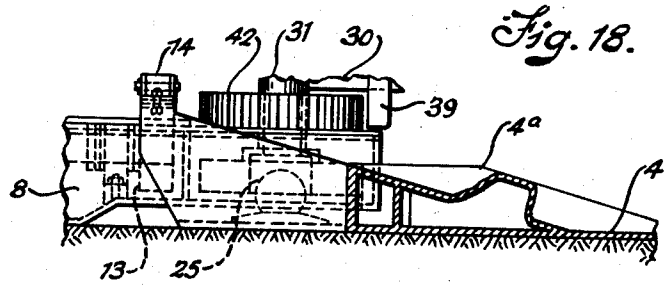
Attorneys

June 10, 1947. C. E. TIBBALS 2,422,053

ENTRY DRIVING MACHINE

Filed Aug. 9, 1944 9 Sheets-Sheet 9

Fig. 18.



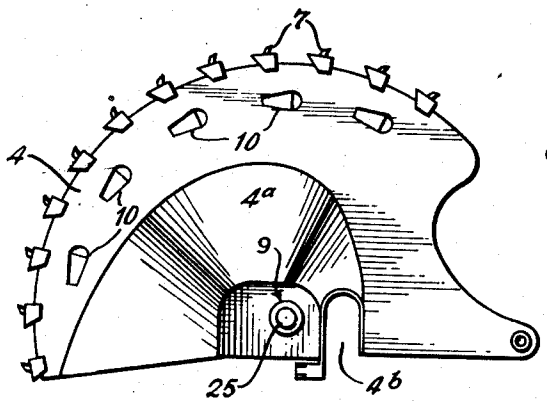


Fig. 19.

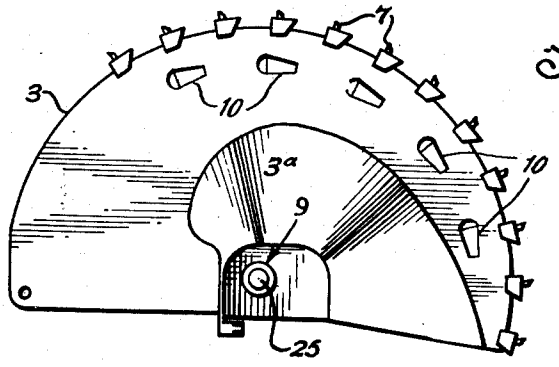


Fig. 20.

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Patented June 10, 1947

2,422,053

UNITED STATES PATENT OFFICE

2,422,053

ENTRY DRIVING MACHINE

Charles E. Tibbals, Bluefield, W. Va.

Application August 9, 1944, Serial No. 548,768

10 Claims. (Cl. 262—9)

1

This invention relates to an improved entry driving machine particularly adapted for the advance mining of narrow entries in coal mines.

Present methods of coal mining involve a mining cycle of cutting, blasting and loading. These operations require considerable manual effort and they interfere with each other in highly concentrated conveyor mining, resulting in low equipment and labor operating efficiency. The blasting and coal handling operations decrease the lump coal yield and therefore the monetary realization from the product.

The primary object of this invention is to combine the cutting and conveying of the coal into one machine and to eliminate the loading labor. All three of these operations are performed simultaneously by this invention, thus vastly increasing the labor and operating efficiency. The coal is broken down onto the machine by automatically operating compressed air picks, with a minimum of coal breakage.

More specific objects and features of the invention will become apparent from the following description when considered in connection with the accompanying drawings, and the invention consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the drawings and claimed.

In the drawings, wherein like reference characters indicate corresponding parts throughout the several views:

Figure 1 is a top plan view of an entry driving machine constructed in accordance with the present invention.

Figure 2 is a central longitudinal section taken substantially on line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary vertical longitudinal section taken substantially on line 3—3 of Figure 1.

Figure 4 is an enlarged transverse section taken substantially on line 4—4 of Figure 1.

Figure 5 is an enlarged fragmentary vertical transverse section taken on line 5—5 of Figure 3.

Figure 6 is a fragmentary horizontal section taken on line 6—6 of Figure 3.

Figure 7 is a fragmentary elevational view looking at the reverse side of a lower portion of the construction shown in Figure 3.

Figure 8 is an enlarged fragmentary vertical longitudinal section taken substantially on line 8—8 of Figure 1.

Figure 9 is a fragmentary horizontal section taken substantially on line 9—9 of Figure 3.

Figure 10 is a fragmentary vertical, longitudinal section taken substantially on line 10—10

2

of Figure 9; this figure constitutes a continuation of the left hand portion of Figure 3.

Figure 11 is an enlarged longitudinal sectional view through one of the three-way sleeve valves.

Figure 12 is a transverse section taken on line 12—12 of Figure 11.

Figure 13 is a diagrammatic plan view of the compressed air system associated with each battery of picks.

Figure 14 is an enlarged transverse section on line 14—14 of Figure 1.

Figure 15 is a transverse section on line 15—15 of Figure 1.

Figure 16 is a fragmentary side elevation looking toward the left of Figure 15.

Figure 17 is a section on line 17—17 of Figure 16.

Figure 18 is a fragmentary section taken on line 18—18 of Figure 4.

Figure 19 is a top plan view of one of the undercutters.

Figure 20 is a view similar to Figure 19, of the other undercutter.

Referring in detail to the drawings, the present invention includes a shaking conveyor 1 to which is fitted a telescoping conveyor section 2. The conveyor 1 is of a well known type consisting of a trough composed of a series of connected sections, conventional means being provided, not shown, for longitudinally reciprocating the trough with a rapid forward movement and a relatively slower rearward movement so as to cause rearward travel of the coal as it is fed onto the shaking conveyor. As this type of conveyor is old and very well known in the art, it is only indicated and described as to type and need not be detailed herein.

Two substantially semi-circular plates or undercutters 3 and 4 are operatively connected to the conveyor section 2 by a direct pivotal connection 5 for the undercutter 3 and by a connecting link 6 for the undercutter 4. Both of the undercutters 3 and 4 rest on the mine floor, but the inner side portion of undercutter 4 is overlapped upon the undercutter 3 and may flex or be upwardly offset for that purpose. Removable cutter bits 7 are provided at the arcuate periphery of each undercutter, and said undercutters are pivoted at their center points 9 to the hollow base members 8 for horizontal oscillation. As the conveyor reciprocates, it causes the undercutters 3 and 4 to oscillate about the center points 9 for a distance slightly more than that between adjacent cutter bits 7. The portions of the undercutters near the center points are raised as at 3a and 4a

to aid in keeping the coal near the outer edge portions of said undercutters. Louvered slots 10 are provided in the outer edge portions of the undercutters to allow upward passage of coal dust therethrough that might collect under said undercutters. The lower undercutter 3, part of the upper undercutter 4, and part of the base embodying members 8 rest flat on the mine floor, but the end of the conveyor section 2 slidably extends between the undercutters to the line 11 (Figure 1). A base plate connects the members 8 as at 8a in Figure 1. A certain amount of flexibility is provided in the assembly by ball and socket joints 25 which constitute the pivots of the undercutters 3 and 4 and which are located at the center points 9 of the latter. The sockets of these joints are held in the frames 26 which are part of the base members 8, by screws 27. Heavy pieces of canvas 28 prevent coal from lodging in the spaces between the undercutters and the hollow base members.

Both the base members 8 and plates 3 and 4 slide on the floor. As shown in Figures 3 and 10 and in Figure 8, the rear portions of members 8 rest on the floor, but the front portions thereof have their bottom wall portions offset upwardly. The rear portions of plates 3 and 4 extend under these upwardly offset bottom wall portions of members 8 and are journaled at 25a on the bases of the ball members of joints 25.

The undercutters 3 and 4 and the base members 8 are fed forward by feed screws 12, the feed screws being, in turn, rotated by pawls 14 engaging ratchet wheels 13 and carried and actuated by the undercutters 3 and 4. As the ratchet wheels 13 remain stationary with the base members 8, and as the pawls 14 oscillate with the undercutters, said pawls act to turn the ratchet wheels 13 when the undercutters swing away from each other and freely ratchet over the ratchet wheels 13 when the undercutters are swung toward each other. The ratchet wheels 13 are relatively wide, and the pawls remain in engagement therewith even though said pawls move in a short arcuate path and shift a slight distance transversely of said ratchet wheels. The feed screws are held in place by bearings 16, and thrust washers 15 transmit the lateral thrust to the front bearing (Figs. 3, 9 and 10). As the feed screws are rotated, they are fed forward by thread boxes in the bases of screw jacks 17 engaged with the roof and floor of the mine at opposite sides of the conveyor section 2. A flexible coupling 18 is inserted in each feed screw. The undercutter 4 has a recess 4b at the back to provide clearance for the pivotal connection 5.

The assembly is held in alignment by guides 19 fitted with wheels 20 which operate in the plane of the kerf 23 cut by the bits 7. Each guide has adjusting screws 21 and hinged joints 22 connect the guides to the base members 8 so that said guides may be swung to either a vertical inoperative position or to a horizontal operative position.

As the machine feeds forwardly, the bits in the peripheries of the undercutter cut the kerf 23 in the coal so as to provide an undercut. The conveyor section is periodically extended by the machine operator through manipulation of the conveyor section feed dogs 52 and 53 by hand crank 59 and insertion of conveyor pans or sections as needed.

A battery of compressed air picks 29 is mounted over each undercutter so as to rotate about the center point 9, the picks of each battery being disposed one above the other in forwardly diverging relation. The picks are mounted in a frame 30 which is connected to a center post 31, and the center post is held in position by braces 32 and is rotated by a gear 33, rack 34 and the piston of a compressed air motor C_1. The rack is held in position by a guide 35, and a bearing 46 in the cover plate 36 keeps the center post and gear in alignment.

The compressed air picks are forced forward and retracted by the pistons of compressed air motors C_2, compressed air for operation of the picks being carried from the pistons to the picks by hollow piston rods 37. The picks move in sleeve supports 38 which are mounted in the frame 30, and rotation of the assembly is controlled by levers 39 and 40 which are actuated by dogs 41 attached to the bodies of the bottom air picks. The levers alternately mesh in teeth of the ratchet wheel 42 so as to permit a one-tooth movement each time the air picks are retracted. It will be noted that the lever 39 is normally released by a spring S, while the lever 40 is normally engaged by a spring S', the dog 41 having a camming action on the forward end of an arm of lever 39 to engage the same with the ratchet wheel 42, and the dog 41 having a pushing action on a slidable bar 40' operatively connected to an end of lever 40, as respectively indicated in Figures 3 and 7. When the picks are retracted, dog 41 releases lever 40 to allow the ratchet wheel 42 to turn. At the same time, dog 41 rides on the forward end of lever 39 so as to cause the latter to engage ratchet wheel 42 and limit turning of the latter to the distance of one tooth. When the picks are projected, the spring S disengages lever 39 from the ratchet wheel and spring S' engages lever 40 therewith so as to hold the same against turning until the picks are retracted again. The pawl 43 permits the ratchet wheel 42 to rotate when the assembly is returned for a new cut, it being understood that the batteries of picks are swung away from each other in the breaking down operation. A spring S2 yieldingly engages pawl 43 with ratchet wheel 42, as shown in Figure 6. The guides 19 comprise inner members hinged at 22 to the base on which the plates 3 and 4 are pivoted, and outer sections that are adjustable laterally by the screws 21 to engage the side walls of the entry even though the width of the latter may vary. It will be seen that when the plates 3 and 4 swing in a direction toward each other, the pawls 14, which swing with the plates 3 and 4, will engage and actuate ratchet wheels 13 so as to rotate screws 12 and thereby shift the plates 3 and 4 forwardly into position for a new cut. As the conveyor section 2 is releasably fixed to the conveyor 1, it partakes of the longitudinal reciprocating movement of the latter, thereby affecting the horizontal oscillation of the plates 3 and 4 by reason of the connections 5 and 6 between the conveyor section 2 and said plates 3 and 4. Of course, the batteries of picks 29 oscillate independently of the plates 3 and 4 so that they can be given a step-by-step movement for successively breaking down the coal as each new set of free faces is established, as indicated in Figure 1.

The rear end of the adjustable conveyor section 2 carries a shoe 46 which rests on the mine floor. A toothed rack 47 is mounted on each side of the conveyor section 2, and a connection plate and frame 48 is fastened to the end of the shaking conveyor 1. Shoes 49 and 50 are mounted in the frame 48 and serve to hold the conveyor section 2 in position. A gripping device which permits the telescoping conveyor section to be extended consists of three dogs 51, 52 and 53 on each side of

the conveyor section. Dogs 51 are mounted on shafts 54 and are held against the racks 47 by springs 55. Dogs 52 and 53 are mounted on cam shafts 56 and are held against the racks 47 by springs 57 and 58. The cam shafts 56 each have two cams so constructed that lines drawn through the center line of the shaft and the center of the cams are at 90° angles with each other. Dogs 52 and 53 are mounted on the two cams on each of these shafts 56. A hand crank 59 and shaft 60 are fitted with levers 61 and 62 which in turn are connected to dogs 52 and 53 by rods 63 and 64. The device is operated by rotating the hand crank 59 when the conveyor section is moving toward the face and the pressure is off of dogs 52 and 53, until dogs 53 are disengaged from the racks 47. When the conveyor section pulls away from the face, dogs 52 will rotate the cam shafts 56 through 90°. This will permit the conveyor to lengthen one tooth on the racks and dogs 51 will engage the next teeth on the racks. If the operator desires to further extend the conveyor section, the hand crank is next rotated in the opposite direction causing dogs 52 to be disengaged from the racks and the conveyor to be lengthened one tooth based on the racks, in a similar manner.

Completely automatic operation of the air picks is accomplished by the control mechanism shown in Figures 9 and 13. A cut-off valve V_5 is inserted in the compressed air supply line to start and stop the unit. The pressure supplied to motor C_3 is controlled by a pressure reducing valve V_4. The three-way valve V_3 controls the motion of the piston of motor C_3 which in turn controls the three-way valve V_2 that controls the motors C_2 and the air picks. Motor C_1 is controlled by the three-way valve V_1, and motor C_4 is used only when rotating the assembly for a new cut to hold the air picks away from the coal face. As motor C_4 works on a higher air pressure than motor C_3, it forces valve V_2 to retract the air picks. A detail of the three-way sleeve valves is shown in Figures 11 and 12, wherein L indicates the compressed air supply line, W the lines leading to the motor, and E the exhaust air ports. While the valve V_1 is illustrated in Figures 11 and 12, the valve V_2 and V_3 are of similar construction. The line L communicates with a chamber *a* leading to ports *b* at opposite sides of the valve casing. In a like manner, the lines W lead from chambers *c* and *c'* that communicate with similar ports at opposite sides of the valve casing. The slidable valve member M is provided with an intermediate transverse partition *d* that divides the same into two chambers *e* and *e'*, and a pair of ports *f* open into the chamber *e* at opposite sides of the latter while similar ports *f'* open into the chamber *e'* at opposite sides of said chamber *e'*. It will be apparent that a port *f* may communicate with chamber *c* and simultaneously another port *f* may communicate with an exhaust port E. At the same time, a port *f'* will communicate with chamber *a* while another port *f'* will communicate with chamber *c'*, thus exhausting compressed air from one end of the cylinder of the associated motor while supplying compressed air to the other end of said cylinder. A reversal of this operation may be accomplished by shifting the valve member M to the right of Figure 11 so that the right hand port *f'* is registered with the right hand exhaust port E. It is pointed out that, as shown in Figures 9 and 13, the piston rod of motor C_4 is operatively associated with a dog on the stem of valve V_2; the piston rod of motor C_3 has lugs which are operatively associated with dogs on the stems of valves

V_2 and V_3; and the stem of valve V_1 has a lug which is operatively associated with the dogs 44 and 45 of rack bar 34, so as to bring about the cycle of operation to be presently described. The motor C_3 has a piston rod 70 which carries two spaced dogs 71 and 72. The valve V_3 is provided with a sliding core provided with a stem 73 having a projection 74. The dogs on the piston rod 70 engage the projection 74 on the stem 73 to move the core and thereby cause the piston of motor C_3 to be moved in the desired direction. The valve V_2 is provided with a sliding core whose stem 75 has projections 76, 77 and 78. The dog 72 on piston rod 70 engages the projections 76 and 77 on the stem 75 to move the core of valve V_2 and thereby cause the piston of motor C_2 to be moved in the desired direction. The motor C_4 has a piston rod 79 which engages projection 78 to move the core of valve V_2 and thereby cause the piston of motor C_2 to be moved in the direction to retract the air picks 29. The compressed air picks 29 are common devices used in the industry, and are available from a number of manufacturing concerns. Air motors C_2 are used to extend and retract the compressed air picks 29 toward and away from the coal face as the unit is shifted to successive operating positions. These air motors also serve to hold the cutting tools against the face as the coal is undercut and broken down. Air for operation of the compressed air picks 29 enters at the back end of the air motors C_2 and forces forward the pistons of air motors C_2, hollow piston rods 37, and compressed air picks 29. The air passes through the hollow piston rods 37 and into compressed air picks 29, and it exhausts through ports (not shown) in the side of the compressed air picks, as is the usual custom in any pneumatically operated picks or hammers. The design of the compressed air picks is not shown as they are well known in the industry. The piston of motor C_3 moves slowly back and forth, the speed being controlled by the setting of valve V_4. Obviously, a low air pressure is needed to accomplish this slow motion of the piston of motor C_3. Motor C_4 is a single acting motor, and it works at full line pressure, thereby causing greater force to be exerted by its piston than is exerted by the piston of motor C_3. Thus, the stem of valve V_2 is forced forwardly by the piston of motor C_4, regardless of the piston of motor C_3. This causes the air picks to be retracted from the face when the mechanism is swung into position for a new breaking down operation.

The cycle of operation is as follows:

The piston rod of motor C_3 extends and pushes the stem of valve V_2, which sets said valve so as to cause retraction of the piston of motor C_2 and the associated battery of air picks. Dogs 41 strike levers 39 and 40, and the assembly rotates one tooth on the ratchet wheel 42, the action of levers 39 and 40 being similar to that of an escapement lever. The piston rod of motor C_3 then retracts and pulls the stem of valve V_3, which sets the latter so as to cause the piston rod of motor C_2 to extend and projects the air picks. The valve V_2 is set so that the air picks automatically operate when extended, and are caused to cease operation when retracted. When the air picks finish a cut, the dog 44 pushes the stem of valve V_1 so as to set the latter for causing the piston of motor C_1 to rotate the assembly in one direction until dog 45 pulls the stem of valve V_1 and sets the latter to cause the piston of motor C_1 to rotate the assembly in the opposite direction. Then pawl 43 holds the ratchet wheel 42 for a new cut. While

the assembly is rotating, valve V_1 is set so that the piston of motor C_4 is extended to set valve V_2 for causing the air picks to retract or move away from the coal face. The piston rod of motor C_3 has a lug engageable with a dog on the stem of valve V_2. This rearward movement of said rod moves said stem and sets said valve to supply the air to the rear end of motor C_2 and thereby project the picks toward the coal face. The method of breaking down the coal is in effect similar to the method used in quarrying building stone by the use of a series of wedges to split off pieces of stone after free faces have been established.

From the foregoing description, it is believed that the construction and operation, as well as the advantages of the present invention, will be readily understood and appreciated by those skilled in the art. Minor changes in details of construction illustrated and described are contemplated, such as fairly fall within the spirit and scope of the invention as claimed.

What I claim is:

1. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, and means to adjustably telescopically connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter.

2. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, means to adjustably telescopically connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter, and means to automatically impart an intermittent forward feeding movement of the base as the undercutters swing toward each other.

3. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, means to connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter, and vertical batteries of compressed air picks arranged to break down the coal as it is undercut and pivotally mounted for horizontally swinging movement about axes coincident with the axes of the undercutters.

4. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, means to connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter, vertical batteries of compressed air picks arranged to break down the coal as it is undercut and pivotally mounted for horizontally swinging movement about axes coincident with the axes of the undercutters, compressed air operated means to retract the batteries of picks and render them inoperative when they reach a limit of movement in one direction and to then swing said batteries of picks to their other limit of movement and project and render said picks operative, and means to automatically impart a step-by-step movement of the batteries of picks toward their first-named limit of movement as they are alternately projected and retracted.

5. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, means to connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter, and laterally adjustable guides carried by said base and engageable with the side walls of the entry for centering the base and loading head transversely of the entry.

6. In an entry driving machine, a base adapted to rest upon the floor of a mine, a conveyor section slidable at its forward end on the base longitudinally of the entry, undercutters pivotally mounted on the base for horizontal oscillation at opposite sides of the forward end of said conveyor section, each undercutter including a horizontal plate movable adjacent the mine floor and having an arcuate forward edge provided with cutter bits, means operatively connecting the forward end of the conveyor section with adjacent sides of said undercutters for oscillating the latter when the conveyor section is longitudinally reciprocated, and means to connect the conveyor section to a longitudinally reciprocating shaking conveyor for actuation by the latter, vertical batteries of compressed air picks arranged to break down the coal as it is undercut and pivotally mounted for horizontally swinging movement about axes coincident with the axes of the undercutters, compressed air operated means to retract the batteries of picks and render them

inoperative when they reach a limit of movement in one direction and to then swing said batteries of picks to their other limit of movement and project and render said picks operative, and means to automatically impart a step-by-step movement of the batteries of picks toward their first-named limit of movement as they are alternately projected and retracted, the base having a housing at each side of the conveyor section, and the compressed air operated means for each battery of picks being arranged in the housing at the adjacent side of the base.

7. In an entry driving machine, horizontally swinging undercutters overlapped at their adjacent sides and pivotally mounted for oscillation adjacent the mine floor, said undercutters including plates having arcuate forward edges provided with cutter bits, a conveyor section reciprocable longitudinally of the entry and operatively connected at its forward end to the adjacent sides of the undercutters for oscillating the latter when said conveyor section is longitudinally reciprocated, said conveyor section being adapted to receive the coal as it is broken down after being undercut by said undercutters, and means to connect the rear end of said conveyor section with a longitudinally reciprocating shaking conveyor for actuation by the latter and so that the broken down coal will be delivered from said conveyor section to said shaking conveyor.

8. In an entry driving machine, a base plate adapted to rest on a mine floor, a shaking conveyor, a conveyor section adjustably telescoped onto the forward end of said shaking conveyor, two substantially semi-circular plates pivoted on said base plate for horizontal oscillation and operatively connected to the forward end of said conveyor section, said semi-circular plates being overlapped at their adjacent sides and provided on their arcuate edges with cutter bits to undercut the coal as the plates are oscillated and fed forwardly by adjustment of the conveyor section, and means to forwardly adjust said conveyor section.

9. In an entry driving machine, a shaking conveyor embodying a longitudinally reciprocating trough, a loading head including a reciprocating

conveyor section and mining devices operated thereby, said conveyor section being adjustably telescoped onto the forward end of said shaking conveyor, and having a shoe on its rear end that rests on the mine floor, a toothed rack mounted on each side of said conveyor section, a connection frame fastened to the forward end of the shaking conveyor, shoes mounted in said frame, a gripping device embodying three dogs on each side of said conveyor section, springs holding said dogs against said racks, cam shafts, two cams on each cam shaft and arranged so that lines extending through the center of the shaft and the center of the cams are at 90-degree angles to each other, certain of said dogs being mounted on said cams, a crank-operated shaft, and levers and rods connecting said crank-operated shaft with the last-named dogs, whereby actuation of the crank-operated shaft will cause adjustment of the conveyor section toward the mine face when the latter moves away from said face.

10. In an entry driving machine, the combination with a shaking conveyor longitudinally reciprocated with rapid forward strokes and slower rearward strokes, of a pair of overlapping segmental undercutting and gathering elements mounted for horizontal oscillation at the front end of said conveyor, and means operatively connecting said undercutting and gathering elements to said conveyor for actuation thereby so as to have quick strokes away from each other and the conveyor and slower strokes toward each other and the conveyor.

CHARLES E. TIBBALS.

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