May 20, 1947. J. B. MAVOR 2,420,755

APPARATUS FOR MINING

Filed July 18, 1944 3 Sheets-Sheet 1

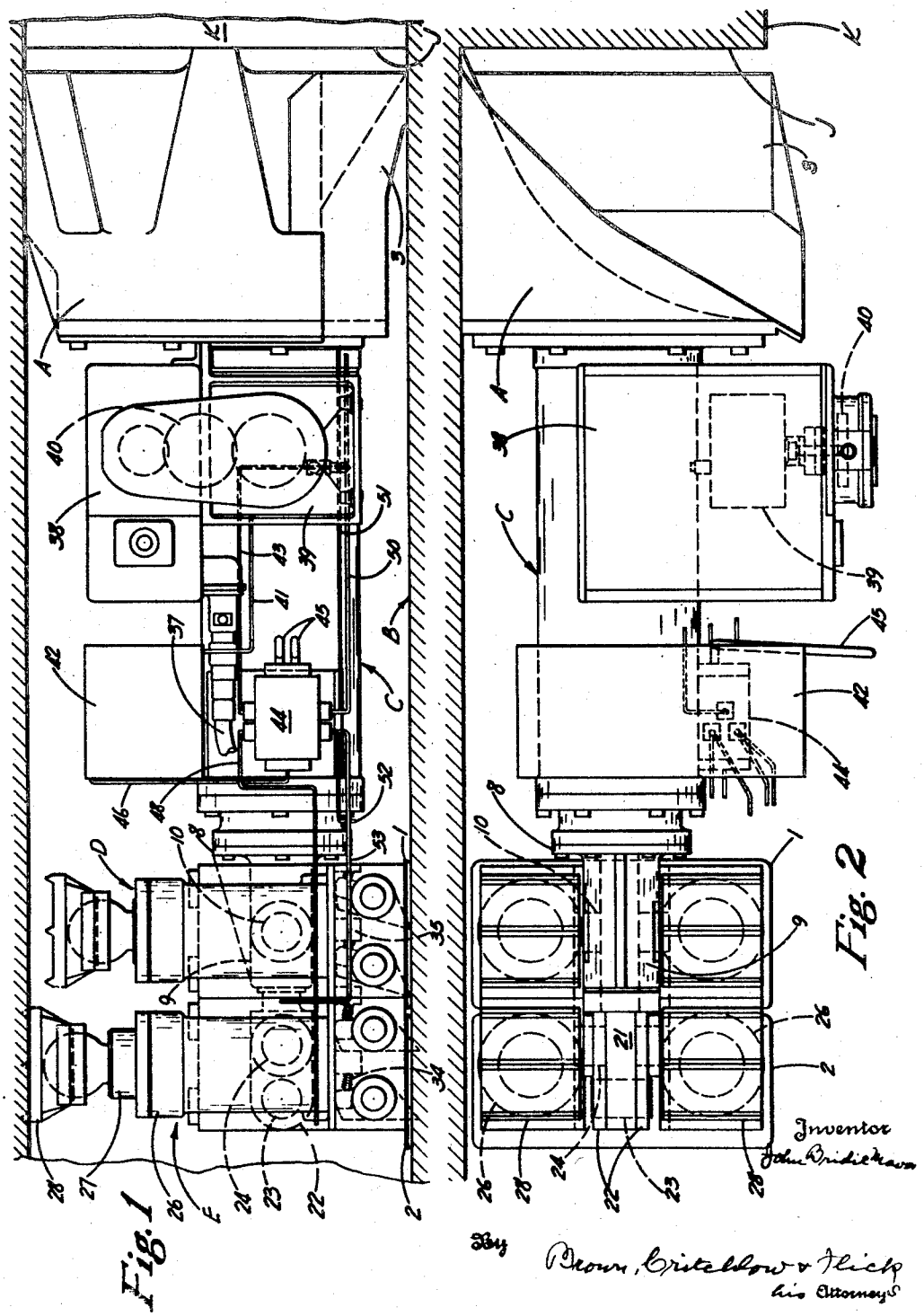


Fig. 1

Fig. 2

Inventor
John Bridickaw

By Brown, Critchlow & Flick
his Attorneys

May 20, 1947. J. B. MAVOR 2,420,755

APPARATUS FOR MINING

Filed July 18, 1944 3 Sheets-Sheet 2

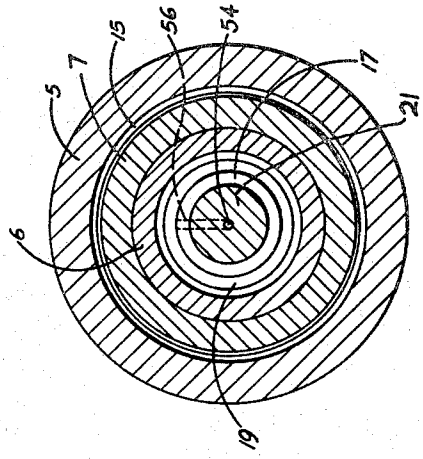


Fig. 5

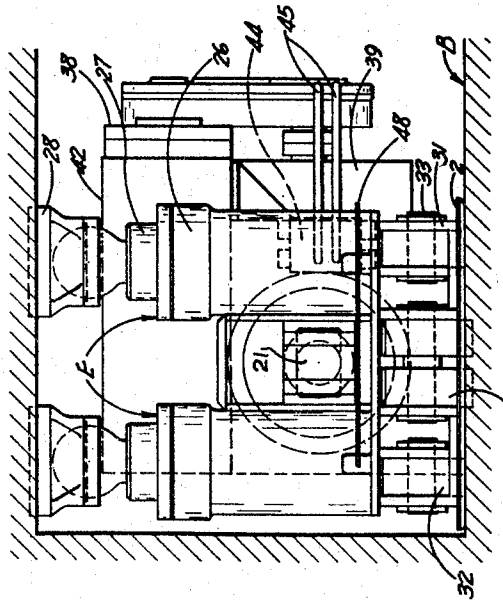


Fig. 3

Inventor
John Bridie Mavor

By Brown, Critchlow & Flick
His Attorneys

May 20, 1947. J. B. MAVOR 2,420,755

APPARATUS FOR MINING

Filed July 18, 1944 3 Sheets-Sheet 3

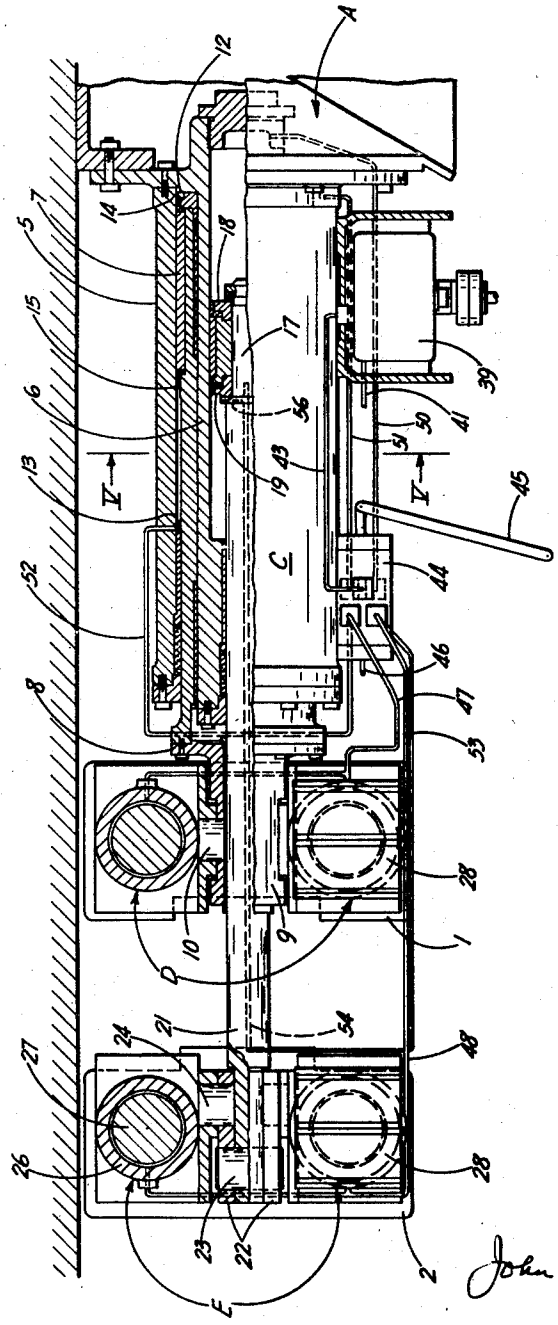


Fig. 4

Inventor
John Bridie Mavor

By Brown, Critchlow & Flick
his Attorneys

Patented May 20, 1947

2,420,755

UNITED STATES PATENT OFFICE

2,420,755

APPARATUS FOR MINING

John Bridie Mavor, Glasgow, Scotland, assignor to Joy Manufacturing Company, Franklin, Pa.

Application July 18, 1944, Serial No. 545,432
In Great Britain December 4, 1942

5 Claims. (Cl. 262—8)

1

Two general methods of machine mining of coal are known. In the first of these, the coal face is cut by a coal cutting machine over a given length in such a way as to weaken it and render it suitable for breaking down by the use of explosive or equivalent disruptive agency. In the second method, a coal cutting machine is used which cuts the coal in such a way that the coal breaks down as fast as it is cut. Machines for carrying out the second method are, according to present practice, designed to make multiple cuts in the coal, i. e. simultaneous cuts in different planes, using cutters which operate with a sawing or abrasive action. One of these cuts, commonly termed the shearing cut, is made in a plane substantially parallel with the coal face.

The present invention has for its object the provision of an improved method of and machine for cutting coal so that it is broken down as fast as it is cut and such that the number of cuts can be reduced.

According to this invention, coal is mined by the coal being severed from the seam wholly or mainly by direct thrust operating with a chisel or wedging action exerted under power in a direction parallel or approximately parallel with the mine floor and parallel or substantially parallel with the coal face.

Under certain working conditions depending principally upon the nature of the coal, the coal may be severed from the seam solely by a chisel action, i. e. without the use of the usual sawing or abrasive action, while in other cases only a shearing cut is made in the coal seam by ordinary abrasive or sawing action and a wedging action is exerted in that cut as the cut is made, to split the coal from the seam.

A machine for carrying out the foregoing method comprises one (or more) power operated ram (or rams) with a chisel or wedging head (or heads) designed to be thrust by the ram directly into the coal in a direction parallel or approximately parallel with the coal face, the machine having a part designed to be held stationary and to take the reaction to the thrust, and the machine being adapted to advance under power, stage by stage.

In practice the ram (or rams) is hydraulic or pneumatic.

Part of the machine may be constructed as a jack (or jacks) to jam between the roof and the floor of the mine and thus be rendered capable of taking the reaction to the thrust of the ram (or rams). There may be two jacks (or two groups of jacks) with two hydraulic ram elements

2

connecting the jacks (or groups of jacks) separately to the head, the arrangement being such that each jack (or each group of jacks) can be jammed in position alternately to take the reaction of the forward thrust of its ram in advancing the head while the other jack is drawn forward with the head preparatory to being jammed in position and taking the reaction of its ram while the first jack is freed and drawn forward, and so on.

The invention is illustrated in the accompanying drawings in which Fig. 1 is a side view of a mining machine made in accordance with this invention; Fig. 2 is a plan view thereof; Fig. 3 is a rear end view; Fig. 4 is a fragmentary view of the machine with the two pairs of jacks spaced apart, part of the machine being shown in plan and part in horizontal section; and Fig. 5 is an enlarged cross section, taken on the line V—V of Fig. 4, of the pistons and cylinders used for advancing the machine.

Referring to the drawings, the machine has a head A which slides along the floor B of a mine and which is secured to the front end of a hydraulic ram unit C. Behind the ram unit is a front pair of hydraulic jacks D and a rear pair of hydraulic jacks E. The front and rear pairs of jacks are mounted on separate bases 1 and 2, respectively, resting on the mine floor, and they are separately connected to the head of the machine through the medium of the hydraulic ram unit C. The head of the machine is of wedge form for chiseling in behind the coal face K and breaking away the coal J. The lower portion of the head is in the form of a shovel or scoop 3.

The ram unit is made up from two coaxial rams, the outer of which connects with the front pair of jacks and the inner of which connects with the rear pair of jacks. More specifically, as shown in Figs. 4 and 5, a pair of spaced concentric cylinders 5 and 6 project rearwardly from head A to which they are rigidly connected. Between these two cylinders there is a double acting sleeve-like outer piston 7 which encircles the inner cylinder. Secured to the rear end of this piston is an annular closure member 8 from which a short tubular piston rod 9 extends rearwardly between the two front jacks. This piston rod is pivotally connected to inner side walls of the jacks by means of short pivot pins 10. The outer cylinder 5 has front and rear pressure faces 12 and 13, and piston 7 has two pressure faces 14 and 15 opposing pressure faces 12 and 13, respectively. Slidably mounted within the inner cylinder is a double acting inner piston 17

provided with front and rear pressure faces 18 and 19. A long piston rod 21 extends rearwardly from this piston and through tubular piston rod 9, and has its rear end portion flattened. Disposed against the flat sides of the rear end of the piston rod is a pair of links 22 the rear ends of which are pivotally connected to the rod by a pin 23 extending therethrough. The front ends of the links are pivotally connected by short pivot pins 24 to inner side walls of the rear jacks. This arrangement allows the rear jack structure to move up or down without putting any strain on the long piston rod.

Each of the jacks includes a vertical cylinder 26 in which there is a plunger 27 that projects from the top of the cylinder and carries an universally mounted crown 28 for engaging the roof of the mine when the plunger is raised in the cylinder. The jack cylinders are supported above bases 1 and 2 by pairs of heavy vertical plates 31 between which sprags or teeth 32 are pivotally mounted on pins 33. These teeth project above the pins, and their upper ends are urged rearwardly by springs 34 (Fig. 1) compressed between them and blocks 35 projecting from the bottoms of the jacks. When the jacks are dragged forward the lower ends of the teeth are swung rearwardly and slide along the floor of the mine, but when pressure is exerted rearwardly against the jacks the teeth can dig into the mine floor and swing to an upright position. Rearward movement of the projecting upper ends of the teeth is limited by engagement with the bottoms of the jacks.

In order to actuate the head and jacks, oil under pressure is pumped into the proper cylinders. For this purpose an electric motor (not shown), taking power from an electric cable 37, is mounted in a housing 38 above the ram unit and drives an oil pump 39 through a train of gears 40. The pump is connected by a pipe 41 to an oil tank 42 behind the motor housing, and is connected by an outlet pipe 43 to a pair of superimposed control valves 44 mounted on the side of the outer clyinder 5. There is a handle 45 for operating each valve (which is of any suitable construction. The valves are connected by an exhaust pipe 46 to the oil tank. The upper valve is connected by a flexible hose 47 to the front jack cylinders, and by another flexible hose 48 to the rear jack cylinders. The lower valve is connected by pipes 50 and 51 to the front ends of the inner and outer ram cylinders, respectively. This valve also is connected by a pipe 52 to the rear end of outer cylinder 5, and by a flexible hose 53 to the rear end of an axial passage 54 in the long piston rod 21. The front end of this passage is connected by a radial opening 56 (Fig. 5) with the inside of inner cylinder 6 behind the inner piston. By moving handles 45 to different positions, different pipes or hoses may be connected with the oil pump for supplying oil under pressure to the desired cylinders, while the remaining pipes and hoses are connected with exhaust pipe 46.

In operation, the machine starts work at a position where the end of the coal seam is exposed, for example at a gate road or at a position where a recess has been made in the coal face to receive the machine. At that time the parts of the machine are in the relative positions shown in Figs. 1 and 2 with the two pairs of jacks D and E close to each other and also close behind the hydraulic ram unit C. The upper valve handle 45 then is swung to the position in

which the upper valve will connect the oil pump with the rear pair of jacks so that they will be extended and jam between the roof and floor of the mine. The lower valve handle is manipulated to cause the lower valve to connect oil under pressure from the pump with the front end of the inner ram cylinder 6 where, due to the thrust on the front end of the inner piston 17 which is held stationary by the rear pair of jacks, the oil pressure will force the two ram cylinders and the head A forward into the coal to split it away from the seam. At the same time, oil under pressure is delivered through pipe 52 to the outer cylinder behind the rear pressure face 15 of piston 7, so that the front pair of jacks will be carried forward with head A, and the front end of the outer cylinder and the rear end of the inner cylinder are connected with exhaust pipe 46.

The head continues to advance until the rear pressure face 19 of the inner piston is engaged by the advancing rear pressure face of the inner cylinder. In Fig. 4 the machine is shown with the head moved forward half of its first stroke. Upon completion of the stroke the upper valve is shifted to allow oil to return from the rear jacks to the tank and to force oil into the front jacks so that the latter will be jammed into position ready to take the rearward thrust of tubular piston rod 9. The lower valve handle 45 then is actuated to connect the pump through pipe 50 with the front end of outer cylinder 5 and to release oil from the rear end of that cylinder, with the result that the two cylinders and the head are driven forward relative to the front pair of jacks. At the same time, oil is released from the front end of the inner cylinder through pipe 51 and is admitted under pressure to the rear end of the inner cylinder so that the inner piston is moved forward in the inner cylinder in order to drag the rear pair of jacks up close to the front jacks by the time this second stroke of the ram has been completed. It will be seen that the travel provided for the inner piston is double that provided for the outer piston, and that in the subsequent advance of the machine only the rear half of the travel of the inner piston is utilized, because while the inner piston is being moved forward to pull the rear jacks ahead the head A and cylinders 5 and 6 are advancing away from the stationary front jacks. By alternately fixing the two pairs of jacks and dragging forward the inoperative pair, a substantially continuous advance of the head of the machine can be obtained. As the head advances into the coal and breaks it down, the coal is scooped up by the scoop 3 and is discharged laterally.

I claim:

1. A coal mining machine comprising a coal dislodging member, a pair of jacks disposed one in front of the other behind said member, means for alternately engaging the jacks with the roof of a mine, extensible concentric means connecting both jacks separately to said member, and means for extending said concentric means alternately whereby to force said member ahead by steps while the thrust is taken by the engaged jack.

2. A coal mining machine comprising a coal dislodging member, a pair of spaced concentric cylinders projecting rearwardly therefrom, a double acting sleeve-like outer piston disposed in the outer cylinder and encircling the inner cylinder, a double acting inner piston disposed in the inner cylinder and extending rearwardly therefrom, jacks disposed one in front of the other

behind the cylinders and each connected independently to one of said pistons, means for alternately engaging the jacks with the roof of a mine, and means for supplying fluid under pressure to the front of the inner cylinder and the rear of the outer cylinder when one jack is engaged and then to the front of the outer cylinder and the rear of the inner cylinder when the other jack is engaged, whereby the engaged jack takes the thrust while said fluid pressure forces the dislodging member ahead with the other jack.

3. A coal mining machine comprising a coal dislodging member, a pair of spaced concentric cylinders projecting rearwardly therefrom, a double acting sleeve-like outer piston disposed in the outer cylinder and encircling the inner cylinder, a double acting inner piston disposed in the inner cylinder and extending rearwardly therefrom, jacks disposed one in front of the other behind the cylinder, means connecting the rear jack to the rear end of the inner piston, means connecting the front jack to the rear end of the outer piston, means for alternately engaging the jacks with the roof of a mine, and means for supplying fluid under pressure simultaneously to the front of the inner cylinder and the rear of the outer cylinder when the rear jack is engaged and then simultaneously to the front of the outer cylinder and the rear of the inner cylinder when the front jack is engaged, whereby the engaged jack takes the thrust while said fluid pressure forces the dislodging member ahead with the other jack.

4. A coal mining machine comprising a coal dislodging member, a pair of spaced concentric cylinders projecting rearwardly therefrom, a double acting sleeve-like outer piston disposed in the outer cylinder and encircling the inner cylinder, a double acting inner piston disposed in the inner cylinder and extending rearwardly therefrom, jacks disposed one in front of the other behind the cylinders, means pivotally connecting each jack to the rear end of one of said pistons on a horizontal axis, means for alternately engaging the jacks with the roof of a mine, and means for supplying fluid under pressure to the front of the inner cylinder and the rear of the outer cylinder when one jack is engaged and then to the front of the outer cylinder and the rear of the inner cylinder when the other jack is engaged, whereby the engaged jack takes the thrust while said fluid pressure forces the dislodging member ahead with the other jack.

5. A coal mining machine comprising a coal dislodging member, a pair of spaced concentric cylinders projecting rearwardly therefrom, a double acting sleeve-like outer piston disposed in the outer cylinder and encircling the inner cylinder, a double acting inner piston disposed in the inner cylinder and extending rearwardly therefrom, jacks disposed one in front of the other behind the cylinders, means pivotally connecting the rear end of the outer piston to the front jack on a horizontal axis, a connecting member extending lengthwise of the rear end of the inner piston, means for pivotally connecting on horizontal axes the opposite ends of said connecting member to the rear jack and the rear end of the inner piston respectively, means for alternately engaging the jacks with the roof of a mine, and means for supplying fluid under pressure simultaneously to the front of the inner cylinder and the rear of the outer cylinder when the rear jack is engaged and then simultaneously to the front of the outer cylinder and the rear of the inner cylinder when the front jack is engaged, whereby the engaged jack takes the thrust while said fluid pressure forces the dislodging member ahead with the other jack.

JOHN BRIDIE MAVOR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,639,050	Morgan	Aug. 16, 1927
1,755,332	Morgan	Apr. 22, 1930
1,880,090	Hughes	Sept. 27, 1932

FOREIGN PATENTS

Number	Country	Date
117,552	Great Britain	July 25, 1918
501,194	Germany	June 28, 1930