W. PILL.

HYDRAULIC COAL BREAKER.

APPLICATION FILED NOV. 17, 1909.

991,017.

Patented May 2, 1911.

2 SHEETS—SHEET 1.

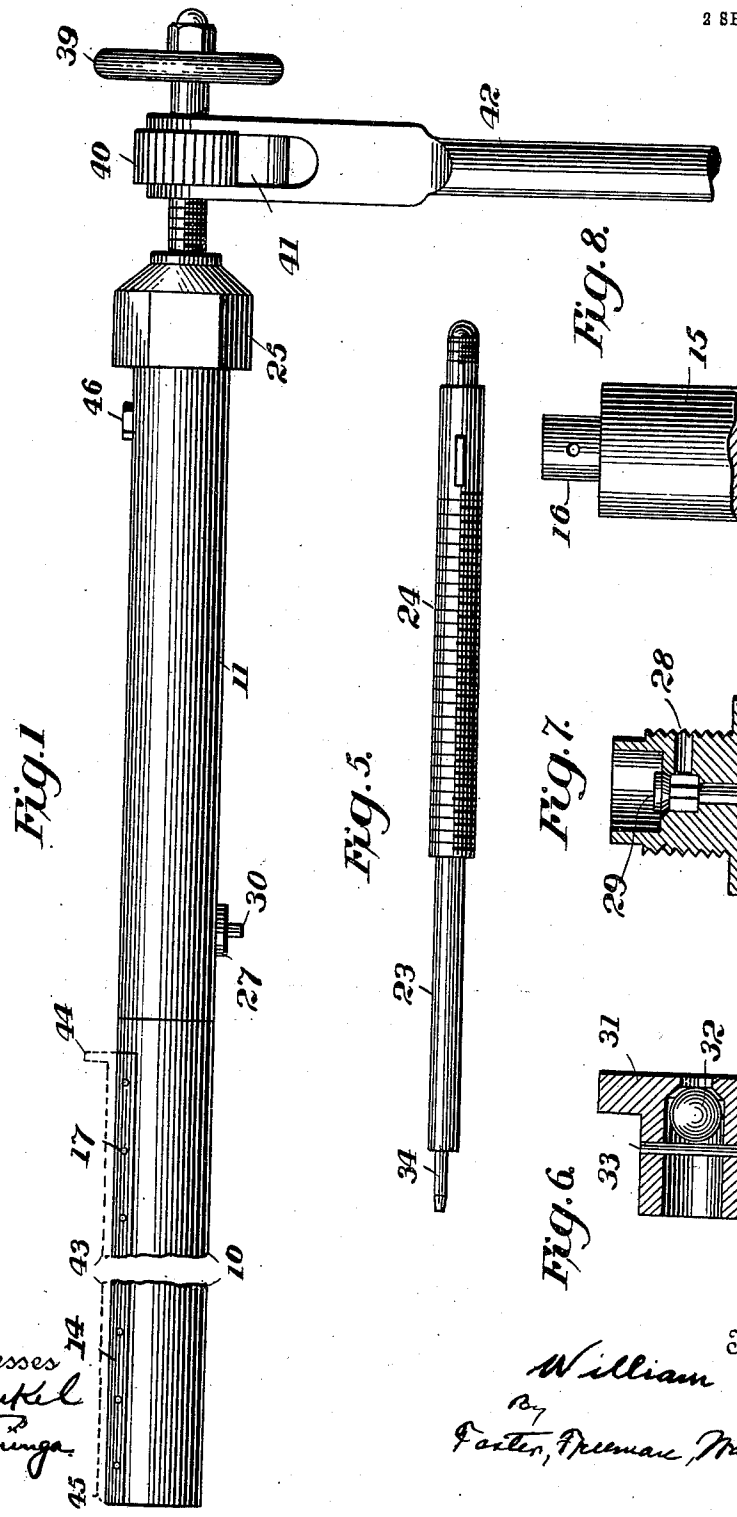

Fig. 1.

Fig. 5.

Fig. 8.

Fig. 7.

Fig. 6.

Witnesses
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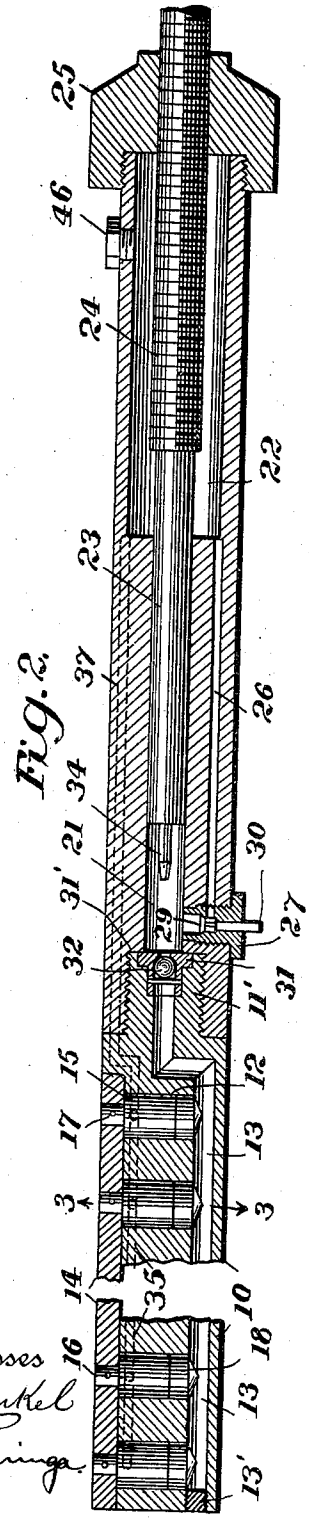

Fig. 2.

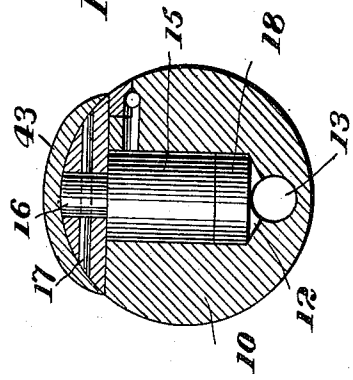

Fig. 4.

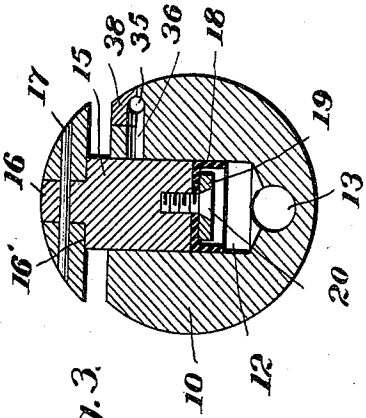

Fig. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM PILL, OF COWANPORTH, ENGLAND, ASSIGNOR OF ONE-FOURTH TO CROOK M. WALDRAN, OF CARBON HILL, ALABAMA, AND ONE-HALF TO VICTOR R. PILL, OF GALLOWAY, ALABAMA.

HYDRAULIC COAL-BREAKER.

991,017. Specification of Letters Patent. Patented May 2, 1911.

Application filed November 17, 1909. Serial No. 528,571.

To all whom it may concern:

Be it known that I, WILLIAM PILL, a citizen of the United States, and resident of Cowanporth, county of Cornwall, England, have invented certain new and useful Improvements in Hydraulic Coal-Breakers, of which the following is a specification.

This invention relates to hydraulic tools adapted to be used for breaking coal, stone, etc.

The objects of this invention are to provide a hydraulic tool which will be self-contained, simple in construction and operation, cheap to manufacture, durable, and by means of which it is possible to apply a great amount of power.

In mining, the coal is undercut and a number of holes about three inches in diameter and about three feet deep are bored as near the roof as possible and spaced about six feet apart. These holes are ordinarily filled with powder cartridges and exploded, or a hydraulic breaking tool may be inserted therein to break down the coal. A hydraulic tool is preferable to a powder cartridge since the former does not shatter the coal as the latter and does not fill the mine with smoke.

The tool which forms the subject-matter of this invention consists in an elongated bar provided with a series of piston chambers. A jaw is movable relatively to the bar and is provided with a number of pistons working in the piston chambers. These pistons are rigidly secured to the jaw and form a unit therewith. The bar has formed therein a pressure chamber in which works a plunger and the pressure and piston chambers are connected by passages by means of which the fluid acted upon by the plunger in the pressure chamber forces the pistons and the jaw outwardly and thus expands the bar and breaks down the coal. The bar has formed therein rearwardly of the pressure chamber an enlarged chamber forming a reservoir for the fluid and this reservoir is connected to the pressure chamber by means of a passage provided with a check valve. A passage connects the upper ends of the piston chambers with the reservoir so that after the pistons have been forced upwardly a predetermined distance, the fluid will flow back through this passage into the reservoir. The check valve located in the passage connecting the reservoir and pressure chambers, and another check valve located in the passage between the pressure and piston chambers, are preferably mounted in the removable cages. The plunger is provided with a thread which engages a thread formed on the bar and this plunger is provided with a hand wheel, whereby the plunger may be quickly turned up, and a ratchet which cooperates with a pawl bar, whereby the final and heavier pressure may be applied.

In the drawings, Figure 1 is a side elevation of the tool; Fig. 2 is a longitudinal section; Fig. 3 is a section on the line 3—3, Fig. 2; Fig. 4 is a similar section showing one of the shoes in section; Fig. 5 is a detail of the plunger; Fig. 6 is a detail of one of the valve cages; Fig. 7 is a detail of the other valve cage; Fig. 8 is a detail of one of the pistons.

The tool is composed of two sections 10 and 11 which together form an elongated bar which is adapted to be inserted in the hole. The sections are connected together by the threaded connection shown at 11′. The section 10 has formed therein a series of piston chambers 12 which may be bored therein. The section 10 will be ordinarily about three feet in length and will be provided with a large number of piston chambers, usually from fifteen to twenty. A passage 13 extends longitudinally of the bar and is closed at its end by a plug 13′. This passage connects the different piston chambers with the pressure chamber hereinafter described. An expander jaw 14 extends longitudinally of the section 10 and is movable relatively thereto. This expander jaw and the section 10 form together a structure of substantially circular cross-section, as shown in Figs. 3 and 4. The expander jaw has rigidly secured thereto a number of pistons 15 which work in the cylinders 12. The pistons are provided with a reduced portion 16 forming shoulders 16′ abutting against the jaw 14, as shown in Fig. 3, and the pistons are rigidly secured to the jaw by pins 17 extending through the reduced portions 16. The pins may be omitted, so that the jaw is removable from the pistons. The pistons 15 are provided with leather packing cups 18 which are secured thereto by washers 19 and screws 20. The leather packing provides a fluid tight joint between the

pistons and the cylinders. The pistons may, however, be provided with the ordinary metallic piston rings.

The section 11 of the bar has formed therein a pressure chamber or cylinder 21 and an enlarged portion 22 forming a reservoir for the fluid. A plunger 23 works in the pressure chamber 21 and has formed thereon threads 24 which engage coöperating threads formed in the cap 25 which closes the reservoir. A channel 26 connects the reservoir 22 with the pressure chamber 21. As shown in Figs. 2 and 7, the valve cage 27 has formed therein a passage 28 which is adapted to aline with the passage 26. A check valve 29 is located in the valve cage and is provided with a stem extending outside of the valve cage so that it is adapted to be engaged for operation. The valve cage 27 is threaded and is adapted to be screwed into the section 11. A ball valve cage 31 is secured in the passage 13 connecting the pressure chamber 21 and the piston chambers. As shown in Fig. 2, this valve cage is held in place by the shoulder 31′ formed on the section 11. The valve cage is provided with a ball valve 32 and the usual cross pin 33 and the plunger 23 has formed thereon a reduced portion 34 which is adapted to move the ball to inoperative position for a purpose hereinafter to be described. The section 10 has formed therein a channel or passage 35 which extends longitudinally of the same and connects with the upper ends of the piston chambers 12 by means of channels 36. The channel or passage 35 may be formed in any suitable manner. It is preferably formed partly in the body of the section 10 and partly in a strip 38 which is secured to the body by means of screws or the like. A channel 37 in section 11 connects 35 with 22.

The plunger has rigidly secured thereto a hand wheel 39 and a ratchet 40. The ratchet is engaged by a pawl 41 pivoted on a pawl lever 42. A filling plug 46 is screwed into section 11.

The tool is provided with a number of shoes 43 which conform substantially to the shape of the bar and are adapted to extend longitudinally of the same, as shown in Figs. 1 and 4. The shoe is provided with a stop or lug 44 and the forward end is preferably beveled, as shown at 45.

The operation of this tool is as follows: The coal is undercut in the usual way and the usual three inches by three feet holes are bored as near the roof as possible. The reservoir 22 is now filled with the fluid, preferably oil, by removing the plug 46, the plug replaced and the hand wheel moved to the right until the plunger is as near the forward end of the pressure chamber 21 as possible. The threaded sections may be provided with a pointer to indicate the position of the forward end of the plunger. The section 10 of the tool is then inserted in the bored hole and the hand wheel 39 is turned to the left moving the plunger 23 rearwardly. The plunger will draw the oil from the reservoir 22 through the passage 26 and underneath the check valve 29 into the pressure chamber 21. After the plunger has moved backward enough to draw in a sufficient amount of oil, the hand wheel 39 is moved to the right and the plunger moved forwardly. The check valve 39 will now close and the oil will be forced past the ball valve 32, into the passage 13 and the piston chambers 12. The pressure of the fluid in the piston chambers will move the pistons and the jaw 14 upwardly and expand the tool. The hand wheel 39 is used until the jaw 14 abuts against the surface of the hole formed in the coal, the full pressure may now be applied by operating the pawl lever 42. By means of this latter arrangement a very heavy pressure may be obtained, the leverage being dependent upon the proportion of the parts, that is, the relative dimensions of the pressure and piston chambers and the number of piston chambers formed in the section 10. The plunger 23 is moved forwardly until it reaches the end of the pressure chamber 21. The operation may now be reversed and the plunger moved forwardly again to pump more oil underneath the pistons 15. After the pistons have however reached the upper limits of their strokes, the lower portion of the cylinder is thrown into communication with the passages 35 and the surplus oil will flow back into the reservoir 22 through the passage 37. It will thus be seen that this construction provides an arrangement whereby the pistons may be stopped at the upper limit of their strokes automatically.

If it is found that the expansion is not great enough the section 10 is contracted in the following manner: The plunger 23 is moved forwardly until the reduced portion 34 engages the ball 32 and opens the passage connecting the piston chambers with the pressure chamber 21. The check valve 29 is now opened by pressure applied to the stem 30 and the oil is allowed to flow back into the reservoir 22. After the pistons have moved downwardly and the expander jaw 14 has moved to the position shown in Fig. 4, the shoe 43 is inserted over the jaw or underneath the section 10 and the section 10 is again expanded, as previously described. This process is repeated until the coal has been broken down and for this purpose a number of shoes 43 are provided.

It will be noted that the shoe can be placed over the jaw of the tool while this tool is in position in the bored hole so that it is not necessary to remove the tool from the hole. This is of great advantage, especially in

mining work where the space is limited. It will be seen that the pistons are rigidly connected to the expander jaw 14, so as to form therewith a single unit. By means of this construction not only is the pressure applied more effectively and evenly to the expander jaw than is the case where the pistons are separate from the jaw and the jaw merely laid on top of them, but all liability of the parts being lost or becoming too readily detached from each other is avoided. Two devices are provided for screwing up the plunger 23, namely, a hand wheel and a pawl on a long armed lever coöperating with a ratchet on the plunger. When the device is first inserted in the hole, since this hole necessarily is a good deal larger than the tool and can not be accurately cut, it is desirable to provide some means whereby the plunger can be quickly turned up so as to take up the slack. After, however, the jaw has expanded a sufficient amount, to start to break down the coal, the pawl and ratchet mechanism is used to obtain a final heavy pressure. The pawl and ratchet mechanism with its long arm is ideal for the final pressure, but is very inconvenient and slow where it is desired to run up the plunger quickly in the preliminary operation. By providing both a pawl and ratchet mechanism and a hand wheel, the work can be quickly accomplished and neither element will interfere with the operation of the other.

It will be seen that the tool is selfcontained and is of tubular form and of simple construction. All the parts are inclosed in a single casing and the pistons and the expander jaw 14 together form a single unit. In this construction the pistons are shown as composed of a series rigidly secured to the expander jaw. It is however obvious that a single piston of oblong form may be secured to the expander jaw. In this form the pistons are shown as rigidly secured to the jaw 14. It is obvious, however, that the jaw 14 may be dispensed with and the pistons 15 may be freely movable and engage the shoe 43 directly. This tool is especially useful in coal mining. It is however obvious that it is also adapted for use in other kinds of mining and also for quarrying rock.

It is obvious that various changes may be made in the details of construction without departing from this invention and it is therefore to be understood that this invention is not to be limited to the specific construction shown and described.

Having described my invention what I claim and desire to secure by Letters-Patent is,

1. In a tool of the class described, the combination with a bar having a piston chamber therein, of a piston working in the chamber and laterally movable with respect to the bar, a pressure chamber in said bar, a plunger working in the pressure chamber, and a tubular extension on the bar forming a reservoir, the bar and extension being provided with passages connecting the reservoir and chambers.

2. In a tool of the class described, the combination with a bar having a piston chamber therein, of a piston working in the chamber and laterally movable with respect to the bar, a pressure chamber in said bar, a plunger working in the pressure chamber, a tubular extension on the bar forming a reservoir, the bar and extension being provided with passages connecting the reservoir and chambers, and a check valve in the passage connecting the reservoir and pressure chamber.

3. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers and laterally movable with respect to the bar, a pressure chamber formed in the bar, a plunger working in the pressure chamber, the bar being provided with an enlarged portion rearwardly of the pressure chamber forming a reservoir, a cap for the enlarged portion provided with a threaded hole, and a coöperating thread on the plunger, the bar being provided with passages connecting the pressure and piston chambers and reservoir.

4. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers and laterally movable with respect to the bar, a pressure chamber and reservoir formed in the bar, a plunger working in the pressure chamber, the bar being provided with a passage connecting the pressure chamber with the lower part of the piston chambers, a passage connecting the reservoir with the upper part of the piston chambers, and a passage connecting the reservoir and pressure chamber.

5. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers and laterally movable with respect to the bar, a pressure chamber and reservoir formed in the bar, a plunger working in the pressure chamber, the bar being provided with a passage connecting the pressure chamber with the lower part of the piston chambers, a passage connecting the reservoir with the upper part of the piston chambers, a passage connecting the reservoir and pressure chamber, a check valve in the last mentioned passage, and means accessible from the exterior of the bar permitting operation of the valve.

6. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers and laterally movable with respect to the bar, a pressure

chamber and reservoir formed in the bar, a plunger working in the pressure chamber, the bar being provided with a passage connecting the pressure chamber with the lower part of the piston chambers, a passage connecting the reservoir with the upper part of the piston chambers, a passage connecting the reservoir and pressure chamber, a check valve in the last mentioned passage, means accessible from the exterior of the bar permitting operation of the valve, a check valve cage in the passage connecting the pressure and piston chambers, a check valve in said cage, and a pin on the plunger to operate the check valve.

7. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers, a detachable extension secured to the bar and provided with a pressure chamber and a reservoir, and a plunger working in the pressure chamber, said bar and extension being provided with passages connecting the pressure and piston chambers and the reservoir.

8. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers, a detachable extension secured to the bar and provided with a pressure chamber and a reservoir rearwardly of the pressure chamber, a plunger working in the pressure chamber, a cap closing the reservoir and provided with a threaded hole, and a coöperating thread on the plunger, said bar and extensions being provided with passages connecting the pressure and piston chambers and the reservoir.

9. In a tool of the class described, the combination with a bar having a series of piston chambers therein, of a series of pistons working in the chambers, a detachable extension secured to the bar and provided with a pressure chamber and a reservoir, a plunger working in the pressure chamber, said bar and extension being provided with passages connecting the pressure and piston chambers and the reservoir, a removable check valve cage in the passage leading to the piston chambers, and a removable check valve cage screwed into the extension and provided with a check valve for the passage between the reservoir and pressure chambers.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM PILL.

Witnesses:
W. HANNAM,
F. G. HOKE.