

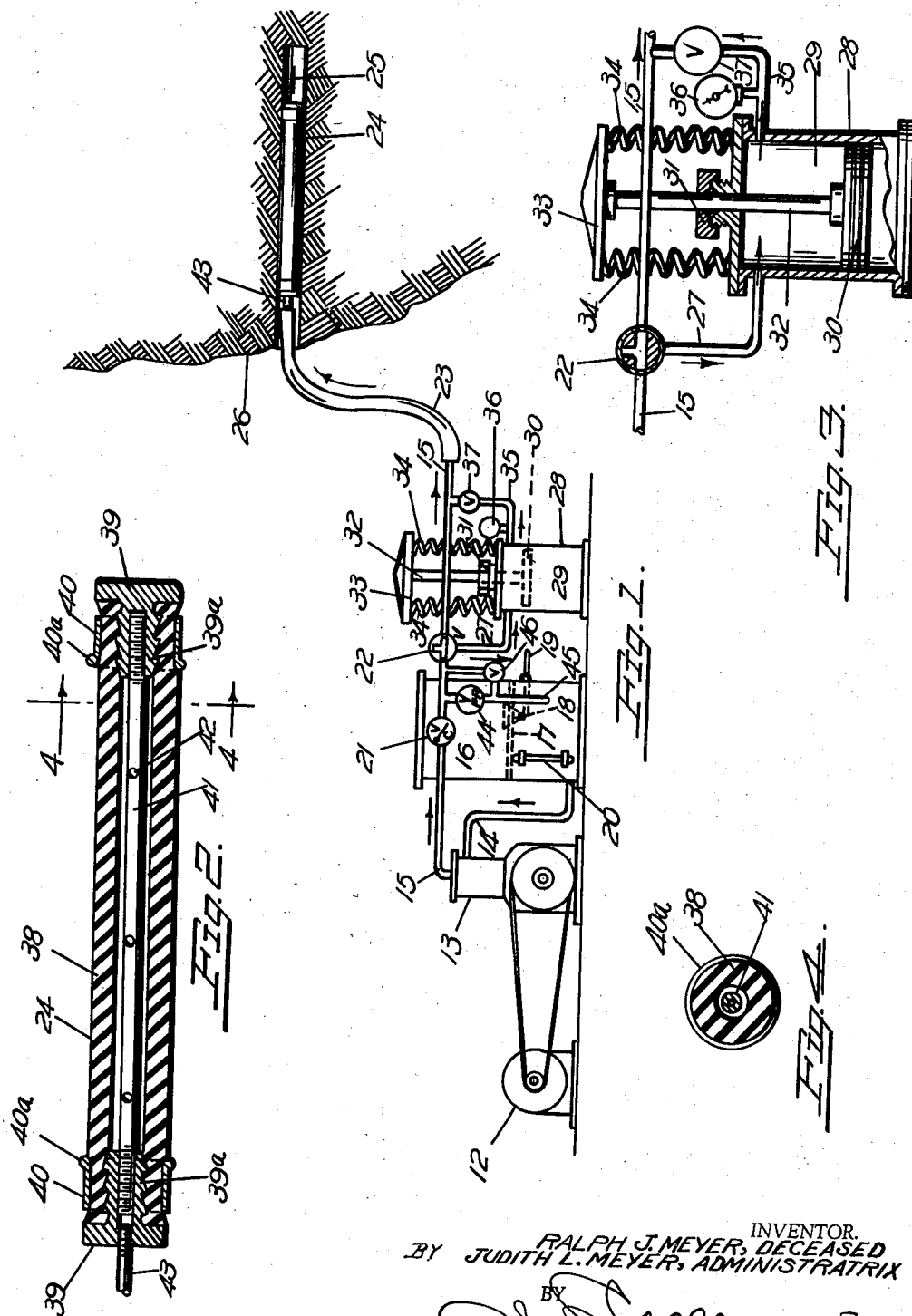
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R. J. MEYER

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APPARATUS FOR AND METHOD OF BREAKING COAL

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INVENTOR.
RALPH J. MEYER, DECEASED
BY JUDITH L. MEYER, ADMINISTRATRIX
BY *[Signature]*
ATTORNEY.

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APPARATUS FOR AND METHOD OF
BREAKING COAL

Ralph J. Meyer, deceased, late of Denver, Colo.,
by Judith L. Meyer, administratrix, Denver,
Colo.

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5 Claims. (Cl. 262—1)

This invention relates to a method and apparatus for breaking coal in natural formations through the intermediary of an expansive fluid.

Methods heretofore employed consist of placing an expansible element in a bore of the coal vein and then introducing an expanding pressure fluid into the element whereby to exert a breaking force on the coal formation. Methods of this character are exemplified in United States Patents No. 1,879,907 and No. 1,915,687, issued to the inventor of the present method.

It has been found that the methods described in the above mentioned patents were effective only under favorable conditions but did not always produce the desired results.

Therefore, it is an object of the present invention to provide a simple method and apparatus by which the coal in the area adjacent the expansible element is subjected to sudden shocks rather than to a gradually applied and progressively increasing pressure.

A further object of the invention is to combine the old method and the new method by first employing a breaking force steadily, to be followed by suddenly applied impulses of increased pressure.

Another object of the invention is to provide, for the purpose above mentioned, an apparatus of simple and efficient construction under full control of the operator; and still other objects and advantages will be found in the course of the following description made with reference to the accompanying drawing. In the drawing, in the several views of which like parts are similarly designated.

Figure 1 is a partly diagrammatic view, illustrating means that are well adapted to carry out the improved method;

Figure 2 is a longitudinal section of part of the device shown in Figure 1;

Figure 3 is a sectional view, of part of the apparatus shown in Figure 1, and drawn to a larger scale; and

Figure 4 is a sectional view on line 4—4 of Figure 2.

In the drawing, reference character 12, denotes a power unit, such as an electric motor, that is in driving connection with a pump 13, having an intake conduit 14 and a discharge conduit 15. A tank or other form of reservoir, is shown at 16, having a dividing partition 17, through which is a cone valve 18, operated by a handle 19, extending exteriorly of the tank.

The lower division of the tank is provided with a liquid sight-gauge 20. The discharge conduit

15 is provided with a check valve 21, and a three-way valve 22, through which it leads to a flexible conduit 23, that connects with a flexible and laterally expansible tube or capsule 24, that is shown operatively positioned in a drilled hole 25 in a coal vein 26.

The three-way valve 22 may be manually, or otherwise, rotated to direct the output from the pump, through a branch conduit 27 into an accumulator 28, that comprises a cylinder 29, a piston 30 therein, with a packing gland 31, and a piston rod 32 therethrough, on which is a cross head 33, that bears against compression springs 34.

An outlet conduit 35, leads from the accumulator back to the main discharge conduit 15, and is provided with a pressure-indicating gauge 36 and a shut-off release valve 37.

In Figures 2 and 4, the details of the expansible tube element, 24, are more fully illustrated and they comprise a thick-walled flexible and expansible tube 38, that is capped at each end with a closing element, or cap 39, each of which has an inwardly projecting nipple, 39a, that engages the inner surface of the tube 38, which is securely clamped therearound, by bands 40, each having a rounded edge 40a, positioned inwardly of the assembly, to prevent cutting or other damage to the tube, when expanded.

The two caps are connected by a hollow rod 41, having apertures 42 in communication with the closed interior of the tube. A pipe nipple 43 serves to complete the connection between the flexible conduit 23 and the hollow rod, while the latter serves the useful purpose of tying the end caps together to prevent longitudinal expansion of the flexible tube 38.

The expansible element, 24, is an improvement over the similar devices disclosed in Meyer Patents Nos. 1,879,907 and 1,915,687, and these improvements are being claimed in another application, Serial No. 189,127, the present application being devoted, primarily, to the method of coal breaking.

The improved method for breaking coal is as follows: A substantially non-compressible liquid is placed in the upper division of the tank 16, and a predetermined amount measured thereof, is permitted to flow to the lower division of the tank, by means of the cone valve 18, wherefrom it is pumped into the system above described. The operator first permits the pumped liquid to be delivered directly through conduit 15 into the expansible tube element 24, to start the cracking of the coal by the hydrostatic pressure applied

to the inner walls of the drilled hole 25, in the coal vein.

After fracture has begun, the three-way valve 22 is rotated to close conduit 15 and direct the pumped liquid into the accumulator 28, which drives the piston thereof, downwardly, compressing the springs 34, until a predetermined pressure is indicated on the gauge 36, whereupon the operator opens the release valve 37, to release the stored or accumulated pressure, thereby delivering a shock or "water-hammer" blow to the breaking coal through the conduits 15 and 23 and the walls of the expansible tube 38.

A three-way valve of this character permits closing of the passage to the accumulator and direct movement of fluid to the tube 38, or the closing of the direct passage to the tube 38 and discharge of the pump into the accumulator, or closing of the pump discharge passage, and opening communication between the accumulator and the tube through passage 27, or if desired, simultaneous closing of the passage 15 and the branch 27.

The sudden shock to the previously cracked and breaking coal, has been found to be more effective than a continuing steady internal pressure, and this method prevents the expansible tube from being damaged, by preventing it from being slowly forced into the cracks as they open in the coal, adjacent the drilled hole 25, which would occur if steady pressure were continued as begun.

Obviously, the elements of the accumulator could be reversed, or some other type of accumulator could be substituted for the one that is shown, merely as an example. The piston 30, for instance, could be forced outwardly against tension springs. In the arrangement shown, the lower end of the cylinder could be provided with a small closable common air valve and, if closed, the air on the side of the piston that is opposite to the pressure liquid, can be used as an elastic compressive cushion to aid the compression springs 24, in their function.

A plurality of branch conduits may be used to serve a plurality of expansible tubes, simultaneously, and the apparatus may preferably be mounted for easy transportation, as, for instance, on a mine car or the like.

By virtue of providing a measured amount of liquid for the pump, only a limited pressure can be built up in the system. As a further safeguard, if, for any reason, pressure, in the system, exceeds a predetermined point, a pressure relief valve 44, will automatically open to pass liquid back into the tank 16, via conduit 45. A manually operable valve 46, may also be opened, when desired, to return liquid to the tank.

The full equivalent of the release valve 37, may be arranged for, either manual or automatic opening at a predetermined pressure, or time, and/or for repeated openings at intervals, the preferred object being to follow steady disruptive preliminary pressure, with one or more shocks or blows to the coal, or a series of shocks may, in some instances, suffice without preliminary pressure.

Thus, coal may be broken from the vein safely,

economically and efficiently, with a high percentage of large lumps and with no delays required to clear the mine of smoke or gas, and with no damage to the expansible tubes, other than normal wear.

Steady expansive breaking pressure has been applied in drilled holes in coal veins heretofore, but the present improvement resides, primarily, in following this with a shock or a series of shocks, radially in all directions or in substituting a shock or a series of shocks, for the steady pressure.

What is claimed and desired to be secured by Letters Patent is:

1. The method of breaking coal or the like in natural formations, which comprises first subjecting coal within such a formation to a sustained fluid pressure, establishing a fluid body under higher pressure, and applying said higher pressure to the coal body under the sustained pressure, by a sudden release of the established fluid body into an expansible element within the formation.

2. The method of breaking coal which comprises, measuring a quantity of liquid, pumping some of the liquid into an expansible element within a body of coal thereby subjecting said coal to pressure, accumulating some of the liquid under pressure exteriorly of the said element, and then admitting the force of the accumulated liquid to the expansible element.

3. In a method of breaking coal or the like inclusive of a flow of fluid under pressure and the step of applying the expansive force of said fluid while confining it, the improvement which comprises diverting some of the fluid to accumulate the same under pressure, and suddenly releasing the pressure of the accumulated fluid into the expanding and confining means, providing a force impulse superimposed on the expanding force.

4. In apparatus for breaking coal or the like inclusive of an expansible element and a source of fluid-flow under pressure connected with said element, the improvement which comprises an accumulator connected with the source of fluid-flow and connected with the expansible element, means for optionally directing the fluid-flow to said element or to the accumulator, and means for suddenly releasing the force of the fluid in the accumulator into the expansible element.

5. In apparatus for breaking coal or the like inclusive of an expansible element and a source of fluid-flow under pressure connected with said element, the improvement which comprises an accumulator connected with the source of fluid-flow and connected with the expansible element, means for optionally directing the fluid-flow to said element or to the accumulator, means for automatically returning the fluid-flow to the source when a predetermined pressure has been built up in the accumulator, and means for suddenly releasing the force of the fluid in the accumulator into the expansible element.

JUDITH L. MEYER.

Administratrix of the Estate of Ralph J. Meyer,
Deceased.