W. J. REILLY & D. V. SICKMAN.

HYDRAULIC CARTRIDGE APPARATUS.

APPLICATION FILED APR. 27, 1914.

1,271,940.

Patented July 9, 1918.

3 SHEETS—SHEET 1.

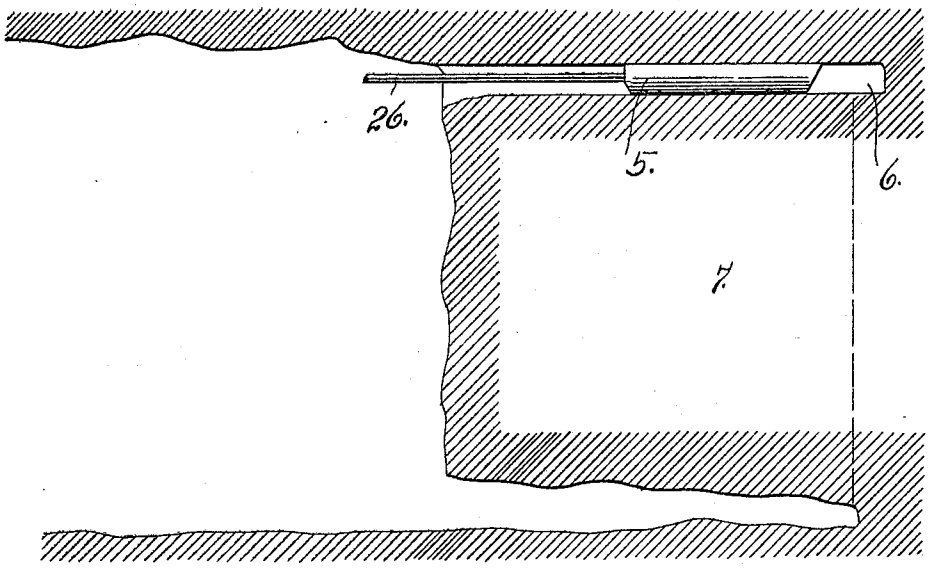



Fig. 1.

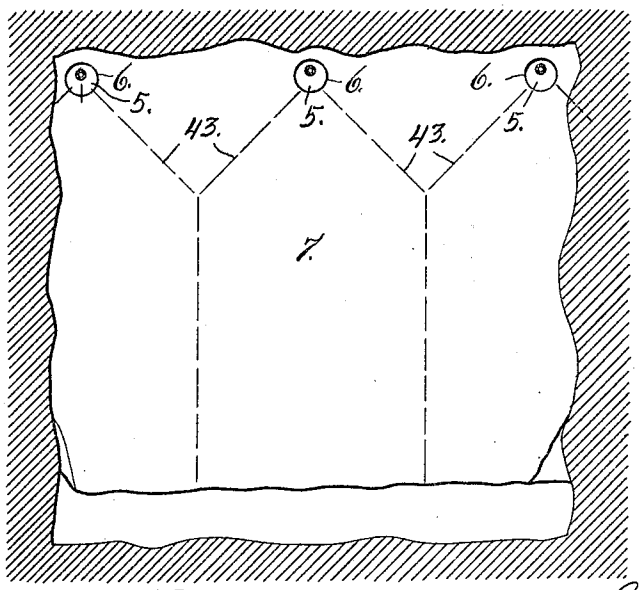



Fig. 2.

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Witnesses
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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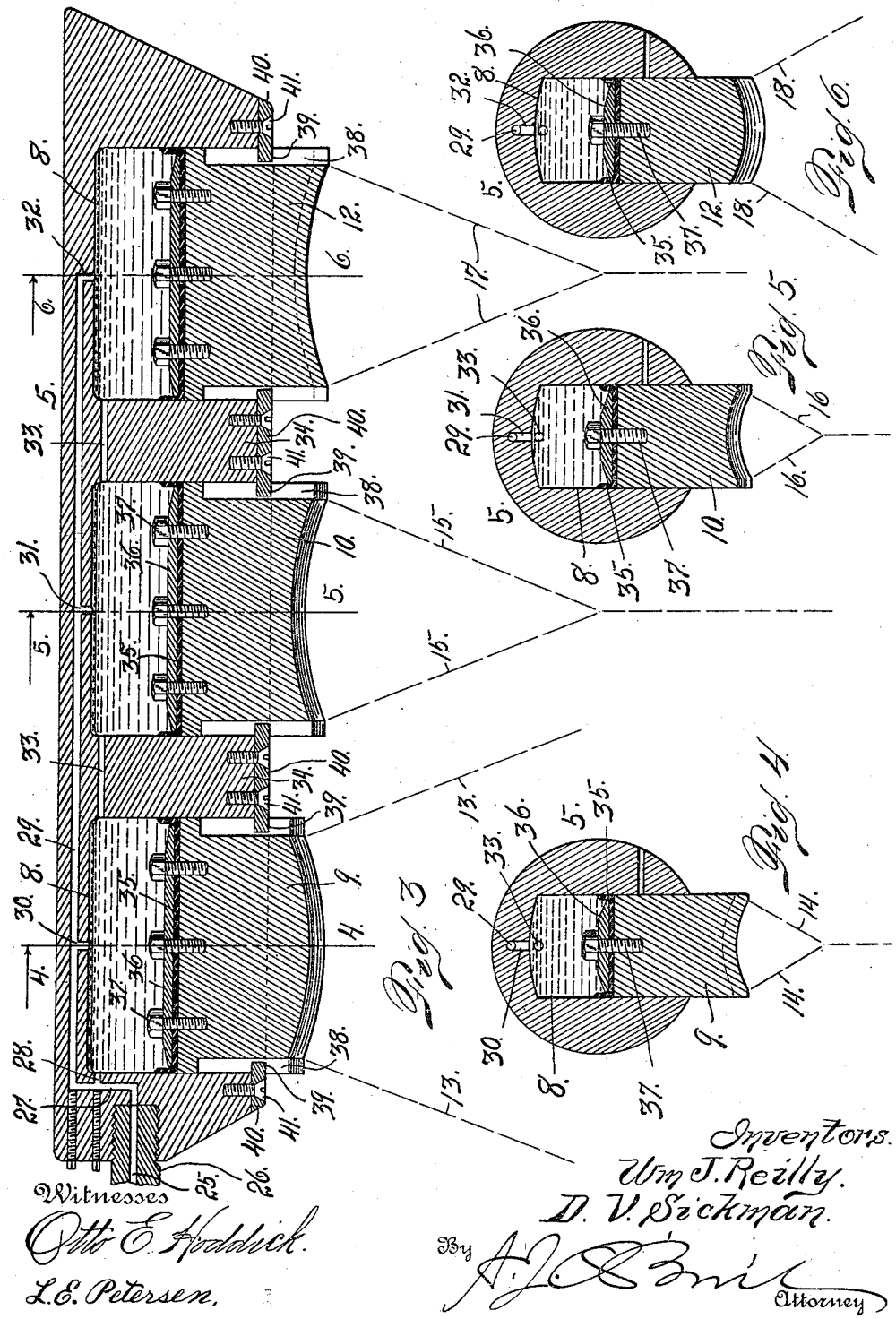
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3 SHEETS—SHEET 3.

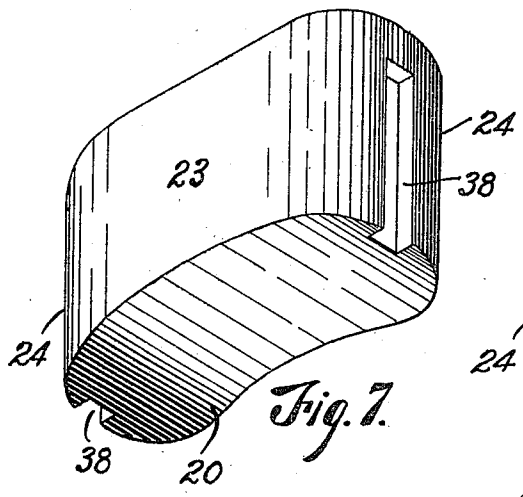


Fig. 7.

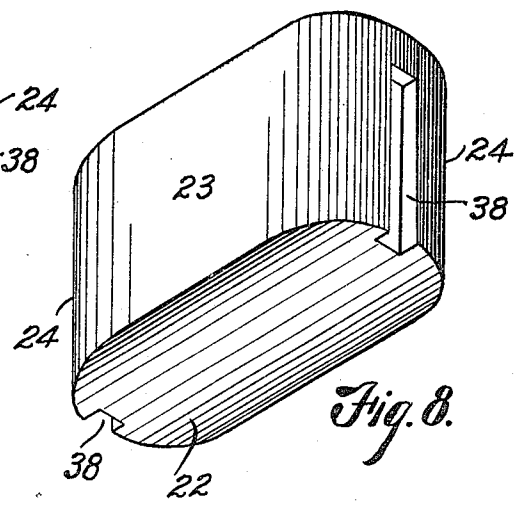


Fig. 8.

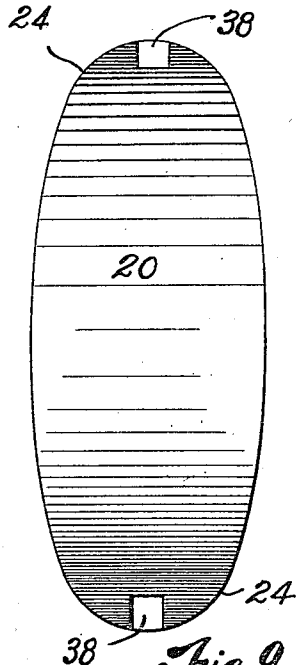


Fig. 9.

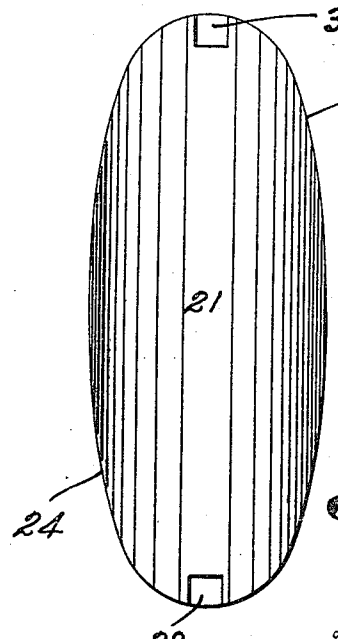


Fig. 10.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

WILLIAM J. REILLY AND DAVY VANCE SICKMAN, OF DENVER, COLORADO.

## HYDRAULIC-CARTRIDGE APPARATUS.

1,271,940. Specification of Letters Patent. Patented July 9, 1918.

Application filed April 27, 1914. Serial No. 834,703.

*To all whom it may concern:*

Be it known that we, WILLIAM J. REILLY and DAVY VANCE SICKMAN, citizens of the United States, residing at the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Hydraulic-Cartridge Apparatus; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

Our invention relates to improvements in hydraulic cartridge apparatus, adapted for use in breaking down coal or other material in mines. Hydraulic cartridges have heretofore been used for this purpose, but our improvement relates to special means whereby the pressure or lines of stress or strain exerted during the breaking down operation, may be regulated and controlled. Our improvement relates to the special shape and construction of the pistons employed in connection with the body of the cartridge. These pistons are elongated or ellipsoidal in shape, whereby a relatively great area or pressure surface may be obtained without increasing the diameter of the body of the cartridge, which is usually cylindrical in shape. Heretofore, the pistons employed have been cylindrical in shape, and for this reason the area of the pressure surface has been limited by the diameter of the cartridge body. By employing the elongated or ellipsoidal form of piston, the pressure area of each piston may be increased at pleasure, without increasing the diameter or transverse thickness of the body of the device.

The ellipsoidal shape of piston, broadly considered, together with some other features of construction of the cartridge, are covered in Patent No. 1,141,077 issued May 25th, 1915, to me, Davy Vance Sickman and my copending application, Serial No. 872,498 filed November 16th, 1914, for improvements in hydraulic cartridges, and this application is limited to the special shape of the pressure surfaces of the pistons, which act directly upon the coal or other material during the breaking down operation. To be more specific, the working or operating surfaces of the pistons are made either concave or convex, or concave in one direction and convex in the other direction, or concave both longitudinally and transversely, or convex both longitudinally and transversely. By virtue of this peculiar shape or configuration of the pistons, the lines of stress or strain exerted by the pistons during the breaking down operation may be regulated and controlled as may be required in order to more advantageously perform the required function.

Having briefly outlined our improved construction, we will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof. In this drawing,—

Figure 1 is a section taken through a portion of a coal mine, for instance, showing a block of coal arranged to be broken down by the employment of hydraulic cartridges, the section being taken longitudinally of the cartridge, or parallel with the direction of a hole in which the cartridge is inserted for breaking down purposes.

Fig. 2 is a transverse section illustrating diagrammatically a number of cartridges in place for breaking down purposes, the lines of stress or strain being indicated by dotted lines.

Fig. 3 is a section taken longitudinally through a cartridge having pistons shaped in accordance with our present invention, the operating or working faces of the pistons being of different configuration in order to bring out the various combinations of piston construction which may be employed in a single cartridge.

Figs. 4, 5 and 6 are cross sections taken through the cartridge on the lines 4—4, 5—5, and 6—6, respectively, of Fig. 3.

Figs. 7 and 8, are perspective views illustrating different shapes of pistons, so far as their working faces are concerned.

Figs. 9 and 10 are views showing the working faces of a corresponding number of pistons of ellipsoidal shape.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the body of the cartridge, which is preferably cylindrical in shape, and adapted to be inserted in a hole 6 formed in the coal or other material adjacent the block or mass to be broken down. As illustrated in the drawing (see Figs. 1 and 2), holes in which the

cartridges are introduced are shown above the block or mass of coal 7 to be broken down. It is evident however, that these cartridges may be employed to break the mass of material by forcing it either upwardly or laterally in either direction, as well as downwardly.

The body of the cartridge is provided with a number of chambers 8 in which is located a corresponding number of pistons 9, 10 and 12. As illustrated in the drawing, the cartridge contains three pistons (see Fig. 3). It is evident however, that a greater or less number of pistons may be employed in a single cartridge, if desired.

These pistons and their chambers which are of course, counterpart in shape, are elongated, and their sides between the curved ends may be either ellipsoidal or gradually curved, (see Figs. 9 and 10), or the opposite sides between the curved ends of the pistons may be flat and parallel, as indicated in Figs. 7 and 8.

Referring now more particularly to Figs. 3 to 6, inclusive, the particular shape or configuration of the working or operating faces of the pistons will be described. The piston designated by the numeral 9 is convex in shape, longitudinally and concave transversely, and by virtue of this peculiar shape, the lines of stress or strain are caused to diverge from each other longitudinally, as indicated by the dotted lines 13, while they are caused to converge transversely, as indicated by the lines 14, (see Fig. 4).

Again, the piston designated by the numeral 10 has its operating or working face concave both longitudinally and transversely, whereby the lines of stress or strain are caused to converge longitudinally, as shown by the dotted lines 15 in Fig. 3, and transversely, as shown by the dotted lines 16, in Fig. 5.

Again, the piston designated by the numeral 12 has its working face concave longitudinally and convex transversely, whereby the lines of stress or strain are caused to converge longitudinally as indicated by the dotted lines 17 in Fig. 3, and diverge transversely, as indicated by the lines 18—18, in Fig. 6.

By this peculiar combination of pistons having different working faces, in a single cartridge, it is evident that the lines of stress or strain may be regulated and controlled at the will of the operator or as circumstances may dictate. Various other combinations so far as the shape of the working or operating faces of the pistons are concerned, may, of course, be employed.

Again, the operating or working face of any piston may have a single curvature either longitudinally or transversely. For instance, in Fig. 7 the working face 20 of the piston is concave longitudinally without any transverse curvature. In Fig. 8, the working face 22 of the piston is concave transversely without any longitudinal curvature. Furthermore, these pistons illustrated in Figs. 7 and 8, while elongated, are not strictly ellipsoidal in shape, as the opposite sides 23 between the curved ends 24 of the pistons are flat and parallel.

Again, in Figs. 9 and 10, the pistons are ellipsoidal in shape, or are curved continuously, though elongated in form, the sides between their curved ends being also gradually curved, their faces, however, are of different configuration. In Fig. 9, the face is longitudinally concave without any transverse curvature. In Fig. 10, the face is transversely concave without any longitudinal curvature.

In operating the pistons, water is delivered through a port 25 in a nozzle 26, to a port 27 in the body of the cartridge from which a branch orifice 28 leads to the foremost chamber 8. The water also passes from the port 27 into a relatively long port 29 from which branches 30, 31 and 32 lead to the respective piston chambers of the cartridge body. These chambers are also in communication with each other by means of ports 33 formed in the partitions 34 which separate the piston chambers. By virtue of this arrangement of ports, water is introduced to the piston chambers under the necessary pressure to act upon the upper extremities of the pistons and force the latter downwardly or outwardly, whereby they act upon the block or mass of coal or other material 7 to break down or dislodge the same. In order to form fluid tight joints between the pistons and the inner surfaces of the walls of their chambers, gaskets 35 are employed, the same being held in place by plates 36 which are secured to the bodies of the pistons by cap screws 37.

The opposite ends of the pistons are grooved as shown at 38 to receive the extremities 39 of guide plates 40 which are secured to the body of the cartridge by screws 41. The extremities 39 of the plates 40 serve as stops which engage the shoulders 42 at the inner extremities of the grooves 38. By virtue of this arrangement the pistons are prevented from moving entirely out of their respective chambers.

From the foregoing description, the use and operation of our improved hydraulic cartridge apparatus will be readily understood. The pistons of each cartridge may be arranged with faces of varying curvature as has already been described, whereby the application of the lines of force or strain may be regulated and controlled to the best advantage in breaking down the coal or other material. For instance, by reference to Fig. 2, which is a diagram merely, we have illustrated three holes 6 formed in the

coal adjacent the block 7 to be broken down, and as illustrated in the drawing, above the said block. In each of these holes is placed a cartridge, and the operation of the three pistons of the three cartridges is illustrated, and these pistons are convex transversely without any longitudinal curvature, whereby the lines of stress or strain are caused to diverge transversely, as indicated by the dotted lines 43, whereby these lines of force are approximately evenly distributed transversely of the block or mass 7. Should it be desired to further distribute the lines of force, these pistons might be curved either concavely or convexly longitudinally, but in this diagram, we have not attempted to illustrate a complicated combination of curvatures, as it would to a certain extent tend to confusion.

Attention is called to the fact that the perforations 33 whereby the piston chambers 8 are in communication, are important, since in the event that the perforations 30, 31 and 32, or any one of them should be stopped, the water would pass from one chamber to the other and thus prevent a failure of operation. The short perforations 28 also performs a similar function with the perforations 33, since it is an additional or auxiliary perforation to the perforations 30, 31 and 32. In this way, a double provision is made for supplying the piston chambers with the necessary water to actuate the pistons for breaking down the coal, in a manner that will be readily understood.

Having thus described our invention, what we claim is,—

1. A piston for hydraulic cartridges, having its operating face curved longitudinally.

2. An elongated piston for hydraulic cartridges, having its operating face concavely curved.

3. An elongated piston for hydraulic cartridges, having its operating face curved both longitudinally and transversely.

4. An elongated piston for hydraulic cartridges, having its operating face concavely curved both longitudinally and transversely.

5. A hydraulic cartridge provided with a piston ellipsoidal in shape and having its operating face concavely curved.

6. A hydraulic cartridge provided with a piston and whose operating face is concavely curved longitudinally.

7. A hydraulic cartridge provided with a piston and whose operating face is concavely curved transversely.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM J. REILLY.
DAVY VANCE SICKMAN.

Witnesses:
MAZE KIRBY,
A. EBERT O'BRIEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."