J. HUBER.

FIRING GEAR FOR DEPTH MINES.

APPLICATION FILED NOV. 7, 1917.

1,319,282.

Patented Oct. 21, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

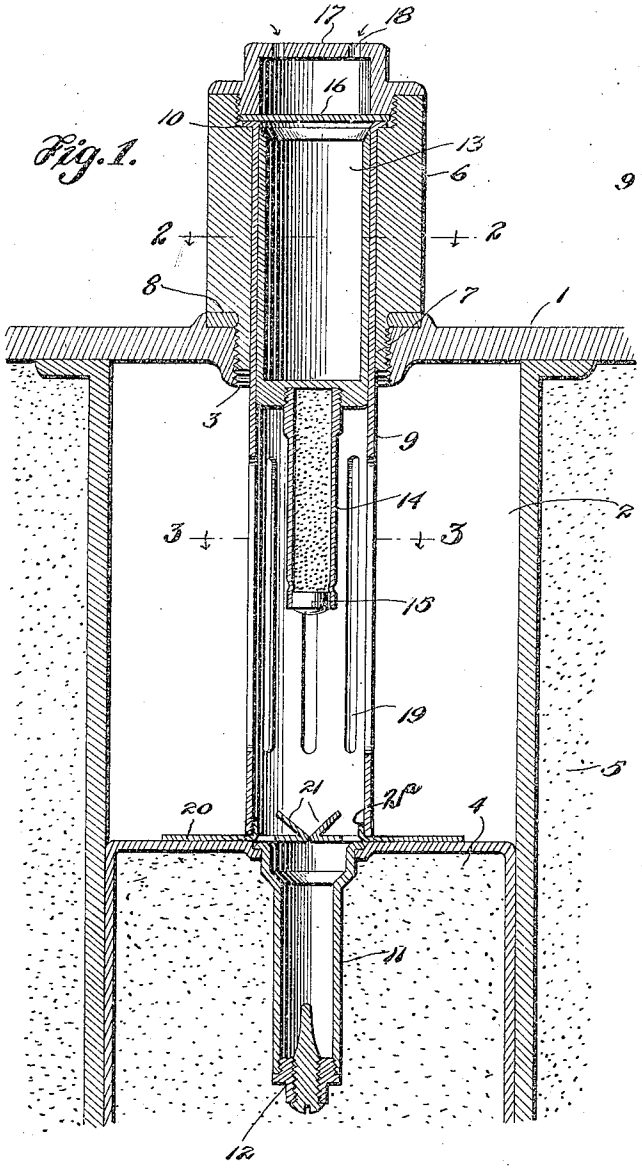
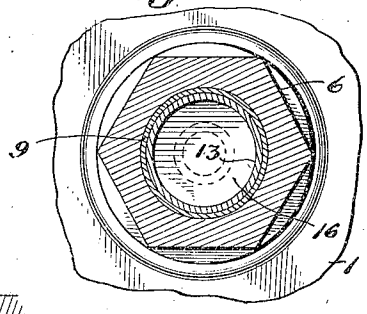


Fig. 2.



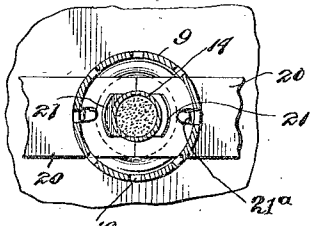


Fig. 3.

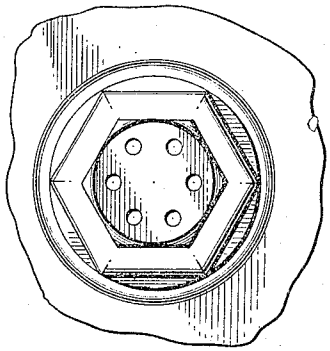


Fig. 4.

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2 SHEETS—SHEET 2.

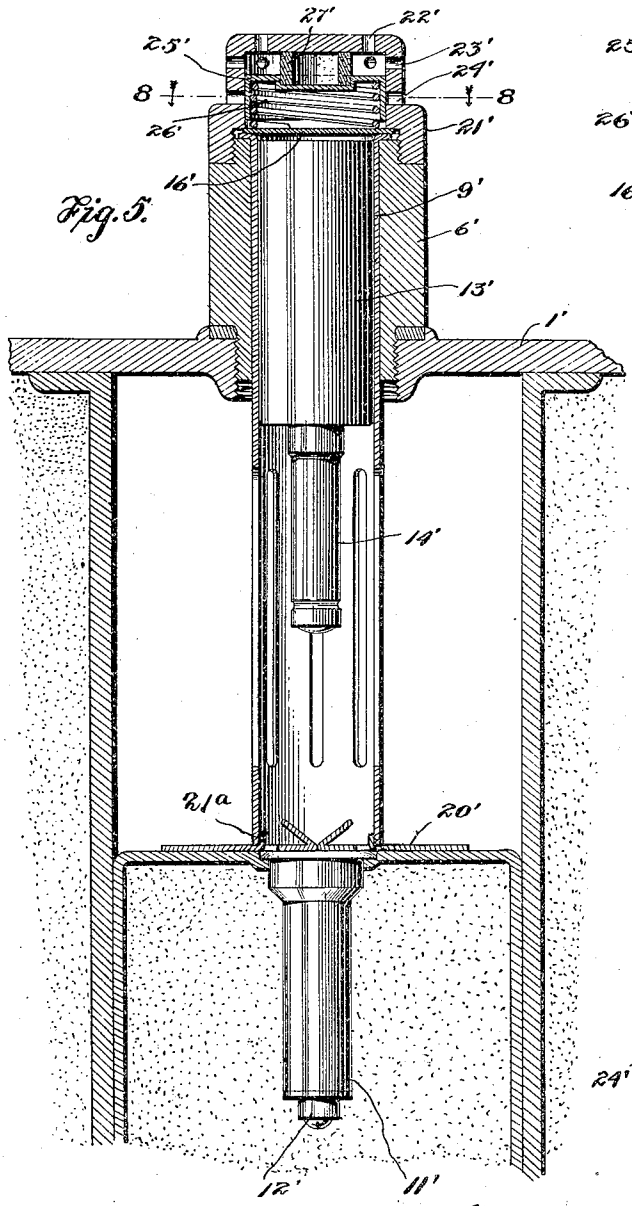


Fig. 5.

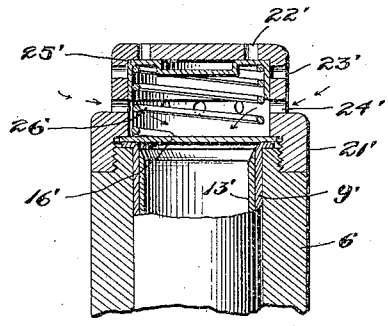


Fig. 6.

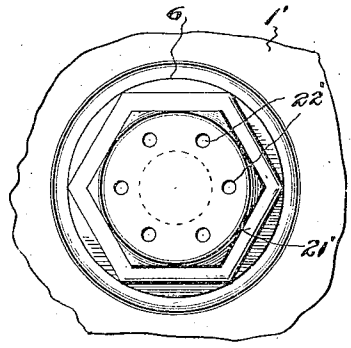


Fig. 7.

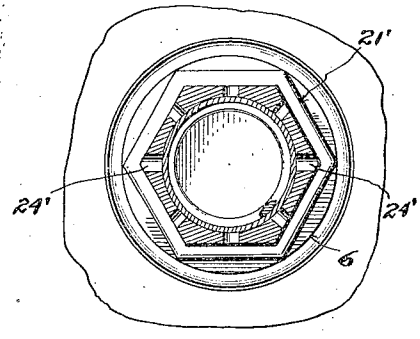


Fig. 8.

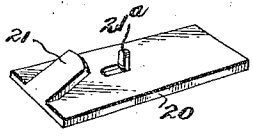


Fig. 9.

Inventor

James Huber,

By Pennie, Goldsmith & Head.

Attorney

UNITED STATES PATENT OFFICE.

JAMES HUBER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO VICKERS LIMITED, OF WESTMINSTER, ENGLAND.

FIRING-GEAR FOR DEPTH-MINES.

1,319,282. Specification of Letters Patent. Patented Oct. 21, 1919.

Application filed November 7, 1917. Serial No. 200,776.

To all whom it may concern:

Be it known that I, JAMES HUBER, a citizen of Switzerland, and a resident of Philadelphia, county of Philadelphia, State of Pennsylvania, and whose post-office address is c/o H. C. Sheridan, Woodward Building, Washington, D. C., have invented certain new and useful Improvements in Firing-Gears for Depth-Mines; and I do hereby 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.

This invention relates to a firing gear for a depth mine.

The primary object of the invention resides in the provision of a firing gear which will only operate after the mine has reached a predetermined depth.

A further object of the invention resides in so constructing the device that it may be set to fire the mine at various predetermined depths.

A still further object of the invention resides in the provision of a firing gear which may be quickly attached to the mine so that such attachment may be made immediately before the mine is cast overboard.

Furthermore it is an object of the invention to provide such a firing gear that the accidental operation thereof, when the mine strikes the water, will be obviated.

With these and other objects in view, such as will appear as my description progresses, my invention comprises the combination and arrangement of parts as set forth in and falling within the scope of the appended claims.

In the drawing—

Figure 1 is a sectional view of the firing gear and a portion of the mine.

Fig. 2 is a horizontal sectional view on line 2—2 of Fig. 1.

Fig. 3 is a similar view on line 3—3 of Fig. 1.

Fig. 4 is a fragmental top plan view.

Fig. 5 is a sectional view of a modified form of the device.

Fig. 6 is a fragmental sectional view showing the relation of the parts after the soluble element has passed into solution.

Fig. 7 is a top plan view.

Fig. 8 is a section on line 8—8 of Fig. 5, and

Fig. 9 is a perspective view of one of the slides, which, together with the corresponding slide, operate to prevent the explosion of the main charge if the detonation charge explodes prematurely.

Referring particularly to Figs. 1 to 4 inclusive, I have illustrated a portion of a mine 1, which has a chamber 2, having a screw threaded opening 3 at its upper side, located therein. Beneath this chamber 2 is the ignition charge case 4 in which the ignition charge is located. Surrounding this case and the chamber 2, is the main charge 5.

In order that the ignition charge may be set off and consequently the main charge may be set off when the mine reaches a predetermined depth, I have provided a firing gear which consists of a body 6, which preferably has a hexagonal outer face for the accommodation of a suitable wrench. This body 6 is provided at its lower end with a screw threaded neck 7, which is adapted to engage in the screw threaded aperture 3 in the mine. The joint between the mine and the body 6 is made tight by a suitable gasket 8. This body 6 is provided with an axial bore in which is located a guide tube 9. The upper end of this tube is flared upwardly and engages a circular shoulder 10 on the body 6, while the lower end of the tube extends downwardly into the chamber 2 and terminates at the upper wall of the ignition charge case 4. Located within the ignition charge case and arranged coaxially with the tube is a detonator receiver 11, which is at its lower end provided with a firing pin 12.

In order that the ignition charge may be fired when the mine reaches a predetermined depth, I have provided a tubular piston 13, which is slidable in the guide tube 9, and the upper edge of which is feathered to make a tight joint with the guide tube. This piston 13 carries at its lower end a detonator charge tube 14, which in turn carries a detonator 15. The piston 13 is adapted to move downwardly in the guide tube 9 when subjected to water pressure so that

the detonator 15 will engage the firing pin 12 and fire the ignition charge.

In order that the movement of this piston may not take place until the mine has reached a predetermined depth, I have provided a diaphragm 16 which rests on the shoulder 10 of the body 6, and is held in place by a cap 17, the outer face of which is also preferably hexagonal. This cap 17 has a plurality of apertures 18 therein, by means of which the water may have access to the diaphragm 16 so as to operate on the same in a manner which will later be described.

When the mine is cast overboard, the piston 13 will be in the position illustrated in Fig. 1. The water will pass through the apertures 18 in the cap 17 and will contact with the diaphragm 16. When the mine reaches a predetermined depth and the water pressure becomes sufficient to burst the diphragm 16, the water will pass suddenly into the piston 13 and will give this piston, together with the detonator, a rapid downward movement and cause the detonator to engage the firing pin 12. The ignition charge, and consequently the main charge, will thus be fired.

It sometimes occurs that the detonator will explode in sympathy with the explosion of another mine before the detonator leaves the chamber in which it is carried, and, of course, when such an action as this takes place, the mine has not reached the proper position for explosion and if the main charge is exploded by the explosion of the detonator, the mine is uselessly sacrificed.

In order that such an explosion of the detonator may have no effect upon the ignition of the main charge, I have provided the guide tube 9 with a plurality of elongated openings or slots 19, which permit the gases which are generated by the ignition of the detonator and detonator charge to pass through the slots and in which the chamber 12, where they are permitted to expand and consequently are prevented from affecting the ignition or main charges. A pair of slides 20 are located at the lower end of the guide tube 9 and close the detonator receiver so that should such a sympathetic explosion occur, the gases will not be permitted to expand into the detonator receiver. These slides are prevented from moving normally by struck-up lugs 21^a. The slides are, however, adapted to be forced apart by the detonator carrier, at which time the lugs 21^a are bent into the plane of the slides. These slides have upwardly diverging cam elements 21, with which the lower end of the detonator charge carrier is adapted to engage when the piston moves downwardly. The engagement of this detonator charge carrier with the cams causes the slides to move apart and permits the detonator to pass into the receiver 11 and to engage the firing pin 12.

It sometimes occurs that the mine will not be properly launched, that is to say it will strike the water upside down and should this occur it is likely to develop an excess pressure so that the diaphragm which protects the piston will be prematurely bursted and the mine consequently prematurely exploded. To obviate this difficulty, I have provided a slightly modified form of firing gear wherein the body 6′, the guide tube 9′, the detonator receiver 11′, the firing pin 12′, the piston 13′, the detonator charge tube 14′, the diaphragm 16′, and the slides 20′, are similar to the corresponding parts in the form illustrated in Fig. 1, being applied to the mine 1′ in a similar manner. The diaphragm 16′ is held in place by a cap 21′ which is in screw-threaded engagement with the upper end of the body 6′ and is provided with a series of vertical apertures 22′ in its upper face and a series of horizontal apertures 23′ in its peripheral face. A second series of horizontal apertures 24′ is arranged below the series 23′. Vertically slidable in the cap 21′ is an inverted cup-shaped valve 25′, which is adapted to have such movement that it will either open or close the apertures 24′, the apertures being closed when the valve is in its lowermost position and open when the valve is in its uppermost position. This valve is normally urged upwardly by a spring 26′ which bears against the valve and against the upper end of the body 6′, but normally the upward movement of the valve is prevented by a ring 27′ of soluble material, such as sal ammoniac. This ring is disposed between the adjacent inner face of the cap 21′ and the adjacent face of the valve 25′, being seated in a depression in the top of the valve.

When the mine is cast overboard, the valve 25′ will be in a position to close the apertures 24′ so that the water pressure will not reach the diaphragm 16′. The water flowing through the apertures 22′ and 23′ will cause the material of the ring 27′ to pass into solution and thus the valve 25′ will be permitted to move upwardly under the action of the spring 26′ and uncover the apertures 24′. At this time the water will reach the diaphragm 16′, and upon the mine reaching the proper depth will burst the diaphragm and operate the piston 13′ in the same manner as described in connection with the other form of the invention. The value of this construction lies in the fact that an excessive pressure is created when the mine is launched so that the cap 21′ strikes the water first, but this excessive pressure is not permitted to burst the diaphragm 16′, because of the fact that the water is excluded from the diaphragm until

the valve 25′ is released by the passing of the material of the ring 27′ into solution.

While I have described the particular embodiments of my invention, they have merely been illustrated and described for the sake of convenience, as it is obvious that many changes may be made in the details of construction without departing from the spirit of the invention or without exceeding the scope of the claims.

What I claim is:—

1. In a depth mine, a pair of spaced firing elements, one of which is movable to engage the other, said movable element being actuated and controlled, directly, by the pressure of the water at a predetermined depth.

2. In a depth mine, the combination with a pair of spaced firing elements, of means for moving one of said elements into engagement with the other, said means being actuated and controlled by a predetermined water pressure, and means for preventing the application of the water pressure to the aforementioned means until said predetermined pressure is reached.

3. In a depth mine, the combination with a pair of spaced firing elements, one of which is movable to engage the other, of means for excluding the water from said movable element until a predetermined water pressure is reached, said movable element being operated by the pressure of the water immediately upon the rendition of the aforementioned means inoperative.

4. In a depth mine, the combination with a pair of spaced firing elements, one of which is movable to engage the other, a carrier for the movable element, which carrier is actuated and controlled entirely by the water pressure applied thereto, and means for preventing the application of the water pressure to the carrier until a predetermined pressure is reached.

5. In a firing gear for depth mines, the combination with a body portion having an axial opening therethrough, of a tube mounted in said opening and extending beyond the end of the body portion, a piston slidable in said tube and carrying a detonator, a diaphragm closing the upper end of said tube, and a perforated cap for securing the diaphragm to the body portion, said body portion being adapted to be engaged with the top of a depth mine.

6. In a depth mine, a firing pin, a detonator adapted to be moved into engagement with the firing pin by water pressure, a diaphragm adapted to burst under predetermined water pressure to permit the water to reach the detonator actuating mechanism and a valve for preventing the access of the water to the diaphgram during the launching of the mine.

7. In a depth mine, a firing pin, a detonator adapted to be moved into engagement with the pin by water pressure, a diaphragm adapted to burst under predetermined water pressure to permit the water to reach the detonator actuating mechanism, a valve for preventing the water from reaching the diaphragm during the launching of the mine, and a soluble element for retaining the valve in its operative position.

8. In a depth mine, a firing pin, a body portion secured to the top of the mine, a tube extending therefrom, a piston operable in the tube and carrying a detonator which is adapted to engage the firing pin, a diaphragm closing one end of the tube, a perforated cap secured to the body portion, a valve for normally closing the perforations to prevent the water from reaching the diaphragm, means normally tending to urge the valve to an inoperative position, and means for preventing such movement.

9. In a depth mine, a firing pin, a body portion secured to the top of the mine, a tube extending therefrom, a piston operable in the tube and carrying a detonator which is adapted to engage the firing pin, a diaphragm closing one end of the tube, a perforated cap secured to the body portion, a valve for normally closing the perforations to prevent the water from reaching the diaphragm, means normally tending to urge the valve to an inoperative position, and a soluble element for preventing such movement.

In testimony whereof I affix my signature.

JAMES HUBER.

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