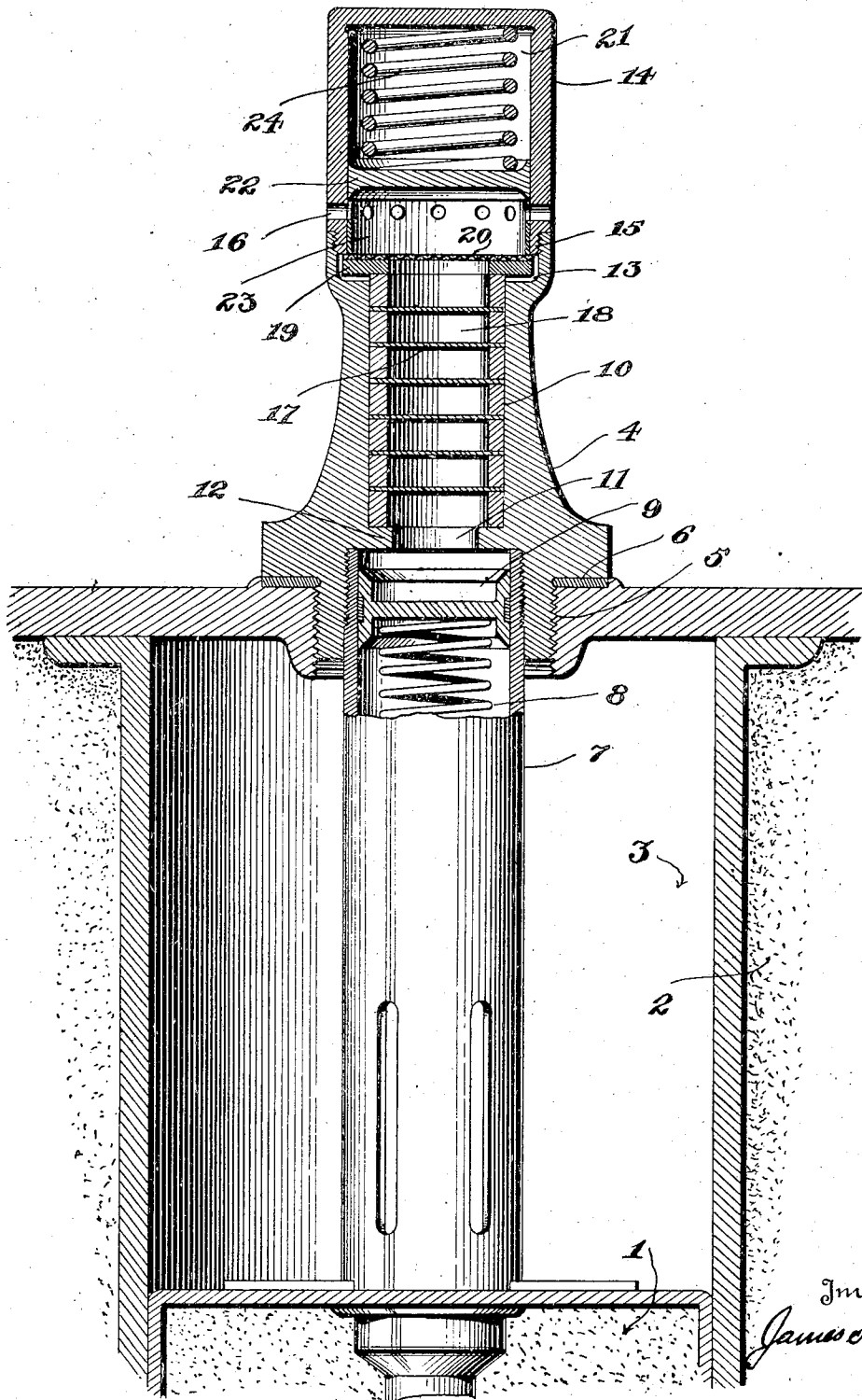


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FIRING GEAR FOR DEPTH MINES.
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1,314,664.

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FIRING-GEAR FOR DEPTH-MINES.

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To all whom it may concern:

Be it known that I, JAMES HUBER, a citizen of Switzerland, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, 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 depth mines and particularly to means for preventing the actuation of the detonator before the mine reaches a predetermined depth.

During the launching of a depth mine, when the mine is thrown from a ship, it often occurs that the firing gear strikes the water first, so that it is subjected to very great pressure, in fact to such pressure, that unless some means is provided for absorbing the pressure the detonator would be prematurely moved. Furthermore, when one mine explodes adjacent to another, the pressure increases to such an extent that unless such an absorbing means is provided, the detonator will be actuated. Of course, the disadvantage here lies in the fact that when one mine is planted and reaches the proper depth for firing it will cause the explosion of a subsequently planted mine which, however, has not reached the proper depth. It is, therefore, an object of the present invention to provide means for absorbing the temporary increase in pressure occurring during the planting of the mine, or caused by an adjacent explosion, so that the detonator will not be actuated until the mine reaches the proper depth for explosion.

In the drawing I have illustrated an embodiment of the invention, the figure being the section of the firing gear and of a portion of the mine.

The mine is of the usual form and includes an ignition charge case 1, a main charge case 2 and a chamber 3 which permits the expansion of the gases generated by the untimely explosion of the detonator, so that the ignition and main charges will not be exploded by such a premature or untimely explosion of the detonator.

A casting 4 is attached to the upper portion of the mine above the chamber 3 by means of screw threads 5, the joint being made by a suitable gasket 6. Mounted on and depending from this casting 4 is a detonator guide tube 7 in which a detonator and detonator actuating mechanism, similar to that illustrated and described in my co-pending application, Serial No. 216,817, filed February 12, 1918, is mounted. As described in said application, the detonator is slidable within the tube 7 and is actuated by means of a spring 8, which latter is compressed by the downward movement of the piston 9. This downward movement of the piston is caused by the pressure of the water which operates against the piston when the mine reaches a predetermined depth. The casting 4 is provided with an axial bore 10, which at its lower end is reduced as at 11, forming an annular flange 12, and is at its upper end enlarged as at 13. A cap 14 is attached to the upper end of the casting 4 by means of screw threads 15, or in any other suitable manner. This cap is provided with a plurality of openings 16 through which the water may pass to the bore 10 and consequently to the piston 9. A plurality of diaphragms 17 are mounted in spaced relation to each other in the bore 10, the diaphragms being maintained in their spaced relation by means of spacing collars 18. These diaphragms 17 are made of frangible material and are of such thickness that they will successively break upon the application of a predetermined water pressure. The diaphragms are all arranged to break at the same pressure, so that when the pressure is applied to the uppermost of the diaphragms, it will progressively rupture the diaphragms in a very short time. A compression washer 19 rests upon the uppermost of the spacing collars 18 and is forced downward against the same by the lower end of the cap 14, so that the diaphragms will all be clamped between the collars and thus properly held in position. A wire gauze 20 is clamped between the lower end of this cap 14 and the washer 19, and extends across the opening in the washer, so that the water passing through the openings 16 may pass directly into the bore 10, and consequently when the proper pressure is reached, to the piston 9.

The openings 16 are arranged adjacent to the lower end of the cap 14 and the cap is provided with a chamber 21 above the openings in which chamber a piston 22 is operable, the piston normally being located just above the openings 16 and being held in such position by a bushing 23, against which it rests, which bushing is provided with openings alining with the openings 16 in the cap 14. Interposed between the piston 22 and the wall of the chamber 21 is a spring 24, against which the piston must operate in order to move upwardly.

If the mine properly reaches the depth at which it is constructed to explode, without encountering any sudden and temporary shocks, the water will pass through the gauze 20 and successively rupture the diaphragms 17 until it has direct access to the piston 9, at which time it will operate the piston, which in turn will actuate the detonator. If, however, the water pressure suddenly and temporarily increases at any time during the descent of the mine, or during the planting of the same, naturally the pressure of the water within the cap 14 will increase. If the piston 22 were stationary, this increase of pressure would cause the water to rupture the diaphragms 17, but inasmuch as the piston 22 is only held in its lowermost position by the spring 24, the piston is caused to move upwardly against the action of the spring by the increase of pressure, so that the effect of the increase is practically destroyed. Furthermore, the wire gauze further destroys the effect of this increased pressure, so that normally, the diaphragms 17 will not be ruptured. Should the pressure increase to such an extent that the entire excess pressure will not be destroyed by the action of the piston 22 and the gauze 20, it is possible that the uppermost of the diaphragms 17 will be ruptured, or even that a number of these diaphragms will be ruptured. However, the provision of a number of diaphragms prevents the water reaching the piston 9, as the temporary increase of pressure will not be sufficient to rupture the entire series. When the pressure returns to normal, the spring 24 will return the piston 22 to its initial position, so that it will be in position for a second operation, should a second sudden and temporary increase of pressure occur.

While I have illustrated a spring, as resisting the movement of the piston 22 in one direction and causing its movement in the opposite direction, when the excess pressure is spent, I wish it to be understood that any compressible medium may be used in place of the spring. For instance, the piston may work against air, or a compressible gas or fluid. In fact, in the form shown in the drawing, the piston works not only against the action of the spring, but also against the

air within the chamber 21, which must necessarily be compressed upon the upward movement of the piston.

What I claim is:

1. In a firing gear for depth mines, a water pressure operated detonator, means for destroying communication between the water and the detonator actuating mechanism, said means being continuously accessible to the water, and means for relieving the first mentioned means from the effect of a temporary increase in pressure.

2. In a firing gear for depth mines, a water pressure operated detonator, a frangible diaphragm for destroying communication between the water and the detonator actuating mechanism, said diaphragm being continuously accessible to the water, and means for relieving the diaphragm from the effect of a temporary increase of pressure.

3. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms for destroying communication between the water and detonator actuating mechanism, said series being continuously accessible to the water, and means for relieving the diaphragms from the effect of a temporary increase of pressure.

4. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms arranged to destroy communication between the water and the detonator actuating mechanism, said series being continuously accessible to the water and the members of said series being successively accessible to the water.

5. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms, each constructed to be ruptured under the same pressure, for destroying communication between the water and the detonator actuating mechanism, said series being continuously accessible to the water and the members of said series being successively accessible to the water.

6. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms, each constructed to be ruptured under the same pressure, for destroying communication between the water and the detonator actuating mechanism, said series being continuously accessible to the water and the members of said series being successively accessible to the water, and a wire gauze for partially destroying the effect of a temporary increase of pressure on the series of diaphragms.

7. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms, each constructed to be ruptured under the same pressure, for destroying communication between the water and the detonator actuating mechanism, said series being continuously accessible to

the water, a wire gauze for partially destroying the effect of a temporary increase of pressure on the series of diaphragms, and a yieldable piston for further destroying the effect of said increase of pressure.

8. In a firing gear for depth mines, a water pressure operated detonator, a series of frangible diaphragms, each constructed to be ruptured under the same pressure, for destroying communication between the water and the detonator actuating mechanism, said series being continuously accessible to the water, and a yieldable piston for partially destroying the effect of a temporary increase of pressure on the diaphragms.

9. In a firing gear for depth mines, ing having an axial bore, a water pressure operated detonator having an actuating mechanism communicating with said series of frangible diaphragms arranged in the bore, a wire gauze closing the upper end of the bore, a cap attached to the upper end of the casting and having a chamber through which the water has communication to the diaphragms, and a yieldable piston arranged within the cap in communication to the wire gauze.

In testimony whereof I affix my signature

JAMES HUI