G. CONSTANTINESCO AND J. R. MIDDLETON.

STORAGE OF ENERGY DUE TO AN EXPLOSION.

APPLICATION FILED DEC. 2, 1918.

1,338,676.

Patented May 4, 1920.

4 SHEETS—SHEET 1.

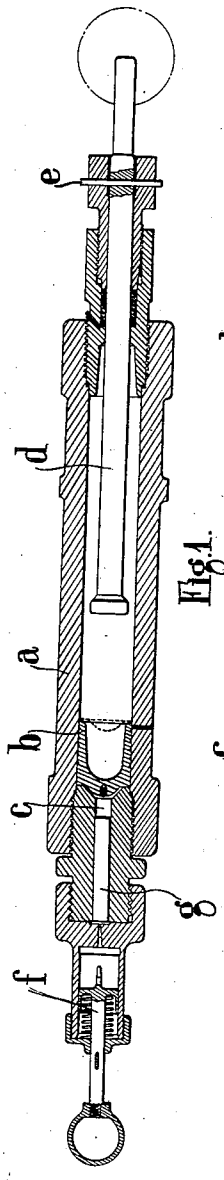

Fig.1.

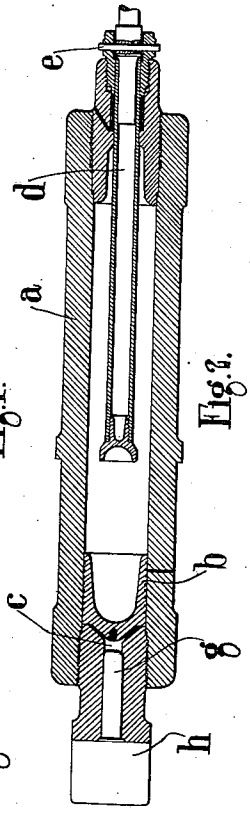

Fig.2.

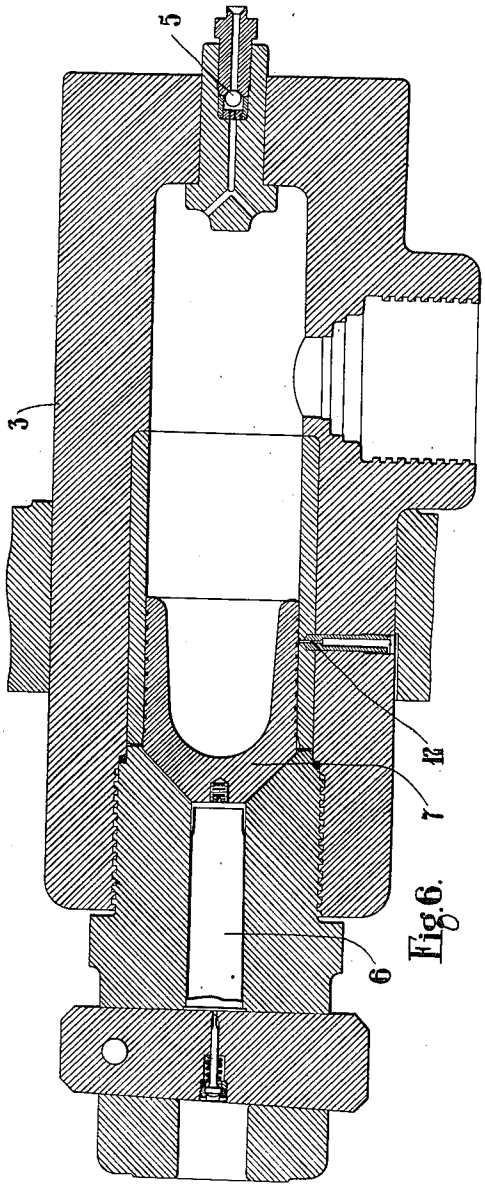

Fig.6.

INVENTOR

G. Constantinesco.

J. R. Middleton.

BY

H. R. Kerslake ATTORNEY

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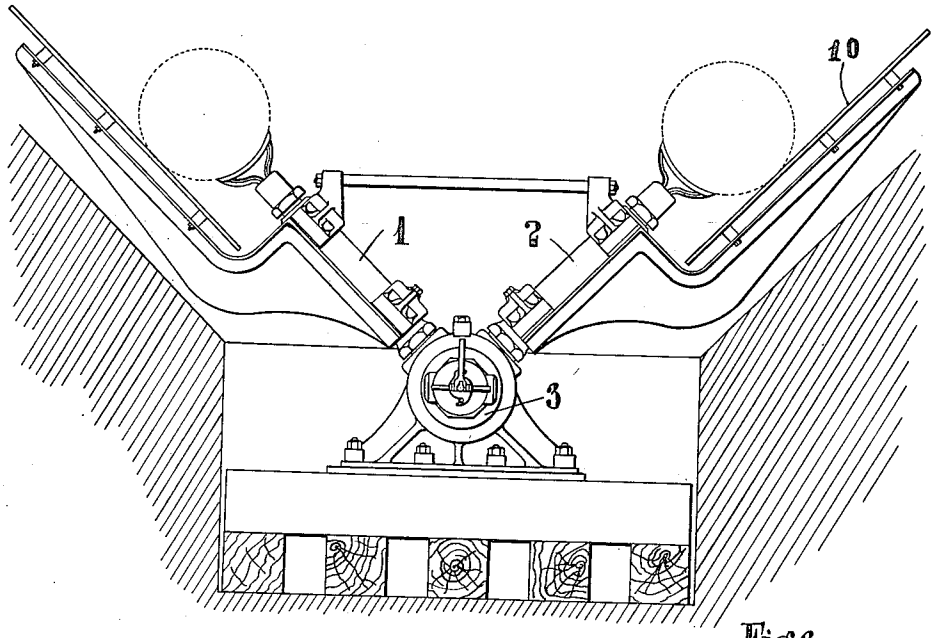

Fig.3.

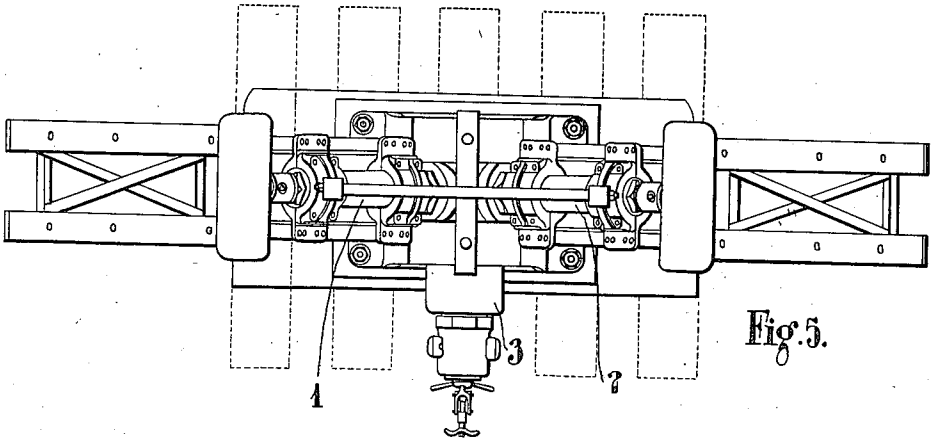

Fig.5.

INVENTOR

G. Constantinesco.

J. R. Middleton.

BY

A. R. Kerslake ATTORNEY

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4 SHEETS—SHEET 3.

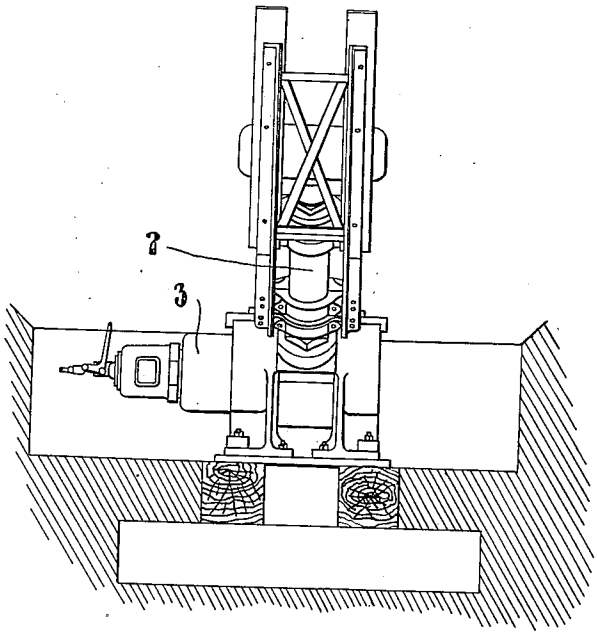

Fig.4.

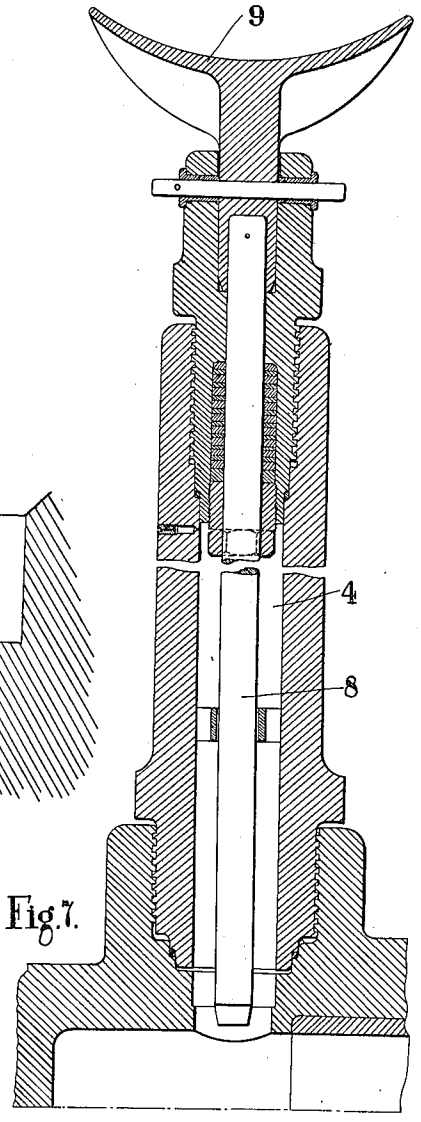

Fig.7.

INVENTORS.
G. Constantinesco.
J. R. Middleton

BY

H. R. Kerslake ATTORNEY

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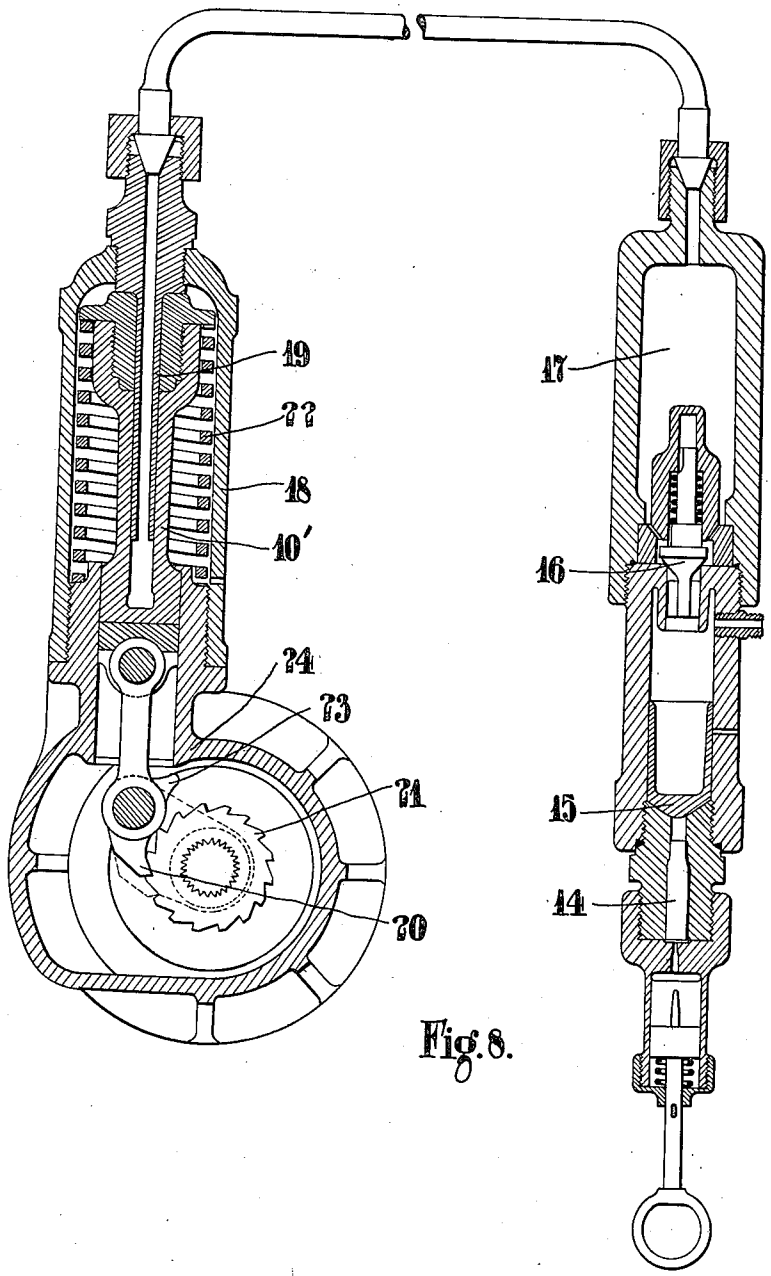

Fig. 8.

Inventors.
G. Constantinesco
J. R. Middleton.
By H. R. Kerslake
Atty.

UNITED STATES PATENT OFFICE.

GEORGE CONSTANTINESCO, OF ALPERTON, AND JOHN RICKARDS MIDDLETON, OF LONDON, ENGLAND.

STORAGE OF ENERGY DUE TO AN EXPLOSION.

1,338,676. Specification of Letters Patent. Patented May 4, 1920.

Application filed December 2, 1918. Serial No. 265,061.

To all whom it may concern:

Be it known that we, GEORGE CONSTANTINESCO, a subject of the King of Great Britain and Ireland, and residing at "Westoe," Stanley avenue, Alperton, in the county of Middlesex, England, and JOHN RICKARDS MIDDLETON, D. S. O., a subject of the King of Great Britain and Ireland, and residing at Victory House, Cockspur street, London, S. W. 1, England, have invented certain new and useful Storage of Energy Due to an Explosion, of which the following is a specification.

The object of the present invention is to obtain storage of energy by acting on liquids by means of explosives. The invention is specially applicable to the production of a silent and flashless gun or howitzer for firing heavy projectiles.

It has already been proposed to fire projectiles by the energy of compression of a liquid, the compression being obtained by the use of a suitable pump or the like. This entails the provision of a comparatively large pumping unit and considerable time in storing the energy. One of the inconveniences of ordinary guns firing heavy projectiles with relatively small charges of explosives is the suddenness of the pressure on the projectile which may produce the premature explosion of the projectile before it leaves the gun. Another inconvenience is the non-accuracy of the fire with such guns on account probably of the fact that the leakage of the gases under the high pressure created by the propellant is not constant for each shot; this being the case and the amount of charge being relatively small, a considerable relative difference would occur in the value of the mean pressure on the projectile. It will be obvious on considering the high pressures which are produced in a gun barrel that any slight difference in the fit of the projectile in the barrel will produce a considerable difference in the leakage of the gases past the projectile as this passes up the barrel. The result of this will be that the pressure behind the projectile when at a given point along the length of the barrel will be different with different shots.

We have found that these troubles can be practically eliminated by firing the propellant in a separate cylinder behind a piston and interposing between this piston and the projectile a relatively large volume of liquid, acting as a cushion between the projectile and the charge. The volume of liquid between the projectile and the piston should be sufficiently large to absorb by its elastic compressibility the shock imparted by the propellant to the piston.

The operation of such an arrangement is as follows:

Suppose an adequate charge of, say, cordite, is fired in the firing cylinder behind the piston. This will develop high pressure on the piston which will be vigorously accelerated against the liquid volume behind the projectile. The pressure in the liquid will thus increase, following the known law of elasticity of liquids, and the projectile will be acted on by pressures distributed over a longer period of time than would be the case if the charge of cordite were fired directly behind the projectile without interposition of the liquid cushion.

If desired, a non-return valve can be interposed in the path of the liquid from the piston to the liquid volume in the gun. In this case the liquid will be trapped in the gun barrel under high pressure, elastically compressed and the acceleration of the projectile will take place in a still longer time. The projectile may be held against the pressure of the liquid and released at will or automatically by any suitable device, for example, a shearing disk or shearing pin or a balanced piston attached to the projectile or the projectile itself made as a balanced piston and released by the shearing of the disk or the pin, or by outbalancing the piston-projectile by a suitable communication of pressure on the leaving side of it, as already proposed.

The invention can be applied to other purposes, for example, for obtaining storage of liquid under high pressure compressed elastically in a bottle from which it can be used, for example, for actuating hydraulic machines, hydraulic starters for engines, etc. The liquid used may be oil, water or any liquid or equivalent.

It is to be noted that the inertia of the firing piston may be arranged to play an important factor in compressing the liquid even after the pressure of the propellant has dropped to a value inferior to the pressure in the volume of liquid which it compresses.

In order to prevent the burning gases

from leaking from the firing piston into the liquid through the clearance between the piston and cylinder and to provide at the same a complete discharge of the burnt gases, an annular recess or a vent hole may be provided on the firing piston which communicates with the atmosphere, so as to form a by-pass and exhaust passage for the spent gases.

The invention is very broad in application because it provides a very simple means for utilizing and storing the power of an explosive. It obviates the necessity for heavy pumps and prime movers in order to store energy in potential form in liquid bottles, so as to be immediately ready for practical use.

Referring to the accompanying drawings:—

Figure 1 is a section of a bomb thrower constructed according to the invention; while

Fig. 2 is a section of a modified form.

Fig. 3 is a side elevation;

Fig. 4 an end elevation; and

Fig. 5 a plan of a multiple bomb thrower constructed in accordance with the invention.

Fig. 6 is a section showing the compression chamber of this machine; and

Fig. 7 is a section showing one of the bomb throwers.

Fig. 8 shows the application of the invention to a motor starter.

In carrying the invention into effect as illustrated in Fig. 1, the chamber *a* is filled with liquid at atmospheric pressure. Within this chamber there is provided a piston *b* which prevents gases from the combustion chamber *c* from entering the liquid space. At the forward end of the chamber *a* there is provided a piston *d* which may be held in the position for firing by a shearing pin *e*. At the rear end of the bomb thrower there is provided a firing pin *f* which, when released, strikes against a cordite cartridge *g* and detonates the charge. The gases formed by the explosion act on the piston *b* which moves forward compressing the liquid in the chamber *a*. The expansion of the liquid acts on the piston *d* forcing this forward and thus throwing a bomb carried on the piston in any suitable manner.

In the modification shown in Fig. 2, the operation is similar to that above described, but the breech *h* is of the ordinary Hotchkiss type.

In the modification shown in Figs. 3 to 7, two bomb throwers 1, 2 are shown connected to a single compression chamber 3. The compression chamber 3 and the cylinders 4 of the bomb throwers are filled with liquid, for example, water, through the non-return valve 5; and when it is desired to fire the bombs this is effected simultaneously by firing the cartridge 6. The explosion forces the piston 7 forward, compressing the liquid in front of it and also compressing the liquid in the cylinders 4 of the bomb thrower. The pistons 8 of these bomb throwers are thus forced forward throwing the bomb which rests on cups 9 and blades 10. When the piston 7 has been forced forward by the explosion it uncovers a vent 12 allowing the gases to escape from the breech.

In the application of the invention to motor starters, as shown in Fig. 8, the gases formed by the explosion of the cartridge 14 act on the piston 15 which compresses liquid through the non-return valve 16 into the chamber 17. This chamber communicates through pipe 19 with a ratchet motor 18 and the expansion of the liquid in the chamber 17 forces down the hollow piston 10′ of the ratchet motor 18. During the downward movement the pawl 20 engages with the ratchet wheel 21 which is connected to the engine shaft. On the return movement which is effected by the spring 22, the projection 23 on the pawl comes in contact with the frame 24, releasing the pawl from the ratchet wheel.

It will be seen that many other applications of the invention besides those above described are possible.

Having now described our invention what we claim as new and desire to secure by Letters Patent is:—

1. A system for utilizing and storing the energy of an explosive which consists in firing the explosive behind a piston, causing the pressure of the gases produced by the explosion behind the piston to compress a liquid whose pressure and expansion are utilized to obtain motion, utilizing the pressure and expansion of the liquid to move a piston, and causing the second piston to move a member.

2. A system for utilizing and storing the energy of an explosive comprising a cylinder, a piston in said cylinder, means for firing an explosive behind said piston, liquid in front of said piston adapted to be compressed by said piston and a second piston in the cylinder for utilizing the pressure and expansion of said liquid to obtain motion, said second piston preventing the escape of the liquid from the cylinder.

3. In combination, a casing provided with a propelling member, pistons located in the casing, means for firing an explosive behind one of the pistons, and a body of liquid located between the pistons and arranged to be compressed by one of said pistons when the explosive is fired for moving the propelling member.

4. A combination as defined in claim 3 having means for permitting the exit of gases after one of the pistons has been moved by the explosive.

5. In combination, a casing provided with a propelling member, pistons located in the casing, means for firing an explosive behind one of the pistons, and a body of liquid located between the pistons and arranged to be compressed by one of said pistons when the explosive is fired, said body of liquid functioning to prevent the escape of the explosive gases past said propelling member, and one of the pistons preventing the escape of liquid past said propelling member and actuating said propelling member.

In testimony whereof we have signed our names to this specification.

GEORGE CONSTANTINESCO.
JOHN RICKARDS MIDDLETON.