(No Model.) 2 Sheets—Sheet 1.

G. H. BABCOCK.

APPARATUS FOR PROJECTING COMBUSTIBLE MISSILES.

No. 429,592. Patented June 10, 1890.

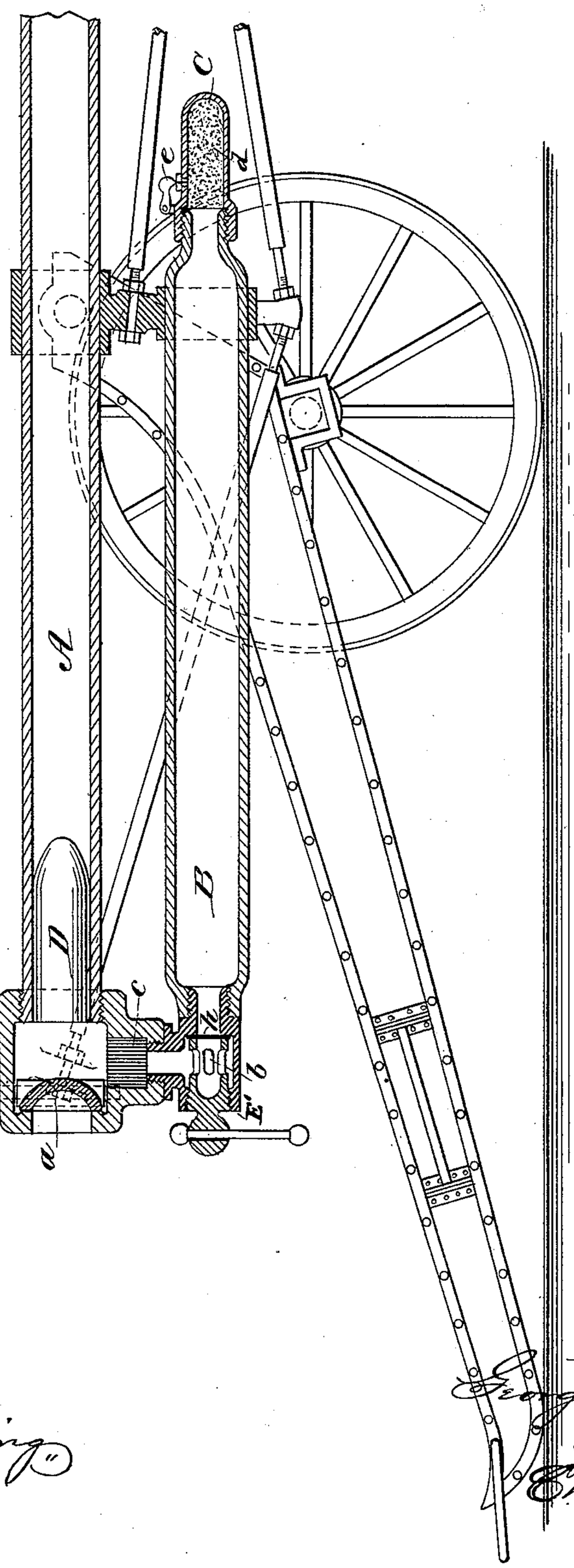

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

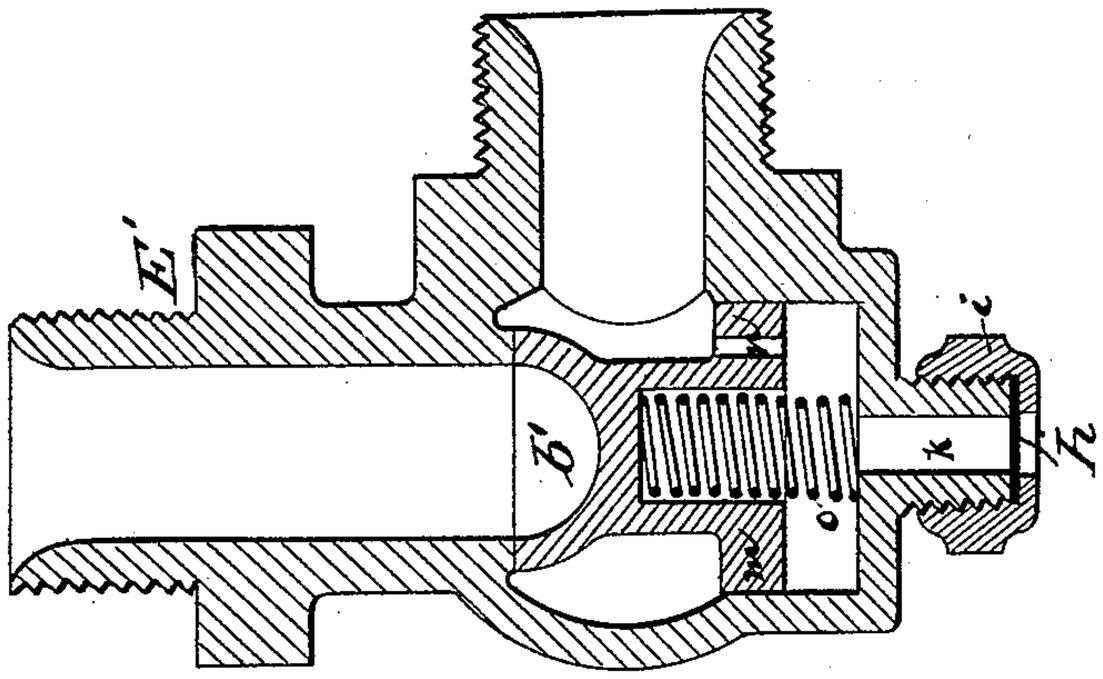
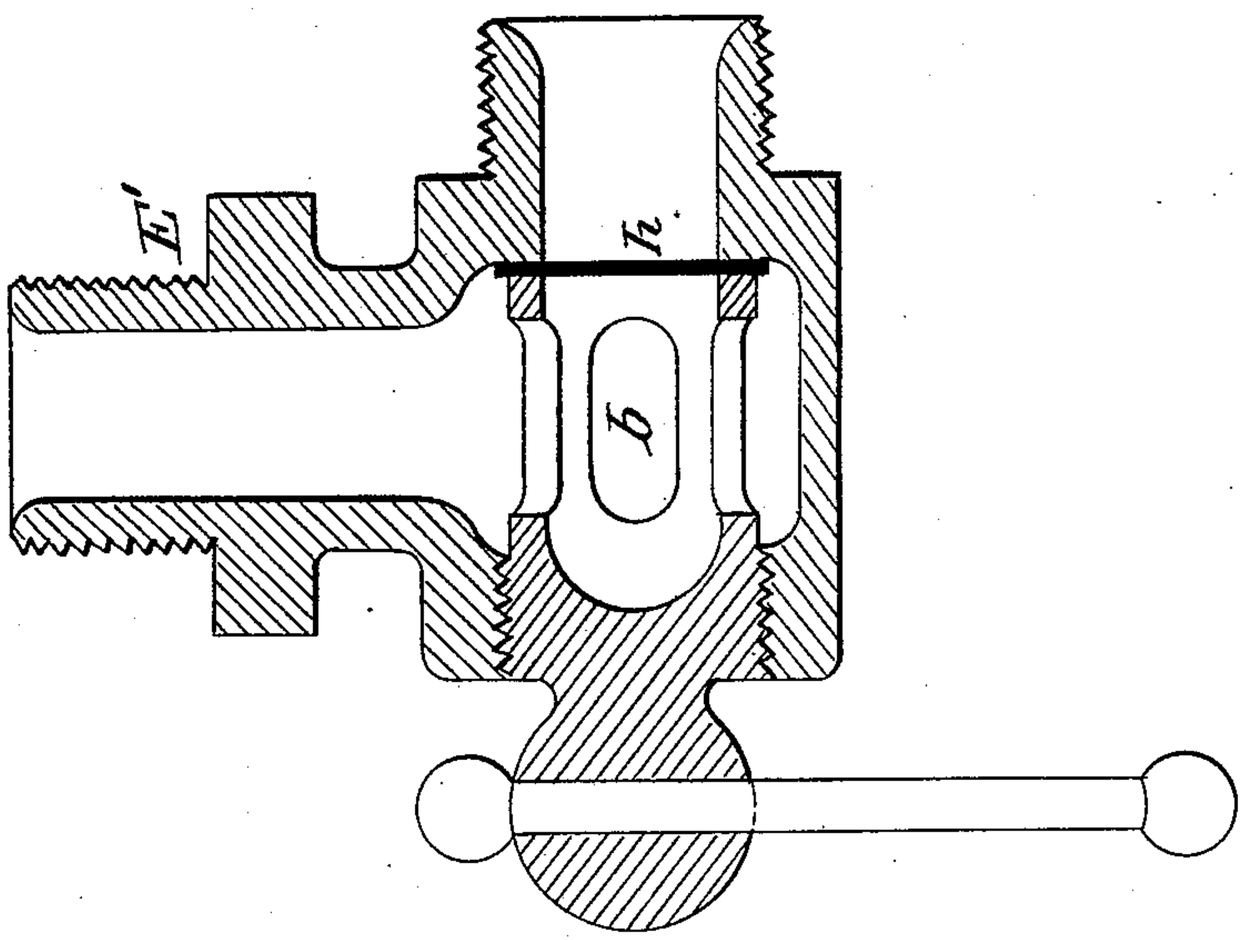


Fig. 2.



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APPARATUS FOR PROJECTING COMBUSTIBLE MISSILES.

SPECIFICATION forming part of Letters Patent No. 429,592, dated June 10, 1890.

Application filed September 17, 1885. Serial No. 177,364. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. BABCOCK, a citizen of the United States, residing at Plainfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in an Apparatus or Gun for Projecting Combustible Missiles, of which the following is a specification, reference being had to the accompanying drawings, forming a part of the same, in which—

Figure 1 is a sectional view of an apparatus or gun, mounted like an ordinary field-piece, embodying my invention; Fig. 2, an enlarged and detached view of a detached part of the same, and Fig. 3 a modified construction and arrangement of such detached part.

My invention consists of a combination of elements constituting a gun for firing dynamite or other substances by gas-pressure, wherein the gas is developed in a reservoir outside the gun-barrel, and automatically admitted to the barrel when a predetermined pressure has been reached.

In order that others may understand and practice my invention, I will for the purpose of this application describe the same in connection with a gun for projecting shells containing dynamite or other explosive, although said gun is equally well adapted to the projection of other missiles.

Heretofore in firing dynamite by means of powder great difficulty has been experienced in preventing the explosion of the dynamite by the heat of the gases. This is easily conceived when it is considered that the temperature of the gases from burning powder is as high as 3,000°, and that nitro-glycerine frequently explodes by simply warming it over a fire, or even when thawing it from the frozen state.

In Fig. 1 of the drawings, A represents the rear portion of the barrel; B, the pressure-reservoir; C, the connected powder-chamber; D, the projectile, and E the breech-block, the construction of the latter, together with its operative parts, being hereinafter more particularly referred to in the description of operation, and also in connection with the modified constructions and equivalent devices represented in Figs. 2 and 3, in which the same letters of reference refer to similar elements or parts. The cartridge of powder or other combustible *d* is placed within the chamber C and exploded by a percussion-hammer *e*, or by other well-known means, the projectile D being inserted in the rear end of the barrel A by opening the swinging breech plate or cover *a*. The percussion-hammer *e* is located near the forward end of the powder-chamber C, adjacent to the pressure-reservoir B, in order to fire the powder at such point, so as to effect a more thorough and gradual combustion and corresponding gradual compression of the air in the reservoir B.

The breech-fixture E is shown secured to the rear end of the barrel A by a threaded connection; but it may be shrunk thereon or secured in other ways, or made as an integral part therewith. This breech-fixture E is made with a hollow projecting part that provides a coupling-connection with a hollow fixture E′, that is also connected with the pressure-reservoir B, forming the passage from the latter to the barrel A. In Figs. 2 and 3 the fixture E′ is shown detached and enlarged.

In Fig. 2 a hollow perforated screw-plug *b* is shown, that retains a diaphragm *h* in the position shown, the latter being capable of removal or renewal by removing the plug *h*. This diaphragm *h* closes the passage leading from the pressure-reservoir B, and its object is to close the latter and retain the pressure accumulated from the combustion therein until it attains a desired degree, the diaphragm being composed of vulcanite or of such material and strength as will break at a point of predetermined pressure, which, by such relief, is transmitted through the plug *b* and passage to the barrel A.

In the modification Fig. 3 the diaphragm *h* is located in a side passage *k*, communicating with the main passage, and is held in place by a cap-nut *i*. In the main passage a valve is shown so constructed as to be closed and held to its seat by the pressure in the reservoir B until said pressure is released by the bursting of the diaphragm *h*, when said valve will automatically open and allow the pressure to be transmitted through the main passage to the barrel A, and will also close the side outlet *k*. This valve *b′* is constructed with a supplemental flange or piston *m*, through which a port *n* is provided, and is held normally to its seat, as shown in Fig. 3,

by the coiled spring *o*, which is somewhat greater in tension than the weight of the valve, at least sufficient to seat it after each discharge. This valve *b'* remains seated when the pressure accumulates in the reservoir B, the port-passage *n* through the supplemental piston-flange *m* transmitting the pressure to its opposite side of greater area, which maintains it to its seat.

The passage *k*, across which the diaphragm *h* is fixed, communicates with the valve and reservoir chamber, as shown, and when the pressure rises to the bursting-point of the diaphragm its sudden relief from the lower side of the piston-flange *m* causes the valve to drop or open, which closes the port *n* before a recovery of the pressure on the under side of the piston-flange *m* can occur.

It is well known that air at 60° Fahrenheit suddenly compressed to one thousand pounds per square inch will be heated by such compression to 1,300° Fahrenheit, (to a dull red heat,) and when compressed to two thousand pounds per square inch its temperature is raised to 1,700° Fahrenheit, (to a full cherry-red heat,) either of which would set any ordinary combustible on fire. Therefore, in order to cool the gases as much as possible before coming in contact with the projectile, (that may contain an explosive compound,) I interpose a device, (shown at *c*,) which may be composed of strips of sheet-iron, alternately plain and corrugated, rolled together into a cylindrical form, and bound with wire. An equivalent of such construction would be made up of a series of small tubes or a mass of woven wires, which would take up the heat of the passing gases. For the better securing the desired effect this may be cooled by ice or other means before placing it in the gun, though this will not usually be necessary. As the heated gases pass through this cooler *c* its lower end is first heated, and the proportions may be such that the upper end will not become heated to any objectionable degree until sufficient air or gas is admitted in contact with the projectile in a cool state to protect it from the heat of the gases of combustion following. As the hotter products of the combustion pass through the cooler *c* in following up the projectile, said cooler will be intensely heated. Therefore it is made removable in order that another may be substituted before another charge is fixed.

In another application filed simultaneously herewith I have claimed my method of operation of my invention and described in connection therewith an apparatus substantially the same as that shown in Fig. 1 of the drawings of this application by which such method may be practiced, and in the present application I have claimed such apparatus and modifications, the invention being thus presented in separate applications, in accordance with the rules of practice made and provided.

Therefore what I claim, and desire to herein secure by Letters Patent, is—

1. In a gun for firing missiles by gas-pressure, a barrel, a reservoir, an intermediate passage connecting the reservoir and barrel, and an automatic pressure-regulator constructed to open said passage by means of the direct gas-pressure when the pressure reaches a predetermined limit, all in combination substantially as described.

2. In a gun for firing dynamite or other projectiles, a closed pressure-regulator and a powder-chamber connected thereto, a barrel for directing the projectile, and an intermediate stopper constructed to open under a predetermined pressure for opening communication between the closed reservoir and the barrel, in combination substantially as described.

3. In a gun for firing dynamite or other projectiles, a closed reservoir, a barrel, and a passage connecting the same, and a valve in said passage adapted to open automatically by means of a predetermined gas-pressure from the side of the reservoir, combined substantially as described.

4. In a gun substantially as described, the combination of a barrel, a reservoir, a passage connecting the two containing a valve, and a diaphragm acting to support said valve in closed position until ruptured by a predetermined gas-pressure, substantially as described.

5. In a gun for firing dynamite or other projectiles operated by compressed air or gas, a barrel and a gas-reservoir, and a removable mass of metal having numerous passages and an extended surface between the reservoir and barrel, whereby the substitution of a new piece gives a new cooling-surface, substantially as described.

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