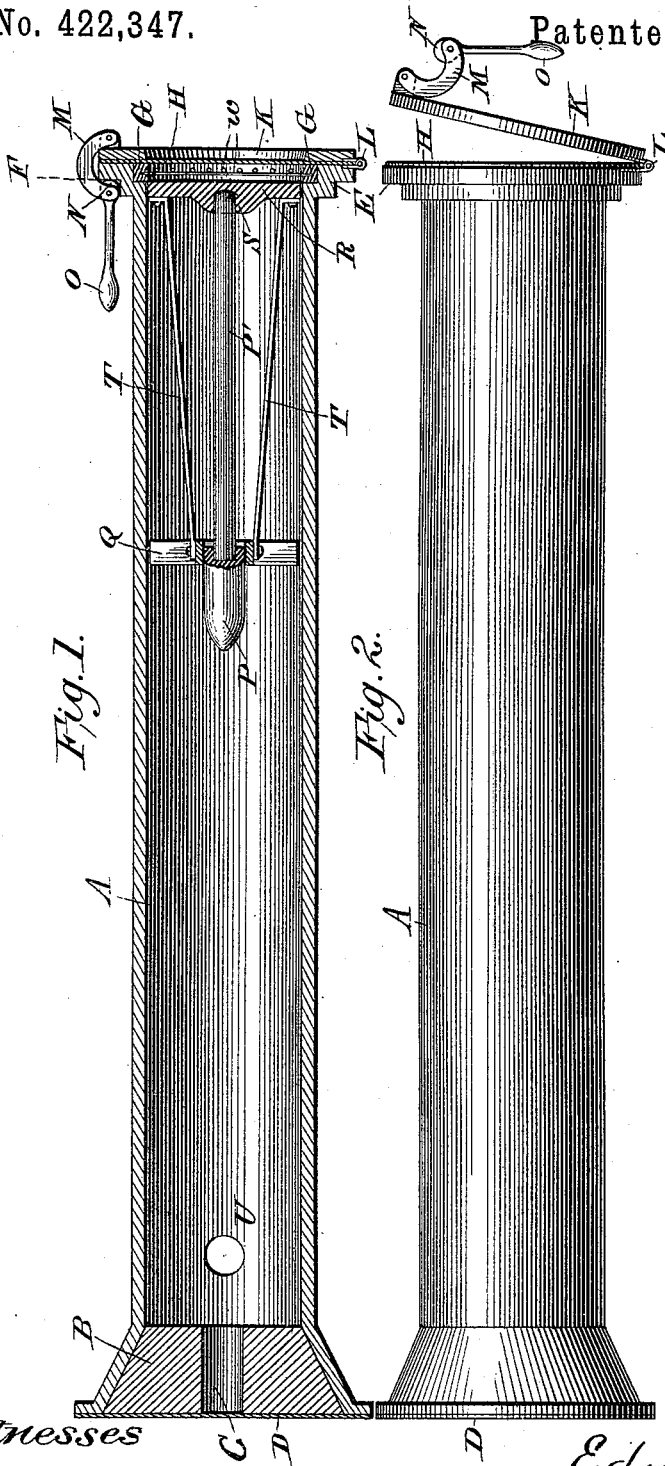


(No Model.)

E. A. HYDE.
GUN.

No. 422,347.

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Witnesses

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GUN.

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To all whom it may concern:

Be it known that I, EDWARD A. HYDE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a new and useful Gun; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain improvements in guns for and methods of throwing projectiles.

Heretofore the initial velocity of projectiles thrown by an explosive substance has in some instances been increased by exhausting the air from the gun in front of the charge, thereby removing the resistance encountered by the projectile while passing through the gun, and also this same plan of removing the resisting medium has in some instances been adopted in compressed-air guns, where the projectile is thrown by the expansion of highly-compressed air admitted from compressing-chambers attached to the gun; but of course it is obvious that this old plan of exhausting the air from in front of the charge has nothing directly to do with the propulsion of the projectile, but is merely done to reduce the resistance of the air to the projectile while in the gun.

The object of the invention is to utilize the natural forces of nature while in their normal condition for throwing projectiles either slowly and for short distances, or with great rapidity and for long distances; and, more specifically, the object of the invention is to utilize the natural and normal force and pressure of the external atmosphere and its natural tendency to fill all space and rush into and fill perfect and partial vacuums for throwing or propelling projectiles, and to concentrate the force and pressure of an inrushing column of air on a projectile of sub-caliber or of considerably less diameter than the cross-section of the column of air, thereby obtaining great velocity, and whereby projectiles can be thrown with great rapidity and in rapid succession from a single gun. There is no report, concussion, smoke, flame, fouling, bursting, or danger. It is impossible for

the gun to explode and fly in pieces. As the natural forces of nature are employed to throw the projectile, the ammunition is always at hand, and the cost of a discharge is reduced to a minimum and amounts to substantially nothing except the cost of the projectile. The gun can be made exceedingly light and cheap in construction and of any material, and is also extremely simple and devoid of complicated parts, and hence easy for any person to operate. The discharges can be made in rapid succession on account of the simplicity of the method and gun and the ease of operation, and incessantly, because it never heats. The projectile starts so slowly and the increase of velocity is so gradual within the gun that there is no perceptible reaction or recoil, and hence wear on the parts is reduced to a minimum, and, more important still, projectiles loaded with dynamite and other high explosives can be discharged with the utmost safety. It is a great improvement and possesses many advantages over the common "pneumatic" guns, wherein the projectiles are thrown by the sudden expansion of compressed air. The gun can shoot from either end—that is, backward as well as forward—and the inflow of external atmospheric air can be regulated to suit the kind of projectile being discharged. These objects are accomplished by, and my invention consists in, the method hereinafter set forth, and specifically pointed out in the claims, and in certain novel features of construction, and in combinations of parts, more fully described hereinafter, and particularly pointed out in the claims.

The simplest form of carrying out my invention might be as follows: Take a gun-barrel or any other air-tight chamber open at both ends and insert a projectile at the muzzle. This projectile should be of such length that it will not have lateral swing in the chamber, and should snugly and yet loosely fit the same, so that it will prevent air from escaping around it, and yet can freely slide in the chamber. A stout cord extends from the projectile through the chamber and out at the rear end of the same. The muzzle is tightly closed with a cork or air-tight paper

cap and the projectile quickly drawn back through the chamber by means of the cord to the open end or breech of the chamber, thereby creating a vacuum or partial vacuum in the chamber, with the projectile sustaining the weight of the column of air behind it. Then cut or release the cord and the pressure of the external atmosphere tending to fill the vacuum will rapidly drive the projectile through the chamber and with such force that it will drive out the cork or cover at the muzzle without materially retarding its great force and speed.

For larger guns the accompanying drawings illustrate an apparatus for carrying my invention into effect, in which—

Figure 1 is a longitudinal section of a loaded gun in readiness to be discharged. Fig. 2 is an elevation or plan of the same, showing the annular breech-door partly open. Fig. 3 is a detail perspective view of the sabot with its projectile in place.

In the drawings, the reference-letter A indicates a vacuum-tube or elongated chamber normally open at each end, and provided, preferably near its front end, with the opening U in its side wall, through which the air-exhaust pipe of an air-pump opens. For a large gun it is more convenient and practical to create the vacuum by means of a separate air-pump connected to the vacuum-chamber by a pipe and continuously operated while the gun is being used either by hand, steam, or other motors.

The vacuum-chamber A is shown provided with a flaring flanged muzzle closed by a plug B, having a central transverse aperture C for the passage of the projectile.

D indicates the paper muzzle-cap covering the plug B and flanges of the muzzle. The paper for the muzzle and breech caps is rendered air-tight by sizing and then varnishing, and the muzzle-cap is put on over the muzzle-plug and secured with paste, glue, or any adhesive substance which will prevent leakage of air, or it might be held in place by an annular hinged door without paste, as at the breech.

E indicates the flanged breech of the chamber counterbored to the line F to receive the annular frame G, carrying the open-work of cross-wires or metallic slats *w*, which forms a base and support for the paper breech-cap H. The breech-cap and support therefor are held in place by an annular hinged door K, with its central opening of the same or a greater diameter than the bore of the vacuum-chamber, and the same is true of the opening of the frame G. This door is secured by a hinge L and is locked in position, tightly pressing the breech-cap against the flange E, to prevent leakage of air, by a latch consisting of the curved link M and the cam-head N to engage the outer face of the flange E, and operated by and provided with a handle O to lock or release said door.

As the usual atmospheric pressure is slight

compared with the enormous pressure of the expanding gases released by the rapid combustion of gunpowder, a propelling-pressure upon a projectile equal to and greater than that of gunpowder is obtained by concentrating the force of an intruding column of external atmospheric air upon a projectile of considerably less diameter than the column of air, or, in other words, by using a sub-caliber projectile carried by a sabot of an equal size with the column of external atmospheric air and lightly constructed, preferably of strongly-ribbed and braced wood, and having the disk at the rear which sustains or receives the weight of the intruding column of air provided with an annular overlapping packing secured to the back face to prevent leakage of air during the discharge. This sabot, as shown, (although not necessarily,) consists of the rear head or disk R, strongly constructed of suitable material and of a size to snugly fit the interior of the vacuum-chamber and prevent escape of air around it and yet allow free longitudinal movement in the chamber, and the front open head or spider-frame Q, located a distance in front of the disk R, with its arms loosely bearing against the walls of the chamber and rigidly secured to the disk R by longitudinal braces T. The spider-frame is provided with a central opening to receive and support the heavy head P of the projectile in the center of the chamber. This projectile P has an opening in its rear end to receive a wooden or other light rod or shaft P', which extends rearwardly and at its rear end fits loosely in a socket S in the front face of the disk R. It should be observed that the diameter of the projectile is far less than that of the vacuum-chamber, and that the opening C in the muzzle-plug is slightly greater in diameter than the projectile.

In operation the sabot and its projectile are first placed in the vacuum-chamber through the breech thereof. The closing or sealing caps are then placed over the muzzle and breech and secured and the air exhausted by means of an air-pump. Cap H is then broken or cut the desired degree and with the desired rapidity, and the intruding column of external atmospheric air against the disk R will force the same and the projectile with great and increasing force and velocity toward the muzzle of the chamber and the projectile will easily glide through the opening C and muzzle-cap D and leave the sabot, which, with the plug B, will fall a short distance from the muzzle of the gun and can be picked up and replaced.

When the gun is discharged, the amount of exposure or cross-section of the column of air admitted (if the present construction is employed by breaking or cutting the paper breech-cap) and the suddenness of the exposure are varied according to the nature of the projectile. For instance, when throwing shells loaded with dynamite or other high explosives the exposure would be gradual, while

with solid projectiles no particular care need be taken in admitting the air.

It is clearly evident that the invention is in no wise confined to the constructions herein set forth. For instance, the sabot might be varied in many ways. The braces T are not absolutely necessary. All that is necessary in the present construction of the gun is to have a disk of the size of the vacuum-chamber to receive the force of the column of air and concentrate the same upon the projectile of sub-caliber. Instead of employing a paper breech-cap, the air might be suddenly or slowly admitted in many other ways and so that it could be carefully and easily regulated, as by a large valve and scale to show the amount and pressure of the air being admitted, and also the vacuum-chamber might be provided with a pressure-gage to show the condition of the vacuum.

The projectile can be discharged from either end of the gun by merely placing it at either end and creating the vacuum in front of it and admitting the external atmospheric air behind it, and, if desirable, the base of the projectile or of the sabot, or a diaphragm carried by either of these parts, might be held in position by suitable means and close the breech while the vacuum is being created and the projectile discharged by releasing the same or its sabot. The vacuum-chamber can be made of wood, paper, glass, or metal, and can be square, round, polygonal, or any shape in cross-section or longitudinally.

There is little, if any, reaction or recoil upon the sabot or gun-carriage when the projectile is discharged.

The great value and advantages of this invention are obvious. There is not the danger or expense of the common pneumatic gun, nor the complicated and delicate parts which necessitate skilled operators. This gun cannot explode, as the pressure is from the outside inward, and not outward, as in the compressed-air guns. The velocity attained by the projectiles from these guns is very high, and it has been found by practical experience that the velocity of the projectile increases with the length of the vacuum-chamber, and also the more perfect the vacuum the greater the velocity. There are also many ways by which a vacuum can be created.

It is most clearly and obviously evident that this method and invention bear no similarity to the before-mentioned plan of withdrawing the air from in front of the projectile in a gunpowder or compressed-air gun merely because it is a hinderance to the passage of the projectile. The propulsion of the projectile in no way depends on this withdrawal of the air; but my invention is a method of throwing projectiles by the external atmospheric air in its normal condition and pressure, and the direct cause of the propulsion of the projectile is the vacuum in front of it, and the creation of this vacuum is the first step in the method of throwing the projectile

and the admission of the normal external atmospheric air is the last step. The advantages of such a method do not require enumeration, they are so obvious. No compressing machines or chambers or explosives are required. The propelling-power is always at hand and inexhaustible, requiring no compression, and the whole atmosphere at its normal pressure and in its normal and natural condition is all that is needed, and that is always ready.

This invention is not limited to any peculiar apparatus, as is clearly evident.

What I claim is—

1. The method of throwing projectiles by the atmosphere at its normal pressure, which consists in creating a vacuum in front of a projectile and then suddenly breaking the vacuum and allowing the external atmospheric air to rush in behind the projectile to fill the vacuum, as and for the purpose set forth.

2. The method of throwing projectiles which consists in exhausting the air from a vacuum-chamber in front of a projectile loosely located therein, and then opening the chamber to the external atmosphere behind the projectile, whereby the air rushing in to fill the chamber carries the projectile through and out at the opposite end of the chamber with great velocity, substantially as described.

3. The method of throwing projectiles which consists in exhausting the air from a vacuum-chamber removably sealed at both ends from the external atmosphere and loosely containing a projectile located near one end, and then breaking the seal upon which the external atmosphere is bearing behind the projectile, whereby the atmosphere rushing in to fill the vacuum carries the projectile with great velocity through and out at the front end of the chamber, substantially as described.

4. The method of throwing projectiles which consists in placing a projectile in the rear end of a vacuum-chamber open at both ends, then removably sealing both ends of the chamber from the external atmosphere, then exhausting the air from the chamber, and then breaking the seal upon which the atmosphere is bearing behind the projectile, substantially as described.

5. The method of throwing projectiles which consists in loosely placing a projectile of sub-caliber in one end of a vacuum-chamber and removably sealing both ends of the chamber, and then admitting a column of air into the chamber behind the projectile and concentrating the force of the inrushing column of air of the same area in cross-section as the chamber upon the sub-caliber projectile, as and for the purpose set forth.

6. A vacuum-gun consisting of an elongated vacuum-chamber open at both ends, and means to removably seal its opposite ends from the outer atmosphere, in combination with a sabot having a disk snugly fitting and

adapted to slide in the interior of said chamber, and a projectile of sub-caliber carried by the sabot, substantially as described.

5 7. A vacuum-gun consisting of an elongated tube open at both ends, and means to removably seal the open ends of the tube, so that the seal at the rear end can be suddenly broken to admit the outer air, said tube adapted to be connected near its front
10 with means to exhaust the air therefrom, in combination with a projectile to slide and be carried through the tube by the air rushing in to fill the vacuum, substantially as described.

8. A vacuum-gun consisting of a tube open

at both ends, means to seal the front end of 15 the tube that can be easily removed by the outrushing projectile, a cap of paper or other easily broken or cut substance sealing the rear open end of the tube from the outer atmosphere, and a support for said cap, said tube 20 adapted to be connected near its front end with means to exhaust the air therefrom, substantially as described.

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Witnesses:

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