N. GOODYEAR.

GAS GUN.

APPLICATION FILED JUNE 24, 1909.

1,057,420.

Patented Apr. 1, 1913

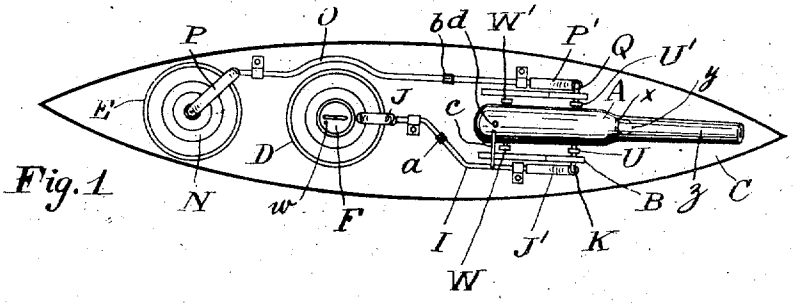

Fig. 1

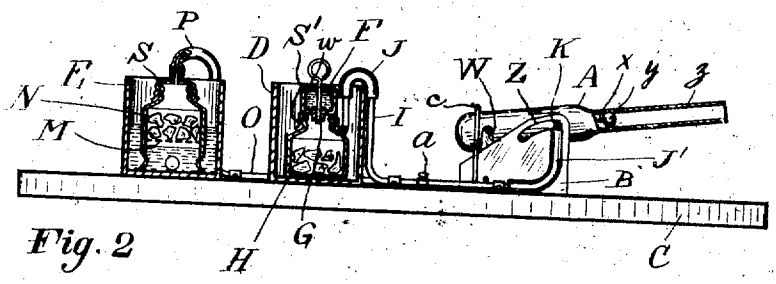

Fig. 2

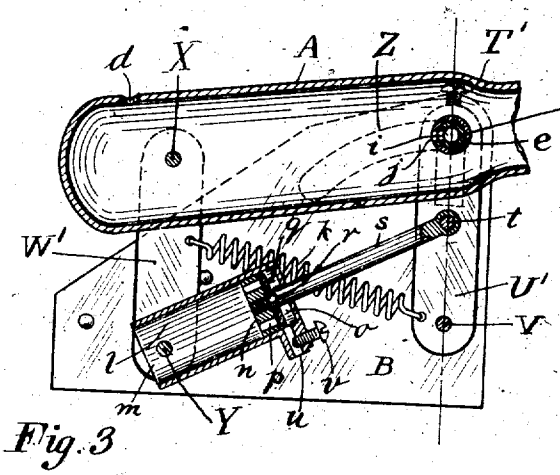

Fig. 3

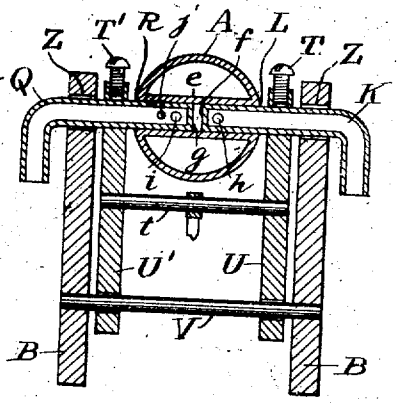

Fig. 4

WITNESSES:

E. P. LaGay

A. Parhams

Nelson Goodyear INVENTOR

BY

Dinnes, Mastick & Dyke ATTORNEYS

UNITED STATES PATENT OFFICE.

NELSON GOODYEAR, OF NEW YORK, N. Y., ASSIGNOR TO MAINE DEVELOPMENT CORPORATION, A CORPORATION OF MAINE.

GAS-GUN.

1,057,420. Specification of Letters Patent. Patented Apr. 1, 1913.

Application filed June 24, 1909. Serial No. 504,112.

To all whom it may concern:

Be it known that I, NELSON GOODYEAR, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Gas-Guns, of which the following is a specification, accompanied by drawings.

This invention consists of a gas gun or cannon in which the explosive used is a mixture of two gases, such for example as oxygen and acetylene, which when ignited explode with considerable violence.

It has for another object an automatic supply of the two gases required and means for conducting them into the firing chamber.

The embodiment of the invention shown in the drawings and particularly described herein relates to a small cannon for saluting purposes or as a toy for Fourth of July celebration, etc.

It has among other advantages low cost for the explosive, enabling a great number of shots to be fired from one charge of gas stored in generators or receivers. Also since the explosive used in the gun is in a gaseous form instead of being in a solid or granular form, as with powder, there is much less danger of damage being done when using the gun as a toy, as there are no solid particles to be thrown out unconsumed.

Another advantage of this invention resides in the fact that when the proper gases are selected, as for example, oxygen and acetylene, or oxygen and hydrogen, there is no danger of explosion or ignition outside of the firing chamber of the gun, as the gases are stored or generated separately and when pure neither gas can be exploded or burned.

Further great advantages of this invention reside in the great number of explosions which can be obtained from a charge of nominal cost. Also the safety of the use of this device is a great advantage over other guns shooting the usual forms of powder or explosives, in that the materials used to generate the gas or gases are themselves non-explosive and great quantities of them can be stored with impunity, and without increasing fire hazard or danger in case of fire if properly packed.

In the following drawings one embodiment of the invention is shown:

Figure 1 is a plan view; Fig. 2 is a side elevation partly in section; Fig. 3 is a longitudinal section through the gun and gun carriage; and Fig. 4 is a transverse section through the gun, gun carriage, and the gas connections.

Referring to the drawings A is a gun or cannon mounted on a carriage B which is in turn supported by a base C.

D and E are respectively an acetylene and an oxygen generator, which may be of any of the well-known forms. In the present instance the acetylene generator D is of the type in which water is permitted to drip from a receptacle F through a needle valve G upon calcium carbid placed in the container H. Acetylene is conducted from the generator through the pipe I which has rubber connections at J and J′ and leads to the pipe K which enters the gun at L. The pipe K also serves as one of the trunnions of the gun.

The oxygen generator is of the displacement type in which the gas generating material, sodium peroxid for example, is placed on a grating M in a vessel N which is open at the bottom to admit of the ingress and egress of the water from the outer tank of the generator E, which is filled to a level considerably above the grating M. The vessel N is provided with a gas outlet pipe O having rubber connections P and P′ corresponding to the connections J and J′ of the acetylene generator, which in turn lead to a pipe Q forming the other trunnion of the gun and entering the latter at R. Both generators are provided with suitable screw covers S and S′ to facilitate charging and emptying when the material is spent.

The gun is supported by the trunnions K and Q which are fastened by set screws T and T′ to rocker arms U and U′ carried by the pivot bearing V which is fastened securely in the gun carriage B. At the breech of the gun there are two rocker arms W and W′ which are attached to the gun by means of the pin X and which are supported on the pivot bearing Y which is also fastened to the carriage B at both ends. The gun carriage B is slotted on both sides as shown at Z, the slot being in the form of

an arc described around the center V. The gas pipes I and O may be provided with stops or cocks *a* and *b*. From the acetylene pipe I a small pipe *c* is led to a point adjacent to the breech of the gun. The breech of the gun is provided with a vent hole *d* near the breech and coming just under the end of the pipe *c*. The end of the pipe *c* is reduced so as to form a restricted passage for the acetylene or inflammable gas, which latter may be lighted so as to maintain a pilot flame or ignition flame near the vent *d* of the gun.

The trunnions K and Q where they enter the gun are inclosed in a close fitting sleeve *e* which is brazed or otherwise tightly fastened to the gun barrel A. The trunnion pipes K and Q are closed at their respective ends *f* and *g* but are provided with gas ports *h* and *i* which are directed toward the breech of the gun, as clearly shown in Fig. 3.

As will be understood from the drawings, the gun is mounted on what is generally termed a disappearing carriage, that is, when the gun recoils the rocker arms U U′ and W W′ revolve around their respective axes V and Y and the gun jumps backward and at the same time drops as the trunnions K and Q travel backward in the circular slot Z, the two sets of rocker arms U and W serving to keep the axis of the gun at all times parallel to its axis when in the upper position. Referring to Fig. 3 it will be seen that the sleeve *e* is provided with a slot or ports *j* which register with the ports *h* and *i* when the gun is in the upper or firing position, and since the sleeve *e* is fastened to the gun the ports *j* do not change their position with reference to the gun. Since the trunnions K and Q are rigidly held in the rocker arms U and U′ it will be seen that when the gun recoils the ports *h* and *i* will change their position with relation to the gun and will be thrown out of register with the ports *j*, that is, the trunnion pipes K and Q will rotate around inside of the sleeve *e* through an angle corresponding to the angular travel of the rocker arms U, thus closing the gas connection between the generators and the firing chamber of the gun, and stopping the flow of gas through the latter.

To permit the movement of the gun without disconnecting the gas connections, flexible pipes may be used, as shown at J′ and P′ or in larger apparatus rigid pipes may be used having swing joints coinciding with the axes of rotation.

A spring *k* is fastened between the rocker arms U′ and W′ in such a way as to permit of the full recoil of the gun while serving to return it to its firing position automatically.

To prevent a too quick recovery a dash pot *l* or an equivalent device such as a ratchet with escapement is provided. In the dash pot illustrated the end *m* is left wide open, which allows the piston *n* to travel down without resistance when the gun recoils, air being freely admitted to the end *o* of the dash pot above the piston by ports *p*. These ports are covered by a leather or rubber flap *q* which is held in place by a shoulder *r* on the piston rod *s*, which latter is fastened to a pin *t* connected to the rocker arms U and U′. The end of the dash pot *o* is provided with an outlet *u* having adjusting screw *v* for varying the aperture of the outlet port. When the gun is fired it recoils rapidly, extending the spring *k*, air rushing in through the ports *p* above the piston *n*. The recoil of the gun is arrested by the trunnions striking the back of the slot Z or by other suitable stops. As soon as the recoil is over the spring at once exerts an upward pull ending to restore the gun to the firing position. This action of the spring tends to compress air within the dash pot above the piston *n* which automatically closes the flexible valve *q* over the ports *p* so that no escape of air is provided, excepting through the small port *u*. It will thus been seen that the recoil of the gun will be quick and the recovery slow and that the recovery may be timed by the adjustment of the screw *v*.

The action of the gun is as follows: The generators D and E are charged with their respective gas generating materials; the stops *a* and *b* are open and the gas issuing from the pilot pipe *c* is manually ignited. Gas will flow into the firing chamber of the gun through the ports *h*, *i* and *j* and as soon as the mixture of gases arrives at the vent *d* an explosion of considerable violence will occur which causes the gun to recoil, which automatically cuts off the flow of gas from the explosion chamber, thus completely extinguishing the flame within the gun. The recoil of the gun interferes in no way with the burning of the pilot flame and as the gun returns toward the firing position the ports *h* and *i* again come into register with the ports *j* and the gun commences to fill up with gas again and firing takes place as soon as the vent *d* comes up under the pilot flame. To afford complete combustion varying gases should be mixed in varying portions according to their nature. For instance, to get the most violent explosion with oxygen and hydrogen two volumes of hydrogen should be admitted to one volume of oxygen, whereas when acetylene and oxygen are used the proportion should be one volume of acetylene to two and one-half volumes of oxygen. In order that the proper mixture may be predetermined, I provide a varying number of ports in the trunnion pipes K and Q or the size of the ports *h* and *i* is varied so as to assure the

proper mixture. The same result may be obtained by a proper adjustment of the stops *a* and *b* and it is quite convenient to open the stops wide and provide for the proper mixture by the size of the ports in the trunnion pipes, or by predetermining the sizes and drilling the ports and the stops *a* and *b* accordingly, which saves experimenting when the gun is to be put into action. The outer casings of the generators D and E are open at the top and the water chamber F of the acetylene generator is provided with a vent hole *w*, so under no conditions can there be an excessive pressure within the generators. Under low pressure neither acetylene or hydrogen can be exploded within the generator after the first residual charge of air has been exhausted. Neither is oxygen explosive in a pure state. It will therefore be seen that it is impossible for any flame to extend beyond the ports *h* and *i*, as the gases arrive pure and unmixed up to these ports. Even should one generator become exhausted while the other was in operation, there could be no mixture within the generators or pipes. For example should the acetylene be exhausted and the oxygen still continue, the issuing gas at the trunnion port *i* would readily find an escape through the vent *d* of the gun, therefore the pressure could not accumulate within the gun so as to force oxygen into the trunnion pipe K through the port *h*.

Referring to Fig. 2, the front end of the gun is broken away for the purpose of showing the stop *x* and the projectile *y*. The stop *x* serves to prevent the projectile rolling or sliding backward into the explosion chamber at the breech of the gun, and may consist of a heavy wire fastened in the walls of the gun at its ends or may be embodied in the form of a shoulder or bead turned within the gun at the point *x* or any form adapted to arrest the backward travel of the projectile without materially interfering with the passage of the exploded gas into the barrel of the gun. The projectile may obviously be of any form for any purpose and if a hollow shell charged with explosives or combustible material for giving a white or a colored light the latter may be ignited by a time fuse which is in turn ignited by the flash of the exploding gas within the gun. When used for firing projectiles they can be rolled down the muzzle *z* when the gun is in the position of extreme recoil or the gun may be operated from the stops *a* and *b* which is the safer method when the gun is of considerable size.

When used simply to make a noise as for Fourth of July celebrations, or for signaling purposes, as an aid to navigation during fogs, the gun may be fired automatically and it will continue exploding at regular intervals, depending upon the adjustment of the screw *v* so long as any gas remains. It should also be understood that I can substitute cylinders of compressed gas to take the place of the generators with equal effect and greater or lesser economy, according to conditions.

By suitable adaptations of the principles involved, many useful applications may be developed from this invention and I do not limit my claims to the particular embodiment of the invention herein shown, as the details of the apparatus may be modified in a great variety of ways.

I claim and desire to obtain by Letters Patent the following:

1. In a gas gun, the combination of a gun barrel and its mounting, means for permitting the gun barrel to recoil quickly and recover slowly to firing position, an automatic recoil check and means for admitting gases to the barrel during its recovery.

2. In a gas gun, the combination of a gun barrel and its mounting, means for permitting the gun barrel to recoil quickly and recover slowly to firing position, an automatic recoil check, gas generators mounted adjacent the gun barrel and means for admitting gases from said generators to the barrel during its recovery.

3. In a gas gun, the combination with the gun barrel and mounting of a plurality of gas storage means, means for leading gases separately from said storage means to the gun barrel, means for automatically igniting and exploding the gaseous mixture in said barrel, means for permitting the gun barrel to recoil and recover to firing position and an automatic recoil check therefor.

4. An automatic gas gun comprising a gun barrel, recoil mechanism therefor, connections for supplying gas to the barrel, and means for preventing harmful admixture of the gases other than in the barrel.

5. In a gas gun, the combination of a gun barrel and its mounting, means for permitting the gun barrel to recoil and recover to firing position, an automatic recoil check, gas generators mounted adjacent the gun barrel, means for leading gases from said generators to the barrel, and means for automatically igniting the gaseous mixture in the barrel after each recovery.

6. An automatic gas gun comprising in combination with the gun barrel an automatic recoil check, of means for supplying gases to said gun barrel and means for automatically igniting said gases in the barrel after each recovery to firing position.

7. An automatic gas gun comprising a gun barrel having a vent, recoil mechanism therefor, means for supplying gas to the barrel, a pilot light connection for exploding the gas at the vent and means controlled by the movement of the barrel for permitting exploding the gas.

8. An automatic gas gun comprising a gun barrel having a vent, recoil mechanism therefor, means for supplying gas to the barrel, and a pilot light connection for exploding the gas at the vent, in fixed position to coöperate with the vent only when the gun is in approximately firing position.

9. An automatic gas gun comprising a gun barrel, recoil mechanism therefor, a connection for supplying gas to the barrel, and a valve actuated by the movement of the barrel for controlling the said connection.

10. An automatic gas gun comprising a gun barrel, recoil mechanism therefor, a connection for supplying gas to the barrel, means for exploding the gas and means controlled by the movement of the barrel for permitting exploding the gas.

11. An automatic gas gun comprising a gun barrel, recoil mechanism therefor, a connection for supplying gas to the barrel, means for exploding the gas, means controlled by the movement of the barrel for permitting exploding the gas and means for regulating the speed of the recoil mechanism.

12. An automatic gas gun comprising a gun barrel having trunnions, a gas inlet connection to one of the trunnions, recoil mechanism, and a valve for said connection actuated by the recoil movement.

13. An automatic gas gun comprising a gun barrel having a vent, recoil mechanism therefor, means for supplying gas to the barrel, means for exploding the gas at the vent and means attached to said recoil mechanism to permit of successive automatic explosions after each recoil and recovery.

14. An automatic gas gun comprising a gun barrel having a vent, recoil mechanism therefor, means for supplying gas to the barrel, means for exploding the gas at the vent in fixed position to coöperate with the vent only when the gun is in approximately firing position and means attached to said recoil mechanism to permit of successive automatic explosions after each recoil and recovery.

15. An automatic gas gun comprising a gun barrel, recoil mechanism therefor, a connection for supplying gas to the barrel, a valve actuated by the movement of the barrel for controlling said connection and means for prohibiting any back firing through said connection.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses, June 23rd, 1909.

NELSON GOODYEAR.

Witnesses:
E. VAN ZANDT,
E. P. LA GAY.