R. C. PIERCE.

FLASH GUN.

APPLICATION FILED OCT. 31, 1919.

1,337,566.

Patented Apr. 20, 1920.

3 SHEETS—SHEET 1.

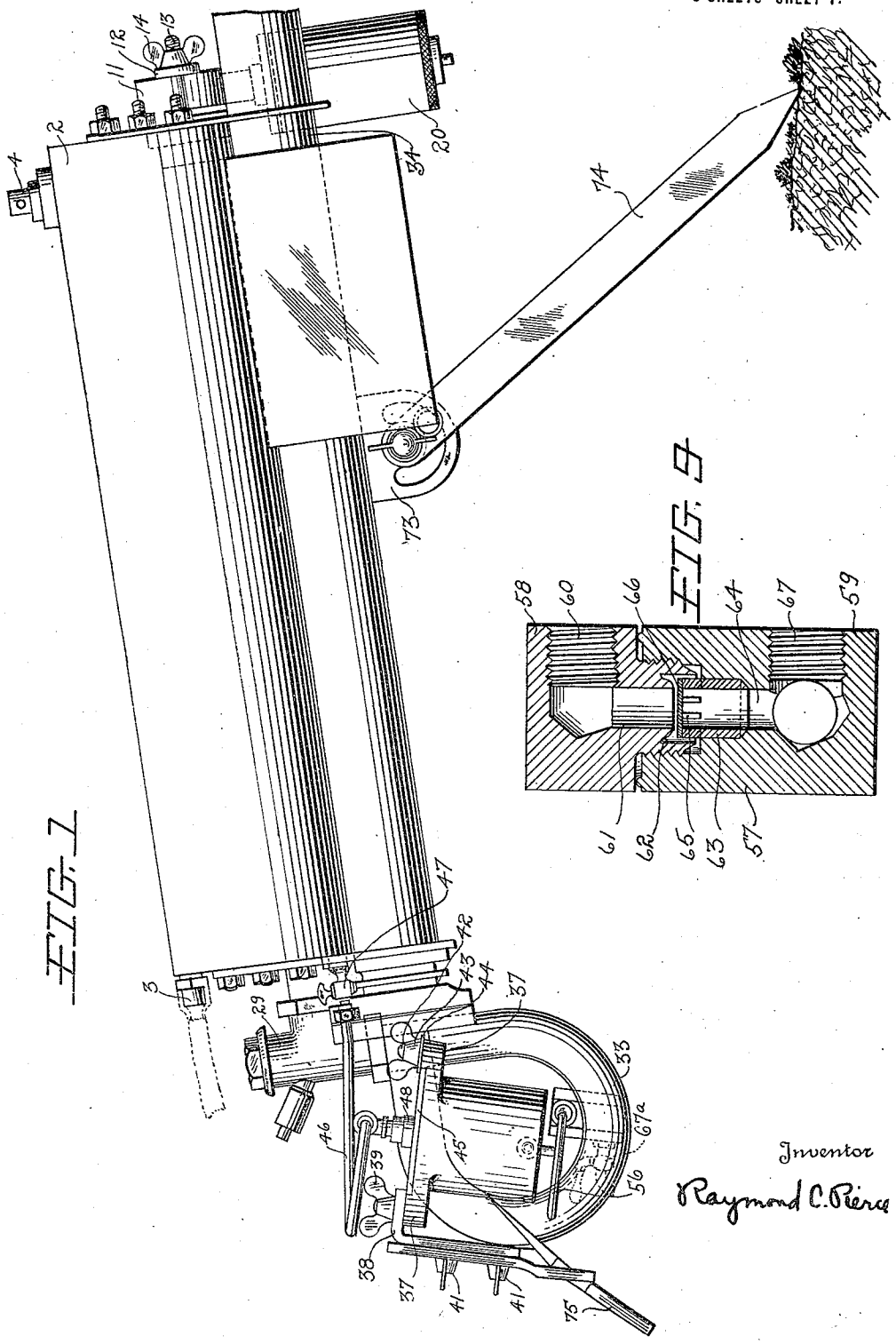


FIG. 1

FIG. 9

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3 SHEETS—SHEET 2.

Fig. 2

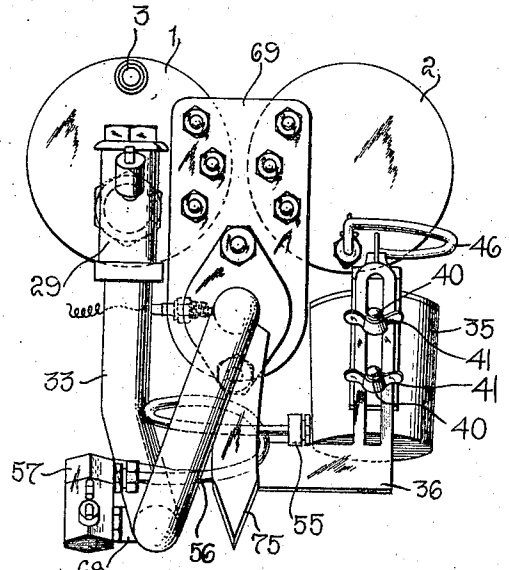
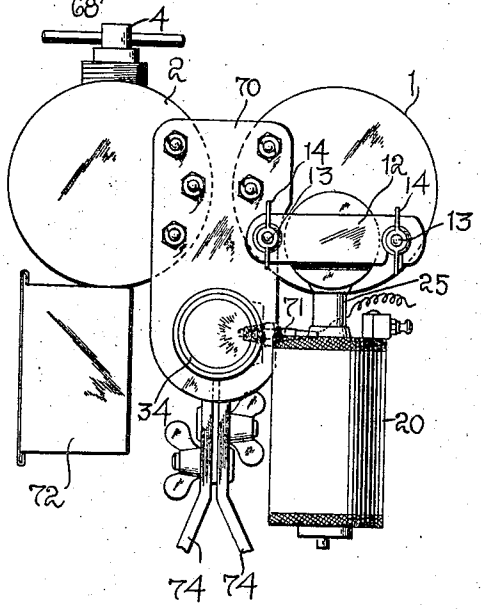


Fig. 3



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3 SHEETS—SHEET 3.

Fig. 6

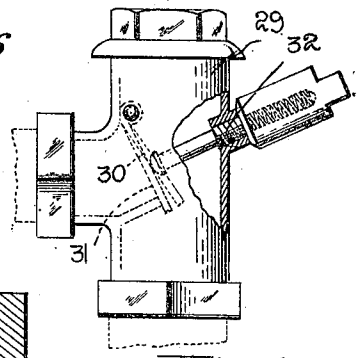


Fig. 5

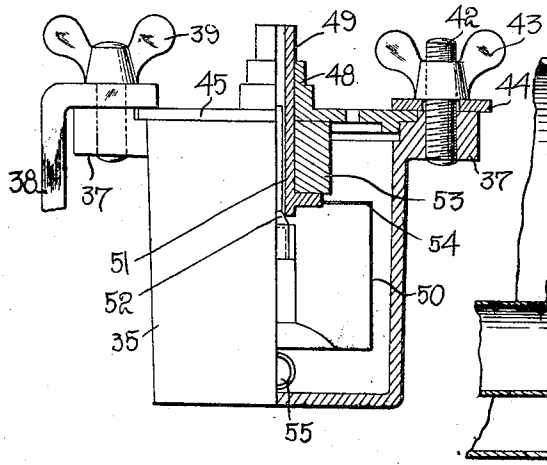


Fig. 4

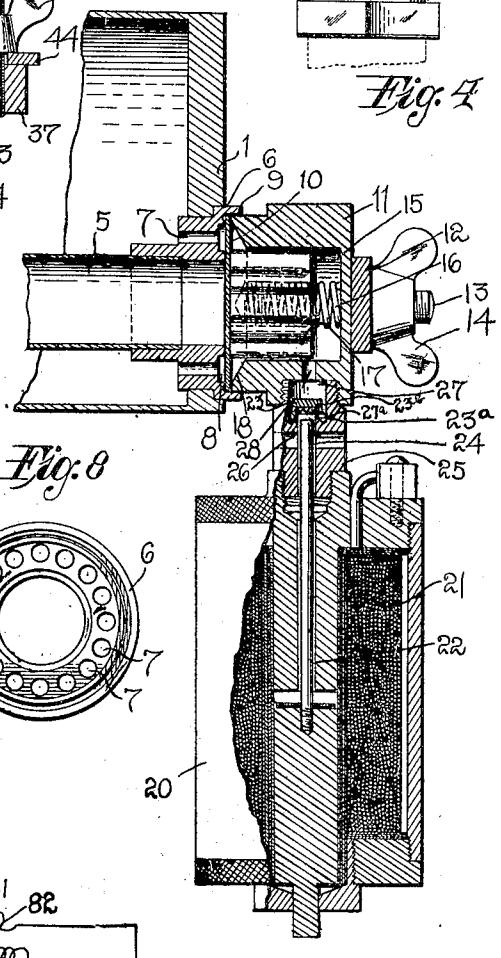


Fig. 7

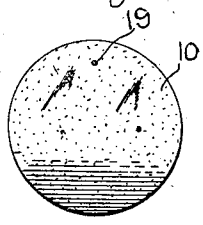
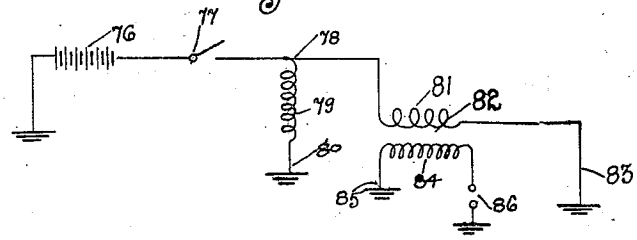


Fig. 8

Fig. 10



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UNITED STATES PATENT OFFICE.

RAYMOND C. PIERCE, OF HORNELL, NEW YORK.

FLASH-GUN.

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Application filed October 31, 1919. Serial No. 334,792.

(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

To all whom it may concern:

Be it known that I, RAYMOND C. PIERCE, captain, Air Service, Military Aeronautics, a citizen of the United States, and residing at Hornell, in the county of Steuben and State of New York, have invented an Improvement in Flash-Guns, of which the following is a specification.

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment of any royalty thereon.

The present invention relates to devices for producing flashes by the ignition of combustible substances, and more particularly to a flash gun capable of simulating artillery fire.

One object of this invention is to provide a device which may be used to create a flash similar to that of a cannon, howitzer, etc.

A second object is to furnish a device of the class described, which shall be capable of use in the training of aerial observers in the observation of artillery fire. It will be understood that aerial observers in actual warfare are stationed either above or near the front lines in airplanes or balloons, from which they take charge of the fire of artillery batteries observing the effect of the fire as indicated by the flashes of the exploding shells.

In the training of aerial artillery observers, battle conditions are duplicated as nearly as possible but it has been found impracticable, in many instances, as well as expensive, to train observers by the firing of loaded shells, and attempts have been made to produce a device, which may be used to create a flash similar to that of artillery. Previous experiments have developed appliances using smokeless powder, as the combustible substance, but smokeless powder has numerous disadvantages in use, being dangerous to handle. Furthermore, a flash gun using powder can not be recharged with rapidity and it is necessary for the operator to remain in proximity to the gun while in operation.

A further object of the invention then is to furnish a means of producing a flash, which shall be capable of rapid manipulation and which may be operated from a distance.

To attain this end, it is contemplated to employ a liquid or gas as the combustible substance and to permit of remote control to employ electrical controlling and ignition devices. To create a flash resembling artillery it has been found best to mix the combustible with oxygen under pressure and a mixture of gasolene and oxygen furnishes a satisfactory combination.

Another object of the invention, then, is to produce a device in which the mixture of the ingredients may be effected and controlled from a distance. This permits the operator to remain in a position of safety and serves further ends, as will be shown.

Remote control of the gun together with automatic functioning of the parts permits of the use of the gun in a number of useful applications. It may be used, for instance, to deceive the enemy as to a true gun position. By firing the flash gun located at a distance from the battery simultaneously with the battery guns, where the simulation is nearly perfect as in this case, the enemy is unable to determine by observation what the true gun position is. When a battery is to be moved, flash guns may be left behind and by means of the remote control, it is possible to operate the gun in safety to imitate the artillery battery and conceal the fact of the removal.

In connection further with the use of this device for camouflage purposes, the present gun has another valuable characteristic, in that in operation the report caused by the firing of a charge can hardly be distinguished from that of the ordinary 3″ field piece. In modern warfare it should be understood that the location of batteries is accomplished not only by actual observation of the flash, but also by the noise of the report. This means of location depends upon the use of sound ranging devices which have recently been developed to a high state of proficiency. With this gun, then, which simulates actual artillery not only as to flash, but also as to report, it will be seen that its use in the field is of the utmost advantage. With the gun hereinafter described and shown, the report is similar to that of a light field piece, but by a slight modification of the parts, such as

the increase in the aperture of the ignition chamber and the use of a larger charge of combustible material, artillery of different sizes may be so closely imitated, both as to appearance and report of discharge, as to deceive observers using both visual and auditory means of observation.

Briefly stated the flash gun forming the subject matter of the present invention depends for its effect upon the projection into the atmosphere of a volume of ignited gas. While ignition takes place within the gun, the combustion occurs in the atmosphere, and in this way any explosive effect is eliminated. A further point of novelty is that the combustible is not ignited continuously to produce a flame, but is fed into the ignition chamber in individual charges, each of which is used to produce a flash. Combustibles have been used alone and in combination with compressed gases to propel projectiles and for this purpose the combustible is employed in the form of a definite charge introduced into the ignition chamber. Combustibles have also been used, as in flame-throwing devices, for instance, in combination with compressed gases to produce a jet of flaming material. In such cases the combustible is fed continuously from the container. But in the flash gun here described, though ignition occurs within the gun, the combustion takes place in the atmosphere and there is projected from the gun a mass of burning gas. Furthermore, the flash occurs as the result of the combustion of a definite charge of combustible, fed intermittently and at will into the ignition chamber. The burning of the charge taking place outside of the gun eliminates such an explosive effect as would occur where the use is that of a propellant.

A further object of this invention is to provide means by which the character of the flash may be varied to imitate various types of artillery. Artillery of different calibers have flashes differing not only in length but in color and visibility. In the present flash gun, the variation is easily accomplished by changing the proportions of the fuel and the oxygen in the mixture, and also by changing the pressure at which the oxygen is stored.

Still another object of the invention is to produce a device which shall be inexpensive to manufacture, simple in operation, light in weight and durable in use. Obviously, a flash gun in use in the field is likely to draw enemy fire and it is essential that it should be cheap to construct. Simplicity of operation is necessary as the gun has to withstand rough usage and it is necessary that it should not fail. The present invention provides a flash gun which has the above characteristics and which may be successfully operated by an inexperienced operator.

With these and further objects in view as will appear from time to time in the following description and claims, for a better understanding of the invention reference is made to the accompanying drawing embodying a preferred form of the device.

Referring now to the drawings:

Figure 1 is a side view of the flash gun in operative position;

Fig. 2 is a view in elevation of the rear end of the gun;

Fig. 3 is a view in elevation of the front end of the gun;

Fig. 4 is a view in cross section of the oxygen control mechanism located at the front end of the gun;

Fig. 5 is a view partly in cross section of the new form of float valve;

Fig. 6 is a view in side elevation, with parts cut away, of a spring weighted swing check valve;

Fig. 7 is a plan view of the diaphragm used in the oxygen control valve;

Fig. 8 is a plan view of a bushing used in connection with diaphragm shown on Fig. 7;

Fig. 9 is a view in longitudinal section of the gasolene check valve;

Fig. 10 is a diagram of the electrical connections.

The invention may be briefly described as consisting of a pair of tanks to contain oxygen and gasolene respectively, electrically controlled devices to release and mix the ingredients, a chamber in which the charge is to be ignited, and electric ignition means.

The oxygen is contained in a cylindrical container designated as 1 and located alongside of this container is a similar reservoir 2 in which the gasolene is stored. The oxygen is introduced into the container through a valve 3 from the tanks of highly compressed gas at a pressure of approximately 60 pounds per inch through a pressure reduction valve. Gasolene is introduced into the reservoir 2 through an opening provided with a screw threaded cap member 4. The gasolene is under atmospheric pressure.

Referring now to Fig. 4 there is located within the container 1 a longitudinal pipe 5, one end of which projects through a bushing or collar 6 in the forward end of the reservoir 1. Bushing 6 is provided with a series of longitudinal holes 7 drilled through the body thereof, and an annular channel 8 is cut in the face of bushing 6 so as to connect the holes 7. Forming the outer edge of the channel 8 is a shoulder 9 on the face of the bushing, within which rests a diaphragm 10. This may be of some form of rubber packing and is shown in Fig. 4. This diaphragm rests within the shoulder so as to cover the channel 8, thus closing the holes 7.

A bonnet 11 fits against the face of the

diaphragm 10 and is held in place by a bar 12 and bolts 13 with lock nuts 14. As seen in Fig. 3 these bolts are secured in the end of the reservoir 1. Within the bonnet 11 is a chamber 15 slightly larger in diameter than the pipe 5 and located in the chamber is a spiral spring 16 holding a plunger 17 against the face of the diaphragm. The inner edge of the bonnet is beveled as shown at 18 for a purpose to be later described. Drilled through the diaphragm and registering with one of the holes 7 is a hole 19 of small diameter.

Attached to the lower side of the bonnet 11 by a threaded connection 25 is a cylindrical container 20 within which are located the coils 21 of a solenoid. Within the solenoid and acting as a core thereof is a plunger 22. The connection 25 has an enlarged chamber 27 in its upper end and there is provided a passageway 28 in the shell of the bonnet connecting the bonnet chamber 15 with the chamber 27. The plunger 22 moves freely within a channel 24 in the connection 25, and diametrically through the connection 25 there are drilled passageways 26, 26.

Located in the chamber 27 at its lower end is an annular seating 27^a projecting inwardly into the chamber 27, and surrounding the opening of the channel 24 into the chamber 27. Within the chamber 27 there is located a disk valve 23, provided on its lower surface with an annular projection 23^a. The valve 23 seats on the seating 27^a and is provided with a rubber disk 23^b mounted in its lower face to seat the disk to make a gas tight closure.

The plunger 22, as shown, will lift the valve 23 off its seat when the solenoid is energized.

The operation of the oxygen control mechanism is as follows:

With a pressure of sixty pounds per square inch in the container 1, pressure is exerted against the diaphragm 10, the gas passing through the holes 7 into the channel 8. By means of the small hole 19, however, the oxygen is permitted to pass through the diaphragm and to flow into the chamber 15 in the bonnet, thus tending to equalize the pressure on both sides of the diaphragm. The actual pressure on the bonnet side of the diaphragm is equal, however, to the pressure of the oxygen per square inch, multiplied by the total area of the diaphragm, plus the pressure exerted by the spring 16, while the actual pressure on the other side of the diaphragm is equal to the oxygen pressure per square inch multiplied by the area of the annular channel. The difference is about fifty pounds pressure with a container pressure of sixty pounds per square inch.

When the electrical connections are closed energizing the solenoid, the plunger 22 is moved up to displace the disk 23 from its seat. The oxygen within the bonnet now escapes into the atmosphere through passage 28, channel 24 and passages 26. The sudden reduction of pressure on the bonnet side of the diaphragm causes the diaphragm to be distended and forced from its seat along the edge of the channel 8. The flexibility of the diaphragm and the beveling of the inner face of the bonnet permits this distention.

With the diaphragm partially unseated a volume of oxygen now flows from the container into the pipe 5 to form an ingredient of the charge.

The solenoid is energized for an instant only, and as the plunger 22 drops when the current ceases to flow the disk valve 23 is reseated, making the chamber 15 gas-tight. Oxygen now passes through the hole 19 in the diaphragm until a sufficient pressure is built up in the chamber to reseat the diaphragm with the aid of the spring-pressed plunger 17. The reseating of the diaphragm 10 cuts off the flow of oxygen from the container and the device is now ready for another shot. It will be seen that the amount of oxygen which is introduced through the oxygen conveying pipe into the ignition chamber may be varied in several ways. Primarily, this is accomplished by varying the size of the hole through the diaphragm. If the hole is made larger, the pressure of the oxygen will build up more quickly in the bonnet chamber to reseat the diaphragm. Increasing the area of the annular channel in the face of the bushing will also serve to vary the amount of oxygen in a charge. If the area of the channel is increased, the oxygen will exert a greater pressure on that side of the diaphragm, and it will take longer for the counteracting presssure to build up to a point where the diaphragm may be reseated. Varying the strength of the spring 16, will permit of variation in the volume of oxygen in charge. Actually, however, only the variations provided by changing the size of the hole in the diaphragm are employed.

At the rear end of the oxygen conveying pipe, which projects from reservoir 1 there is a swing check valve 29 shown in Figs. 1, 2 and 6. This check valve is of the ordinary form of T connection provided with a swinging gate 30 which is ordinarily held against its seat 31 by means of a spring pressed plunger 32. A weak spring is used to actuate the plunger 32 so that the use of this check valve does not interfere with the free passage of oxygen therethrough especially under the pressure as here used, but by means of the spring it is assured that the gate will be closed when the gas has ceased to flow therethrough. This fea-

ture is necessary to prevent the back fire from the flash traveling into the oxygen tank.

From the lower end of the swing check valve 29 there is a pipe 33 extending downwardly and provided with a return bend so as to connect the valve with a chamber 34 placed below the reservoir and container and extending parallel to their longitudinal axes. This chamber is of larger diameter than the pipe 33 and it is within this chamber that the ignition of the charge occurs.

The flow of gasolene from the reservoir 2 is controlled by a float valve of the usual type but with slight modifications. The float valve is contained within the float chamber 35 which is slidably mounted on a bracket 36. The upper end of the float chamber is provided with ears 37 to one of which is attached a strap member 38 by means of a thumb screw 39. Strap member 38 is provided with bolts 40 projecting through a slot in the bracket 36 and provided with thumb nuts 41. By means of this arrangement the float chamber may be adjusted as to height. The second ear 37 of the float chamber is provided with a bolt 42 and thumb screw 43. Beneath the thumb screw there is a washer 44 of large diameter. This arrangement of the parts permits the cover 45 of the float chamber to be held firmly in place along one edge while the other edge is held secure by means of strap member 38 which projects slightly thereover.

Connection is made between the float chamber and the gasolene container by means of a flexible pipe 46 provided with a shut-off valve 47. The pipe 46 is connected by a union to a member 48 projecting from the top of the cover 45. Within the member 48 there is a sleeve 49 through which the gasolene is conveyed from the pipe 46 to the float chamber proper. The lower end of the sleeve 49 is machined to form a seating for a needle valve. The float 50 located within the float chamber is of the usual cylindrical form provided, however, at its upper end with a stem 51 enlarged as shown at 52 to act as a needle valve, seating against the machined surface of sleeve 49. The stem 51 projects some distance into sleeve 49 and serves further as a guide for the float 50 in its upward and downward movement.

It will be understood that the gasolene flows freely into the float chamber through the pipe 46 and sleeve 49 until the level of the gasolene in the chamber has raised the float 50 until the needle valve 52 closes the opening of the sleeve 49. In order that this closing action may be more positive and more rapid there is provided a pair of magnets diametrically placed at the top of the float chamber on either side of the sleeve 49. One of these magnets 53 is shown in Fig. 5. A thin iron disk 54 is attached to the top of the float 50. The strength of the magnets is such that when the float 50 has been raised by the presence of gasolene in the float chamber to within a short distance of the magnets their influence on the disk 54 raises the float 50 sharply so as to cut off the flow of gasolene. However, when the gasolene has been drained from the float chamber, the weight of the float counteracts the influence of the magnets and permits the float to drop. By means of this magnetic feature it is possible to measure more accurately the proportion of gasolene which is to form a part of the charge and to produce a charge more quickly. The lower end of the chamber has an outlet 55 to which is connected a flexible tube 56. Tube 56 conducts the gasolene from the float chamber to the check valve 57, for a clearer understanding of which reference is made to Fig. 9.

This gasolene check valve is made up of two halves 58 and 59. Gasolene is conducted from an opening 60 in the upper half through a passage way 61 to the chamber 62 formed between the halves of the valve. In the lower half there is provided a sleeve 63 forming a wall of the upper portion of the passage 64, corresponding to passage 61. The sleeve 63 projects into the chamber 62 and is provided at its projecting end with a plurality of longitudinal slots 65. Covering the end of the sleeve 63 there is a metallic diaphragm 66 of such size as to shut off completely the passage 61 when brought into action.

It will be seen that under ordinary conditions gasolene will flow into the check valve into the passage 61 thence into the chamber 62 and through slots 65 into the passage 64 and thence through the opening 67 which is joined by means of a connection 68 to the return bend pipe 33. It is seen that gasolene may flow freely from float chamber into the pipe 33. However, in the event of a sudden backward pressure on the gasolene the disk 66 will be forced off its seat against the end of the passage 61 so as to close it completely. This arrangement is necessary and useful in preventing a back fire from entering the float chamber. The lower half of the shut-off valve is provided with a drainage cock 67ª of the usual type, to permit of the draining of the tube 33 and float chamber 35 when the gun is to be taken down and stored.

The return bend pipe 33, as explained before, is connected at one end to the barrel 34 which is mounted between junction plates 69 and 70, located at either end of the gasolene and oxygen cylinders, and bolted thereto. These junction plates serve not only to support the barrel, but also to hold the

cylinders in rigid relation. Adjacent the front end of the barrel 34 there is provided an opening for an ignition device here shown as a spark plug 71 projecting into the barrel. Beneath the gasolene container and rigidly attached thereto is a coil box 72 in which is a booster coil. A source of electrical energy, not shown, is provided and this may consist of a number of dry cells connected to the coil.

The electrical devices and connections used to fire the gun are shown in Fig. 10. A source of energy is provided, and for this purpose it is found most convenient to use a battery 76 of 6 dry cells. The source is connected on one side through a push button 77 to one binding post 78 of a solenoid 79, the other side of the battery being grounded. The other post of the solenoid is grounded as indicated at 80. In parallel with the solenoid is connected the low tension coil 81 of a booster coil 82, which is in turn grounded as indicated at 83. The high tension coil 84 is grounded on one side as shown at 85 and on the other side grounded through a spark plug 86. When the circuit is closed by pushing the button 77, the current energizes the solenoid and starts a spark across the plug-gap at the same instant. This timing is exact enough to serve the desired purpose of igniting a charge released by the action of the solenoid on the oxygen control valve.

When it is desired to use a gun controlled from a distance it is only necessary to substitute a relay in the place of the push button, when the gun may be fired by energizing the relay to close the circuit. This actuation of the relay may, of course, be performed from any desired distance as will be readily understood.

Attached to the lower side of the barrel 34 there is a member 73 to which is pivotally and adjustably mounted a pair of supporting legs 74. At the rear end of the barrel there is mounted a supporting leg 75.

When the gun is to be used in the field the gasolene reservoir is filled and oxygen is introduced into the container at a pressure of approximately 60 pounds per square inch. The gun is set up by means of the legs forming a tripod and with the electrical connections in place it is ready for operation. As previously stated the proportion of oxygen which is to enter into a charge is determined by the size of the hole 19 in the disk 10 in the oxygen control valve and the amount of gasolene which is to enter into a charge is determined, of course, by the level of the gasolene in the float chamber. The float chamber, as stated, is adjustable in its bracket and a greater or less amount of gasolene may be introduced into the return bend pipe 33 as may be desired to form part of a charge. It will be understood that gasolene will automatically flow into the pipe 33 so as to keep a certain charge continuously in the lower bend thereof. Oxygen, however, will not be introduced into this pipe except by energization of the solenoid actuating the oxygen control valve. With a charge of gasolene in the bend of pipe 33 when the solenoid is energized oxygen enters the pipe 33 under pressure and at a relatively high velocity. This is sufficient to force the gasolene ahead of the oxygen into the chamber 34 and at the proper instant the spark jumps the gap in the plug igniting the charge.

Under the influence of its initial velocity the ignited charge is projected into the atmosphere so as to produce a flash which resembles very closely that produced by artillery fire. Owing to the difference in size of the pipe 33 and chamber 34 the charge of gasolene forced from pipe 33 is partially atomized in the chamber. The charge continues forward in the chamber until ignition occurs a short distance from the end of the chamber. The heat of combustion so started is sufficient to complete the transformation of the charge to a volume of gas which is expelled into the atmosphere.

The visibility and appearance of the flash may be varied as may be desired by changing the proportions of the mixture. This is accomplished by raising and lowering the float chamber. For instance, to imitate the fire of a French 75 m/m gun a pressure of about 60 pounds of oxygen is required and a low gasolene level should be used, this resulting in a light yellow and relatively short flame. By raising the gasolene level and using approximately the same pressure of oxygen it is possible to make a deep red flame of great length which imitates very closely that produced by large howitzers. The desirability of being able to imitate flashes of different types of guns will be obvious.

It is also clear that the gun being electrically operated may be controlled from any distance. This may necessitate the use of relays but no considerable modification is necessary in the electrical devices themselves.

It is not desired to limit the invention to the forms shown although these are preferable, but it is clear that the various parts are capable of further modification within the meaning and scope of the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent is:

1. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, an igniter, and means to force an ingredient of a charge of said materials through the chamber to expel the ignited charge therefrom.

2. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, an igniter, and manually controlled means for forcing one ingredient of a charge of said materials through said chamber to expel such charge ignited therein.

3. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, an igniter, and means for forcing one ingredient of a charge of said materials through said chamber to expel such charge ignited therein.

4. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, an igniter, means for forcing one ingredient of a charge of said materials through said chamber to expel the ignited charge, and means to control the characteristics of the flash.

5. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, means to vary the proportions of said materials in a charge, an igniter, and means to force an ingredient of said charge into said chamber to expel the ignited intermixture of said ingredients therefrom.

6. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, means for controlling the admission of one ingredient of a charge of said materials into said chamber in varying proportions, said controlling means being actuated by the passage therethrough of said ingredient, and an igniter for such charge.

7. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, means to control the admission of one ingredient of a charge of said materials into said chamber, means to force a second ingredient of said charge through said chamber to expel said charge of intermingled ingredients therefrom, and an igniter for such charge.

8. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, means to produce a mixture of said materials in said chamber to form a charge, means to control the production of said mixture, including a valve actuated by the passage of an ingredient of said charge therethrough, and an ignited for such charge.

9. In a flash-gun, a source of flash-producing material, an ignition chamber having a discharge orifice, a valve to control the admission of a charge of said material into said chamber, said valve having a diaphragm seated to shut off the flow of said material, means to equalize the pressure on both sides of said diaphragm, means to cause a reduction of pressure on one side of said diaphragm to cause it to be unseated, and an igniter for such charge.

10. In a flash-gun, comprising a source of flash-producing material, an ignition chamber and an igniter, a valve to control the admission of a charge of said material into said chamber, consisting of a bushing mounted in a container for said material, a bonnet inclosing a spring-pressed plunger, a diaphragm normally held against the face of said bushing by said plunger, means to equalize the pressure on both sides of said diaphragm, and manually controlled means to reduce the pressure on one side of said diaphragm to unseat it.

11. In a flash-gun, sources of flash-producing materials, an ignition chamber having a discharge orifice, an igniter, and means for controlling the admission of a charge of said materials into said chamber, said means being adapted to permit one ingredient of said charge to be forced through said chamber to expel the ignited intermixture of ingredients therefrom.

12. In a flash-gun, a source of flash-producing material, an ignition chamber having a discharge orifice, a valve to control the admission of a charge of said material into said chamber, said valve being partially actuated by the passage of said material therethrough, and an igniter for such charge.

13. In a flash-gun, a source of flash-producing material, an ignition chamber having a discharge orifice, a float valve to control the admission of a charge of said material into said chamber, said valve being actuated in part by the passage of said material therethrough and in part by magnetic means, and an igniter for such charge.

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