June 7, 1932. R. GODDARD 1,861,852

SMOKE PRODUCER

Filed Nov. 13, 1928 3 Sheets-Sheet 1

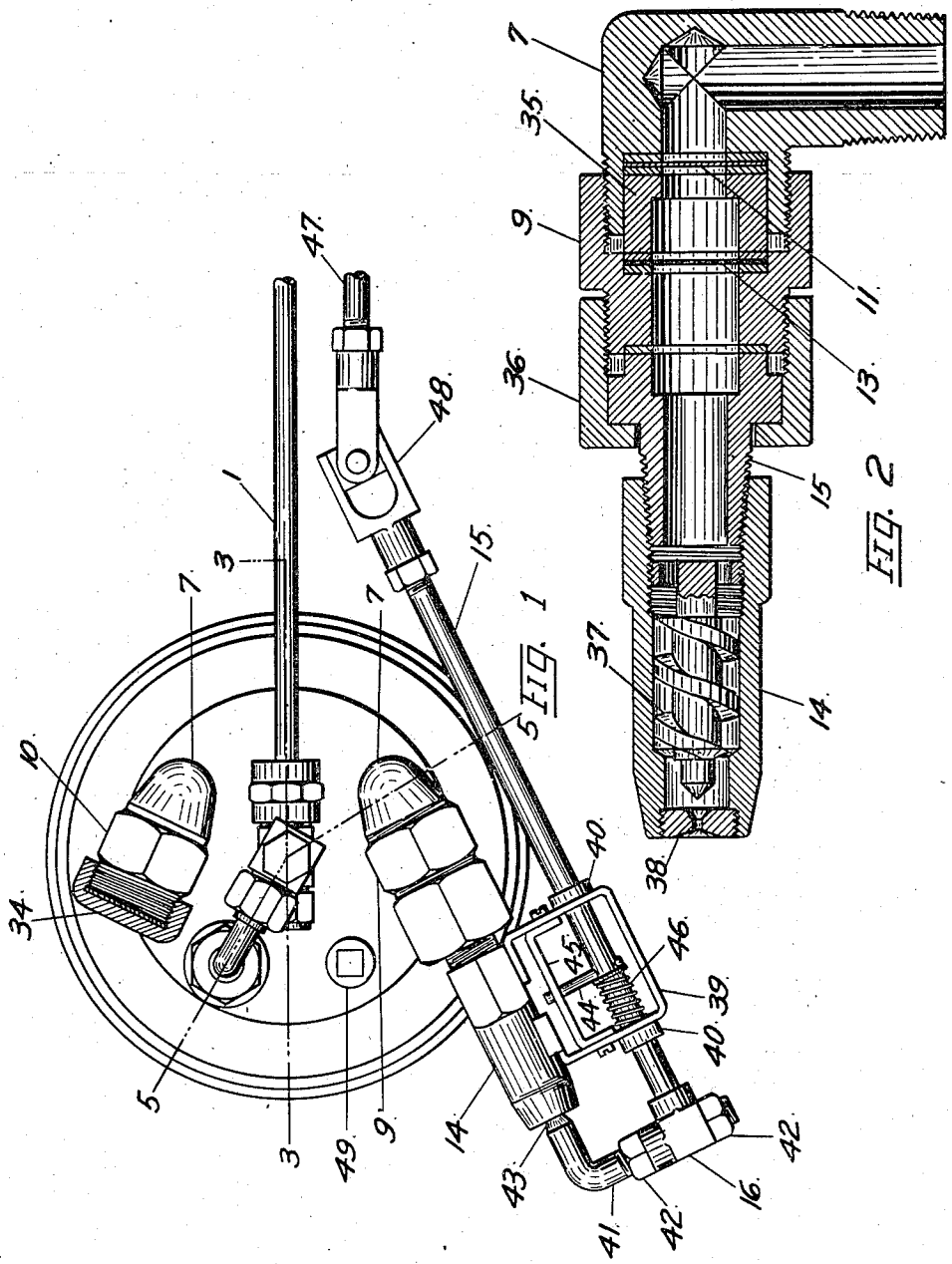


FIG. 1

FIG. 2

INVENTOR.
Rupert Goddard

BY
Semmes & Semmes
ATTORNEY.

June 7, 1932. R. GODDARD 1,861,852

SMOKE PRODUCER

Filed Nov. 13, 1928 3 Sheets-Sheet 2

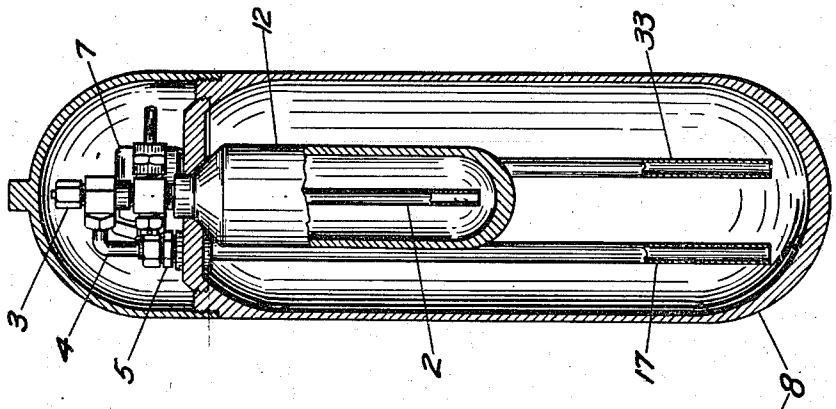


Fig. 3

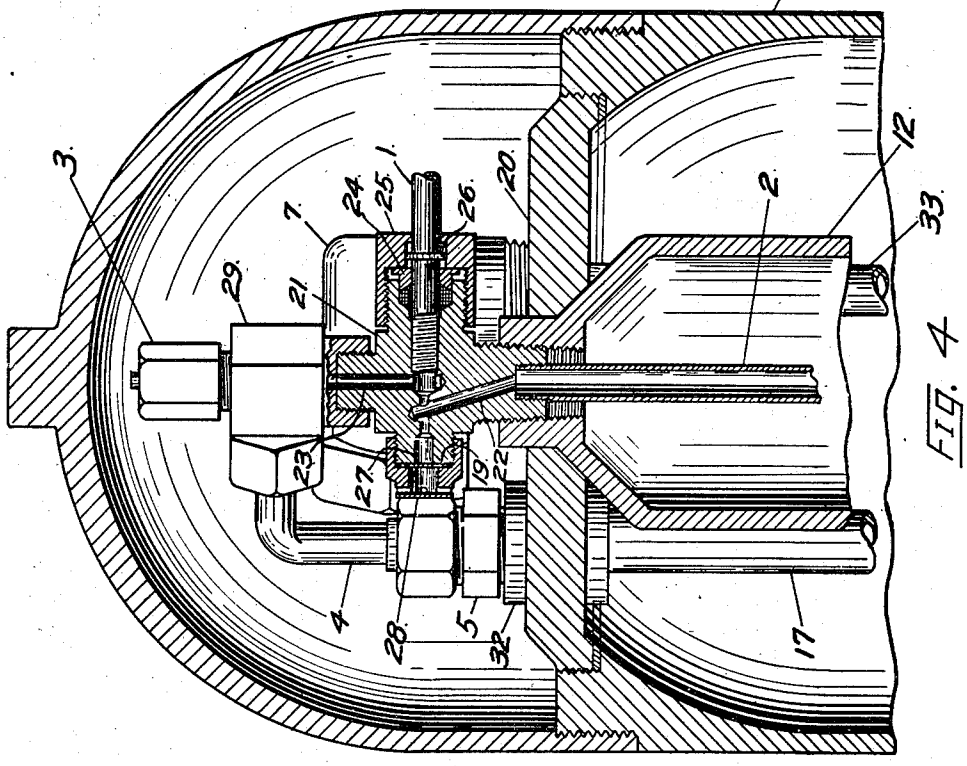


Fig. 4

INVENTOR.
Rupert Goddard
BY
Semmes & Semmes
ATTORNEY.

June 7, 1932. R. GODDARD 1,861,852

SMOKE PRODUCER

Filed Nov. 13, 1928 3 Sheets-Sheet 3

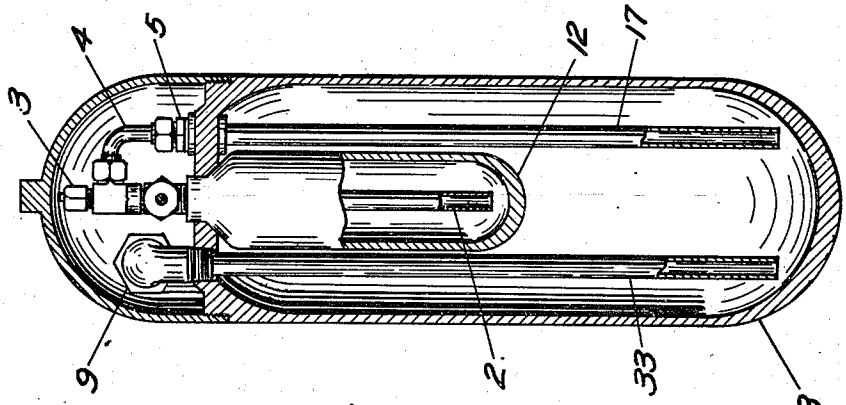


FIG. 5

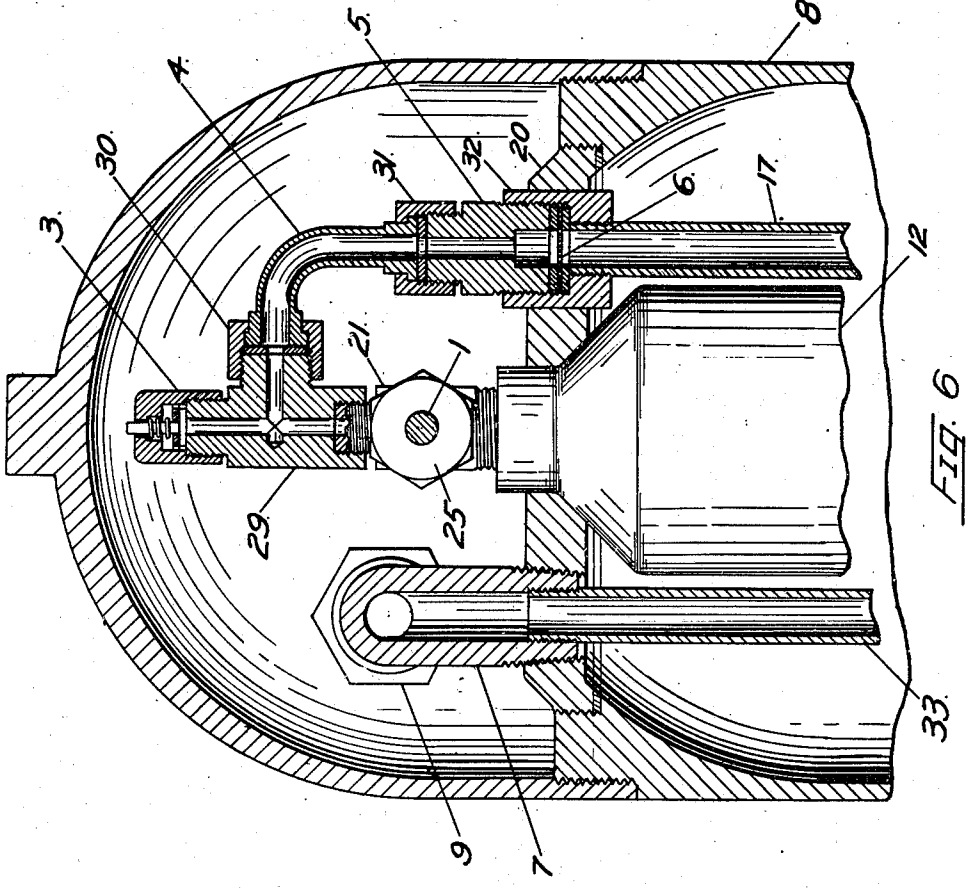


FIG. 6

INVENTOR.
Rupert Goddard
BY
Semmes & Semmes
ATTORNEY.

Patented June 7, 1932 1,861,852

UNITED STATES PATENT OFFICE

RUPERT GODDARD, OF HAVRE DE GRACE, MARYLAND

SMOKE PRODUCER

Application filed November 13, 1928. Serial No. 319,175.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for Government purposes, without the payment to me of any royalty thereon.

My invention relates to apparatus for producing smoke screens and more particularly to means for controlling the production and emission of smoke from the producing apparatus.

Heretofore more or less difficulty has been experienced in the production of smoke screens due to clogging or binding of the controlling valves. This difficulty is particularly noticeable when corrosive gas or gases are used as the smoke producing medium. In many instances, particularly when the smoke producing apparatus is charged with the corrosive gas and is not used for a time, the valves become badly corroded, making the operation of the same difficult and in some cases impossible.

The disadvantage of such an arrangement can be readily seen, particularly when it is considered that smoke producing apparatus must be ready for operation instantly whenever desired, especially if it is to be used in emergencies.

An object of my invention is to provide in a smoke producing apparatus a quick and positive acting opening and shut-off device that will not clog or fail to seal the smoke emission nozzle when using a corrosive smoke producing fluid.

Another object of my invention is to provide in a smoke producing apparatus an acid-proof or non-corrodible disc inserted between the smoke producing agent such as titanium tetrachloride, and the valve for controlling the admission of the pressure producing agent, to prevent the corrosion and binding of the valve and the consequent inoperativeness of the entire apparatus.

Another object of my invention is to provide in a smoke producing apparatus an acid-proof or non-corrodible disc between the outlet conduit from the smoke generator and the smoke emission nozzle, that is of such a thickness that it will burst at a predetermined pressure to permit the operation of the smoke producing apparatus.

Another object of my invention is to provide in a smoke producing apparatus a bleeder valve to prevent the rupture of the discs due to the building up of pressure caused by any leakage from the pressure container.

Still another object of my invention is to devise a method of introducing a pressure agent such as liquid carbon dioxide into a smoke producing agent in a manner to insure a rapid absorption to the proper degree, without mechanical agitation.

With these and other objects in view which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention, may be varied in construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements in their useful applications to the particular constructions, which for the purpose of explanation, have been made the subject of illustration.

In the accompanying drawings forming a part of this specification:

Figure 1 is a plan view of a smoke producing apparatus showing a nozzle and a nozzle opening and shut-off device attached to one of the smoke emission conduits.

Figure 2 is a sectional view of the emission pipe and nozzle, showing the location of one of the non-corrodible discs.

Figure 3 is a vertical sectional view of the smoke producing apparatus taken on line 3—3 of Figure 1.

Figure 4 is an enlarged detailed view of the upper portion of the device shown in Figure 3.

Figure 5 is a sectional view of the smoke producing apparatus taken on line 5—5 of Figure 1.

Figure 6 is an enlarged detailed view of the upper portion of the apparatus shown in Figure 5.

Referring to the drawings showing the preferred embodiment of my invention, reference numeral 8 indicates a cylindrical receptacle adapted to contain a smoke producing fluid. Mounted within the cylinder 8 is another smaller cylinder 12 adapted to contain a pressure agent. The neck of cylinder 12 extends up through the head 20 of cylinder 8 and is internally threaded to receive a fitting 21. Small cylinder 12 is securely fastened to the head 20 of cylinder 8 so as to prevent any movement between the two cylinders.

Fitting 21 is provided in its lower portion with an internally threaded socket which receives a conduit 2 extending to a point adjacent the bottom of the small cylinder 12. As shown in Figure 4, the fitting 21 is provided with a duct 22 which is in communication with opening 2, and with duct 23 through an opening the size of which is controlled by valve stem 1. The latter is threadedly mounted in the fitting 21 so that the size of the opening controlled by the valve stem may be varied as desired, or closed off entirely by rotating the valve stem 1.

Surrounding the valve stem 1 at the point where it enters into the fitting 21 is a suitable packing gland 24 held in place by means of a suitable threaded member 25 which also serves as a guide and stop for the valve stem 1 carrying a flange 26.

Directly opposite the valve stem 1 is a duct 27 surrounded by a threaded projection on which is secured a closure member 28. This duct 27 may be used as a means for charging the cylinder 12 with the pressure agent and also to provide access to the valve 1 and its seat. This duct 27 permits full pressure from cylinder 12 to be exerted against copper disc 19 which bursts when pressure in cylinder 12 has increased considerably above its normal vapor pressure due to abnormal conditions.

As shown in Figure 6, a suitable T-fitting 29 is threadedly secured onto the member 21. On the upper end of the T-fitting a suitable bleeder valve 3 is mounted. This valve 3 is of the type that is held in an open position by a spring so constructed as to permit the closing of the valve when a predetermined pressure acts thereon.

Detachably connected with the side opening of the T member 29 by a suitable union 30 is an elbow conduit 4. The lower portion of the conduit 4 is also detachably connected by a union 31 to a cored plug member 5.

A bushing member 32 is secured in the head 20 of the cylinder and its lower portion is internally threaded to receive a conduit 17, extending downwardly in the cylinder 8 to a point adjacent its bottom. The upper portion of the bushing 32 is internally threaded to receive the plug 5 which is larger in diameter than the conduit 17. By having the ends of bushing 32 constructed with different sized openings, a shoulder is provided therein which serves as a seat for the disc 6.

In assembling, a disc 6 provided on both sides with leak-proof gaskets is placed on the seat for the same, in the bushing 32. The plug 5 is inserted in the bushing and screwed in sufficiently tight to retain the disc 6 in position and provide a leak-proof joint. Conduit 4 is then connected to the T member 29 and the plug 5 by unions 30 and 31, thus providing a connection from the T member to the interior of the cylinder 8. Of course, with the disc 6 in place there is no communication with the interior of cylinder 8.

Disc 6 is preferably constructed of material that will withstand the corrosive effect of substances such as titanium tetrachloride commonly used as smoke agents. The disc may be constructed of laminated sheets treated with substances to resist corrosion. The advantage of constructing the disc of laminated sheets rather than a single thick sheet of material lies in the fact that a sheet of known breaking strength might be used, and as many thicknesses of said sheet might be used together as would be required to give the disc a certain predetermined breaking strength. Thus discs of any predetermined breaking strength which is a multiple of the breaking strength of a single thickness might be constructed from a single piece of stock without testing the strength of each disc.

Nearly any of the so-called acid-proof materials will serve for this purpose. It is essential that the material of which the acid-proof discs are made have such properties, that discs of the material of a certain thickness will break, when subjected to a predetermined pressure.

With an acid-proof, or non-corrodible disc 6 in place in the bushing 32, there will be no communication between the interior of the tank 8 containing the corrosive smoke agent, and the T member 29, and the valve fitting 21. Thus there will be no opportunity for the corrosive smoke producing fluid to get at the valve fitting 21 and corrode the same. If it is desired, however, to conduct the pressure fluid contained in cylinder 12 to the interior of tank 8, the valve 1 is opened permitting the escape of the contents of cylinder 12, which in this particular instance is carbon dioxide, into the T member 29 and the conduit 4. Due to the rush of the released pressure fluid, the valve 3 is closed preventing the escape of the pressure fluid.

After a small time interval the pressure in the T member and the conduit 4 will build up to a point sufficient to rupture the disc 6, thereby permitting the pressure fluid to flow into the tank 8 through conduit 17.

A plurality of elbow members 7 are threaded into suitable openings provided in the head 20 of tank 8. The elbows extending into the head 20 are also internally threaded

to receive conduits 33, which extend within the tank 8 to a point adjacent its bottom. These conduits serve as the outlet means, for smoke produced in the tank 8 constituting the smoke generator.

Suitable fittings 9 and 10 are mounted on the elbows 7 and are adapted to receive either a nozzle 14, or a closure cap 34. As shown in Figure 2, the fittings 9 and 10 which are similar serve to retain a disc 11 and a screen member 13 in operative positions.

The free end of elbow 7 is provided with an internal seat adapted to receive a disc 11 held between two leak-proof gaskets, and a retaining member 35. Fitting 9 comprises an internally threaded portion adapted to cooperate with the externally threaded free end of elbow 7. A suitable recess is constructed in the fitting 9 adapted to receive a screen member 13 held between two suitable gaskets. When assembled, the disc 11 and the screen 13 are held in operative position by the bushing member 35 which transmits the pressure exerted on the screen member by tightening the fitting 9 to the disc 11, thus providing a leak-proof joint.

A nozzle 14 may be secured by a suitable union 36 to either of the fittings 9 or 10, depending on which direction the smoke is to be projected. The nozzle is provided with a screw 37 and an orifice plate 38 to provide for the desired discharge of the smoke.

The disc 11 is constructed of the same material as disc 6, previously described, and serves to prevent the corrosive smoke agent reaching the nozzle 14 and its closure member, and corroding the same. After the fluid from the pressure cylinder 12 ruptures the disc 6 and enters into the tank 8 a pressure is built up. When the pressure in the tank 8 reaches a predetermined point, the disc 11 breaks, permitting the egress of the smoke through nozzle 14.

My invention further provides a device for rapidly and positively opening and closing the aperture in the orifice plate 38. A supporting rack 39 is attached to the nozzle structure and carries suitably aligned bushings or bearings 40 adapted to receive a shaft 15, carrying an apertured end member 16. A threaded rod 41 extends through an aperture in the member 16 and is secured in position by nuts 42 threaded on the rod 41. A part of the rod 41 is bent at a right angle to the threaded portion and is provided with a conically pointed end 43 adapted to enter into the aperture in the orifice plate 38 to close the same.

The shaft 15 is provided with a pin 44 adapted to cooperate with a member 45 carried by the rack 39, to guide the closure member 43 into the aperture in the plate 38. A suitable spring 46 is provided to retain the closure member in either an operative or an inoperative position. If desired a shaft 47 may be connected to shaft 15 by a suitable universal joint 48, and extended parallel to the valve stem 1 to a point of remote control.

When it is desired to uncover the aperture in plate 38 the shaft 15 is moved axially against the force of spring 46 until the member 43 clears the nozzle 14, then the shaft is rotated and the force against the spring released, allowing the shaft to move backwardly under the force of the spring. To close the orifice the shaft carrying the closure is moved forwardly and rotated in the proper direction until the pin 44 engages the guide 45, then the force of the spring 46 is allowed to act on the shaft to close the opening in the orifice plate.

In the operation of my invention, the large tank 8 is filled with a smoke agent such as titanium tetrachloride, through an opening in the head 20 which is closed by the plug 49. The small cylinder 12 is filled with a pressure agent such as liquefied carbon dioxide, through the duct 27 as previously pointed out. To prevent the corrosion of the operating valves, discs 6 and 11 are placed in the conduits connecting the tank 8 with the pressure agent control valve 1 and the nozzle 14.

When it is desired to operate the device to produce smoke, the valve 1 is opened, which permits the pressure fluid to flow up through the eduction conduit 2, through the valve 1 and into the conduit 4, which is closed by the disc 6. Due to the sudden rush of the fluid from the container 12, the bleeder valve 3 is closed, thus preventing the escape of any of the fluid, and causing the pressure to be built up in the conduit 4. When the pressure reaches a predetermined point, for instance, 150 pounds per square inch, the disc 6 will burst, and permit the pressure fluid to flow into the generator tank 8.

The pressure fluid such as carbon dioxide enters into the tank 8 and saturates to a certain degree the titanium tetrachloride contained therein. The unabsorbed carbon dioxide builds up a pressure in cylinder 8 to act on the disc 11 causing it to rupture and allowing the partly saturated smoke fluid to pass to the nozzle 14 from which it is ejected into the atmosphere. In this particular instance, disc 11 is constructed to break at a pressure of about 150 pounds per square inch.

It is absolutely essential that the nozzle 14 be opened before the valve 1 is opened, otherwise the internal pressure in cylinder 8 will not be controlled by the disc 11. Too high an internal pressure in cylinder 8 will decrease the functioning time of the apparatus and will cause improper operation thereof.

Before the device is put into operation, there is a possibility of the pressure fluid leaking out into the conduits and building up a pressure sufficient to break the disc 6.

The bleeder valve 3, however, prevents such an occurrence by permitting the escape of the pressure fluid in small quantities. As previously described, the valve 3 will close when a sudden rush of the pressure agent occurs, such as would be caused by the opening of valve 1.

If, after the smoke producer has been in operation for a time, it is desired to shut off the stream of smoke, the control shaft 47 is pushed forward and rotated in a counterclockwise direction until the pin 44 engages the guide member 45. Then the shaft is allowed to be moved backwardly by the force of the spring, thus causing the conical closure member 43 to enter the aperture in plate 38, shutting off the stream of smoke. Of course, if it is desired to again permit the emission of smoke, it will be necessary only to open the aperture in plate 38 of the nozzle 14.

In a device constructed as described, provided with discs 6 and 11 that will break at a pressure of 150 pounds per square inch, and using carbon dioxide as the pressure agent and titanium tetrachloride as the smoke agent, the time elapsed between the opening of the valve 1 and the emission of smoke from nozzle 14 will not exceed twenty seconds.

The pressure agent upon the breaking of disc 6 flows downwardly through conduit 17 to a point adjacent the bottom of cylinder 8. By introducing the pressure agent at the lower portion of the cylinder containing the smoke agent, a more intimate mixture of the pressure agent and the smoke agent is obtained. This results in a shorter reacting time, thus providing for the rapid production of smoke.

My device provides for the ejection of smoke in either of two directions depending on which of the fittings 9 or 10, the nozzle and its control mechanism is secured.

In the foregoing description I have described in connection with my invention the use of carbon dioxide and titanium tetrachloride. However, I wish it to be clearly understood that these reagents were described merely for purposes of illustration and that any suitable smoke agents may be used that are desirable.

Thus it can be seen that my invention provides a smoke producer in which the valves are protected against the corrosive effect of the smoke agent and which may be operated to produce smoke when desired and under complete control of the operator.

While I have described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details and steps herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. In a smoke producer, the combination of a pressure chamber and a cylinder adapted to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder, a second conduit for conducting smoke from said cylinder, a control valve in said first mentioned conduit for controlling and shutting off the flow of fluid from said pressure chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder; said first mentioned conduit being provided with a vent between the control valve and the disk and means for automatically closing the vent on substantial flow of pressure fluid from the pressure chamber.

2. In a smoke producer, the combination of a pressure chamber and a cylinder adapted to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder, a second conduit for conducting smoke from said cylinder, a control valve in said first mentioned conduit for controlling and shutting off the flow of fluid from said chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder, a second disk of predetermined breaking strength positioned in said second mentioned conduit, said first mentioned conduit being provided with a vent between the control valve and the disk therein, and means for automatically closing the vent on substantial flow of pressure fluid from the pressure chamber.

3. In a smoke producer, the combination of a pressure chamber and a cylinder adapted to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder, a second conduit for conducting smoke from said cylinder, a control valve in said first mentioned conduit for controlling and shutting off the flow of fluid from said pressure chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder, said first mentioned conduit being provided with a vent between the control valve and the disk, a bleeder valve structure including a housing with a chamber therein communicating with said vent, a bleeder valve with plunger slidably mounted in said chamber, the plunger extending through an enlarged opening in said housing, said valve being held in open position away from the opening in the housing by a spring associated therewith, said spring being of a strength such that on the substantial flow of pressure fluid from the pressure chamber the valve will be moved towards the housing opening so as to close the same.

4. In a smoke producer, the combination of a pressure chamber and a cylinder adapted

to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder, a second conduit for conducting smoke from said cylinder, a control valve in said first mentioned conduit for controlling and shutting off the flow of fluid from said chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder, a second disk of predetermined breaking strength positioned in said second mentioned conduit, said first mentioned conduit being provided with a vent between the control valve and the disk, a bleeder valve structure including a housing with a chamber therein communicating with said vent, a bleeder valve with plunger slidably mounted in said chamber, the plunger extending through an enlarged opening in said housing, said valve being held in open position away from the opening in the housing by a spring associated therewith, said spring being of a strength such that on the substantial flow of pressure fluid from the pressure chamber, the valve will be moved towards the housing opening so as to close the same.

5. In a smoke producer, the combination of a pressure chamber and a cylinder adapted to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder a second conduit for conducting smoke from said cylinder, a control valve in said first mentioned conduit for controlling and shutting off the flow of pressure fluid from said chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder, a second disk of predetermined breaking strength positioned in said second mentioned conduit, said first mentioned conduit being provided with a vent between the control valve and the disk therein, means for automatically closing the vent on substantial flow of pressure from the pressure cylinder, and a valve in said second mentioned conduit for closing the same at a point on the side of the disk therein most distant from said cylinder.

6. In a smoke producer, the combination of a pressure chamber and a cylinder adapted to contain a smoke agent, a conduit for conveying a pressure agent from said chamber to said cylinder, a second conduit for conducting smoke from said cylinder, said last mentioned conduit being provided with a spray nozzle, a control valve in said first mentioned conduit for controlling and shutting off the flow of pressure fluid from said chamber, a disk of predetermined breaking strength positioned in said first mentioned conduit between said control valve and said cylinder, a second disk of predetermined breaking strength positioned in said second mentioned conduit, said first mentioned conduit being provided with a vent between the control valve and the disk therein, means for automatically closing the vent on substantial flow of pressure from the pressure cylinder, and closure means for said spray nozzle including an orifice plate forming the opening of said nozzle, a support mounted on said nozzle, an axially movable revolvable shaft carried on said support, said shaft extending beyond the open end of the said nozzle and having a part on its end extending backwardly in line with said nozzle, a conical member on the end of said shaft adapted to extend into said orifice plate and close the opening therein, means resiliently urging said conical member toward said nozzle, means for forcing said shaft axially outwardly and rotating it so as to disengage said conical member and said orifice and means to guide said shaft and said conical member back into closed position.

In testimony whereof I affix my signature.

RUPERT GODDARD.