United States Patent

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[72] Inventor **Arthur Marcoux**
Hermosa Beach, Calif.

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[73] Assignee **McDonnell Douglas Corporation**
a corporation of Maryland

[54] **SPRAYING DEVICE**
10 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **239/308,** 239/337; 51/356; 77/55.3
[51] **Int. Cl.** **A62c 13/24**
[50] **Field of Search** 239/310, 337, 302, 308; 51/356; 77/55.3

[56] **References Cited**

UNITED STATES PATENTS

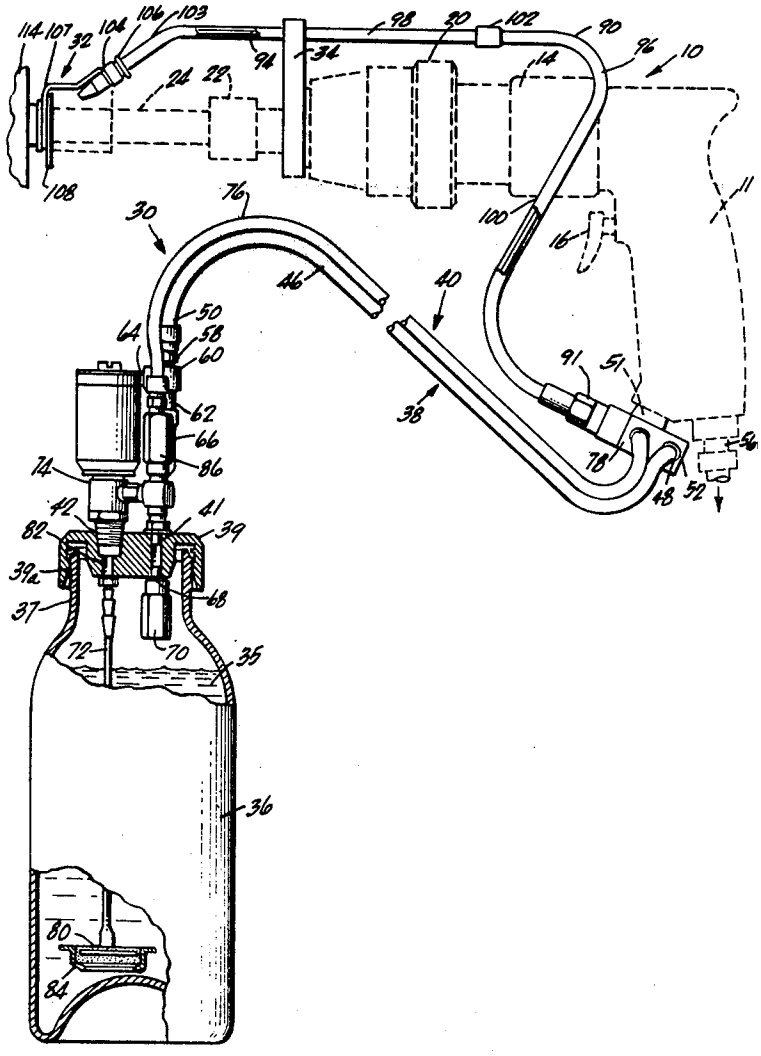
2,650,557	9/1953	Hauser	77/55.3X
2,723,405	11/1955	Woodward	77/55.3X
2,946,244	7/1960	Maynard	77/55.3

FOREIGN PATENTS

633,052	12/1949	Great Britain	77/55.3

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Michael Y. Mar
Attorneys—Walter J. Jason, Donald L. Royer and Ming Y. Moy

ABSTRACT: A spraying device for supplying a cooling and lubricating agent to a high-speed drill whenever the drill is placed in operation. The spraying device comprises means for transmitting a pressurized gas to a container and means for transmitting the cooling and lubricating agent from the container to the drill. The agent transmission means includes a nozzle which is removably mounted on the high speed drill by an adapter which directs the lubricating agent from the nozzle upon the drill.



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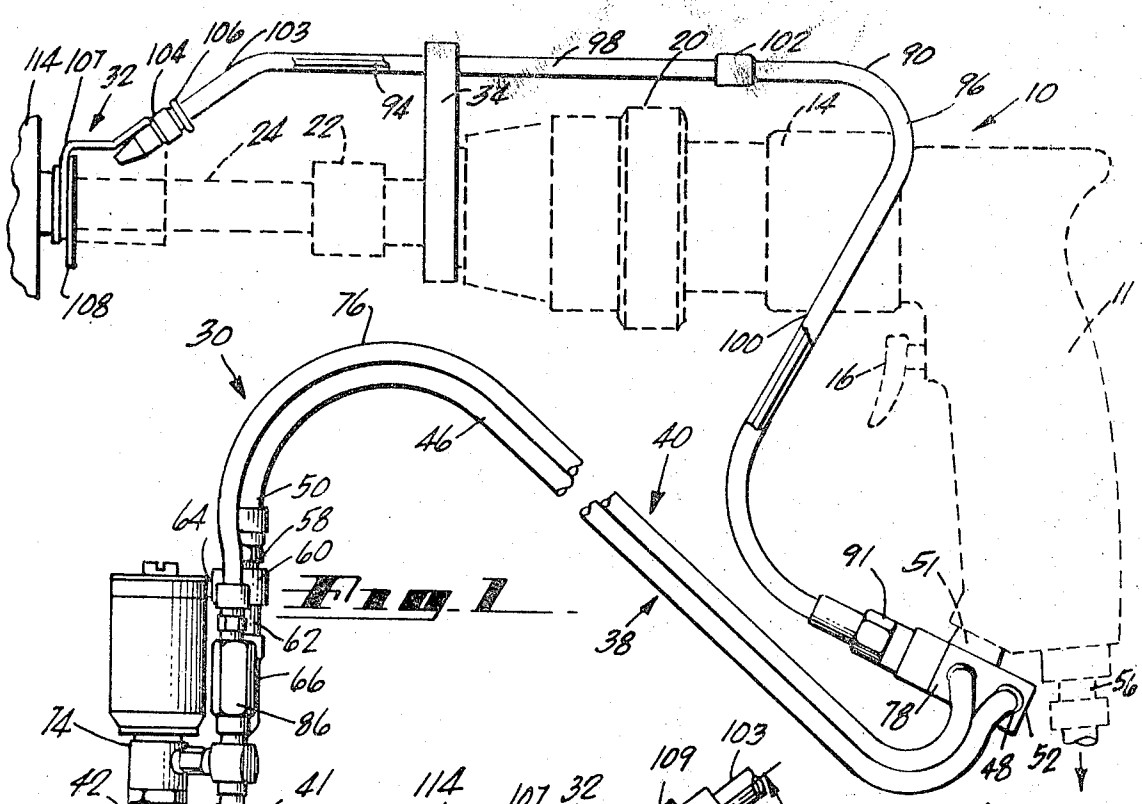


FIG. 1

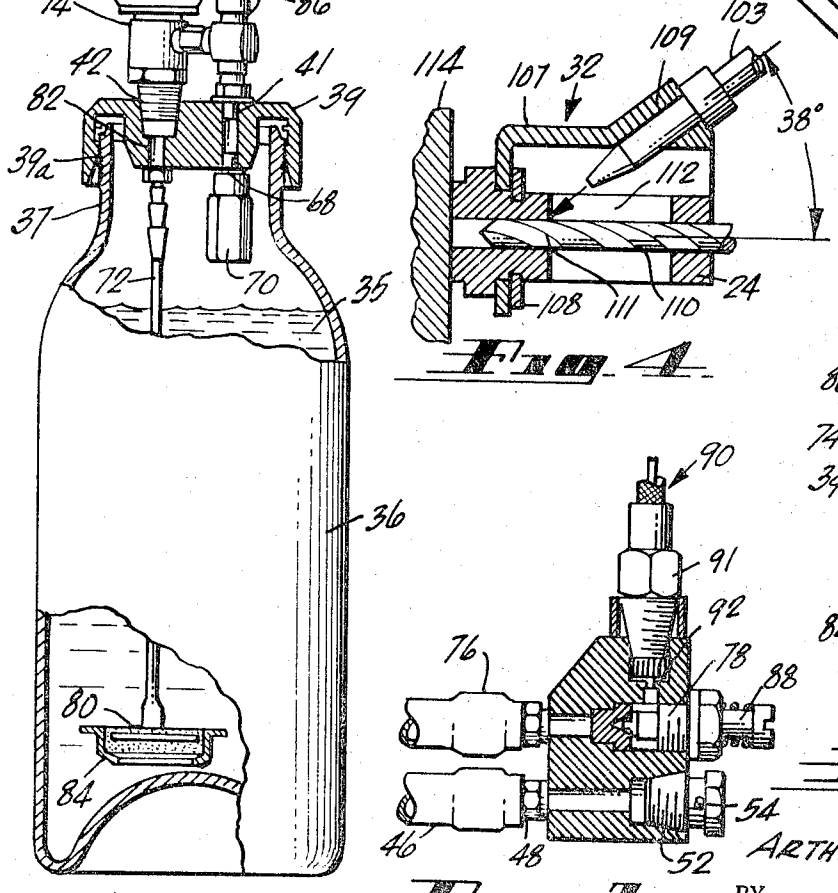


FIG. 4

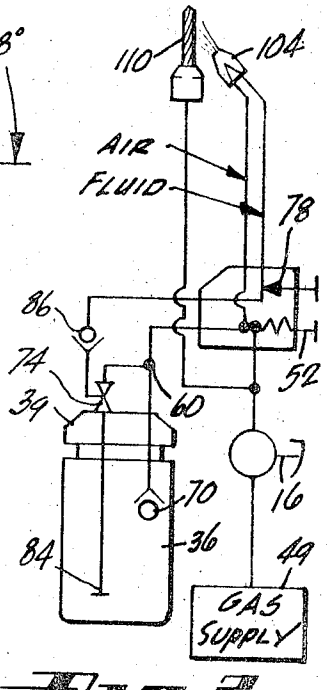


FIG. 5

FIG. 3

INVENTOR.
ARTHUR MARCOUX

BY

Murray J. Moy
- ATTORNEY -

SPRAYING DEVICE

BACKGROUND OF THE INVENTION

This invention relates to spraying devices and more particularly to spraying devices for supplying a cooling and lubricating agent to a high-speed drill whenever the drill is placed in operation.

In high-speed drilling operations, it is essential that the drill be equipped with means providing a continuing flow of cooling and lubricating agent to the drill point. It has been found that liquid spraying devices in general do not operate satisfactorily unless the liquid is supplied to them at some substantial pressure. It is desirable that this pressure be regulated by proper pressure regulation means to avoid hazardous operation. Additionally, to increase the efficiency of the high-speed drill the cooling and lubricating agent should be sprayed on the drill with minimum splatter and waste. It is also desirable to have effective concurrent on-off control of both the spraying device and the driving motor which operates the drill. The spraying device of the present invention accomplishes the above objectives with great assurance.

SUMMARY OF THE INVENTION

In carrying out the principles of this invention according to one embodiment thereof, there is provided a spraying device having a container for storing a lubricating and cooling agent for a high-speed drill, gas transmission means for transmitting a pressurized gas to the container, and agent transmission means for transmitting the cooling and lubricating agent from the container to the drill. A control element is provided for concurrently controlling on-off operation of the drill and the spraying device, thus supplying a constant flow of lubricating and cooling agent to the drill whenever it is placed in operation. The agent transmission means further includes a shutoff valve for instantaneously preventing flow of agent from the container to the drill upon deactivation of the control element, the shutoff valve being actuated by pressurized gas in the gas transmission means upon activation of the control element to permit agent from the container to pass therethrough.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a high-speed drill unit equipped with the spraying device of this invention;

FIG. 2 is a schematic diagram illustrating the operation of the present invention;

FIG. 3 is a top view, partially in section, of the pressure regulator and the flow control valve used in the system shown in FIG. 1; and

FIG. 4 is a sectional view of the nozzle and the nozzle adapter used in the system shown in FIG. 1.

DESCRIPTION OF THE SHOWN EMBODIMENTS

In FIG. 1 a high speed air drill unit of conventional pistol grip type is seen at 10 to have a handle 11 and a motor case 14 housing a drill motor therein. The drill unit 10 further includes a control element 16, a pressure foot adapter 20, a pressure foot barrel 22, a drill guide 24, and a twist drill set in a drill chuck (not shown). All of these parts are well known and require no further description.

A spraying device is seen at 30 to be removably clamped to the pressure foot adapter 20 by a probe guide 34, removably secured to the handle 11 by connecting means 51, and removably secure to the drill guide 24 by a nozzle adapter 32. The spraying device or lubricating and cooling apparatus 30 comprises a container 36 for storing a liquid cooling and lubricating agent 35, a gas transmission means 38 for transmitting a pressurized gas to the container 36, an agent transmission means 40 for transmitting the cooling and lubricating agent 35 from the container 36 to the high-speed drill unit 10.

The container 36 may be of any desired shape and size and it is made of a material capable of storing the liquid cooling and lubricating agent 35 under pressure. The container 36 has

a neck portion 37 which is preferably cylindrical and is exteriorly threaded to engage a threaded portion 39a of a cap member 39. The cap member 39 is preferably formed of a metalic material or the like. The cap member 39 has apertures 41 and 42 which provide communication between the interior of the container 36 and the gas transmission means 38 and the agent transmission means 40.

As shown in FIGS. 1, 2 and 3 the gas transmission means 38 comprises a gas conduit 46 having a gas inlet portion 48 and a gas outlet portion 50. The conduit 46 may be formed of any material capable of transmitting a gas under pressure and preferably of a flexible vinyl hoselike construction. The gas inlet portion 48 is connected to a pressure-regulating means 52 which is provided for regulating the pressure input to the container 36. The pressure regulator 52 is connected to a pressurized gas or air supply 49 by connecting means 51 through a passage means 56. The pressure regulator 52 comprises a constant bleed orifice 54, the diameter of which may be fixed or adjustable depending upon the pressure of the gas supply 49 and the pressure desired in the container 36. The input of pressurized gas from the gas supply 49 to the regulator 52 and to the drill motor through passage means 56 is controlled by the control element 16 which concurrently controls the on-off operation of both the drill motor and the spray unit 30. The gas outlet portion 50 is connected to an inlet portion 58 of a T-shaped connector 60 which includes two outlet portions 62 and 64. Outlet portion 62 of the T-shaped connector 60 is connected to a relatively rigid tubular member 66 which extends to the interior of the container 36 through the aperture 41. The tubular member 66 has an output portion 68 and has connected thereto a check valve 70. The check valve 70 is provided for preventing reverse flow of fluid from the container 36 into the gas transmission means 38 upon deactivation of the control means 16.

The agent transmission means 40 comprises a tubular member 72, a shutoff valve 74, an agent conduit 76 and a flow control valve 78. The tubular member 72 is positioned within the container 36 through the aperture 42. The tubular member 72 has an inlet portion 80 and an outlet portion 82. The inlet portion 80 has connected thereto a filtering means 84 for filtering contaminating particles. Both the inlet portion 80 and the filter 84 connected thereto are positioned near the bottom of the container 36 and submerged substantially into the liquid cooling and lubricating agent 35. The filter 84 is capable of filtering particles greater than 10 microns which helps to prevent blockage in the agent transmission means 40.

The outlet portion 82 of the tubular member 72 is connected to a shutoff valve 74 the outlet of which is connected to a check valve 86 which in turn is connected to the inlet portion of the conduit 76. The shutoff valve 74 is further connected to the outlet 64 of the T-shaped connector 60, the shutoff valve 74 being normally actuated by pressurized gas from the conduit 46. The shutoff valve 74 is provided for preventing flow of the cooling and lubricating agent 35 from the container 36 to the conduit 76 through the check valve 86 upon deactivation of the control element 16. The shutoff valve 74 when actuated by gas in the gas transmission means 38 permits the cooling agent from the container to pass therethrough.

The check valve 86 is employed to prevent reverse flow of fluid from the conduit 76 into the container 36; the function of the check valve 86 will be further discussed in subsequent paragraphs. The conduit 76 is formed of a material which is compatible with the particular lubricating agent used. The conduit 76 is capable of transferring the lubricating and cooling liquid agent 35 under pressure and its construction is generally similar to the conduit 46. The outlet of the conduit 76 is connected to a flow control valve 78 which is included in the agent transmission means 40 for controlling the volume of liquid agent passing therethrough. As seen in FIG. 3, the flow control valve 78 is of conventional needle valve construction and the volume of fluid passing therethrough can be controlled by adjusting means 88.

The agent transmission means 40 further includes a nozzle 104, the nozzle adapter 32 and a coaxial hose 90. As shown in FIGS. 1 and 4, a fitting 91 is provided to connect the coaxial hose 90 to the outlet 92 of the needle valve 78 and the gas-connecting means 51. The coaxial hose 90 comprises an inner tube 94 and an outer tube 96. The inner tube 94 is connected to the outlet 92 of the needle valve 78 for passage of liquid cooling and lubricating agent 35, while the outer tube 96 is connected to the connecting means 51 for passage of pressurized gas from the gas supply 49. The coaxial hose 90 comprises a rigid portion 98 and a flexible portion 100 and the two portions are connected by a connector 102. The rigid portion 98 of the coaxial hose 90 is slidably supported in an aperture formed in the probe guide 34 such that its axis is substantially parallel to the axis of the drill guide 24. The probe guide 34 is removably clamped to the pressure foot adapter 20 by a split ringlike element having its ends joined by a screw (not shown).

As shown in FIGS. 1 and 4, the rigid portion 98 of the coaxial tube 90 includes an arm 103 which projects forwardly and downwardly to a twist drill 110 of the high-speed drill unit 10. The arm 103 has connected thereto at its end the nozzle 104 which is removably secured to the nozzle adapter 32 by clip-securing means 106. The nozzle adapter 32 is removably secured to the drill guide 24 by clip-securing means 108. The nozzle adapter 32 includes a housing structure 107 which has formed therein an aperture 109 within which the nozzle 104 is slidably supported. The nozzle 104 is provided for the purpose of mixing and discharging the cooling and lubricating agent with pressurized gas from the gas transmission means 38.

The twist drill 110, adapted for making holes in a workpiece 114, is shown as being positioned in the drill guide 24. The twist drill 110 is of conventional construction and it includes a cylindrical body having at least one flute 111 for introducing lubrication to the drill point. The flute 111 generally forms an angle of approximately 38° with the cylindrical body of the drill 110. It has been found that the efficiency of the high-speed drill unit 10 can be increased if the lubricating agent can be sprayed on the twist drill 110 with minimum splatter and waste. For this purpose, the nozzle adapter 32 has been provided for directing the agent and gas mixture from the nozzle 104 upon the twist drill 110 at an angle substantially equal to the angle formed between the flute 111 and the cylindrical body of the twist drill 110. As shown in FIG. 4, the nozzle 104 is positioned by the nozzle adapter 32 at 38° relative to the body of the drill 110, and the lubricating agent is sprayed on the drill 110 through an opening 112 formed in the drill guide 24.

The operation of the present invention can be best illustrated by the schematic diagram as shown in FIG. 2 in combination with the apparatus shown in FIG. 1. Upon actuation of the control element 16, pressurized gas from gas supply 49 enters the gas transmission means 38 to energize the spraying device 30. Since the same pressurized gas is also employed to actuate the air drill motor which is used in conjunction with the spray unit 30, the gas supply is normally pressurized to approximately 100 p.s.i., this pressure being normally required to operate the air drill motor. Upon entering the gas transmission means 38 of the spraying device 30, the pressurized gas goes through the pressure regulator 52. The pressure regulator 52 drops the pressure of the gas supply to approximately 20 p.s.i. This pressurized gas is routed through the conduit 46 and the connector 60 to the check valve 70, and the pressurized gas actuates the check valve 70 prior to entering the container 36.

The increased pressure in the container 36 causes the liquid cooling and lubricating agent 35 to exit by way of the agent transmission means 40 through the filter 84 which prevents contaminating particles larger than 10 micron from passing therethrough. After going through the filter 84, the liquid cooling and lubricating agent is then forced to pass through the shutoff valve 74 which had been actuated by the pressurized gas from the conduit 46 of the gas transmission means 38 through the outlet 64 of the T-shaped connector 60. From the shutoff valve 74, the liquid lubricating and cooling agent then passes a check valve 86 and agent conduit 76 to a fluid flow control valve 78 which is adjustable to control the volume of liquid agent passing therethrough. After passing through the control valve 78 the liquid agent is then forced to the nozzle 104 through the inner tube 94. The nozzle 104 mixes the liquid lubricating and cooling agent with pressurized gas from the gas supply 49 through the outer tube 96 and pressure regulator 52 and sprays the mixture on the twist drill 110 through an opening 112 in the drill guide 24 as shown in FIG. 4.

Upon deactivation of the control element 16, the check valve 70 of the gas transmission means 38 prevents reverse flow of fluid from the container 36 into the gas conduit 46, while the shutoff valve 74 instantaneously prevents flow of the liquid agent 35 from the container to the agent conduit 76. Further the check valve 86 has been provided to prevent any possible reverse flow of agent and gas mixture from the nozzle 104 to the container 36 through the coaxial tube 90 and the agent conduit 76 upon deactivation of the control element 16.

I claim:

1. In combination, a high-speed drill unit and a lubricating and cooling apparatus for said high-speed drill unit, said apparatus comprising:

a container for storing a cooling and lubricating agent;

gas transmission means connecting said container to a pressurized gas source for transmitting a pressurized gas to said container to pressurize it;

control means operatively connected to said gas transmission means and said high-speed drill unit for concurrently controlling on-off operation of said gas transmission means and said high-speed drill unit; and

agent transmission means connected to said container for transmitting the cooling and lubricating agent from said container to said drill unit, said agent transmission means including shutoff valve means for preventing flow of agent from said container to said drill unit upon deactivation of said control means, said shutoff valve means being connected to said gas transmission means and actuated by gas from said gas transmission means upon activation of said control means to permit agent from said container to pass therethrough.

2. The combination of claim 1 wherein said gas transmission means includes:

pressure regulating means for regulating pressure in said container; and

check valve means for preventing reverse flow of fluid from said container into said gas transmission means upon deactivation of said control means.

3. The combination of claim 1 wherein said agent transmission means includes:

nozzle means, connected to said gas transmission means, for mixing and discharging cooling and lubricating agent with pressurized gas from said gas transmission means; and

nozzle adapter means, removably mounting said nozzle means on said high-speed drill unit, for directing the agent and gas mixture from said nozzle upon a drill of said high-speed drill unit.

4. The combination of claim 3 wherein said drill includes a cylindrical body having at least one flute, said flute forming a predetermined angle with said cylindrical body, and said nozzle adapter means directs the agent and gas mixture from said nozzle means upon said drill at an angle substantially equal to the predetermined angle formed between said flute and said cylindrical body.

5. The combination of claim 2 wherein said agent transmission means includes:

filter means for preventing contaminating particles from passing through said agent transmission means;

flow control valve means for controlling the rate of agent flow from said container to said drill unit;

nozzle means, connected to said gas transmission means, for mixing and discharging cooling and lubricating agent with pressurized gas from said gas transmission means; and

nozzle adapter means, removably mounting said nozzle means on said high-speed drill unit, for directing the agent and gas mixture from said nozzle upon a drill of said high-speed drill unit.

6. The combination of claim 5 wherein: said drill includes a cylindrical body having at least one flute, said flute forming a predetermined angle with said cylindrical body, and said nozzle adapter directs the agent and gas mixture from said nozzle means upon said drill at an angle substantially equal to the predetermined angle formed between said flute and said cylindrical body.

7. In combination, a high-speed drill unit and a lubricating and cooling apparatus for said high-speed drill unit, said apparatus comprising:

a container for storing a cooling and lubricating agent;

gas transmission means connecting said container to a pressurized gas source for transmitting a pressurized gas to said container;

control means operatively connected to said gas transmission means and said high-speed drill unit for concurrently controlling on-off operation of said gas transmission means and said high-speed drill unit; and

agent transmission means connected to said container for transmitting the cooling and lubricating agent from said container to said drill unit, said agent transmission means including nozzle means, connected to said gas transmission means, for mixing and discharging cooling and lubricating agent with pressurized gas from said gas transmission means, nozzle adapter means, removably mounting said nozzle means on said high-speed drill unit, for directing the agent and gas mixture from said nozzle upon a drill of said high-speed drill unit, and shutoff valve means for preventing flow of agent from said container to said drill unit upon deactivation of said control means, said shutoff valve means being connected to said gas transmission means and actuated by gas from said gas transmission means upon activation of said control means to permit agent from said container to pass therethrough.

8. The combination of claim 7 wherein said drill includes a cylindrical body having at least one flute, said flute forming a predetermined angle with said cylindrical body, and said nozzle adapter means directing the agent and gas mixture from said nozzle means upon said drill at an angle substantially equal to the predetermined angle formed between said flute and said cylindrical body.

9. The combination of claim 7 wherein said gas transmission means include:

pressure regulating means for regulating pressure in said container; and

check valve means for preventing reverse flow of fluid from said container into said gas transmission means upon deactivation of said control means, and wherein said agent transmission means include:

filter means for preventing contaminating particles from passing through said agent transmission means; and

flow control valve means for controlling the rate of agent flow from said container to said drill unit.

10. The combination of claim 9 wherein said drill includes a cylindrical body having at least one flute, said flute forming a predetermined angle with said cylindrical body, and said nozzle adapter means directing the agent and gas mixture from said nozzle means upon said drill at an angle substantially equal to the predetermined angle formed between said flute and said cylindrical body.