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RESONANT PULSE JET FOGGER

Filed Dec. 12, 1966

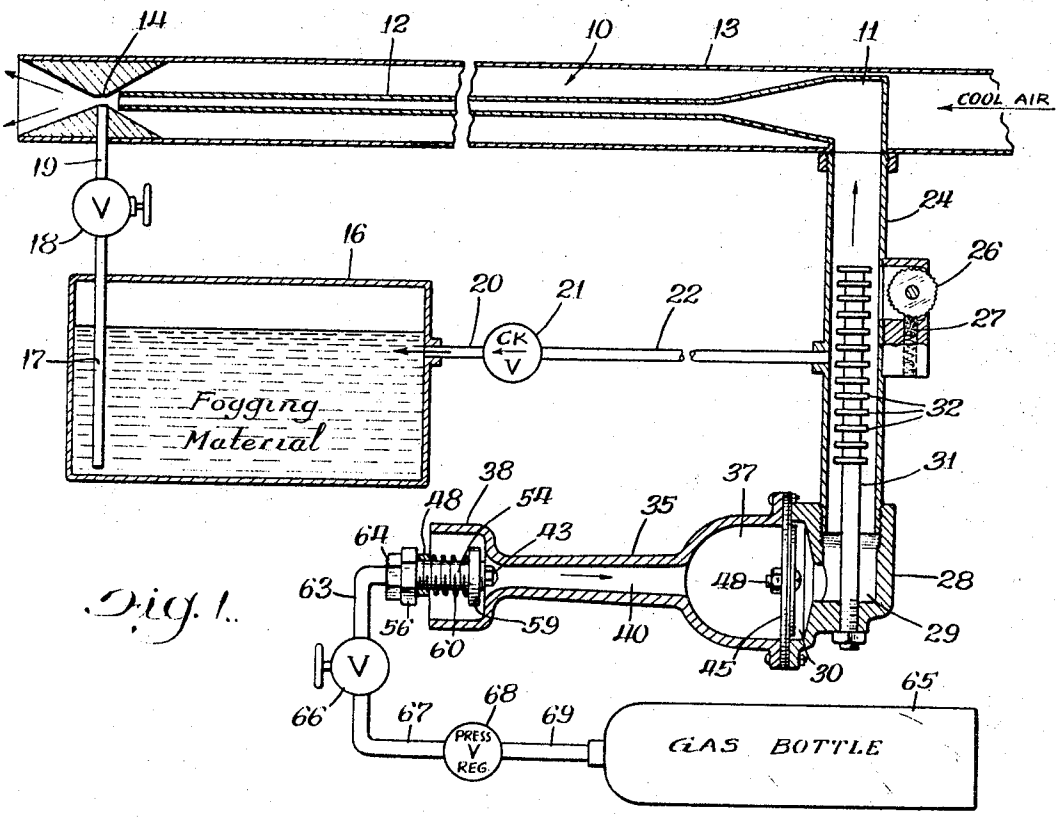

Fig. 1.

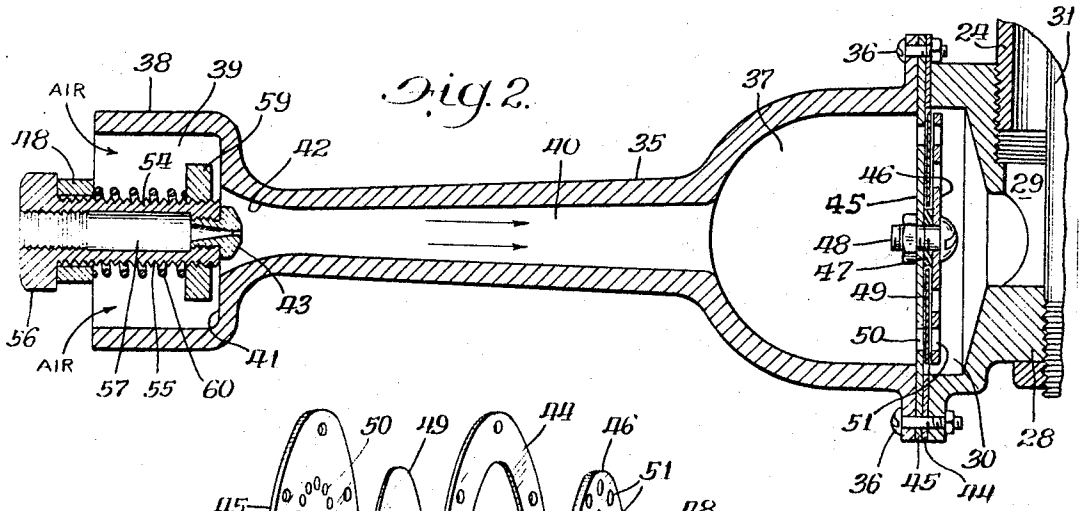

Fig. 2.

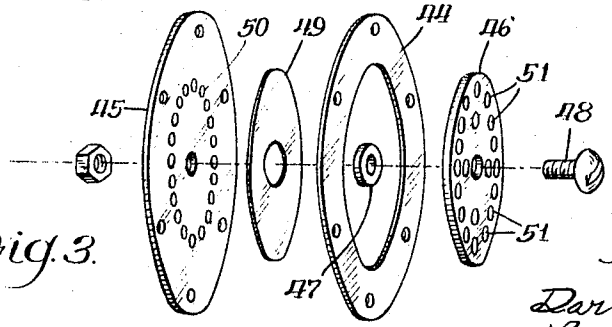

Fig. 3.

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RESONANT PULSE JET FOGGER

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ABSTRACT OF THE DISCLOSURE

The present invention relates to a fogger of the type wherein a resonant pulse jet engine is employed to develop the heat and fluid flow for the dispersing of a liquid material in the form of a fog. For engine fuel the present invention employs gas released from a pressurized gas bottle. The structure is such that the gas as it is released aspirates air to form a combustible mixture and forces the combustible mixture through a backflow obstructing valve, which is so constructed as to permit the mixture flow therethrough under the pressure developed by the aspirating gas. This greatly facilitates the ability to start the engine.

Summary of the invention

Foggers normally require the use of a pressurized air source to obtain the combustible mixture in the resonant pulse jet engine during the starting procedure. See for example U.S. Patent No. 2,821,966, dated Feb. 4, 1958. Such engines often are difficult to start because of the interrelationship of the necessity of producing a combustible mixture and then igniting that mixture. In the present invention bottled gas under pressure is employed to aspirate air to form a combustible mixture at a pressure in excess of atmospheric. This combustible mixture passes through an anti-backflow valve in a conduit leading to the combustion chamber of the engine, because of the creation of the pressure in excess of atmospheric. So long as the engine is not running this flow will be constant. This combustible mixture is easily ignitable either in the combustion chamber of the engine or in the conduit between the valve and the combustion chamber. As compared to prior art devices employing pressurized air sources for starting, the ease of starting an engine embodying the present invention is distinctly superior.

Anti-backflow valves have previously been used in resonant pulse jet engines, see for example U.S. Patent No. 2,609,660. However, the form of the valve employed in the present invention is different from that of known prior art devices. Two spaced plates are employed with a thin flexible diaphragm loosely mounted between the plates. The upstream plate, as considered with respect to the flow of the combustible mixture, has holes therethrough which are adapted to be covered by the diaphragm when the pressure on the downstream side of the valve becomes greater than the pressure on the upstream side of the valve. This form of valve provides little impediment to the flow of the combustible mixture through the valve when the pressure on the downstream side of the valve is atmospheric or below. Thus the combustible mixture may be forced to the combustion chamber of the engine with the comparatively low pressures developed by gas bringing in the ambient air.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings in which:

FIGURE 1 is an elevational sectional view, in rather schematic form, of a fogger embodying the present invention;

FIGURE 2 is an enlarged view of the aspirator and anti-backflow valve, and

FIGURE 3 is an exploded view of the valve.

Although the following disclosure offered for public dissemination is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose; as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

FIGURE 1 illustrates a fogger embodying a resonant pulse jet engine, generally **10**, comprising a combustion chamber **11**, and a resonance tube **12**. A shroud **13** is employed about the combustion chamber and tube, both as a protection against burns and so that ambient air will be aspirated about the chamber and tube by the flow of gases from the discharge end of the tube. Adjacent the discharge end of the resonance tube **12** is a venturi **14** to produce a low pressure area to facilitate the feeding of the fogging material into the hot gaseous stream ejected from the resonance tube.

The fogging material, which for example, might be an insecticide in a kerosene carrier or vehicle, is held in a closed container **16**. Container **16** has a fill opening, not shown, which may be rendered pressure tight after the fogging material is introduced into the container or tank. The fogging material flows to venturi **14** through a syphon tube **17**, a control valve **18**, and a pipe **19**. Tank **16** is pressurized through pipe **20**, check valve **21**, and pipe **22**.

A pipe **24** forms a part of a conduit for directing the combustible mixture into the combustion chamber **11**. Preferably this combustible mixture enters the combustion chamber tangentially. Located in one portion of pipe **24** is an igniter formed by a rotatable spark wheel **26**, which engages a flint **27**. Pipe **24** is threaded into a body section **28** having communicating openings **29** and **30** therein. A flame arrester in the form of a rod **31** with a plurality of rings or discs **32** extends along the interior of pipe **24**. Rod **31** is affixed to body section **28**.

A second body section **35** is attached to body section **28** by means of bolts **36**. Body section **35** defines an enlarged chamber **37**, a bell shaped housing **38**, and a channel **40** communicating between the chamber **37** and the hollow interior **39** of bell **38**. The cross-sectional size of channel **40** is much smaller than that of either chamber **37** or interior **39**. Bell **38** has a relatively flat interior wall **41**, and defines an aspirator throat **42**.

Intermediate the two body sections **28** and **35** is a gasket **44** and a first plate **45** of the anti-backflow valve. Secured to first plate **45** is a second plate **46**. The two are spaced from each other by means of a washer **47**, and are held in this position by a bolt **48**. Loosely received in this space between the two plates is a flexible diaphragm **49**. The diaphragm is substantially thinner than the space between the two plates so that it is freely movable in that space. Plate **45** has plurality of holes **50** therethrough and plate **46** has a plurality of holes **51**. When the gas pressure in chamber **37** is greater than that in chamber **30**, diaphragm **49** will move against plate **46** to permit the gas to flow through holes **50** in plate **45** and from there about the sides of the diaphragm **49** into chamber **30**. When the gas pressure in chamber **30** exceeds that in chamber **37**, diaphragm **49** is forced into contact with plate **45** thus closing openings **50** and preventing any reverse gas flow. Diaphragm **49** is relatively thin and flexible, as for example a film of plastic impregnated fiberglass having a thickness of 0.003 inch and gas impervious. A suitable form of impregnated fiberglass is that sold under the trademark Fluorglas No. M 381–3. Parts 44–47 and 49 all are circular.

The combustible gas is introduced through a nozzle **43**, which is threaded into a cylinder **54**. Cylinder **54** has ex-

ternal threads **55**, a nut shaped end **56**, and a hollow interior **57**. It is threaded into and held by a mounting bar **48** affixed to housing **38**. An air flow adjustment plate **59** is threaded onto cylinder **44**. Plate **59** is cylindrical in external configuration. A spring **60** is in compression between plate **59** and mounting bar **58** so as to prevent any unwanted rotation of plate **59**.

A pipe **63** is attached to cylinder **54** by means of a fitting **64**, with the pipe being in communication with the hollow interior **47** of the cylinder. Pipe **63** communicates with gas bottle **65** through control valve **66**, pipe **67**, pressure regulating valve **68**, and pipe **69**. In actual practice these gas passages and valves may be formed in a single block. The gas in cylinder **65** may be any combustible gas which normally is a gas at the usual ambient temperatures and atmospheric pressure, as for example propane or butane. In the usual instance it will be reduced in pressure by regulating valve **68** to about 15 to 25 pounds per square inch.

Nozzle **43** and throat **42** form an aspirator. As the gas is ejected through nozzle **53** it produces a low pressure which results in air being drawn in through bell **38** and into channel **40** to form a combustible mixture with the gas. This combustible mixture in chamber **37** is at a pressure in excess of atmospheric. It therefore pushes diaphragm **49** away from holes **50** to permit the mixture to flow through the conduit defined by opening **30**, opening **29** and the hollow interior of pipe **24** to combustion chamber **11**. A manual rotation of spark wheel **26** (in a clockwise direction as viewed in FIGURE 1) is all that is required to ignite the combustible mixture and start the engine. The initial ignition pressurizes the combustion chamber and the conduit leading to the anti-backflow valve. This pressure wave closes the valve for so long as the pressure in opening **30** exceeds the pressure in chamber **37**. As a slug of burned gas flows down resonance tube **12** a low pressure is created in combustion chamber **11** and in the conduit leading to the anti-backflow valve. This low pressure, in conjunction with the pressure in chamber **37**, results in a new charge of combustible mixture flowing through the anti-backflow valve and to the combustion chamber where it is automatically ignited by the still burning gases there present. This process is repeated over and over as in the operation of a conventional resonant pulse jet engine.

The pressurizing of pipe **24** also results in the pressure wave flowing through pipe **22**, check valve **21** and pipe **20** to pressurized container **16**. This plus the low pressure existing at venturi **14** as the hot gases of combustion come out of resonance tube **12** cause the fogging material to be injected into the hot gases at venturi **14**. This fogging material is ejected by the gas flow and heated thereby to produce the desired fog.

The comparatively large size of chamber **37** not only permits the use of a diaphragm having a comparatively large diameter, but also provides space for the storing of a combustible mixture during those brief intervals when the anti-backflow valve is closed by a pressure wave in opening **30**. To obtain a proper combustible mixture with a given type of gas and pressure at nozzle **43**, adjusting plate **59** is moved towards or away from wall **41** of bell **38**. This may be done by manually rotating plate **59** one way or the other so that it moves towards or away from wall **41**.

I claim:

1. In a fogger wherein a resonant pulse jet engine with a combustion chamber is employed to develop the heat and fluid flow for the dispersing of a liquid material as a fog, the improvement comprising: a container of combustible fluid under pressure, which fluid is a gas at atmospheric pressure and ambient temperature; an aspirator having a nozzle communicating with said container for introducing gas into the aspirator for flow in a given direction, said aspirator being open to atmosphere on the upstream side to permit air to be drawn therein by the aspiration effect to form a combustible mixture under a pressure in excess of atmospheric downstream of said aspirator; means forming a conduit from the downstream side of said aspirator to said combustion chamber; and valve means in said conduit for permitting said mixture to flow therethrough to the chamber when the pressure downstream of the valve means is less than said excess pressure and for blocking the flow of fluid in the reverse direction when the pressure in the downstream side of the valve means is greater than said excess pressure; said aspirator including an externally threaded hollow cylinder having the nozzle mounted on one end in communication with the hollow interior of the cylinder, said container also communicating with the hollow interior, an air control plate about said cylinder and engaging the threads of the cylinder, and means contacting said control plate to prevent unwanted rotation of the plate on the cylinder.

2. In a fogger as set forth in claim **1**, including an igniter in said conduit downstream of said valve means, said igniter comprising a flint and manually operable spark wheel in contact with the flint.

3. In a fogger wherein a resonant pulse jet engine with a combustion chamber is employed to develop the heat and fluid flow for the dispersing of a liquid material as a fog, the improvement compirsing: a container of combustible fluid under pressure, which fluid is a gas at atmospheric pressure and ambient temperature; an aspirator having a nozzle communicating with said container for introducing gas into the aspirator for flow in a given direction, said aspirator being open to atmosphere on the upstream side to permit air to be drawn therein by the aspiration effect to form a combustible mixture under a pressure in excess of atmospheric downstream of said aspirator; means forming a conduit from the downstream side of said aspirator to said combustion chamber; and valve means in said conduit for permitting said mixture to flow therethrough to the chamber when the pressure downstream of the valve means is less than said excess pressure and for blocking the flow of fluid in the reverse direction when the pressure in the downstream side of the valve means is greater than said excess pressure; said aspirator and conduit means comprising a first body portion detachably affixed to a second body portion, said first body portion defining an internal chamber upstream of the downstream end thereof, a hollow bell at the upstream end thereof and a fluid channel communicating between the interior of the bell and the chamber, said channel being smaller in cross-section than that of the bell and chamber, said nozzle being positioned at the upstream end of the channel and directed towards said chamber; said valve means being mounted across the downstream end of said first body portion.

4. In a fogger as set forth in claim **3**, wherein said first body portion defines a transverse wall at the upstream end of the channel, said fogger including an air control plate in said bell and transversely thereto, said plate being adjustable toward and away from said transverse wall.

5. In a fogger as set forth in claim **4**, wherein said aspirator includes an externally threaded hollow cylinder in the bell and axially aligned with said channel, said cylinder having the nozzle secured thereto in the channel end thereof, said nozzle and said container communicating with the hollow interior of the cylinder, said plate being about said cylinder and engaging the threads thereof, and mounting means connecting said cylinder and said bell.

6. In a fogger as set forth in claim **5**, including a spring about said cylinder and in compression between said plate and said mounting means; said valve means including a first plate extending transversely of said conduit between said two body portions, said first plate having holes therethrough, a second plate attached to the first plate and spaced therefrom on the downstream side thereof, and a flexible diaphragm between said plates and movable in the space therebetween in a direction toward and away from

said first plate, said diaphragm covering said holes when moved against said first plate.

References Cited

UNITED STATES PATENTS

1,809,425	6/1932	Roberts	158—118
2,383,641	8/1945	Focke et al.	158—118 X
2,523,378	9/1950	Kollsman.	
2,701,950	2/1955	Huber et al.	
2,857,332	10/1958	Tenney et al.	239—129 X
2,858,162	10/1958	Frank	239—129
2,926,855	3/1960	Dürr et al.	239—129
2,959,214	11/1960	Dürr et al.	158—4
3,093,962	6/1963	Gluhareff	60—39.77 X
3,279,179	10/1966	Kemenczky	60—247

FOREIGN PATENTS

386,908	1/1933	Great Britain.

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U.S. Cl. X.R.

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