

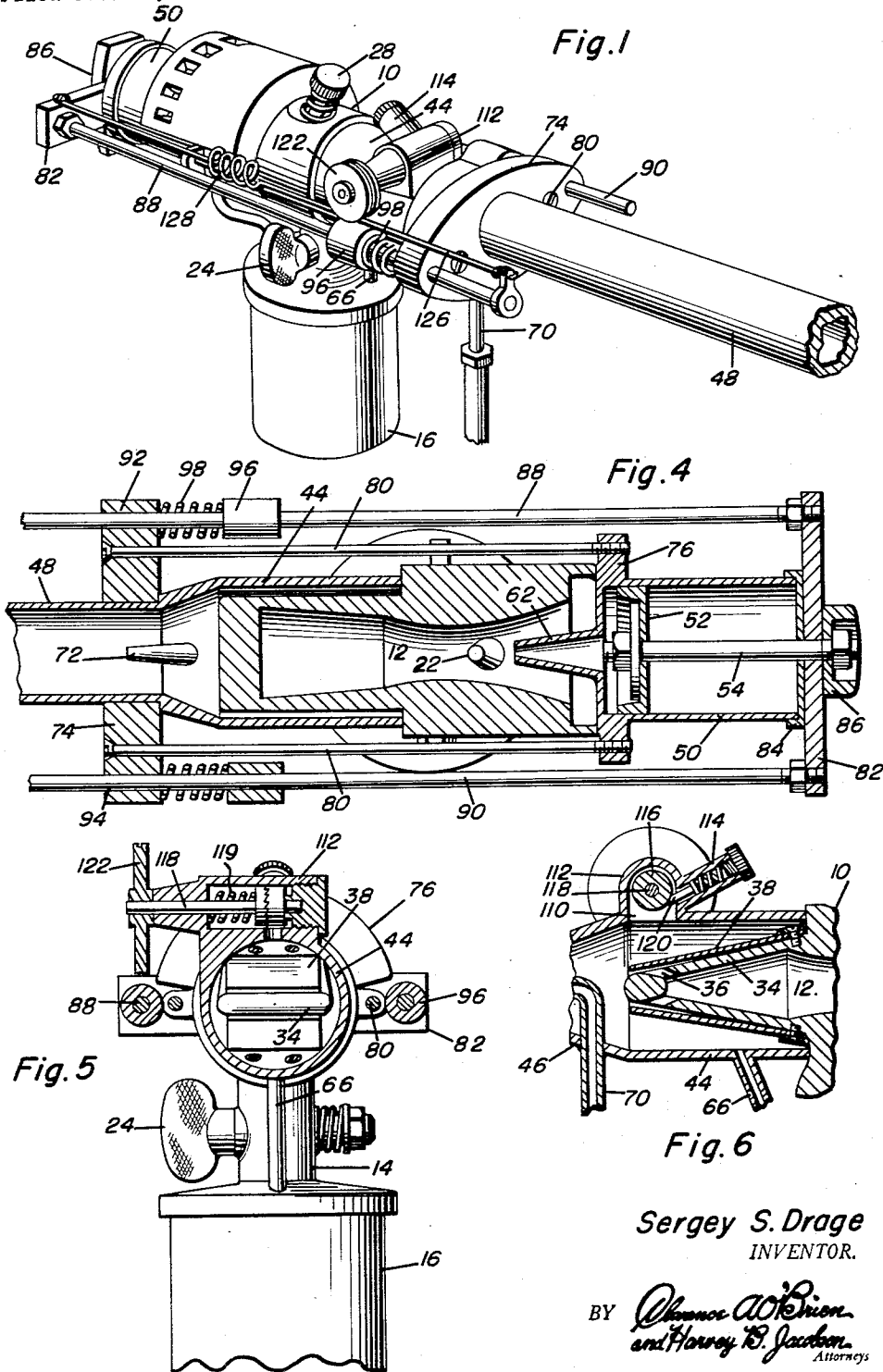
May 27, 1958

S. S. DRAGE  
FUEL FEEDING AND IGNITION MEANS FOR PULSE  
JET TYPE HOT GAS OR STEAM GENERATOR

2,836,036

Filed Oct. 27, 1953

2 Sheets-Sheet 1





1

2,836,036

## FUEL FEEDING AND IGNITION MEANS FOR PULSE JET TYPE HOT GAS OR STEAM GENERATOR

Sergey S. Drage, Elmhurst, N. Y., assignor of fifty percent to Star Co., New York Mills, N. Y., a corporation

Application October 27, 1953, Serial No. 388,581

3 Claims. (Cl. 60—39.55)

This invention relates to a jet heat gun and particularly to a gun of the jet impulse type for providing either heat or steam as the case may be.

In a cleaning operation, such as that conducted for producing a clean surface for applying a new paint surface, it has heretofore been customary to use steam guns or heat guns either to remove the old paint or to clean the paint so that a new surface may be applied thereon. Heretofore, it has been customary to use relatively large devices weighing several hundred pounds and including boilers and the like for producing the steam cleaning fluid, or to use torch-like devices for producing heat. The steam cleaning devices heretofore used have required several minutes in order to heat the coils sufficiently to provide a flow of steam to the cleaning surface, and the devices are extremely unwieldy to handle or to transport from place to place. The present invention provides a combination heat and steam gun weighing only a few pounds and readily transported from place to place and capable of being placed in initial operation within a few seconds.

This is accomplished by means of a jet impulse type heater utilizing a mixing chamber, preferably of the Venturi type, and a combustion chamber separated from a mixing chamber by means of a normally closed valve having a frequency of vibration substantially equal to the resonant frequency of the combustion chamber and any nozzle attached thereto. Means are provided for supplying a fuel into the mixing chamber together with a flow of air therein and the combustion chamber is provided with an ignition device for initially operating the device. After the device is placed in operation, the pulsating effect of the combustion of gases in the combustion chamber will cause alternate suction or vacuum impulses to be applied to the mixing chamber to introduce new fuel therein. An initial pressure device utilizes a pump for supplying fuel under pressure as well as supplying air into the mixing chamber, while a by-pass valve from the combustion chamber will constantly supply pressure into the fuel reservoir for forcing more fuel into the device during the normal operation thereof. Any suitable spray nozzle may be utilized for introducing water and preferably in an atomized condition into the heat chamber.

It is accordingly an object of the invention to provide an improved heat gun.

It is a further object of the invention to provide a heat gun for supplying steam either superheated or saturated, as may be desired.

It is a further object of the invention to provide a heat gun operated by a jet impulse device.

It is a further object of the invention to provide a light weight heat gun.

2

It is a further object of the invention to provide a heat gun which may be initially manually operated.

It is a further object of the invention to provide means for initially igniting a charge in the gun.

Other objects and many of the attendant advantages of the present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a heat gun according to the invention;

Figure 2 is a top plan view of the jet heat gun according to the invention;

Figure 3 is a sectional elevation of the jet heat gun taken substantially on the plane indicated by the section line 3—3 of Figure 2 and showing the mixing and combustion chambers and the construction of the gun;

Figure 4 is a transverse section through the heat gun taken substantially on the plane indicated by the section line 4—4 of Figure 3 and further showing the construction of the gun;

Figure 5 is a cross-section through the jet heat gun taken substantially on the plane indicated by the section line 5—5 of Figure 3 and showing the arrangement of the resonant or pulsator nozzle;

Figure 6 is a fragmentary sectional elevation of the valve in open position and also showing the arrangement of the igniter device; and

Figure 7 is a perspective view of the resonant valve according to the invention.

In the exemplification according to the invention, a mixing chamber 10 is provided with a substantially Venturi-shaped opening 12 therein and a handle-like member 14 has a fuel reservoir 16 mounted thereon in any suitable manner, herein indicated as threads 18. A fuel conduit 20 extends from adjacent the bottom of the reservoir 16 upwards through the handle member 14 and terminates in a jet nozzle 22 and is provided with a control valve 24 therein. A needle member 26 is mounted on a stem 28 which is threaded into a bore in the body 10 so that the needle 26 may be operated with respect to the nozzle 22 to control the aperture thereof.

The rear end of the mixing chamber 10 is provided with a closure plate 30 having a plurality of apertures 32 therein for admitting air into the Venturi chamber during normal operation thereof.

The forward end of the mixing chamber 10 is closed by means of a valve plate 34 preferably substantially V-shaped in construction and somewhat resembling a duck's bill. The forward end of the plate is provided with a plurality of ports 36 which are normally closed by strip steel valve plates 38. The valve plates 38 being connected to the plates 34 adjacent the rear end thereof by any suitable means, such as the screws 40, and preferably by means of an attaching plate 42.

A substantially cylindrical combustion chamber 44 encloses the valve plate 34 and the valves 38 thereon and terminates in a substantially reduced end portion 46 which associates with a suitable discharge conduit or nozzle 48. In order to initiate operation of the device, a pump chamber 50 is attached to the rear end of the chamber 10 and is provided with a suitable valve-type piston 52 operated by means of a piston rod 54 which, in turn, is operated by means of a suitable manual handle 56. A conduit 58 communicates the pump cylinder 50 with the interior of the fuel reservoir 16 and a unidirectional valve 60 is mounted on the end thereof so as to prevent the flow of fluid backwards from the reservoir

16 into the pump cylinder 50, but permitting the ready flow of air or other gas from the pump chamber 50 into the reservoir 16.

A nozzle 62 is connected to the cylinder 50 and extends into the Venturi-type throat 12 substantially to the nozzle 22 so that air may be forced through the nozzle 62 into contact with fuel discharged through the jet nozzle 22. A conduit 66 communicates the combustion chamber 44 with the interior of the reservoir 16 and is provided with a unidirectional valve 68 for inhibiting flow from the reservoir 16 into the combustion chamber through the conduit 66, but admitting ready flow of gases through the conduit 66 into the reservoir 16.

A conduit 70 communicates with the reduced portion 46 of the combustion chamber 44 and terminates in a nozzle 72 of the spray type for atomizing water or other material introduced therethrough. A fastening plate 74 is placed around the nozzle 48 and abuts the reduced portion 46 of the combustion chamber 44. A fastening member 76 includes the portion 30 having the ports 32 therein and provides an upstanding rib 78 which is connected to the collar 74 by means of suitable fastening means, such as the bolts 80. A crosshead 82 is mounted on the piston rod 54 and abuts the closure 84 of the cylinder 50, closure 84 having air passage holes 83 therein. A handle 86 is rigidly mounted on the end of the piston rod 54 and is movable with the cross-head 82. A pair of guide rods 88 and 90 are secured to the cross-head 84 and extend longitudinally along the device and the forward ends of the rods 88 and 90 are received in the bearing apertures 92 and 94 of the collar 74. Collars 96 are placed on the rods 88 and 90, and suitable springs 98 are introduced between the collars 96 and the collar 74 to cushion the stroke of the piston 52.

In order to prevent backflow of gases from a mixing chamber through the intake ports 32, portion 76 is provided with intake apertures 102 which may be closed by means of suitable flexible valve 104. The valve is in the form of a flat elastic plate which is forced by gas pressure to a position closing apertures 102 and drawn by suction to a position opening apertures 102. This is precisely the same as the valve actuation of an impulse or resonance reactance jet engine.

An initial igniter for the combustion chamber 44 comprises an aperture 110 in the top of the combustion chamber 44 and a suitable housing 112 thereon. A flint tube 114 communicates with the housing 112 and a sparking wheel 116 is mounted therein on a suitable axle 118. The drive between sparking wheel 116 and axle 118 is established through the spring loaded clutch 119 (Figure 5). A flint 120 is projected into contact with the periphery of the sparking wheel 116. A sheave 122 is mounted on the outer end of the shaft 118 and a driving element therefor comprises a flexible cord-like member 126 which is connected to the opposite ends of the rod 88 and is entrained over the sheave 122 and is provided with a resilient element, such as a spring 128, intermediate the ends thereof so that in one direction of stroke of the pump, the wire or cord 126 will be relatively loose while in the other direction, it will be tight and cause rotation of the sheave 122.

In the operation of the device according to the invention, the valve 24 will be opened to admit fuel from the reservoir 16 into the mixing chamber 12 and the pump piston 52 will be reciprocated by means of the handle 86 to cause air pressure to flow through the conduit 58 into the reservoir 16 to compel the flow of fluid upward through the conduit 20 and the jet nozzle 22 into the throat portion of the Venturi-like opening 12. At the same time, the piston 52 will force air through the jet 62 to entrain the fuel delivered by the jet 22 and the pressure of the air in the mixing chamber 12 will cause the valve 104 to close the opening 102 to prevent the flow of fuel mixture outward through the ports 32. The pressure in the chamber 12 will cause the valves 38 to open so that the fuel

mixture will flow into the combustion chamber 44. The reciprocation of the plunger 52 will cause the rotation of the wheel 116 and a constant production of sparks during the forward direction of the motion of the piston 52, but the spring will release the tension on the tension member 126 so it will slide freely on the surface of the sheave 122 during the reverse stroke so as to prevent unnecessary utilization of the flint or the accidental ignition of the charge at the wrong portion of the stroke. As soon as the mixture is sufficiently rich to be ignited, a spark will cause ignition thereof and the pressure of the burning fuel will close the valves 38 and expansion of the gases because of the burning fuel will cause a rush of burned gases through the reduced portion 46 and the outlet conduit 48, and this will result in substantial vacuum in the chamber 44 so that a fuel mixture will be drawn through the apertures 36, raising the valves 38 in the doing. The tail end of the burning mixture in the discharge nozzle 48 will ignite the fresh charge so that the device will burn with a succession of impulse explosions. The increase in pressure in the chamber 44 will cause gas to flow through the conduit 66 and through the unidirectional valve 68 to maintain the pressure in the chamber 16.

The weight and length of the valve 38 should be proportioned in proportion to the size of the combustion chamber 44 and the size and length of the discharge nozzle 48 so as to be substantially resonant therewith so that the valve opens with a minimum of pressure to allow the flow of fuel therethrough, and substantially automatically closes before the pressure is applied thereto so that the valve and the jet impulses are substantially resonant.

When it is desired to use steam for cleaning or other purposes, water will be introduced through the conduit 70 and caused to be substantially atomized by the sprayer nozzle 72 and the heat in the throat 46 and the exhaust nozzle 48 will cause the water to be turned to steam. The quantity of water admitted will determine the condition thereof as well as the amount of fuel controlled by the needle 28. With a small amount of water and a high amount of fuel, the steam will obviously be superheated while if the water and fuel are reversed, the steam may be saturated. Obviously, if it is desired to use the device as a straight heat gun, water will not be admitted through the conduit 70 and straight heated gases will be delivered through the exhaust nozzle 48.

It will be apparent that the present invention provides a combination heat or steam gun which will be relatively light in weight and easy to transport and which may be readily started by a simple manual operation after which it will maintain itself in operation, alternately drawing fuel from the mixing chamber and igniting the same in the combustion chamber to produce successive pressure impulses so that the device is completely self-sustaining after starting.

For simplicity of illustration, a preferred embodiment of the invention has been shown and described according to the best present understanding thereof. However, it will be apparent to those skilled in the art that various changes and modifications may be made in the construction and arrangement of the parts thereof without departing from the true spirit and scope of the invention.

What is claimed as new is as follows:

1. A jet heat gun comprising a Venturi-shaped mixing chamber, air inlet ports opening into said chamber, valves associated with said air inlet ports, a combustion chamber, a valve plate between said mixing chamber and said combustion chamber, said plate having a port therein, a flat spring biased into closing relation with said port, a fuel reservoir, a fuel conduit communicating said reservoir with said mixing chamber, an air pump including a pump operator, an air duct communicating said pump with said reservoir, a check valve in said air duct for inhibiting return flow from said reservoir to said pump, an air nozzle communicating said pump with said mixing chamber, a fuel nozzle on said fuel conduit, said air

5

nozzle extending into the throat of said Venturi-shaped mixing chamber, an igniting device, means operatively connecting said igniting device with said pump operator for actuation of said device in response to actuation of said pump, said means including a rod movable with said pump operator, a flint holder having a flint, a sparking wheel engaging said flint, a sheave connected to said sparking wheel, a flexible member connected to said rod and entrained over said sheave to drive said sheave, and a longitudinally resilient member constituting a portion of said flexible member so as to establish a drive connection between said sheave and member when said member is moved in one direction.

2. The jet heat gun of claim 1 wherein said pump operator includes a reciprocating piston and piston rod, a cross head secured to said piston rod, the first mentioned rod secured to said cross head.

3. The jet heat gun of claim 2 wherein there is a nozzle in said combustion chamber, and means for conducting water to said nozzle in said combustion chamber.

6

## References Cited in the file of this patent

## UNITED STATES PATENTS

|           |                   |               |
|-----------|-------------------|---------------|
| 496,450   | Shedlock          | May 2, 1893   |
| 1,236,793 | Warman            | Aug. 14, 1917 |
| 1,455,069 | Bluemel           | May 15, 1923  |
| 1,814,192 | Slattengren       | July 14, 1931 |
| 1,828,784 | Perrin            | Oct. 27, 1931 |
| 2,106,914 | L'Orange          | Feb. 1, 1938  |
| 2,414,828 | McCollum          | Jan. 28, 1947 |
| 2,707,515 | Lafferentz et al. | May 3, 1955   |
| 2,738,334 | Tenney et al.     | Mar. 13, 1956 |

## FOREIGN PATENTS

|         |               |               |
|---------|---------------|---------------|
| 735,757 | France        | Sept. 6, 1932 |
| 386,908 | Great Britain | Jan. 26, 1933 |
| 666,519 | Great Britain | Feb. 13, 1952 |