United States Patent [19]

Bowman et al.

[11] **3,736,093**

[45] **May 29, 1973**

[54] **INTEGRAL REGULATED HAND TORCH**

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[22] Filed: **Dec. 14, 1971**

[21] Appl. No.: **207,931**

[52] **U.S. Cl.** **431/89,** 239/417.3, 239/419.5, 239/464, 431/344

[51] **Int. Cl.**.....**F23d 13/04**

[58] **Field of Search**.....239/416.5, 417.3, 239/419, 419.5, 463, 464, 474; 431/89, 344, 353, 354, 355

[56] **References Cited**

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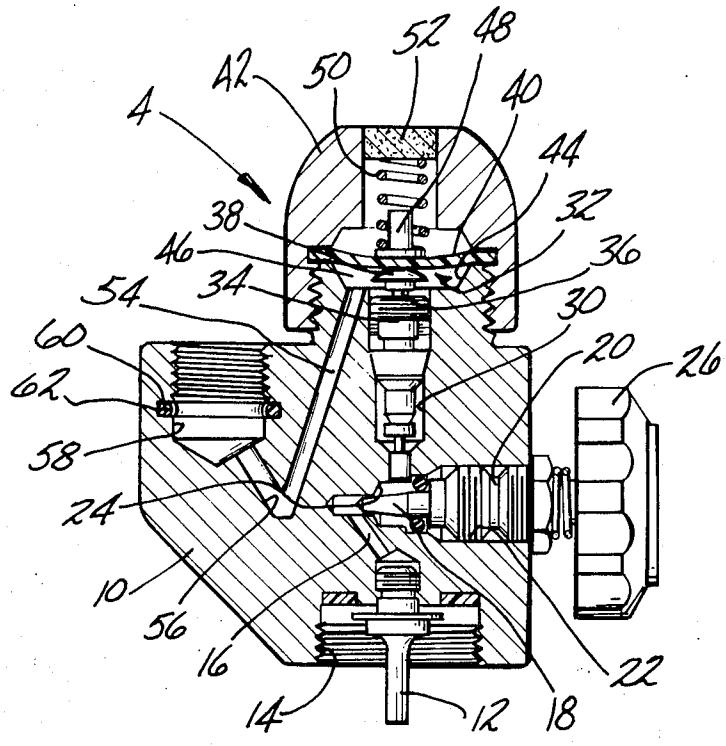
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Attorney—Donald R. Motsko, H. Samuel Kieser and William W. Jones

[57] **ABSTRACT**

A portable gaseous hydrocarbon-burning torch having a pressure regulated outlet valve wherein the torch will produce a flame having predetermined characteristics throughout a wide range of ambient operating temperatures.

2 Claims, 5 Drawing Figures



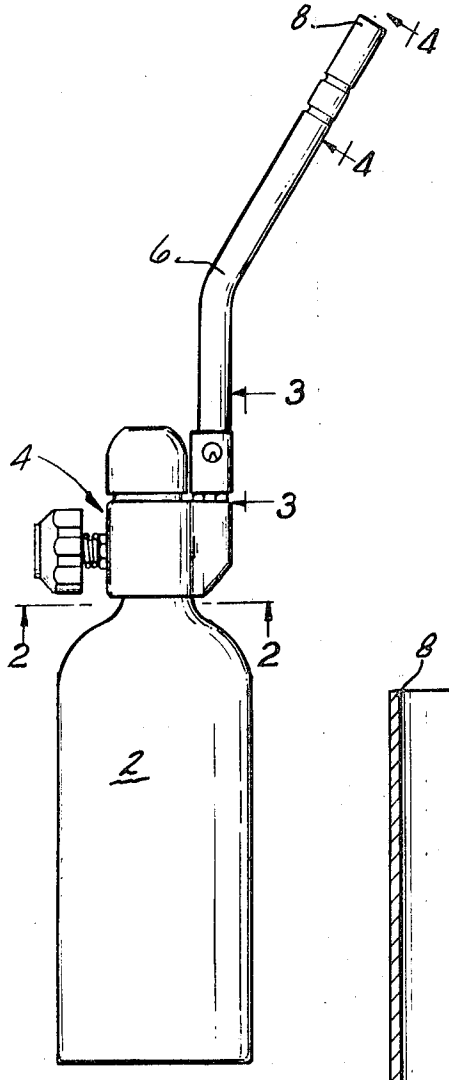


FIG-1

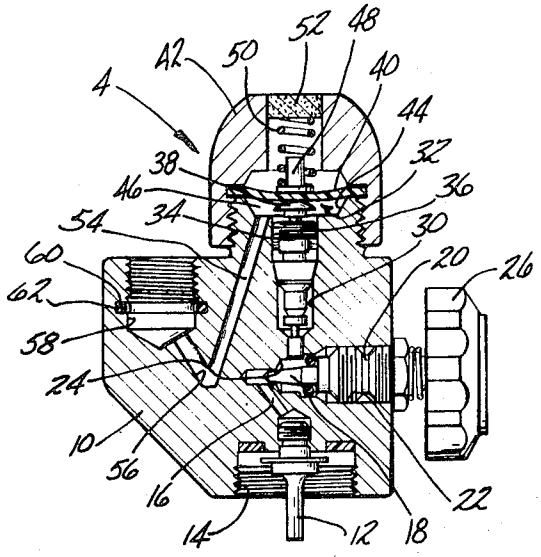


FIG-2

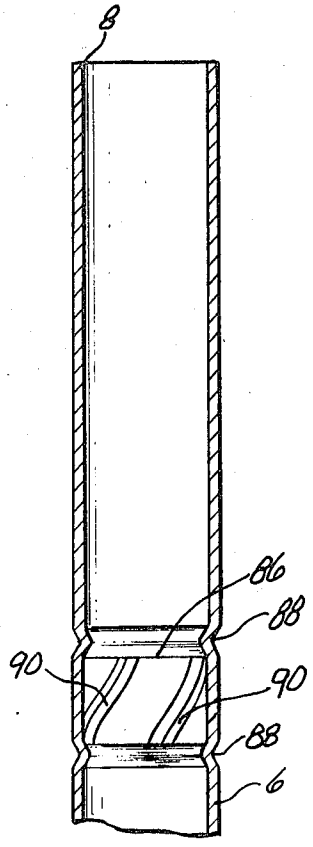


FIG-4

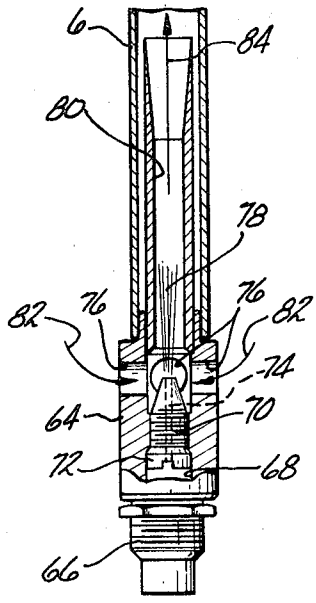


FIG-3

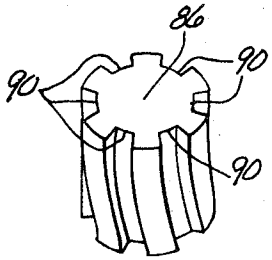


FIG-5

INTEGRAL REGULATED HAND TORCH

This invention concerns a portable gaseous hydrocarbon-burning torch which is capable of producing a flame of constant characteristics over a wide range of ambient operating temperatures.

Torches which burn liquified petroleum gas are subject to variations in operating pressures caused by different ambient temperatures. Such torches utilize a pressurized container of liquified petroleum gas having an outlet valve through which the gaseous form of the fuel is emitted to a nozzle and burner head. Variations in ambient temperatures result in variations in the internal pressure of the fuel container thereby varying the pressure at which the gaseous fuel is emitted from the container. Thus the flame of a torch which is designed to operate at room temperature will become so small as to be useless in subfreezing temperatures or may become so large as to be unmanageable in higher ambient temperatures common during the summer. Portable torches of this variety have endeavored to overcome this problem by using a variety of orifice sizes designed for different ambient operating temperatures. Thus the operator is forced to use one orifice size in lower temperatures, a second orifice size at intermediate temperatures and yet a third orifice size at higher ambient temperatures.

Gaseous hydrocarbon-burning torches utilizing a supply of liquified petroleum gas are further subject to problems when used in an inverted position. When turned up-side-down in order to direct the flames against a horizontal surface, the liquid phase fuel is brought into contact with the outlet of the fuel tank since the outlet is at tank pressure. Therefore, fuel in the liquid phase is squirted through the orifice of the torch. This causes improper air/fuel mixtures and produces large yellow flames having unusually high CO and HC concentrations instead of the more desirable small blue flames.

The torch of this invention includes a pressure regulated outlet valve assembly which is connected to the fuel tank and which automatically increases and decreases fuel flow from the tank in response to decrease and increase respectively in the internal tank pressure caused by the ambient operating temperature. Thus the torch of this invention will provide a greater rate of fuel flow from the tank at low temperatures and conversely will provide a lesser rate of fuel flow from the tank at higher temperatures. Furthermore, the regulator valve produces a first pressure drop in fuel passing from the fuel tank into the regulator which causes partial vaporization of the liquid state of the fuel should the torch be inverted during use, and a second pressure drop as the partially vaporized fuel passes through the torch orifice. The sequential pressure drops result in complete vaporization of the fuel when the torch is held in the inverted position at ambient temperatures as low as 0°F. It has been found that heat imparted to the partially vaporized fuel by the regulator during its dwelling time therein further aids in vaporizing the liquid-gaseous fuel mixture within the regulator when the torch is inverted.

The torch of this invention also includes a flame holder which produces a swirling jet of flame movable at a high velocity toward the work piece. Such a flame produces an almost negligible amount of heating of the air-fuel delivery tube thereby increasing the importance that the fuel passing through the delivery tube be in the gaseous state, since the absence of heating of the delivery tube will not vaporize liquified fuel moving through the delivery tube. This is in contrast to the prior art portable torches which utilize liquified petroleum fuels and which further utilize other flame holder designs. The prior art flame holder designs have been found to generate substantial heat in the delivery tube thereby at least partially causing vaporization of liquified fuel passing through the delivery tube but displaying inefficient utilization of heat directed at the work piece.

It is, therefore, an object of this invention to provide a portable gaseous hydrocarbon-burning torch which produces a flame having constant characteristics throughout a wide range of ambient operating temperatures.

It is yet another object of this invention to provide a torch of the character described which produces a fuel flow rate which varies according to variations of pressure imposed on the fuel supply by variations of the ambient operating temperatures.

It is still another object of this invention to provide a torch of the character described which provides substantially complete vaporization of fuel passing through the torch orifice at temperatures as low as about 0°F when the torch is used in the inverted position.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description of a preferred embodiment of the invention taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view of a preferred embodiment of the torch of this invention;

FIG. 2 is a vertical sectional view of the regulator portion of the torch of FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view of the orifice portion of the torch of FIG. 1 taken along line 3—3 of FIG. 1;

FIG. 4 is a vertical sectional view of the flame holder portion of the torch of FIG. 1 taken along line 4—4 of FIG. 1; and

FIG. 5 is a perspective view of the flame holder portion of FIG. 4.

Referring now to the drawings, FIG. 1 shows a preferred embodiment of a torch formed in accordance with the invention. The torch includes a cannister 2 in which there is a supply of fuel under pressure and in the liquid state, such fuel being, for example, propane. The cannister 2 is of conventional construction and includes an outlet valve (not shown) at its upper end, the outlet valve being of the type commonly referred to as a tire valve. A pressure regulated valve assembly identified generally by the numeral 4 is mounted on the top of the fuel cannister 2. An air-fuel delivery tube 6 extends from the regulator 4 and terminates at the torch tip 8.

Referring now to FIG. 2, details of the regulator 4 are shown. The regulator 4 includes a valve body 10 having a pusher pin 12 secured thereto for engaging the outlet valve of the fuel cannister 2. When mounted on the fuel cannister 2 it will be appreciated that the pusher pin 12 is operative to open the cannister outlet valve to permit the fuel to escape from the cannister. The valve body 10 is also provided with a threaded bore 14 which is screwed onto the cannister and to which the pusher pin

12 is connected, the bore 14 thus forming an inlet into the valve body through which gaseous fuel passes from the canister 2. Thus when the threaded bore 14 is threaded into assembly with a complimentary cannister thread, the pusher pin 12 will automatically engage and open the outlet valve of the cannister to release a flow of gaseous fuel through an opening in the pusher pin 12 communicating with a central tubular inlet passage 16 in the valve body. Further flow of gaseous fuel through the valve body is controlled by the opening and closing of a tapered valve head 18 formed on the end of a stem 20 carried in an internally threaded bore 22 formed in the valve body 10. The valve body 10 has a seat 24 engageable with the valve head 18. The stem 20 may be selectively actuated by means of an enlarged control knob 26 connected to the end of the stem 20 and positioned exteriorly of a stop nut 28. Thus the valve may be set and fuel passing the valve head 18 will be directed into an intermediate passage 30 for further control by a regulator apparatus shown generally at 32.

A valve assembly 34 in the form of a tire valve is mounted in the intermediate passage 30 and controls the passage of fuel therethrough. The valve 34 is provided with an external actuating pin 36. The actuating pin 36 carries a rivet-shaped member 38 at its upper end, the rivet-shaped member 38 engaging a diaphragm 40 of resilient material, such as rubber. The diaphragm 40 is held in place by a cap 42 which is threaded onto the valve body 10. The upper portion of the valve body 10 is recessed as at 44 so as to combine with the diaphragm 40 to form a chamber 46. A guide member 48 is mounted in a coil spring 50 positioned within the cap 42, the guide member 48 being biased against the diaphragm 40 by the spring 50, the latter of which bottoms against an insert 52. It will be noted that downward movement of the valve actuating pin 36 opens the valve 34 to permit a greater flow of fuel into the chamber 46 while relative upward movement of the valve actuating pin 36 causes a closing of the valve 34 which permits a lesser flow of fuel into the chamber 46. In this way the rate of flow of fuel into the chamber 46 is precalibrated by the spring force of the spring 50 and the positioning of the insert member 52. A passage 54 extends from the chamber 46 and intersects a second passage 56 which opens into a threaded outlet 38 formed in the valve body 10. A sealing ring 60 is mounted in a groove 62 within the regulator outlet 58.

It will be readily appreciated that when the valve head 18 is opened gaseous fuel will flow from the inlet passage 16 into the intermediate passage 30 and thence through the valve 34 into the chamber 46. The gaseous fuel then flows from the chamber 46 through the passages 54 and 56 and into the regulator outlet 58. If the ambient operating temperature is relatively high the pressure within the fuel cannister will increase accordingly and the rate of fuel flowage through the regulator 4 will increase. This will cause an increase of pressure within the chamber 46 which increase in pressure will be sensed by the diaphragm 40 and will cause the diaphragm 40 to flex upwardly against the force of the spring 50. This upward movement of the diaphragm 40 will cause the rivet-shaped member 38 and valve actuating pin 36, both of which are spring biased upwardly in a conventional manner, to move upwardly thus reducing the flow of fuel through the valve 34. Conversely, if the ambient operating temperatures are relatively low, the pressure within the fuel cannister will drop accordingly and the rate of flow of fuel through the regulator will be less. This will cause a drop of pressure within the chamber 46 which will permit the spring 50 to flex the diaphragm 40 downwardly thus depressing the rivet-shaped member 38 and valve actuating pin 36 thereby further opening the valve 34 to increase the flow of fuel therethrough. In this manner the regulator permits a greater flow of fuel therethrough at lower ambient temperatures and a lesser rate of flow of fuel at higher ambient temperatures. Furthermore, as the fuel flows through the valve 34 into the chamber 46 there will occur a first pressure drop during which any fuel in the liquid state which passes into the chamber will tend to vaporize. Also, the valve body 10 will tend to transmit ambient heat into the chamber 46 and subsequent passages 54 and 56 which heat will further tend to vaporize any liquid fuel found therein.

Referring now to FIG. 3 the orifice and combustion air inlet portion of the torch is shown. This portion of the torch includes a housing 64 having a threaded portion 66 which is threaded into the valve body outlet 58. The housing 64 includes an internal passage 68 having an internal threaded portion 70 into which is threaded a nozzle member 72 having a through passage 74 providing the orifice for the torch. The housing 64 also includes a plurality of radial openings 76 which are located laterally of the orifice 74 and which serve to admit ambient air into the stream of gaseous fuel emitted from the orifice 74. In order to increase the volume of ambient air drawn into the fuel stream 78 through the openings 76, there is provided a jet pump 80 which operates on the Venturi principle downstream of the orifice 74. Thus air is drawn into the housing 64 along paths indicated by the arrows 82 and mixed with the stream of fuel 78, the mixture of fuel and air is then driven through the delivery tube 6 along a path indicated by the arrow 84 by the jet pump 80.

Referring now to FIGS. 4 and 5 the flame holder portion of the torch is shown. The flame holder is in the form of a cylindrical block 86 which is mounted within the delivery tube 6 and held longitudinally in place therein by spaced apart crimps 88 formed in the delivery tube 6. The side wall of the flame holder 86 is provided with a series of slots 90 each of which is a helical axis. The air-fuel mixture passes through the slots 90 and has imparted thereto a helical flow path. Ignition of the helically flowing air-fuel mixture is accomplished downstream of the flame holder 86 to provide a flame which issues from the tip 8 of the torch. The flame includes a plurality of helically spiraling jets moving at high velocity. It is noted that the grooves 90 may be formed with a straight line axis instead of a helical axis provided that the groove axis is skew with respect to the axis of the flame holder 86, or alternatively, may be in the form of apertures which are radially offset from the axis of the flame holder and skew with respect thereto.

It has been found that a torch formed in accordance with this invention will provide a flame having fixed characteristics over a wide ambient operating temperature range such as between about 0°F to about 100°F without changing the orifice size of the torch. The constant flame characteristic is achieved by varying the flow rate of fuel through the orifice in accordance with variations in the ambient operating temperatures, there being a greater fuel flow rate provided at lower ambient operating temperatures and a lesser fuel flow rate pro-

vided at higher ambient operating temperatures. It has further been found that the two step pressure drop incurred by the regulator and orifice will provide complete vaporization of liquid fuel at temperatures as low as about 0°F, which liquid fuel will enter the regulator when the torch is inverted.

Since many changes and variations of the described embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. A fuel flow control assembly for use in conjunction with a portable gaseous hydrocarbon-burning torch having a delivery tube and burner head, and a cannister containing a supply of liquid petroleum fuel under pressure, said assembly comprising:

a. a body having a passage extending therethrough for feeding fuel from the cannister to the delivery tube, said passage including an enlarged portion thereof providing an expansion chamber;

b. first valve means mounted on said body upstream of said expansion chamber and operative to open and close said passage to fuel flowage therethrough;

c. second valve means in said passage downstream of said first valve means and upstream of said expansion chamber to vary the volume of fuel passing through said passage;

d. spring means contacting said second valve means to force the latter toward an increased fuel flow rate position; and

e. a diaphragm extending across said expansion chamber to form a flexible wall thereof, said diaphragm contacting said spring means and said diaphragm being exposed to fuel pressure variations occurring in said expansion chamber and flexible in response thereto, flexure of said diaphragm in response to increased fuel pressure in said expansion chamber being operative to lower the force of said spring on said second valve means to thereby lower the volume of fuel flowing into said expansion chamber.

2. The fuel flow control assembly of claim **1**, further comprising means contacting said spring means for precalibrating the force exerted by said spring means on said second valve means.

* * * * *

Disclaimer

3,736,093.—*Cadet E. Bowman* and *Frank Hayward*, Sycamore, Ill. INTEGRAL REGULATED HAND TORCH. Patent dated May 29, 1973. Disclaimer filed June 28, 1973, by the assignee, *Olin Corporation.*

Hereby enters this disclaimer to claims 1 and 2 of said patent.

[*Official Gazette December 4, 1973.*]