

PORTABLE MIST FIRE FIGHTING APPARATUS

Field of invention

The present invention relates to a portable high pressure fire fighting apparatus using a fluid, such as water, for producing mist to extinguish fires. More particularly, the invention provides a portable, high pressure mist producing fire fighting apparatus capable of continuous/extended operation.

Background of the invention

Mist fire fighting apparatuses serve various purposes including fire extinguishment, fire suppression, fire control and temperature control. The generation of a fine mist of a fluid, such as water, cools the fire incident scene and blocks heat transfer from the fire to the objects in the fire incident scene. Additionally, the fine mist of water vapourises quickly, expands into gaseous form and displaces oxygen required for continual burning. Thus, mist has a smothering effect and cooling effect upon the fire.

Water mist fire fighting apparatuses are available either in the form of heavy duty units described in Singapore patent no. 118178 (Koe, et al) or portable self-contained units disclosed in EP patent no. EP1932566 (Renato, et al) and Chinese utility model publication no. CN201136726 (Bian, et al).

Heavy duty water mist fire fighting apparatuses are transported on wheels to the fire incident scene mainly due to the size and mass of their engines, which are essential to the generation of the high pressure mist. Such fire fighting apparatuses are available commercially, e.g., at <http://www.phirexfareast.com/MobilePortamist.html>. Such an apparatus

typically includes a high pressure hose on reel so that the mist may be generated at a distance away from the rest of the heavy duty water mist unit, which may not be possible to transport into the fire incident scene due to its size and restricted mobility.

Portable water mist fire fighting apparatuses which may be brought directly into the fire incident scene by the fire fighter is desirable for front line fire fighting. Renato, et al and Bian, et al disclose self contained units driven by pressurized air or portable power sources such as a battery. The main disadvantage of such portable water mist fire fighting apparatuses is that mist is generated from water from a contained water source which forms part of the portable apparatus, thereby limiting such units to operate intermittently for generally up to 15 minutes until the water source is depleted.

There remains a need for a portable mist fire fighting apparatus that is not limited by the capacity of its storage tank and is thereby capable of uninterrupted operation for extended duration.

Summary of the invention

The main object of the present invention is to provide an improved portable mist fire fighting apparatus that is capable of uninterrupted operation for extended duration. The mist fire fighting apparatus is capable of being carried, for example, on the back of a fire fighter like a typical breathing apparatus, to the fire incident scene, eliminating the need for a high pressure hose on reel of existing heavy duty water mist fire fighting apparatuses, and additionally is capable of receiving a continuous supply of fluid for uninterrupted operation.

In accordance with the present invention, there is provided a portable fire fighting apparatus comprising a mist generating nozzle; a fluid pressurising means having an inlet for receiving a continuous supply of fluid and an outlet for the pressurised fluid; a power source for driving the fluid pressurising means; a power transmission means to transmit power from the power source to the fluid pressurising means; a delivery means for delivery of the pressurised fluid from the outlet of the fluid pressurising means to the mist generating nozzle; a frame upon which the fluid pressurising means, power source and power transmission means are mounted, characterized in that the power of the power source and the transmission ratio of the power transmission means are set to produce a desired fluid pressure.

The fluid pressurising means is preferably a pump, the power source is preferably an engine and the power transmission means is preferably a sprocket chain. The gear ratio of the sprockets is preferably 4.33 and the power of the engine is preferably 3 hp, thereby producing a fluid pressure of at least 80 bars. The fluid is preferably water.

The frame is preferably a back-pack harness with shoulder stripes and waist cushioning. The pressurising means, power source and power transmission means mounted onto the frame are preferably enclosed within a protective housing.

An air cylinder is preferably additionally mounted on the back-pack frame for use in instances where air for breathing is not available in adequate quantities at the fire incident scene.

In other aspects of the invention, the power transmission means may be a pulley system, a belt system, a shaft system or a gear system. In another aspect of the invention, additives may be

added to the fluid or the fluid may be sea water and the power source may be a battery.

These and other underlying purposes and advantages of the present invention will be fully understood upon a perusal of the following detailed description taken in conjunction with the attached drawings.

Brief Description of the Drawings

A portable mist fire fighting apparatus in accordance with the present invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a preferred embodiment of the invention with the main components exposed.

FIG. 2 shows a perspective view of the preferred embodiment of the invention where the main components are enclosed in a protective housing.

FIG. 3A and FIG. 3B are perspective views of the mist generating nozzle of the preferred embodiment of the invention.

Detailed description of the preferred embodiment

The preferred embodiment of the invention 10, as illustrated in FIG. 1, comprises a back-pack frame 1 with an upper base 7, upon which an engine 3 is mounted, and a lower base 8, upon which a pump 4 is mounted. An air cylinder 5 is also mounted on the side of the back-pack frame 1 for use in instances where air for breathing is not available in adequate quantities at the fire incident scene.

The back-pack frame 1 is designed for rough handling due to the nature of the fire-fighting and is preferably constructed from mild-steel for such purposes. Pedestal legs 13 are affixed at the bottom of the lower base 8 of the back-pack frame 1 to allow the preferred embodiment to stand on its own when not in use.

Padded shoulder strips 11 and back-waist cushioning 12 attached to the back-pack frame 1 create a 3-point body contact for comfort and weight distribution. They further minimize contact with the components of the preferred embodiment as well as transmission of vibration from the engine 3 to the user during operation.

The engine 3 is a petrol-driven miniature 3 hp engine which is selected for its light weight, performance and compact design. The petrol engine includes a drive shaft 17 and a petrol tank 18 which delivers petrol to the engine 3 for operation. The petrol tank 18 has an inlet 19.

The pump 4 is a high pressure water pump that receives a continuous supply of water, for instance from the tap at approximately 3 bar through an inlet 15, and pressurises such water. The pressurised water exits through outlet 16 at the desired range of above 50 bar, preferably between 100 to 200 bar.

A sprocket chain 6 with a gear ratio of 4.33 connects the drive shaft 17 to shaft 14 of pump 4. The gear ratio and the power of the engine may be further adjusted to attain the desired output pressure from the high pressure pump.

As shown in FIG. 2, the components of the preferred embodiment 10 are enclosed in a protective housing 2, which is likewise mounted onto the back-pack frame 1. The protective housing 2 contains holes for pump inlet 15 and pump outlet 16.

Inlet 19 of the petrol tank 18 is exposed through the housing 2 for easy access during refilling of petrol.

As shown in FIGS. 3A and 3B, the pressurised fluid is delivered via delivery means 21 to the mist generating gun 20 of the preferred embodiment 10 which is similar to the mist gun of Koe, et al. The mist generating gun 20 includes an inner piping 30 and a convenient housing 50 for holding the inner piping 30. The housing/casing 50 includes suitable grips and may include a flash light on the top as shown. The inner piping 30 receives water by an inlet connector 32 and projects the water as mist at outlet 34. Fluid received from the inlet connector 32 is stopped from traveling through the rest of the inner piping 30 by trigger mechanism 38. It is only allowed to proceed when the trigger is depressed where it travels through the inner piping 30 to mist selector 44. The mist selector 44 diverts liquid into either pipe 40 or 42. Water directed to pipe 40 exits outlet 34 from a long throw atomising nozzle 46 which sprays the liquid as a mist such that it has a long range. Water traveling through pipe 42 exits the outlet 34 through four wide angle nozzles 48. Each of the wide angle nozzles atomises the liquid so that a wide area of mist is created from the outlet 34. It is to be understood that the term "atomising" is intended to mean separation into fine droplets, generally of less than 1 mm in droplet diameter, but preferably less than 0.1 mm and more preferably less than 0.1 mm in droplet diameter.

The performance of the preferred embodiment with the following specifications was evaluated:

Pump Specifications

L/min	U.S. g.p.m	bar	p.s.i	KW	HP	Kg	lb	R.P.M	Shaft Size (mm)	Torque (lbf-ft)
11.20	2.96	110	1600	2.20	3.00	4.80	10.60	1450	24.00	10.87

Engine Specifications

Bore x Stroke (mmxmm)	Displacement (cm ³)	Max Output (HP/RPM)	Max Torque (kg.m/rpm)	N.W/G.W (kg)	Max Output (kW/rpm)	Max Torque (lbf-ft)	Max Torque (Nm/rpm)
41.8 x 35.8	53.2	2.04/6800	0.33/4500	5.5	1.5/6800	2.38/4500	3.2/4500

A sprocket and chain gear system was selected as the power transmission means from the engine to the pump. The gear ratio of the sprockets was modified until a constant flow of pressurised water at 80 bar, the target pressure, was achieved, which gear ratio was found to be 4.3 for the engine specifications described above. A functional portable water mist fire fighting apparatus fashioned with the above components weighed about 20kg, which is deemed an acceptable weight for the user.

The present invention may be used for fluids other than water. Salt water and water with additives, such as a fire fighting foam or a wetting agent, may be used. A suitable fire fighting foam is an aqueous film-forming type.

Furthermore, the present invention applies to all water mist and water spraying nozzles whether they are used for fire extinguishment purposes or other uses, and includes nozzle designs for other liquid mediums apart from just water. The above invention also embodies the use of single orifice water mist nozzles and not just multiple orifice nozzles. Also the present invention may have other applications or uses such as, for example, spraying pesticides and chemicals for treating agricultural crops, and the inventions and concepts contained herein incorporate such applications.

Although a particular embodiment of the present invention has been illustrated and described, it will be apparent to those

skilled in the art that various changes and modifications can be made without departing from the spirit of the present invention. It is therefore intended to encompass within the appended claims all such changes and modifications that fall within the scope of the present invention.

Claims

1. A portable fire fighting apparatus comprising:

a mist generating nozzle;

a fluid pressurising means having an inlet for receiving a continuous supply of fluid and an outlet for the pressurised fluid;

a power source for driving the fluid pressurising means;

a power transmission means to transmit power from the power source to the fluid pressurising means;

a delivery means for delivery of the pressurised fluid from the outlet of the fluid pressurising means to the mist generating nozzle;

a frame upon which the fluid pressurising means, power source and power transmission means are mounted,

characterized in that the power of the power source and the transmission ratio of the power transmission means are set to produce a desired fluid pressure.
2. The portable fire fighting apparatus in accordance with claim 1, wherein the fluid pressurising means is a pump.
3. The portable fire fighting apparatus in accordance with claim 1, wherein the power source is an engine.
4. The portable fire fighting apparatus in accordance with claim 1, wherein the power transmission means is a sprocket chain.

5. The portable fire fighting apparatus in accordance with claim 4, wherein the gear ratio of the sprockets is 4.33 and the power source is a 3 hp engine and the fluid pressure is at least 80 bars.
6. The portable fire fighting apparatus in accordance with claim 1, wherein the frame is a back-pack harness with shoulder stripes and waist cushioning.
7. The portable fire fighting apparatus in accordance with claim 6, wherein the pressurising means, power source and power transmission means mounted onto the frame are enclosed within a protective housing.
8. The portable fire fighting apparatus in accordance with claim 5, wherein the fluid is water.
9. The portable fire fighting apparatus in accordance with claim 5, wherein an air cylinder is additionally mounted onto the frame.
10. The portable fire fighting apparatus in accordance with claim 1, wherein the power transmission means is a pulley system.
11. The portable fire fighting apparatus in accordance with claim 1, wherein the power transmission means is a belt system.
12. The portable fire fighting apparatus in accordance with claim 1, wherein the power transmission means is a shaft system.
13. The portable fire fighting apparatus in accordance with claim 1, wherein the power transmission means is a gear system.
14. The portable fire fighting apparatus in accordance with claim 1, wherein the fluid is water.

15. The portable fire fighting apparatus in accordance with claim 1, wherein the fluid is sea water.
16. The portable fire fighting apparatus in accordance with claim 1, wherein the fluid is water with fire fighting foam.
17. The portable fire fighting apparatus in accordance with claim 1, wherein the power source is a battery.