

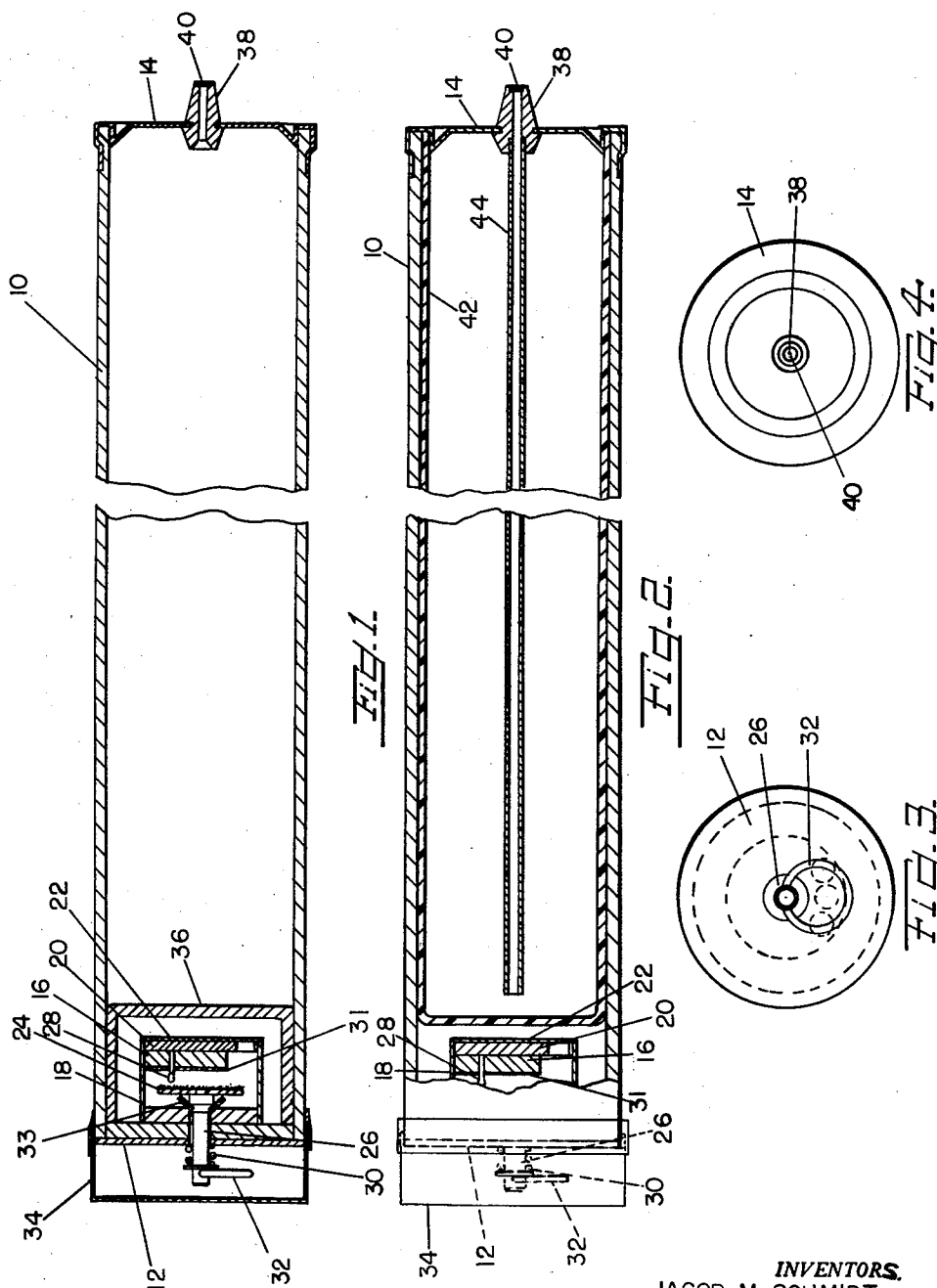
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LIQUID DISPENSER

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LIQUID DISPENSER

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This invention relates to improvements in liquid dispensers and is concerned more particularly with hand-held devices for dispensing a liquid under pressure in the form of a jet or spary, the pressure being applied at the time of operation by igniting and burning a small, self-contained charge of solid propellant.

Heretofore, hand-carried devices used for liquid sprayers, or fire extinguishers, usually have been operated by pressurizing the cylinder with a pump, a liquified gas cartridge or by a gas generated by mixing chemicals as in the acid-soda type extinguisher. Various disadvantages characterize such prior devices. Hand-pumped devices are tiring to the operator and are difficult to operate at the high pressures required for many applications. The pressurizing of a dispenser with liquified gas requires the use of a high pressure container and furthermore the final chamber pressure cannot be higher than the liquifying pressure of the particular gas employed and is, therefore, a direct function of the ambient temperature. The generation of gas by mixing of chemicals such as in the acid-soda method is limited to relatively low pressure and usually presents corrosion problems.

The general object of the present invention is to avoid the foregoing and other disadvantages attendant upon the use of prior devices and to provide a highly improved form of liquid dispensing device which is pressurized under quite different principles.

As its principal feature, the present invention provides a dispenser which is pressurized by the burning of a small piece of solid propellant. The propellant is similar to that used to give thrust to a rocket or guided missile. Such propellant, once ignited, burns uniformly across the exposed surface. The burning rate is determined partially by the ambient temperature of the propellant, but mostly by the pressure within the combustion chamber. The charge of propellant for the device described herein may be so designed as to generate gas at a sufficient rate to maintain the pressure within the dispenser fairly constant until all the liquid has been discharged, and to be completely consumed at the time the last liquid leaves the container. The rate of gas generation is determined by the area of burning surface and the duration of gas generation is determined by the thickness of the burning propellant. Thus, the dimensions of the propellant charge used depend upon its chemical composition, upon the pressure required and upon the time required to empty the particular vessel used.

Normally, the solid propellant used either in rockets or other missile or gas-generating devices is ignited by electrical means and such means or any other appropriate igniting means may be employed in the present invention. However, it is preferred that ignition be accomplished by mechanical means such as a rotary friction striker which ignites matches or other materials that ignite by friction. This, in turn, ignites a chemical mixture spread over the surface of the propellant which will burn long enough to ignite the propellant proper. The use of this mechanical striker makes it possible for the device to be completely self-contained,

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As a further feature of the invention, the dispenser may be made primarily of paper and/or plastic components and, therefore, may be quite inexpensive and expendable. We have found that paper tubes can safely hold a pressure of several hundred pounds per square inch and are sufficiently fire-resistant when properly coated so that they do not burn up during the relatively short time, for example, not more than ten seconds, that the propellant is burning. During this time the outside of the tube will become warm, but not too hot to hold with the bare hands. Thus, the operator, after igniting the propellant, needs only to hold the device to direct the stream of discharged liquid until the charge is exhausted whereupon the device may be thrown away.

Other objects and advantages will be apparent from the following detailed description taken in conjunction with the accompanying drawings wherein preferred embodiments of the principles of the invention have been selected for exemplification.

In the drawings:

Fig. 1 is a longitudinal sectional view of one form of a liquid dispenser constructed in accordance with the present invention and employing a piston follower;

Fig. 2 is a view similar to Fig. 1 but partly in section of another form of liquid dispenser constructed in accordance with the present invention and employing a collapsible bag as the follower;

Fig. 3 is a rear end view; and

Fig. 4 is a front end view, it being understood that the end views in both forms of the invention are the same.

Referring more particularly to the drawings, wherein like numerals refer to like parts, the container 10 for the liquid to be dispensed may be a paper tube, either spiral or convolute wound, preferably made impervious to the liquid present in the container 10 by impregnation or coating with any appropriate material. The rear and front end closures, 12 and 14, respectively, can be made of thin metal and held in place by crimping and cementing, such as the closure 14, or can be made of impregnated paper, pressed wood or molded plastic and cemented in place, such as the closure 12. The fuel 16 is a piece of uniformly slow-burning solid propellant that produces gas at a rate sufficient to maintain the proper pressure for expelling the liquid in the container 10. The propellant 16 is disposed inside of a small ignition or combustion chamber 18 secured to the rear inner end portion of the container 10. An apertured disc 20 may support the propellant 16 and a paper seal 22 may normally close the discharge end portion of the chamber 18, being subject to rupture by the discharge pressure when the device is operated.

The igniting means may consist of a rotatable abrasive disc 24 supported by a pin 26 and adapted to be pressed inwardly in rotating engagement with ignitable means such as a match head 28 carried by the propellant 16. The surface of the propellant 16 is preferably provided with a readily ignitable material 31 capable of sustaining a flame long enough to ignite the propellant. The match head 28 may be an ordinary safety match head and the striking surface of the disc 24 may be composed of a mixture of red phosphorus and powdered glass held together by glue. However, the invention contemplates the use of any other suitable friction ignition materials.

The rotatable disc 24 normally is held a safe distance from the igniting materials by the spring 30 bearing against a crank ring 32 provided at the extended end of the pin 26. A rubber washer 33 is preferably provided as a flexible seal around the pin 26. A tearaway paper cap 34 may be held by tape over the end closure 12 to protect the extended portion of the firing pin assembly 26, 30 and 32 until the time for operation of the dispenser when the cap 34 is pulled away, the pin 26 pressed

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inwardly against the tension of spring 30 so that the striking surface 24 is in contact with the match head 28 which is ignited upon rotation of the crank ring 32 to initiate operation of the device.

The products of combustion or gas generated by the burning of the solid propellant 16 discharge through the openings provided in the disc 20 against a piston or follower 36 which, as shown in Fig. 1, is disposed in the container 10 between the source of pressure and the liquid to be dispensed in slidable but gas-tight position along the inner wall of the container. The piston 36 may be a thin walled flexible plastic cup since the rapid transfer of heat from the hot gas to the liquid will avoid melting but, of course, the piston may be of any other suitable construction of material.

The liquid discharge nozzle 38 carried by the front end cap closure 16 of the container 10 may consist of an inner conical inlet section and an outer cylindrical exit section, as shown in Fig. 1. A seal 40 of suitable material disposed in the nozzle 38 normally holds the liquid in the container 10 and is adapted to be broken to free the discharge passage as the pressure of generated gas is applied by the piston 36 against the body of liquid to be dispensed.

In the modified form of the invention shown in Fig. 2, various parts may be the same as shown in Fig. 1, except that a follower in the form of a collapsible plastic bag 42 is employed in place of the piston follower 36. Also, since the liquid is contained within the bag 42 the walls of container 10 need not be liquid proofed and, to avoid any blocking of the discharge nozzle 40 by collapsing of the bag 42, a perforated plastic tube 44 is secured to the inner end of the nozzle 38 and extends interiorly of the container 10 for nearly the extended length of the bag 42. A helical tightly wound spring of non-corrosive metal could serve as well as a perforated tube, if desired. It will be apparent that if the bag 42, on the application of gas pressure, tends to collapse anywhere along its length before all the contained liquid is expelled, any remaining liquid can find its way into the tube 44 through the various perforations along its length thus to reach the discharge nozzle 38. It will be apparent that the modified form of the invention operates in essentially the same manner as the form illustrated in Fig. 1.

In a particularly efficient embodiment of the invention, the propellant 16 is formed of a mixture of ammonium nitrate as the oxidizer and a butyl rubber fuel with or without a ferric oxide catalyst, as disclosed in the co-pending application of Charles E. Bartley and Lawrence R. Settlement Serial No. 355,148 filed May 14, 1953. The readily ignitable surface layer 31 for the propellant 16 is a mixture of ammonium perchlorate as the oxidizer and an organic fuel binder, also as disclosed in the said co-pending application, deposited upon a fine wire mesh screen which is adapted to be flash heated by combustion of the perchlorate mixture to a red glow and in turn uniformly to ignite the relatively slower burning nitrate mixture 16. A mixture of sodium borate and water as the fire extinguishing liquid within the container 10 provides very efficient results. Elongated containers 10 having a length about ten times their width, such as thirty by three inches, operate quite successfully and in use are capable of projecting the discharged liquid a distance of sixty feet or more, being also operable when held at any angle.

It is to be understood that the present invention is not confined to the particular constructions and arrangements of parts herein illustrated and described but embraces all such modifications thereof as come within the scope of the following claims.

We claim:

1. A liquid dispenser comprising, a container for liquid, a combustion chamber disposed within one end of the container, solid propellant material in said combustion

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chamber for generating gas whereby to force said liquid through a discharge opening at the opposed end of said container and means in said combustion chamber for igniting said solid propellant material whereby to

generate said gas.

2. A liquid dispenser comprising, a container for liquid, a combustion chamber disposed within one end of said container, a solid propellant material in said combustion chamber and means carried by said one end of said container for igniting said solid propellant whereby to generate gas, the generated gas forcing said liquid through a discharge opening at the opposed end of said container.

3. A liquid dispenser comprising, a container for liquid, a liquid discharge outlet at one end of said container, a follower means in said container for forcing liquid outwardly through said discharge outlet, a combustion chamber disposed within the opposed end of said container in communication with said follower means, a charge of solid propellant material disposed in said combustion chamber and adapted to generate gas when ignited, the said generated gas actuating said follower means whereby to force liquid through said discharge outlet and means in said combustion chamber for igniting said solid propellant material whereby to generate said gas.

4. A liquid dispenser comprising, a container for liquid, a liquid discharge outlet at one end of said container, follower means in said container for forcing liquid outwardly through said discharge outlet, a combustion chamber disposed within the opposed end of said container in communication with said follower means, a charge of solid propellant material disposed in said combustion chamber and adapted to generate gas when ignited, and means carried by said opposed end of said container and operable exteriorly of said chamber to ignite said solid propellant material whereby to generate gas, the said generated gas actuating said follower means whereby to force liquid through said discharge outlet.

5. A liquid dispenser comprising, a container for liquid, having a discharge opening, a uniformly slow-burning solid propellant material in communication with said container for generating gas whereby to force said liquid from said container through said discharge opening and means for igniting said solid propellant material.

6. A liquid dispenser comprising, a container for liquid having a discharge opening, solid propellant material in communication with said container for generating gas whereby to force said liquid from said container, through said discharge opening, a layer of combustible material on a surface of said solid propellant material for uniformly igniting said surface and means for igniting said layer of combustible material.

7. A liquid dispenser comprising, a container for liquid having a discharge opening, solid propellant in communication with said container for generating gas whereby to force said liquid from said container through said discharge opening, a layer of combustible material on a surface of said solid propellant material for uniformly igniting said surface and friction ignitable means for igniting said layer of combustible material.

8. A liquid dispenser comprising, a container for liquid having a discharge opening, solid propellant material in communication with said container for generating gas whereby to force said liquid from said container through said discharge opening, friction ignitable means for igniting said solid propellant material and means for striking said friction ignitable means.

9. A liquid dispenser comprising, a container for liquid having a discharge opening, solid propellant material in communication with said container for generating gas whereby to force said liquid from said container through said discharge opening, a layer of combustible material on a surface of said solid propellant material for uniformly igniting said surface, friction ignitable means for igniting said layer of combustible material and means for striking said friction ignitable means.

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10. The dispenser of claim 5 wherein the liquid comprises a mixture of sodium borate and water.

11. The dispenser of claim 5 wherein the solid propellant material comprises a mixture of ammonium nitrate and butyl rubber.

12. The dispenser of claim 6 wherein the solid propellant material is relatively slowly burning and the layer of combustible material is relatively quickly burning.

13. The dispenser of claim 12 wherein the solid propellant material comprises a mixture of ammonium nitrate and butyl rubber and the layer of combustible material comprises a mixture of ammonium perchlorate and an organic fuel binder.

14. A liquid dispenser comprising, an elongated, portable and disposable container for liquid, a discharge nozzle at one end of said container, follower means in said container for forcing liquid outwardly through said discharge nozzle, a combustion chamber secured to the inner opposed end portion of said container and in communication with said follower means, a uniformly relatively slow-burning solid propellant charge disposed within said combustion chamber adapted to generate gas when ignited, the said generated gas actuating said follower means, and means carried by said opposed end portion of said container for igniting said solid propellant charge.

15. The device of claim 14 wherein the combustion

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chamber communicates with the follower through an opening in said combustion chamber and the said opening is normally closed by a seal subject to rupture by the pressure of generated gas.

16. The device of claim 14 wherein the discharge nozzle is normally closed by a seal subject to rupture by the pressure of liquid urged toward said discharge nozzle by the follower.

17. The device of claim 14 wherein the means for igniting the solid propellant charge comprises a friction means.

18. The device of claim 17 which includes a body of combustible material for uniformly igniting a surface of the solid propellant material and means carried by and operable exteriorly of the container for frictionally igniting said combustible material.

19. The device of claim 17 which includes a body of combustible material for uniformly igniting a surface of the solid propellant material and means pressable inwardly of said container and movable whereby frictionally to ignite said combustible material.

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