July 19, 1966 M. T. WADDELL ETAL 3,261,346

SOLID FUELED HEATER

Filed Nov. 19, 1964

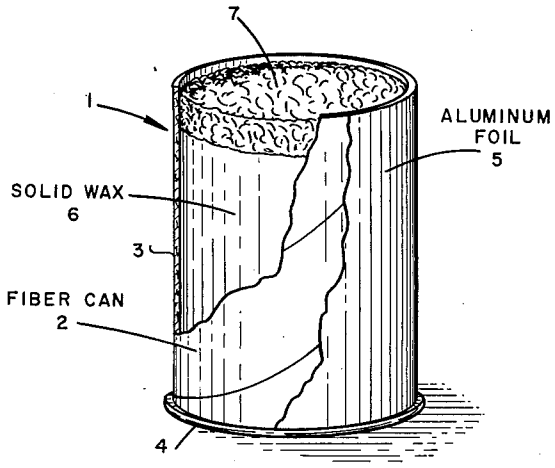


FIG. 1.

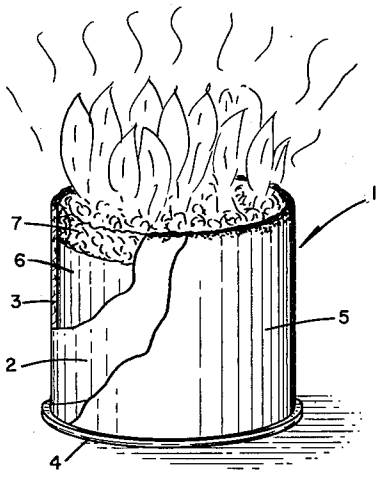


FIG. 2.

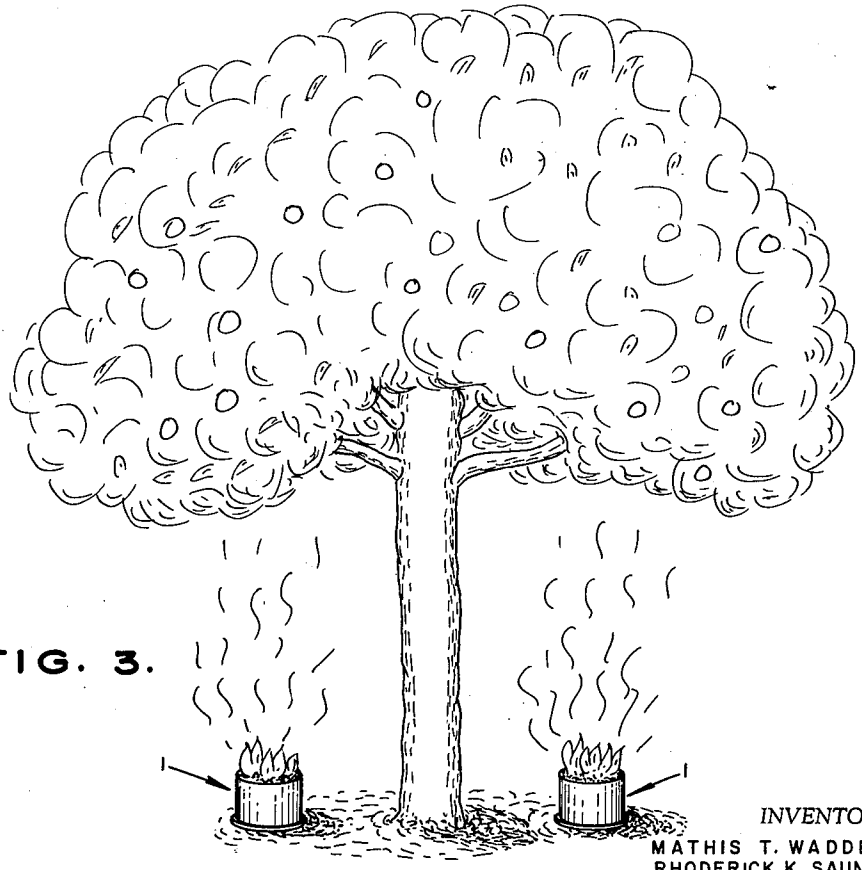


FIG. 3.

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United States Patent Office

3,261,346

Patented July 19, 1966

3,261,346

SOLID FUELED HEATER

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Filed Nov. 19, 1964, Ser. No. 412,559
8 Claims. (Cl. 126—59.5)

The present invention is directed to a solid fueled heater. More particularly, the invention is directed to a solid fueled heater which is particularly adapted for an orchard heater.

The present invention may be briefly described as a solid fueled heater which comprises a container consisting of a lower end and a body of combustible material covered with a flame-proof and water-resistant substance; a wax having a melting point above about 140° F. and a fire point above about 525° F. which substantially fills the container; and a wax-impregnated, heat-insulating, non-combustible cap in the container contiguous with the wax and conforming to the lower end of the container.

The solid fueled heater of the present invention is primarily designed to protect citrus trees from freezing. However, the heaters of the present invention (due to their size, the use of solid fuel, and available heat with low flame height) may be used in a large number of ways such as camp stoves, heaters or the like. Heretofore, devices used in an attempt to protect citrus trees from freezing have had the common purpose and design to heat the whole or at least large segments of an orchard. Such devices such as liquid fueled smudge pots and large stoves had the disadvantage of requiring careful handling of the fuel and uneven distribution of the heat throughout the orchard.

It is an object of the present invention to provide a solid fueled heater.

It is further an object to provide a solid fueled heater of a convenient size for handling and storage which is easily lit and which is safe to handle.

These and other objects and advantages of the present invention will appear more clearly from the following description setting forth the invention in detail.

The heater of the present invention comprises a container; a wax which substantially fills the container; and a wax-impregnated, heat-insulating, non-combustible cap in the container contiguous with the wax. Each element of the heater of the present invention performs a specific function so that the heater when used burns without any appreciable amount of liquid fuel being formed which may spill or leak. Thus, when the heater of the present invention is lit, the cap acts as a non-combustible wicking material which rests on the solid wax with substantially all the liquid wax contained in the cap. While the fuel is combusted and the cap moves downward in the container, the combustible container is burned away.

The container means of the heater of the present invention may be in the shape of an upright cylinder or an oblong or square box. The container consists of a lower end and a body and may, although it is not preferred, have an upper end. The lower end determines the shape of the container. The body of the container is the upright portion and is made of a combustible material which is preferably a corrugated fiber board. The outside of the body of the container is covered with a flame-proof and water-resistant substance. Suitable substances may be a thin sheet of aluminum foil covering the outside of the fiber-board body. Likewise, an aluminum paint or a silicate solution may be sprayed or painted on the outside of the body to make the body from the outside

flame proof and water resistant. Thus, the container of the solid fueled heater of the present invention is made suitable for use outside and to withstand the elements. However, the amount of flameproof and water-resistant substance placed on the outside of the body of the container does not prevent the burning of the container from the inside to the outside during the use of the heater.

The container is filled with a wax. The term "wax" as used herein is defined to include both petroleum waxes and petrolatums which are predominately saturated hydrocarbons obtained from crude oil, i.e., heavy distillates or residual materials. The wax suitable in the heater of the present invention may thus be obtained from lube oil fractions, residuums, or the like. The wax used in the present invention must have a melting point above 140° F. and a fire point above about 525° F. The preferred waxes have fire points measured by ASTM Method D–92 if between about 525° F. to 600° F. The selection of the wax is important in that for an effective heater, the flame will burn throughout the life of the heater at a desired 3 to 8 inches average height. A wax of a lower melting point than 140° F. may melt on storage or when burning excess wax will melt. When a wax of a low fire point is burned, a high flame results which tends to pulse and not burn evenly or uniformly.

The solid fueled heater of the present invention has a wax-impregnated, heat-insulating, non-combustible cap which is in the container contiguous with the wax. The cap is above the solid wax in the operating position and has the same shape as the lower end of the container. The cap may be a suitable thickness of asbestos fiber, rock wool, or other non-combustible porous material. The particular thickness of the cap used in any heater is dependent on the particular material used and with the particular wax burned as the fuel. The cap functions not only as a non-combustible wicking material but is designed to provide easier lighting since only a thin layer of wax need be heated to the fire point before fire is sustained. Furthermore, the cap reduces the thickness of the melt layer through the insulating properties of the cap so that substantially all the liquid wax is maintained within the cap. The cap also enables a more uniform flame height to be maintained even under drafty conditions and reduces the tendency of the flame to blow out. It has been found that a suitable thickness for the cap is between 1 inch and 2½ inches. In the preferred embodiments of the present invention, cap thicknesses are between about 1½ inches to about 2½ inches. The cap may be impregnated by either the wax which fills substantially all the container as fuel, or it may be impregnated with a wax which is more easily ignited than the wax used as the fuel or a mixture thereof.

In the operation of the solid fueled heater of the present invention, the wax-impregnated cap is lit and allowed to burn, thereby melting the wax impregnating the cap. Upon continued burning, the cap rests on the solid wax while allowing only sufficient wax through the cap to supply a constant flame. Thus, during the burning process, a relatively constant flame results which continuously burns the body portion of the container as the cap moves downward in the container as the wax is consumed. Thus, in the burning of a solid fueled heater of the present invention, there is very little of the body of the container above the cap and substantially all the liquid wax is contained within the cap.

The present invention will be further illustrated by reference to the drawings in which:

FIG. 1 is an isometric view of an embodiment of a solid fueled heater of the present invention, with parts cut away;

FIG. 2 is an isometric view of a partially burned heater with parts cut away; and

FIG. 3 is a schematic view of the use of the heaters of the present invention in an orchard.

Referring to FIG. 1, a specific embodiment of a heater **1** of the present invention is shown. The heater **1** comprises a container **2**, which consists of a body **3** and a cylindrical lower end **4**. The body **3** of the container is combustible. The preferred container **2** is a one-gallon fiber board can. Around the outside of the body **3** is a thin film of aluminum foil **5**. The container **2** is filled with a wax **6**, which has a melting point above 140° F. so that it is solid at room temperatures. Also within the container **2** is placed a wax-impregnated cap **7** which may be a piece of rock wool insulation material. The cap **7** conforms to the shape of the lower end **4** of the container.

The heater **1** may be constructed by taking a one-gallon container **2**, which consists of a fiber body **3** and a metal lower end **4** and filling the container with hot wax up to a point about 2½ to 3 inches from the top. The wax is allowed to cool, forming a solid wax **6**. The cap may be prepared by cutting out the proper shaped piece of rock wool or may be prepared by mixing a fibrous or powdered insulating material impregnated with either the same wax already placed in the container or another wax to form the cap **7**. If the material making the cap is in the nature of a pad, it is placed in the container before impregnating with the wax. On the other hand, if the material making up the cap is a fiber or small particle solid, it is found that it may be mixed with the wax impregnating the cap **7** and placed in the container with a trowel or spatula to form the cap **7**. It is obvious that other methods may be used in forming a heater **1** of the present invention.

In FIG. 2, there is shown a heater **1** of the present invention representing a heater which is burning, to illustrate the uniform flame height of heaters of the present invention. The heater **1** provides a flame which will burn throughout the life of the heater at about 3 to 8 inches average height. A device which has a higher flame or one which is not relatively constant has been found to be unsatisfactory, since, as illustrated in FIG. 3, the heaters **1** of the present invention are designed to be effectively used to save citrus trees from freezing. The heaters **1** are placed under the canopy of citrus trees and, therefore, constant and low flame height is necessary so that low limbs are not destroyed. The heaters **1** of the present invention produce radiant and convective heat to the individual tree and burn for a period of time sufficient to last overnight.

To further illustrate specific heaters of the present invention, the following Table I lists various heaters made in accordance with the present invention.

The containers used in the foregoing Table I had a burning area of about 33 square inches. The one-gallon cans were about 8 inches in height. As can be seen, a number of materials, namely, powdered asbestos, granulated asbestos, fiber asbestos, rock wool, rock wool batt, pieces of cotton cloth and mixtures thereof, may be effectively used to make a suitable cap for the heaters of the present invention. The waxes used in the heaters listed in Table I all had melting points above 140° F., preferably in the range of 150° to 170° F., and a fire point above 525° F., preferably in the range of 525° to 650° F., as set forth more fully in Table II below wherein the melting point, flash point, and fire point are given for the commercially available waxes used:

TABLE II

Wax	M.P., ° F.	Flash, ° F.	Fire, ° F.
"C" Petrolatum	[1] 169. 5	[2] 610	[3] 650
Bright Stock Petrolatum	[1] 169	[2] 550–580	[3] 620
Cylinder Oil Petrolatum	[1] 167	[2] 550–580	[3] 620
Mikrovan 1650	160–170	540	590
8059 Petrolatum	[1] 135–150	520	[3] 570
450 Neutral Petrolatum	[1] 151	475	[3] 525

[1] ASTM Petrolatum M.P.
[2] Flux Kerosene Free.
[3] Estimated.

It is noted that some commercial petrolatums contain oil. It is desired that, for the petrolatums to be useful as waxes for the heaters of the present invention, the amount of oil be less than 40% and preferably less than 25%. The presence of the oil tends to soften the mixture, and accordingly, petrolatums substantially free of oil are the most desirable.

The nature and objects of the present invention have been completely described and illustrated and the best mode thereof contemplated set forth. Other specific modes may be made, and accordingly, the invention should be considered in view of the following claims. What we wish to claim as new and useful and secure by Letters Patent is:

1. A solid fueled heater which comprises:
a container consisting of a lower end and a body of combustible material, the outside of said material covered with a flame-proof and water-resistant substance;
a wax having a melting point above about 140° F. and a fire point above about 525° F. which substantially fills said container; and
a wax-impregnated, heat-insulating, non-combustible cap which is in said container contiguous with said wax and conforms in shape to said lower end of said container.

TABLE I

Container [1]	Treatment [2]	Cap, Amount and Material	Wax		Comments
			Type	Wt.	
1 gal	Al foil	35 g. loose rock wool	"C" Pet	8. 6	Very good.
1 gal	do	150 g. JM #450 asbes. Unwoven cotton cloth.	"C" Pet	7. 1	Do.
1 gal	Sodium silicate	do	"C" Pet	7. 1	Best performance.
1 gal	Al foil	28 g. rock wool batt	"C" Pet	5. 6	Good.
1 gal	do	150 g. gran. asbes	450 Neut. Pet	5. 3	Steady performance.
1 gal	Sodium silicate	200 g. gran. asbes. Layer cotton cloth	Cy. Oil Pet. +450 Neut. Pet	6. 6	Good.
1 gal	Al foil	50 g. rock wool batt	Brt. Stk. Pet	6. 6	Excess liq. in wick.
⅔ gal	do	50 g. rock wool	8059 Pet	5. 3	Good.—Hard to light.
⅔ gal	do	100 g. gran. asbes 100 g. fiber asbes	8059 Pet	5. 0	Good.—Slow start.
⅔ gal	do	200 g. gran. asbes	8059 Pet	4. 8	Good.
⅔ gal	do	do	Mikrovan #1650 8059 Pet	4. 6	Good.—High flame late in period.

[1] Fiber cans.
[2] Outside of container.

Al—Aluminum.
JM—Johns Manville.
Asbes.—Asbestos.
Gran.—Granulated

Brt. Stk.—Bright stock.
Pet.—Petrolatum.
Neut.—Neutral.
Cy.—Cycle.

2. A solid fueled heater in accordance with claim 1 wherein said container is cylindrical.

3. A solid fueled heater in accordance with claim 1 wherein said container is rectangular.

4. A solid fueled heater in accordance with claim 1 wherein said wax has a melting point within the range of 150° to 170° F. and a fire point within the range of about 525° to 650° F.

5. A heater which comprises:

a container consisting of a cylindrical can consisting of a metal lower end and a fiber body, the outside of said fiber body covered with a flame-proof and water-resistant substance;

a wax having a melting point above about 140° F. and a fire point above about 525° F. which substantially fills said container; and

a wax-impregnated, heat-insulating, non-combustible cap which is in said container contiguous with said wax.

6. A heater in accordance with claim 5 wherein said cap is made of rock wool.

7. A heater in accordance with claim 5 wherein said cap is made of asbestos.

8. A heater in accordance with claim 5 wherein said wax has a melting point within the range of 150° to 170° F. and a fire point within the range of about 525 to 650° F.

References Cited by the Examiner

UNITED STATES PATENTS

1,960,288	5/1934	Sherman	67—22 X
2,168,698	8/1939	Bunt et al.	67—22
2,276,220	3/1942	La Veille	126—59.5 X
2,671,330	3/1954	Ajello	67—21

FOREIGN PATENTS

1,248	1886	Great Britain.

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