

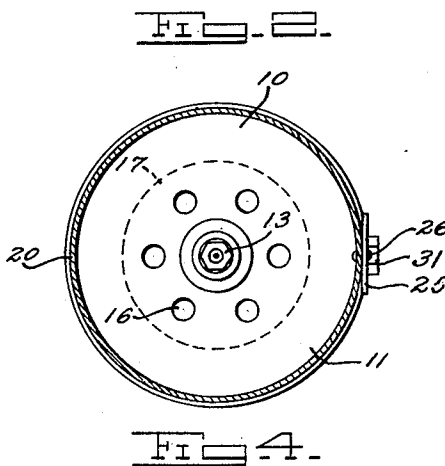
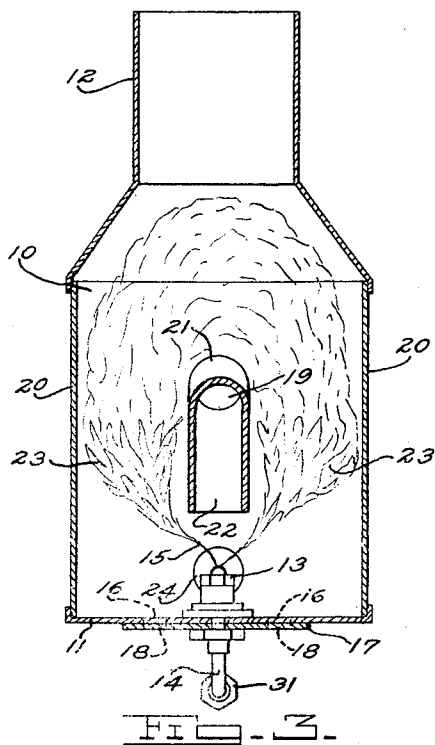
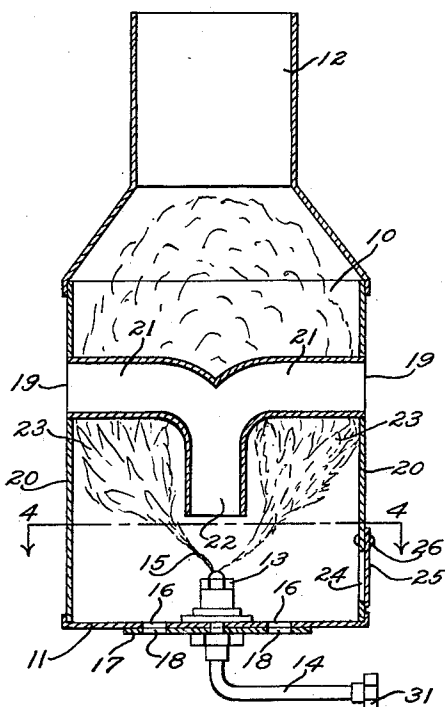
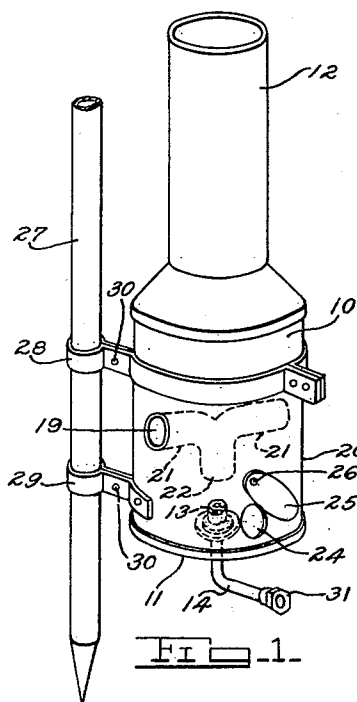
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ORCHARD HEATER

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ORCHARD HEATER

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Md.; dedicated to the free use of the People of
the United States of America

Application November 16, 1939, Serial No. 304,786

4 Claims. (Cl. 158—4)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described and claimed, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to us of any royalty thereon.

We hereby dedicate the invention herein described to the free use of the people of the United States of America to take effect on the granting of a patent to us.

Our invention relates to orchard heaters of the oil burning type. Orchard heating, by means of portable, oil-burning heaters or firepots, during occasional periods of freezing temperatures, is practiced on an extensive scale in certain sections, notably in citrus fruit producing areas. Heaters of the portable type are used, as they are required, ordinarily for only short periods, during only a small part of the year, and their presence in the orchards and groves at other times interferes with necessary cultivation and harvesting operations. Orchard heaters burning oil fuels have been found most convenient and economical and are used almost exclusively for this service. Heaters heretofore employed have been of the vaporizing type, which utilize part of the heat developed by combustion of the oil to evaporate the liquid oil into a vapor, this being the sole means of maintaining combustion in such burners. Heaters of this type are objectionable and unsatisfactory for numerous reasons. The vaporizing method of operation necessitates, for best performance, the use of fuel oils of relatively high volatility. Fuel oils of this grade are higher in cost and are in less demand than heavier grades and are consequently produced in less quantities by oil refineries. Stocks of these oils usually carried are much smaller than those of the more generally used heavier and less volatile grades. The demand for the lighter oils for orchard heating is always uncertain and irregular. During unusually protracted periods of freezing weather the supply of fuels, suitable for vaporizing type heaters, is liable to be inadequate. This condition develops just at the times when heat is most urgently needed for the protection of valuable crops against damage and loss by freezing. Even when burning the lighter oils, operation of vaporizing burners is generally attended by the production of smoke and greasy soot in objectionable amounts, and the total amount emitted by many hundreds of these heaters in simultaneous oper-

ation has, at times, resulted in serious damage, from smoke and soot, to buildings, furnishings, and other property. During unusually protracted periods of cold, when immediately available supplies of lighter oils become exhausted, the use of the heavier oils becomes almost imperative and the resulting smoke damage becomes excessive. This and the matter of providing adequate fuel storage present serious economic problems in areas where these heaters are extensively used.

A further objection to heaters now in use is the cost of stand-by labor required to keep heaters of the vaporizing type in operation. The size and fuel capacity of heaters is necessarily limited by the requirements of portability. In vaporizing heaters of the "distilling" type, vaporization is effected directly in the fuel container by heat from a portion of the flame burning low down in the heater, close to the surface of the liquid oil. In such heaters, the lighter fractions of the oil are distilled off and burned first, the residue remaining in the heater becoming progressively heavier as burning proceeds, tending to leave tarry deposits in the heater and to cause carbonization and choking up of air inlets, resulting frequently in very smoky operation or in the extinguishing of burners. Relighting of burners so extinguished is not always easy, especially after the lighter fractions of the fuel have burned off and the burner has become cooled. Heaters, of the types heretofore employed, must be more or less constantly watched and attended while in operation, choked up and badly smoking heaters cleaned and relighted, and all heaters cleaned and relighted as fuel in heaters becomes exhausted, fresh fuel being usually distributed to the heaters by hand, in buckets. The work of attending these heaters is unavoidably emergency night work of a cold, dirty, disagreeable nature.

Attempts have been made to apply pressure-atomizing burners to orchard heaters, but clean, smokeless combustion and satisfactory thermal efficiency has heretofore been attained in only those burners to which air was supplied under pressure. The cost of supplying both oil and air under pressure, to large numbers of temporarily located heaters, has made the use of such heaters uneconomical and impractical.

We overcome these objections by the invention described herein and illustrated in the accompanying drawing in which:

Figure 1 is a perspective view of an assembled

apparatus embodying the features of this invention.

Figure 2 is an elevational section of Figure 1.

Figure 3 is another elevational section of Figure 1, but in a plane disposed 90° with respect to the section shown in Figure 2.

Figure 4 is a plan section at the level indicated by the line 4-4 in Figure 2.

Like numerals refer to like parts throughout the several views.

Referring with more particularity to the drawing, the orchard heater comprises a vertical cylindrical combustion chamber 10 having a closed bottom 11 and surmounted by a stack 12 for discharging to the atmosphere heated gaseous products of combustion produced by the combustion of oil within said combustion chamber, thereby setting up a draft within said chamber. A spray nozzle 13 centrally positioned in the bottom 11 of the combustion chamber is supplied with fuel oil under pressure through an oil pipe 14 from a source of supply (not shown), and delivers upwardly into the combustion chamber a spray of atomized fuel oil in the form of a hollow inverted cone 15. Air for the first or primary stage of combustion of the oil is admitted to the combustion chamber through primary air ports 16 in the bottom 11 of the combustion chamber. The volume of primary air admitted is controlled by the adjustment of a rotatable shutter 17 having opening openings 18, which register with the air ports 16, when the shutter is rotated.

Air inlet ports 19 are provided in the sides 20 of the combustion chamber and air inlet tubes 21 connect said ports to the upper end of a down draft tube 22. The down draft tube 22 is centrally positioned in the combustion chamber 10, coaxial with the spray nozzle 13, and its lower end terminates within the hollow cone 15 of atomized oil delivered by the nozzle and in proximity to the same. The atomized oil, on being ignited, burns in an annular flame 23. The tubes 21 and 22 are in the hottest part of the combustion chamber and are surrounded by the annular flame 23 of the burning oil, so that they become heated to a high temperature. Air drawn into the combustion chamber through the ports 19 and tubes 21 and 22 is heated in passing through the heated tubes and is delivered at a high temperature within the cone 15 of oil spray, at the base of the flame 23.

By this arrangement heated secondary air for completing combustion of the oil is supplied within and at the base of the annular flame, resulting in a high combustion temperature; clean, smokeless combustion; and high thermal efficiency.

An ignition port 24 is disposed in the lower side wall of combustion chamber 10 and is provided with a swinging shutter 25, pivotally attached at 26 to the wall of said chamber, permitting a lighted torch to be inserted into the chamber for igniting the oil. The heater is mounted on a stake 27, adapted to be driven into the ground, and is secured to said stake by an upper band-clamp 28 and a lower bracket clamp 29. The bracket clamp 29 is secured to the wall 20 of combustion chamber by any suitable means, such as riveting or welding. By means of bolts 30, the clamps 28 and 29 may be tightened on the stake 27 so as to hold the heater at any desired height on the stake. A union coupling 31 on the oil pipe 14 provides means for making connection to an oil supply pipe line (not shown).

Pressure atomization of the oil fuel, in connec-

tion with thorough mixing with an adequate air supply, makes possible the use of heavier and less volatile grades of fuel oil than can be burned in orchard heaters previously employed. With pressure atomization, no residue is left behind to clog the burners, all of the oil being thrown in a finely atomized condition directly into the flame of the burning oil, thereby providing conditions highly favorable for prompt and complete vaporization of the oil. When the resulting vapor is adequately mixed with a proper quantity of air, clean smokeless combustion is attained. Forced draft, or the supplying of air under pressure, has heretofore been considered necessary to attain this result. In orchard heaters embodying our invention, this important result is attained by natural draft only, without forced draft. Our improved heater requires only that it be supplied with oil under a pressure sufficient to atomize the same, and, operating under natural draft, effects a sufficiently thorough mixing of oil vapor and air to give clean, smokeless combustion without formation of soot. With simple precautions to prevent sediment and water or other incombustibles from entering the oil supply line, cleaning or relighting of the heater is seldom necessary and large numbers of heaters may be operated from a single fuel supply with a minimum of attention, kept in continuous operation for as long as may be necessary and extinguished simultaneously, whenever desired, by simply cutting off the fuel supply.

This invention makes possible important economic savings in orchard heating. It eliminates damage from smoke and soot. It utilizes less costly and more generally available fuel of higher heating value. It reduces fuel consumption for a given duty, through higher thermal efficiency, and it reduces the amount of attendance required.

Having thus described our invention, we claim:

1. An orchard heater of the oil burning type comprising a combustion chamber, a flue surmounting said chamber, a spray nozzle within said chamber, said spray nozzle being adapted to receive fuel oil under pressure and to deliver it upwardly into said chamber in the form of a spray of atomized oil, primary air inlets below said nozzle, means for regulating the flow of air through said inlets, a down draft air tube disposed above said nozzle terminating at a point which, in operation, is within the spray of atomized oil delivered from said nozzle, and air inlet tubes connecting said down draft air tube with the exterior atmosphere.

2. In an oil-burning orchard heater the combination, with a combustion chamber and a stack therefor, of a pressure-atomizing spray nozzle, said spray nozzle being adapted to deliver upwardly into said chamber a spray of atomized oil in the form of a hollow inverted cone, and a down-draft air intake tube extending from an intake port in the side of said chamber across a portion of said chamber thence downwardly to and terminating at a point which, in operation, is within the hollow conical spray of atomized oil delivered from said nozzle, the downwardly extending portion of said tube being positioned above and coaxial with said nozzle.

3. In an oil burning orchard heater the combination, with a combustion chamber and a stack therefor, of a pressure atomizing spray nozzle adapted to deliver upwardly into said chamber a spray of atomized oil in the form of a hollow inverted cone and a down draft air intake tube

extending from an air intake port in the side of said chamber, across a portion of said chamber, thence downwardly, the downwardly extending portions thereof being positioned above and coaxial with said nozzle and terminating at a point which, in operation, is within the hollow conical spray of atomized oil delivered from said nozzle.

4. An oil-burning orchard heater comprising a combustion chamber, a stack connected to and extending upwardly from said chamber for conveying to the open air heated gaseous products of combustion generated within said chamber and thereby producing a draft within said chamber, a pressure atomizing spray nozzle adapted to receive fuel oil under pressure and to deliver upwardly into said chamber a spray of atomized oil in the form of a hollow inverted cone, a fuel oil delivery pipe connected to said nozzle, primary air inlets through the bottom of said cham-

ber adjacent to and below said nozzle for admitting air into said chamber for partial combustion of the atomized oil, an adjustable shutter in cooperative relation with said air inlets for regulating the effective capacity of said inlets, a secondary air inlet port in the wall of said chamber, an air intake tube extending from said port to a point above said nozzle thence downwardly toward said nozzle with the downwardly extending portion of said tube positioned coaxially with respect to said nozzle and terminating at such height above said nozzle that, in operation, air drawn through said tube into said chamber by the draft therein produced will be delivered within and in proximity to the hollow conical spray of atomized oil discharged from said nozzle.

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