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JACKETED COOKING VESSEL
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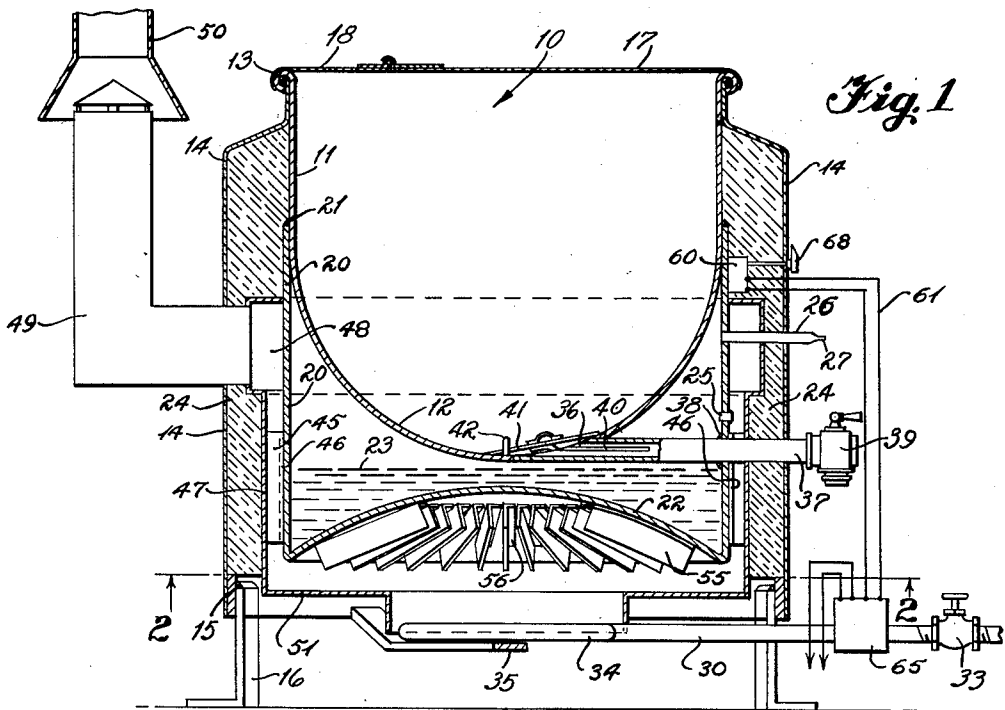


Fig. 1

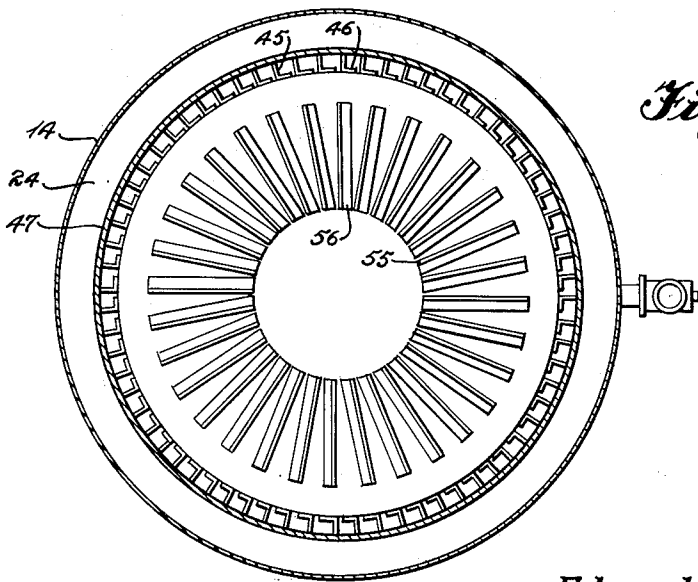


Fig. 2

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JACKETED COOKING VESSEL

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3 Claims. (Cl. 126—378)

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The present invention relates to apparatus for heat treating materials. More particularly, the invention relates to an apparatus for raising materials to a predetermined, adjustable temperature and for maintaining them at that temperature, or at different desired, higher or lower temperatures, with greater accuracy of control than has been possible heretofore.

A primary object of the invention is to provide a heat treating apparatus, such as a cooking vessel or kettle, of greatly simplified construction, which is more efficient in use than devices heretofore provided for the same general purpose.

Another object of major importance is to provide, in a device of this character, an improved and more efficient heat exchange system, to the end that, for a particular heating operation, less heat input is required.

A further object is to provide apparatus which is in some respects similar to steam jacketed kettles now in use for the cooking, heating and storing of comestibles and the like, but which is less complicated, cheaper to manufacture, simpler to install, and easier and more economical to operate than those now in use.

Another object is to provide apparatus of this class which has improved safety factors, which is substantially everlasting in use and in which repairs and replacements of parts are substantially never required.

In the past, steam jacketed kettles have been widely used in the food processing and packing industry, in restaurants and hotels, and in chemical manufacturing and allied industries. Such prior devices, for the most part, consist of large, complicated, permanent installations, including kettles, jackets, water supply systems, valves, sight glasses, gauges, heating means and more or less complicated control devices therefor. In many areas, special water softening and purifying devices are necessarily employed for the make-up water, to prevent fouling of the boilers, pipes, jackets, or the like. In other installations, complicated steam piping and condensate return lines are employed, while in others, water lines, and gas or other fuel pipes leading to the individual kettles are employed.

In accordance with the present invention, the construction of the kettles and the installation accessories are greatly simplified. The kettle itself is a unitary, self-contained, portable device. Water supply, steam supply and condensate return pipe lines are entirely eliminated and the only auxiliary equipment required is a source of heat and a control valve or the like associated therewith. Of course, in large installations, if a flame is used as the source of heat, a flue should be provided for carrying off the products of combustion, as is well understood.

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Essentially, the apparatus of the invention consists of a kettle, vessel, or other container of substantially conventional design, having associated therewith a jacket of gas and liquid impervious material, such as stainless steel or other suitable metal, continuously welded to the vessel and providing an hermetically sealed space surrounding a portion thereof. The space is completely evacuated (within practical limits) of air and other non-condensable gases, and is partially filled with a vaporizable and condensable liquid, such as water, so that the space is completely filled with this material, partially in liquid phase and partially in vapor phase. The level of the liquid, at atmospheric temperatures should be below the bottom of the vessel, so that the entire surface of the vessel within the jacket is in contact with the vapor phase material. Because of the low pressure in the jacket at atmospheric temperature, the liquid is always at its boiling point, with the result that the application of the smallest amounts of heat to the liquid causes boiling thereof and condensation of a corresponding amount of vapor on the walls of the vessel, thereby effecting a transfer of heat from the source, evenly to the entire surface of the vessel exposed to the condensable gas.

As a result of the entire elimination of non-condensable gas, such as air, the efficiency of the heat transfer system is greatly increased, as is well understood in the steam turbine and allied arts.

The invention provides a construction which has the following advantages, among others; heat may be transferred from a suitable source to the material to be treated at any temperature from room temperature up to any practical limit; precise surface temperature control is easily obtained by regulating the absolute pressure in the jacket; an extremely simple, factory completed, steam jacketed kettle is provided, requiring only a source of heat for operation; the application of heat to the liquid in the jacket results in instant heat transfer because the heat transfer liquid in the jacket is always at its boiling point and the application of the slightest heat generates vapor; the apparatus is inherently simple and inexpensive, since it requires no vent valves, trap, pop valves, water glasses, trycocks, low water cut-off devices, water make-up system, water treating system, blow down, or packing glands, only a safety device such as a shear disk of fusible plug being required; heat transfer rates on the vapor side are materially increased due to the absence of non-condensables in the vapor and the absence of impurities in the liquid; corrosion problems within the boiler or jacket are eliminated; maintenance and parts replacement are at an ir-

reducible minimum; and space requirements are likewise reduced because of the absence of numerous auxiliary devices and accessories.

Other and further objects and advantages of the invention will be apparent from a consideration of the following description of certain specific embodiments, shown for purposes of illustration in the accompanying drawings, in which

Figure 1 is a somewhat diagrammatic, vertical sectional view of an apparatus; and

Figure 2 is a horizontal section taken substantially on line 2—2 of Figure 1.

Referring to Figure 1, a seamless metallic vessel or kettle 10 having a cylindrical side wall 11 and a substantially semi-spherical bottom 12 is supported at its upper end 13 by a metallic casing 14, carried by a circular frame 15 having floor supported legs 16 secured thereto. The upper edge 13 of the vessel may be in the form of a curled bead embracing the upper end of the casing 14, or the parts may be otherwise joined. A cover 17, having an upwardly opening hinged section 18 may be removably secured to the upper, open end of the vessel in any approved manner.

The bottom portion 12 of the vessel 10 is enclosed within a jacket of suitable gas and liquid impervious material, such as stainless steel, having a cylindrical side wall 20, continuously welded at its upper end 21 to the side wall 11 of the vessel, and a circular bottom 22, which may be in the form of a section of a sphere and upwardly concaved, as shown, to increase the strength and effectively to withstand pressure differentials on opposite sides thereof.

The space or chamber within the jacket is partially filled, for instance to the line 23 with a readily vaporizable liquid, such as water, and the space thereabove is substantially completely evacuated of air and non-condensable gases, with the result that it is filled with the same material as the liquid, only in vapor phase.

Within the casing 14, there is a body of heat insulating material 24, filling the space between the casing at the upper end thereof, but spaced from the side wall 20 of the jacket, to provide an area of suitable size for the circulation of heat produced by the heating means described below.

The side wall 20 of the jacket is provided with a suitable bore, in which is hermetically sealed a fusible plug 25, the material of which will melt at a predetermined temperature, above that normally produced within the jacket, but well below the temperature which would result in sufficient pressure within the jacket to cause an explosion. If desired, a conventional pressure release, shear disk-type of safety device may be used instead of the fusible plug. Since both are equivalents, either may be employed.

In another bore in the side wall of the jacket, a pipe 26 is welded or otherwise hermetically sealed. Through this pipe, the air within the jacket may be exhausted, during the process of initial manufacture, for instance, by repeatedly boiling the liquid in the jacket, withdrawing the air and vapor, cooling the liquid and connecting the pipe to an efficient vacuum pump. When the air and non-condensable gases have been so withdrawn, the end 27 of the pipe may be pinched and welded closed, to prevent the re-admission of air into the jacket.

The pipe 30 leads from a suitable source of fuel supply, such as gas, through a manual valve 33, to the adjustable control mechanism 65, described below, and then to a suitable burner 34,

positioned beneath the jacket and supported by a cross-bar 35, carried by the frame 15 of the casing. An appropriate pilot light, not shown, may be employed with the burner, as is well understood in the art.

The bottom 12 of the vessel 10 may be provided with a discharge opening 36, communicating with a discharge pipe 37, extending through the side wall 20 of the jacket and hermetically sealed, as by a continuous weld 38 thereto, and thence through the insulation 24 and the casing 14. The outer end of the discharge pipe 37 may be provided with a conventional discharge valve 39, while the inner end is covered by a strainer 41 held in place by a stem 40 and a lug 42.

To the exterior surface of the side wall 20 of the jacket are welded a plurality of vertically extending, radially projecting fins 45, which may be L-shaped in cross-section, with their inner legs 46 welded to the jacket wall. The radially outer ends of the fins are enclosed within a circular casing 47, terminating at its upper end in a collector ring 48, communicating with a flue 49 of conventional construction, leading to a stack 50 or the like. The collector ring and casing 47 are mounted within the outer casing 14 and are surrounded by insulation 24. At its lower end, the casing 47 may be provided with an inwardly projecting, centrally apertured plate 51, serving to confine the products of combustion from the burner 34.

The concave bottom 22 of the jacket has welded to its undersurface a plurality of radially arranged, heat absorbing fins 55, with their inner flanges 56 in contact therewith. The fins 55 and 45 provide a greatly extended heat exchange surface, and make it possible for the jacket to absorb greater amounts of heat and to produce higher rates of heat transfer than is possible with smooth surfaces.

The control device for this form of the invention may be of the temperature responsive type, consisting of an adjustable thermostat switch 60, positioned in heat exchange relation to the interior of the jacket, for instance by being mounted upon the exterior of the side wall thereof, connected in an electric circuit 61, with an electrically operated valve 65, which may include a solenoid or the equivalent for opening and closing a valve in the gas pipe 30 leading to the burner 34, depending upon the opened or closed position of the adjustable thermostat switch 60.

If desired, a motor controlled valve may be employed, to open and close the gas line variable amounts, depending upon the temperature conditions of the thermostat 60, the latter being adapted to control a variable resistance or the like. The adjustment of the thermostat 60, of whatever type may be employed, is effected by a pointer 66, extending through the side wall of the casing 14.

It is thought that the operation of the apparatus of the invention will be readily understood by those skilled in the art, from the foregoing description.

The indicator 68 is positioned at the desired point, depending upon the temperature desired in the kettle 10, and, with the kettle filled with the material to be heated, the gas flame is ignited. The heat transfer to the bottom and side walls of the jacket causes the liquid within the hermetically sealed space or chamber to boil. The hot vapors are quite promptly condensed upon the cooler surface of the bottom 12 of the vessel, thereby transferring their heat of condensation

to the vessel and raising its temperature. As the temperature of the vessel bottom rises, condensation proceeds at a slower rate and the temperature and the pressure of the gases within the jacket is raised. This action continues until the desired temperature is reached, at which point the heat transmitted to the adjustable thermostat 60 will partially or completely close the valve 65, thereby diminishing or cutting off the supply of heat. The apparatus substantially immediately reaches a condition of balance, under which just enough gas is delivered to the burner to supply the amount of heat necessary to maintain the desired temperature and pressure conditions within the jacket and, hence, within the kettle. The adjustment of the thermostat 60 may be changed at any time, by manual action or the like, and the action of the burner will be correspondingly changed to produce the desired temperature and pressure conditions.

In many cases the use of other materials than water within the jacket space or chamber is preferred. Liquid having higher or lower boiling points than water are advantageous in certain cases, depending upon the range of temperatures to be produced and maintained, and other factors. For instance, various low boiling point alcohols result in certain advantages, particularly where accuracy of control at low temperature is desired. The boiling point of the material being low, the pressure within the jacket is greater at relatively low vessel temperatures, e. g. 135-165° F., and the relatively high pressure is more effective in controlling the heat applying means, to maintain the temperature within a narrow range, than would be the case with higher boiling point liquids and lower pressures in the jacket space.

Hence, the invention is not limited to the use of any particular liquids and vapors within the jacket space. Alcohols are suitable, as well as dowtherm (a mixture of diphenyl and diphenyl oxide), carbitol, and the like.

Another advantage flowing from the use of apparatus in accordance with the present invention is the efficient heat insulating characteristics of the jacket associated with the vessel. The jacket space, being evacuated of air and non-condensable gases prevents the transmission of heat from the kettle contents to the exterior, when the heat is turned off.

It must be understood that the invention is not limited to the specific details of construction shown in the accompanying drawings and described above, but includes all modifications, coming within the scope of the appended claims and their equivalents.

We claim:

1. A unitary, self-contained, substantially portable apparatus for heating materials, comprising a vessel adapted to receive the materials, a jacket enclosing at least a portion of the vessel and continuously welded thereto, thereby providing an hermetically sealed space surrounding said portion of the vessel, said space being evacuated of air and non-condensable gases, a body of liquid partially filling said space, said jacket having a cylindrical side wall and a circular bottom, and a plurality of vertically extending, outwardly projecting, heat absorbing fins secured to its side wall, a casing of heat insulating material enclosing the jacket, in spaced relation thereto, adjacent the outer edges of the fins, a collector ring within the casing at the upper ends of the fins, and a burner below the jacket for heating the

liquid in said hermetically sealed space and for the uniform transfer of heat to the vessel by the condensation of vapor thereon.

2. A unitary, self-contained, substantially portable apparatus for heating materials, comprising a vessel adapted to receive the materials, a jacket enclosing at least a portion of the vessel and continuously welded thereto, thereby providing an hermetically sealed space surrounding said portion of the vessel, said space being evacuated of air and non-condensable gases, a body of liquid partially filling said space, said jacket having a cylindrical side wall and a circular, upwardly concaved, substantially hemispherical bottom, a plurality of radially arranged downwardly projecting, heat absorbing fins welded to the under-surface of said bottom, a casing of heat insulating material enclosing the jacket, and a burner below the bottom of the jacket for applying heat through the fins and the bottom to the liquid in said space for the uniform transfer of heat to the vessel by the condensation of vapors thereon.

3. A unitary, self-contained, substantially portable apparatus for heating materials, comprising a vessel adapted to receive the materials, a jacket enclosing a portion of the outer surface of the vessel and continuously welded thereto, thereby providing an hermetically sealed space surrounding said portion of the vessel, said space being evacuated of air and non-condensable gases, a body of liquid partially filling the space, said jacket having a cylindrical side wall and a circular, upwardly concaved, substantially hemispherical bottom, a plurality of vertically extending, heat absorbing fins welded to its cylindrical side wall, and a plurality of radially arranged heat absorbing fins welded to the concave undersurface of its bottom wall, a casing of heat insulating material enclosing the jacket, in spaced relation thereto adjacent the outer edges of the fins, a gas collector ring at the upper ends of the vertical fins, and a burner below the jacket for transferring heat to said liquid through said fins and the bottom and side walls of the jacket.

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