United States Patent [19]

Pava

[11] **3,874,365**

[45] **Apr. 1, 1975**

[54] **SELF-CONTAINED IMMERSION EXOTHERMIC FUEL CHARGE**

[76] Inventor: **Thurman Pava,** 126 Woodside Ter., Springfield, Mass. 01108

[22] Filed: **July 10, 1974**

[21] Appl. No.: **486,951**

[52] **U.S. Cl.** **126/263,** 126/367, 44/38, 252/70

[51] **Int. Cl.** **F24j 1/00**

[58] **Field of Search** 126/367, 263; 149/15, 16; 44/38, 40; 252/70

[56] **References Cited**

UNITED STATES PATENTS

2,953,443	9/1960	Lloyd	44/3
3,527,201	9/1970	Epstein	126/263
3,549,436	12/1970	La Rocca	149/15
3,811,422	5/1974	Olson	126/263

Primary Examiner—Carroll B. Dority, Jr.
Assistant Examiner—Larry I. Schwartz
Attorney, Agent, or Firm—Chapin, Neal and Dempsey

[57] **ABSTRACT**

An immersion heater having a combustible heating charge in helical tubular form. The heating charge is form-stable and constituted of a combustible composition in unitary helical configuration. A refractory material is interposed between each convolution of the heat generating helix. In the preferred form of the invention, the heating charge is bonded to the inner wall of a tubular receptacle for immersion in a medium to be heated in its container.

6 Claims, 3 Drawing Figures

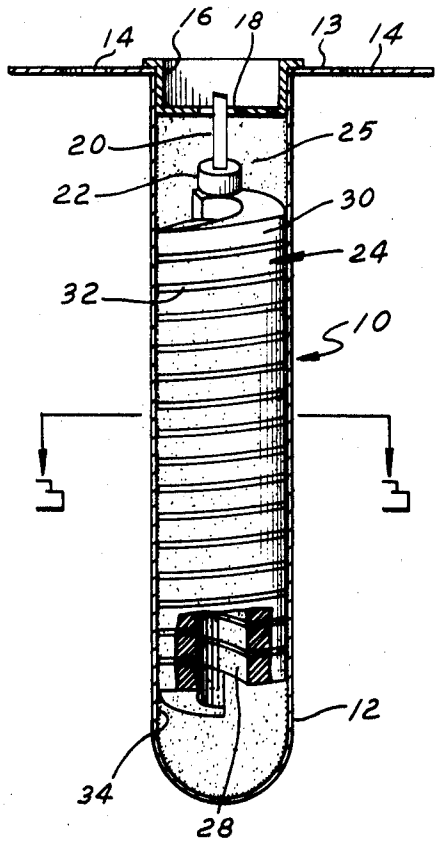


Fig. 1.

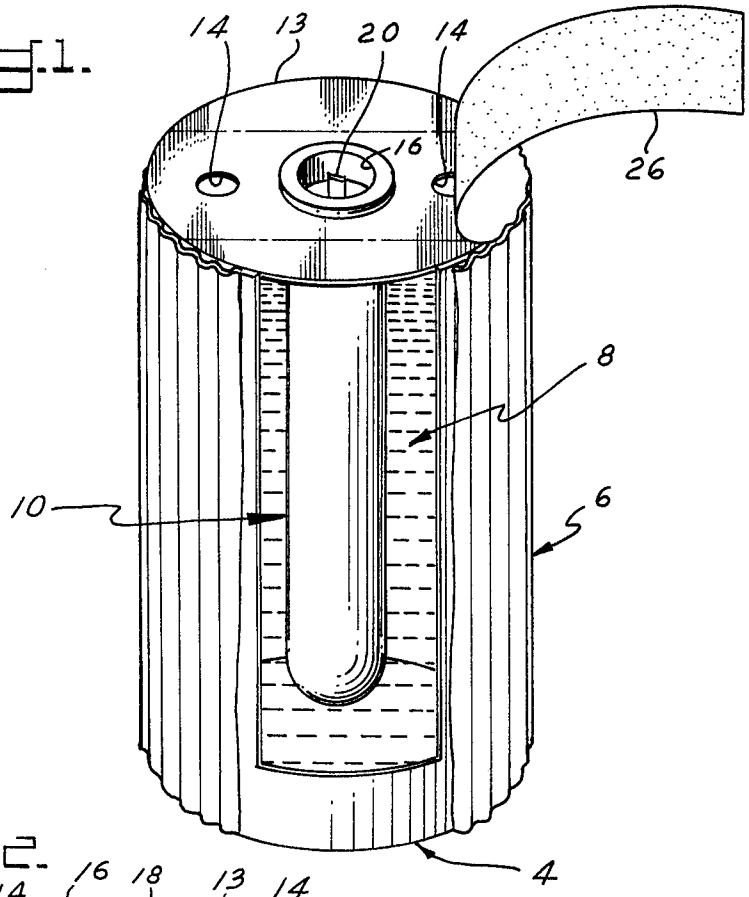
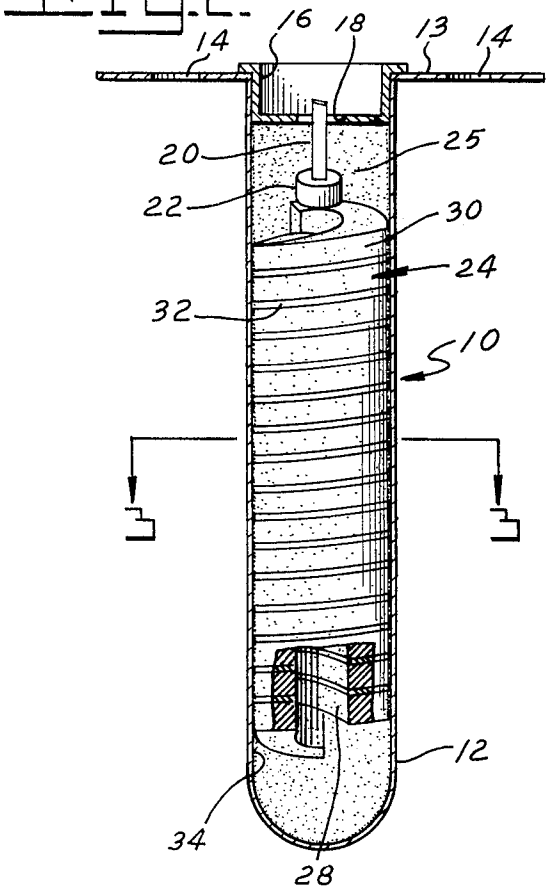


Fig. 2.



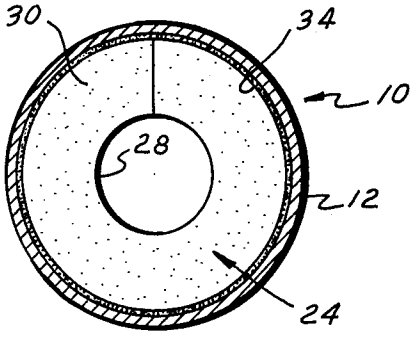


Fig. 3.

SELF-CONTAINED IMMERSION EXOTHERMIC FUEL CHARGE

BACKGROUND

For a number of years attempts have been made to produce a solid fuel charge for use as an immersion heater capable of heating beverages or foods in the container in which they are packaged so as to provide a convenient, safe, reliable, inexpensive self-heating package which will meet with wide market approval.

A number of suitable combustible compositions containing their own source of oxygen have been provided for such immersion heaters. These are disclosed in numerous prior art patents, including U.S. Pat. Nos. 802,256, 2,384,278, 2,388,466, 2,953,443, 3,527,021 and British Pat. Nos. 8642 of 1915 and 816,512.

In general, the approach heretofore utilized in such selfheating containers was to heat the outside walls of the container. This approach proved too slow and too expensive and the containers were generally too heavy and too bulky.

Another significant approach was to use an immersion heater, and while this proved to be advantageous from the standpoint of heating efficiency, the fuel compositions used were generally characterized by too violent or rapid combustion. Attempts to overcome this problem involved the use of heavy fuel holders, heat sinks and the construction of special heating chambers divided by partitions to slow combustion. In addition, various exothermic compositions were used in an attempt to provide controlled burning. None of these approaches for one reason or another was found entirely acceptable in the market place.

The principal object of this invention is to provide an immersion type heater which is safe, reliable, compact, easy to use and relatively inexpensive to produce.

Another object of this invention is to provide a food or beverage package with a built-in self-contained heater so that the contents of the container can be completely heated anywhere indoors or outdoors to provide a convenient hot meal or beverage without the need of any utensiles or heating equipment.

A further object of this invention is to provide a food or beverage container of the above type constructed so that in order to initiate combustion one must of necessity vent the container to prevent pressure buildup from heating the contents of the container.

The above and other objects and advantages of this invention will be more readily apparent from the following description and drawing, in which:

FIG. **1** is a perspective view partially in section of a type of beverage container embodying the invention;

FIG. **2** is a cross sectional view showing the immersion heating element removed from the container of FIG. **1**; and

FIG. **3** is a section taken along line **3—3** of FIG. **2.**

Referring now in detail to the drawing, in FIG. **1** is shown a can or container **4,** such as a sealed cylindrical receptacle, which may be fabricated of any suitable material, such as metal or plastic and may be an ordinary tin plated food or beverage container in which foods and beverages are hermetically sealed for preservation, shipment and marketing. A sleeve of insulating material is shown about the circumference of the container **4** and serves to insulate the container against too rapid heat transfer from the contents of the container. Moreover, the sleeve enables handling of the container without danger of the user being burned, even though its contents are hot. The sleeve may be any suitable insulating material, including polystyrene foam, corrugated fibrous sheet material or the like and may be perforated to enable safe handling, while at the same time providing good heat transfer from the metal container should the heating composition be ignited when the container is empty. A sleeve is shown at **6.**

In the embodiment shown, the container **4** is filled with a supply of liquid **8** which is to be heated by the immersion heater shown generally at **10.** The immersion heater **10** comprises an upwardly opening cylindrical tube **12** having a closed lower end. At its upper end the tube has an outwardly extending flange **13** which forms or is joined to the top wall of the container **4.** A pair of ports or holes **14** are provided through the top wall **13** of the container to provide means for venting the container to prevent excess pressure buildup when the liquid **8** is being heated. A closure member or cap **16** is fitted into the upper end of the tube **12** and includes a central aperture **18** through which extends the upper end of an igniter strip or fuse **20.** The lower end of the fuse **20** terminates in an igniter head **22** engaged with a solid combustible fuel charge **24** disposed within the tube **12.** A suitable gas permeable refractory insulation **25** may be packed around the fuse **20** and igniter **22** to secure the latter in place within the heater tube **12** and serves as a flame suppressor and smoke filter.

A closure strip **26,** which may be fabricated of any suitable material, such as plastic or metal foil having its undersurface coated with a suitable adhesive or bonding agent, removable seals over the vents **14** and also over the upper end of the fuse **20.** The vent ports are disposed on diametrically opposite sides of the hole **18** in the upper end of the heater tube **12.** Therefore, to uncover the fuse **20** one necessarily also uncovers the ports **14.** This safety feature prevents ignition of the fuse strip **20** without venting the container to the atmosphere, thereby preventing pressure buildup in the container as a result of heating its contents.

The heating charge **24,** best seen in FIGS. **2** and **3,** is in the form of a cylindrical tube having a central bore **28** extending therethrough from end-to-end. The charge, while integral, is composed of two interfitted or mating helices, one axially offset from the other. The outer helix **30,** in an axial direction, is a solid, integral fuel train in helical configuration with each convolution thereof separated from the adjacent convolution by a convolution of a skeleton or inner helix **32.** The inner helix is also in unitary form and composed of a suitable refractory material which will prevent combustion in one layer of the fuel train from advancing linearly in an axial direction of the charge. As a consequence, combustion, which starts at the igniter **22,** will follow a helical path, starting at one end of the fuel train and advance continuously to the other end.

Preferably fuel charge **24** is retained in fixed location in the tube **12** in uniformly spaced relation with respect to the inner surface of the tube. This is achieved by a thin layer **34** of refractory mortar or sand bonded to the inner wall of the tube. The refractory layer **34** provides a insulating barrier layer which protects the thin metal tube **12** against becoming overheated from direct contact with the "Thermit" mixture. In addition, the layer **34** serves to retain the fuel charge **24** in fixed position within the tube **12.**

The fuel charge **24**, embodying this invention, burns at a controlled rate so that the maximum temperature encountered at any point within the tube **12** is maintained well below the melting point of the tube. Indeed, when a fuel helix as described was burned in a steel fuel holder or tube **12** surrounded by air at room temperature, having a wall thickness of 0.01 inch and the wall coated with a thin layer of refractory material **34**, the fuel holder did not melt. As a result, it has been found that relatively low cost, highly exothermic materials can be safely used in combination with low cost, lightweight, thin wall fuel holders.

The fuel charge **24** may be fabricated in any suitable manner, such as by feeding alternate layers of the combustible mixture which will form the layers of the helix **30** and the refractory mixture which will form the layers of the helix **32** into a rotating mold or directly into the fuel holder.

The refractory skeleton **32** may be formed of any suitable material which will retain its helical configuration and be of sufficient integrity to support the burning convolutions of the fuel helix and insulate one convolution of the fuel train from the other so that direct axial transgression of combustion from layer to layer is prevented. The refractory convolutions of the skeleton **32** may be formed of any suitable material to provide such insulation, including refractory mortar or sand with suitable binder of sodium silicate to insure form stability of the helix **32.**

The fuel helix **30** embodying this invention may be a mixture of iron oxide, aluminum, widely known as Thermit and inert filler, such as sand, with a sodium silicate to bond the other constituents into helical cylindrical tubular configuration. The amount of inert filler, such as sand, and selection of its particle size from fine to coarse are variables which may be controlled to achieve the desired combustion rate. Using a fuel charge made in accordance with this invention, the combustible helix **30** supported by the refractory skeleton helix **32** will retain its helical configuration throughout the combustion during which the Thermit mixture reacts with very high temperatures over 3000° F. The fuel charge **10** is thus characterized as form stable prior to, during and after combustion, thereby preventing agglomeration of molten residue or slag which might tend to concentrate heat at one location in tube **12.** This is an important safety factor, especially if the container is empty, as in the case of a defective container from which the liquid contents have leaked out. Even in this unusual situation, the heater embodying this invention will not pose a danger to the user.

To use, the sealing or closure strip **26** is simply grasped at one end and peeled from the top of the container. In so doing, the fuse **20** is exposed and simultaneously the ports **14** are uncovered, thus venting the contents of the container. The fuse **20** may then be ignited by any ordinary match, cigarette lighter or the like. The igniter **22**, which may be in the nature of an enlarged match head will also be ignited and cause the upper end of the fuel train helix **30** to commence combustion. Burning will advance helically around the fuel charge at a controlled rate so that the contents of the container will be rapidly but safety heated. Since the immersion heater **10** is disposed generally in the center of the container, efficient heat transfer to the contents is achieved. Any steam evolved will be vented by ports **14.** During combustion, the bore **28** serves to vent the burning fuel charge through the port **18** provided in the cap **16.**

During and after combustion the combustible helix retains its helical form and remains fixed in place in the fuel holder **12.** As a result, when the contents of the container is liquid, boiling will occur in a very short time without danger of excessively high temperatures melting the relatively thin wall forming the fuel holder **12.** When the liquid has been heated, it may be poured into a suitable serving vessel, using one of the vent ports **14.** If the liquid is water, it may be used for making instant soup, coffee, tea or other beverage.

Having thus described my invention, what is claimed is:

1. Immersion heater comprising a heating charge, including a combustible mixture of unitary helical configuration and a refractory material interposed between adjacent convolutions of the combustible mixture, said heating charge being of tubular cross section from end to end and disposed within a receptacle.

2. Immersion heater as set forth in claim **1** in which said heating charge is form stable during and after combustion.

3. Immersion heater as set forth in claim **2** in which said receptacle is tubular and said heating charge is bonded to the inner wall of said receptacle and being spaced therefrom by a layer of refractory material.

4. Immersion heater as set forth in claim **2** in which said combustible mixture is composed of a mixture of iron oxide, aluminum, refractory filler and a binder to hold the constituents thereof in said form stable condition during and after combustible reaction of the mixture and in which said refractory material is in helical form and serves as a skeleton for the combustible mixture.

5. Immersion heater as set forth in claim **3** in which igniter means is provided for igniting said combustible mixture, said igniting means including a fuse extending outwardly of said tubular receptacle.

6. Immersion heater as set forth in claim **5** in which said heater is disposed within a sealed container for holding a beverage or food to be heated, said container having vent means opening through the top wall thereof, and a sealing strip removably bonded to the top wall of said container sealing said vent means and preventing access to said fuse whereby removal of said sealing strip provides access to said fuse and simultaneously vents said container.

* * * * *