United States Patent

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[72] Inventors **John Ayres**
Mountainside;
Irving Reich, Princeton Junction, N.J.

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[73] Assignee **Carter-Wallace, Inc.**
New York, N.Y.

[54] **HEATER FOR AEROSOL FOAM-DISPENSING CONTAINERS**
7 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **219/214,** 219/10.49, 219/10.51, 219/307, 222/146, 239/135
[51] **Int. Cl.** **B67d 5/62,** H05b 5/00
[50] **Field of Search** ..... 219/10.49, 10.51, 300, 307, 301, 214; 222/146, 146 (HE); 222/146 (HA); 239/135

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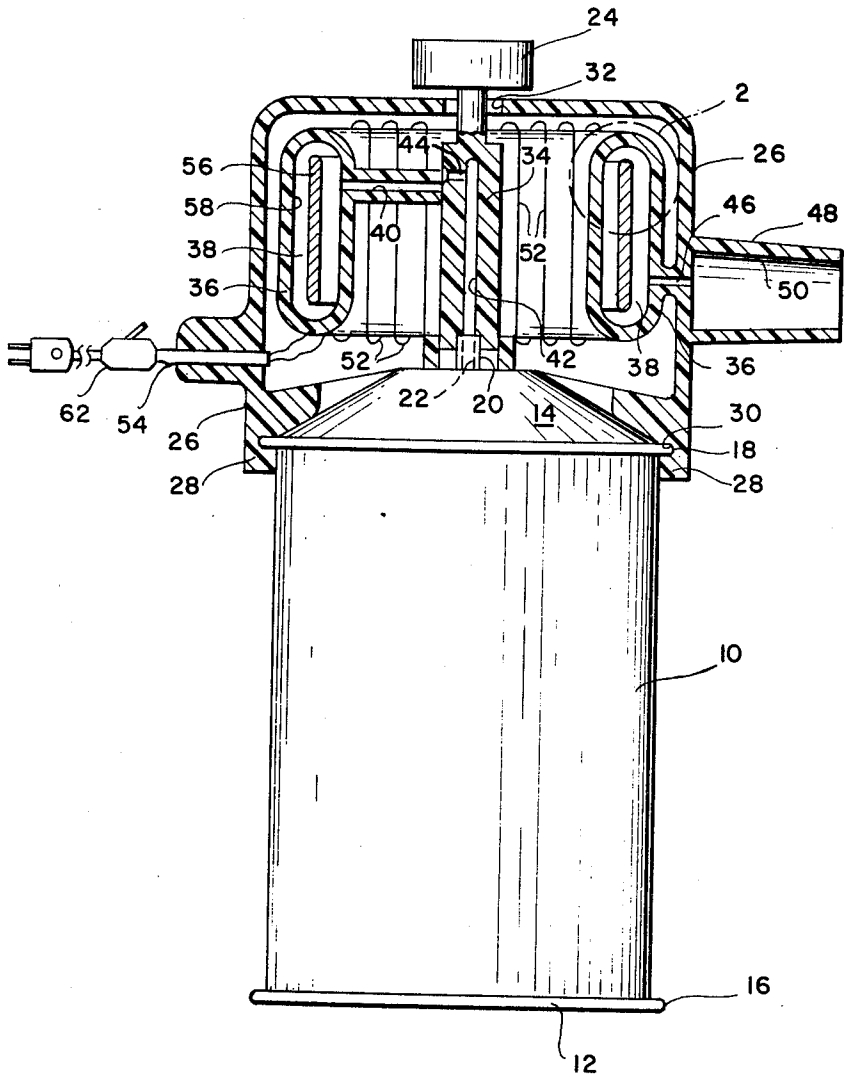
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Primary Examiner—A. Bartis
Attorney—Morgan, Finnegan, Durham & Pine

ABSTRACT: An electric heating device for heating foam products as they are discharged from an aerosol container by passing the foam in direct contact with the hot surfaces of the secondary winding of a stepdown transformer. The device includes a housing having an inlet admitting pressurized foam from the aerosol container and an outlet for discharge of unpressurized foam. A toroidal shell mounted in the housing forms an annular flow path between the inlet to the outlet. The stepdown transformer includes a multiturn primary wound about the outer surface of the shell and a cylindrical iron core centered within the shell and a single-turn closed secondary winding that is formed by a thin plating of cadmium or copper on the core.



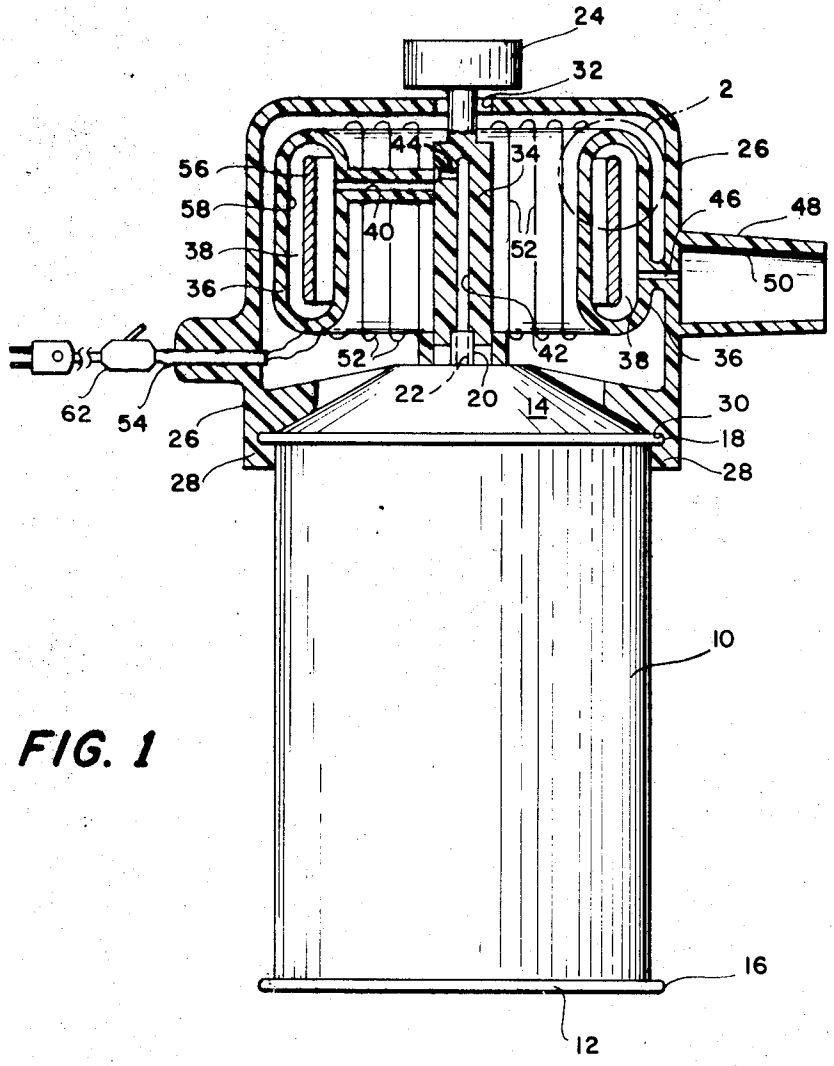


FIG. 1

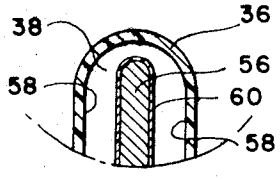


FIG. 2

INVENTORS

JOHN AYRES
IRVING REICH

BY MORGAN, FINNEGAN, DURHAM & PINE
ATTORNEY

HEATER FOR AEROSOL FOAM-DISPENSING CONTAINERS

This invention relates to a heating device for aerosol containers, and more particularly to an electrical heating device for rapidly heating foam products, such as foam shaving lather and the like, as they are discharged from the container.

Conventional aerosol containers use a propellant gas to discharge the foam products from their containers. Generally, the propellant gas is dispersed throughout the product under pressure and in liquefied form. Upon release of the discharge outlet of the container, the propellant forces the product out of the container and simultaneously expands to form gas bubbles and generate the foam.

Expansion of the propellant from a liquid to a gas, however, has a cooling effect on the foam product. This cooling effect is particularly undesirable in shaving lathers, because cold shaving lather foams are not only uncomfortable but also are slow in softening the beard for shaving. Human hair is more easily shaved after it has been softened by the penetration of moisture from the lather, and this softening effect increases with increasing lather temperature.

For this reason numerous heating devices have been proposed for heating foam shaving lathers as they are discharged from their containers. Some of the proposed devices use electrical heating elements to heat a conduit or tube through which the foam passes. Generally, the heating element comprises an electrical resistance wire that surrounds the outside of the tube and indirectly heats the lather as it passes through the tube.

These electrical heating devices, however, have generally not proven entirely satisfactory in heating foam shaving lathers to the desired temperature. Electrical resistance heating devices require a considerable "warmup" time between the time the heating element is actuated and the time the element and heat transfer tube become hot enough to the foam. Further, desired foam temperatures have not been obtainable in such devices unless the flow rate of the foam is substantially reduced so that the residence time in the device is long enough to allow sufficient transfer of heat to the foam. At these low flow rates, however, the time necessary to accumulate sufficient amounts of hot lather results in a cooking or coarsening of the foam.

For these reasons, it is desirable to provide an improved heater for aerosol containers that heats up quickly, rapidly heats the foam product as it is discharged from the container, and delivers the required amount of hot shaving lather to the user at a desirable flow rate.

Accordingly, it is a primary object of this invention to provide a new and improved electrical heating device for heating foam products as they are discharged from aerosol containers.

Another object of this invention is to provide an electrical heating device for aerosol containers that reaches its operating temperature very quickly, rapidly heats foam shaving lather as it is discharged from the container to a temperature substantially above room temperature, and delivers the heated lather at a desirable flow rate.

Still another object of this invention is to provide an electrical heating device for directly heating foam shaving lather that avoids danger of electrical shock to the user of the device.

A further object of this invention is to provide an electrical heating device for rapidly heating foam shaving lather that uses the heat generated in the secondary winding of a stepdown transformer to heat the foam as it is discharged from the container.

Yet a further object of this invention is to provide an improved electrical heating device for heating foam shaving lather that can be detachably interconnected with a discharge opening of an aerosol container, that is adaptable to all sizes of aerosol containers, that is rugged, and that is convenient and safe in operation.

Additional objects and advantages of the invention will be set forth in part in the description which follows and in part will be obvious from the description or may be learned by

practice of the invention the objects and advantages being realized and attained by means of the instrumentalities, devices, and combinations particularly pointed out in the appended claims.

To achieve the foregoing objects and in accordance with its purpose, this invention as embodied and broadly described, comprises an electrical heating device for heating foam as it is discharged from the outlet of a valve-actuated aerosol container. The heating device includes a housing having inlet means communicating with the outlet of the container for conducting foam discharged from the container into the housing; flow-confining means located within the housing and defining a chamber for confining the flow of foam through the housing; foam-heating means comprising a stepdown transformer having primary and secondary circuits, said secondary circuit being electrically resistant to the flow of electrical energy and exposed to the flow of foam through the chamber; and outlet means for discharging heated foam from the housing.

The accompanying drawings which are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and, together with the description, serve to explain the principles of the invention.

Of the drawings:

FIG. **1** is a sectional elevation of the heating device of this invention mounted to the top of an aerosol container; and

FIG. **2** is an enlarged view of a portion of the heating device within circle **2** of FIG. **1**.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory but are not restrictive of the invention.

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

The present invention provides an electrical heating device for aerosol containers that heats up very quickly and rapidly transfers heat to foam shaving lather as it is discharged from the container.

A typical aerosol container **10** is shown in FIG. **1**. Container **10** has a bottom **12** and a lid **14**, each provided with a peripheral curl **16** and **18**, respectively, to secure them to the container. Lid **14** has a central opening in its top for discharge of the foam product from the container. The product is maintained in container **10** under the pressure of a propellant gas, allowing for discharge of the product through the central opening in the top of the container.

Aerosol container **10** includes a valve actuator **20** having an outlet passage **22**. When valve actuator **20** is depressed by actuation of a valve button **24**, foam is expelled from the container in a controlled manner. A typical valve construction is described in U.S. Pat. 3,171,572 to Reich et al., and reference is made to that patent for a more detailed discussion of the construction and operation of this valve. While the valve construction illustrated in U.S. Pat. No. 3,171,572 is suitable for use with the heating device of this invention, it will be understood, of course, that other and different forms of valve mechanisms may also be satisfactorily employed.

An embodiment of the heating device of the present invention and its removable attachment to the top of an aerosol container is shown in FIG. **1**. The heating device includes a housing **26** made of plastic. Housing **26** preferably has good stiffness and lightness and good thermal electrical insulation properties. Suitable plastic materials for construction of the housing include linear polyethylene, polypropylene, polystyrene, or other similar materials.

As shown in FIG. **1**, the bottom of housing **26** is provided with a peripheral annular flange **28** having an internal annular groove **30** that grips peripheral curl **18** of lid **14** for snap attachment of the heating device to container **10**.

The sides of housing **26** extend upwardly and inwardly across the top forming an enclosure. An aperture **32** is provided in the top of housing **26** and valve button **24** having a valve stem **34** extends through aperture **32** to permit actuation

of valve actuator **20** when the heating device is attached to the container.

In accordance with the invention, flow-confining means are provided that define a chamber for confining the flow of foam through the housing. As embodied, and as shown in FIG. **1**, this means comprises a toroidal shell **36** that is mounted within housing **26** forming an annular chamber **38** that confines the flow of foam through the housing to a thin, wide sheet. Sheet **36** is of electrically nonconductive material, and preferably is of the same plastic material as housing **26**.

Shell **36** is provided with an inlet passage **40** that communicates with a passageway **42** in valve stem **34**. Passageway **42** also communicates with outlet **22** of valve actuator **20** and includes an outlet **44** that flares outwardly and is aligned with inlet passage **40** of shell **36** when valve button **24** is depressed by the user of the device.

Chamber **38** communicates with inlet passage **40** and an outlet passage **46** in the wall of housing **26**. A discharge spout **48** extends radially outward from the exterior surface of housing **26** and contains an internal conduit **50** that communicates with outlet passage **46** for discharge of heated foam from the housing.

In accordance with the invention, foam-heating means are provided within housing **26** to rapidly heat the foam as it is discharged from the container. As embodied and as shown in FIGS. **1** and **2**, this means comprises a stepdown transformer having primary and secondary circuits. The primary circuit comprises a multiturn primary winding **52** that is helically would about the outer surface of electrically nonconductive shell **36**. Primary winding **52** is constructed of electrically conductive material, such as copper or the like, and is electrically connected to the terminals of a conventional (**110** AC) household circuit through an electrical cord **54**.

The transformer also includes an iron core **56** that is mounted within chamber **38** of shell **36** and spaced slightly apart from the inner wall surfaces **58** of shell **36** to form passageways between the core and the shell for the flow of foam through chamber **38**. Core **56** is cylindrical and provides a closed path for the flow of magnetic flux induced in the core by the flow of alternating current through primary winding **52**.

As best shown in FIG. **2**, the secondary circuit of the transformer comprises a single-turn secondary winding **60** that is a thin plating of electrically conductive material, such as copper, cadmium, or the like, on the outer surface of iron core **56**. The secondary winding **60** is exposed to the flow of foam through chamber **38**.

Control means are also provided to control the flow of current to the heating device of this invention. As shown in FIG. **1**, for example, this means comprises a manually operated line switch **62** mounted to electrical cord **54**.

In operating the heating device of this invention, the user plugs cord **54** into an electrical outlet and moves switch **62** to the ON position which supplies a source of alternating current to primary winding **52**. The passage of the relatively high voltage, low current power from a 110-volt AC circuit through multiturn primary winding **52** induces an alternating magnetic flux in iron core **56** which, in turn, induces a relatively low voltage, high current power in single-turn secondary winding **60**. Power is thus transferred and altered in passing through the stepdown transformer from primary winding **52** to secondary winding **60**.

Secondary winding **60** offers resistance to the flow of this large amount of current through it because of its small cross-sectional area, and, therefore, heats up very quickly to provide a hot surface for heating the foam as it passes through chamber **38**.

After secondary winding **60** has reached the required operating temperature, the user moves electrical switch **62** to the OFF position, and depresses valve button **24** to actuate valve actuator **20**. The propellant within aerosol container **10** propels the pressurized product out of the container through outlet **22** in valve actuator **20**, through passageway **42** in valve stem **34** and into inlet passage **40** and chamber **38** of shell **36**. Since, as can be seen in FIG. **1**, the cross-sectional area of inlet passage **40** is less than that of chamber **38**, the pressurized foam discharging from inlet passage **40** into chamber **38** changes from a pressurized to an unpressurized state. As the foam enters chamber **38**, it is formed into a thin, wide sheet and passes between the inner walls **58** of chamber **38** and cylindrical core **56**. Under the pressure of the container, the unpressurized foam proceeds through chamber **38** toward outlet passage **46** and emerges from spout **48**.

As the unpressurized foam passes through chamber **38**, a rapid heat transfer occurs through intimate and direct contact of the foam with the hot surfaces of secondary winding **60** on both sides of iron core **56**. Because the product is confined to a thin, wide sheet during its passage through chamber **38**, intimate contact of the mass of foam with the hot surface is assured and the formation of multiple layers of bubbles, which would otherwise act as heat insulators, is reduced. A high rate of heat transfer, therefore, occurs in the heating device of the present invention, permitting the unpressurized foam to be discharged from the device at a useful flow rate and at a temperature of from 130° to 160°F.

Since relatively low voltages are present in secondary winding **60**, there is no danger of electrical shock to the user of the device even if the heating device is energized while the foam is flowing through chamber **38** in direct contact with the secondary winding.

For safety reasons, however, a thermostat can be provided, if desired, to sense the heat generated in secondary winding **60** and automatically terminate the flow of current to the transformer when the device has reached the required operating temperature.

The present invention thus provides a heating device for rapidly heating foam shaving lather as it is discharged from an aerosol container. The stepdown transformer that is used in the heating device of this invention heats up very quickly and permits intimate contact of the foam with the hot surfaces of the secondary winding of the transformer to rapidly heat the foam and deliver the desired amount of heated foam at a useful flow rate. By increasing the temperature of the lather and thereby increasing its solubility in water, better contact with the beard and increased comfort for the shaver is afforded.

While a separate device for removable attachment to an aerosal container has been illustrated in the accompanying drawings, it will be understood from the above description that the heating device of this invention can also be made a permanent part of the container.

The invention in its broader aspects in not limited to the specific details shown and described, but departures may be made from such details within the spirit and scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

We claim:

1. Apparatus for dispensing heated unpressurized foam comprising:
   a. a portable pressurized foam container for storing foam in a pressurized state;
   b. outlet means for selectively discharging a quantity of pressurized foam from said portable pressurized foam container;
   c. flow-confining means comprising a heating chamber having an inlet passage and an outlet passage positioned opposite from each other, said heating chamber having walls forming a hollow annular cavity, said inlet passage being operatively coupled to said outlet means of said portable pressurized foam container for directing to said heating chamber pressurized foam discharged from said pressurized foam container and said inlet passage additionally having a cross-sectional area that is less than that of said heating chamber such that pressurized foam discharging from said inlet passage into said heating chamber changes from a pressurized state into an unpressurized state;
   d. foam-heating means comprising a stepdown transformer having primary and secondary circuits, said primary cir-

cuit being disposed about the exterior of said heating chamber and operatively coupled to a supply of electrical energy, said secondary circuit being electrically resistant to the flow of electrical energy and including a closed core member centered within said heating chamber for direct thermal contact with said unpressurized foam as said unpressurized foam is caused to flow in a thin layer between said secondary circuit and the walls of said heating chamber; and

e. heated foam outlet means coupled to said outlet passage of said flow-confining means for providing an outlet for the discharge of heated unpressurized foam.

2. The electrical heating device of claim 1, in which the chamber confines the flow of foam to a thin, wide sheet.

3. The electrical heating device of claim 1, wherein the flow-confining means is constructed of electrically nonconductive material.

4. The electrical heating device of claim 3, wherein the primary circuit is a multiturn primary winding wound about the outside of the chamber and the secondary circuit is a single-turn electrically conductive metallic coating on the core.

5. The heating device of claim 4, wherein the chamber is toroidal and the core is cylindrical.

6. The heating device of claim 4, wherein the core is of iron and the secondary circuit is a thin copper plating on the surface of the core.

7. The heating device of claim 1, which includes control means electrically connected between a supply of electrical energy and the primary circuit of the transformer to control the flow of electrical energy to the transformer.