

Jan. 16, 1968

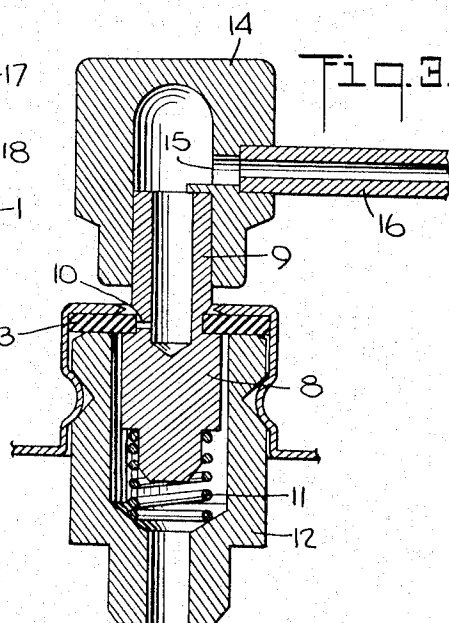
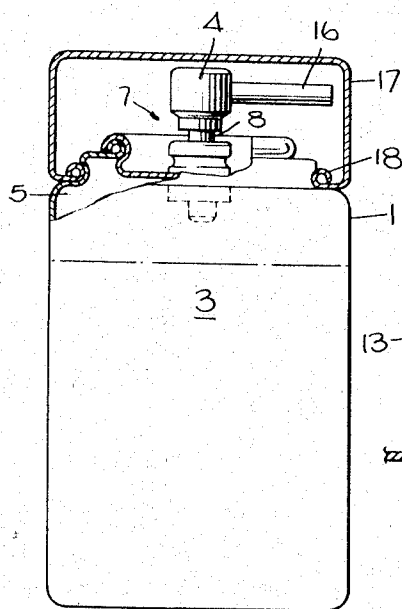
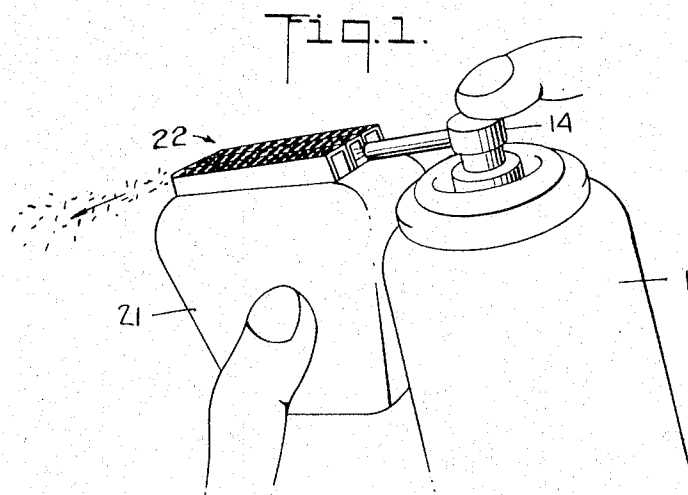
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3,364,068

PROCESS FOR THE CLEANING OF RAZOR HEAD COMPONENTS

Filed Nov. 22, 1966

2 Sheets-Sheet 1



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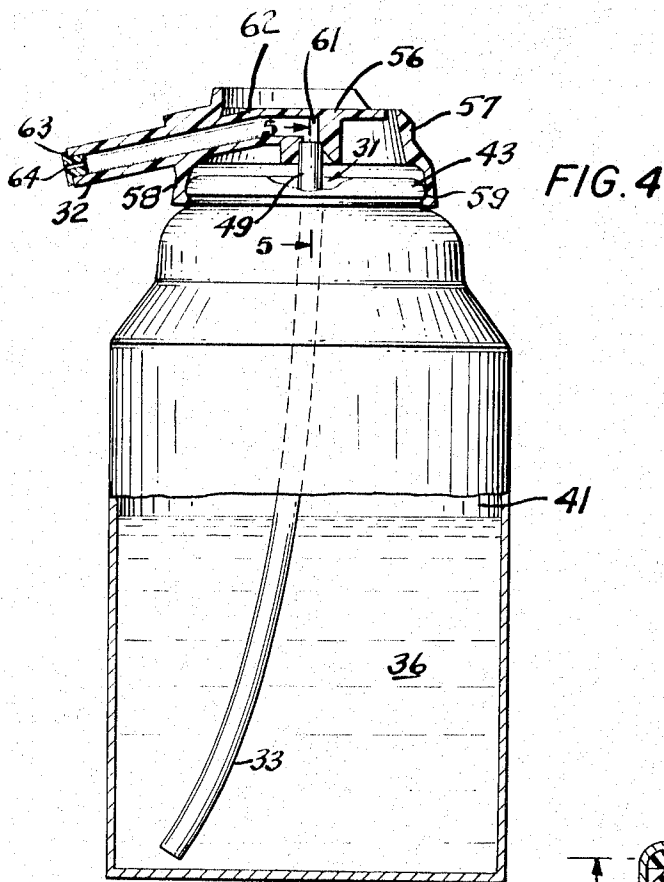


FIG. 4

FIG. 6

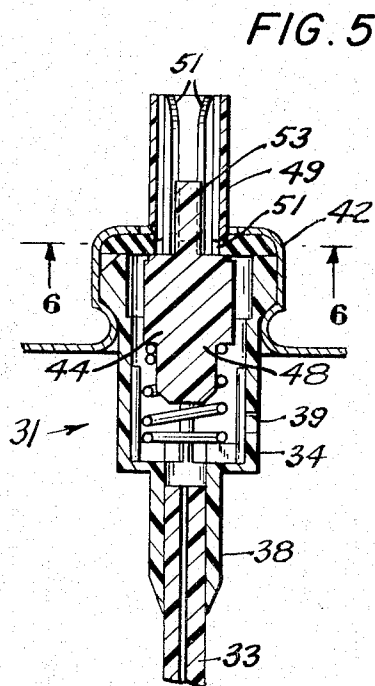
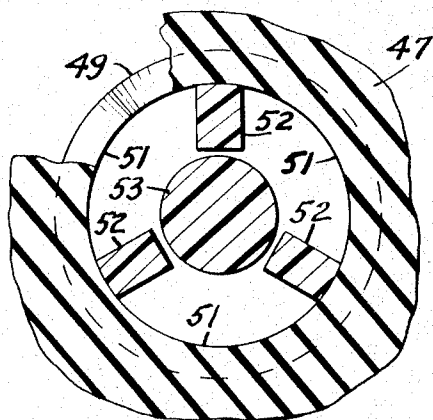


FIG. 5

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PROCESS FOR THE CLEANING OF RAZOR HEAD COMPONENTS

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Continuation-in-part of application Ser. No. 370,963,
May 28, 1964. This application Nov. 22, 1966, Ser.
No. 596,333

17 Claims. (Cl. 134—22)

This application is a continuation-in-part of application Ser. No. 370,963 filed May 28, 1964, now abandoned.

This invention relates to the cleaning of razors and, more particularly, to the cleaning of electric razors.

Although electric razors have been in popular use for several decades, no satisfactory method of cleaning the operative heads of the razor after use has been developed. The several cleaning methods in general use have many disadvantages. Thus, cleaning by rubbing the inside of the razor head back and forth with a brush made up of bristles entwined in a metal spine results in damage to the delicate elements of the head when the wire spine of the brush rubs against them. Also, when the brush direction is reversed, those bristles which are bent against the elements within the head must reverse the direction in which they are inclined; this brings them with considerable pressure against the shearing edges of the head elements, cutting the bristles and dulling the edges.

Cleaning by blowing often results in inhalation of undesirable hair clippings, since the user's mouth must be brought close to the razor head and the user naturally tends to suck air in just before, and after, blowing and several breaths are usually needed. Blowing also tends to deposit fine droplets of moisture from the breath on the shaver head; this can have an undesirable corrosive effect on the carbon steel of which the shearing elements may be made. Blowing is not very selective; some clippings are left on the razor head while some are so scattered that they come to rest on the adjacent furniture. When shaving powder is used, as is customary particularly in hot humid weather, the particles of perspiration-laden powder caked up with the fine hair clippings are especially difficult to remove with one's moist breath.

Another method of cleaning is by tapping the electric razor sharply against a firm stationary object. This, however, removes only some of the hairs and other debris and increases the danger of breaking or distorting parts of the electric razor because of unduly violent or misdirected tapping.

There are, on the market, liquid preparations for cleaning electric razor heads. When such liquids are employed the user generally removes the head of the electric razor, for immersion in the liquid and agitates the head manually in the liquid, or in some cases immerses the head, still attached to the body of the razor, into the liquid and operates the razor during such immersion. These methods are cumbersome and do not give the head a thorough cleaning in a reasonable time.

Some electric razor heads are constructed of non-corrosive material and are specially designed so that they may be washed under a stream of hot water. Aside from inherent danger of electric shock, such cleaning is time consuming, since the razor should be dried after use. Also, this method of cleaning is not applicable to the most common types of electric razors, but requires more elaborate and expensive constructions to protect the electric razor from the water.

It is one object of this invention to provide a novel, more efficient and sanitary method for the cleaning of electric razor heads.

Other objects of this invention will be apparent from

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the following detailed description and claims. In this description and claims all proportions are by weight unless otherwise indicated.

In accordance with one aspect of this invention, the cleaning of an electric razor head is effected by directing at the head, or at the individual parts thereof, a fine blast of a biocidal gas, preferably a mixture of a propellant component gas and a fungicidal component gas, from a small, hand-held pressurized container having a finger-operated valve. Advantageously, the propellant gas used includes one of the propellants customarily employed for aerosol sprays, such as a highly volatile, non-toxic fluorohydrocarbon or fluorochlorohydrocarbon. The fungicidal component gas is advantageously formaldehyde, which is both a fungicide and a bactericide and which is highly reactive with the proteins of bacteria and fungi. The pressurized container is desirably of a size which may be conveniently held in one hand, and like the usual commercial aerosol containers, its valve is so positioned that it may be readily operated by the thumb, or one finger, of the hand in which it is held. Unlike most aerosol containers, the outlet of the container is equipped with a small tube which serves to direct its output in a precise, narrow stream, and makes it possible to blow the debris from the shaver head accurately into a suitable container such as a wastebasket. Because of the thorough removal of foreign material, such as hair clippings or skin particles, by the method of this invention, the resistance encountered by the inner shearing member in its movement is reduced, thus permitting the electric razor to operate at its maximum speed and with less heating; as a result, the user can obtain better and more comfortable shaves and avoid frequent repairs to the instrument.

The method of this invention also facilitates sales demonstrations of electric razors to large numbers of prospective purchasers, because it helps to prevent the buildup of bacteria and fungi on the razor head and the resulting transfer from one user to the next. In addition, by keeping down the accumulation of bacteria and fungi on the electric razor head, it decreases the danger of self-reinfection of the user and the danger of cross-infection when the razor is used by several members of the same family.

In the accompanying drawing, illustrating certain preferred forms of the invention,

FIG. 1 is a side view illustrating the operation of the process,

FIG. 2 is a side view partly in cross-section illustrating one form of container,

FIG. 3 is a cross-sectional side view of the valve and tube of the container,

FIG. 4 is a side view, partly broken away to show a cross-section, of a particularly preferred form of container,

FIG. 5 is a cross-sectional view of the valve, taken along the line 5—5 of FIG. 4, and

FIG. 6 is a cross-sectional view of a portion of the valve taken along the line 6—6 of FIG. 5.

In the drawing, reference numeral 1 designates a cylindrical can containing a liquid 3 which may be a mixture of the propellant with a small amount of formaldehyde, the free space 5 above the top of the liquid being filled with a gaseous mixture of these ingredients. The can may be, for example, of sheet steel, about 2 to 3 inches in external diameter and about 5 to 8 inches in height. At the top of the can 1, there is a finger-operable valve 7, of the usual type, comprising a reciprocable valve stem 8, hollow at its upper end 9 and having a radial valve port 10 communicating with its interior, which stem 8 is pressed upward (by a spring 11 which is mounted within a hol-

low valve housing 12) to a position where its port 10 is sealed by an annular rubber seal 13. A hollow pushbutton 14 having a side port 15 is fixed atop the valve stem 8 so that when the button 14 is depressed, the valve stem port 10 is displaced from the rubber seal 13 permitting the gas to flow through the housing 12, port 10, stem 8, and pushbutton 14. Extending from the outlet port 15 is a thin tube 16 which may be force-fitted to, or integral with, the pushbutton 14; suitably the tube 16 is circular, with an internal diameter preferably in the range of about $\frac{1}{100}$ to about $\frac{1}{10}$ inch (e.g. about $\frac{1}{50}$ inch) and an unobstructed length preferably in the range of about $\frac{1}{16}$ to about $1\frac{1}{2}$ inch (e.g. $\frac{1}{4}$ inch). The tube may, for example, be made of flexible (high pressure) polyethylene or other plastic. A cylindrical removable cap 17, advantageously of about the same external diameter as the can 1, is adapted to fit tightly over the valve 7 when the can is not in use, with the bottom 18 of the cap 17 frictionally engaging the outer portion of the can 1. The internal diameter of the cap 17 is sufficient to permit the tube 16 to be housed within the cap without displacement of said tube. The cap may be of sheet steel or other suitable material.

In the cleaning process, an electric razor 21 is held in one hand, preferably close to a suitable waste container for receiving the debris which is blasted away from the razor head during the process, while the can 1 is held in the other hand with the outlet of its tube 16 closely spaced from the head 22 of the razor, preferably, as shown in the drawing, after the usual removable razor head guard element has been removed. The push button 14 is depressed to cause the release of gas from the can 1 and the evaporation into the free space 5 of a corresponding portion of the liquid. The parts are then moved relatively to each other so that the jet of gas emerging from the tube is directed against all parts of the head and, if desired, against the case of the electric shaver and the head guard thereof.

In accordance with one aspect of this invention, the blast of gas from the discharge tube of the device may contain materials, described more fully below, whose vapor pressure is relatively low in comparison with the vapor pressure of the propellant. The embodiment shown in FIGS. 4, 5 and 6, facilitates the transfer of these materials into the main stream of gas.

As shown in FIGS. 4 and 5, the device includes a pushbutton-operated valve, indicated generally as 31, and a discharge tube 32. Unlike the embodiment shown in FIG. 2, that of FIGS. 4 to 6 has a dip tube 33 extending down from the hollow valve housing 34, into the liquid 36 in the container 37. This dip tube has a much smaller diameter (e.g. less than 0.1 inch, for example, 0.02 inch) than those generally used for dip tubes of aerosol containers employed for the dispensing of liquids. It is preferably a flexible polyethylene tube of uniform diameter press-fitted into a tubular extension 38 (FIG. 5) of the hollow valve housing 34 so that there is a clear passageway from the liquid 36 through the dip tube 33 and through the interior of the valve housing 34. Communicating with this passageway is an aperture 39 (which may be formed in the main portion of the valve housing 34) whose entrance is in the gas space 41 above the body of liquid in the can. This opening may, for example, be circular and of a diameter of about 0.04 inch.

The liquid 36 is principally composed of propellant, but it contains a small proportion of the less volatile materials which I wish to be present in the blast of gas. Since the gas phase, above the liquid in the container, is derived by evaporation of that liquid, the concentration of the less volatile materials in the gas phase is much lower than it is in the liquid phase, and may be practically zero. The less volatile materials are generally of a type which is normally non-gaseous; that is, they are liquid or solid at room temperature.

It is found that when the valve 31 is operated, the gas passing through the aperture 39 aspirates up a small quantity of the less volatile components, through the dip tube 33 thereby increasing the concentration of the less volatile materials in the gas blast leaving the discharge tube 32.

The valve housing 34 is supported (like the housing 12) by a crimped portion 42 of the sheet metal can top 43. The housing may be of rigid plastic material such as polystyrene, for example.

The valve 31 carries a reciprocable valve stem 44 which operates in a manner similar to that of stem 8 in FIG. 3, being pressed upward by a spring 46 and having its ports sealed by an annular rubber seal 47, the stem and its ports being moved downwardly, to an unsealed position, when the push button is depressed. Like the stem 8, the stem 44 may be a unitary part, molded of rigid plastic, having an imperforate lower portion 48 and a tubular upper portion 49. Instead of a single port, the stem 44 has three generally rectangular ports 51 extending in an almost complete circle around the valve stem, the individual ports 51 being separated only by the lower portions of three thin vertical vanes 52 which integrally connect the upper and lower portions 48, 49. The large port area permits a freer discharge of gas when the valve is operated. The stem 44 also has an integral central upstanding projection 53 (within its tubular upper portion 49) and extending part way up from the level of the ports 51). The arrangement provides a desirable flow of gas through the portion 49.

In the embodiment shown in FIG. 4, the discharge tube 32 and the push button 56 are both formed as portions of a one-piece molded adapter 57 which has a depending annular flange 58 shaped to be snapped over, and held by, an annular ridge 59 formed in the sheet metal top 43 of the container. The push button portion 56 fits over and is aligned with the upper end 49 of the valve stem 44 in such a manner that the hollow in the valve stem communicates with a central opening 61, in the portion 56, and thus to the interior of the discharge tube. The push button portion 56 is free of the main body of the adapter 57 except for an integral hinge-like connection therewith along a short line at 62, so that the push button portion 56 can be depressed slightly by the user, thus depressing the valve stem 44 and permitting the gas to pass through opening 61 and discharge tube 32. The adapter 57 is of suitable plastic (e.g. isotactic polypropylene) which can act as a hinge, as described.

In the embodiment shown in FIG. 4, a plug 63 having a small central bore 64 (e.g. a circular bore 0.02 inch in diameter) is press-fitted into the end of the discharge tube 32 to give the precise, narrow gas stream previously mentioned. Also, the discharge tube is directed downwardly at an angle of, say, about $45-70^\circ$ (e.g. 75°) to the vertical axis of the can, which makes it simpler for the user, holding the razor at a similar angle, to blow the clippings from the razor into a wastebasket or similar receptacle supported below the razor.

The propellant gas used is advantageously a highly volatile, non-toxic chlorofluorohydrocarbon such as dichlorodifluoromethane (F-12), trichloromonofluoromethane (F-11), or dichlorotetrafluoroethane (F-114 or F-114a). When dichlorodifluoromethane is employed, it may be blended with F-11, F-114 or F-114a to depress its vapor pressure. Other propellants may be employed, alone or in admixture with the chlorofluorohydrocarbon; for example, a blend of F-11 and propane may be used. Advantageously, the propellant, which dilutes the highly reactive formaldehyde and at the same time generates a sufficient pressure to provide a strong fine blast of the gas, constitutes the major portion, by weight, of the liquid 3. It is preferred to use propellants which have boiling points in the range of about -70 to $+10^\circ$ C. The amount of formaldehyde in the mixture need not be large;

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amounts well below 10% may be employed. Thus, while good results have been obtained with 6% formaldehyde, it is found that much smaller proportions, such as about 1%, or less, for example in the range of about 0.1 to 0.6% may be employed. When these smaller proportions are employed, the gas discharged during use has a fresh clean odor.

More suitably, a propellant such as F-12 is blended with monochlorodifluoromethane (F-22) using a proportion of less than 25% of the latter, best results being obtained with proportions of F-22 in the range of about 5 to 15%, most preferably about 10% (e.g. 90% F-12 and 10% F-22). The F-22 has a high vapor pressure, producing a higher pressure in the container and a desirable high blast velocity which is more effective for removal of hair clippings. When F-22 is used, the rubber sealing ring in contact with the valve stem should be of an oil-resistant rubber, such as neoprene (polychloroprene).

The liquid may be introduced into the can by filling the can with a mixture of the propellant and paraform or other solid polymer of formaldehyde and then capping the can with the valve and, while the valve is closed, heating the can to decompose the paraform and generate monomeric formaldehyde to produce a substantially anhydrous mixture of formaldehyde and the propellant. In one example, 6% of paraformaldehyde mixed with 94% of a blend of equal proportions of F-11 and F-12 was used. Trioxane may be employed together with, or in place of, paraformaldehyde.

The can may also be filled, under superatmospheric pressure, by injecting the constituents through the valve using any of the pressure-filling devices conventionally employed for filling of aerosol containers. Refrigeration may be employed during filling. Thus, the individual substantially anhydrous gases, liquefied by cooling to a low temperature below their boiling points, can be fed to the can or the mixture of gases maintained at a temperature below the boiling point of that mixture can be fed to the can, all while maintaining the can at a similar low temperature; this can be done, for example, under some pressure through the valve of the can or at atmospheric pressure before the can is capped with the valve.

In another filling method, particularly suitable for use in factories which also pack materials, such as foods, which may be affected by the presence of formaldehyde gas, the formaldehyde is supplied as an aqueous solution, preferably of relatively high concentration, e.g. above 35%, most preferably above 45%, for example 70%. When such aqueous solutions are employed with the preferred water-immiscible propellants, it is desirable to include a blending agent, e.g. ethanol, to promote even distribution of the formaldehyde in the propellant liquid. One suitable mixture contains 98.7% of a propellant which is a mixture of equal parts of F-11 and F-12, 0.5% formaldehyde, 0.4% ethanol and 0.4% water. It is often desirable to effectively remove the water from the liquid in the can by including therein a dehydrating agent, which may be of conventional type such as silica gel, in amount sufficient to take up the water present. Liquid anhydrous formaldehyde under pressure may be employed in this method.

While the invention has been specifically disclosed using formaldehyde as the biocidal gas, it will be understood that the use of other fungicidal or bactericidal gases, in place of, or in combination with, the formaldehyde is within the broad scope of this invention. Ethylene oxide is an example of such a gas. Advantageously, the components of the gas are non-corrosive to the materials of the razor head.

It is also within the broader aspects of this invention to carry out the process of the invention in the substantial absence of the biocidal component. In such a case, the liquid in the container will consist essentially of the propellant.

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The use of a substantially anhydrous stream of gas is also advantageous in that it has a dehydrating effect on the debris on the razor head, making it less sticky and thereby facilitating its removal.

In the preferred form of the invention, the non-gaseous materials in the composition are of such nature, and present in such small amount, that the blast from the container forms substantially no liquid deposit on the razor head and there is no tendency for the cut hairs on the shaving surfaces of the razor to become anchored to these surfaces. In contrast, when one uses a device which sprays a liquid lubricant (e.g. an oily liquid) onto the shaving surfaces (forming a deposit thereon noticeable to the naked eye), the cut hairs tend to adhere to these surfaces (possibly owing to surface tension of the liquid).

In a particularly preferred form of the invention, the liquid phase in the container comprises the propellant (preferably, as mentioned above, including a minor proportion of F-22), together with small proportions of: an essential oil, such as eucalyptus oil; an alcohol such as isopropanol; a lubricant, such as magnesium stearate; and trioxane. The proportion of propellant is usually well above 95%, preferably above 99% of the liquid phase.

The essential oil gives the blast of gas a desirable fragrance and also has an antiseptic and fungicidal effect. The presence of the F-22, which has solvent properties, appears to enhance the vaporization of this oil. Other materials which may be used in place of, or in addition to, the oil of eucalyptus are paradichlorobenzene and camphor. A typical proportion of essential oil is in the range of about 0.001% to 0.1% based on the total weight of the material charged to the container.

The isopropanol or similar alcohol has a bactericidal effect and is also found to increase the degree of vaporization of the essential oil. A typical proportion of this ingredient is in the range of about 0.001% to 0.1% based on the total weight of the material charged to the container.

The lubricant helps to lubricate the moving parts of the electric razor. I have found the solid, water-insoluble metallic soap, magnesium stearate, to be particularly suitable for this purpose. It is non-reactive to the skin and, unlike the liquids commonly employed as lubricants for electric shavers, it gives a mild lubricating effect without causing the cut hairs to adhere to the razor. A typical proportion of this ingredient is in the range of about 0.01% to 1% based on the total weight of the material charged to the container. The metallic soap may be added as coarse solid particles, which dissolve or otherwise disperse in the propellant; the presence of the F-22 assists in dispersing this ingredient. A typical proportion of the F-22 is in the range of about 5% to 15% based on the total weight of the material charged to the container.

The trioxane, which may be similarly added to the other ingredients in solid form (e.g. as a powder), has an unusual effect. During the cleaning of the electric shaver by the blast of gas, the trioxane forms a visible white deposit on the part being blasted, which white deposit almost immediately sublimes (causing a volumetric expansion which helps to push the gas into all the corners and crevices). A typical proportion of this ingredient is in the range of about 0.1% to 1% based on the total weight of the material charged to the container.

A preferred typical charge, which fills about $\frac{1}{2}$ to $\frac{3}{4}$ the free volume of the container, has the following composition:

	Weight, ounces	Percent Approx.
Propellant, comprising 90% F-12 and 10% F-22.....	5.4	99.7
Magnesium stearate.....	1/600	0.03
Trioxane.....	3/200	0.3
Eucalyptus oil (1/100 cc.).....	1/3,000	0.005
Isopropanol (technical 91%) (1/100 cc.).....	1/3,000	0.005

As previously mentioned, the provision of the fine dip tube 33 and of the gas opening 39 causes a small amount of the relatively non-volatile components to be drawn up through the dip tube 33 and to be brought into contact, turbulently, with a large amount of propellant entering at the opening 39, causing thorough dispersion (including volatilization) in the gas stream of the small amounts (e.g. less than 1%) of these relatively non-volatile components. When the arrangement shown in FIGS. 2 and 3 (with no dip tube) is employed, it may take a relatively long time (on the order of several hours) for the concentration of the essential oil in the gas phase in the container to build up sufficiently to make its odor noticeable on re-use after the discharge of sufficient gas to clean a single electric razor head. With the arrangement shown in FIGS. 5 and 6, the odor is maintained even on quick reuse (even without shaking of the container before each reuse). Another less preferred technique for effecting more rapid buildup of the concentration of the essential oil or other perfuming material in the gas phase is the use of a small float (e.g. of balsawood or other suitable material of low density) impregnated, or otherwise treated, with the essential oil. This, in effect, provides a concentrated source of the essential oil in direct contact with the vapor space of the can. Still other less preferred techniques include the replacement of the long dip tube by a short tube at whose lower end is a small cup, which becomes wholly or partially filled with the liquid in the container on shaking of the latter, or by a short tube at whose lower end is a porous solid material, such as a sponge or similar foam or other absorbing substance becomes saturated with the liquid on such shaking; the long dip tube may also be replaced by a long filament or wick leading from the liquid phase to a point adjacent the gas inlet of the valve housing.

The electric razors to be cleaned by the process of this invention are well known to the art. Usually, such electric razors have a main body adapted to be held in the hand of the user and containing a suitable vibrator or other small electric motor, and a razor head which comprises one or more stationary outer members, each having a very thin shear plate with many slots or other openings in it to rest against the skin, and a corresponding number of inner members, each of which has many teeth or slots cooperating with the nether edges of the walls of said openings of the shear plate in a shearing action, the inner members being held up tightly against the inside surface of their respective shear plates by springs or other suitable means and being reciprocated or rotated very rapidly underneath the shear plates by the motor. The hairs of the face which penetrate the openings in the shear plates are thus sheared off by the motion of the inner members in cooperation with the nether edges of the walls of said openings. The widths of the slots are very small, usually less than $\frac{1}{16}$ inch, e.g. about $\frac{1}{32}$ inch.

In FIG. 1 of the drawing, the nozzle 16 is shown directing a fine concentrated blast at an electric shaver head whose shear plates and inner members are shaped like inverted channels, having flat slotted upper portions and integral depending parallel sides located in planes perpendicular to the plane of the upper portions, the blast being shown directed into the space just below said upper portions, where the cut hairs tend to accumulate. The construction and position of the tube 16 in relation to the can on which it is mounted is such as to permit the end of the tube to approach the head components very closely, within a fraction of an inch.

The autogenous pressure of the gases within the valved containers used in this invention will generally be less than about 200 p.s.i.g., e.g. within the range of about 60 to 130 p.s.i.g. at 70° F.

It will be understood that while the invention has been illustrated for use with a household electric razor, it may

also be used with other types of electric razors such as the electric hair clippers used by barbers and beauticians.

It is to be understood that the foregoing detailed description is given merely by way of illustration, and that variations may be made therein without departing from the spirit of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Process for the cleaning of electric razor head components having finely cut hair particles thereon which comprises providing a quantity of a liquefied biocidal gas under pressure in a closed hand-held container, so venting said container to the atmosphere as to produce a concentrated jet consisting essentially of said gas, and directing said stream against said electric shaver head component to dislodge said particles.
2. Process as set forth in claim 1 in which said biocidal gas consists essentially of a mixture of a major proportion of a propellant having a boiling point in the range of about -70 to $+10^{\circ}$ C. and a minor proportion of a fungicide.
3. Process as in claim 2 in which the gas carries trioxane.
4. Process as in claim 2 in which the gas carries magnesium stearate.
5. Process for the cleaning of razor head components having finely cut hair particles thereon which comprises providing a quantity of a liquid in a closed hand-held container, said liquid having a boiling point below room temperature and being so volatile that said liquid is under an autogenous pressure in the range of about 30 to 200 p.s.i.g. in said container, there being a gas phase and a liquid phase in said container, so venting said container to the atmosphere as to produce a fine concentrated stream of the gas phase of said liquid, and directing said fine stream against said head component to dislodge said particles, said gas being non-corrosive of said head component.
6. A process as in claim 5 in which the pressure is about 60 to 130 p.s.i.g. and said liquid comprises about 5 to 15% of monochlorodifluoro methane.
7. Process as in claim 6 in which said liquid contains a normally liquid perfuming agent.
8. Process as in claim 6 in which said liquid comprises an essential oil.
9. Process as in claim 5 in which the gas carries trioxane.
10. Process as in claim 5 in which the gas carries a solid lubricant.
11. Process as in claim 5 in which said liquid includes a normally non-gaseous component, said process including the venting of the gas phase of the container to the atmosphere while forming within the container a stream of the gas being vented and while bringing the liquid phase in the container into close proximity to the latter stream whereby the fine stream of gas leaving said container includes a minor proportion, less than about 5%, of said non-gaseous component.
12. Process as in claim 5 in which the amount of non-gaseous material in said fine stream is below about 1%.
13. Process as in claim 5 in which said liquid comprises a non-toxic chlorofluorohydrocarbon.
14. Process as in claim 11 in which said non-gaseous component comprises trioxane.
15. Process as in claim 14 in which the proportion of trioxane is in the range of about 0.1% to 1%.
16. Process as in claim 12 in which the non-gaseous component comprises a solid.
17. Process as in claim 12 in which the non-gaseous component comprises a solid which sublimates at atmospheric pressure.

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