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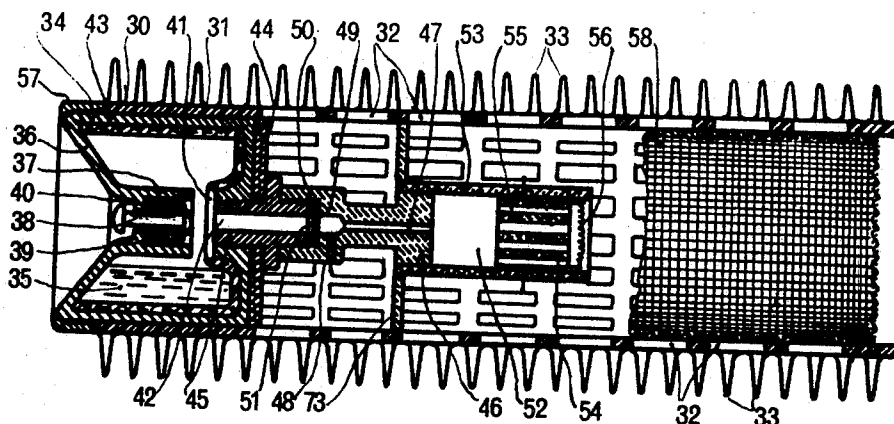
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[54] **HAIR CURLER**
24 Claims, 3 Drawing Figs.

[52] U.S. Cl. 132/33
 [51] Int. Cl. A45d 2/12
 [50] Field of Search 132/33, 7,
 40; 219/(Inquired), 222; 126/(Inquired);
 431/(Inquired); 222/402.1

ABSTRACT: A hair curler containing a supply of fuel, preferably liquefied fuel such as butane or propane, and a nozzle for releasing gaseous fuel from the supply and for providing a mixture of said fuel and an oxygen containing gas, preferably air, so as to provide a flow or current of a gaseous combustible fuel mixture, which is directed to an area within the hair curler where the fuel of the mixture is oxidated or burned in the presence of an oxidation catalyzing material whereby heat is generated within the curler.



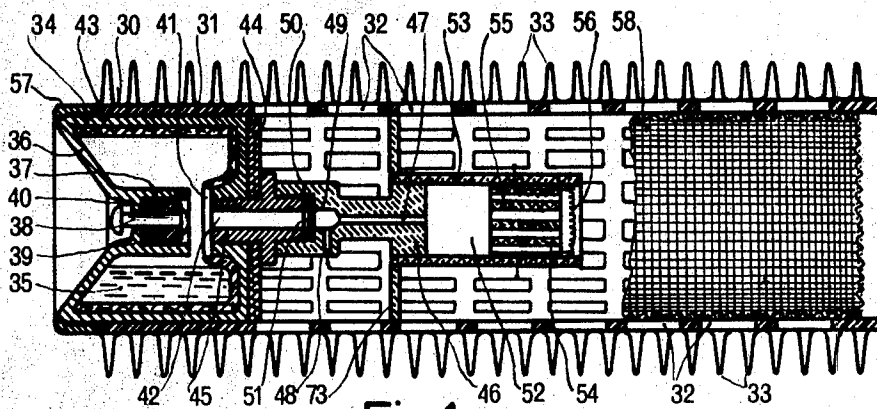


Fig.1

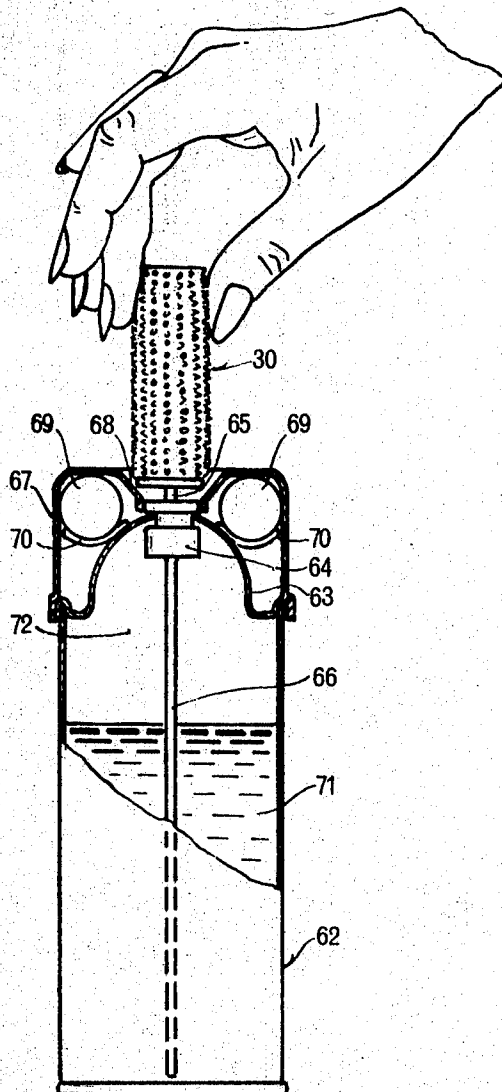


Fig.2

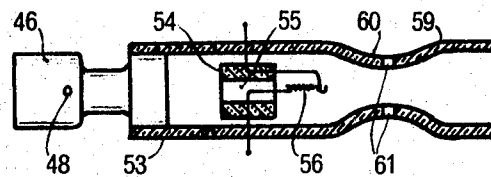


Fig.3

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HAIR CURLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to a hair curler and more particularly to a hair curler of the type being able to contain a supply of fuel and comprising means for oxidating said fuel to generate heat within the curler.

2. Description of the Prior Art

My copending application Serial No. 560,582 now Pat. No. 3,478,755 filed on Jun. 27, 1966 discloses a hair curler of the above-mentioned type using a wick for transferring fuel from the fuel supply of the curler to the said oxidation or combustion area. The present invention constitute an improvement of the hair curler described in the said application.

SUMMARY OF THE INVENTION

One object of the invention is to provide a hair curler of the said type being able to contain liquefied fuel being in a gaseous state under atmospheric pressure and temperature conditions, such as propane and butane.

Another object of the invention is to provide a hair curler of the above-mentioned type in which the use of wicks and the like for leading fuel from said supply of fuel to the area of oxidation or combustion may be avoided.

A further object of the invention is to provide a hair curler which is reliable in use and able to dry wet hair.

A still further object of the invention is to provide an appliance of the type comprising a container for liquefied fuel being in a gaseous state under normal atmospheric pressure and temperature conditions and a nozzle opening communicating with the inner of the container for providing a current or flow of gaseous fuel, in which appliance a substantially uniform current or flow of gas through the nozzle opening is secured despite of the position of the appliance.

A still further object of the invention is to provide a refill container enabling a simple refill of the fuel container of an appliance with liquefied fuel, such as butane or propane.

According to the invention the hair curler comprises a supply of liquefied fuel, such as propane or butane or any other type of fuel being in a gaseous state under normal atmospheric temperature and pressure conditions, oxidation catalyzing means and a nozzle for directing a flow of gaseous fuel from said fuel supply to said catalyzing means. According to the invention the hair curler may comprise means for introducing an oxygen containing gas, preferably air, into the flow of gaseous fuel. The amount of oxygen introduced into the flow of fuel may be chosen so as to provide optimum combustion conditions. Alternatively, in order to avoid that the gaseous fuel mixture is ignited outside the hair curler, in case for some reason no oxidation of the fuel has taken place within the curler, an amount of air sufficient to render the mixture of fuel and air unflammable under normal atmospheric conditions, may be introduced into the flow of gaseous fuel. In the first mentioned case, however, the risk of ignition outside the curler may be reduced or removed by introducing air or another noncombustible gas into the flow of fuel downstream to the oxidation or catalyst area. In both cases the means for introducing air or gas into the flow or current of fuel from the nozzle may for example be injector means such as a Venturi tube through which said fuel current is directed.

The size of the nozzle opening is chosen in response to the type and pressure of the liquefied fuel of the fuel supply in the curler and to the heating rate desired. Normally the diameter of the nozzle opening is chosen within the range from about 15 μ to about 80 μ . An opening of this size may advantageously be formed by means of laser light.

The oxidation catalyzing means used in the curler according to the invention may comprise a first catalyst having a relatively long useful life and a second more active catalyst having a shorter useful life, and said catalysts may be arranged in the path of the gas mixture from the nozzle in such a manner that said first catalyst is the first to be contacted by the gas mixture.

By such an arrangement oxidation of fuel contained in said flow of gas mixture is initiated by said second more active catalyst, and after that the catalyzing action is taken over by the second catalyst which may be more sturdy and cheaper than the second catalyst. As an example the second catalyst may comprise platinum, palladium, copper peroxide and/or chromium trioxide, and said first catalyst may comprise aluminum oxide and/or silica.

According to the invention the catalyzing means may comprise a filament of an oxidation catalyzing metal, such as platinum. Such filament may constitute said second catalyst or part thereof. Alternatively, the filament may be the only catalyzing means present in the curler in case a suitable amount of oxygen is introduced into the gaseous fuel released from the fuel supply through the nozzle opening. The oxidation process may advantageously be initiated by momentary heating the filament, e.g. by supplying electrical current thereto.

The present invention also relates to a portable appliance of the type comprising a container for containing a supply of liquefied fuel, means for successively releasing said fuel in a gaseous state and means for leading said released fuel to an oxidation or combustion area of the appliance, where the fuel may be oxidated or burned. In case said releasing means comprise a nozzle having a rather small opening this opening may easily become clogged by possible impurities in the fuel. Furthermore, the releasing rate of the fuel will greatly depend on the position of the container, i.e. on the fact whether liquid phase of said fuel is present at the nozzle opening or not. According to the invention these drawbacks may be eliminated by the provision of a porous mass or layer arranged in such a manner than the fuel in the fuel container has to pass said mass or layer in order to reach the opening of the nozzle. Thus, the said mass or layer is preferably arranged so as to cover the entrance of the nozzle opening. The said mass or layer may for example be made from pulp, paper, ceramic materials or sintered metals.

The said porous mass or layer may preferably be in contact with wick means arranged so as to be in contact with the liquid phase of the fuel in the fuel container in all positions of the same. Thus, for example, the said wick means may comprise a skirt of paper material or another absorbing material covering a substantial part of the inner sidewalls of the fuel container. The said wick means secure a constant moistening of the porous mass or layer with liquid phase of the fuel, whereby a substantially uniform releasing of gaseous fuel through said mass or layer and through the nozzle opening is secured in all positions of the fuel container.

The appliance described above may be a hair curler. It is, however, also envisaged that the appliance may be for any other use. As an example the appliance described may be a gas lighter.

The invention also relates to a storage container or refill container for liquefied fuel, such as propane and butane. The container is of the type comprising a discharge valve at the top of the container and a dip tube extending from said valve to a point adjacent the bottom of the container. According to the invention in addition to a liquid and a gaseous phase of the fuel the storage or refill container contains a second compressed gas which is inert to and immiscible with the liquid phase of the fuel. The said second compressed gas, which may for example be nitrogen, should be compressed to such an extent that the pressure thereof exceeds the vapor pressure of the liquid fuel even when the storage container is almost emptied for liquid fuel, whereby is obtained that liquid phase of the fuel may be discharged from the container in an upright position of the same merely by operating the discharge valve of the storage container.

In case the fuel container of a hair curler described is provided with a suitable filling valve, the fuel container of the curler may be filled with liquid phase fuel by placing the curler at the top of the storage or refill container and operating the valve of said container. The said valve at the top of the storage container may be of the type operated by exerting a downward

pressure at the top end of the dip tube. In such case the fuel container of the hair curler may be filled by placing the curler at the top of the dip tube of the storage container and pushing the curler downwardly toward the upper part of the storage container.

It is envisaged that the storage or refill container described above may be used for filling the fuel container of any type of minor appliances of the type using liquefied fuel, such as gas lighters and the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of an embodiment of the hair curler according to the invention;

FIG. 2 is a perspective and partially sectional view illustrating a refill container and how the fuel container of the curler shown in FIG. 1 may be refilled; and

FIG. 3 is an enlarged sectional view of a further embodiment of the oxidation or reaction tube of the curler shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The hair curler shown in FIG. 1 is represented generally by the numeral 30 and comprises an outer tubular member 31 having a plurality of openings 32 and radially outwardly projecting pins 33 or other suitable hair engaging means. At one end of the hair curler the tubular member 31 contains a fuel container 34 for containing a supply of liquefied fuel 35, such as butane or propane. The outer end wall 36 of the fuel container is funnel-shaped, and at the center part thereof a filling valve 37 is provided. The valve member of said valve comprises a valve stem 38 and a collar or sleeve 39 of rubber, plastic or another suitable material tightly surrounding one end of the stem 38. The said valve member may to some extent be moved axially whereby the left end (as viewed in FIG. 1) of the sleeve 39 may be moved into and out of engagement with the valve seat 40. The fuel container 34 further contains a filtering and/or gasifying member 41, which may, for example, be shaped as a sheet, a layer, or a pellet covering a discharge opening 42 of the liquid container. The member 41 may, for example, be made from paper materials, ceramic materials and/or sintered metals. The fuel container 34 may contain wick means, which may, for example, comprise a lining 43 covering the inner sidewalls of the fuel container and being made from a fibrous material, such as filtering paper, textile materials, or other absorptive materials, and the member 41 is connected to or contacted by the lining 43. The outside of the fuel container end wall facing the inner of the hair curler is covered by a heat insulating layer 44.

Through a tubular connecting member 45 the discharge opening 42 of the fuel container 34 is communicating with an axially extending injector or Venturi member 46 containing an axially extending channel or duct 47 communicating with a transversely extending air introducing channel or duct 48, the outer end of which opens into the atmosphere. The injector member 46 is preferably made from a refractory material such as a ceramic material. A nozzle plate 49 is clamped between adjacent radial surfaces of the connecting member 45 and the injector member 46, respectively. If desired, one or two annular packings or sealing rings 50 may be used. At the center of the nozzle plate a nozzle opening 51 having a diameter ranging from about 15 μ to about 80 μ is provided, preferably by means of laser light. The axially extending channel or duct 47 of the injector member 46 opens into an oxidation or catalyst chamber 52 defined by an axially extending tubular member 53 which is preferably made from a transparent material, and one end of which is tightly connected to the injector member 46. At the free end of the tubular member 53 the chamber 52 opens into the atmosphere. The said chamber 52 contains one or more oxidation catalyzing materials which may, for example, comprise a porous member or pellet 54 of aluminum oxide having one or more axially extending ducts 55. The pellet 54 may, preferably at the downstream end thereof, serve as

a carrier for a second and more active catalyst material, such as platinum and palladium. At the right end of the pellet 54 (as viewed in FIG. 1) a filament 56 of a catalyzing material, such as platinum, is arranged. The end of said filament is in a manner not shown electrically conductively connected to the fuel container end wall 36 and to a contact ring 57, respectively, said contact ring being electrically insulated from said fuel container end wall.

A transversely extending partition wall 73 divides the inner space of the tubular member 31 into an air suction chamber and a combustion gas exhaust chamber, and the total inner space of the tubular member 31 not occupied by the fuel container 34 is surrounded by a security cage 58 of wire mesh.

FIG. 3 shows the injector member 46 connected to a modified embodiment of the tubular member 53 provided with an extension 59 having a Venturi throat 60. At the throat 60 one or more transverse openings 61 are formed for permitting suction of air into the gas flowing through said throat.

FIG. 2 illustrates a storage or refill container generally represented by the numeral 62. The container 62 comprises a top wall or dome 63 at the center part of which a discharge valve 64 is mounted, which valve may be operated by depressing a discharge tube 65. From the housing of the valve 64 a dip tube 66 extends to a point adjacent the bottom of the container. The discharge valve 64, the discharge tube 65 and the dip tube 66 may be of the types commonly used in aerosol packages or containers.

The dome 63 is covered by a hood or cap 67 having a central opening for receiving the discharge tube 65 and the housing of the discharge valve 64. The cap wall portion 68 surrounding said central opening is shaped as a funnel for receiving the end of the hair curler 30 at which the filling valve 37 is arranged. In the space defined between the dome 63 and the cap 67 dry cells or another source of electrical current are arranged. By means of suitable mounting members 70 the poles of the dry cells are maintained in electrical contact with contact members (not shown) arranged at the funnel-shaped cap wall portion 68 in such a manner that the said contact members are brought into contact with the end wall 36 of the fuel container 34 and with the contact ring 57, respectively, whereby an electrical current in the filament 56 is automatically provided when the fuel container end of the hair curler is inserted in the funnel 68 as further described below.

The refill container 62 contains a supply of liquefied fuel 71, such as butane or propane. The container space 72 above the liquid phase 71 comprises in addition to the gaseous fuel phase a second compressed gas which is immiscible with and inactive to the liquefied fuel. The said second gas may for example, be nitrogen and should be compressed to such an extent that the gas pressure within the space 72 substantially exceeds the vapor pressure of the liquefied fuel at the normal operating temperatures, even when almost all the liquefied fuel 71 has been discharged from the refill container 62.

The operation of the above-described hair curler is as follows:

When the hair curler 30 is to be used the curler is gripped, and the funnel-shaped end wall 36 is pressed over the discharge tube 65 of the refill container 62 as shown in FIG. 2. Thereby the discharge tube 65 is led into contact with the valve stem 38, and the filling valve 37 of the hair curler as well as the discharge valve 64 is opened. Due to the nitrogen pressure in the space 72 of the refill container liquefied fuel from the liquid phase 71 is pressed up through the dip tube 66, through the opened valves 64 and 37 and into the fuel container 34, which may be almost filled with liquefied fuel. As an example the nitrogen pressure in the space 72 of the refill container may be about 8 atm. gauge, and the volume of the fuel container 34 may be about 4 cm.³ which corresponds to a fuel capacity of about 2 grams of liquefied gas. From the fuel container 34 the gas begins to flow through the filtering or gasifying member 41 and the discharge opening 42 to the nozzle opening 51. The porous filtering or gasifying member 41 filters the gas flowing to the nozzle opening and thereby

prevents clogging of the same. The pressure drop created through the porous filtering or gasifying member 41 causes a gasification of the liquefied fuel, and due to the fact that the member 41 is maintained moistened by liquefied fuel by means of the wick or lining 43 as previously described the said pressure drop is almost constant despite of the changing quantity of liquefied fuel left in the fuel container and despite of the position in which the curler is held. Thus, the gas pressure at the upstream side of the nozzle plate 49 is kept almost constant under all operational conditions and an even and controlled flow of gas through the nozzle opening 51 may be obtained.

The size of the nozzle opening is normally chosen dependent on the pressure drop through the gasifying member and through the ducts and channels of the curler, on the vapor pressure obtained in the fuel container 34 under operational conditions, and on the heating intensity desired within the curler.

The flow of gaseous fuel through the channel or duct 47 creates a suction in the same, and thus by injector effect air from the air suction chamber is automatically sucked into the duct 47 through the air introducing channel 48 whereby a mixture of fuel and air is directed into the oxidation chamber 52. Air may be sucked into the air suction chamber through the openings 32 in the outer tubular member 31. However, when hair is wound around the tubular member 31 these openings may be partly or totally covered and closed. Therefore, the hair curler may preferably have longitudinally extending ducts or channels (not shown) communicating with the air suction chamber and opening into the atmosphere at the periphery of the funnel-shaped end wall 36 of the curler. For the sake of safety the said mixture may contain such an amount of air that a normal combustion of the fuel in the mixture is impossible when no catalyst is present.

When the hair curler 30 is depressed over the discharge tube 65 of the refill container as described above an electrical current is automatically supplied to the filament 56 as previously described. Thus, the initial flow of gas-air mixture through the oxidation chamber 52 contacts the glowing catalyzing filament 56 whereby oxidation of the gaseous fuel in the mixture is initiated. The combustion gases are exhausted through the openings 32 and/or the adjacent open end of the curler. The partition wall 73 prevents that combustion gases from the chamber 52 are mixed with the air introduced into the duct 48, and the insulating layer 44 prevents undue heating of the fuel container 34.

When the fuel container 34 of the curler 30 has been filled or almost filled with liquefied fuel from the storage container 62, the curler is removed from the storage container. Then the valves 37 and 64 are automatically closed, and the electrical current through the filament 56 is interrupted. The oxidation process once having been started within the chamber 52, the less active catalyst or catalysts in the pellet 54 are able to catalyze the further oxidation of the gaseous fuel in the chamber 52, whereby the more expensive catalysts or catalysts having a relatively short useful life may be spared.

When the curler 30 has been removed from the refill container 62 the curler may be arranged in hair, which should be curled and/or dried, in the normal manner. Heat generated by the oxidation of the fuel in the chamber 52 is transmitted to the hair partly by radiation through the transparent tubular member 53 and through the openings 32, and partly by convection.

The heat generation within the oxidation chamber continues as long as liquefied fuel is present within the fuel container 34. Therefore, if after use the user wants to stop the heat generation this may conveniently be done by depressing the stem 38 of the filling valve 37, whereby the valve is opened so that fuel in the container 34 may escape into the atmosphere.

The security cage 58 has for its object to prevent that the hair curler ignites in flammable vapors or gases which may be present outside the curler during operation thereof.

When an embodiment of the tubular member 53 as that shown in FIG. 3 is used in the hair curler 30 it is possible to use a gas-air mixture being more optimal for combustion, because the exhaust flow of gas through the Venturi throat 60 causes a suction of air through the openings 61 into the tubular extension 59. Thus, the gas mixture exhausted from the hair curler may be made nonflammable even if for some reason no oxidation of the fuel has taken place within the chamber 52.

It should be understood that several modifications of the hair curler described above could be made without departing from the scope of this invention. It is also envisaged that the combustion of the fuel within the hair curler according to the invention could take place also in case no oxidation catalyst is present in the combustion chamber or combustion zone. At the present time, however, such embodiment of the hair curler is not preferred.

I claim:

1. In a hair curler having means for storing a supply of fuel in said curler, means for releasing fuel in gaseous form from the supply and means for catalyzing an oxidation of the released gaseous fuel so as to generate heat, the improvement that said fuel releasing means comprise a nozzle for directing a flow or current of gaseous fuel from said fuel supply to said catalyzing means.

2. A hair curler according to claim 1, further comprising means for introducing an oxygen containing gas into said flow of gaseous fuel from said nozzle so as to provide a gas mixture combustible in the presence of said catalyzing means.

3. A hair curler according to claim 2, wherein said oxygen introducing means comprise injector means positioned in alignment with said nozzle at the down stream end thereof for introducing oxygen containing gas into the flow of gaseous fuel by injector effect.

4. A hair curler according to claim 2, wherein said nozzle defines a nozzle opening the diameter of which is 15—80 μ .

5. A hair curler according to claim 4, wherein said nozzle openings has been provided in said plate by laser light.

6. A hair curler according to claim 2 wherein said catalyzing means comprise a first catalyst having a relatively long useful life and a second and more active catalyst having a shorter useful life, said first catalyst being positioned upstream to said second catalyst in the flow of gas mixture.

7. A hair curler according to claim 6, wherein said first catalyst defines the inner surface of a channel or duct portion for said flow of gas mixture, said second catalyst being placed at the downstream end of said duct portion.

8. A hair curler according to claim 6, wherein said second catalyst comprises a filament of an oxidation catalyzing material for initiating oxidation of the gaseous fuel by heating said filament through supplying an electrical current thereto.

9. A hair curler according to claim 2, further comprising means for introducing a noncombustible gas or gas mixture into the flow of gas having passed the catalysts in order to obtain that the resulting gas mixture flow leaving the curler is nonflammable even when for some reason no oxidation of the gaseous fuel emitted by the nozzle has taken place in the curler.

10. A hair curler according to claim 6, wherein said first catalyst comprises aluminum oxide and said second catalyst comprises platinum.

11. A hair curler according to claim 2, wherein said supply of fuel is present in a liquid as well as in a gaseous state, said fuel releasing means further comprising a porous mass positioned between said fuel supply and said nozzle in such a manner that the fuel has to penetrate said porous mass in order to reach the opening of the nozzle, whereby releasing of the fuel in a gaseous state is secured and clogging of the nozzle opening is prevented.

12. A hair curler according to claim 11, further comprising wick means contacting said liquid phase of the fuel supply and the porous mass, respectively, so as to secure moistening of said porous mass with liquid fuel phase in all positions of the hair curler.

13. A hair curler according to claim 11, wherein said porous mass is made from a material selected from the group consisting of pulp, paper, ceramic materials and sintered metals.

14. A hair curler according to claim 2, further comprising heat insulating material arranged so as to substantially reduce transfer of heat generated by said oxidation of fuel to said supply of fuel.

15. A hair curler comprising a container for containing at an elevated pressure a supply of a liquefied combustible gas being in a gaseous state at atmospheric pressure and temperature conditions, valve means permitting loading of said container with liquefied gas, a nozzle communicating with said container and comprising an air intake, said nozzle being adapted to direct a current or flow of a mixture of air and combustible gas into an internal space defined in said curler, and catalyzing means arranged in said space for catalyzing an oxidation of combustible gas in said flow or current.

16. A hair curler according to claim 15, wherein said nozzle defines a nozzle opening having a diameter of $15\ \mu\text{--}80\ \mu$, said opening having been provided by use of laser light.

17. A hair curler according to claim 15, wherein said catalyzing means comprises a first catalyst having a relatively long useful life and a second and more active catalyst having a shorter useful life, said first catalyst being arranged closer to the nozzle opening than said second catalyst, whereby the initial oxidation of the gas in said flow or current may be catalyzed by said second catalyst, whereas the oxidation may be catalyzed by said first catalyst, the catalyzing process once having been started, thereby sparing said second catalyst.

18. A hair curler according to claim 17, wherein said second catalyst comprises a filament, means being provided for sup-

plying an electrical current to the filament in order to heat the same, whereby initiation of the oxidation is facilitated.

19. A hair curler according to claim 15 further comprising a tube or duct of the Venturi type arranged downstream to said catalyzing means and being adapted to introduce further air into the flow or current of gas mixture leaving said internal space in order to secure that gas mixture exhausted from the hair curler is nonflammable even when for some reason no oxidation of the combustible gas has taken place in the hair curler.

20. A hair curler according to claim 17, wherein said first catalyst comprises aluminum oxide, and said second catalyst comprises platinum.

21. A hair curler according to claim 15, further comprising a filtering means arranged between said gas container and said nozzle in such a manner that combustible gas from said container has to pass said filtering means in order to reach the nozzle opening.

22. A hair curler according to claim 21, further comprising wick means arranged in said gas container and adapted to moisten said filtering means with liquefied gas despite of the position of said container.

23. A hair curler according to claim 21, wherein said filtering means comprises a material selected from the group consisting of pulp, paper, ceramic materials and sintered metals.

24. A hair curler according to claim 15, further comprising a heat insulation arranged between said gas container and said internal space of the curler to reduce transfer of heat generated by the oxidation of combustible gas to said gas container.

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