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(11) **EP 1 018 620 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
12.07.2000 Bulletin 2000/28

(51) Int. Cl.⁷: **F23Q 2/42**

(21) Application number: **99925369.3**

(86) International application number:
PCT/JP99/03249

(22) Date of filing: **18.06.1999**

(87) International publication number:
WO 00/06950 (10.02.2000 Gazette 2000/06)

(84) Designated Contracting States:
BE DE DK ES GB LU NL

(30) Priority: **27.07.1998 JP 21137298**

(71) Applicant: **Tokai Corporation**
Tokyo 151-0073 (JP)

(72) Inventors:
• **MIFUNE, Hideo,**
Main Factory,
Tokai Corporation
Sunto-gun, Shizuoka-ken 410-1431 (JP)

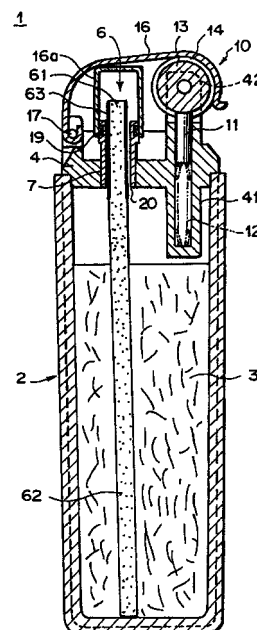
• **SERIZAWA, Nobuyuki,**
Main Factory,
Tokai Corp.
Sunto-gun, Shizuoka-ken 410-1431 (JP)
• **NAKAMURA, Yasuaki,**
Main Factory,
Tokai Corporation
Sunto-gun, Shizuoka-ken 410-1431 (JP)

(74) Representative:
Klunker . Schmitt-Nilson . Hirsch
Winzererstrasse 106
80797 München (DE)

(54) **FUEL TANK FOR LIQUID FUEL COMBUSTION DEVICE**

(57) Liquid fuel is impregnated into and held in cotton filling (3) formed of absorbent fibrous material stored in a fuel tank (2), and the liquid fuel is sucked up by a suction section (62) of a wick (6) and burnt in a combustion section (61). A fuel containing section of the fuel tank (2) has a split structure, with split sections of split, parts (21) and (22) being joined together. The cotton filling (3) and the wick (6) are fitted into the fuel tank (2) in a good condition.

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Description

TECHNICAL FIELD TO WHICH THE INVENTION BELONGS

[0001] The present invention relates to a fuel tank constituting a fuel container having cotton filling as a liquid absorbing fibrous material for being impregnated with and holding liquid fuel, in a liquid fuel burner such as a smoker's lighter or an igniter, etc., that draws in and burns liquid fuel contained in a fuel tank utilizing the capillary phenomenon in a combustion wick, using liquid fuel with alcohol as its main constituent.

BACKGROUND OF THE INVENTION

[0002] Alcohol such as ethyl alcohol, benzene fuel of the petroleum benzene group, including petroleum, or liquefied gas fuel such as butane gas or propane gas are generally used as the fuel for a burner such as a smoker's lighter, an igniter, a torch, lamp, or heater etc.

[0003] The performance, place of use and structural design of various burners differ according to the type of fuel used, and they have various characteristics.

[0004] For example, in the case of benzene fuel using a mixture of petroleum benzene system hydrocarbon compounds, this fuel is a mixture of compounds having differing boiling points. Early on in the operation of igniting the burner the benzene component having a low boiling point is evaporated and then the volatile components migrate to the hydrocarbon having sequentially increasing boiling point, which means that the fuel composition building up inside the burner varies according to the combustion time, and variation arises in flame length as a result of the variation in fuel composition. The same applies to gasoline. Also, the volatility of benzene and gasoline is high, and in a burner using this type of fuel there is a need for a sealed structure to reduce evaporation from parts of a fuel storage section and a wick, and if the sealing is insufficient fuel is lost due to evaporation and the frequency of replenishing the fuel is annoyingly often, and further, benzene and gasoline have an inherent smell, and are sometimes not preferred.

[0005] In the case of liquefied gas fuel, the gas pressure becomes high in the temperature range in which the burner is used, and it is necessary for a container storing fuel to have a pressure resistant structure. Also, the flame length varies in response to variations in the above described gas pressure, and in particular that gas pressure has a characteristic that it varies logarithmically with respect to temperature, and there is a problem that variation in flame length is large with respect to temperature. In order to reduce this variation in flame length, a fuel supply structure of the burner requires special design measures for carrying out temperature compensation, thus complicating the structure and increasing costs.

[0006] On the other hand, in the case of alcohol fuel, liquid fuel having alcohol such as low-grade monovalent alcohol like ethyl alcohol, methyl alcohol or propyl alcohol, as its main constituent is a liquid at normal temperature, vapor pressure is also comparatively low, and there is no need for a pressure resistant fuel storage section; and so sealing of the fuel tank and the wick can be of a sealed structure only to the extent that alcohol does not evaporate which makes it possible to simplify the structure of the burner and reduce cost.

[0007] Also, with a burner using liquid fuel with alcohol as its main constituent, surface tension of the liquid fuel is generally used as the means for supplying the liquid fuel from a fuel tank to a combustion section, and connecting pores or slits containing bundles of fine fiber sucked up fuel utilizing the capillary phenomena, with the tip of the fibers being used as a wick that is burned.

[0008] With this type of liquid fuel burner, if it is used in an upright position, such as when it is a lamp or a heater, then liquid fuel can be introduced into the fuel tank in that standing position, but in a burner that is required to be portable such as a smoker's lighter or an igniter, a fibrous cotton material known as cotton filling is stuffed into the fuel tank and impregnated with fuel, which it then holds, and a suction section of the wick is brought into contact with the cotton filling, liquid fuel is supplied to the combustion section utilizing the capillary phenomena and combustion takes place. In this manner, in both a burner having portability and a burner that is used standing upright, injected liquid fuel can be prevented from leaking from a fuel tank regardless of the direction the burner is oriented when it is turned over while being carried or used.

[0009] The above described fuel tank is generally has either a deep cylindrical shape, a flat cylindrical cross section making it suitably portable, or an elliptical shape, and is formed as a deep container if the amount of stored fuel is increased.

[0010] The above described fuel tank generally an integrally formed component made by extruding synthetic resin, drawing a metallic plate or extruding a metal billet. However, even if a wick and cotton filling are integrated to make insertion easy, prevention of deformation of the wick and filling is difficult when while they are placed inside a deep fuel. Further, separate housing of the wick and filling is even more difficult, and productivity is low in this case.

[0011] In other words, a fixed amount of the cotton filling, namely the absorptive fibrous material impregnated with and holding liquid fuel, necessary for holding a specified amount of liquid fuel contained at a uniform packing density in the fuel tank, is good for improved performance. However, it is difficult to pack the cotton filling into the above described type of fuel tank.

[0012] For example, forcing a spongy fibrous material as cotton filling into a fuel tank made of metal or plastic either as it is or after being cut up to an appropriate size is not appropriate for mass production because

the ease of manufacture is low as it is difficult to handle the cotton material, and also the packing density of the fibrous material varies due to packaging conditions and packing density control becomes complicated and difficult. If the fibrous material packing density becomes non-uniform, there is a danger that the overall amount of liquid fuel held and fuel supply characteristics of the suction section of the wick will vary.

[0013] Also, if the cotton filling or the wick move inside the fuel tank due to sliding or rocking when the liquid fuel burner is being carried or used, or due to consumption of the liquid fuel, variations in the packing state and the fibrous material packing density sometimes arise, and besides that, if variations occur gradually over time there is a possibility of a problem arising where fuel holding characteristics and supply characteristics similarly vary, and it is desired to reduce these movements as much as possible.

[0014] On the other hand, when liquid fuel inside the fuel tank is supplied from the cotton filling to a lower suction part of the wick and fuel supply to the combustion section is carried out, it is necessary to have good contact between the suction part of the wick and the cotton filling so that this fuel supply is accurately carried out, but with a container shaped fuel tank simply pressing the suction part of the wick into the cotton filling so that it sticks into it sometimes makes it difficult to obtain good contact. In particular, with material of the suction part of the wick that has low material hardness and is flexible, insertion itself is difficult and insertion at the appropriate location is difficult no matter what the shape of the tip end. Also, even if the suction part of the wick is inserted into the container shaped fuel tank in advance and the fibrous material stuffed around the wick, it is difficult to shape the wick and arrange it at a specified location of the fibrous material at a specified position so distribution of fuel is uneven, and this stuffing in of the fibrous material has the problem that, as described before, productivity is low, and it is difficult to obtain uniform fibrous material packing density.

[0015] The present invention has been conceived in view of the above described situation, and is intended to provide a fuel tank of a liquid fuel burner that enables cotton filling and a wick to be filled into the fuel tank simply and in a good condition.

DISCLOSURE OF THE INVENTION

[0016] In order to solve the above described problems, a fuel tank for a liquid fuel burner of the present invention causes liquid fuel that has impregnated and is stored in a cotton material made of absorbent fibrous material contained in the fuel tank to be sucked up by a suction part of a wick and burnt in a combustion section at the tip of the wick, and a fuel containing part of the fuel tank has a split structure with split parts being joined together.

[0017] The fuel containing section is made of a syn-

thetic resin material that is not caused to chemically react, dissolve or swell by the liquid fuel, or of a material provided with a film that is not caused to chemically react, dissolve or swell by the liquid fuel or a coating for preventing leakage of the liquid fuel that is deposited, coated or painted on, to contain the liquid fuel so that the liquid fuel does not leak out and wet the inner surface of a fibrous paper material. In this case, it is possible for the fuel containing section to be made of a metal foil and a synthetic resin film laminated on a paper material.

[0018] The split parts of the fuel containing section are provided with good sealing characteristics as they are joined together by ultrasonic welding, thermal welding or adhesive.

[0019] In the case where fuel with alcohol as its main constituent is used as the liquid fuel, the main body of the fuel containing section or an inner section of the fuel containing section coming into contact with the liquid fuel through an inner surface coating or a film layer is preferably formed of either polyethylene, polypropylene, polystyrene, polyacetal, polyethylene phthalate, polyacrylonitrile, denatured polyphenylene ethyl, or polyphenylene sulfide.

[0020] Also, at least one of the stored cotton filling and the wick is preferably provided with a protrusion for fixing in order to engage or abut inside the block constructed fuel tank. In this case, it is possible for the protrusion to be provided in a shape for fixing by sticking into at least one of the cotton filling or the wick. Similarly, at least one of the contained cotton filling and wick can have an abutment member for fixing in order to abut or locate inside the fuel tank.

[0021] Further, it is possible for a reinforcing member for preventing deformation of the fuel containing section to be arranged inside the block constructed fuel tank. The arrangement of this reinforcing member is particularly applicable if the fuel containing section is made of a paper material. The above described reinforcing member can be formed as a component gripping the paper material surrounding the cotton filling or the cotton filling.

[0022] After the cotton filling and the wick have been stored inside the fuel containing section, the split parts of the fuel tank are preferably joined together.

[0023] As a fibrous material for the cotton filling, one or a mixture of natural fiber such as soft wood pulp or hardwood pulp, or synthetic fiber such as polypropylene fiber are used. The packing density of each of the fiber materials is preferably such that the amount of liquid fuel it can be impregnated with and hold is large, and the residual amount after consumption of the liquid fuel is low, for example, the packing density of polypropylene fiber is preferably 0.05 - 0.15 g/cm³, the fiber thickness is preferably 6 - 18 denier, and it is preferably mixed with fiber of a different thickness. Also, natural pulp and heat fusible fiber having a fiber diameter of 35 - 60μm can be mixed together.

[0024] Also, the cotton filling can be arranged so that the fibrous material is covered by a coating film and then shaped beforehand so as to conform to the internal shape of the fuel tank, and in this case, in order to make the coating film, paper, fabric, a thin plastic sheet, or a non woven fabric formed from synthetic fibers or woven fabric are provided in a cylinder or bag and the fibrous material is put into the tube or bag at a specific packing density, or alternatively the fibrous material is held inside the coating film at a specific packing density using a heat fusible sheet, and formed into a specified shape by heat fusing necessary places on the edge of the coating film. As the heat fusible sheet, it is possible to use polypropylene fiber paper, polyethylene mesh sheet, or polyester fiber paper, polypropylene film, polyethylene film or polyester film, or a laminated sheet of one of these and paper.

[0025] It is also possible to insert the suction part of the wick into the fibrous material of the cotton filling and to integrate the two and to pack this combined unit into the partitioned fuel tank, then join the split parts together. Still further, it is possible to partially heat fuse between the coating film at points and lines using outer surfaces of the coating film, and to restrict movement of the fibrous material. In this way, a protrusion on the surface of the fuel tank or a protrusion on an abutment member similarly suppress the generation of density differences caused by movement of the fibrous material due to shocks etc, when assembling the fuel tank, injecting fuel or using the burner.

[0026] With respect to the wick, the suction section that comes in contact with the fibrous material and sucks up liquid fuel, and the tip combustion section where ignition and combustion takes place, are integrally formed of the same material, or alternatively the suction section and the combustion section can be made separately of different material, but this is appropriately determined depending on the use to which the liquid fuel burner is put.

[0027] As a liquid fuel having alcohol as its main constituent, for example, a main constituent of low grade monohydric alcohol such as methyl alcohol, ethyl alcohol, or propyl alcohol is mixed with a saturated hydrocarbon such as or hexane or heptane to give the alcohol flame color.

[0028] With this type of fuel tank, by giving the fuel containing section a split structure, arrangement of the wick and the cotton filling impregnated and holding fuel to be housed in the fuel tank can be carried out easily with positional stability, and uniformity of fiber density of the cotton filling, as well as the contact conditions between the wick and the cotton filling, can be improved.

[0029] In particular, with respect to the cotton filling, there is no need to stuff the filling into the inside of the fuel tank, and it is possible to carry out assembly so that the cotton filling is sandwiched between parts of predetermined shape in advance, and it is thus possible to

make the packing density distribution uniform.

[0030] As well as simplifying production thus far described where packing of the wick and cotton filling in to the fuel tank from an opening of the fuel tank is made easy, it is possible to provide a protrusion for abutment and positioning of the cotton filling and the wick on at least one side of the split parts, and it is possible to simply improve on the situation with the integrated tank of the related art where shaping was difficult, and where insertion of the wick and cotton filling were difficult if this protrusion was provided.

[0031] With the provision of the protrusion for fixing at the inner surface of the block constructed fuel tank, it is possible to prevent movement of the wick and the cotton filling inside the tank when the finished product is being moved or carried around, and it is possible to obtain positional stability and maintain fuel supply performance.

[0032] With the arrangement of an abutment member for fixing as a separate part inside the fuel tank, the fuel tank can be expected to have a stabilized cotton filling and wick even if shape processing is not carried out on the inner surface.

[0033] By providing a reinforcing member for preventing deformation of the fuel containing section inside the block constructed fuel tank, it is possible to prevent deformation of the fuel tank such as by squashing, and to prevent damage and leakage of liquid fuel, even if the fuel containing section is formed from a paper material. In this case, if the reinforcing member is made from a paper material surrounding the cotton filling or a part gripping the cotton material, ease of assembly can be improved due to integration of the cotton filling and the wick.

[0034] On the other hand, if a fixed amount of fibrous material is previously formed into a shape coinciding with the shape of the fuel tank and gathered together as the cotton material, and the density of the fibrous material is homogenized, the ease of handling with respect to manufacture of fibrous material that is protean is improved and control of packing density is also simplified, and further, filling into the block constructed fuel tank can be carried out simply in production, it is suitable for mass production and the burner can be manufactured easily.

[0035] Also, with suction section of the wick integrated with the cotton filling and the integrated unit packed in to the block constructed fuel tank in advance, assembly of the wick is simplified, and it is possible to arrange at an appropriate position without insertion in to the fibrous material, even if the wick suction section is of a flexible material having a low material hardness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

Fig. 1 is a schematic cross sectional drawing of a

smoker's lighter as one example of a liquid fuel burner provided with a fuel tank of a first embodiment of the present invention.

Fig. 2 is a perspective exploded view of the fuel tank section of Fig. 1.

Fig. 3 is a schematic cross sectional drawing of a smoker's lighter as one example of a liquid fuel burner provided with a fuel tank of a second embodiment of the present invention.

Fig. 4 is a perspective exploded view of the fuel tank section of Fig. 3.

Fig. 5 is a schematic cross sectional drawing of a smoker's lighter as one example of a liquid fuel burner provided with a fuel tank of a third embodiment of the present invention.

Fig. 6 is a perspective exploded view of the fuel tank section of Fig. 5.

Fig. 7 is a schematic cross sectional drawing of a smoker's lighter as one example of a liquid fuel burner provided with a fuel tank of a fourth embodiment of the present invention.

Fig. 8 is a perspective exploded view of the fuel tank section of Fig. 7

Fig. 9 is a perspective exploded view of a fuel tank section of a fifth embodiment.

Fig. 10 is a perspective exploded view of a fuel tank section of a sixth embodiment.

Fig. 11 is a perspective exploded view of a fuel tank section of a seventh embodiment.

Fig. 12 is a perspective exploded view of a fuel tank section of an eighth embodiment.

Fig. 13 is a perspective exploded view of a fuel tank section of a ninth embodiment.

PREFERRED MODE OF CARRYING OUT THE INVENTION

[0037] Various embodiments of a fuel tank for a liquid fuel burner of the present invention will be described in the following, with reference to the attached drawings.

(First Embodiment)

[0038] Fig. 1 shows the schematic cross sectional structure of a smoker's lighter as a liquid fuel burner provided with the fuel tank of this embodiment. Fig. 2 shows an exploded view of the fuel tank.

[0039] The lighter 1 has a fuel tank 2 that is cylindrical with one end closed off, and cotton filling 3 formed from absorbent fibrous material for being impregnated with and holding liquid fuel is arranged inside the fuel tank 2, with an upper cover 4 being fixed to an upper part of the fuel tank 2. The cotton filling 3 is arranged towards the bottom of the fuel tank, and a space is provided in the upper part.

[0040] A metallic wick holder 7 is fixed to the upper cover 4, passing vertically through the upper cover 4 to the inside of the fuel tank 2, and a wick 6 passes

through and is held by the wick holder 7. The wick 6 is comprised of a tip end combustion section 61 protruding upward from the wick holder 7, and a suction section 62 coming into contact with the cotton filling 3 lower down that are integrally formed using a material that will be described later.

[0041] An igniting member 10 opposite a tip end of the combustion section 61 of the wick 6 is also arranged in the cover 4. This igniting member 10 is configured having a flint 11 and flint pressing spring 12 inserted so as to be moveable in the vertical direction in to a bracket 41 extending vertically and provided integrally with the cover 4, a spark wheel 13 and a side wheel 14 rotatably supported on struts 42 on both sides of an upper part of the bracket 41, and the tip of the spark wheel 13 is pressed against the peripheral edge of the spark wheel 13 by the spring force of the flint pressing spring 12. A spark is caused to fly off in the direction of the wick 6 by the rotating operation of the side wheel 14.

[0042] A blocking cap 16 for preventing evaporation is also provided in an upper part of the upper cover 4 in such a way that it can be opened and closed. This blocking cap 16 is rotatably hinged by a pin 17 at one end of the upper surface of the upper cover 4, and an inner cap 16a surrounding the periphery of the wick holder 7 and covering the combustion section 61 to make it airtight is provided on the inner surface of the blocking cap 16. An O-ring 19 is horizontally attached to a peripheral blade section of the wick holder 7, and pressure welded to the inner surface of the inner cap 16 to increase airtightness.

[0043] Vents 20 located inside the inner cap and connecting the inside of the fuel tank 2 to the outside when the blocking cap is closed are provided in the wick holder 7.

[0044] The fuel tank 2 has a split structure with a fuel containing section of the fuel tank having a base section and a side wall longitudinally divided into two split parts 21 and 22, with split parts of the two split parts 21 and 22 widened out to flange shaped connecting sections 21a and 22a. The fuel tank is formed by joining the two split parts together after the cotton filling 3 and the wick 6 have fitted in, and joining the assembly to the upper cover 4. The split parts 21 and 22 of the fuel tank 2 are synthetic resin molded components formed of polyethylene terephthalate, and are provided so that the internal volume of the fuel tank 2 is 8 cm³ in the assembled state.

[0045] The fibrous material of the cotton filling is softwood pulp having a fiber width of 50 μm, and a fiber thickness of 15 μm. When the cotton filling is packed inside the fuel tank 2, it is divided in two to give a density of 0.07 g/cm³ and arranged either side of the suction section 62 of the wick 6. The divided cotton filling is then gripped from both sides by the split parts 21 and 22, and the connecting sections 21a and 22a of the side surfaces and the bottom sections of the split parts 21 and 22 are integrated by heat fusion with the combustion

section 61 of the wick 6 protruding from an opening section connecting to the upper cover 4.

[0046] The volume of the cotton filling loaded inside the fuel tank 2 is 7 cm^3 . The cotton filling 3 is impregnated with liquid fuel that is a mixture of 95 % by weight ethyl alcohol and 5 % by weight n-hexane, which is then held. Joining together of the upper opening section of the fuel tank 2 and the upper tank 4 is carried out using ultrasonic welding, heat fusing or adhesive, and the fuel tank is made so that liquid fuel does not leak from these joining section.

[0047] The wick is made of ceramic fiber. For example, a microscopic amount of organic binder of is added to a ceramic fiber formed by making a raw material having alumina with a thickness of $2.8 \mu\text{m}$ and silica as main constituents into fibers, and the fibers formed into a plate having a fiber density of 0.16 g cm^3 , and this plate is cut, formed into rod-shaped pieces having a length of 70mm and of $3 \text{ mm} \times 3 \text{ mm}$ rectangular cross section, and the rod-like pieces are inserted into a wick holder 7 having an inner diameter of 4.0 mm, an outer diameter of 6.0 mm, and a length of 9.0 mm. The combustion section 61 of this wick 6 is fixed so as to protrude from the upper end surface of the wick holder seven to a length of 3mm, and the suction section 62 has a length of 45mm from the lower end inserted into the cotton filling.

[0048] An outer skin 63 that is porous and has lower permeability to liquid fuel than the internal material is coated on at least the outer surface of the combustion section 61 of the wick 6, so as to make a flame shape tapered. This outer skin 63 is formed at a side 10mm from the upper end of the wick 6, and a ceramic fiber surface is exposed on the upper surface of the combustion section 61 and the side of the suction section 62.

[0049] The wick 6 as described above sucks up liquid fuel that the cotton filling is impregnated with using the suction section 62 and utilizing the capillary phenomenon, supplies the sucked up liquid fuel to the combustion section 61. The combustion section 61 protruding upwards from the wick holder 7 is then ignited to generate a flame and the fuel is burnt.

[0050] With the above described split structure of the fuel tank 2, cotton filling can be simply packed into the inside of the fuel tank 2 at a uniform packing density, a good contact condition can also be maintained with respect to the wick 6, and the arrangement is simple.

[0051] The wick can also have the upper combustion section 61 and the lower suction section 62 made separately from different materials, and with a lower end of the combustion section 61 and an upper end of the suction section 62 in contact with each other, they can be held together using the wick holder 7. In this case, it is possible, for example, for the combustion section 61 to be formed from ceramic fiber, as described previously, for the suction section 62 to be formed by bundling and fixing alumina fibers together or adding a binder to acrylic fiber and pressing them into a rod-like

shape, with a thickness of the acrylic fiber being 3 denier and a porosity being 60%.

(Second Embodiment)

[0052] Fig. 3 shows the overall structure of a lighter provided with a fuel tank of this embodiment, and Fig. 4 shown an exploded view of the fuel tank section.

[0053] Similarly to the previous embodiment, the cotton filling 3 is softwood pulp having a fiber width of $50 \mu\text{m}$, and a fiber thickness of $15 \mu\text{m}$. When it is packed into the fuel tank 2, an amount necessary to give a density of 0.07 g/cm^3 is covered, together with the suction section 62 of the wick 6 similar to the first embodiment, by a coating layer 31 of heat fusible polypropylene non woven fabric, side edges and lower edges are heat fused and the cotton filling and wick mass is formed into a bag shape matching the internal shape of the fuel tank. After that, the coating layer 31 on both side surfaces is heat fused at four points 32 to prevent movement of the internal fiber material due to shocks etc. The volume of the cotton filling is 7 cm^3 .

[0054] The split structure of the second embodiment is the same as that of the first embodiment, with a base section and a side wall longitudinally divided into two split parts 21 and 22, and the material is also the same, being synthetic resin molded components formed of polyethylene terephthalate. Also, a needle shaped projection 50 is formed on an inner surface of one of the split parts 22, so as to pass through an upper part of the suction section 62 of the wick 6 projecting from the cotton filling 3, and this needle shaped projection 50 prevents movement of the wick 6 due to shocks etc. The internal volume of the fuel tank 2 after it has been assembled is 8 cm^3 . Apart from this feature, the second embodiment is the same as the first embodiment.

[0055] After the cotton filling 3 integral with the wick 6 has been enclosed on both sides by the two split parts 21 and 22 of the fuel tank 2 and the projections 50 pierce the wick 6 to lock it, the flange-shaped connecting sections 21a and 22a on the side and bottom surfaces of the split parts 21 and 22 are subjected to ultrasonic welding to finally form the container shaped fuel tank 2.

[0056] With this embodiment, by integrating the cotton filling and the wick 6 in advance, arrangement of the fuel tank 2 is easy, and it is possible maintain fuel storage and supply performance with a uniform fiber density, by preventing movement of the fibrous material of the cotton filling by coating with the outer coating 31 and welding at the points 32.

(Third Embodiment)

[0057] Fig. 5 shows the overall structure of a lighter provided with a fuel tank of this embodiment, and Fig. 6 shows an exploded view of the fuel tank section.

[0058] Similarly to the first embodiment, the material of the cotton filling 3 is softwood pulp having a fiber width of 50 μm , and a fiber thickness of 15 μm . When it is packed into the fuel tank 2, an amount necessary to give a density of 0.07 g/cm³ is covered, together with the suction section 62 of the wick 6 similar to the first embodiment, by a coating layer 31 of heat fusible polypropylene non woven fabric, side edges and lower edges are heat fused and the cotton filling and wick mass is formed into a bag shape matching the internal shape of the fuel tank. The volume of the cotton filling is 7 cm³.

[0059] The split structure of the fuel tank 2 is divided into two split parts 23 and 24 by cutting away a side surface, and the material is polyethylene terephthalate. One of the split parts 23 has a flat plate shape forming one side surface of the fuel tank 2, while the other split part 24 has a cross section like an open-ended square, forming the other side surface of the fuel tank, a bottom wall and curved side walls.

[0060] Six needle shaped projections 51 are formed on the inner surface of the other split part 24 for holding the cotton filling 3, and these projections 51 pierce the cotton filling 3 and lock it, thus preventing the cotton material 3 from moving as a result of shocks etc. Two claw-like projections 26 (52?) are also formed on a connection section for the upper cover 4 for gripping the suction section 62 of the wick 6 to lock it, thus preventing the wick 6 moving as a result of shocks etc. The internal volume of the fuel tank 2 after it has been assembled is 8 cm³.

[0061] The cotton filling 3 integrated with the wick 6 is fitted inside the split part 24 having the open-ended square shape, the cotton filling 3 and the wick 6 are fixed by the projections 51 and 52 and the plate shaped split part 23 is mounted over the top. The joining sections 23a and 24a of the two split parts are subjected to ultrasonic welding to finally form the fuel tank 2. Apart from this feature, the third embodiment is the same as the first embodiment.

(Fourth Embodiment)

[0062] Fig. 7 shows the overall structure of a lighter provided with a fuel tank of this embodiment, and Fig. 8 shows an exploded view of the fuel tank section.

[0063] The material of the cotton filling 3 is a mixture of 90 % by weight softwood pulp having a fiber width of 50 μm , and a fiber thickness of 15 μm , and 10% by weight of polypropylene fiber having a thickness of 6 denier. When it is packed into the fuel tank 2, an amount necessary to give a density of 0.07 g/cm³ is packed into a mold having a cavity shape corresponding to the shape of the fuel tank 2, and the suction section 62 of the wick 6 similar to that of the first embodiment is inserted at a fixed position, heated to a temperature higher than its fusing temperature, for example 180°C to fuse the fibrous materials together, and the cotton filling

3 is integrated with the wick 6 so as to keep a shape matching the shape of the inner surface of the fuel tank 2. The volume of the cotton material 3 is 7 cm³.

[0064] The split structure of the fuel tank 2 is similar to that of the first embodiment, being divided into two split parts 21 and 22 having flange shaped joining sections 21a and 22a. The material of the fuel tank is a sheet of 1 mm thickness having low density polyethylene film press coated on one or both surfaces, and the coated sheet is then pressed to form them into shapes of the respective split parts. Each of the split parts 21 and 22 has a heat fusible cover film for preventing leakage of liquid fuel formed on an inner surface of a sheet formed of fibrous material. The internal volume of the fuel tank after assembly is 8 cm³.

[0065] A locking member 8 for fixing the wick 6 and the cotton filling 6 is arranged inside the divided fuel tank 2. This locking member 8 is formed as a folded metal plate such as, for example, a steel plate having a width of 20 mm, a length of 55 mm and a thickness of 0.2 mm, and is made to match substantially half of the internal shape of the fuel tank 2. The plate is folded inwards on itself at four places, two on either side, to form pointed projections 81 for piercing the cotton filling, and this projections 81 lock the cotton filling 3 in place. The plate is also folded over at two places at an upper part to form a projection 82 for gripping and holding the wick 6.

[0066] The subassembly of the cotton filling 3 locked in place in the locking member 8 using the projections 81 and 82 is sandwiched on either side by the split parts 21 and 22, and heat fusible cover films on the connecting sections 21a and 22a of the split parts 21 and 22 are joined together by ultrasonic welding or heat welding to finally form the fuel tank 2. Apart from this feature, the fourth embodiment is the same as the first embodiment.

[0067] The cotton filling 3 of this embodiment simplifies handling since the fibrous materials are fused together, and makes it possible to prevent the fibrous material being unevenly distributed.

[0068] If the fuel tank 2 is formed of the above described paper material, it is also possible to use a laminated metallic foil. For example, laminating an alumina foil on one surface of board 1 mm thick, coating that surface with low density polyethylene to provide a heat fusible cover film, and pressing into the shapes of the respective split parts so that the cover film becomes the inner surface, to form the split parts. Then, the connecting sections of the split parts are joined together by ultrasonic welding with the cotton filling stored inside, to finally form the fuel tank 2. The alumina laminate is more effective in preventing leakage of the liquid fuel compared to the board, and strength is also improved.

(Fifth Embodiment)

[0069] Fig. 9 shows an exploded view of a fuel tank

of the fifth embodiment. The fuel tank 2 of this embodiment has a split structure having two split parts 25 and 26 formed by cutting in one side wall away. One of the split parts 25 is a flat plate having a connecting section 25a along its edge, and the other split part 26 has an open-ended square shaped cross section with flange shaped connecting sections at its sides and bottom. The split part 26 that is the main part of the container is formed of polyethylene terephthalate and the other split part 25 is a 1 mm thick board having an inner surface coated with a cover film of heat fusible polyethylene terephthalate, or a polyethylene terephthalate synthetic resin plate. The internal volume of the fuel tank is 8 cm³.

[0070] The cotton filling 3 is integrally molded with the wick 6 in the same way as the fourth embodiment. The cotton filling is placed inside the split part 26 having 3 a cross section that is like an open ended square, and the split part 25 is then placed over that. The connecting sections 25a and 26a of two split parts 25 and 26 are then joined together by heat fusing to form the fuel tank. Apart from this feature, the fifth embodiment is the same as the fourth embodiment.

(Sixth Embodiment)

[0071] Fig. 10 shows an exploded view of a fuel tank section of the sixth embodiment. The split structure and material of the fuel tank 2 are the same as in the fourth embodiment, namely with board as a base.

[0072] The fibrous material of the cotton filling 3 is also the same as in the fourth embodiment, namely a mixture of 90 % by weight softwood pulp having a fiber width of 50 μm, and a fiber thickness of 15 μm, and 10% by weight of polypropylene fiber having a fiber thickness of 6 denier. This mixture is heat treated and compressed into a mat having a specified thickness, which is then cut into a rectangular parallelepiped corresponding to the inner shape of the fuel tank 2. Also, the cotton filling 3 is vertically divided in two in correspondence with the mounting position of the wick 6, and the suction section 62 of the wick 6 is fitted into and supported by the split surfaces. Three vertical engagement slots 3a are formed in a central portion of one surface of the cotton filling 3.

[0073] On the other hand, a reinforcing member 33 for preventing deformation of the fuel tank 2 is wrapped around and inserted into the cotton filling 3 while it is held. This reinforcing member 33 is formed from a cardboard material punched into a specified shape and having insertion tabs 33a coming together on both ends. The reinforcing member 33 is folded over so as to wrap up the side surfaces of the cotton filling 3, and with the insertion tabs 33a inserted into the engagement slots 3a in the cotton filling so as to be integral with the cotton filling 3 this subassembly is inserted into the divided split parts 21 and 22, the flange shaped connecting sections 21a and 22a are joined and the fuel tank 2 is formed. Apart from this feature the sixth embodiment is

the same as the fourth embodiment.

[0074] When the insertion tabs 33a of the reinforcing member 33 are inserted into the engagement slots 3a of the cotton filling 3, the tips preferably make contact with the inner surface of the cardboard opposite which is effective from a reinforcement viewpoint. Also, the reinforcing member integral with the cotton filling can be inserted into the fuel tank after assembly. Besides a paper type fuel tank 2, the reinforcing member 33 can also be provided for a fuel tank 2 made of a light case of synthetic resin.

[0075] In this embodiment, the side wall strength of the fuel tank 2 is improved by the reinforcing member 33, deformation such as caving in of the low strength side walls can be prevented even for a paper type fuel tank 2, and lowering of the commercial value with deformation and stored liquid fuel breaking through when the cotton filling is pressed can be avoided. Also, the cotton filling is surrounded and held by the reinforcing member 33 which simplifies handling.

(Seventh Embodiment)

[0076] Fig. 11 shows an exploded view of a fuel tank section of the seventh embodiment. The base structure is the same as that in the sixth embodiment.

[0077] The cotton filling 3 is divided in two across its width and the suction section 62 of the wick 6 is fitted into and supported by the split surfaces. Also, three vertical engagement slots 3a are formed in a central portion of one surface of the cotton filling 3, as in the previous embodiment.

[0078] The reinforcing member 33 inserted into the fuel tank 2 is formed of cardboard, as in the previous embodiment, but the insertion tabs 33b have a substantially triangular shape. The reinforcing member 33 is folded over so as to be wrapped around and the cotton filling 3, and the insertion tabs 33b are inserted into the cotton filling 3. These insertion tabs have a substantially triangular shape which makes them easy to insert into the engagement slots 3a. Apart from this feature, the seventh embodiment is the same as the sixth embodiment, and the operation is also the same.

(Eighth Embodiment)

[0079] Fig. 12 shows an exploded view of a fuel tank section of the eighth embodiment, and features another reinforcing member.

[0080] The cotton filling is the same as that in the sixth embodiment, being divided in two in its width direction, and having the suction section 62 of the wick 6 inserted into and supported by the split surfaces.

[0081] Also, reinforcement members 35 and 26 inserted into the fuel tank 3 are formed of synthetic resin gripping the cotton filling 3 from both sides. One of the reinforcement members 35 has three needle shaped projections 35a formed on one side of a plate section,

while the other reinforcement member 36 has three engagement holes 36a into which tips of the needle shaped projections 35a fit.

[0082] The reinforcement members 35 and 36 grip the cotton filling 3m with the needle shaped projections 35a of the one reinforcement member 35 piercing the cotton filling 3 and tips fitting into the engagement holes 36a in the other reinforcement member 36 on the other side of the cotton filling 3 and fastening the three together, thus integrally holding the cotton filling 3.

[0083] After the cotton filling has been inserted together with the reinforcement members 35 and 36 into the separated partitioned sections 21 and 22, the flanged connecting sections 21a and 22a are joined, to finally form the fuel tank 2. Apart from this feature, the eighth embodiment is the same as the sixth embodiment.

[0084] In this embodiment, by arranging the reinforcement members 35 and 36, the needle shaped projections 35a constitute a strut-like reinforcement structure to improve the lateral strength of the fuel tank 2, and even for a paper type fuel tank it is possible to prevent deformation such as normally results when the low strength sides of such a fuel tank cave in when pressed. It is also possible to avoid reduction in the commercial value due to leakage of the liquid fuel forced into the cotton filling 3 and stored or deformation. Because the cotton filling 3 is gripped by the reinforcement members 35 and 36, handling is made easy.

(Ninth Embodiment)

[0085] Fig. 13 shows an exploded view of a fuel tank section of the ninth embodiment, and apart from the reinforcement members it is the same as the other embodiments.

[0086] The cotton filling 3 is divided in two in its width direction, as in the eighth embodiment, and the suction section 62 of the wick 6 is fitted between and supported by the split surfaces of the cotton filling 3. The width of the cotton filling 3 is formed thinner than the thickness of the storage section of the fuel tank 2 by the extent of the strut-like reinforcement member 37, which will be described later.

[0087] The reinforcement member 37 inserted into the fuel tank 2 is formed as a molded component having a paper base. This reinforcement member 37 is formed substantially in a U-shape having columnar sections 37a running along either side of the cotton filling 3, and a bottom section 37b running along the bottom of the cotton filling. The cotton filling 3 is surrounded by and held in an inner rectangular hollow part 37c.

[0088] After the cotton filling 3 has been inserted together with the reinforcement member 37 into the separated partitioned sections 21 and 22, the flanged connecting sections 21a and 22a are joined, to finally form the fuel tank 2. Apart from the fact that the bottom of the fuel tank 2 is curved in an arc shape, the split

structure is the same as in the sixth embodiment.

[0089] In this embodiment, by arranging the reinforcement member 37, the strength of the two sides and the bottom of the fuel tank 2 are improved, and even for a paper type fuel tank it is possible to prevent deformation such as normally results when the low strength sides of such a fuel tank cave in when pressed. It is also possible to avoid reduction in the commercial value due to leakage of the liquid fuel forced into the cotton filling 3 and stored or deformation. Also, because the cotton filling 3 is contained in the reinforcement member 37, handling is made easy.

In the split structure of each of the above described embodiments, cotton filling 3 has been arranged inside, but this filling can

be changed as appropriate.

Claims

1. A fuel tank for a liquid fuel burner, that causes liquid fuel that has impregnated and is stored in a cotton material made of absorbent fibrous material contained in a fuel tank to be sucked up by a suction part of a wick and burnt in a combustion section at the tip of the wick,

a fuel containing part of the fuel tank having a split structure with split parts being joined together.

2. The fuel tank of claim 1, wherein the fuel containing section is formed of synthetic resin.

3. The fuel tank of claim 1, wherein the fuel containing section is provided with a coating film for preventing infiltration of liquid fuel to the inner surface of a fibrous paper material.

4. The fuel tank of claim 3, wherein the fuel containing section is formed from a laminated material having metallic foil and a synthetic resin film laminated on the fibrous paper material.

5. The fuel tank of claim 1, wherein split sections of the fuel containing section are joined together by ultrasonic welding, heat fusion or adhesive.

6. The fuel tank of claim 1, wherein the liquid fuel is fuel having alcohol as its main constituent, and an inner surface of a fuel containing section is formed of either polyethylene, polypropylene, polystyrene, polyacetal, polyethylene phthalate, polyacrylonitrile, denatured polyphenylene ethyl, or polyphenylene sulfide.

7. The fuel tank of claim 1, wherein protrusions for fixing at least one of the cotton filling and the wick are formed on an inner side of the fuel containing sec-

tion.

8. The fuel tank of claim 7, wherein the protrusions pierce and fix at least one of the cotton filling and the wick. 5
9. The fuel tank of claim 1, wherein a locking member for fixing at least one of the cotton filling and the wick is arranged inside the fuel containing section. 10
10. The fuel tank of claim 1, wherein a reinforcement member for preventing deformation of the fuel containing section is arranged inside the fuel containing section. 15
11. The fuel tank of claim 10, wherein the reinforcement member is a paper material surrounding the cotton filling. 20
12. The fuel tank of claim 10, wherein the reinforcement member is a part for gripping the cotton filling. 25
13. The fuel tank of claim 1, wherein the split sections are joined together after the cotton filling and wick have been placed inside the fuel containing section. 25

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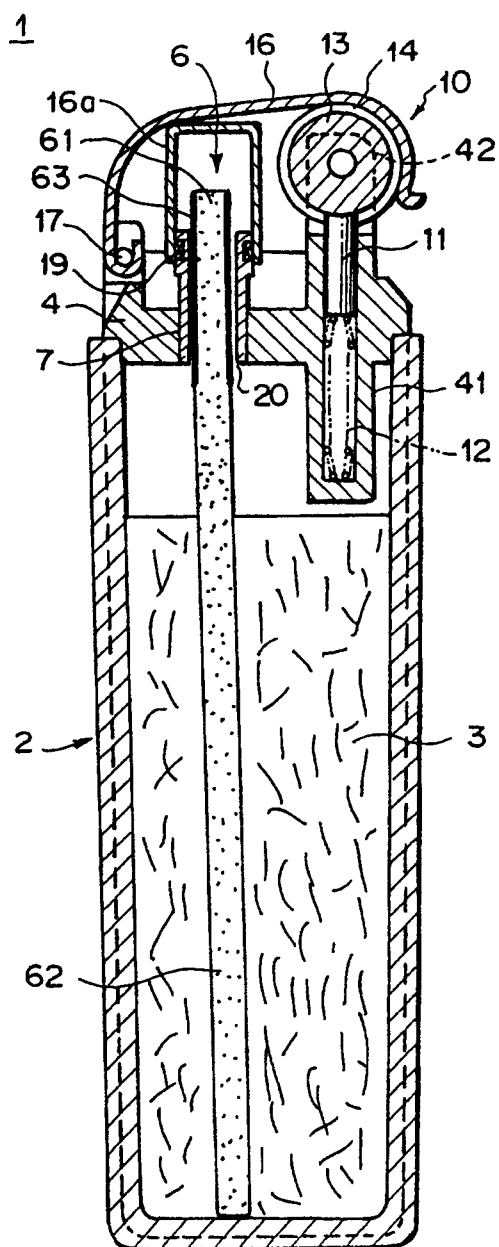
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FIG. 1



F I G . 2

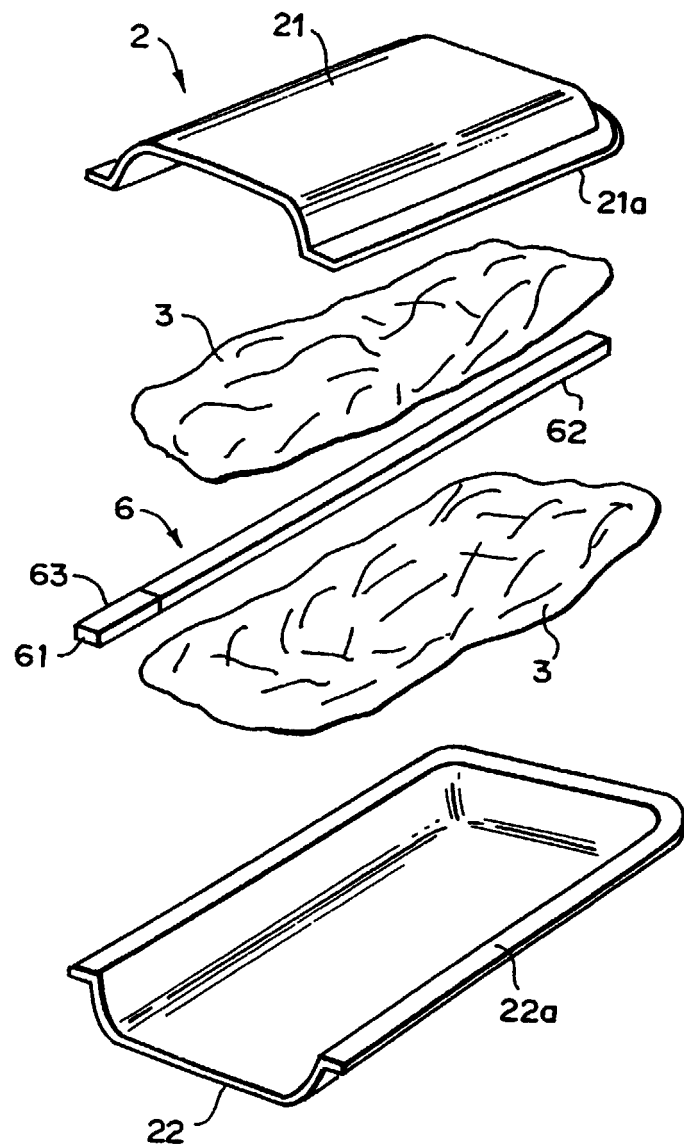


FIG. 3

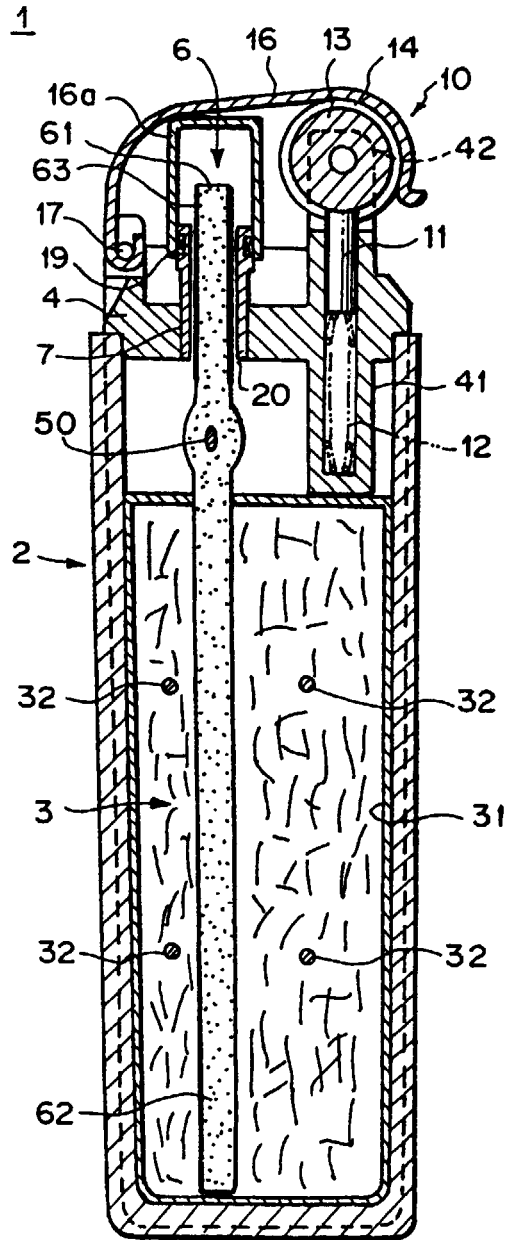
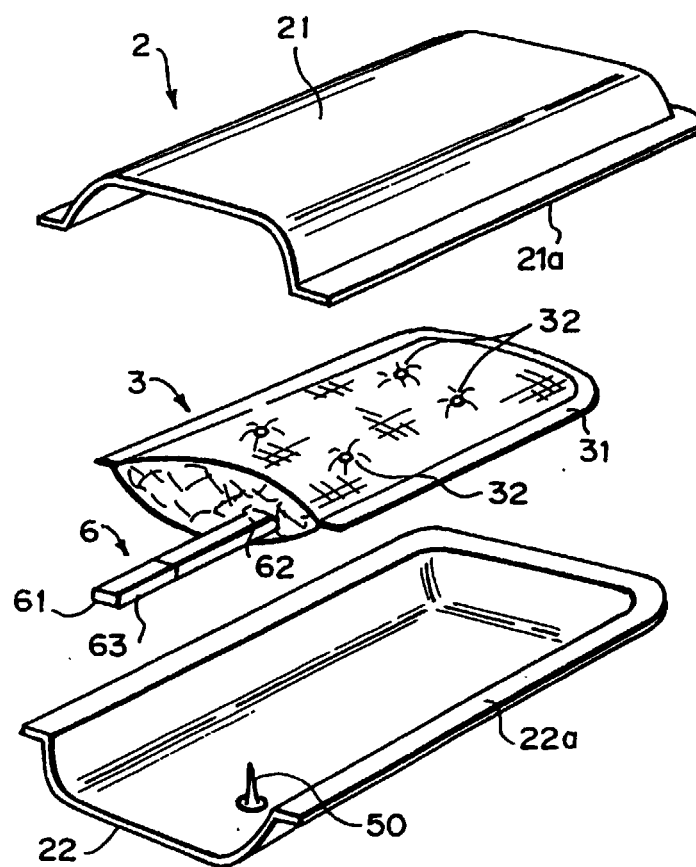
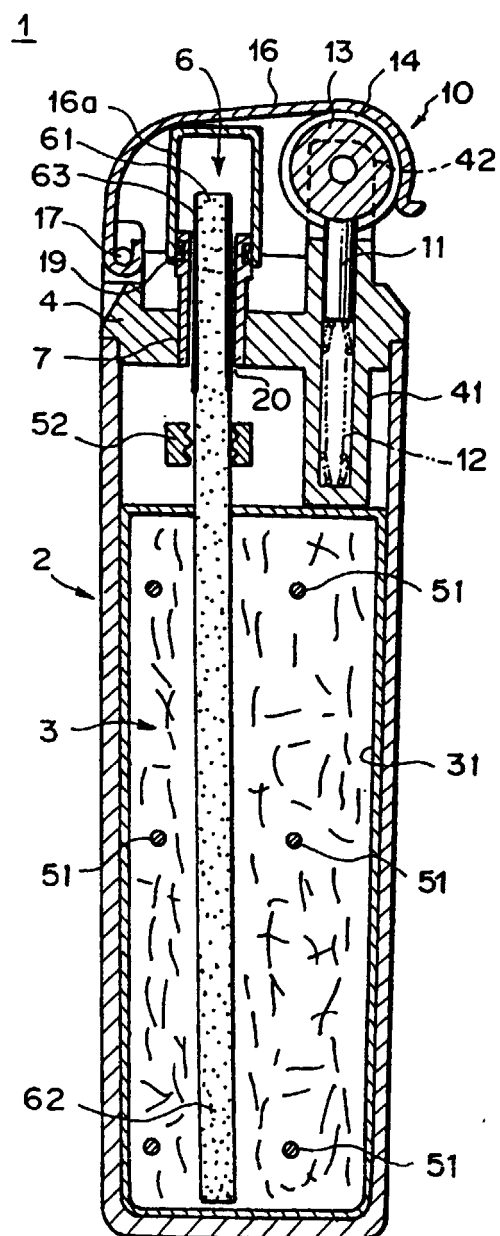


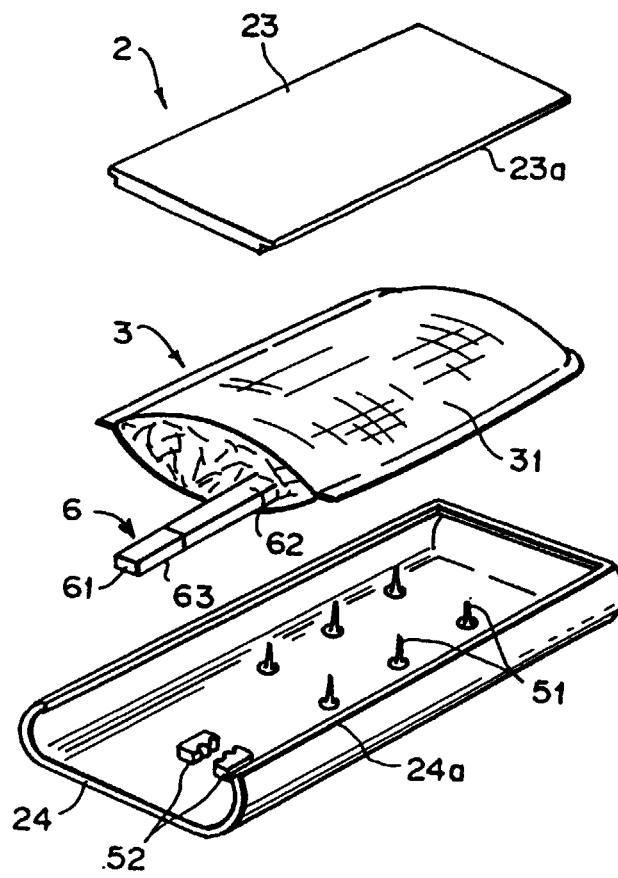
FIG. 4



F I G . 5



F I G . 6



F I G . 7

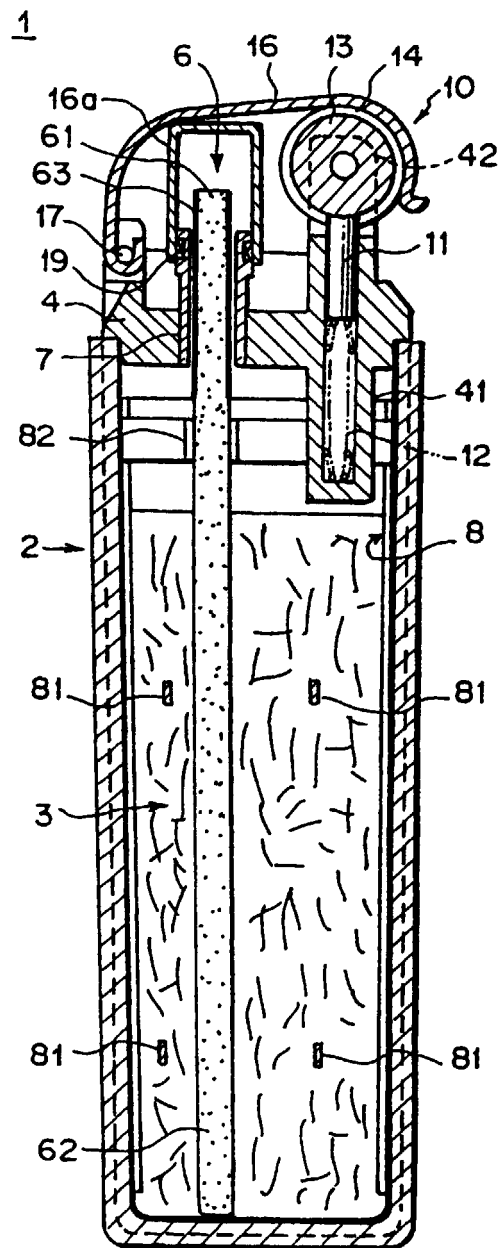
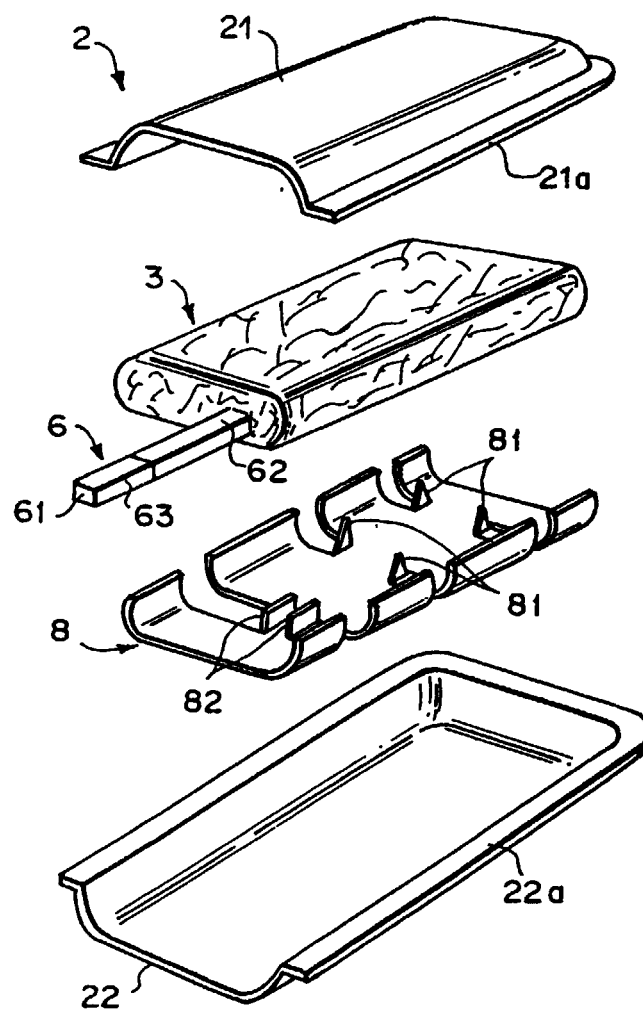
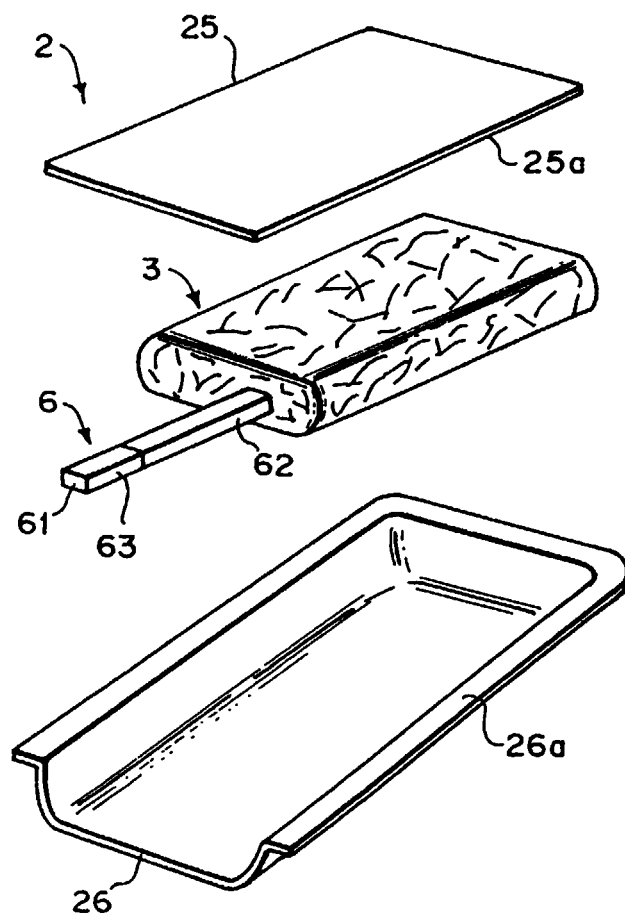


FIG. 8



F I G . 9



F I G . 10

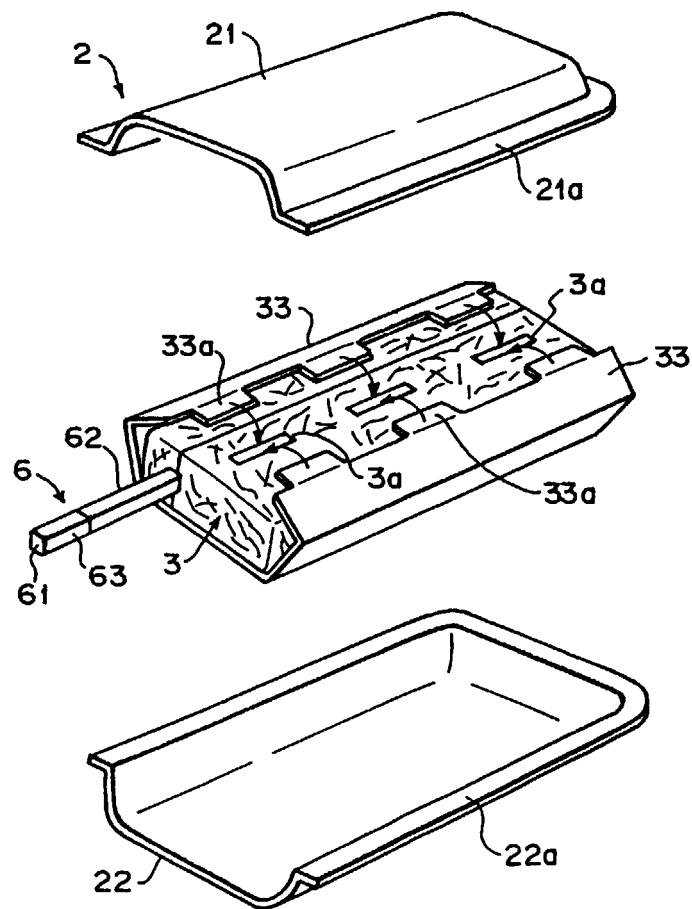
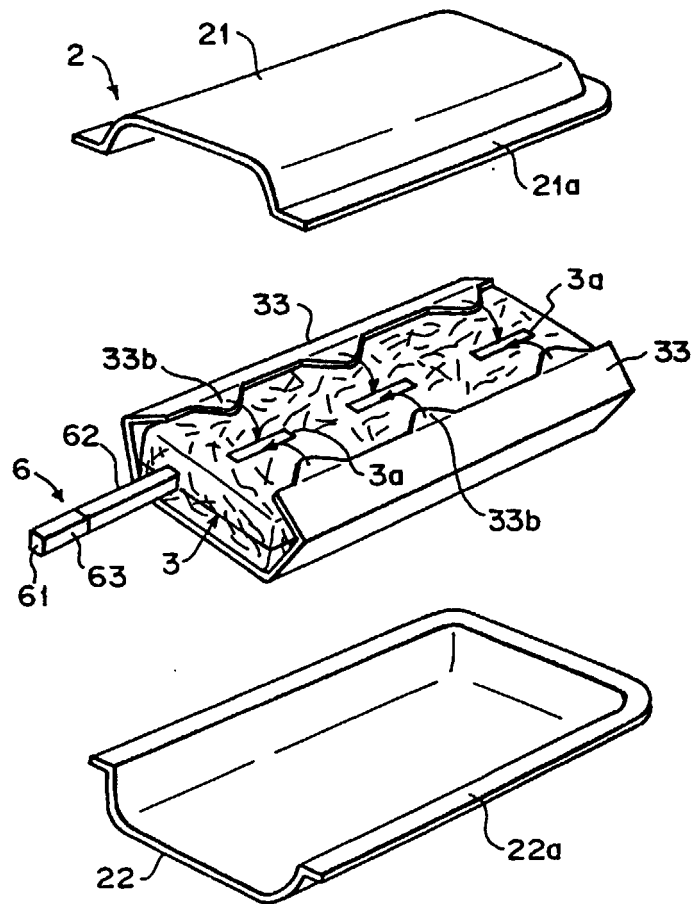


FIG. 11



F I G . 1 2

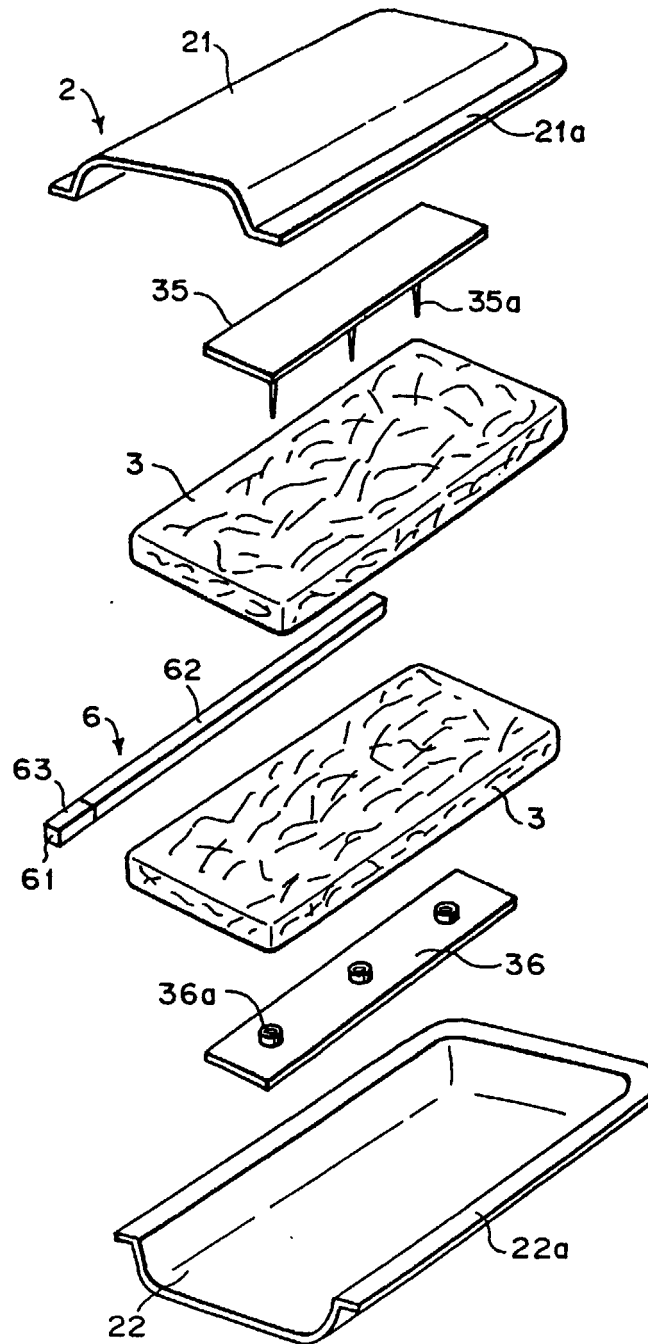
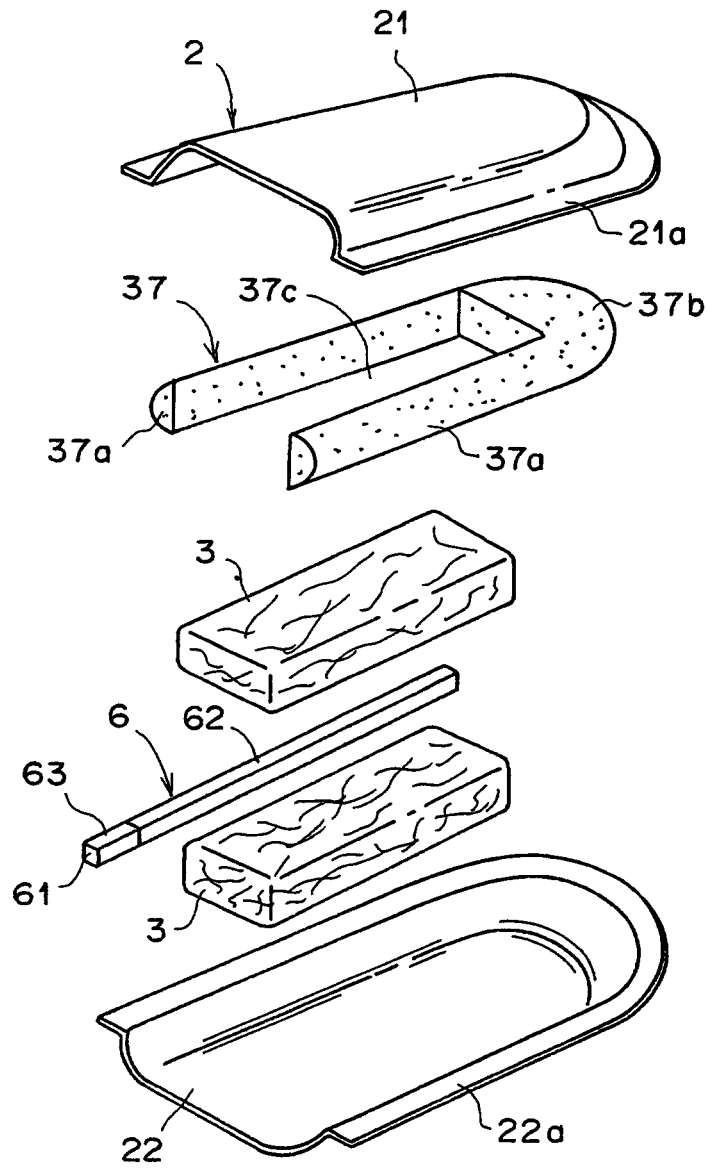


FIG. 13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/03249

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁶ F23Q2/42		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁶ F23Q2/42		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1940-1996 Toroku Jitsuyo Shinan Koho 1994-1999 Kokai Jitsuyo Shinan Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 55-135404 (Laid-open No. 57-61357) (K.K. Kawasaki Seiki Seisakusho), 12 April, 1982 (12. 04. 82), Full text ; Figs. 1 to 3	1, 2, 5, 6, 10, 13
A	Full text ; Figs. 1 to 3 (Family: none)	3, 4, 7-9, 11, 12
Y	JP, 57-26325, A (Fukuo Iwahori), 12 February, 1982 (12. 02. 82), Full text ; Figs. 1 to 5	1, 2, 5, 6, 10, 13
A	Full text ; Figs. 1 to 5 (Family: none)	3, 4, 7-9, 11, 12
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "Z" document member of the same patent family		
Date of the actual completion of the international search 14 September, 1999 (14. 09. 99)		Date of mailing of the international search report 28 September, 1999 (28. 09. 99)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)