H. L. FISHER. 3843

SOLID FUEL AND PROCESS OF MAKING THE SAME.

APPLICATION FILED APR. 9, 1917.

1,389,638. Patented Sept. 6, 1921.

Fig. 1

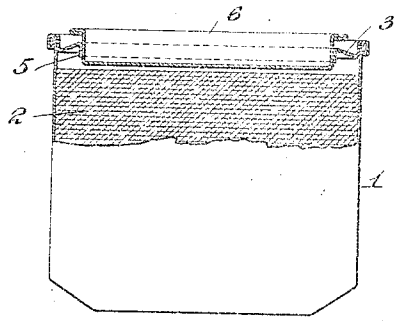


Fig. 2

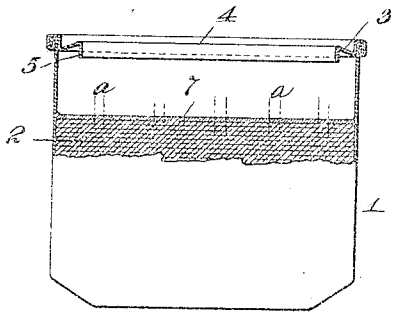
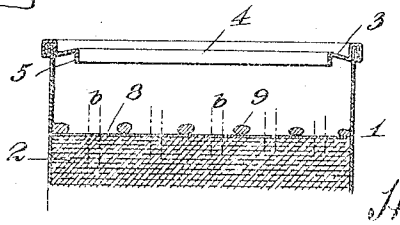


Fig. 3



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SOLID FUEL AND PROCESS OF MAKING THE SAME.

1,389,638. Specification of Letters Patent. Patented Sept. 6, 1921.

Application filed April 9, 1917. Serial No. 160,670.

To all whom it may concern:

Be it known that I, HARRY L. FISHER, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented a certain new and useful Solid Fuel and Process of Making the Same, of which the following is a specification.

My invention relates to a fuel composed mainly of alcohol, which is in the form of a jell and which can be lighted on the application of a flame.

One object of my invention is to produce a fuel which will, after it has been ignited and the flame extinguished, automatically seal itself from the air.

Another object of my invention is to produce a fuel which will not melt from the heat transmitted to it from its burning surface.

These and further objects will more fully appear in the following specification and accompanying drawings, considered together or separately.

I have illustrated one embodiment of my invention in the accompanying drawings in which like parts are designated by similar characters of reference and in which,

Figure 1 is a side elevation partly in section of a can containing my improved fuel before the latter has been ignited.

Fig. 2 is a similar view of the same but with the fuel partly consumed and the sealing film formed on its exposed surface; and

Fig. 3 is a diagrammatic view showing the method of burning.

In carrying out my invention I provide a container 1 which carries the fuel 2 in the form of a jell. The upper part of the container comprises a top 3 having a flame opening 4. The top is in the form of an annular rim having a down turned cylindrical extension 5. In connection with the container is a cover 6 which is adapted to frictionally engage wall 5 of the flame opening to seal the receptacle.

One manner of carrying out my invention is to form in ethyl alcohol (having a predetermined minimum amount of water) which has been heated approximately from 70° to 75° C, a soap mixture formed from stearic acid and sodium hydroxid and an excess of stearic acid. The object of the free stearic acid is to cause the soap left on the surface of the material as described later to melt at a relatively low temperature in order to facilitate relighting. I may, however, do away entirely with this excess stearic acid.

I have specified above that the ethyl alcohol is to have a predetermined minimum amount of water for the reason that I have found from experiments that the water content has a very large influence in determining the melting temperature of the material, the water acting to destroy in a measure the solid condition of the jell.

I prefer to use triple pressed stearic acid as this has a minimum amount of oleic acid which I have found acts very much the same as water as described above. I have also discovered in my experiments to produce material with a high melting point, that the fewer ingredients there are in the mixture the higher the melting point. In view of this I find it best to use materials which are as pure as possible and if it were possible to obtain in practice stearic acid free from both oleic and palmitic acid, I should prefer to use this.

I have found that the melting point of my mixture can be raised also by forming a neutral soap, that is one having no free fatty acid, as the free fatty acid simply adds one more ingredient to the mixture and thereby lowers the melting point.

When my fuel is ignited the alcohol content of the material at the surface burns, leaving its soap mixture on the top of the mass in the form of a crust. The melting point of the mixture determines to a very large extent the degree of protective crust that is formed on the surface of my material.

The mass as a whole will remain in its solid condition while the material is being burned, thereby obtaining the great practical advantage of absence of danger from fire in the event of the container being accidentally over-turned while lighted, for the reason that none of the lighted fuel can leave the container.

When the flame has been extinguished the soap mixture on the surface of the mass will harden and form a film 7 over its entire surface. The soap mixture will also adhere to the sides of the container and thereby tend to prevent the evaporation of alcohol vapor.

When it is desired to re-light the fuel the film or crust 7 may be broken, as at *a*, by means of the match used to light the fuel, and the surface of the jellied mass below the

crust, exposed thereby, will readily ignite on the application of the flame of the match. Upon re-lighting the heat of the flames at the openings *a* in the crust of the soap mixture formed on the surface of the mass, will melt and, by reason of the surface tension, form globules thereby exposing a fresh surface underneath upon which a new film 8 of soap mixture will be formed to be melted in its turn upon being broken and re-lighted and so on until all the alcohol is consumed.

When the film or crust 7 or 8 is being formed by reason of the burning of the fuel it (the crust or film) is of a more or less porous nature so that the fuel beneath it may be consumed by the flame and the crust will be built up from below. Upon cooling the crust will harden.

On relighting, the crust 8 will be punctured as before. The heat of the flames at the openings *b* will melt the crust 8 and the globules 8 formed from the previous crust or crusts and the melted soap mixtures will unite and form larger globules.

The usual method of extinguishing the flame is to invert the cover 6 and slide it over the flame opening 3. As the can or container, however, becomes very much heated when the fuel is burning, the container cannot be safely handled until some time after the flame has been extinguished and the cover cannot be tightly inserted in the flame opening until the container becomes cool enough to handle. The result of this is that the operator may forget or neglect to properly seal the container and were it not for the presence of the film or crust, the alcohol would evaporate and the mass in the container become useless for heating purposes.

While I have described my fuel as composed principally of ethyl alcohol, I prefer in order to prevent the deposition of free carbon on the bottom of the vessel holding the ingredients to be heated, to use a certain amount of material having a smaller carbon content than ethyl alcohol, for example methyl alcohol, and by proportioning these materials, say one part of methyl alcohol by volume to three parts of ethyl alcohol by volume. In practice I prefer, for reasons of economy, to use what is known as the United States formula #1 denatured alcohol.

If the alcohols contain too much water for my purpose I may remove the excess by distilling with calcined lime and find I get a satisfactory material when there is about from three and a half to four per cent. of water in the finished product. Generally speaking, my product improves as the water content decreases up to a certain point.

One formula for producing my material consists in heating 100 cubic centimeters of partly dehydrated alcohol to from 70 to 75° C., then dissolving in this four and one-half grams of triple pressed stearic acid, then neutralizing the major portion of this fatty acid with sodium hydroxid. If the alcohol has been dehydrated to about 98%, I find it feasible to use an aqueous solution, having density of 35° Baumé of sodium hydroxid for neutralizing the fatty acid. If the alcohol has not been dehydrated to this extent, then I dissolve the sodium hydroxid in a part of the alcohol and the triple pressed stearic acid in the balance of the alcohol and incorporate them when they are both heated to the above temperature.

Instead of mixing the stearic acid and sodium hydroxid and forming a soap in the alcohol, I may dissolve say 4% of sodium stearate in the alcohol and then add a small amount of free stearic acid or not, as I may or may not desire a free fatty acid in the fuel as explained above.

The mixture while hot is poured into the container and the cover is placed tightly in position in the flame opening. The fuel is usually dispensed in the container in which it is burned.

The fuel made in this way will not liquefy from the heat of the flame on the burning surface but will remain in its jellied state. The soap which forms and is melted on the top of the burning mass is of a thick, viscous, tacky nature, and will not escape even if the can be over-turned and will not be reabsorbed by the mass of the fuel either when it (the soap) is hot or cold.

As long as the soap is combined with the alcohol in the mass in solid form, the mass will not be melted by the heat of the flame on the surface of the alcohol. The amount of soap in the mixture is relatively small and will not become ignited in the flame of the alcohol and there will be no danger of fire even if the fuel were burned with the can inverted and the melted soap permitted to drop from the flame opening. Moreover, by referring to the drawing it will be seen that the top 3 and wall 5 will prevent any loose particles of the soap from dropping from the can except in the event of the can being entirely inverted.

In accordance with the provisions of the patent statutes I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is merely illustrative, and that the invention may be carried out in other ways.

Having thus described my invention what I now claim as new and desire to secure by Letters Patent, is:

1. A solid fuel comprising alcohol having approximately a 4% water content, the reaction product of caustic soda and stearic acid substantially free of oleic and palmitic acids, and stearic acid substantially free of oleic and palmitic acids.

2. A process of making a solid fuel, which comprises mixing alcohol, sodium stearate and stearic acid in the following proportions: 75 cubic centimeters of ethyl alcohol, approximately from 95 to 98%; 25 cubic centimeters of methyl alcohol, approximately from 95 to 98%; and adding a small proportion of the reaction product of sodium hydrate and stearic acid substantially free of oleic and palmitic acids, and a small quantity of stearic acid substantially free of oleic and palmitic acid.

3. A process of making a solid fuel composed mainly of alcohol, which comprises mixing alcohol having approximately a 4% water content, the reaction product of a fatty acid and an alkali, and a free fatty acid.

This specification signed and witnessed this fifth day of April, 1917.

HARRY L. FISHER.

Witnesses:
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