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ARTIFICIAL FUEL AND METHOD OF MAKING SAME.

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To all whom it may concern:

Be it known that I, CHARLES J. GREENSTREET, a citizen of the United States, residing at St. Louis and State of Missouri, have invented new and useful Improvements in Artificial Fuel and Methods of Making Same, of which the following is a specification.

This invention relates to a fuel product and a method of making the same, and, more particularly, to a fluid fuel composed of a liquid fuel and a finely divided solid fuel suspended therein in a substantially permanent suspension.

The many advantages in the use of fluid fuels such as their low labor cost in firing, their freedom from ash, the exact control of the rate at which they may be supplied and burned and the exact proportioning of air to fuel which is possible with them and the high efficiency and economy which these features make possible, have made the prospect of transforming solid fuels into liquid fuels highly attractive and desirable. This is more particularly the case as a large amount of solid fuel is produced in the form of dust, powdered and small dimensioned particles, such as culm, which are difficult to burn on the ordinary types of grates and therefore have little commercial value. Certain fuels, such is lignite, which disintegrates to a powder on exposure to the atmosphere, can not be readily handled and burned in the solid form, are of little value.

Attempts have been made to utilize powdered fuels of the above types by simply mixing them with fluid or liquid fuels to serve as a vehicle or carrier and burning the mixture similarly to a liquid fuel. The densities of these fuels are, however, generally different from those of the liquid fuels which are available for this purpose, and the solid particles settle out after standing for a short time and form hard cakes which clog the conduits and passages of fluid fuel burning apparatus. Attempts to reduce the coal particles to a size approaching colloidal dimensions, while offering possibilities in the way of stability of suspension, are not commercially feasible or practicable since the excessively fine grinding which this requires makes the cost of the fuel prohibitive.

An object of the present invention is to provide a fuel product in which solid fuel particles of a size readily and cheaply obtainable by ordinary grinding are suspended in a substantially stable, uniform suspension in a fluid fuel medium.

Another object of the invention is to provide a fluid fuel product comprising solid particles above colloidal dimensions suspended in a liquid fuel medium treated to render it resistant to the settling or separation of said particles.

A further object of the invention is to provide a method of forming a substantially permanent suspension of solid fuel particles of above colloidal size in a fluid fuel medium.

Further objects of the invention are to provide a fuel product in which solid fuel particles are maintained in suspension in a fluid fuel medium by changing the fluid fuel medium into a medium of greater thickness or viscosity by the formation of addition or substitution products of oxygen or hydrogen or other suitable substances and to a method of stabilizing liquid and solid fuel mixtures by changing the liquid fuel medium into a medium of greater supporting or stabilizing ability.

With these and other objects in view, the invention comprises the product and method described and set forth in the following specification and claims.

In the present invention the solid fuel is reduced by any suitable grinding means available for grinding on a commercial scale, to a sufficient degree of fineness so that the particles may readily pass through the passages of the fuel burning apparatus without danger of clogging. The fuel is preferably ground as fine as is practicable with ordinary commercial methods, since the finer the grinding the more easily may the particles be maintained in suspension, but grinding to a degree within colloidal dimensions is not necessary. The finely divided solid fuel particles are then uniformly dispersed and suspended in a liquid fuel medium in the quantity desired for the particular purpose in view. To fix or stabilize this suspension, the liquid fuel is converted into a liquid of greater consistency or thickness or having the property of resisting the rapid settling of the particles. This is preferably done by oxygenizing or hydrogenizing the liquid or forming other suitable addition or substitution products of the liquid having greater consistency or stabilizing properties.

In practicing my invention I employ as a

base, a liquid fuel, and I mix with this base, a solid fuel in a more or less finely divided state. In order to produce a complete mixture, it is desirable that the base should be in a highly fluid state at the time that the solid fuel is mixed with it, but a high degree of fluidity in the mixture thereafter is undesirable because the solid fuel tends to gravitate, or settle to the bottom of the container.

According to my invention, after producing the mixture between a liquid and a finely divided solid fuel, in which the solid fuel is held in temporary suspension, I stabilize or fix the mixture. In other words, I "convert" the base into a mass, the fluidity of which is so reduced that it becomes a substantially permanent carrier for the solid fuel. In this way I produce a relatively homogeneous mixture in which the proportion of the solid fuel to the liquid fuel is substantially the same at all levels of the mixture. The degree of reduction of the fluidity may be anything desired, that is to say, the treatment to which I subject the mixture may produce a sluggish and turbid mixture, or I may carry the treatment far enough to produce a semi-solid gelatinous mass; in any case, the base is "converted" from its highly fluid state, so that it operates as a carrier holding the solid fuel in permanent suspension.

As a base, I may employ a mineral oil, coal tar, or any suitable liquid fuel product of animal or vegetable origin or any suitable mixture of any of these various liquid fuel products. The base may include alcohol. With this liquid fuel I mix any solid fuel which is in a more or less finely divided state, for example, powdered coal, or powdered or disintegrated dry peat; in fact I may employ waste dry cellulose from beet sugar refineries or pulp mills or any other solid cumbustible material. The liquid base holds the solid fuel in temporary suspension.

Any suitable means or agent may be employed to "convert" the liquid base for the purpose set forth above, it being understood that the function to be performed by this agent, or agents, is to increase the consistency or reduce the fluidity of the liquid base, that is to say, it is a semi-solidifying or thickening agent operating to transform or convert the base into a more or less permanent carrier holding the solid fuel in suspension. The procedure, in order to accomplish this object will depend somewhat upon the nature of the base which has been selected.

When I employ a vegetable oil or other suitable unsaturated or partly saturated products as a base carrier for the solid fuel, I prefer to "convert" the fluid by hydrogenizing the oil to an extent which will decrease its fluidity sufficiently to enable it to hold any of the above named combustible solids in permanent suspension. I may then use this product by itself as a fuel, or I may mix the vegetable oil or similar liquid carrying the solid fuel in a substantially permanent suspension, with a mineral oil or coal tar in any desired proportion.

If desired, I may incorporate alcohol in the complete fuel, and for this purpose I may employ the alcohol made from waste molasses. In order to introduce such alcohols with a mineral oil base, I employ a saponifying agent as a vehicle to carry the alcohol into suspension in the mineral oil. The saponifying agent will also have the effect of converting the base, that is to say, it will reduce its fluidity.

If desired, the reduction of the fluidity of the liquid may be carried to such an extent that the mixture may be described as "semi-solidified." When I employ a semi-solidifying or thickening agent, I may use equal parts of a mineral oil and powdered coal, and mix therewith from 15 to 30 per cent of the semi-solidifying agent, that is to say, any of the substances named above, or by suitably hydrogenizing or transforming a suitable liquid medium, though I wish it understood that this percentage is given merely by way of example, and I do not limit myself in any way to any proportions whatever.

I also "convert" the mixture when it contains a mineral oil base by oxidizing the oil in a very simple way. This may be accomplished by blowing an oxygenizing gas, such as warm or hot air through the oil, thereby reducing its fluidity and increasing its consistency to a degree necessary to enable it to hold powdered coal or other powdered fuel in suspension.

If my method is practiced in such a way that the fluidity of the resulting artificial fuel will permit it to be poured, it can obviously be readily transported in tank-cars; if the degree of the fluidity is so low that it cannot be readily poured, then the substance may be handled by means of scoops or shovels or by heating locally sufficiently to permit the fuel to flow when desired for use. The fuel may be burnt in any suitable manner.

It is, in many cases, not essential that sufficient stability to maintain the suspended particles in suspension for an infinite period of time be given to the product but that sufficient stability be provided so that no appreciable settling take place for a time within which the fuel is to be used. In such cases the fuel need not be ground as fine as when stability for a longer period of time is desired and the liquid medium need not have as much consistency or stabilizing medium. The term, "substantially permanent" is

therefore used in the sense of sufficiently permanent for the purpose in view.

It is understood that the embodiment of the invention described herein is only one of the many embodiments my invention may take, and I do not wish to be limited in the practice of my invention nor in my claims, to the particular embodiment set forth.

What I claim and desire to secure by Letters Patent is:—

1. The method of producing an artificial fuel substance which consists in mixing with a liquid fuel a finely divided solid fuel so that the said solid fuel is in a temporary state of suspension, and then oxygenizing the liquid fuel to increase its viscosity, the increase in viscosity operating to enable the liquid to hold the solid fuel substantially fixed in a state of suspension.

2. The method of producing an artificial fuel substance which consists in employing a combustible mineral oil, mixing a finely divided solid fuel therewith so that the said solid fuel is in a state of temporary suspension in said oil, and then blowing an oxygenizing gas through the mixture to reduce the fluidity of the mixture, and convert the said oil into a substantially permanent carrier for said solid fuel that holds the solid fuel in a state of substantially permanent suspension.

3. The method of producing an artificial fuel substance which consists in employing a combustible mineral oil, mixing a finely divided solid fuel therewith, then blowing air through the mixture to agitate the finely divided fuel and simultaneously convert the oil into a viscous or semi-solid mass, operating as a permanent carrier for said fuel to hold the same in a state of substantially permanent suspension.

4. A method of forming a fuel product which comprises forming a temporary suspension of a finely divided solid fuel in a liquid fuel containing unsaturated bodies and increasing the saturation of said bodies to transform said liquid medium into a substance of greater consistency and suspension holding properties.

5. A method of forming a fuel product which comprises forming a suspension of finely divided solid fuel particles in a liquid fuel medium and forming an addition product of said liquid fuel medium to increase its consistency and suspension holding property.

6. A fuel product which comprises a liquid fuel and a finely divided solid fuel suspended in said liquid fuel said liquid fuel being oxygenized until sufficiently viscous to hold said solid fuel in substantially permanent suspension.

7. A fuel product which comprises a liquid fuel medium and a powdered solid fuel said liquid fuel being sufficiently thickened by oxygenized products to hold said solid fuel products in substantially permanent suspension.

8. A fuel product which comprises a liquid fuel medium, a powdered solid fuel suspended in said liquid medium and oxygenized products in said liquid medium to increase its consistency and suspension holding properties.

In testimony whereof, I have hereunto set my hand.

CHARLES J. GREENSTREET.