

UNITED STATES PATENT OFFICE

2,443,029

FUEL COMPOSITION

Fred Elkan, New York, N. Y.

No Drawing. Application July 14, 1944,
Serial No. 545,015

6 Claims. (Cl. 44-23)

1

This invention relates to a fuel composition which can be used as a fire kindler for igniting anthracite coal, as well as bituminous coal, coke, and other solid fuels, in all types of boilers, furnaces, stoves and other equipment burning solid fuels, as well as a fuel in itself, which constitutes kindler and self-contained fuel all in one.

This application is a continuation-in-part of my patent application Ser. No. 466,473, filed November 21, 1942 (now abandoned).

It is an object of the present invention to provide a combustible product of the kind above referred to which can be manufactured economically and in any desired shape, is of high thermal efficiency, is not adversely affected by weather conditions, is clean to handle, not fragile and is of comparatively low cost.

It is another object of the present invention to provide a fuel composition which consists of a plurality but at least of three groups of hydrocarbons each of which has a higher flash point than the previous one, whereby the one with the lowest flash point can be lit with a match in the presence of a solid combustible material, whereas the hydrocarbons of higher flash points develop sufficient heat to effect incandescence of the solid combustible material and to kindle even anthracite in an open grate fire.

It is still another object of the present invention to provide a binder which allows the binding and solidifying of finely divided coal particles into briquets or the like, even in the presence of liquid and semi-liquid hydrocarbons up to 30% of the total weight of the final briquetted compound.

This and other objects are achieved by making the mixture of particles such as obtained from coal and charcoal and a plurality of hydrocarbons, preferably at least three, with graded flash points, since the proper selection of the hydrocarbons according to their flash points and the proper binder which binds the composition are decisive for the desired effect.

It was believed until now that it is necessary to use a kindler developing long lasting flames with a high thermal effect in order to light such a hard and difficultly inflammable material as anthracite. I believe that I am the first to discover that not flames alone, even of highest temperatures and long lasting, but a kindler material brought to quick incandescence will produce the high temperature necessary to effect the incandescence and ignition of the anthracite to be kindled most efficiently, most easily and quickest.

2

This new found principle was decisive in the selection of the ingredients and the method of preparing the compound according to the present invention, according to which the minimum amount of flames necessary for draft and at the same time a quick incandescence within itself will be produced, the incandescence spreading rapidly to the anthracite to be kindled.

The compound according to the present invention can be accommodated to the special use as a kindler or as a fuel—i. e. as kindler developing only moderate flames for a short period of time with following quick incandescence of the body of the kindler; as fuel developing hot, large flames for a long time (about 25 to 40 minutes according to the amount used) with following incandescence lasting for a still longer period of time (about 60 to 120 minutes according to the amount used)—although it can be used in either capacity as kindler for kindling of the hardest inflammable anthracite or as a fuel for kitchen stoves, all kinds of furnaces, open grate fire-places, and the like. In this connection it is important to state that the compound according to the invention in its use as a kindler is capable of kindling even anthracite in an open fire-place which could not be achieved with any known kindler until now.

In accordance with the present invention the compound comprises about 0 to 15% most readily inflammable hydrocarbons, 0 to 20% readily inflammable hydrocarbons, 0 to 20% less readily inflammable hydrocarbons, 0 to 20% most difficultly inflammable hydrocarbons, 45 to 65% solid combustible material, 1 to 30% pitch and 1 to 12% cornstarch, the mentioned four groups of hydrocarbons amounting to at least 18%. Though preferably at least three groups of hydrocarbons are used, it is possible to use a greater number of groups of hydrocarbons with graded flash points. Any pitch can be used in the binder, as pitch of coal-tar, wood-tar, turpentine, of different oils and even any artificial pitch.

In the preferred compound of four groups of hydrocarbons the first group of 0 to 15% most readily inflammable hydrocarbons contains hydrocarbons of a flash point up to about 150° F., as kerosene, which group can be ignited by a match in the presence of solid combustible material, preferably carbonaceous material. The second group of 0 to 20% readily inflammable hydrocarbons contains hydrocarbons of a flash point from about 150° F. up to about 260° F., as a crude petroleum of a medium flash and fire point. The third group of 0 to 20% less readily

inflammable hydrocarbons contains hydrocarbons of a flash point from about 260° F. up to about 300° F., as paraffin or any equivalent. The fourth group of 0 to 20% most difficultly inflammable hydrocarbons contains hydrocarbons of a flash point from about 300° F. up to about 600° F. as any heavy oil, which can be a heavy mineral or animal oil or vegetable oil of high viscosity. The heavy oil may be an oil having a very high specific gravity and which requires a comparatively high temperature to get ignited, which oils are used for instance in heavy oil motors or as lubricating oils, or it may also be a heavy organic oil of the proper flash point characteristic of the highest group, or a heavy tar-oil.

In one of the favored embodiments of the invention the fuel compound comprises about 1 to 30% pitch, 1 to 12% cornstarch, about ½ to 20% paraffin, ½ to 20% crude oil of medium flash point, ½ to 15% kerosene, ½ to 10% kaoline, 3 to 60% coal particles, 3 to 60% charcoal particles. To this compound can be added ½ to 30% naphthalene, about 1 to 2% slaked or other lime, about 1 to 2% iron oxide, about 1 to 2% antimony sulphide and 1 to 2% zinc oxide.

Thus according to the purpose to which the compound is to be used, a part of its ingredients will vary as necessary. The most important ingredients which are contained in all variations of the compound to be used either as kindler or as fuel are the binder, namely, any pitch, preferably coal-tar pitch, its stiffening agent as, preferably, cornstarch, paraffin always as an element of the mentioned third group of the ignition steps and also charcoal as at least one of the carbonaceous or solid combustible materials. In accordance with the different purposes the compound of the present invention is to be used for, additional ingredients are added in the four ignition groups and chosen mainly according to their flash points and secondly also according to their specific gravity.

A special compound for kindler purposes consists mainly of coal-tar pitch and cornstarch as binder, kerosene as element of the group with lowest flash point, crude oil of medium flash and fire points as element of the group with next higher flash point, paraffin as element of the group with still higher flash point, a heavy oil of a high viscosity as element of the group with highest flash points, crushed charcoal and other anthracite and/or bituminous coal particles, whereby the latter comprise not more than 65% but at least 45% by weight of the compound and the hydrocarbons of the four mentioned groups comprise at least 18% of the compound.

A variation of the compound, especially suited for fuel purposes, preferably in the form of briquets for open fire-places, kitchen stoves, and the like has about the same ingredients as the variation for use as a kindler, but the amount of each of the ingredients varies, accommodating the compound to the special purpose. In this modification only three of the four groups of hydrocarbons of different flash points are used and in a further modification naphthalene is added in the first group of hydrocarbons with lowest flash point, which initiates more efficiently the first stage of the burning process. In all variations of the compound the solid combustible substances consist of particles of different meshes, thereby forming a sufficient number of interstices which remain between the particles to impart a porous character to the compound, beneficial to the burning process.

It will be understood that kindlers embodying my invention will possess the quality to produce strong in candescence within themselves in a surprisingly short period of time, a quality which is required to ignite anthracite coal fires and other fires more quickly and efficiently than it can be done with charcoal or wood alone and at a cost which is less than for charcoal or wood on a heat unit content basis.

The compound according to this invention represents an ideal kindler which is absolutely safe and innocuous in use, not liable to catch fire though it can be lit by a match, nor dangerous, nor in any way disagreeable in use, for instance by the generation of evil smelling fumes. The said compound is cheap, convenient to handle and to use and fulfills to perfection its function as a kindler and as a self-contained fuel as well, under all circumstances, and very economically without the assistance of paper, wood, or any other kindling material.

In the preferred embodiment of the invention the fuel compound comprises a binder consisting of 1 to 30% coal-tar pitch and 1 to 12% cornstarch, four groups of hydrocarbons with graded flash points, namely 0 to 15% kerosene as the hydrocarbon with lowest flash point, 0 to 20% crude oil of a medium flash point as the hydrocarbon of the second group, 0 to 20% paraffin as the hydrocarbon of the third group with higher flash points than that of the second group, 0 to 20% of a heavy oil, as a heavy mineral oil, or any heavy or tar-oil, as the hydrocarbon of the fourth group of highest flash points, 3 to 65% coal particles 3 to 60% charcoal particles as the carbonaceous or solid combustible materials, whereby the four groups of hydrocarbons amount to at least 18% of the compound, and the coal and charcoal particles together amount to 45 to 65% by weight of the compound. To the compound as defined may be added ½ to 5% kaoline, ½ to 30% naphthalene, about 1 to 2% slaked or other lime, about 1 to 2% iron oxide, about 1 to 2% antimony sulphide and 1 to 2% zinc oxide.

As equivalent to paraffin all animal, vegetable, or mineral waxes can be used as well as the next following derivatives of the fractional distillation of naphtha, as for example Vaseline oil, watchmaker's oil, etc.

The paraffin serves mainly three purposes: first, it makes the compound readily but not highly inflammable in the presence of carbonaceous material acting as a wick, second, it increases the heat unit content of the compound considerably, and third, it seals the final product against evaporation of volatiles from within and atmospheric and other external influences.

As equivalent for pitch, asphalt, coal-tar, lacquers, rosins, limed rosins, (rosin 125 to 155 M. P. and 2 to 5% lime) can be used. The pitch serves mainly three purposes: first, it contributes largely to the high thermal effect of the compound in the burning process and adds another grade of inflammability to the hydrocarbons, i. e. a flash point of 290°-415° F., second, it acts as additional sealing agent in the same manner as paraffin works in this capacity, third, it represents the binding agent in the process of forming briquets, logs, or the like, which effect is supported by the boiling in of cornstarch as a stiffening agent, thus preventing the pitch from running or draining off during combustion and carbonizing the pitch to reduce its smoke in the burning process, thereby rendering briquets that

5

will not disintegrate while burning and will not give off obnoxious smoke.

As equivalent for cornstarch, flour or dextrine, or a similar material, working as stiffening agent can be used; and naphthalene can be substituted by phenantrene.

The following examples are given, whereby the ingredients of the compounds are cited in percent of weight:

Example 1

For kindler purposes in granulated or briquetted form.

(A)

	Per cent
Pitch	13
Cornstarch	7
Crude oil or fuel oil of medium flash point	8
Paraffin	10
Heavy mineral oil	5
Crushed bituminous coal	27
Powdered charcoal	10
Granulated charcoal	20

In a variation an example which is also used for kindler in granulated or briquetted form is shown as follows:

(B)

	Per cent
Pitch	11
Cornstarch	7
Slaked lime	2
Sulphur	1
Iron oxide	1
Antimony sulphide	1
Zinc oxide	1
Kerosene	1
Crude oil of medium flash point	8
Paraffin	9
Crushed anthracite coal	10
Crushed bituminous coal	19
Powdered charcoal	10
Granulated charcoal	19

Example 2

For special use as a fuel for open fire-places, kitchen stoves in briquet or log shape:

(A)

	Per cent
Pitch	13
Cornstarch	7
Kerosene	6
Paraffin	8
Heavy mineral oil	12
Crushed anthracite coal	23
Powdered charcoal	7
Granulated charcoal	24

Another example in use for the same purpose is the following:

(B)

	Per cent
Pitch	16
Cornstarch	7
Kerosene	4
Paraffin	12
Heavy mineral oil	6
Iron oxide	1
Crushed anthracite coal	27
Powdered charcoal	10
Granulated charcoal	17

Example 3

For special use as fuel for cooking stoves whereby it produces the required heating effect almost immediately and has the additional advantage

6

that at any time anthracite or other coal may be added and quickly ignited while the fuel compound continues its previous function as fuel and thus acts as heating and kindling material at once:

(A)

	Per cent
Pitch	6
Cornstarch	5
Kerosene	2
Crude oil of medium flash point	6
Paraffin	6
Naphthalene	12
Heavy mineral oil	8
Crushed anthracite coal	11
Crushed bituminous coal	12
Powdered charcoal	10
Granulated charcoal	22

Another example in use for the same purpose is the following:

(B)

	Per cent
Pitch	4
Cornstarch	4
Crude oil of medium flash point	4
Paraffin	2
Naphthalene	20
Heavy mineral oil	10
Crushed anthracite coal	16
Crushed bituminous coal	15
Powdered charcoal	8
Granulated charcoal	17

It is another object of the present invention to provide a method of preparing a fuel compound according to which a material is produced in either granulated, briquetted or log-shaped form. This object is achieved, first, by heating of pitch above its melting point and stirring in cornstarch, and by heating the mixture further until the cornstarch is fully dehydrated, i. e. until the water of condition of the cornstarch is driven out. The cornstarch integrates with the pitch and forms a gellertic mass with it. Second, another mixture is prepared simultaneously in a separate tank by introducing the largest part of the coal first and heating it up to about the same temperature as pitch and cornstarch, in order to dehydrate said coal, and then paraffin and the liquid hydrocarbons are either introduced in the same tank containing the coal which is further heated to the same temperature, whereby the dehydrated coal partly absorbs the liquid and semi-liquid hydrocarbons after their melting, or to expediate this procedure the semi-liquid hydrocarbons are simultaneously melted in a third tank, then the liquid hydrocarbons are added while the total is being heated up to the same temperature as pitch and coal. In the first case, when operating with two tanks only, the contents of both tanks are intimately united by agitating them thoroughly while keeping them constantly at a temperature above the melting point of pitch, and in the second case, when operating with three tanks the content of the third tank containing the liquid and liquefied hydrocarbons after heating them up to the temperature of that in the first and second tanks is added to the dehydrated coal contained in the second tank and after the liquid and liquefied hydrocarbons having been united with and partly absorbed by the coal the content of the second tank is intimately united with the content of the first tank in the manner described above. During the whole procedure the materials in all tanks are kept at a

7

temperature above the melting point of the pitch. All tanks are preferably jacketed for steam-heat and covered in order to avoid the evaporation of the volatiles and equipped with agitating devices because it is very important to agitate during the whole procedure all of the contents of the tanks.

Irrespective of using two or three tanks as described or a more modern conveyor-belt mixing method or any other method to the final mixture (coal plus liquid and semi-liquid hydrocarbons plus pitch binder) which still is kept above the melting temperature of the pitch, the rest of the charcoal, namely, the most coarsely granulated charcoal is added in its cold state.

The finished product is then either poured out and cooled off, thus maturing into a mass of granulated shape, or preferably, pressed in its still hot state at the temperature above the melting point of pitch into briquets, logs, or the like. The pressing can be effected by molding, extruding, or any other convenient way. The pressed compound either can be baked now, in the known manner, in order to carbonize the compound and thereby reduce the smoke development of the briquets in the burning process, and then letting it cool off whereby it solidifies to a surprisingly hard briquet not subjected to breakage in shipment and disintegration in the burning process, or simply cooled off immediately after pressing, again either by molding or extruding in any desired shape, resulting in the same surprisingly hard briquet, since it develops a negligible amount of smoke only even if not subjected to the baking process. After the complete combustion there will be no undesirable residues or clinkers left, but a little white ash (about 6%).

By adding granulated charcoal in its unheated state to the entire mixture it has been found that the mixture does not penetrate into the granulated charcoal. This has three explanations: first, the air contained in the granulated charcoal expands to such an extent as to prevent penetration of the fluid, second, intense evaporation of water still contained in the unheated charcoal occurs so that fluids which have penetrated at the surface are deprived of their heat to such an extent that they solidify and thereby prevent further penetration, third, the pitch binder added to the mixture before incorporating the coarse, unheated charcoal particles has, although still being hot, already solidified the liquids to such an extent that they are hard to absorb. Consequently, these dry charcoal particles will become incandescent in the burning process first and extend their incandescence quickly to the other substances.

I find it important for some special purposes to add to the mixture oxidizers, or sulphur or the like.

The new fuel compound has an outstanding superiority over all known regular coal and coke, packaged fuels, briquets and all kinds of kindlers.

It is the first coal fuel compound which is ignitable by a match and able to light even anthracite coal in an open grate fire. Furthermore, so much heat is developed in the kindling period already that the heating period begins simultaneously with the start of the fire. Finally due to the condensed high calorific compound and its rate of combustion as well as incandescence one obtains a considerably stronger heating effect with a lesser amount of fuel and in much shorter time than with any other kind of natural or artificial solid fuel.

8

After having described my invention, I am aware of the fact that further modifications can be made therein by persons skilled in the art without departing from the scope of the invention as expressed in the claims.

What I claim is:

1. A fuel composition consisting substantially of about 0 to 15% most readily inflammable liquid hydrocarbons of a flash point not higher than about 150° F., 0 to 20% readily inflammable liquid hydrocarbons of a flash point from 150° F. up to about 260° F., a substantial amount up to 20% paraffin as less readily inflammable hydrocarbon of a flash point from 260° F. up to about 300° F., 0 to 20% least readily inflammable liquid hydrocarbons of a flash point from 300° F. up to about 600° F., 1 to 30% pitch, and 1 to 12% starch, 3 to 65% by weight finely divided coal material and 3 to 60% of charcoal, both said coal material and said charcoal totalling 45 to 65%, and said hydrocarbons comprising said paraffin and at least two of said other groups of hydrocarbons, all said hydrocarbons including paraffin amounting to at least 18% of the total composition.

2. A fuel composition consisting of 1 to 30% pitch and 1 to 12% starch, substantially 3 to 65% of finely divided coal material and substantially 3 to 60% charcoal, both said coal material and said charcoal totalling 45-65%, paraffin and at least two other hydrocarbons selected from the group consisting of liquid and solid hydrocarbons, each of the hydrocarbons including paraffin having a flash point different from that of the other hydrocarbons and a calorific value sufficient for igniting the hydrocarbon of next higher flash point and said paraffin and said other hydrocarbons amounting to at least 18%.

3. A fuel composition consisting of at least three groups of hydrocarbons comprising substantially about 1 to 15% kerosene, 0 to 20% crude oil of a flash point of 150° F. to 260° F., a substantial amount up to 20% paraffin, 0 to 20% heavy hydrocarbon oil of a flash point of about 300° F. up to 600° F., each of said hydrocarbons having a higher flash point than the previous one and being of a calorific value sufficient for igniting the next group of a higher flash point, 3 to 60% charcoal particles, 3 to 65% coal particles, 1 to 30% pitch, and 1 to 12% starch, said charcoal and coal particles together amounting to from 45 to 65%, both said paraffin and at least two of said other hydrocarbons amounting to at least 18%.

4. A fuel composition consisting of at least three groups of hydrocarbons comprising substantially about 0 to 15% kerosene, 0 to 30% naphthalene, 0 to 20% crude oil of a flash point of 150° F. to 600° F., a substantial amount up to 14% paraffin, 0 to 20% heavy hydrocarbon oil of a flash point of about 300° F. up to 600° F., each of said hydrocarbons having a higher flash point than the previous one and being of a calorific value sufficient for igniting the next group of a higher flash point, 3 to 60% charcoal particles, 3 to 65% coal particles, 1 to 30% pitch, and 1 to 12% starch, said charcoal and coal particles together amounting to 45 to 65%, and both said paraffin and at least two of said other hydrocarbons amounting to at least 18%.

5. A method of preparing a fuel composition, which consists of heating of 1 to 30% pitch above its melting point and stirring in 1 to 12% starch, and further heating of said pitch and starch to the point of dehydration of the latter and to the

point of integration of pitch with starch, heating separately 3 to 65% by weight of finely divided coal material to the point of its dehydration, then adding at least 18% of both paraffin and at least two other hydrocarbons selected from the group consisting of liquid and solid hydrocarbons of a flash point of about 150° F. up to about 600° F., each of the hydrocarbons, including paraffin, having a flash point different from that of the other hydrocarbons and a calorific value sufficient for igniting the hydrocarbon of next higher flash point, to said dehydrated finely divided coal material and heating it up to the temperature of the said pitch and starch before mixing all said heated ingredients together with said pitch and starch, finally adding 3 to 60% charcoal in cold state to the said mixture, both said coal material and said charcoal totalling 45 to 65%, mixing finally all said ingredients together, thoroughly agitating the mixture during the whole procedure and then cooling off the final mixture.

6. A method of preparing a fuel composition, which consists of heating of 1 to 30% pitch above its melting point and stirring in 1 to 12% starch, and further heating of said pitch and said starch to the point of dehydration of the latter and to the point of integration of pitch with starch, heating separately 3 to 65% by weight finely divided coal material to the point of its dehydration, then adding at least 18% of both paraffin and at least two other hydrocarbons selected from the group consisting of liquid and solid hydrocarbons of a flash point of about 150° F. up to about 600° F. each of the hydrocarbons, including paraffin, having a flash point different from

that of the other hydrocarbons and a calorific value sufficient for igniting the hydrocarbon of next higher flash point, to said dehydrated finely divided coal material and heating it up to the temperature of the said pitch and said starch, before mixing all said heated ingredients together with said pitch and said starch, finally adding 3% to 60% of charcoal in cold state to the said mixture, both said coal material and said charcoal totalling 45 to 65%, mixing finally all said ingredients together, thoroughly agitating the mixture during the whole procedure, then forming the mixture under pressure to predetermined shape before cooling it off.

FRED ELKAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
44,940	Covert	Nov. 8, 1864
836,897	Schorr	Nov. 27, 1906
1,290,992	Hite	Jan. 14, 1919
1,682,195	Sheehan	Aug. 28, 1928
1,811,935	Hue	June 30, 1931
2,227,256	Haffner	Dec. 31, 1940

FOREIGN PATENTS

Number	Country	Date
14,014	Great Britain	1903
4,377	Great Britain	1912
9,065	Great Britain	1912