Patented Oct. 17, 1939 2,176,127

UNITED STATES PATENT OFFICE

2,176,127

COATING COAL

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No Drawing. Application January 22, 1936, Serial No. 60,262

9 Claims. (Cl. 44—6)

This invention relates to the protective coating of coal, and like fuels.

In coating coal protectively, there are the usual factors of excellence in the product and expense of production which are to a certain extent irreconcilable. It has become a well-known practice to spray lumps of coal, coke, and like fuels, with a petroleum oil, such petroleum oil being generally a cut of the oil which has substantial viscosity, but which is of a viscosity sufficiently low to permit it to be sprayed upon the coal at normal atmospheric temperatures and under moderate pressure.

As noted in my co-pending application Serial No. 713,694, filed March 2, 1934, a simple petroleum oil is incapable, when applied to the surface of lump coal, of forming a permanent solid protective coating thereon. In fact the petroleum oil commonly applied to lump fuel by spraying, in order to prevent deterioration by either or both oxidation and objectionable dusting, exists as a truly protective film on the surface of the fuel lumps for an approximate period of but three weeks. In about three weeks the oil, by evaporation, and by penetration into the body of the coal has become so dissipated from the surface of the lumps that its value as a protective coating is lost.

The spray application of such oil—that is, a petroleum oil having a viscosity range of from 50 to 150 Saybolt Universal seconds at normal room temperature—is an inexpensive mode of protecting coal against dusting when such coal is used within a very short time after mining. It is, however, of no value on coal which is stored or transported for a peirod of even a relatively small number of weeks before it is used. Commercial difficulty also arises from the fact that purchasers of coal, supposedly of a protected grade, are with reason dissatisfied upon finding that the oil-protected coal becomes subject to dusting upon relatively short delay intervening before it is used.

Coal, when protectively coated in accordance with the preferred teaching of my application above noted, or that of my prior Patent No. 1,912,697, dated June 6, 1933, is a quality material which may be stored for long periods of time without degradation due to oxidation and without dusting. While the cost of applying a relatively permanent protective coating to coal is not great, it is a fact that protective coatings, which consist wholly of waxes, or which consist preponderantly of waxes, require some specialized mode of application which is more costly than an application of the coating material to the coal by simple pressure spray. That is, if a protective coating material for coal consists wholly or in great preponderance of wax, such as paraffin wax, it must be desposited on the coal by dipping, by forming a heated water bath containing the material, or by steam spraying as disclosed in my co-pending application Serial No. 36,365, filed August 15, 1935.

I have discovered that I am able so to improve the qualities of petroleum oil, of the cut sprayed upon coal, that I am able to impose on the coal by simple spraying a protective coating which remains effectively upon the surface of the coal for a period of time extended greatly over that in which coal is protectively coated by a film of petroleum oil alone.

To this end, I add to the cut of petroleum oil used in the spray coating of coal a waxy content in substantial proportion. I have found that by the addition of a substantial quantity of wax to a cut of sprayable petroleum oil having a Saybolt viscosity of from 50 to 150 seconds I obtain a protective film formed by an oil solution of the wax on the coal, which has a greatly increased period of effectiveness as compared with the effective duration of a film of the oil alone as applied to the coal. I have also found that oil containing a substantial quantity of wax may be applied by simple spraying to lumps of coal, thus giving a coal product which is protectively coated throughout a lengthened period of time without substantial increase in the cost of the material which forms the protective film on the coal, and with little or no increase in the cost of applying the film to the coal.

It has been stated above that the desired effect is obtained by adding a substantial quantity of wax to the oil. The term "substantial quantity" is relatively loose in itself, but by this term as herein used I mean the addition of wax to the oil in a quantity at least adequate to give the blend a pour-point as high as normal room temperature. In a blend of the oil and wax, the presence of the wax in such substantial quantity tends to hold the oil on the surface of the coal against both penetration and evaporation, in addition to holding it against mechanical removal.

The following table, giving the effect of the addition of various proportions by volume of crude petrolatum to a spraying oil, illustrates the increase in pour-point and viscosity obtained by the addition of wax to the oil. The spraying oil specifically used in working out the table was a cut of petroleum having a viscosity of 100 Say-

bolt seconds, which is the cut commonly sprayed on coal, and the crude petrolatum was the crude waxy product obtained from a crude Pennsylvania petroleum having so small a proportion of asphaltic ingredients as to be considered as a wholly paraffin base oil. This crude petrolatum comprised approximately 50% paraffin wax, the remaining content of the petrolatum being petroleum oil subject to fractionation into cuts of widely varied boiling point and viscosity.

Oil, percent	Petrolatum, percent	Approximate pour-point, ° C.	Viscosity in Ford cup seconds
100	0	15	40–41 at 25° C.
75	25	24	36–38 at 58° C.
66⅔	33⅓	35	36–38 at 58° C.
50	50	35	36–38 at 58° C.
0	100	40	35–40 at 60° C.

From the foregoing table it will be seen that a 25% inclusion of petrolatum, which amounts to a 12½% inclusion of wax, gives a material with a pour-point no lower than normal room temperature, which pour-point is of importance in obtaining a film of substantially increased life when the material is applied to coal. It will be noted that the elevation in pour-point obtained by adding a substantial quantity of wax to the oil is not coupled with commensurate increase in the viscosity of the material at temperatures of but slight elevation. Because of my appreciation of this fact, I was led to discover that a coating material comprising a sprayable oil, with a wax added in substantial but limited quantity, might be applied by a simple spraying operation as distinguished from dipping, or the use of a water bath or steam spray.

It should be understood that the application of coating material to coal is not uniform with all classes and grades of coal, even though the material itself and the mode of its application be identical. Variation in the character of the film due to varied sorts of coal on which a protective film is formed is, however, properly to be considered a matter of degree only. I have taken for purposes of illustration coal as mined at Wildwood, Allegheny County, Pennsylvania. This coal is from what is known as the upper Freeport vein, and is a good grade of bituminous coal, having a relatively high volatile content and a relatively high ash content. The following table will illustrate, with particular reference to this coal, the relative endurance thereon of petroleum base films in which the petroleum oil is blended with varied volumes of wax. In this table the petrolatum is, as in the preceding table, a crude petrolatum derived from Pennsylvania petroleum, and the petroleum oil is a cut of oil having a viscosity of 100 Saybolt seconds at 60° F.

Oil, percent	Petrolatum, percent	Effective life of film
100	0	3 weeks.
75	25	6–8 weeks.
50	50	12–16 weeks.
25	75	32–64 weeks.
0	100	1–2 years.
0	100+25 added wax	2–3 years, or permanent.

It will be noted that the last example given approximates the preferred composition of my above-noted application Serial No. 713,694, filed March 2, 1934. As above explained, the petrolatum may be considered as a blend consisting of approximately equal proportions of wax and oil. It may be derived either from Pennsylvania crude petroleum or Mid-Continent crude petroleum. The oil may be a cut from any of the known classes of petroleum. It is, however, desirable that the oil used be from such source, or be so treated, that it does not possess the definitely unpleasant odor associated with certain crude petroleums.

If wax, without an oil content, be used instead of petrolatum, it is desirable that this wax be in the amorphous state, as the presence of crystalline wax in an applied film tends to render the film brittle at low temperatures. If paraffin wax, as such, be added to the oil, there is advantage in adding to the blend a small quantity of a naphthenic oil, or a tar acid material which possesses the quality of inhibiting crystallization of the paraffin.

As to the application of coating material, a blend of oil and paraffin wax, up to approximately a 15% content of the wax, may satisfactorily be sprayed on coal without elevating the spraying temperature above normal room temperature, and utilizing a spraying pressure of about 50 to 60 pounds. Returning to the specific examples above given, the blends of oil and crude petrolatum up to and including an example comprising 25% oil and 75% petrolatum may be sprayed at a spraying temperature equal to normal room temperature, if a high spraying pressure, such as a pressure of from 100 to 400 pounds, be employed. I have found it to be more practical, however, to use gentle heating rather than high pressure in spraying a blend of oil and wax.

Referring to the pour-point and viscosity table given above, I have found adequate, to insure proper spraying, a temperature equal to the Ford cup viscosity temperatures given above for each proportional example of the blend. As these temperatures are all relatively low, the blend may be suitably warmed for spraying merely by use of a hot-water jacket, or other means of supplying heat in moderate degree. As explained above, the blend may be applied to the lumps of coal, which it is to protect, in several ways, the simple pressure spraying of the blend being the simplest and least expensive mode of application.

In giving a viscosity range from 50 to 150 Saybolt seconds as defining the oil content of my blend, I do not intend specifically to limit my invention to the addition of wax as a content of crude petrolatum, or otherwise, or in other condition, to an oil falling within this viscosity range. It is, however, a fact that the use of cuts of petroleum oil having a viscosity substantially higher than 150 Saybolt seconds results in a marked increase in the difficulty of applying the film without commensurate advantage in the quality of the film formed by application of the blend. Petroleum cuts of a viscosity substantially lower than 50 Saybolt seconds does not in itself form on the fuel a film having an endurance adequate to allow it to be considered useful as a sprayable coal-coating oil. I prefer to use as the oil content of the blend petroleum oil within the viscosity range rendering the oil usable by itself in protectively coating coal.

Referring to the table giving the approximate useful life of various percentage compositions of my blend, it will be noted that a blend of 50% oil to 50% crude petrolatum is capable of forming upon coal of a usual class and grade a film which has a useful life of from 12 to 16 weeks.

while the blend comprising 75% oil to 25% crude petrolatum is capable of forming a film having a useful life of from 6 to 8 weeks. These two examples comprise what may be considered the preponderant practice, since they illustrate a condition in which such modification over the use of a simple spraying oil has been made, that coal coated with the material is protected for an increased period of time adequate to make allowance for the incidental delays in shipment and use which render the spraying of coal with a simple petroleum oil in practical effect inadequate and commercially inadvisable.

As a general guide to the appropriate proportional inclusion of wax in the sprayable blend of oil and wax, reference should be made to the porosity of the coal coated in determining the adequacy of the wax content in preventing absorption of the oil into the body of fuel to maintain an unbroken film on the surface of the fuel throughout the time period of requisite duration. In applying a protective film to coke, rather than to raw coal, however, the coke having a high porosity, a blend of lower wax content than that requisite for coating raw coal may nevertheless be used to form a film having a useful life of a duration equal to that of the film when applied to raw coal.

Amorphous paraffin wax, either as an isolated material or in the form of petrolatum, is the material which I chiefly employ. The class of amorphous waxy petroleum-derived materials so changed by treatment that they are not accurately defined by the term "paraffin" are also preferred as the solid film-forming content of the blend. While other amorphous waxes and waxy materials, such as carnauba wax and lanolin, may be introduced into the petroleum oil without rendering wholly impossible the pressure spraying of the coating material so formed, such waxes and waxy materials are not so desirable for the purpose. Aside from the higher initial cost of such materials, they do not have solvency for petroleum oil comparable with that possessed by paraffin and the other petroleum-derived waxy materials.

I claim as my invention:

1. A petroleum application blend for dustproofing and otherwise protectively treating coal and coal-derived particulate fuel consisting substantially of petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., charged with a substantial content of amorphous petroleum wax, the perroleum oil constituting not less than 75% the total weight of the application blend, and the application blend having a viscosity below 38 Ford cup seconds at 58° C.

2. A petroleum application blend for dustproofing and otherwise protectively treating coal and coal-derived particulate fuel consisting substantially of petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., charged with a substantial content of amorphour petroleum wax, the amorphous petroleum wax being included in a substantial proportion below 15% the total weight of the application blend, and the application blend having a viscosity below 36 Ford cup seconds at 58° C.

3. The herein described method of treating coal and coal-derived particulate fuel which comprises blending petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., with a substantial amorphous petroleum wax content in a proportion (below an upper limit of 15% the total weight of the blend) apportioned to the viscosity of the oil to give a flowable application blend which as a film on the fuel tends to gel thereon, and applying the blend to the fuel by spraying it thereon under a pressure roughly apportioned to the viscosity of the blend at the temperature of spraying.

4. The herein described method of treating coal and coal-derived particulate fuel which comprises blending with petroleum-wax petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., in a proportion of from 75% to 85% total petroleum oil to a complementary content of amorphous petroleum wax to give a wax charged petroleum application bend having a viscosity lower than 38 Ford cup seconds at 58° C. and applying the blend to the fuel by spraying it thereon under a pressure roughly apportioned to the viscosity of the blend at the temperature of spraying.

5. The herein described method of treating coal and coal-derived particulate fuel which comprises blending low viscosity non-volatile petroleum oil within the approximate viscosity range of 50 and 150 Saybolt at 100° F. with amorphous petroleum wax in a quantity so apportioned to the quantity and viscosity of the oil as to impart to the low viscosity petroleum oil the property of ready gelation when applied to the fuel while retaining the ability of the oil initially to flow rapidly over the surface of and lubricate the fuel, and flowing the blend over the surfaces of the fuel.

6. The herein described method of treating coal and coal-derived particulate fuel which comprises blending low viscosity non-volatile petroleum oil within the approximate viscosity range of 50 and 150 Saybolt at 100° F. with amorphous petroleum wax in a quantity so apportioned to the quantity and viscosity of the oil as to impart to the low viscosity petroleum oil in the property of ready gelation when applied to the fuel while retaining the ability of the oil initially to flow rapidly over the surface of and lubricate the fuel, and applying the blend to the fuel by spraying it thereon under a pressure roughly apportioned to the viscosity of the blend at the temperature of spraying.

7. The herein described method of treating coal and coal-derived particulate fuel which comprises blending petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., with a substantial amorphous petroleum wax content in a proportion (below an upper limit of 15% the total weight of the blend) apportioned to the viscosity of the oil to give a flowable application blend which in a film on the fuel tends to gel on the surface thereof, and applying the blend to the fuel by heating the blend and spraying the heated blend under a pressure roughly apportioned to the viscosity of the blend

at the temperature to which the blend is heated.

8. The herein described method of treating coal and coal-derived particulate fuel which comprises blending with petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., with amorphous petroleum wax content in a proportion of from 75% to 85% total petroleum oil to a complementary content of petroleum wax to give a wax charged petroleum application blend having a viscosity lower than 38 Ford cup seconds at 58° C. so that the blend tends readily to flow at low temperature over the surfaces of the fuel particles, and applying the blend to the fuel by heating the blend and spraying the heated blend under a pressure roughly apportioned to the viscosity of the blend at the temperature to which the blend is heated.

9. The herein described method of treating coal and coal-derived particulate fuel which comprises blending petroleum oil, having in application to the fuel a fluidity corresponding to that of a Pennsylvania petroleum-derived oil within the approximate viscosity range of 50 Saybolt seconds at 100° F. and 150 Saybolt seconds at 100° F., with an amorphous petroleum wax content in a proportion (below an upper limit of 15% the total weight of the blend) apportioned to the viscosity of the oil to give a flowable application blend which as a film on the fuel tends to gel thereon, and applying the blend to the fuel in the absence of applied heat under a pressure of from about 100 pounds to 400 pounds roughly apportioned to the viscosity of the blend at the temperature of spraying.

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