June 18, 1940. G. M. WATTLES 2,204,781

ART OF PROTECTING COAL AND LIKE

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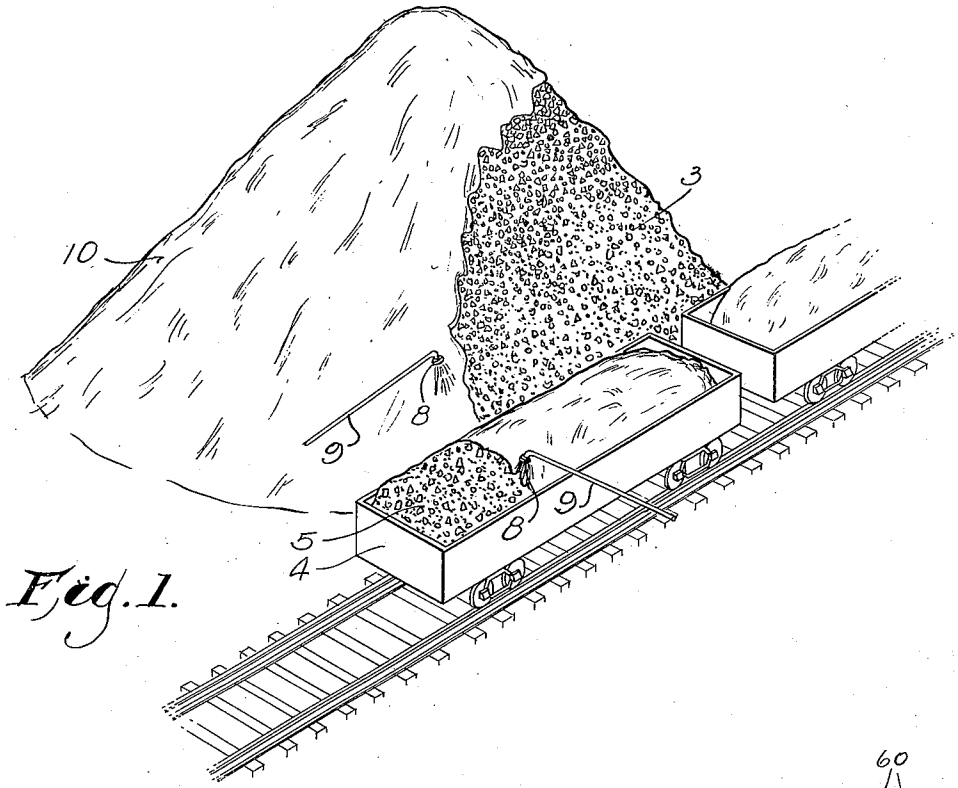


Fig. 1.

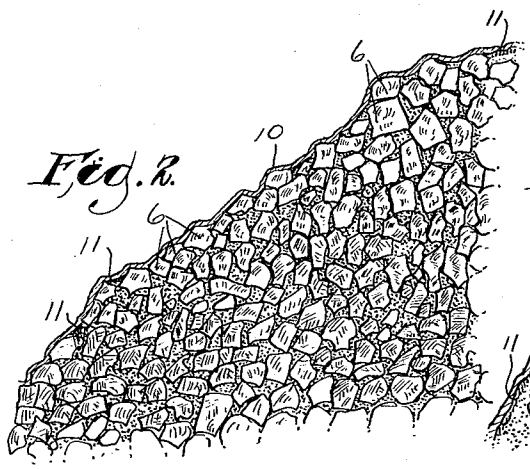


Fig. 2.

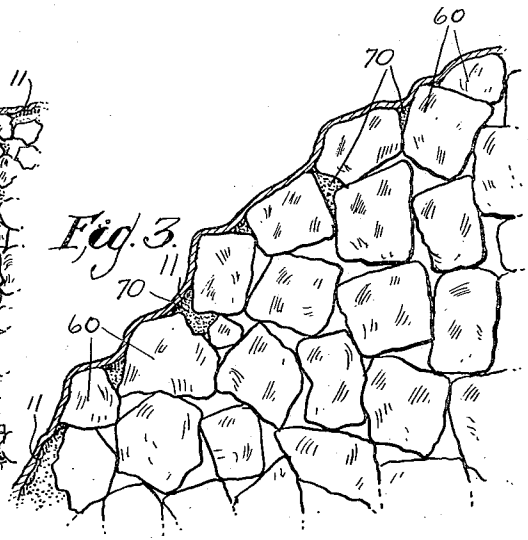


Fig. 3.

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ART OF PROTECTING COAL AND LIKE

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Application July 27, 1939, Serial No. 286,809

11 Claims. (Cl. 44—6)

This invention relates to improvements in the art of protecting coal and the like from the weather. The invention has to do with the method and resulting product.

Both in the shipment and storage of coal and the like, considerable difficulty is experienced because of the exposure of the product to the weather. Shippers of coal and coal companies who store their coal in large piles experience spontaneous combustion and freezing of the coal. Users of coal, who store their coal in the open air, whether in bins or in piles, have the same troubles. It is common for rain or melting snow to penetrate deeply through a mass of coal and the like with the result that when the weather turns colder the entire mass of coal may be frozen solid, making it extremely difficult to remove from the mass or pile such coal or the like as is required to meet current deliveries or for current consumption.

The presence of excess surface moisture in the coal is also very objectionable to consumers. If the moisture is present in the coal at the time it is purchased its weight is included in the weight of the coal for which the consumer pays and in the freight charged to him. Furthermore, where the coal is used in stokers or the like, any excess of moisture seriously interferes with the proper operation of the stoker. Stokers commonly burn small sizes and dust, or screenings, which are peculiarly subject to the retention of moisture and which will neither feed properly nor burn to the best advantage when wet.

It is the primary object of the present invention to protect amorphous commercial coal from the acquisition of moisture from the atmosphere either enroute or in storage, by the application to exposed surfaces of the coal of a protective weather-excluding coating. More particularly stated, it is my idea to provide a coated mass of coal by first selecting or preparing coal which has mostly "fines" and dust at its surface to provide a more or less smooth and continuous bed for the coating, and secondly, applying to the surface of the coal mass a coating which is normally congealed at atmospheric temperature but is rendered sufficiently liquid by heat to enable it to be spread on to the coal mass, the coating being of such a nature that it will neither remain unduly soft nor will become unduly brittle.

If the coal lumps are large, and particularly if they are of such a nature as to have the regularity of bricks, there will be a strong tendency for lumps to cleave or part, particularly in the course of shipment, to such an extent as to overcome the elasticity of any liquid which is practical to use as a coating. This will result in numerous and widespread cracks through which the moisture will penetrate practically uninterrupted. Accordingly it is my purpose to treat small coal, such as stoker coal, in which there are large quantities of dust and "fines". In the event that the coal requiring treatment is of larger sizes, I may apply over the surface thereof a sufficient quantity of dust or "fines" to seal the crevices and to provide that continuity of surface which I prefer as a base for my coating.

It is my experience that the coating should preferably be of such a nature as to be rendered liquid by heat, rather than by a solvent. A coating rendered liquid by heat will tend to congeal almost instantly upon contact with the coal. A coating rendered liquid by a solvent will tend to penetrate deeply, thus tending to require an undue quantity of coating material. Furthermore, where a thermally melted coating is used, in accordance with the preferred form of this invention, it is possible to predetermine the characteristics of such a coating at any given atmospheric temperature with an accuracy which would be impossible if a solvent might be evaporated to a greater or less degree or might be soaked up in loose coal to a greater or less degree, according to circumstances.

The objects of the invention will more fully appear from the following disclosure.

In the accompanying drawing:

Figure 1 is a view showing a pile of coal or the like and conventional carloads of coal or the like, both in process of treatment in accordance with this invention.

Figure 2 is a greatly enlarged detail view representing diagrammatically a fragmentary cross section through a mass of coal or the like, illustrating in cross section the appearance of the substantially impervious coating applied thereto.

Figure 3 is a detail view representing diagrammatically a fragmentary cross section through a mass of screened coal of larger sized particles to which "fines" have been applied as a basis for the application of an impervious coating in accordance with this invention.

Like parts are identified by the same reference characters throughout the several views.

While there is a wide variety of materials suitable for use in carrying out this invention, some are much preferable to others, not only from the standpoint of expense but from the standpoint of results. The temperature and other conditions at the time of application of the coating to the

pile of coal or the like should be taken into consideration, as well as the extreme range of temperatures to which the coating may be subject throughout its life. It is also material to know the purposes for which the contents of the coated pile will be used. A coating material used on coal should preferably be combustible, whereas a coating material used on other commodities might perhaps be objectionable if combustible.

If the material used is too brittle at a given temperature it will crack and thus admit water and air to the pile and defeat its protective purpose. If, on the other hand, the material used is too soft, it will penetrate unduly into the pile, thereby not only wasting the material but perhaps so decreasing the tensile strength of the coating that it may fall apart, again defeating its purpose.

I have found the best results to follow from the use of a coating which involves a mixture of materials having different characteristics. Its advantages can best be explained with reference to some particular material. Coal is, from many standpoints, the best example since it is combustible and is therefore desirably coated with a combustible material.

For the purposes of illustration, therefore, the pile 3 will be understood to represent a pile of coal. Ordinarily the coal will include some dust and "fines."

"Fines" are usually identified in the industry as coal below a 2'' size and include "nut," "pea" and "dust" or "screenings." Most of the coal sold in these small sizes is mixed and includes dust.

Even despite any attempt to grade the coal, a certain amount of it will crumble. The gondola type freight cars shown at 4 will be considered as illustrative of any confined bin adapted to receive the material such as coal at 5, with the upper surface of the coal exposed. In the cross section shown in Fig. 2 the lumps 6 will, by way of example, be understood to represent lumps of coal between which there exist fine particles as indicated at 7.

In the cross section shown in Fig. 3 the lumps 6a are larger lumps which may have been screened and consequently may be comparatively free of "fines" or dust throughout the interstices of the pile. Before applying to such a pile of coal a coating in accordance with the present invention, I first preferably throw over the coal pile just enough "fines" or dust to comprise a thin deposit largely in the cracks and crevices as shown at 10 in Fig. 3, whereby to build up a surface sufficiently continuous to receive and support the coating. Both in Fig. 2 and Fig. 3, the fact that the "fines" or dust intervene between the lumps tends to hold the lumps more securely in the positions in which they are piled, and tends to prevent the lumps from shaking apart and cracking the coating.

Any suitable nozzle or spray head 8 supplied with coating material under pressure through a pipe 9 may be used to build up on the surface of the pile or mass of coal a coating such as that shown at 10. Naturally the thinner this coating can safely be made without cracking or pulling apart, the less will be the amount of material required. The characteristics of the coating in this regard will depend largely on the material used.

I have found it essential to employ a material which will be and remain congealed throughout the ordinary range of atmospheric temperatures to which the coated mass may be subject. In order to spray a material which is normally congealed it is necessary to reduce such material to liquid state by heating it or otherwise. Heating is preferred to the use of solvents for reasons explained above. This may conveniently be done through the use of the apparatus disclosed in the application Serial No. 175,765 of Benjamin H. Card, but any way of heating the material and delivering it under pressure to the spray head is acceptable for the purposes of the present invention.

The material which I prefer to use is a paraffin wax oil of low melting point. I have used oils having melting points from 70° to 120°. I have sometimes used a mixture of paraffin oils which are solid at atmospheric temperatures, with liquid oils of high wax content such as those commercially available for waxing floors. The addition of such liquid oils reduces the melting point but does so at increased cost as compared with the expense of a paraffin wax which has the desired melting point in the first instance.

The consistency of the coating which I have found most satisfactory for general purposes is a little harder than the consistency of cup grease. I may, however, vary the melting point according to seasonal conditions and the purposes for which the coating is intended. A coating of paraffin wax having an extremely low melting point will not become so brittle as to crack on a carload of coal in winter. It has sufficient softness to accommodate itself to the movement of the coal at practically any temperature to which the coal may be subject during transportation. At the same time its tensile strength as a coating is relatively high and there is little interference of the coating with the normal removal of material from the car or pile.

A color in the form of a dye or pigment added to the material at the time of the spray, assists the operator in covering the coal uniformly. The material is used preferably at the rate of 8 or 10 quarts per square (100 sq. ft.). It is applied at a temperature of approximately 160° F. from the spraying apparatus for ordinary purposes.

It is probable that the actual proportion of oil and wax in the coating is somewhat different from the proportion in which it is sprayed. The lighter constituents of the coating tend to penetrate more deeply than the wax into the "fines" such as those shown at 7, the penetration of oil being indicated at 11. The total penetration of oil has been found to be comparatively slight, the impervious coating of wax and admixed oil being very thin. This definitely limits the number of individual particles of coal which are affected by the coating in any way, and also results in considerable economy. The penetration of the oil into the coal from the mixture is an advantage insofar as it assists in the rapid congealing of the coating and in binding the coating to the pile. Absorption of a part of the oil by the underlying coal dust is therefore a desirable result, provided it is held under sufficient control so that the characteristics of the completed coating can be determined with fair accuracy in respect of the temperature and other conditions of use.

I am aware of the fact that coal has been treated with various oils and waxes for the purpose of laying the dust, the effort being to treat all component particles of the coal for the complete coating of each individual particle. In such

treatment the layer of material deposited on the coal is wholly inadequate for the purposes of the present invention and does not exclude moisture or air penetration. The present invention seeks to avoid as far as possible the coating of individual particles in the pile or mass, and seeks to confine the coating to a shell having the least thickness and area required to completely enclose the exposed surface of the pile or mass as a whole to constitute a more or less flexible economical waterproof and airproof envelope which, so far as coal is concerned, should also be combustible so that the individual particles which unavoidably have some of the coating adhering to their surfaces, will not be rendered non-combustible. To accomplish these results the shell or jacket 10, while thin as compared with the mass of the pile, is so thick as compared with the individual particles of coal, that it could hardly be called a coating in the sense in which that term is used in the control of dust. Moreover, in my present invention the layer of material is actually bonded to the "fines" on the surface of the pile so that some particles of coal at the surfaces are completely enveloped in the material, while other particles at some distance below the surface are untouched by the material. Thus the completed coating or shell provided by the present invention protects the pile as a whole but includes the "fines" at the surface.

The binding effect of the envelope 10 is such that it resists not merely the penetration of water and air, but also resists the destructive erosion of wind. Much coal is frequently lost from cars of coal in transit, as well as from coal piles, by wind and erosion. All such losses are preventable through the use of this invention.

It is generally recognized that spontaneous combustion is most apt to occur in the presence of surface moisture. The danger from spontaneous combustion is decreased in the present invention both by the elimination of surface moisture and also by the substantial exclusion of air from the pile.

This application is a continuation-in-part of my application 189,802, filed Feb. 10, 1938.

I claim:

1. A method of protecting a pile or mass of heterogeneous particles which are free of each other in the body of the mass and include sufficient fines at least at the surface of the mass to obstruct flow toward the interior, which method consists in spraying on to the outside surface of the pile or mass a material congealable at atmospheric temperatures to constitute a non-tacky weather resistant jacket adherent to the fine particles at the surface of the pile or mass.

2. A method of coating a body of coal to exclude water and air therefrom, said method comprising heating a normally congealed combustible coating material to a temperature at which such material can be sprayed and from which it will substantially immediately drop to the congealing point upon contact with the coal, and spraying such material on to the outside surface of a mass of non-adherent particles of coal containing at least at such surface particles sufficiently fine and in sufficient quantities to preclude substantial penetration of the sprayed material into the mass, and continuing the spraying just sufficiently to build up a protective layer substantially completely enveloping the mass of coal without substantial contact with the particles comprising the mass of coal except at the surface of said mass.

3. A method of protecting coal from the weather, which comprises piling non-adherent irregular particles of coal into a mass composed at least at its outside surface substantially entirely of fines with interstices sufficiently small to prevent substantial seepage into the interior of the mass of the coating compound hereinafter referred to, spraying the coal fines over substantially the entire outside surface of the mass with a combustible coating compound adapted upon contact with the fines and with previously deposited coating compound to constitute a water-shedding jacket, and continuing the spraying of such combustible coating compound just sufficiently to build up a protective layer substantially completely enveloping the mass of coal and congealing on the surface fines without substantial penetration into said mass.

4. The method of protecting coal in storage and transportation, which method comprises the assembly of non-adherent amorphous lumps of coal in a pile comprised at least at its outer surface substantially exclusively of particles sufficiently fine to obstruct penetration of a coating, melting a water-repellant combustible coating substance normally solid and non-tacky and comprising wax, and spraying the outer surface of the pile with the molten coating in quantities and at temperatures such that said coating will congeal upon contact with the fines at the surface of said pile without substantial penetration to form an envelope over the surface of the pile to shed water therefrom and obstruct the circulation of air therethrough.

5. A method of protecting coal from the weather in storage and transportation, which comprises piling loose coal particles into a mass composed at least at its outside surface substantially entirely of fines with interstices sufficiently small to prevent substantial seepage of a coating compound into the interior of the mass, spraying the outside surface of the mass with a combustible coating compound comprising a liquid component and a congealable component, whereby to absorb at least a portion of the liquid component of the coating into the fines at the surface of the mass while congealing a component of said coating compound at said surface with reinforcing fines embedded therein and without substantial penetration of any portion of said compound into said mass, and continuing the spraying of said compound just sufficiently to build up a protective layer enveloping the mass of coal to constitute a water-shedding jacket therefor without impairing the utility of the coal in said mass for burning in automatic stoker and powdered fuel equipment.

6. A method of protecting a pile of heterogeneous particles from the weather, which method comprises the heterogeneous piling of amorphous lumps, filling the crevices between lumps at the surface of the pile with fine particles sufficiently minute to prevent substantial seepage, spraying the fine particles at the otuside of the pile with a weather-shedding coating material congealable at atmospheric temperatures upon contact with said particles, and continuing to spray such material upon material previously deposited to build up a protective layer substantially completely enveloping the outside surface of the mass, and embedding the fine particles at the surface without substantial penetration into the pile of amorphous lumps, whereby said protective layer is bonded to the fine particles at the surface of the pile and reinforced thereby to constitute a water-excluding coating.

7. The combination with a vehicle body open at its top and particles of coal or the like comprising a mass extending to all sides of the body and having an upwardly exposed surface comprising particles of coal sufficiently fine to obstruct substantial penetration by a coating, of a yieldable, tenacious, non-tacky water-repellant envelope substantially completely covering the mass of coal within the body and adherent to said body and to the fine particles at the surface of said mass without substantial penetration therein, the particles comprising said mass being free of each other except insofar as they are bonded at the surface with and by said envelope.

8. The combination with a mass of amorphous particles of coal at least superficially comprising fines sufficiently minute to obstruct the penetration of a coating into said mass, of a water-repellant, non-tacky jacket primarily comprising combustible material and substantially completely enveloping the surface of the mass and bonded with said fines without substantial penetration into said mass, said jacket being adapted to shed water from said mass and to obstruct air circulation therethrough, said particles of coal being free except as bonded by the coating at the surface of the mass.

9. The combination with a mass of amorphous irregularly shaped particles of solid material at least superficially comprising fines sufficiently minute to obstruct the penetration of a coating into said mass, of a water-repellant non-tacky jacket, meltable only at superatmospheric temperatures and substantially completely enveloping the surface of the mass in congealed form and bonded with said fines without substantial penetration into said mass, said jacket being adapted to shed water from said mass and to obstruct air circulation therethrough, the component particles comprising the mass being free except as bonded by and to the coating at the surface of the mass.

10. The method of protecting a pile of coal composed at least at its outside surface substantially entirely of fines with interstices sufficiently small to prevent substantial penetration of a coating material by seepage, such method comprising spraying on to the pile a molten water-repellant waxy combustible coating material having substantially the consistency of cup grease at atmospheric temperatures, and continuing to spray said molten material in quantities just sufficient to form a substantially continuous water-shedding envelope over the surface of the pile without substantial penetration thereof, said spraying being conducted at such temperatures that said coating material congeals substantially upon contact with the pile.

11. The method of protecting a mass of amorphous coal superficially comprising fines in sufficient quantities to prevent internal penetration of the mass by a congealable coating agent, which method consists in melting a normally congealed paraffin compound and spraying it on to the surface of the mass at a rate approximating eight to ten quarts per square and at a temperature such as to congeal promptly upon encountering the surface of the mass, whereby to form a water-excluding envelope over the surface of the mass embedding the surface fines without substantial penetration thereof.

GEORGE M. WATTLES.