Patented Jan. 19, 1937 2,068,489

UNITED STATES PATENT OFFICE

2,068,489

REDUCING DUSTINESS OF DUSTY MATERIALS

Benjamin R. Harris, Chicago, Ill.

No Drawing. Application July 13, 1935, Serial No. 31,294

21 Claims. (Cl. 44—6)

My invention relates to the treatment of dusty material to prevent the dust from rising into the atmosphere when such dusty material is handled. It relates more in particular to an improved process for treating such materials, to an improved product for use in the treating process, as well as to a novel process for producing the treating material.

It is well known that when dusty materials, such as coal or coke, for example, are handled, the dust flies up in a very disagreeable manner, causing all of the surroundings to be dirtied with the dust, and the air becomes so laden with the dust that even at relatively long distances away, the dust will subsequently be deposited, as, for example, in the upper part of a building when coal is handled in the basement thereof. I am aware that suggestions have been made for overcoming this disagreeable factor, but as far as I am aware, no treatment heretofore suggested has satisfactorily met the problem.

The principal object of my invention, therefore, is to prevent the dust, ordinarily contained in such materials, from flying and being taken up by the surrounding air.

Another object is to make ordinarily dusty materials for all practical purposes substantially dustless.

Another object is the provision of a method for accomplishing these results.

Another object is to treat coal or similar combustible material to reduce dustiness and cause it to burn better.

Another object is the provision of an improved treating material with which a dusty material may be treated to render it, for all practical purposes, substantially dustless.

Another object is the provision of a novel process for producing such material so that it will be commercially available for the most satisfactory use.

Other objects and features of the invention will be apparent from a consideration of the following detailed description.

In general, my invention consists in the discovery that glycerine "foots", a by-product in the manufacture of glycerine, may be used to render dusty material substantially dustless by a suitable treatment. I have found that if the glycerine "foots" is treated in accordance with the following specification, coal or other dusty material may be treated therewith and may subsequently be handled by shoveling it, running it on conveyors or chutes or in any other way, and substantially no dust whatever will rise in the atmosphere. The material, for all practical purposes, can be said to be substantially dustless.

The disposal of glycerine "foots" heretofore has been a problem for the glycerine manufacturer. As a rule, he is not permitted to run the "foots" into the ordinary commercial sewer systems, and even if it were permitted, there would always be the danger of clogging in the system, and the like, even though the product is substantially water soluble. The product cannot be satisfactorily burned, and dumping it on waste land is also unsatisfactory. Glycerine "foots" is a black, evil smelling material, varying in consistency from a thin syrup to a tacky solid and, in general, its principal constituents are polymerized glycerols, which are the substances of principal value in my process, sodium chloride, sodium sulphate, and salts (principally sodium salts) of various aliphatic acids. This material may be used directly by dissolving it in water and spraying it onto the material to be rendered dustless in suitable proportions. In the direct use of the product, the best results are obtained by dissolving about one pound of the "foots" in a gallon of water, and this solution should be sprayed onto the dusty material in proportions of from approximately one-half gallon to four gallons per ton, depending upon the characteristics and condition of the material. Among the materials which can be and have been rendered dustless, in accordance with my invention, are coke, coke breeze, various types of bituminous or semi-bituminous or anthracite coals, in either the form of slack, mine run, screenings or prepared sizes. It will be understood readily that straight bituminous slack will require substantially the greatest amount of treatment, while prepared sizes of anthracite coal usually will require a minimum amount of the solution to render it entirely dustless.

I have referred above to the fact that the glycerine "foots" has an obnoxious odor and it is desirable, for obvious reasons, to remove this odor, if possible. I have found that this can be accomplished by treating the "foots", preferably at a slightly elevated temperature as, for example, 150° F., with caustic soda or other strong alkali in proportion of from one-half to three pounds for one hundred pounds of "foots". This alkali treatment can be carried on in any suitable way. I have obtained good results by first dissolving the caustic soda in its own weight of water and then incorporating the solution of alkali with the "foots".

I have found that, when some types of ma-

terial, particularly coal, alkali treated according to the process just described, are permitted to stand for prolonged periods of time, objectionable odors develop. Where such materials are stored in household or factory bins or otherwise, this represents an undesirable feature. I have discovered that particularly where prolonged storage conditions are likely to be encountered, it is desirable to subject the "foots" to a treatment which will eliminate any tendency of the "foots" to develop objectionable odors even under relatively long periods of storage of coal and other materials which are normally dusty or tend to develop dustiness in handling.

One way in which this result can be achieved is as follows: In an upright iron still or other suitable apparatus, 900 gallons of "foots" (approximately 9,000 pounds with a moisture content of from 15% to 20%) are warmed to a temperature of about 150° F. Approximately 46 gallons of sulphuric acids (60° Baumé) diluted with 150 gallons of water are then run into the warmed "foots" and the mixture is agitated by a mechanical stirrer or other suitable means. Live steam at a gauge pressure of about 85 pounds is then blown into the "foots"—acid mixture and the steam distillation is continued in this manner until from about 14,000 to 15,000 pounds of steam have been consumed. Generally, this will require from six to six and one-half hours, and during this time the average temperature of the contents of the still will be about 240° F. The condensate is a vile smelling, more or less highly colored liquid which, upon standing, separates into two layers, one of which contains the largest amount of material and is composed of water having odoriferous material dissolved therein. The other layer, which is immiscible with water, varies in weight but, in general, will amount to about two to three hundred pounds of material. The residue in the still, which is now substantially neutral in odor, is then pumped into a cooling tank and when its temperature has dropped to about 150° F., approximately 450 pounds of caustic soda, preferably in flake form, are stirred in and the agitation is continued until a homogeneous mass is obtained. The resulting product is a mixture having a medium heavy consistency and possesses marked hygroscopic properties. It is free of objectionable odors in and of itself and remains free therefrom after being sprayed or otherwise contacted with coal, coke or other materials which are dusty or tend to form dust.

It will be appreciated that the illustrative example set forth above for removing objectionable odors from the "foots" is not to be construed in a limited sense. The procedure outlined represents merely an example of one embodiment of the invention. The process can be varied in several ways. For example, the distillation can be carried out with superheated steam, or with steam or superheated steam in a vacuum. In this latter case, lower operating temperatures may be employed. The process may be varied also by the employment of other strong acids in place of or in addition to the sulphuric acid. In this connection, the mineral acids such as hydrochloric acid may be satisfactorily employed. Similarly, alkalies other than caustic soda may be utilized in place of or in addition to caustic soda. Caustic potash and soda ash are illustrative examples of alkaline material which is quite suitable for the purpose. Additionally, it will be understood that the proportions of acid may be varied depending upon the particular acid employed or the specific character of the results sought to be obtained. Where varying proportions of acid are used, it will be apparent that the amount of alkali will be correspondingly varied.

Inasmuch as the treatment of coal, for example, usually takes place in an open yard where the temperature at times will be extremely low, I have found it advisable to suppress the freezing point of the solution, so that even in the coldest weather, the solution can be sprayed onto the coal. This is accomplished by using any suitable freezing point depressant, such as ordinary sodium chloride, sodium nitrate, potassium chloride, etc., unless, of course, unusually low temperatures are to be encountered, in which case other freezing point depressants, such as calcium chloride or magnesium chloride, or mixtures thereof may also be employed.

A particularly effective freezing point depressant for this purpose is a calcium chloride-magnesium chloride product prepared from natural brines by evaporation of the water therefrom. It has been proposed to employ this (hygroscopic) salt product in connection with coal for allaying dust. While somewhat effective for this purpose, it possesses various disadvantages, among which may be mentioned the corrosive effect of the product upon metal surfaces such as shovels, chutes, etc. which are employed for handling the coal and similar products. I have found that a mixture of the "foots", treated or not as heretofore described, with this calcium chloride-magnesium chloride product, will allay dust very effectively and at the same time materially reduce the corroding action of said salt product. This result is extremely beneficial in that it enables the effectuation in a very simple manner of the combined effects of dust allaying and substantially complete reduction of corrosive action, and the ability to utilize the product under conditions of extreme cold. Some illustrative mixtures which have been used with excellent results are herewith listed.

	Parts
A. $CaCl_2$-$MgCl_2$	1025
NaCl	775
Treated foots	200
B. $CaCl_2$-$MgCl_2$	875
NaCl	525
Treated foots	600
C. $CaCl_2$-$MgCl_2$	1025
NaCl	715
Na_2CO_3 (soda ash)	60
Treated foots	200

These illustrative mixtures are employed in the same manner that the mixture of salt and foots is utilized as hereinafter described.

The use of a freezing point depressant, such as salt, permits me to prepare the glycerine "foots" in a most desirable manner for deliveries through the usual avenues of trade. I am able to prepare the product in a substantially dry form which can be shipped in bags, drums or barrels, and the following specific example of the practice of the invention is sufficiently illustrative of the advantages secured.

The glycerine "foots" is first treated with the caustic soda, potash or other strong alkali, in proportions to one-half to three pounds of the caustic soda to one hundred pounds of "foots", whereby the "foots" is substantially deodorized. I then take the treated "foots" and mix it with

common salt in the proportion of one part of the "foots" to three parts of salt. It will be understood that the steam distilled glycerine "foots" as well as the untreated "foots" can also be admixed with frezing point depressants to produce substantially dry products in the same manner. I have found that the best results are obtained if kiln-dried granulated salt is used for this purpose. The resulting mixture of the salt and treated "foots" is a somewhat moist, but mealy-like, substance resembling, very much, ordinary brown sugar in both color and consistency. This product is available for shipment in moisture-proof burlap bags, for example, or other suitable containers.

In using the prepared "foots" product, it is dissolved in water in proportions of one hundred pounds of "foots" to approximately twenty-seven or twenty-eight gallons of water. This produces about thirty-four or thirty-five gallons of a solution, the freezing point of which is suppressed to such an extent that the solution will not commence to freeze until about —10 degrees F. It is, of course, obvious that the final solution has, roughly, about one pound of "foots" for each gallon of solution, so that this salt solution is also used in proportions of about one-half to four gallons per ton of dusty material treated. This proportion, however, is merely illustrative, as there may be times when less of the solution will be sufficient for the purpose, and other times possibly in which somewhat more may be employed with satisfaction.

For best results, precaution should be taken to obtain an intimate mixture of the "foots" solution with the material. In the treating of coal or coke, for example, the spraying can be carried out while the coal is being moved, either by shoveling, on conveyors or chutes, or when it is being dumped onto a truck, or at any time when the maximum surface of the coal is available for contact with the spray.

A very great advantage from the use of my process is that after treatment of combustible material such as ordinary bituminous coal with the glycerine "foots", a substantially different product results and the coal has burning characteristics which the same coal untreated does not possess. The combustion is very much more complete than otherwise, with a given fuel, there is much less accumulation of soot and "fly-ash", and the flues do not require such frequent cleaning as when untreated fuel is used.

Although I have described my invention in detail to permit those skilled in the art to practice the same, it is obvious that I do not restrict myself to the details described, the invention being limited only by the scope of the appended claims.

This application is a continuation-in-part of my application, Serial No. 575,158, filed November 14, 1931.

What I claim as new and desire to protect by Letters Patent of the United States is:—

1. The method of reducing dustiness of coal, coke, or the like dusty material which comprises spraying such material with an aqueous solution of glycerine "foots".

2. A method of reducing the dustiness of coal, coke or similar material which is normally dusty or has a tendency to form dust in handling, comprising, preliminarily removing objectionable odors or substances having objectionable odor forming tendencies from glycerine "foots" by a steam distillation treatment, and intimately contacting the coal, coke or similar material with a relatively small amount of the treated "foots".

3. The method of reducing the dustiness of coal, coke, or the like dusty material, which comprises forming a solution of glycerine "foots", water and a freezing point depressant, and spraying the material with such solution.

4. A method of reducing the dustiness of coal, coke, or the like dusty material, which comprises mixing glycerine "foots" with a relatively small amount of strong alkali, forming a solution of the resulting mixture with water and spraying the dusty material with the solution.

5. A method of reducing the dustiness of coal, coke or similar material which is normally dusty or has a tendency to form dust in handling, comprising, intimately contacting said material with a relatively small proportion of an acid treated, steam distilled, and alkali treated glycerine "foots" product.

6. The method of reducing dustiness of coal, coke, or the like which comprises forming a solution of glycerine "foots" in water and spraying the dusty material with such solution while the coal is being separated to expose the maximum amount of surface thereof to the solution.

7. A fuel having a tendency normally to develop dust during the handling thereof, intimately admixed with a relatively small amount of glycerine "foots", whereby the tendency to form dust is effectively reduced.

8. A fuel having a tendency normally to develop dust during the handling thereof, intimately admixed with a relatively small amount of glycerine "foots" and a freezing point depressant, whereby the tendency to form dust is effectively reduced.

9. A dust preventive composition for the treatment of coal, coke or similar dusty or dust forming materials, comprising a solution of glycerine "foots" in water, the glycerine "foots" being present in proportion sufficient to effectively reduce the dustiness of said materials when applied thereto.

10. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising a solution of steam deodorized glycerine "foots" in water, the "foots" being present in proportion sufficient to effectively reduce the dustiness of said material when applied thereto.

11. A dust preventive composition for the treatment of coal, coke or similar dusty or dust forming materials, comprising a solution of glycerine "foots" in water and an added freezing point depressant.

12. A dust preventive composition for the treatment of coal, coke or similar dusty or dust forming material, comprising a mixture of glycerine "foots" and an added alkali.

13. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising a mixture of a substantial proportion of glycerine "foots" and a freezing point depressant, the freezing point depressant being present in an amount sufficient to produce a composition having a substantially solid form.

14. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising an acid treated, steam distilled and alkali treated glycerine "foots" product.

15. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising a mixture of steam deodorized glycerine "foots" and a freezing point depressant, said composition being in substantially dry form.

16. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising a mixture of glycerine "foots" and a calcium chloride—magnesium chloride product.

17. A dust preventive composition for the treatment of coal, coke and like dusty material, comprising a mixture of glycerine "foots" and a calcium chloride-magnesium chloride product, said composition being in substantially dry form.

18. A dust preventive composition for the treatment of coal, coke and like dusty material, said composition being in substantially dry form and containing the following ingredients in the following proportions:

	Parts
Calcium chloride-magnesium chloride	875 to 1025
Sodium chloride	525 to 775
Steam distilled glycerine "foots"	600 to 200

19. A method of treating glycerine "foots" to produce a dust preventive composition which comprises mixing a relatively strong acid with said "foots", subjecting the mixture to steam distillation, cooling it and admixing therewith caustic soda to produce a substantially homogeneous mass.

20. A method of treating glycerin "foots" to produce a dust preventive composition which comprises mixing a relatively strong acid with said "foots", subjecting the mixture to steam distillation, cooling it and admixing therewith an alkaline material to produce a substantially homogeneous mass.

21. A method of treating glycerin "foots" to produce a dust preventive composition which comprises admixing approximately 900 gallons of "foots" having a moisture content of between about 15% and 20% with approximately 46 gallons of 60° Baumé sulphuric acid and 150 gallons of water, injecting live steam at a gauge pressure of about 85 pounds into the mixture for several hours whereby it is subjected to steam distillation, cooling the residue, adding about 450 pounds of caustic soda, and stirring the mass until it becomes substantially homogeneous.

BENJAMIN R. HARRIS.