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TREATMENT FOR IMPROVING
BITUMINOUS COAL

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This invention relates to a treatment of coal which has for one of its principal objects the prevention of the accumulation of soot in the fire box and flues or stack of the burner.

More specifically, by reason of the fume or vapor, the material used in the treatment, causes a burning and combustion of deposits therefrom such as the soot; and further, the soot formations resulting from the burning of my treated coal ignite at lower temperatures than soot from like untreated coal.

This invention particularly relates to a treatment of bituminous coal, and it is an object of the invention to effectively so treat bituminous coal that the accumulation of soot shall be very little. By comparison it is as little or less than that resulting from semi-bituminous coal such as "Pocahontas" coal.

A further specific object of the invention is to cause a material change in the temperature at which the soot ignites, so lowering it as to cause its burning at low temperatures.

A further specific object of the invention is to cause the soot-preventing chemicals to adhere to the coal by a material which shall be substantially water-proof, thus resisting weather, and which shall be non-corrosive in its nature thus avoiding corrosion of the railway cars or bins in which it may be mixed or stored.

A more specific object is to so treat the coal that the final product shall be substantially dustless.

A resulting advantage from the use of my treatment is that of reducing the fire hazard by preventing large accumulation of soot due to the fact that the soot ignites at temperatures several hundred degrees lower than those usually required to ignite the soot from bituminous coal.

In extensive tests and experiments over a considerable period of time, it had been found that common salt heretofore attempted to be used to reduce soot deposits, could not be retained upon the coal by the use of common waterglass for the reason that the salt caused decomposition and a sediment formed in the solution before it could be applied.

The commonly known treatment of coal by the use of zinc to prevent formation and reduce soot or to cause an ignition of the soot previously deposited, was not of itself sufficient to accomplish substantial results.

The effectiveness of common salt and zinc, however, if they could be retained upon the coal by a moisture or waterproof binder, became apparent. Many of my experiments demonstrated

that by using certain sodium silicates in which the alkali content was great in proportion to the silica, namely the ratio of Na_2O to SiO_2 was very high, salt could be retained in certain proportion, but, the resulting residue on the coal after the water evaporated was not waterproof, however, if common waterglass is used therewith the mixture will effectively retain the salt in solution and render the coal waterproof and dustless.

Numerous tests resulted in the discovery that about sixty percent of the sodium silicate should be common waterglass, and forty percent should be that of high alkali content. In the chemical trade, common water glass denotes a material of about 40° Baumé and has a proportion of sodium oxide to silica of a ratio of approximately one to three, respectively. The high alkaline water glass denotes a proportion of sodium oxide to silicon dioxide of a ratio of approximately one to two, respectively, which produces the material averaging a density of about 59.1° Baumé.

This mixture retained the common salt and at the same time rendered the product substantially waterproof, thus avoiding the removal of the effective chemicals, as for example when exposed to rain. If larger quantities of the high alkali content silicate are used there is still less danger of precipitation, but the material more readily washes off from the coal.

Such a material applied to the coal results in lowering the ignition temperature of the soot from bituminous coal from say around 1200° F. to about 1000° F. For example, the application of such mixture as 14 fluid ounces of waterglass and 8½ fluid ounces of high alkali sodium silicate to one gallon of water with 1½ pounds of salt, and 8 ounces zinc dust, mixed and used in sufficient quantities that when sprayed upon about one ton of coal it will cover the same, results in effectively clearing the fire box and pipes of various types of furnace and stove burners.

I have found that a further addition, namely of black copper oxide (CuO) in proper quantities increases the efficiency as a soot preventive. However, if too much was used, a dense soot was caused which did not readily burn. If too little was used, a higher temperature was required to ignite or burn the soot out of the pipes. The addition of about one-quarter pound of black copper oxide to each ton of treated coal was found to be most efficient.

I prefer to first mix with each gallon of water 14 fluid ounces of waterglass, 8½ fluid ounces sodium silicate having a very high alkali content. I then add in proportion to each gallon of water,

1½ pounds of salt, 2 ounces black copper oxide and 4 ounces of zinc dust. I find that to thoroughly cover the coal about 2 gallons of this mixture or somewhat less, is sufficient.

5 A further result found from actual use of my treated coal, that is, actual burning of the coal, is that of the ignition temperature of the soot was lowered materially, and the residue remaining in the pipes after the ignition of the soot consisted
10 largely of fine coal ash containing a small quantity of sodium chloride and copper and zinc oxides, with only a negligible quantity of combustible matter, i. e. soot. This residue occurring in the pipes aids the almost completed removal of
15 soot when the burning takes place, and in fact it appears to have an insulating effect upon the pipes. The quantity of residue does not increase after a given time, there being a sort of equilibrium established at the time when the soot blows
20 away at about the same rate it is deposited.

So effective is the material of my treatment that soot formed in large quantities by the burning of very poor bituminous coal, yard scrapings, and so forth, in a heating plant, was effectively
25 if not entirely burned away by the use of but a few pounds of coal treated with my formula. This was by temperatures no greater than a moderate fire. Thereafter the burning of coal so treated results in the deposits being minimized
30 and such soot deposit as does occur is subject to burning ignition at around 800° F.

This latter point is of importance in that by the burning out of flues at such low temperatures and of such small quantities of soot, the fire
35 hazard is greatly reduced, or largely eliminated.

As to the corrosive effect of the compound used on the coal, I have found that not only does this not aid corrosion but evidently has a property of
40 functioning as a rust-preventive. The corrosive action of the sodium chloride or common salt is apparently off-set and counter-acted by the protecting film action of the sodium silicate.

The use of my treatment makes possible the control of smoke, particularly because of the clear
45 flues whereby the air may be more definitely controlled.

Coal treated by my process may be burned in heaters not designed for bituminous coal or coal of high content of volatile matter. In ordinary
50 home furnaces and stoves there is no provision for the effective combustion of volatile gases, thus attempts to use soft coal, or coke, in a furnace in a house or in household heaters results in excessive soot and smoke. By my invention the
55 soot nuisance and difficulty is eliminated and one is thereby enabled to regulate the quantity of air to the heater which enables the burning of the volatile gases instead of allowing them to form soot and smoke.

For example, if the content of the flue gases is maintained so that 15 percent of carbon dioxide (CO₂) is present, even with clean flues considerable smoke is evolved, but if enough air is admitted to the fire to reduce the content of carbon
5 dioxide to 10 percent, no more smoke may be observed than when using semi-bituminous coals such as Pocahontas, particularly if burned under the same conditions. Thus the ordinary householder is enabled to not only eliminate soot and
10 reduce smoke, but he is permitted the use of very much cheaper bituminous coal for heating in place of the expensive semi-bituminous (Pocahontas) or like coals.

By this invention the ordinary householder is
15 also enabled to use clean, dustless, moisture-proof coal, having the foregoing advantages.

Having thus described my invention, what I claim is:

1. A process of treating ordinary coal comprising
20 mixing with 1 gallon of water, 14 fluid ounces of sodium silicate having a ratio of sodium oxide to silicon dioxide of about one to three, respectively, 8½ ounces of sodium silicate having a ratio of sodium oxide to silicon dioxide of about
25 one to two, respectively, 1½ pounds of salt, and applying the same evenly to the mass of coal to form a thin coating thereon.

2. A process of treating ordinary coal comprising
30 mixing 28 fluid ounces of sodium silicate having a ratio of sodium oxide to silicon dioxide of about one to three, respectively, 17 ounces of sodium silicate having a ratio of sodium oxide to silicon dioxide of about one to two, respectively,
35 3 pounds salt, and one-quarter pound copper oxide and sufficient water to permit applying the same evenly to approximately a ton of coal.

3. A coating for coal, adapted to prevent a formation of soot as a result of combustion and to render the coal substantially dustless, comprising
40 salt and a plurality of sodium silicates, one having a very high alkali content, the other being common waterglass, the quantity being of substantially the same or of less weight than the combined silicates.
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4. A coating for coal consisting of salt, black copper oxide, waterglass which is ordinary sodium silicate, and sodium silicate having a high
50 alkali content, the latter being approximately two-fifths of the amount of the waterglass.

5. A coat adapted for use on a bituminous coal and consisting of the following ingredients and amounts for each ton thereof; three pounds of salt, one-quarter pound black copper oxide, one-half pound zinc, twenty-eight ounces of common
55 water glass, and about seventeen ounces of sodium silicate having a high alkali content.

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