

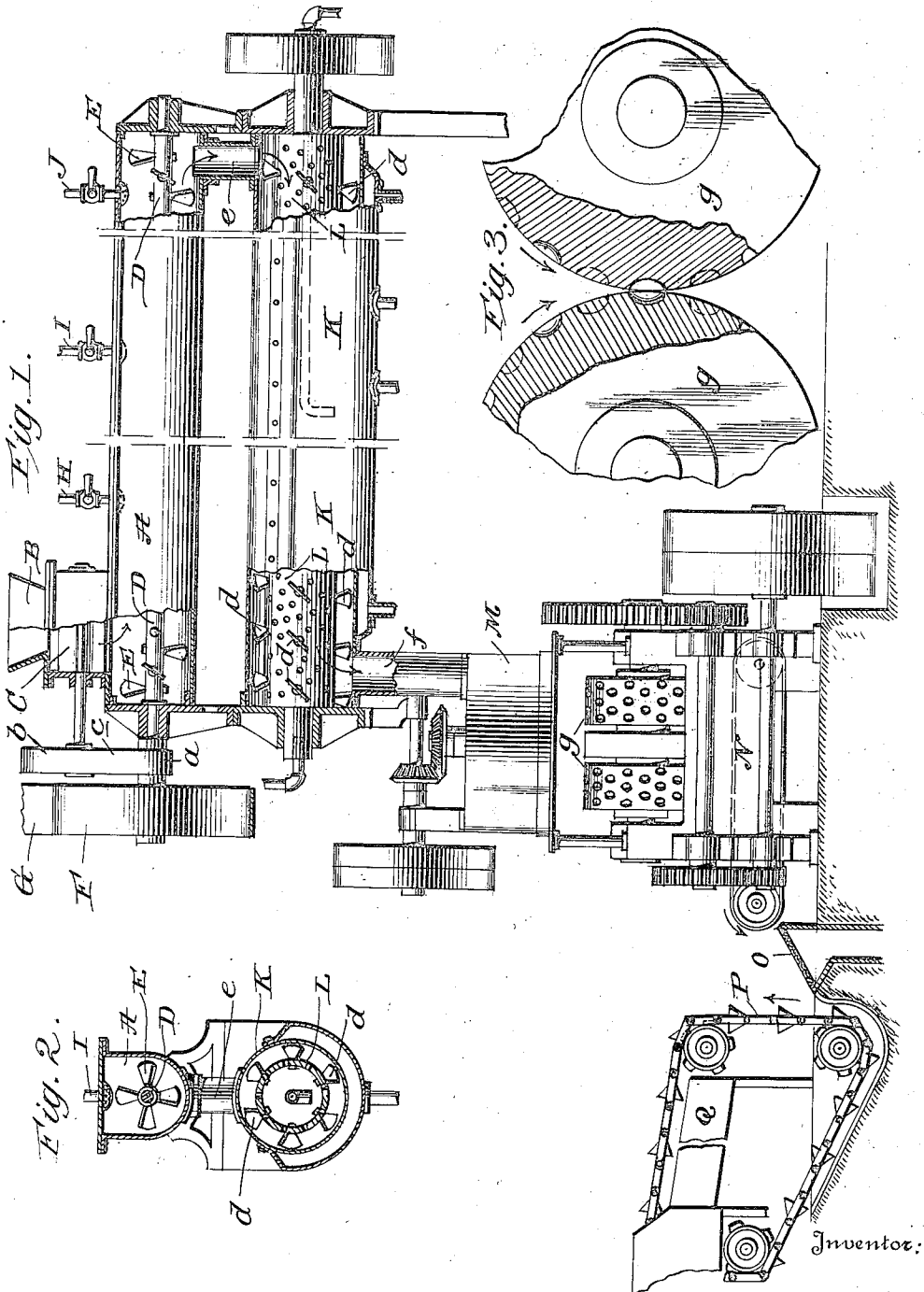
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BRIQUETTE AND PROCESS OF MAKING SAME

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BRIQUETTE AND PROCESS OF MAKING SAME.

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To all whom it may concern:

Be it known that I, GERARD ANTHONY SCHADE VAN WESTRUM, a subject of the Queen of the Netherlands, residing at 17 West 42nd Street, New York, N. Y., have invented certain new and useful Improvements in Briquettes and Processes of Making Same, of which the following is a specification.

This invention pertains to the manufacture of briquettes, blocks and the like and consists in a method or process in which the coal or other material and the coating and binding agent or composition are kept at all times at a relatively low temperature, never greatly exceeding the melting or fusion point of the binder.

Briefly stated, the process, in its preferred form, consists in reducing coal, lignite, or other combustible substance of suitable character, to a granular condition; thoroughly coating each separate particle with a binder applied in the form of an emulsion and at a relatively low temperature, with or without a preliminary coating of sulphite of cellulose, or analogous solution; removing the water of the emulsion wholly or substantially; and subjecting the coated particles to pressure sufficient to produce firm and compact bodies of suitable form and dimensions, adapted for use as fuel. The preliminary coating is deemed desirable in some instances, but it is not essential, and larger or smaller particles may be used, according to the size of the briquette, block or body to be made.

By this process I am enabled to produce briquettes retaining in their finished form all the volatile and combustible elements or heat-producing properties of their components: water-proof in their finished and complete form or even when chipped or broken; and capable of withstanding the effects of rough handling and changing atmospheric conditions. The preliminary coating with sulphite of cellulose, starch solution, or the like serves to prevent the formation of balls during the mixing process, and later, facilitates coking.

By employing a binder in the form of an emulsion, I am enabled thoroughly to coat each separate particle or granule of coal, lignite, or like body, with a thin layer of the binder, sufficient to seal the same against moisture, and so to prevent or lessen escape of the more volatile matters, and to preclude

cementation during such coating operation; the subsequent elimination of the water from the emulsion restoring the property of cementation. This thin, tenacious and somewhat elastic asphaltic coating is not liable to crack or chip off, as is a thick and brittle binder coating such as pitch or the like in commercial condition, and hence the integrity of the water-proof coating is preserved under all ordinary conditions of storage, transportation, and use. Moreover, with such limited quantity of asphaltic binder present in the briquettes, and by reason of its combustible character, its coking capacity, and its relatively high percentage of heat units, it not only binds or holds the particles together until all are consumed, but it also aids the combustion of the particles of coal, lignite, or like substances. The production of smoke or free carbon is reduced to a minimum, because of the small quantity of binder required.

In the employment of binders requiring fusion as a condition precedent to their use or application, it is necessary ordinarily, first to heat nearly to the fusion point of the binder, the granules or bodies which are to receive the coating, in order to remove moisture, and bring the particles to approximately the temperature of the binder. Otherwise the binder will adhere only feebly to the surfaces to be coated. The emulsion which I use takes up any surface moisture that may be present, and spreads over and adheres to the surface of the particles, the added moisture being insufficient to dilute the emulsion materially or to any injurious extent. With an emulsion which remains fluid at temperatures above the freezing point, there is no necessity for heating it at the time of use, and hence no necessity for heating the granules or pulverulent matter composing the bulk of the briquette. It is, however, important that such body material be above the freezing point so that the binder may not be chilled by coming into contact with a materially colder body, and thus prevented from making the close contact and adhesion that would otherwise result.

The emulsion which I use and the employment of which constitutes a distinguishing feature of my invention, is composed of asphaltum, with or without a moderate percentage of tar, pitch, or the like, and of fatty oil, rosin, and soda, potash, or ammonia, or

ny of them. The formula for the emulsion is variable within reasonable limits, and in fact should be varied somewhat according to the nature, quality or properties of the coal, lignite, or other substance or substances forming the body material of the briquettes. The emulsion which has thus far afforded the most satisfactory results with anthracite and bituminous coal, and with lignite, consists of approximately the following ingredients or components in about the proportions stated, to wit:

Asphaltum, about 50 parts; water, about 10 parts; fatty oil, 2 to 4 parts; rosin, 2 to 3 parts; soda, or potash, or ammonia, 2 to 3 parts, any one or more of these ingredients being increased or diminished in quantity as conditions require or suggest.

An emulsion of the character described possesses little or no cementing properties, though capable of spreading readily over surfaces, and adhering to or coating the same with a thin film. Such emulsion has the further property of acting as a lubricant, enabling the minute particles or granules of coal, lignite, or other body material, to be moved freely among themselves, and thus to insure the coating of every face of all the particles. This in turn insures a thorough water-proofing, preventing the access of moisture to the particles, and serving later as a means of cementing the particles firmly together, the coating or binder being caused under heavy pressure to fill the small voids or interstices between such particles of coal or the like.

After all the particles are thoroughly coated or covered with a film of the emulsion it is converted or restored to its original condition as asphalt, with the other ingredients named, if such be used, united with and distributed through the asphaltum, whereupon cementation takes place, and escape of volatile matters is prevented. Such reconversion is accomplished preferably through the aid of a chemical or chemicals, either a soluble metal salt, such as sulphate of iron, sulphate of aluminum or chloride of zinc, or a decomposing acid, as muriatic acid, which will cause the water to separate out of the emulsion. In the case of a seaponaceous emulsion the conversion may be perfectly performed by volatilizing the ammonia through the aid of heat.

Removal of the water restores the cementing properties of the binder, and the powdered or granular material being so coated is next subjected to pressure sufficient to bring the particles into intimate or immediate contact throughout their faces.

The process may be carried out without the aid of special machinery or apparatus, though for economy and in order to manufacture briquettes of uniform size, shape and compactness on a large and commercial

scale, it will be found advisable to use mechanical appliances such as grinders, graders, mixers, conveyors, presses, and driers, or such of these as may be needed. These, however, may be of well known and common form, operating in their usual manner.

A form of apparatus suitable to the purpose is illustrated in the drawings, in which:

Figure 1 is a side elevation of apparatus designed to receive and coat the finely divided coal, lignite, or other material or materials to be formed into briquettes with the aid of the binder; showing also a common type of briquetting press arranged to receive the prepared material and mold it into form, and a conveyor adapted to receive the briquettes from the press, to expose them to suitable drying devices or media, and to deliver them to suitable receptacles or to other conveyors by which they are finally carried to such receptacles.

Figure 2 is a cross section of the chambers A and K, showing the provision for heating the latter;

Figure 3 is a fragmentary view of the press for molding the briquettes.

In the commercial handling of coal and like substances on a large scale, considerable quantities of fine granular or pulverulent matter are produced through impact and attrition, and also, in the case of softer coals, through slaking. Such fine material accumulates in considerable quantities in storage bins or piles, in cars and other transporting vehicles, and at those places where coal and the like are transferred from storage receptacles to vehicles, or vice versa. Large quantities are also found at and about coal mines. Where a supply of sufficiently fine material exists, special crushing or reducing apparatus may be dispensed with, but where the coal is in lumps of large size it should be reduced to smaller dimensions. I do not, however, restrict myself to any particular size, as relatively large particles or lumps may be used where blocks of considerable size are to be produced. It is advantageous to employ particles of varying size, since by reason of the smaller particles working into the spaces between larger ones, voids are prevented or filled, and a firm and compact briquette or block results.

If the process be carried out without the aid of special machinery, a measured quantity of the fine coal, lignite, or the like, and of paper stock liquor, starch solution, or the like, if these are to be employed, may be placed in a suitable receptacle or in a mixing bed, and thoroughly mixed with the aid of a hoe or like implement, until the particles receive their preliminary coating. A measured quantity of the asphaltic emulsion is next supplied, and similarly worked into the mass, so as to give a second coating. These liquid preparations should represent

but a very small percentage of the entire bulk. In the finished product the asphalt ordinarily will not exceed from 2 to 5% of the mass.

5 When the particles are thoroughly coated, the asphalt may be restored to its original state as above described.

Of course, if the first coating be not employed the asphaltic emulsion is added to 10 the coal or fuel particles at the outset.

When the mass assumes a somewhat mealy state, but while some slight moisture still remains, the material may be molded into briquettes or blocks of suitable size and 15 form. This may be done by simply pressing the prepared material between the hands, though, of course, better results are attainable by the use of suitable molding machinery.

20 Referring again to the drawings, A indicates a chamber or receptacle having a semi-circular bottom, and provided at or near one end with a hopper B containing a rotary feed device or distributor C, such as a bucket-wheel, or cylinder, adapted to receive from 25 the hopper and deliver into the chamber A measured quantities of the powdered or granular coal, lignite, or other body material of which the briquettes are to be made. Extending longitudinally through the cyl- 30 inder is an axial shaft D, provided with oblique blades or wings E, or other suitable agitating and conveying means adapted to keep the material in a state of agitation, and gradually traverse the same longitudinally 35 through the cylinder. This shaft D is provided with a belt-wheel F, to which motion may be imparted by a belt G or other means of power transmission from a suitable prime 40 motor. A second pulley *a* carried by the shaft D imparts motion to a pulley *b* on the shaft of the distributor C through the medium of a belt *c* or equivalent means, thus causing the distributor to deliver material 45 at a uniform rate.

At a suitable point in the length of the chamber A and near the distributor C, is located an inlet pipe H for the introduction of sulphite of cellulose, sulphite solution, 50 starchy solution, or the like, if such preliminary coating preparation is to be employed. This may be provided with a rose or spray nozzle, better to distribute the liquid over the powdered coal, etc., within 55 the chamber A. I indicates an inlet pipe for the asphaltic emulsion, and J indicates a third inlet pipe for the introduction of sulphate of iron or other agent serving to effect a separation of the water from the asphalt emulsion. Each of these pipes may 60 be provided with a cock or valve by which to control the rate of inflow, and to proportion the supply of each preparation to the contents of the chamber A and to the speed 65 of rotation of shaft D and distributor C.

Chamber A is placed directly above and may conveniently be supported by a second chamber or hollow cylinder K having an axial shaft L, preferably of tubular form, and carrying oblique blades *d* suitable for 70 thoroughly working or mixing the mass, and gradually moving it lengthwise of the cylinder, but in a direction opposite to its travel through the chamber A. Communication between the chamber A and cylinder K is 75 afforded by a suitable connecting pipe or passage *e* near the end opposite that at which the hopper B is located.

The cylinder K is preferably steam jacketed, and the tubular shaft L is advisably 80 perforated, both the jacket and the shaft being supplied with steam when necessary from any suitable boiler or generator by appropriate piping or connections. The purpose of thus heating the cylinder K both 85 internally and externally is to drive off the bulk of the water or moisture from the mass of material traversing the cylinder K, and thus to bring the mass to a proper condition for molding. The cylinder K is supported 90 by a suitable framework, and in turn supports the chamber A. Said cylinder is provided at the end opposite that at which its supply opening *e* is located, with a discharge opening and spout *f*, which may deliver the 95 prepared material to any suitable container or receptacle, storage bin, or the like, or preferably, to the feed hopper M of a molding press N, here represented as comprising four peripherally-pocketed rolls *g*, arranged 100 in pairs, those of each pair running in peripheral contact, so that the material falling into the bite of the rolls is received in the pockets formed by mating recesses of the two rolls. Suitable scrapers carried by a 105 vertical shaft concentric with the hopper M and geared or driven, serve to agitate and loosen up the material in said hopper, and to discharge it in constant streams through 110 openings in the bottom of the hopper.

The apparatus so described, including the molding press, is all of usual type and construction, and is merely illustrative.

The briquettes formed in the pockets of the molding rolls are discharged therefrom 115 after passing below the horizontal plane of the axes of said rolls, and fall upon an inclined vibrating screen O by which they are directed to the boot of an endless chain elevator P. The vibrating screen O serves 120 to deliver into a dust bin beneath it the small particles, dust, etc., resulting from the thin film or web which is produced by the squeezing out of the material, and more particularly the binder, between the rolls and 125 around the pockets thereof, it being impracticable to maintain the rolls in such perfect contact as to preclude the formation of this web or connecting film. The chain elevator P carries the briquettes upward and trav- 130

erses them over a heater Q, which dries off the moisture brought to their surfaces by the heavy pressure to which they are subjected in the molding operation, such limited
 5 percentage of moisture being intentionally left in the prepared mass to facilitate the movement and rearrangement of the particles while in the mold, and to prevent adherence of the briquettes to the molds. Any
 10 equivalent means of drying the briquettes may be employed, such, for instance, as fans forcing currents of air over and into contact with the briquettes. No claim is herein made to the apparatus per se.

15 As has been indicated, the leading or prominent feature of my invention resides in the use of a binder applied in the form of an asphaltic emulsion capable of being subsequently freed of its water component
 20 and restored to substantially its original asphaltic condition, in which condition it possesses high power of cementation, and also serves as an efficient protection against the entrance of moisture or the escape of
 25 volatile elements of the coal, lignite, or like substance.

The most perfect results are attainable through the use of a pure asphaltic emulsion, that is to say, one having no pitch, tar,
 30 or like substance, added to or combined with the asphalt. Owing, however, to their greater cheapness, and to the relatively slight impairment of the emulsion through use of a limited percentage of such pitch, tar, or the
 35 like, it will be found expedient in many cases to employ the same.

In the foregoing description reference is made to sulphide of cellulose or analogous solution. In the manufacture of wood pulp
 40 or paper stock, use is sometimes made of one and sometimes of another soda preparation, and the waste liquor is commonly called by different names accordingly as pulp liquor, sulphite of cellulose, paper
 45 stock liquor, etc. the term "paper stock liquor" used in the claims is intended to cover such liquors generally and it and the phrase "sulphite of cellulose or analogous solution" are both to be read with this understanding.
 50

I am aware that it has been proposed to grind coal-tar pitch, water-gas pitch, or similar bitumen-bearing cementitious solid,
 55 in water or other liquid in which it is not soluble, to produce a fluent mixture; to incorporate this cementitious mixture with coal or other body material; and subsequently to convert the mass into briquettes by heating it sufficiently to evaporate and
 60 drive off the liquid and to melt the particles of pitch, and finally subjecting the mixture so produced to pressure in molds of suitable form and size. I am not aware, however, that any one has in fact succeeded in making
 65 a stable fluent mixture by merely grinding

pitch or like bituminous substance in water, or in coating the surfaces of particles of fuel with a thin closely adhering film of such mixture, or in removing the water content
 70 at a temperature below that at which volatilization of elements of the pitch would occur. Nor am I aware that any one has heretofore succeeded in producing at a temperature below that of such volatilization,
 75 a briquette or like solid and compact body, each and every particle of which is individually coated with a waterproof cementing body serving under pressure, to bind and hold firmly together, and to protect against
 80 moisture, even in case of fracture or abrasion, the briquette and its separate portions and particles.

By my method of procedure, which involves the use of a true emulsion (that is, a liquid preparation in which there is a minute
 85 division of one fluid in another as contrasted with a mere suspension or floating of a powdered solid in a liquid), I am enabled completely and perfectly to apply to and leave upon the entire superficial area
 90 of each individual particle of coal, lignite, or like combustible material employed in the manufacture of the briquette, a thin, strongly adhering film or coating which, on
 95 elimination of the water serves as a waterproof coating and as a strong cementing medium, whereby the particles are tenaciously held one to another and protected against
 100 disintegration under varying atmospheric conditions, or in consequence of considerable pressure, impact or attrition.

I am further aware that it has been proposed to produce fuel compositions in the form of briquettes and the like, by mixing
 105 together pulverized coal or other carbonaceous material, and asphaltum or pitch, or both: submitting a mixture to a temperature of 400° F. until liquified, and then injecting heated grease or low grade products of mineral oils into the mass, with a
 110 view to causing the asphaltum to flux and combine with the carbonaceous material preparatory to compression into blocks or briquettes.

Neither of these proposed plans is claimed
 115 by me, nor will either produce a briquette having the properties of those here described and claimed. Volatilization of elements present and retained in the briquettes produced by my process, would result from
 120 the use of a temperature far below 400° F., and the presence of grease or products of the paraffin group, would result in the formation of dense smoke when the briquettes were burned. I am unaware that briquettes
 125 have ever been commercially or successfully produced by either of the processes referred to, whereas highly satisfactory briquettes have been manufactured by my process, and
 130 sold in carload quantities.

Having thus described my invention, what I claim is:

1. The herein-described process of producing combustible briquettes, which consists in the following steps performed in the order stated: first, coating small particles of combustible material with a solution such as paper stock liquor to facilitate coking; second, coating the particles so treated with an asphaltic emulsion; third, adding a dehydrating agent as sulphate of iron, to effect a separation of the water out of the emulsion; and fourth, subjecting the coated particles to pressure.

2. The herein-described process of producing briquettes, which consists in first coating particles of finely divided combustible material with an agent such as paper stock liquor to facilitate coking; second, coating said particles with an asphaltic emulsion; third, separating the bulk of the water contents from said asphaltic emulsion; and fourth, compressing the coated particles into compact bodies of the required form and dimensions.

3. The herein-described process of producing briquettes, which consists in first coating particles of finely divided combustible material with a solution such as paper stock liquor to facilitate coking; second, coating said particles with an asphaltic emulsion; third, separating the bulk of the water contents from said asphaltic emulsion; fourth, compressing the coated particles into compact bodies of the required form and dimensions; and finally removing the surface moisture from said bodies.

4. The herein-described process of producing briquettes, which consists in coating the individual particles of the body-forming material with an asphaltic emulsion; eliminating the water from the emulsion; and compressing the coated particles into briquettes of the required form and dimensions.

5. In the manufacture of briquettes, the steps, which consist in coating finely divided particles of combustible matter with asphalt applied in the form of an emulsion, and thereafter adding a dehydrating agent as sulphate of iron, whereby the bulk of the water is caused to separate out of the emulsion, leaving the particles coated with asphalt.

6. A process of producing briquettes, which comprises as a step in the operation, a

complete and individual coating of the finely divided particles of combustible material with an asphaltic emulsion.

7. A process of producing briquettes, which comprises as a step in the operation, a complete and individual coating of the finely divided particles of combustible material with a saponaceous asphaltic emulsion.

8. The steps in the process of producing briquettes, which consist in individually coating the finely divided particles of body-forming material with an asphaltic emulsion, and subsequently eliminating the water of such emulsion, whereby there is deposited upon each particle a thin and tenacious coating of asphalt.

9. As a new article of manufacture, a briquette produced at a temperature below that of volatilization of any of its ingredients, and comprising finely divided particles of combustible material each having a thin asphaltic coating of the character set forth, said particles being compressed into close cementing contact.

10. A briquette produced at a temperature below that of volatilization of any of its ingredients, and comprising a mass of small particles of combustible material individually coated with and cemented together by a preparation such as described, consisting chiefly of asphalt.

11. A briquette produced at a temperature below that of volatilization of any of its ingredients, and comprising a mass of small particles of combustible material individually coated with a preparation such as described, consisting chiefly of asphalt, said briquette having its particles pressed into close contact and the voids or interstices filled by the asphaltic preparation.

12. As a new article of manufacture, a briquette produced at a temperature below that of volatilization of any of its ingredients, and comprising finely divided particles of combustible material each having a thin asphaltic coating of the character set forth, said particles being compressed into close cementing contact, the asphaltic contents not exceeding five per cent by weight of the briquette.

In testimony whereof I have signed my name to this specification.

GERARD ANTHONY SCHADE van WESTRUM.