

# UNITED STATES PATENT OFFICE.

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## ARTIFICIAL FUEL.

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*To all whom it may concern:*

Be it known that I, WILLIAM A. KÖNEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Artificial Fuel, of which the following is a specification.

My object is to provide as a new article of manufacture an improved artificial briquet which shall possess calorific qualities of an exceptionally high order, yielding substantially complete combustion without waste of any of its carbonaceous ingredients and be capable of withstanding disintegration in ordinary handling or from exposure to the elements.

My improved fuel-briquet comprises, generally stated, a mixture consisting of pulverulent non-coking coal, such as anthracite, graphitic carbon, certain lignites, &c., and a more or less finely-divided coking-coal in desired proportions, together with an insoluble agglutinant which will serve to hold the briquetted material against disintegration in handling or from the effects of the atmosphere or of moisture and which when the briquet is fed into a furnace will hold the particles of coal together until the non-coking coal portion becomes entangled and held by the coke formed from the coking-coal during initial combustion.

In the production of my improved briquets I take advantage of the fact that the oxidation of a mineral substance may be most quickly and readily effected when the same is subjected in a finely-pulverized condition to an incandescing temperature in the presence of oxygen. To this end I subject the non-coking-coal ingredient of my improved briquet to artificial pulverization because ordinary non-coking coal-culm—such as screen-dust, slack, and refuse anthracite—is too coarse for economical use in my briquets. The coking-coal, as I provide it, may be somewhat coarser than the non-coking coal, though it should be sufficiently fine to effect properly intimate intermixture. In the preparation of the coals for the briquets I provide

them of a degree of fineness and in the relative proportions which will produce the quality of fuel desired.

One of the important features of my invention lies in the fact that thereby a fuel of any desired quality and for any desired purpose may be readily produced and objectionable features alleviated. For example, ordinary anthracite waste or screenings contains fifteen per cent. or more of incombustible material or ash. If such anthracite is suitably pulverized and mixed in the proportion of two-thirds thereof to one-third coking-coal yielding six per cent. of ash, a fuel is obtained yielding but twelve per cent. of ash. The per cent. of ash may be still further reduced by employing a somewhat-better grade of anthracite screenings in the mixture. If it is desired to obtain a fuel which in burning shall be absolutely smokeless and give but little flame, a mixture consisting of eighty per cent. anthracite waste and twenty per cent. strong coking gas-coal meets the requirements and affords a highly-desirable fuel for self-feeding stoves. A smokeless fuel having very high calorific power and giving a long flame may be produced by mixing sixty per cent. of anthracite with forty per cent. of coking-coal of good grade, resulting in a smokeless fuel highly desirable for marine use and also for use in grates, as it gives off a flame similar to that of burning wood. For ordinary commercial steam use a first-class fuel may be produced with a mixture consisting of two-thirds anthracite and one-third coking-coal possessing thirty-five to forty per cent. of volatile ingredients. It will suffice to state that in the preparation of the coal ingredients to produce the best results they are fed in the predetermined proportions to a suitable pulverizer and there ground and intimately mixed until the whole mass will pass through a screen of a fineness which will insure perfect combustion of the most refractory combustible ingredients thereof. The binding agent or agglutinant which I prefer to employ is what has been termed "bone-soup," an extract prepared



from animal bones mixed with butcher-shop and slaughter-house refuse, carcasses of animals generally; also, the bones, entrails, &c., of fowls. In preparing the extract for my purpose I prefer to reduce the bones to small pieces and subject them with the other refuse material in a suitable vessel to the action of steam under preferably about forty pounds pressure for a suitable length of time, usually about six hours. In the treatment of the bones, &c., as described large percentages of gelatin and chondrin, as well as meat fiber, refuse, and grease, are produced, all of which have commercial value, and a filter-press may be employed to separate therefrom the crude bone-liquor extract or bone-soup. The bone-soup consists of about two-thirds glutin and one-third chondrin, to which water may be added before use to make a ten to fifteen per cent. solution. The diluted extract is thoroughly stirred into the coals mixture to become closely associated therewith. The agglutinating material should be rendered insoluble, and for that purpose I prefer for reasons of economy to subject it to the action of chlorine-gas generated within the moistened coals mixture, to which is added a suitable sulfate-of-iron solution. As a still further aid to combustion, particularly when a large percentage of graphitic carbon is used, a small amount—say one-half to one and one-half per cent.—of potassium nitrate or other oxygen-yielding salt may be added to the mixture.

In regulating the proportions of anthracite or non-coking coal and bituminous coking-coal it is necessary for the best results to provide the latter in relative proportion at least sufficient to operate when coked as a means for holding by agglomeration the non-coking particles. Taking this proportion of coking-coal as the minimum, more may be employed, if desired. Sufficient—say from ten to twelve and one-half per cent.—of the ten to fifteen per cent. solution of agglutinating liquor is mixed with the coal after pulverization, as described, to render the mass sufficiently coherent for ready molding into briquets, the same being formed under pressure in any desired manner and dried. When the briquet is burned, the agglutinating material operates to hold the coal particles together, while during the initial combustion of the particles of coking-coal the coking-coal particles are forming into coke and until they entangle themselves with the particles of anthracite or other non-coking coal employed. The agglutinating material described burns without appreciable smoke, and in the conversion of the coking-coal into coke the hydrocarbons initially eliminated, owing to the fine state of division of the coal and the small percentage of volatile hydrocarbons set free from the mass of briqueted material, are so completely consumed that under proper conditions no appreciable smoke is generated. When the briquet

is ignited, immediate combustion and consequent destruction of the agglutinant takes place, and were it not for the presence of the agglomerating coking-coal the briquet would disintegrate and the component powder would soon choke the fire; but as the coking action of the coking-coal commences at once and continues during the entire time that the volatile constituents are discharged the coke so formed entangles the fine particles of anthracite or the like and holds them in a way to insure rapid and perfect combustion. Experiments carried on in the burning of my improved briquets formed with seventy-five per cent. anthracite have resulted in such perfect combustion that no unconsumed carbonaceous material was present in the ash. The same effect may be produced with my improved briquet formed with graphitic and other non-coking coals when suitably pulverized and when sufficient coking-coal is mixed therewith in the briquet.

My invention makes it possible to utilize in the production of highly-desirable artificial fuel carbonaceous material which has hitherto, either on account of its physical condition or inherent properties, or both, been generally regarded as an undesirable fuel, and therefore of little commercial value. Immense beds of graphitic coal and large quantities of low-grade anthracite-coal screenings, which are incapable of use as fuel in their existing condition, may be rendered valuable by my improvement. By pulverizing such anthracite or graphitic carbon to a sufficiently-fine mesh and mixing it with a suitable proportion of bituminous coal and a suitable agglutinating material, such as described, a most desirable and economical fuel-briquet is readily provided.

It will be understood from the foregoing description that my invention consists, broadly, in the method of manufacturing an artificial-fuel briquet, as above described, and also in the article of manufacture consisting of anthracite or other non-coking coal ground to a fine powder and more or less finely divided coking-coal, mixed together in suitable proportions with an insoluble and combustible agglutinant which will operate when the briquet is ignited to hold the particles of coal together during the coking of the bituminous coal, so that the latter will operate to hold the anthracite particles until both are consumed, leaving no unconsumed carbon in the ash. The insoluble agglutinant above described is the one I prefer to employ, because it is eminently satisfactory and is the least expensive of any insoluble smokeless agglutinating material of which I am aware. In fact, in the production of the bone-soup, as described, the by-products have a commercial value which more than covers the entire cost of agglutinating material and labor. In the present connection, however, I do not wish to limit my invention in its broadest sense to



the use of any particular agglutinating material, though coal-tar, pitch, and other volatile heavy hydrocarbons are objectionable because they produce smoke. The insoluble  
 5 gluten and chondrin binding material above described will operate to maintain the briquet intact during ordinary handling. The briquet may be strengthened, if desired, by mixing with the pulverized mass fibrous material,  
 10 such as hemp. The hemp fiber may be obtained from waste rope, which is inexpensive. The incorporation of combustible fibrous material with the briquet material is very desirable where the briquets are to be capable  
 15 more especially of withstanding more than ordinary rough handling—as, for example, where they are to be shipped to foreign countries and handled repeatedly.

What I claim as new, and desire to secure  
 20 by Letters Patent, is—

1. The method of manufacturing an artificial-fuel briquet, which consists in reducing a non-coking coal to a pulverulent condition, reducing a coking-coal to a pulverulent, or  
 25 approximately pulverulent, condition, mixing the two together with an agglutinant and forming the mixture into briquets.

2. The method of manufacturing an artificial-fuel briquet, which consists in reducing  
 30 a non-coking coal to a pulverulent condition, reducing a coking-coal to a pulverulent, or approximately pulverulent condition, mixing the two together with agglutinating material, rendering the agglutinating ingredient in the  
 35 mixture insoluble, and forming the mixture into briquets.

3. The method of manufacturing an artificial-fuel briquet, which consists in pulverizing and mixing together in one operation non-  
 40 coking and coking-coals in suitable proportions, and adding to and mixing with the coal mass an agglutinating material, and forming the mixture into briquets.

4. The method of manufacturing an artificial-fuel briquet, which consists in reducing  
 45 a non-coking coal to a pulverulent condition, reducing a coking-coal to a pulverulent, or approximately pulverulent condition, mixing the two together, preparing an agglutinant  
 50 composed of gluten and chondrin, mixing the same with the pulverized-coal mixture, rendering the agglutinant insoluble, and forming the mixture into briquets.

5. As a new article of manufacture, an artificial-fuel briquet composed of pulverulent  
 55 non-coking coal and more or less finely-divided coking-coal intimately mixed together, and insoluble agglutinating material mechanically uniting the mixed particles of coal and  
 60 having the property of holding them together until entangled and held by the coke formed from the coking coal during initial combustion.

6. As a new article of manufacture, an artificial-fuel briquet composed of pulverulent  
 65 anthracite and more or less finely-divided

coking-coal intimately mixed together, and insoluble agglutinating material mechanically uniting the mixed particles of coal and  
 70 having the property of holding them together until entangled and held by the coke formed from the coking-coal during initial combustion.

7. As a new article of manufacture, an artificial-fuel briquet composed of pulverulent  
 75 anthracite and more or less finely-divided bituminous coking-coal intimately mixed together, and insoluble agglutinating material mechanically uniting the mixed particles of coal and having the property of holding them  
 80 together until entangled and held by the coke formed from the bituminous coal during initial combustion.

8. As a new article of manufacture, an artificial-fuel briquet composed of a mass of pulverulent non-coking coal mechanically pulverized to pass through a screen of twenty  
 85 mesh, or finer, and more or less finely-divided coking-coal in less proportion than the anthracite intimately mixed therewith, and insoluble agglutinating material mechanically  
 90 uniting the mixed particles of coal and having the property of holding them together until entangled and held by the coke formed from the coking-coal during initial combustion.

9. As a new article of manufacture, an artificial-fuel briquet composed of pulverulent non-coking coal and more or less finely-divided coking-coal intimately mixed together,  
 100 and an insoluble mixture of gluten and chondrin mechanically uniting the mixed particles of coal, whereby when the briquet is burned the non-coking particles are held by the coke formed from the coking particles  
 105 during initial combustion.

10. As a new article of manufacture, an artificial-fuel briquet composed of pulverulent non-coking coal, more or less finely-divided coking-coal, and combustible fibrous material,  
 110 all intimately mixed together, and insoluble agglutinating material mechanically uniting the mixed particles of coal and fiber and having the property of holding the coal particles together until the particles of non-  
 115 coking coal are entangled and held by the coke formed from the coking-coal during initial combustion.

11. As a new article of manufacture, an artificial-fuel briquet, composed of pulverulent  
 120 non-coking coal, more or less finely-divided coking-coal, and an oxygen-yielding salt intimately mixed together, and insoluble agglutinating material mechanically uniting the mixed particles of the mass and having  
 125 the property of holding the particles of coal together until the particles of non-coking coal are entangled and held by the coke formed from the coking-coal during initial combustion.

12. As a new article of manufacture, an artificial-fuel briquet, composed of pulverulent  
 130

non-coking coal, more or less finely-divided  
coking-coal, combustible fibrous material, and  
an oxygen-yielding salt, all intimately mixed  
together, and an insoluble agglutinating ma-  
5 terial mechanically uniting the particles of  
mixed material and having the property of  
holding the particles of non-coking coal until

entangled and held by the coke formed from  
the coking-coal during initial combustion.

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In presence of—

ALBERT D. BACCI,  
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