

W. J. LYND.

Coking Fossil Coals or Lignites.

No. 150,872.

Patented May 12, 1874.

Fig. 1.

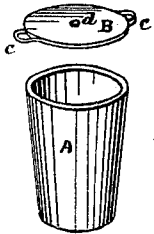


Fig. 2.

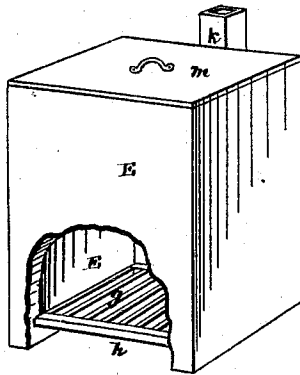


Fig. 3.

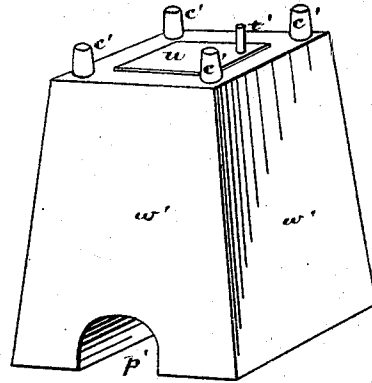


Fig. 4.

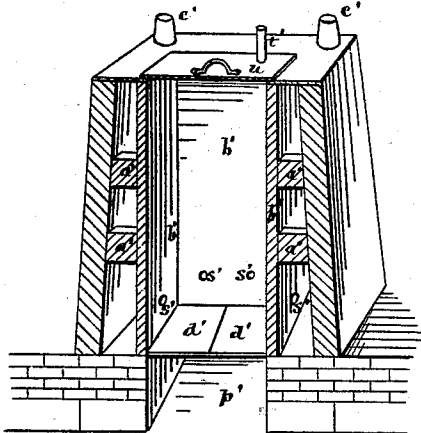


Fig. 5.

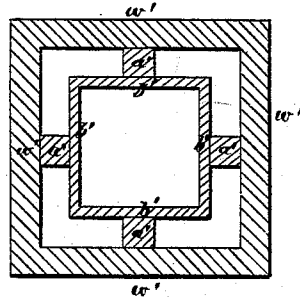
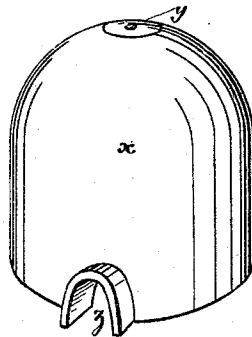


Fig. 6.



Witnesses.

Ewell Dick
Wm. G. Chaffee

Inventor.

Wm. J. Lynd
by atty H. C. H. H.

UNITED STATES PATENT OFFICE.

WILLIAM J. LYND, OF DENVER, COLORADO TERRITORY.

IMPROVEMENT IN COKING FOSSIL COALS OR LIGNITES.

Specification forming part of Letters Patent No. **150,872**, dated May 12, 1874; application filed April 20, 1874.

To all whom it may concern:

Be it known that I, WILLIAM JOHN LYND, of Denver, Colorado Territory, have invented new and useful Improvements in Coking certain Fossil Coals; and I do hereby declare the following to be a full and exact description of the same.

That it may be more clearly known what are the coals understood by certain fossil coals, I specifically designate as such the coals found in the Territories of Colorado, Wyoming, Utah, and New Mexico, and all similar coals wherever found in the United States. Some of these coals are at present mined near Cañon City, in Fremont county, at or near Trinidad, and elsewhere in Colorado Territory; at Rock Springs and elsewhere in Wyoming Territory; at Evans-ton and elsewhere in Utah Territory; at Coos Bay and elsewhere in Oregon Territory; at Bellingham Bay and elsewhere in Washington Territory; at Monte Diablo and elsewhere in California. These fossil coals are reported by geologists to be of the eocene formation. In the geological survey of Ohio, vol. 1, page 83, is the following statement: "It should also be mentioned that in North America the cretaceous was a great coal-making period, as rocks of this age in the far west contain, at various points, important beds of lignite, some of which are from thirty to fifty feet in thickness. The coals of Vancouver's Island, Bellingham Bay, Monte Diablo, those of New Mexico and Arizona, as well as some of the most valuable beds in Utah, Colorado, and Wyoming, are of cretaceous age. These, with some tertiary lignites, comprise all the so-called coals of the far west." In Professor Hayden's report of 1870, page 186, is the report of the Omaha Gas Company: "Residue, after coking in retort, twelve bushels of earthy breeze in small cubes, which, when put in the furnace fires, smothered them. The coke is worthless for heating purposes. Coal from Rock Springs, Wyoming, was also treated, and is also precisely similar." These coals are commonly called and recognized as lignites; yet, as other names are given, I prefer to denominate them as fossil coals, and to specify localities at which some of them are found and are mined, that they may be definitely known. From these coals I make a serviceable coke, useful for all heating pur-

poses. I coke them on a principle founded on the admitted fact that no fossil coals contain bitumen, while all fossil coals do contain bituminous organic matter—in other words, the elements or constituents from which bitumen is formed. These constituents are hydrogen and carbon, and sometimes oxygen combined with them. I here subjoin a careful analysis of European coals:

	Carbon.	Hydrogen.	Oxygen and Nitrogen.	Ashes.
Brown coal.....	71.71	4.85	21.67	1.77
Hard bituminous coal.....	82.92	6.49	10.86	.13
Cannel.....	83.75	5.66	8.04	2.55
Coking coal.....	87.95	5.26	5.41	1.40
Anthracite.....	91.98	3.92	3.16	.94

From this table it is evident that the brown coal has about five times more oxygen and nitrogen than hydrogen, and the other coals contain hydrogen, and oxygen, and nitrogen in nearly the same quantities.

Now, as coals require, in order to coke or fuse together, about or more than four parts free or disposable hydrogen, and less than two parts hydrogen combined or fixed to one hundred parts carbon, and as eight per cent. oxygen holds in combination one hydrogen, it is evident that the coals which have little oxygen and the requisite or more than requisite free hydrogen, and which are called, on this account, hydrogenous coals, will coke or fuse, when, on the contrary, those which have an excess of oxygen, and less than the requisite hydrogen, will not coke or fuse by the ordinary processes. The fossil coals specifically designated above differ in the quantity of oxygen and free hydrogen they contain. Nearly all have been analyzed, and one of the superior sort gives the following analyses: Oxygen and nitrogen, 17.63; phosphorus, 0.00; sulphur, .07; carbon, 76.00; hydrogen, 4.75; ash, 1.55; specific gravity, 1.25. According to the report of Professor Mees, of Columbus, Ohio, this coal gives dust for coke. According to Professor Hayden's report, as above, the coke was an earthy breeze in small cubes, and worthless for heating purposes. This will not coke or fuse in slack form, but I have found that by

finely pulverizing it, it will coke and make a superior coke, when treated as hereinafter described.

One of the inferior grades of these fossil coals gives the following average of five analyses: Water, 16.00; volatile substances, 38.00; ash, 4.50; fixed carbon, 41.50. This coal will not, under ordinary conditions, coke or fuse, whether in slack or pulverized state. But with the addition of a powder of coal sufficiently hydrogenous, it will make a first quality of coke, if treated as described below.

Now, as almost all the above-designated and similar fossil coals carry oxygen in excess over what the coking coals hold, we must, in case of some, disengage the hydrogen, so that its full virtue can be exerted; and, in case of others, add sufficient of hydrogenous coal to effect the desired end. But I have discovered that a less percentage of hydrogen is necessary to be present in coal to effect fusing than is usually thought requisite, because, by minute pulverization, all the hydrogen present can be made effective.

I am aware that asphaltum, coal-tar pitch, and hydrocarbons in general, can be used to aid in coking; but, aside from the expense of pulverizing the asphaltum, the still greater expense, and almost utter impossibility, of commingling it evenly and in just proportions with the coal, and the inferior quality of coke thus produced, make all attempts to coke by this means unavailing.

In carrying out my invention, I use coal, either in the slack or finely-pulverized state; but I prefer to use the powdered coal. I have discovered that the more finely powdered coal is the better it is adapted by these processes for making good coke. When the coke is finely powdered, and the heat is properly applied thereto, as hereinafter described, the constituents of bitumen will be more readily disengaged, and will combine so as to draw the particles of the coal and make them cohere, and form a uniform, compact, dense coke.

In practicing my invention I can employ several kinds of apparatus, as, for instance, a covered crucible, the cover having a hole in it for the escape of gases, as seen in Figure 1 of the accompanying drawings.

A is a crucible. B is the cover, with handles *c* and an aperture, *d*.

Fig. 2 represents a furnace to receive the crucible. E is the furnace or crucible-chamber. *g* is the grate. *h* is the ash-pit; *k*, the chimney; *m*, the cover.

In order to make the coke of a uniform texture, compact, dense, and without the lumps usually visible in coke from slack, the coal should be reduced to a fine powder or flour. The crucible is charged with the coal powder, and covered and placed in the furnace E, in which a fire is burning. The entire crucible is raised to a high degree of heat. The burning of the gases which escape by the aperture *d* assist in heating the cover and upper part of crucible, and the coal is thus bituminized and

coked. When coked a blue flame appears at the aperture *d*, and the crucible should then be taken out and cooled and its contents removed. The above indicates one simple form of apparatus for carrying out my process, from which it will be noted that said process may readily be practiced with any furnace so arranged or constructed that its heat can be applied to the exterior of the vessel, retort, or kiln containing the coal to be coked, in such manner as to produce bituminization and consequent coking of the coal.

A second kind of furnace is that of a vertical retort fixed within walls, and having apertures for the escape of gases, which are burned by air or steam that enters through apertures in the outer walls, the gases thus burned increasing the heat of the retort, which is first heated to a high degree before charged with finely-powdered coal. An apparatus for this purpose is shown in Figs. 3, 4, and 5.

Fig. 3 is a perspective view of said apparatus. Fig. 4 is a vertical central section, and Fig. 5 a horizontal section, of the same.

a' a' a' a' are fire-tiles built into walls for braces to retort. *b' b' b'* are walls of retort. *s' s' s' s'* are apertures for the escape of gases. *t'* is a pipe attached to cover *u*. This pipe is for the escape of such gases as may be in excess, and not able to find vent through apertures *s' s'*. *d' d'* are two heavy iron doors, which swing on hinges, and are kept in place by a horizontal transverse bar which is movable, and can be taken out or removed from under said doors, when the latter are to be dropped. *w' w'* are outer walls. *p'* is the arched opening for cars to enter to receive the coke when discharged from the retort, and *c' c' c'* are the chimneys. The chimneys connect with space between the retort and outer walls. The coal is put into the retort, first heated to a red or white heat, and the gases evolved from the coal burned outside the retort by air or superheated steam which enters through apertures in the outer walls, and by the gases so burned the first heat of the retort is maintained or increased. Bituminization is effected in this way, and, as a consequence, the charge of coal is coked. The charge is withdrawn after the retort is cooled a little, and another charge is introduced and proceeded with in like manner. I can use this form of retort, whether single or in cluster, as in the case of the Appolt oven, with apertures in any part of retort for escape of gases, near the top, or near the bottom, or near both top and bottom of retort, whether with single or double outer walls; or I can use any kiln or retort constructed on a similar plan to burn the gases which escape from the coal being coked for heating the vessel or inclosure containing the coal, whether horizontal, vertical, or otherwise.

Another form of apparatus adapted to carry out my process is represented in Fig. 6.

x is a circular oven, arched in the form of a dome. *y* is aperture for escape of gases. *z* is

doorway for introducing coal and discharging coke. The oven is heated to a high temperature, and then charged with coal. It is better to tamp it a little, or, in the case of some coals, to dampen a little. The door is closed, or only one or two small apertures left open for the introduction of a very little air, and the aperture in dome is partly closed. The coal is thus heated by the radiation of the oven and the constituents of bitumen evolved and combined. As the process of bituminization progresses the particles of coal are drawn together and made to cohere. When the bituminization has sufficiently progressed, the gases escaping are set on fire, and, by increasing the heat of interior or lining of furnace, cause the particles to fuse and cohere more strongly. When the whole mass has been subjected to this increased heat and the gases cease to evolve, the coal is coked. The oven can be closed awhile to cool sufficiently, and the coke may then be withdrawn. Air for the burning of the gases in this kind of oven may be supplied by pipes running from the bottom of outside walls upward, and circling round the dome and radiating to the interior of kiln like spokes of a wheel. The entrance of air can thus be easily controlled and the door be entirely closed. If this kind of kiln be furnished with one or more chimneys, so that the escape of gases can be controlled, then the aperture of dome may be closed. The openings into the chimneys will be in the dome. In lieu of this particular form of kiln, I can use any other kiln in which the gases are burned within the kiln, and in which the radiation of the heat caused by the

gases so burned effects completely bituminization and consequent coking of these fossil coals.

I do not, therefore, confine myself to the use of any one class of ovens, but use every sort of oven in which bituminization and consequent coking, as above described, can be effected.

As above stated, I prefer, when coking in the above manner, to have the coal in a pulverized condition, in which condition it is possible and practicable to coke coals whose slack is not cokable by ordinary processes. In the case of coals which will not coke even when pulverized, I mix with the powder of such coals the powder of a largely hydrogenous coal, whereby bituminization and consequent coking of the whole mass may be effected.

Having described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

The process herein described of treating fossil coals, such as above designated, by reducing the coal to a finely-divided or powdered state, and then subjecting the same, whether mixed or not with a powdered or finely-divided hydrogenous coal, to the coking operation, as set forth.

In testimony whereof I have hereunto signed my name this 20th day of April, A. D. 1874.

WM. J. LYND.

Witnesses:

EWELL DICK,
HENRY R. ELLIOTT.