H. RODMAN.

METHOD OF UTILIZING FUEL.

APPLICATION FILED JUNE 22, 1915.

1,334,405.

Patented Mar. 23, 1920.

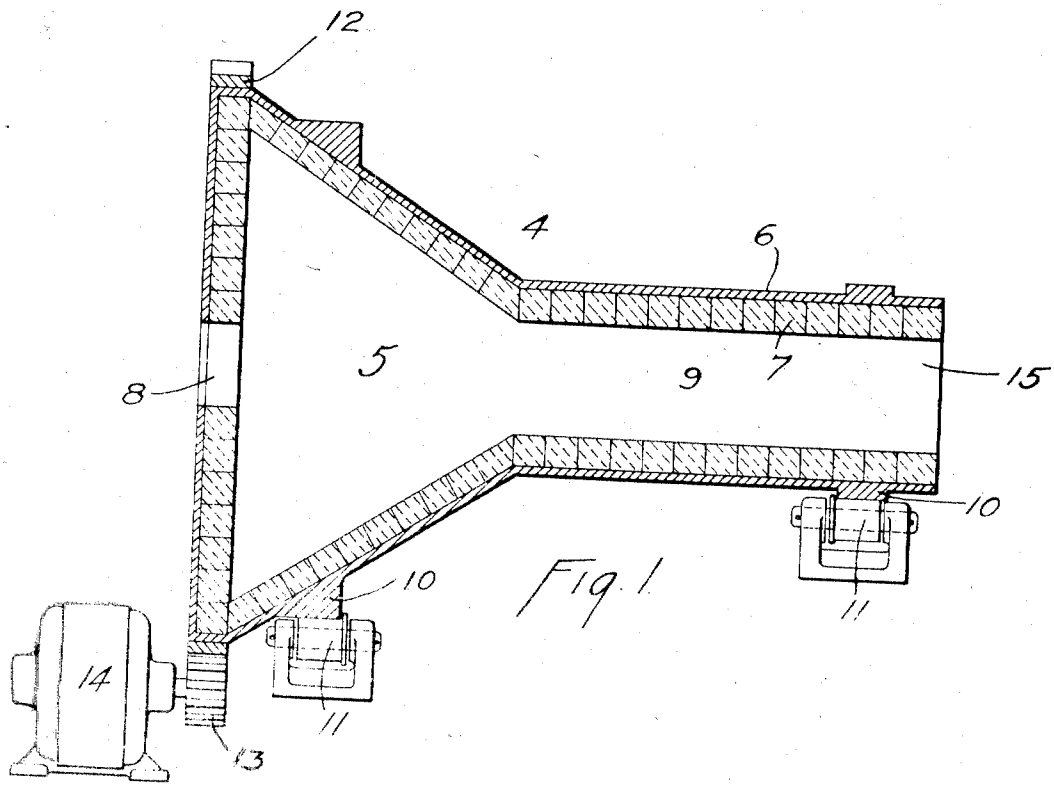


Fig. 1

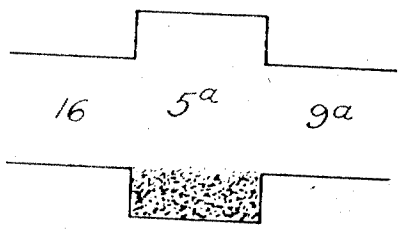


Fig. 2

INVENTOR.

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BY

HIS ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

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METHOD OF UTILIZING FUEL.

1,334,405. Specification of Letters Patent. Patented Mar. 23, 1920.

Application filed June 22, 1915. Serial No. 35,594.

To all whom it may concern:

Be it known that I, HUGH RODMAN, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Method of Utilizing Fuel, of which the following is a specification.

This invention relates to the utilization of fuel, particularly of coking coal, and discloses a new and improved process therefor.

It has been proposed to burn or partially burn solid fuel while tumbling it and passing it through a rotary kiln. When this process is attempted with coking coal which passes through a viscous state before assuming a rigid coke condition a prohibitive difficulty is encountered. The tumbling and traveling mass of coal, gradually heated, becomes sticky and viscous and at some zone in the kiln adheres to the walls so as to impede or stop the flow of fuel and gases.

My invention overcomes this difficulty. It consists in introducing the coal into a relatively large mass of tumbling, non-viscous heated material, such for example as previously formed coke. By this means the coal is coked while tumbling with the already heated mass without adhering to the walls of the furnace or kiln containing it. The coal may be so introduced into the tumbling mass as to avoid the formation of large coke lumps; in fact, the process can be so regulated as to make coke of pea size if desired, which operation will be referred to later.

In the drawings accompanying and forming a part hereof Figure 1 is a sectional view of a furnace or kiln which may be employed in carrying out my invention.

Fig. 2 is a diagrammatic sectional view of a modified form of kiln which may also be employed.

The kiln illustrated in Fig. 1 is so constructed that the incoming coal will fall upon a relatively large mass of hot coke and be tumbled therewith until the coal has passed through the viscous state. This is accomplished by constructing the kiln so that the feed end will hold a deep bed of fuel, as distinguished from the ordinary shallow bed, and preferably by forming the kiln so that the feed end will be in effect a reverberatory furnace and reflect heat upon the bed of material receiving the coal.

The kiln illustrated in Fig. 1 as the preferred form for carrying out this invention consists of a rotatable cylinder 4, which is enlarged at the feed end to form a chamber 5 similar in shape to the frustum of a cone. In my copending application, Serial Number 35,592, filed June 22, 1915, I have illustrated diagrammatically a kiln of similar form and have described a process of coking coal which is based on the process herein described. The kiln of the drawings in the present application consists of a metal shell 6 which is lined throughout with fire brick 7 or some other refractory material. The base of the frustum-shaped chamber 5 is provided with a feed opening 8, which is of less diameter than the cylindrical discharge portion or chamber 9 of the kiln. As illustrated, the kiln is provided externally with supporting annular tires 10, each of which is mounted upon two or more rollers or flanged wheels 11. The kiln is also provided around its periphery with a girth gear 12 which meshes with a driving pinion 13. Any suitable means may be employed for driving the pinion, but as illustrated, I have provided a direct connected motor 14.

In operation the kiln is rotated at relatively low speed, such for example as 10 revolutions per minute for a 6 foot diameter kiln, and coal and air are admitted to the chamber 5 through the feed opening 8. The coal so admitted falls upon a tumbling mass of hot material and tumbles therewith until it has at least passed through its viscous state. The gases evolved by the coking coal are partially or completely burned in the chamber 5 with the incoming air and the heat generated serves to maintain the temperature of the tumbling mass. This is also aided by the reflection and radiation of heat from the inclined furnace wall which performs the functions of a reverberatory furnace. The coal in tumbling with the heated mass, passes through its viscous state and becomes coke without adhering to the furnace walls and without building up unwieldy masses or agglomerates.

In carrying out my process for obtaining complete combustion of fuel, I prefer to

regulate the draft and feed so that coking only takes place in the chamber 5. Under such conditions the coke agglomerates pass from the chamber 5 into the chamber 9 where complete combustion occurs. The ashes and hot gases are discharged from the end 15 of the chamber 9, the ashes dropping into an ash pit and the hot gases being delivered to a boiler or other apparatus for utilizing heat. If desired or necessary, additional air may be admitted at any point along the chamber 9 or to the hot gases leaving the discharge opening 15.

I have used such a kiln for the production of pea size coke of low density by maintaining the tumbling bed about eighteen inches deep at the feed end and one or two inches deep at the discharge end of the chamber 5, and by admitting sufficient air to burn the gases evolved and maintain the tumbling bed at a coking temperature, but not enough air to burn the coke produced. In making such coke I prefer to shorten the chamber 9 or do away with it entirely, since it merely performs the function of a discharge passage for the coke produced. The coke as delivered is cooled by any well known means such as a water spray.

While I have described my process as applied to complete combustion and to the production of coke of low density, it will be obvious that the process may be employed in any industrial operation in which it is necessary to pass coal through its viscous state. I may, for example, produce dense coke by employing a drum of large diameter and, thereby maintaining a deep mass of heated material in the chamber 5. This may also be accomplished by maintaining a tumbling mass of considerable weight, such as a mass of iron balls or similar material in the chamber 5 upon which the coal is fed.

The process may also be utilized for the production of coke together with the recovery of by-products, the tumbling bed being maintained at a temperature above the softening point of the coal by means of any desired heating device. For instance, the tumbling drum may be heated externally to about 850° F., or it may be heated by blowing heated non-oxidizing gases through the device. Such gases will preferably consist of previously distilled gases which have had their valuable by-products, as ammonia and tar, extracted. The coal distilling and coking on the tumbling mass will produce a quantity of gas containing ammonia, etc. This gas will be delivered through the discharge opening 15 to appropriate apparatus for recovering the ammonia, etc., and part of the gas will then be heated and returned to the kiln to assist in heating and coking more coal.

In carrying out the process in the complete combustion of fuel, or for the purpose of producing coke of either high or low density, it may be desirable to partially heat the coal prior to delivering it to the coking chamber. Where this is desirable I may employ a kiln, such as is diagrammatically illustrated in Fig. 2, which consists of an ordinary cylindrical kiln, except that it is enlarged at a point intermediate its ends, to produce the coking chamber, or the chamber in which the incoming coal is coked while being tumbled with previously coked coal or other non-viscous material. As shown the kiln is provided with a pre-heating chamber 16, into which the fuel to be coked is fed. The delivery end of this chamber communicates with an enlarged chamber 5^a, in which a mass of non-viscous hot material is maintained.

The delivery end of the chamber 5^a communicates with a chamber 9^a, which is similar both in construction and functions performed to the chamber 9 of Fig. 1. The essential feature of this kiln is that the chamber 16 must be so proportioned as to length that the coal will be delivered by it to the chamber 5^a prior to reaching its viscous state.

What I claim is:

1. The method of utilizing coking coal which consists in feeding crushed coking coal into a heated tumbling mass of separate non-viscous particles, the mass being of sufficient size relatively to the amount of coal fed thereto to insure a separation of the coal during the process of coking, in subjecting the coal to the tumbling action of said mass as it passes through the viscous state.

2. The method of utilizing coking coal which consists in feeding crushed coking coal into a heated tumbling mass of separate non-viscous particles of previously coked coal of sufficient size, relatively to the amount of coal fed thereto to insure separation of the coal particles during the coking process, in subjecting the coal to a coking temperature while tumbling in said mass and in discharging the coked products from the surface of the tumbling mass.

3. The method of utilizing coking coal which consists in continuously feeding particles of coking coal into a tumbling mass of non-viscous previously coked coke, in subjecting the coal to the tumbling action of said mass while subjecting it to a coking temperature and in continuously discharging coke from the surface of the tumbling mass.

4. The process of utilizing coking coal which consists in continuously feeding particles of coking coal into a hot mass of non-viscous particles, said mass being of sufficient size relatively to the amount of coal fed thereto to insure a separation of the coal particles as they pass through the viscous state, in subjecting said coal to a coking tem-

perature while tumbling with said mass and in discharging the coke product from the surface of said mass.

5. The process of utilizing coking coal which consists in continuously feeding particles of coking coal into a hot and tumbling mass of non-viscous particles, the mass being of sufficient size relatively to the amount of coal fed thereto to insure separation of the particles of uncoked coal as they pass through the viscous state, coking the coal while subjecting it to the tumbling action of said mass, discharging the coke product from the surface of said mass and in burning the coke so discharged.

In testimony whereof I have hereunto subscribed my name this 21 day of June, 1915.

HUGH RODMAN.

Witnesses:
C. W. McGHEE,
E. W. McCALLISTER.