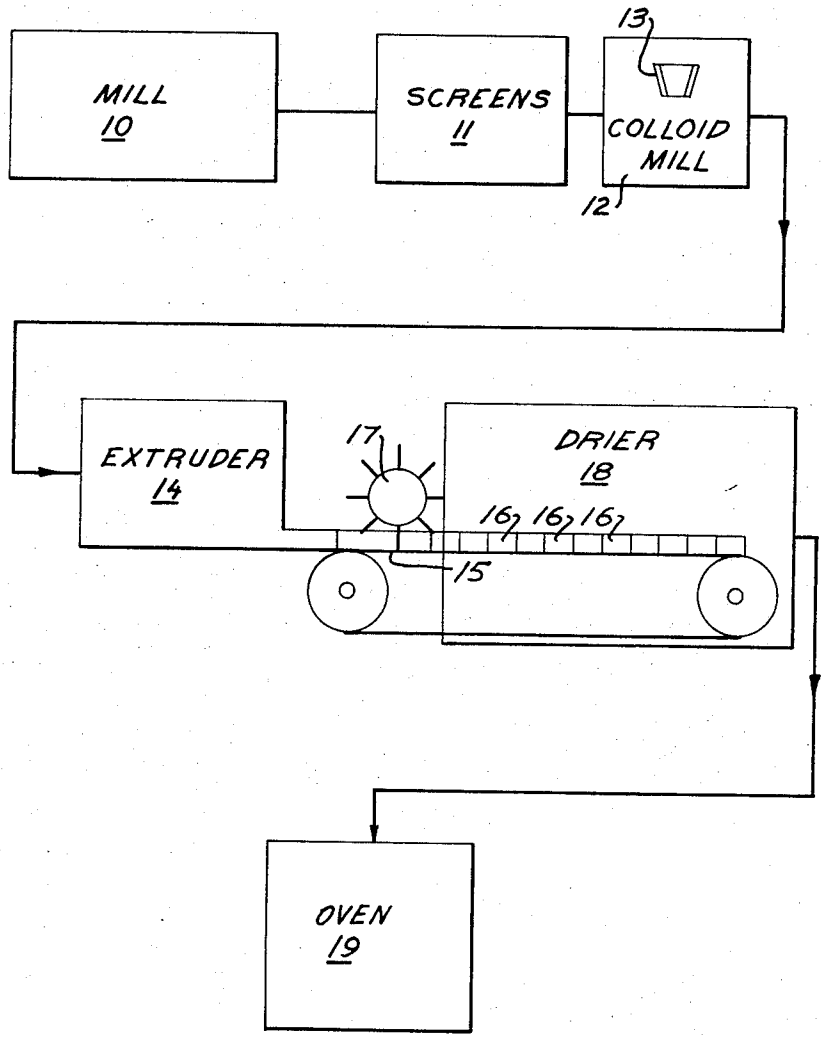
Sept. 11, 1973 K. O. P. FISCHER 3,758,385

PROCESS FOR COKING LIGNITIC COAL

Filed Dec. 3, 1970



Karl O. P. Fischer,
Inventor

by

Lyle G. Trorey,
Agent

United States Patent Office 3,758,385 Patented Sept. 11, 1973

3,758,385

PROCESS FOR COKING LIGNITIC COAL

Karl Otto Paul Fischer, Chilliwack, British Columbia, Canada, assignor to Fischer Holdings Ltd., Chilliwack, British Columbia, Canada

Filed Dec. 3, 1970, Ser. No. 94,826
Int. Cl. C10b 45/02
U.S. Cl. 201—6 9 Claims

ABSTRACT OF THE DISCLOSURE

A process for preparing coke from lignitic coal wherein a paste of coal and water is prepared. The paste is then divided into equi-axed pieces which are dried to reduce moisture content of the pieces below ten percent, and the pieces are then coked.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to preparation of coke from lignitic coal.

Prior art

In smelting of iron ore a blast furnace is usually charged with descending layers of crushed limestone, iron ore and coke through which a large volume of ascending hot gas is passed. The coke used must have a crushing strength sufficient to support, without crushing, weight of iron ore and limestone. Coke which crushes easily usually breaks down into fines which not only inhibit the passage of hot gas through the furnace but can be lost during initial smelting stages thus reducing furnace effectiveness and increasing production costs.

Most bituminous coals when heated at uniformly increasing temperature, in the absence or partial absence of air, fuse and become plastic. Such coals are designated caking coals having high agglomeration and agglutination values; different coals possess this caking property in varying degree.

Caking is an essential property of coal to be used in prior art processes for manufacture of coke. More strongly caking coals, usually high rank bituminous coal, give cokes that show good swelling and cell structure with required crushing strength for use in smelting of iron ore. Subbituminous coal and anthricite are considered non-caking. Lignitic coals, including lignite and brown coal, do not fuse readily and natural coke—i.e. coke prepared from coal which, other than being reduced to proper particle size, has not otherwise been treated prior to coking—does not have required crushing strength for use in the smelting of iron ore.

Available deposits of good coking coal are rapidly being depleted. Consequently considerable research has been undertaken to produce an acceptable coke for smelting purposes from lignitic coals.

In prior art processes for producing coke from lignitic coal the coal is usually milled to a maximum particle size of about four mm. The milled coal is then dried to reduce moisture content to about ten percent. A binder, usually asphaltic, is added and the coal is then kneaded to produce a plastic mixture. The mixture is briquetted under high pressure and the briquettes then coked. Coke thus produced, termed constructed coke, can be controlled as to size and shape of individual coke pieces. Constructed coke prepared in this manner from a good coking coal has a high crushing strength suitable for smelting purposes and is considered an ideal reductor for smelting as size and shape of individual coke pieces can be accurately controlled and related to ore granulated size. Constructed coke produced from lignitic coals in accordance with the process above does not, however, have sufficient crushing strength required of smelting coke.

Constructed coke produced in accordance with the prior art process also is costly, as energy requirements are high particularly in pressing procedures to form the briquettes. Production, correspondingly, is slow.

SUMMARY OF THE INVENTION

The present invention provides a process for making constructed smelting coke, having a high crushing strength, from lignitic coals.

Constructed coke prepared in accordance with the process of the present invention is less costly than constructed coke of prior art processes as energy requirements are lower, binder are not required and production is higher.

In the present process lignitic coal is reduced to a maximum particle size of 0.15 mm. and formed into a paste having a moisture content between fifty and sixty percent. Equi-axed pieces of the paste are then prepared and the pieces dried until moisture content is approximately ten percent. The pieces are then coked.

A detailed description following, related to drawing gives exemplification of apparatus and process according to the invention which however is capable of expression in process and apparatus other than those particularly described and illustrated.

DESCRIPTION OF THE DRAWINGS

The drawing shows, diagrammatically, apparatus for carrying out coke production in accordance with the invention.

DETAILED DESCRIPTION

The process for making coke from lignitic coal in accordance with the present invention can be divided into general steps as follows:

Step I. Preparing a coal paste.
Step II. Dividing the paste into equi-axed pieces of predetermined size.
Step III. Drying the pieces.
Step IV. Coking the dried pieces.

With reference to the drawing the general steps of the process are as follows:

STEP I

Lignitic coal is first passed through a mill **10**, such as a ball or other suitable mill to reduce particle size to about 4 mm. The milled coal is then passed over screens **11** to remove wood components, usually found in brown coal, and oversize coal particles are returned to the mill **10** for further reduction.

The screen coal is then further reduced and kneaded in a colloid mill **12** to form a paste having a particle size less than 0.15 mm. The colloid mill can be of a known type such as is used in comminuting wood pulp and has kneading and comminuting rotors **13**. Moisture content of the coal paste is maintained at not less than fifty percent—fifty-five percent being optimum. Consequently water must be added during kneading in the colloid mill to provide a paste having the desired moisture content when preparing drier coal.

To produce smelting coke, the coal is milled in the colloid mill to a particle size between 0.08 mm. to 0.12 mm. and, if it is to be used to produce a coke having a charcoal structure, it is milled to a particle size between 0.12 mm. to 0.15 mm.

STEP II

The paste produced in the colloid mill is then passed through an extruder **14** onto a travelling grate **15**. The extruder can be a worm press and operates at low pressure as the paste is fluid.

The extruded paste is cut into equi-axed pieces **16** by a cutter **17** arranged over the grate. The cutter shown in FIG. 1 can be of a rotating type having radially extending blades peripheral speed of tips of which is the same as travel speed of the grate. Dimensions of coke pieces ultimately to be produced dictate required dimensions of the paste pieces, consequently thickness of the extruded paste and spacing of the cutter blades are adjusted to provide paste pieces of predetermined size.

STEP III

The paste pieces are carried by the travelling grate into a drier **18** in which moisture content is reduced to less than ten percent.

In order to reduce cracking drying is carried out under controlled temperature conditions. The pieces are dried in streams of warm air (between 20° C.–30° C.).

During drying the pieces shrink, edge length being reduced to about fifty percent of former length and specific gravity increases about three hundred percent. The pieces become sufficiently hard to withstand, without undue breakage, handling and transportation by conventional means.

STEP IV

The dried pieces are then coked in an oven **19** in a known manner.

To produce smelting coke the pieces which are formed of coal milled to a particle size between 0.08 mm. and 0.12 mm. is coked at a temperature between 950°–1,100° C. To produce cokes having a charcoal structure the pieces formed of coal milled to a particle size between 0.12 mm. and 0.15 mm. are coked at a temperature between 600° C.–650° C.

Smelting coke produced by the present process has a fine porous texture and has a high crushing strength. Abrasion test results run as high as eighty-five percent, comparing favourably with the best pit coal cokes.

The present process can, most advantageously be used in the smelting of iron ore fines. Normally iron ore fines can be smelted only with great difficulty and at a high cost. During preparation of the coal paste iron ore fines can be added so as to produce a homogenous mixture of coal and ore. The ore fines remain entrapped in the pieces during coking and during subsequent use of the coke in a blast furnace.

Brown coal which has a soft earthy structure and which has an inherent moisture content of between fifty and sixty percent is ideally suited to the production of coke in accordance with the present process, so that little, if any, water need be added for the production of coal paste having optimum moisture content. Furthermore energy requirements to comminute and reduce the coal to required particle size in the colloid mill is also low. In lignites inherent moisture ranges from thirty to forty-five percent, lower ranking lignites being softer and having a higher moisture content than higher ranking lignites. It follows, therefore, that energy requirement, particularly in milling and drying, increases and production decreases with increase in rank.

Lignites of highest rank which are sometimes classified as low rank subbituminous coal may not be suitable for production of coke in accordance with the present process as they usually do not retain sufficient moisture when

prepared in paste form to maintain desired shape prior to and during drying. It is to be understood, therefore, that the process is directed to production of constructed coke from brown coal and, usually, lignites of lower rank.

I claim:

1. A process for making coke from lignitic coal consisting essentially of the steps of:

(a) preparing a lignitic coal paste having between fifty percent and sixty percent moisture content, and a maximum particle size of 0.15 millimeters,

(b) dividing the paste into substantially equi-axed pieces,

(c) drying the pieces within a temperature range between 20° C. and 30° C. to less than ten percent moisture content,

(d) coking the dried pieces within a temperature range of between 600° C. and 1100° C. to produce coke.

2. A process as claimed in claim **1** in which the paste is prepared by first milling the coal to a maximum particle size of four mm. and then reducing the milled coal to a maximum particle size of 0.15 mm.

3. A process as claimed in claim **1** in which the paste is divided by extruding the paste onto a travelling grate, then cutting the extruded paste into pieces of predetermined dimension.

4. A process as claimed in claim **1** in which the paste pieces are dried in streams of warm air having a temperature between 20° C. and 30° C.

5. A process as claimed in claim **1** in which maximum particle size of the coke paste is between 0.12 mm. and 0.15 mm.

6. A process as claimed in claim **1** in which the coke paste has a maximum particle size between 0.08 mm. and 0.12 mm.

7. A process as claimed in claim **5** in which the dried pieces are coked at a temperature between 600° C. and 750° C.

8. A process as claimed in claim **6** in which the dried pieces are coked at a temperature between 900° C. and 1,100° C.

9. A process as claimed in claim **1** including adding ore fines to the coal during preparation of the coal paste.

References Cited

UNITED STATES PATENTS

3,010,882	11/1961	Barclay et al.	
3,272,720	9/1966	Peet	201—5
3,026,189	3/1962	Hall	201—8 X
3,184,293	5/1965	Work et al.	201—6 X
3,414,480	12/1968	Stotler et al.	201—5 X
3,637,464	1/1972	Walsh et al.	44—10 C

FOREIGN PATENTS

4,962	6/1932	Great Britain.
16,126	10/1929	Great Britain.
14,970	4/1929	Great Britain.

NORMAN YUDKOFF, Primary Examiner

D. EDWARDS, Assistant Examiner

U.S. Cl. X.R.

44—10 D, 16 D; 201—44