RAW-COAL
(BITUMINOUS OR SUB-BITUMINOUS COAL OR LIGNITE)

CRUSHING TO 0-3mm
IN
A HAMMERMILL

DRYING AND PRE-HEATING
UP TO 340-420°C IN A
FLUIDIZED-BED OVEN

SUPPLEMENTARY HEATING UNDER
PRESSURE WHILE BRIQUETTING AT
MORE THAN 300 kp/cm²

COOLING OF THE BRIQUETTES BY
AIR OR WATER SPRAYING
3,592,617

PRODUCING SMOKELESS-BRIQUETTES FROM BITUMINOUS COAL, SUB-BITUMINOUS COAL, OR LIGNITE


Filed May 12, 1969, Ser. No. 823,657
Claims priority of application Turkey May 11, 1968, 25,740/5,929, Patent 14,873

Int. Cl. C101 S/00

5 Claims

ABSTRACT OF THE DISCLOSURE

A process for producing smokeless-briquettes from bituminous or sub-bituminous coal or lignite by hot-briquetting, comprising speedily drying the coal or lignite, preheating it to 340–420°C, without pressure, and finally heating it under pressure until the tar vapours have completely escaped.

This invention relates to the production of smokeless-briquettes from bituminous coal, sub-bituminous coal, or lignite.

Semi-coke is known as a smokeless fuel, made by low-temperature distillation of coal, which is now sought for burning in households and light industry, to prevent smoke and smog formation in big cities. Particularly, semi-coke from lignite is a good and cheap fuel with a high reactivity. Unfortunately the grain size is very small. Because of its softness, abrasion during transport is high. It also sometimes tends to ignite spontaneously when kept in stock. For these reasons many efforts have been made to improve its properties, especially the grain size of such semi-coke.

Distillation followed by briquetting the fine-sized semi-coke with a binder has been proposed, but low-temperature distillation of lignite, preferably by hot combustion gas, gives only about 60% of the semi-coke particles bigger than 10 mm. Briquetting of fine-size semi-coke with binder such as pitch, molasses or sulfate wastes from paper pulp-milling needs about 10% of binder and a second heating process to make the briquettes stronger, water-resistant and smokeless.

To avoid these disadvantages it has been proposed to make smokeless or nearly smokeless briquettes from fuel by hot-briquetting. According to this process, coal in fine-sized particles, for example, 0–3 mm, is heated up speedily in a fluidized-bed oven at 340–410°C and immediately pressed at a minimum pressure of 350–500 kp./cm.². The briquettes obtained by this prior art process are strong, completely water resistant, but not fully smokeless. To make them smokeless, additional shock-heating of the hot briquettes, for example, in a sand-bed oven, is necessary, but this treatment reduces the strength of the briquettes. Therefore, some kinds of coal, especially lignite, are not suitable for this process.

According to the present invention all the difficulties mentioned above can be prevented by preheating the coal or lignite under pressure until no more tar vapours escape. The briquettes produced under such conditions are real semi-coke briquettes of high strength, completely smokeless and water-resistant. The temperature at which the coal is preheated depends on the properties of the coal. Lignite, for example, can be preheated up to 400°C and even more, so that the supplementary indirect heating rate under pressure is less. Tar vapours escape completely at about 430°C. For producing good semi-coke, briquettes pressures no greater than 300 kp./cm.² are then necessary. Drying the coal and preheating in a fluidized-bed oven are advantageous, as previously proposed for hot-briquetting. A wet lignite with over 20% of moisture requires a second upper stage for preheating.

Particularly suitable for the new process is an Exter press (invented by Exter over 100 years ago and used in Germany for briquetting of lignite), which easily makes possible a longer pressing time during the supplementary heating and it also regulates the pressure by means of the length of its press-channel and its dimensions. A square channel can be formed so that quick heat-transfer is possible. The channel can also be easily heated electrically, if it is made of stainless steel, and, for example, connected with a power source that is low in voltage but high in current. This kind of electrical heating is possible without any changing of the construction of the common Exter press used for the classical method of briquetting brown coal. Furthermore, the temperature of the lignite in the channel can be easily regulated in this way.

The low-temperature-distillation gas which still escapes from the preheated lignite in the pressure-channel may, for example, be exhausted through a hole in the briquette. This hole in each briquette cooperates with holes in other briquettes to a tube beginning with the first briquette and ending with the last briquette of the channel. For this purpose the stamper may have a plug on its plate in the center to cause the hole in the briquette.

The drawing is a flow sheet of a preferred form of the process of this invention.

Lignite, for example, that denoted by international code No. 1200, having a moisture of 40% and considerable volatile matter is sent to a fluidized-bed oven for speedily evaporating the water content to less than 20%. From here the predried coal flows to the stage where it is completely dried and heated, for example, up to about 410°C. Hot combustion gas free of oxygen is mixed with recirculating gas at a temperature of 900°C, produced in a furnace, and first enters the lower stage and then passes the upper stage with a temperature of about 500°C. It leaves the fluidized-bed oven with a temperature of about 220°C. After precipitating the dust from the gas as by a cyclone, the gas may be cooled to approximately 60°C in a cooler and partly sent to the combustion chamber by means of a blower. The rest is used for output.

The preheated coal flows from the fluidized-bed oven to an intermediate bunker. From here it enters an Exter press by means of an inlet. The stamper moves the preheated lignite through the heated pressing channel, which is long enough to increase the temperature of the coal under pressure until no further tar vapours escape. Coke briquettes and low-temperature distillation gas leave the press outlet. Afterwards, the briquettes are cooled by air or by water-spraying, in the common way.

One such coke-briquette obtained has the following properties:

- Preheating temperature—410°C.
- Pressure used in the press—300 kp./cm.².
- Pressure test—250 kp./cm.².
- Bending test—10 kp./cm.².
- Density—1.25 g./cm.³.
- Surface—No cracks.
- Water absorption after 1 hour irrigation—2.5% H₂O.
- Loss of the strength of briquettes—20%.
- Inorganic matter—21%.
- Tar content—0%.

The quality of the briquettes is very good.

In most of the cases, such strength is not necessary. Even if the temperature of the preheated lignite is in-
creased up to 420° C. and the pressure reduced below 300 kp./cm.², the briquettes are marketable, as shown here:

- Preheating temperature—420° C.
- Pressure used in the press—200 kp./cm.²
- Pressure test—8 kp./cm.²
- Bending test—1.20 g./cm.²
- Density—1.20 g./cm.²
- No cracks
- Water absorption after 1 hour irrigation—3%
- Loss of the strength of briquettes—25%
- Volatile matters—22%
- Tar content—0%

The advantage of the new process is mainly that the volatile matter in the briquettes does not depend on the property of the coal, as it is the case by the prior-art hot-briquetting processes. Because it is suitable also for bituminous or sub-bituminous coal, a smoothly fluidized bed is assured in the oven without any blockage or disturbed fluidization. Up till now, a hot-briquetting of lignite was sometimes not successful.

Therefore, lignite did not become plastic enough during the short normal pressing time, therefore bituminous or sub-bituminous coal was added (15%). The new process however allows pressing of all kinds of coal without any mixing, except anthracite and xylite. (Xylite is found more or less in all kinds of lignite and looks like wood.) The quality of the briquettes can be easily varied by changing the pre-heating temperature or the temperature under pressure, or the pressing time and the pressure. So it is possible to produce all kinds of briquettes which are in demand in the market.

It is also possible to reduce the volatile matter up to that left in high-temperature coke, by additional degasifying for example, by hot combustion gas, hot pebbles or other known methods. The strength of the briquettes is so high that a second heat treatment is possible without reducing the quality of the briquettes.

The economics of the process is better than hot-briquetting without heating under pressure, because no special carbonization plant is necessary. The installation costs are

less, the process is simple and fewer service workers are needed. This is the only process to produce directly from coal a formed semi-coke, without fine-grain-size pieces, with very less abrasion and no self-burning on the stock.

What is claimed is:

1. A process for producing smokeless briquettes from bituminous or sub-bituminous coal or lignite by hot-briquetting, comprising speedily drying the coal or lignite, preheating it to 340–420° C. without pressure, compressing it into briquettes and finally heating the briquettes while holding them under pressure until the tar vapours have completely escaped.

2. The process of claim 1 wherein the press form is electrically heated.

3. The process of claim 1 characterized by taking off continuously the low-temperature distillation gas that is volatized during the step of heating the briquettes under pressure, the gas being taken off through a hole through the briquettes in the press-channel.

4. The process of claim 1 characterized by an additional heat-treatment of the hot briquettes for further degasification.

5. The process of claim 1 characterized by the heating of the briquettes under pressure being done at pressures between about 300 and 500 kp./cm.².

References Cited

UNITED STATES PATENTS

1,780,205 11/1930 Maurel 44—14 44—10
3,093,463 6/1963 Radley 44—10 44—14

FOREIGN PATENTS

655,314 7/1951 Great Britain 44—10.31

241x746