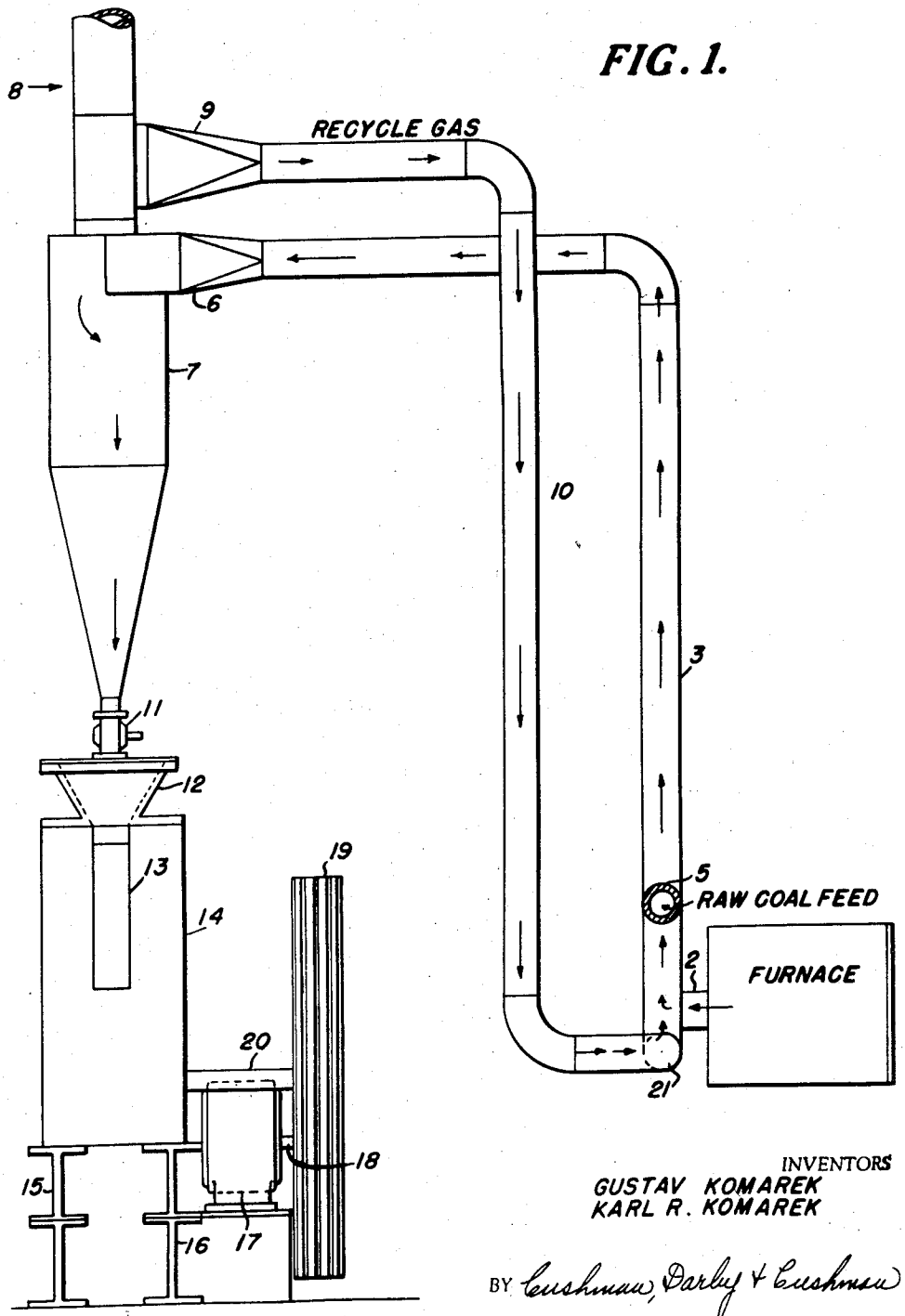
May 17, 1960 G. KOMAREK ET AL 2,937,080

PROCESS OF MAKING BINDERLESS BRIQUETTES

Filed Feb. 14, 1957 2 Sheets-Sheet 1

FIG. 1.



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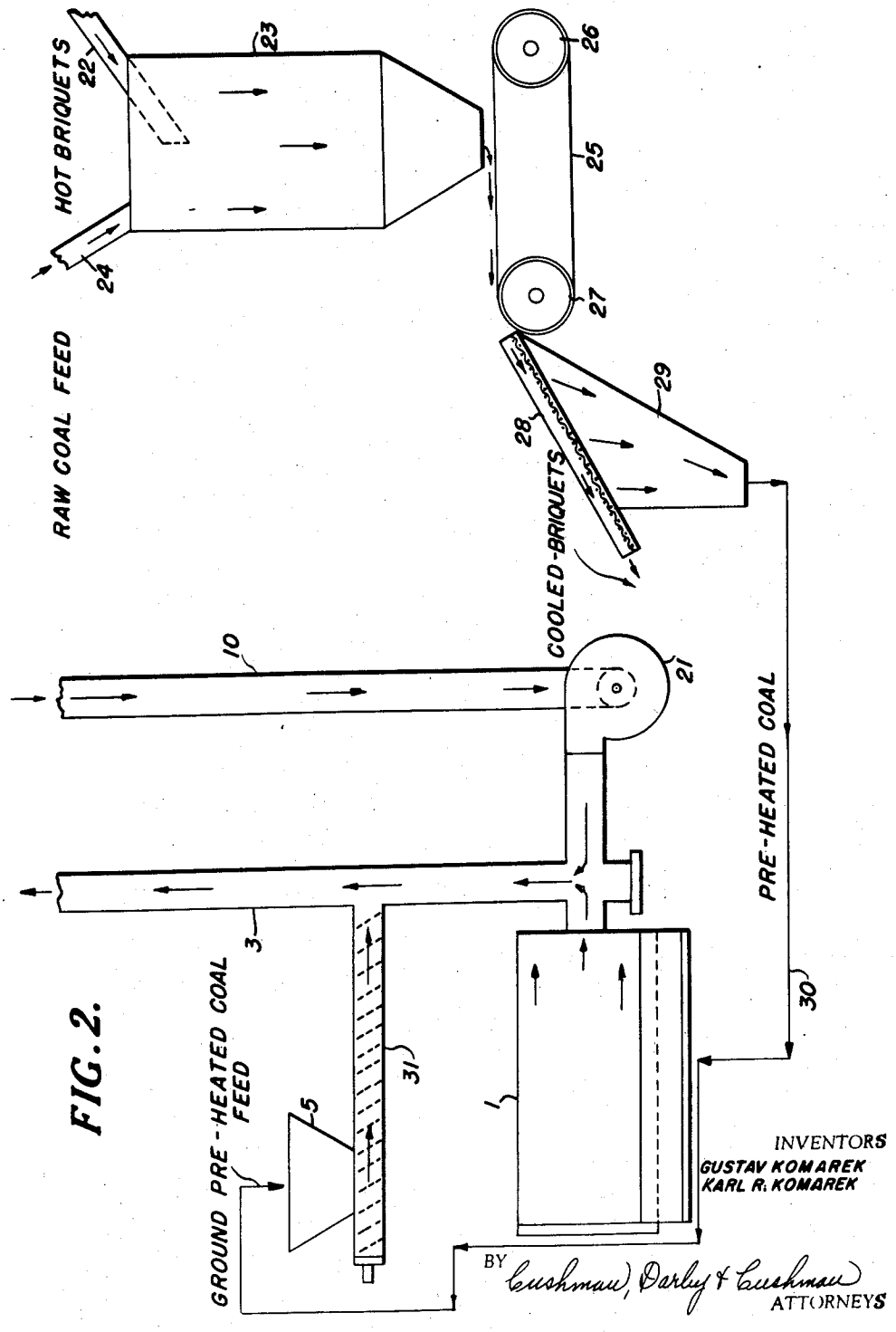


FIG. 2.

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PROCESS OF MAKING BINDERLESS BRIQUETTES

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Application February 14, 1957, Serial No. 640,238

10 Claims. (Cl. 44—10)

The present invention is concerned with a process for the production of binderless briquettes from coal.

It is an object of the present invention to provide a more desirable way of feeding coal to the briquetting machine.

It is a further object of this invention to control the temperature of the coal.

It is still another object of this invention to control the velocity of the coal.

It is another object of this invention to control the amount of oxidation of the coal.

It is still another object of this invention to provide a method of simultaneously cooling the finished briquettes and preheating the unprocessed coal.

The accomplishment of these and other objects of the invention will become apparent from a reading of the following description and the figures of the drawing.

The novel process involves feeding coal particles of fineness from 20 mesh or coarser up to 300 mesh or finer by means of a hot gas stream into a cyclone separator from which the coal particles are separated from the gas and fed into a conventional briquetting machine. A portion of the gas is vented off to the atmosphere, while the remainder of the gas is recycled and fed by means of a blower into the gas stream at a point between the gas coming from a furnace (the main source of gas) and the point of injection of the coal particles into the gas stream, or as shown in the drawings, which will be referred to with particularity hereinafter, the recycled gas may be fed into the gas stream at a point before that at which the gas from the furnace enters the stream. The amount of gas vented to the atmosphere is always equal to the amount of gas introduced at the burner plus any water vapor evaporated from the coal. The recycling of the hot gases has several advantages over the prior art methods of feeding the coal to the briquetting machine. The first advantage is heat economy. The recycled gas will assist in heating the coal and, hence, a lesser amount of fuel will be required to introduce heated gas into the system. The coal can be conveyed at the most suitable velocity through the system without regard to the amount of heat or gases being supplied by the furnace. Since the velocity of the gases in the system is independent of the furnace, but controlled only by the speed of the blower, the character of the gases may be made either oxidizing or reducing, as required, for most efficient processing of the coal. More or less heat may be furnished from the furnace in order to heat the coal to the most desirable processing temperature without regard to the initial temperature of the coal and without effecting the velocity of the coal or gases through the system. This provides the necessary flexibility to process coals of diverse chemical composition and of widely divergent initial temperature conditions under conditions most favorable for each coal. It has long been recognized, for example, that satisfactory briquettes for most purposes are not produced from coals with a high swelling index, e.g., a swelling number above 7½ British standard swelling test. On a test with coal (New River coal) of high swelling number, e.g., over 9+, the briquetted coal of the briquettes showed a satisfactory swelling number, namely, of 7—.

It has been established that, with the equipment herein described, satisfactory briquettes can be made from such coals with greatly reduced swelling properties by controlling the amount of free air contained within the system, e.g., by using 10% to 50%, preferably 25%, air and the balance of the gas being the products of combustion. Coals of low swelling index, e.g., a swelling index of less than 5, require no free air in the system in order to form briquettes with satisfactory properties. The process and equipment herein described, therefore, serve a dual purpose, not only to produce briquettes with satisfactory physical strength, but also with satisfactory burning properties as well.

In a preferred form of operating the present invention, the briquettes are discharged from the briquette press by means of a chute or other suitable conveyor into a bin or hopper and admixed with the unprocessed coal which is fed into the bin in suitable quantity from an independent conveyor. The bin is so sized that a suitable contact time, e.g., about 10 to 20 minutes, between the unprocessed coal and the finished briquettes will bring the briquettes and unprocessed coal into substantial thermal equilibrium. The cooled briquettes and preheated coal are discharged continuously from the bottom of the bin by any suitable conveyor and screened, the finished briquettes being now ready for storage or shipment and the preheated coal ready for processing. It is also possible, although with reduced efficiency, to obtain heat exchange without actually mixing the hot briquettes and raw coal. Thus, heat transfer can be accomplished by passing the raw coal and hot briquettes in countercurrent or concurrent flow in conduits separated by a thin metallic sheet, e.g., steel, or other good conductors of heat. Such a process, of course, would eliminate the step of screening the raw heated coal from the cooled briquettes.

The preferred method of operating the invention results in even greater heat economy than the method wherein the briquettes are not used to preheat the incoming coal. Briquettes have a tendency to ignite spontaneously if not cooled before stockpiling. When operating according to the preferred form of the invention, this problem is overcome as the briquettes are adequately cooled by the incoming coal.

The temperature of the gases within the system, after admixture with the gases from the furnace, should be from 500° F. to 1000° F. After the preheated coal is introduced into the gas stream, the temperature of these gases drops rapidly to 300° F. to 700° F. The temperature of these gases at the cyclone is about 5° F. hotter than the temperature of the coal. The temperature of the coal should be maintained between about 300° F. to 700° F. when it reaches the briquetting machine rolls. After admixture of the briquettes with the untreated coal, the temperature of the briquettes drops to about 200° F. to 300° F., e.g., 250° F.

The percentage of recycled gas to total gas is usually between about 40% and 80% and preferably about 60%.

The temperature of the coal just before it reaches the briquetting machine should be just below the softening point, e.g., point of nascent plasticity, of the coal for maximum efficiency in operation. Many coals can be compressed into suitable agglomerates within the temperature range of about 300° F. to 700° F.

Referring to the drawing:

Figure 1 is a schematic drawing of a suitable appa-

ratus for carrying out the present invention, while Figure 2 is a schematic drawing of part of the apparatus and including the preferred embodiment for heating the incoming coal.

Referring to the drawing, and more particularly to Figure 1, hot gas is blown from a coal or oil burning furnace **1** through pipe **2** to conduit **3**. The burner in the furnace is under pressure from a fan (not shown) to blow the gas upwardly. Raw coal is introduced through hopper **5** into conduit **3**, thence through connection **6** into cyclone separator **7**. A part of the gas is removed through vent **8** while the remaining gas passes through connection **9** into conduit **10** from whence it is recycled and fed by means of a blower **21** into conduit **3**. The recycled gas may enter the gas stream at a point along conduit **3** intermediate the gas coming from the furnace (the main source of gas) and the point of injection of the coal particles into the gas stream, but as shown in Figure 1, preferably the recycled gas is introduced into conduit **3** in advance of the gas from the furnace **1** which enters conduit **3** through pipe **2**.

The coal is separated from the gas particles in the cyclone separator and passes through airlock **11** into chute **12** from whence it falls between briquetting rolls **13** in briquetting machine **14**. The briquetted coal is removed onto a chute **22** (Figure 2). The briquetting machine is supported by stands **15** and **16**. Motor **17** is also mounted on stand **16**. Shaft **18** runs from motor **17** and carries a pulley (not shown) upon which is mounted a series of belts which are also entrained over pulley **19** to which is connected shaft **20** which is attached through appropriate means to the briquetting rolls.

Referring to Figure 2, the hot briquettes emerge from the briquetting machine on chute **22** and fall into mixing bin **23**. Ground raw coal feed is introduced into mixing bin **23** through conduit **24**. Bin **23** is so sized that there is an average contact time between the raw coal feed and the hot finished briquettes of about 10 to 20 minutes, at the end of which time the raw coal and briquettes will be in substantial heat equilibrium. The mixture of raw coal feed and briquettes fall onto endless conveyor **25** which is entrained over pulleys **26** and **27** which are connected to a source of power (not shown) so as to advance the conveyor continuously carrying along with it the mixture of heated raw coal and cooled finished briquettes. As the conveyor passes over pulley **27**, the raw coal and finished briquettes fall off onto screen **28**. The screen is selected so as to have openings large enough to permit the passage of the heated raw coal therethrough, but small enough to prevent the passage of the cooled briquettes therethrough. The cooled briquettes emerge from the lower end of the screen **28** ready for use. The heated raw coal passes through screen **28** into preheated coal chute **29** and thence, by conveyor means **30**, to hopper **5**. From hopper **5** the preheated coal passes by way of coal feeder **31** to conduit **3**.

Example 1

In a typical example, embodying the features of our invention and using the preferred form of the apparatus, the following conditions were employed. The gas from the furnace on analysis showed carbon dioxide, nitrogen, oxygen, and standard products of combustion, depending on the fuel used. The blower was operated to give a velocity of gas of about 3000 to 6000 feet per minute. Approximately 60% of the gas was recycled. Raw coal of 9+ swelling number and mesh size between about 20 and 100 was fed into mixing bin **23** while, simultaneously, hot briquettes also were fed into the mixing bin at a rate equivalent to the raw coal.

Example 2

The blower was operated to give a velocity of gas of about 4500 feet per minute. The furnace gas contained carbon dioxide, nitrogen, oxygen and steam. Approximately 60% of the gas was recycled. A high swelling raw coal having a mesh size between about 20 and 100 was fed into mixing bin **23** while, simultaneously, hot briquettes also were fed into the mixing bin at a rate equivalent to the raw coal. The temperature of the furnace gases which was initially 500° F. dropped to 300° F. after admixture with the coal, and the temperature of the coal at the time it reached the briquetting machine was 295° F.

Example 3

Example 2 was repeated utilizing a high swelling coal having a softening point of about 505° F. and a mesh size of about 20 to 100. About 40% of the gas was recycled. Furnace gases were employed having an initial temperature of 750° F. This temperature dropped to 500° F. after admixture with the coal, and the temperature of the coal at the time it reached the briquetting machine was 495° F.

Example 4

Example 2 was repeated utilizing a high swelling coal having a softening point of about 705° F. and a mesh size of about 20 to 300. About 80% of the gas was recycled. Furnace gases were employed having an initial temperature of 1000° F. This temperature dropped to 700° F. after admixture with the coal, and the temperature of the coal at the time it reached the briquetting machine was 695° F.

While the invention has been described in accordance with the preferred embodiments, it is apparent that many variations and modification may be resorted to without departing from the scope of equivalents within the purview and spirit of this invention, as defined in the appended claims.

This application is a continuation-in-part of our application Serial No. 413,929, filed March 3, 1954, and now abandoned.

We claim:

1. The process of handling raw coal being fed to a briquetting machine comprising feeding coal into a stream of hot gas, moving the coal directly with the aid of said gas to the briquetting machine while simultaneously venting off part of the gas and recycling the remainder of the gas to the stream of gas used to transport the coal, the temperature of the gas being between about 300° F. and 700° F. after admixture with the coal and the temperature of the coal being between about 300° F. and 700° F. when it reaches the briquetting machine rolls, said temperature of the coal being sufficiently high to completely prepare the coal for briquetting.

2. A process as in claim 1 in which the amount of recycled gas to total gas is between about 40% and 80%.

3. The process of claim 1 wherein the gas from the extraneous source is introduced into the main gas stream at a point intermediate the introduction of the recycled gas thereof and the point where the coal is introduced into the gas stream.

4. A process according to claim 1 including the additional steps of mixing the hot briquettes formed with the raw coal, whereby the raw coal is preheated and the briquettes are cooled, separating the briquettes from the preheated raw coal and then feeding the preheated raw coal into the hot gas stream.

5. The process of claim 4 wherein the preheated coal is passed to a cyclone separator with the aid of said gas, separating the coal from the gas in said separator, venting a part of the gas directly from the separator to the atmosphere, recycling the rest of the gas, and allowing the coal to fall from said cyclone separator to said briquetting rolls.

6. The process of claim 4 wherein the recycled gas is introduced into the main gas stream at a point intermediate the introduction of gas from an extraneous source thereof and the point where the coal is introduced into the gas stream.

7. The process of claim 1 in which the coal passes directly from said cyclone separator through an airlock and thence to the briquetting machine.

8. The process of claim 1 in which the temperature of the gas after admixture with the coal is 300° F.

9. The process of claim 1 in which the temperature of the gas after admixture with the coal is 700° F.

10. The process of claim 1 wherein the coal and gas mixture is under the influence of the atmosphere from their point of intermingling to their point of separation.

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