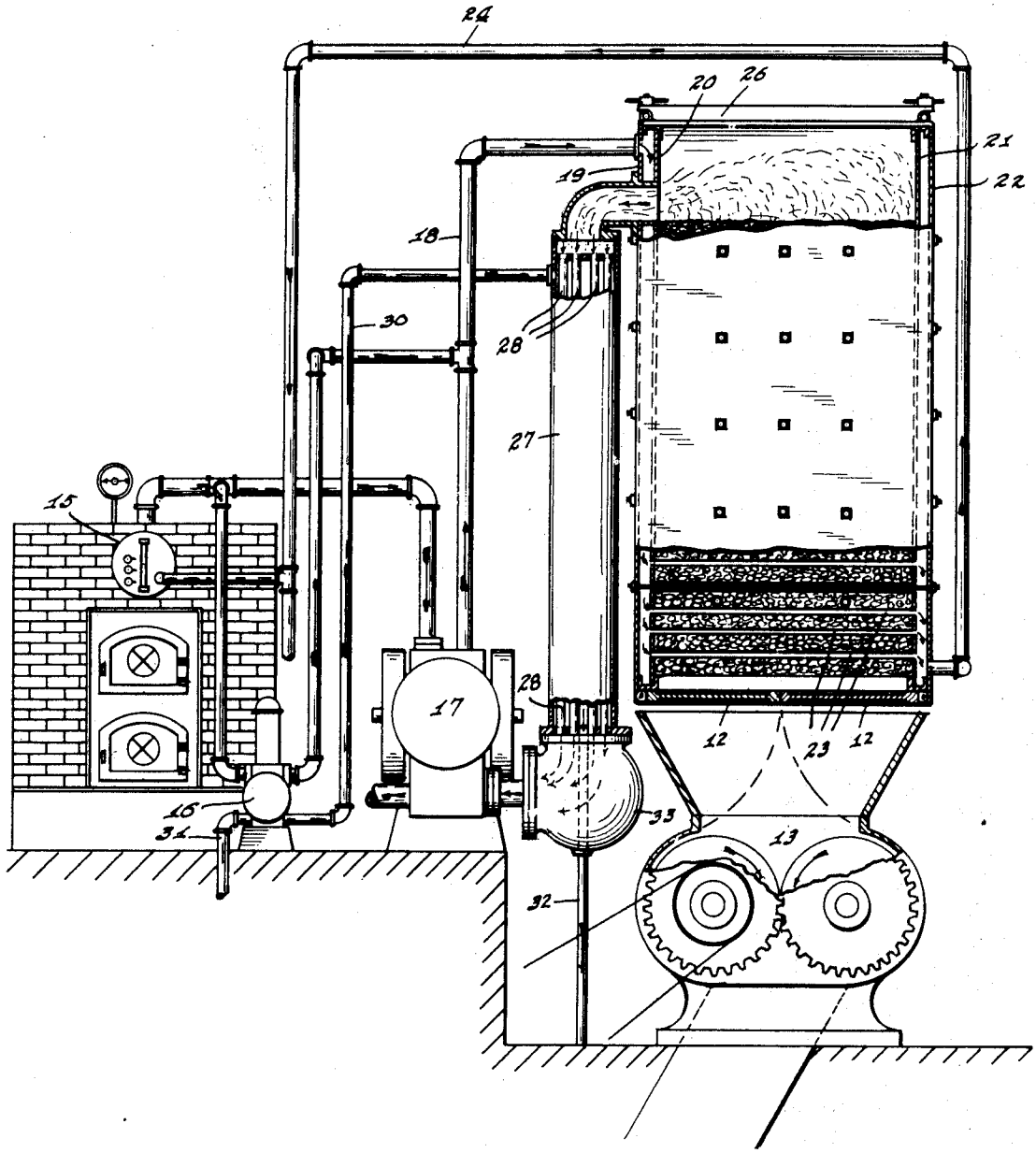
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PROCESS AND APPARATUS FOR DRYING AND PULVERIZING COAL

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PROCESS AND APPARATUS FOR DRYING AND PULVERIZING COAL

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It is the object of my invention to produce an improved apparatus and process for the pulverization of coal or other material normally occurring in lump form. More specifically it is my object to dry the material as well as to pulverize it, and to dry it before pulverization, the drying process which I employ having the effect of making the material more readily capable of pulverization. In addition, it is my object to treat coal by a process which will make it in a finely powdered state less liable to the dangers of spontaneous combustion and explosion.

I accomplish the above objects by drying the material in its lump form, preferably under reduced pressure, and subsequently passing it to a crusher in which it is finely pulverized, and very soon after, or even during the pulverizing, I expose the powdered coal to air.

The accompanying drawing illustrates my invention, the single figure being a somewhat diagrammatic elevation with parts of the apparatus broken away to illustrate more clearly the interior construction.

As stated above, my apparatus and process are capable of use in connection with any lump material having an appreciable moisture content, but for simplicity of explanation, I shall describe my invention as used in connection with the pulverization of coal.

My apparatus embodies a tank or bin 10 in which the lump coal is initially received and dried. The bin 10 which I prefer is arranged to receive coal through its top and to discharge coal through its bottom. To retain the coal in the bin while it is being dried, I may form the bottom of the bin of two hinged doors 12 which when raised serve to close tightly the open bottom of the bin. Below the bin I place a crusher 13 which may be of any desired type. It is not essential that the crusher be located below the bin, but I prefer to arrange it in that position as it is then unnecessary to provide any means for conveying coal from the bin to the crusher.

After the coal has been placed in the bin, I subject it to heat and to reduction of pressure. I prefer to use steam as a medium for heating the coal, and to this end I provide a boiler 15. Steam from this boiler is employed to drive a water pump 16 and an air pump 17, the purpose of which will be set forth below. The exhaust steam from the water pump 16 is combined with that from the air pump 17 and flows through a pipe 18 to a space provided between a side wall 19 of the bin 10 and a partition 20 spaced from such side wall. A second partition 21 spaced from the opposite side wall of the bin 22 provides a second space which communicates with the space between the side wall 19 and partition 20 through a plurality of steam-conducting pipes 23 extending transversely of the bin. The space between the partition 21 and side wall 22 communicates with the return line 24 of the boiler.

To close the upper end of the bin 10 in order that the pressure within it may be reduced, I provide a cover plate 26 which fits tightly against the top of the bin and prevents leakage of any air thereinto. The interior of the bin 10 is connected to the inlet opening of the pump 17 preferably through a condenser comprising a casing 27 and a plurality of tubes 28 extending longitudinally therethrough. The space within the casing 27 and surrounding the tubes 28 is connected by a pipe 30 with the outlet of the water pump 16, the inlet of which is connected by a pipe 31 to any convenient source of water. Water, after its passage through the condenser, is conveyed away through a suitable discharge pipe 32. At the bottom of the condenser I may provide a trap 33 also connected to the pipe 32.

In the operation of my apparatus, the bottom doors 12 are closed, the bin 10 is filled with lump coal, and the cover 26 is applied. Both the doors 12 and the cover 26 are arranged so that when in place they effect air-tight closures for the bin 10. The pumps 16 and 17 are started, and the exhaust steam from these pumps passes through the pipes 23 in the bin 10 and heats the coal therein. At the same time, the air pump 17 is operating to produce a partial vacuum within the tank 10 thus aiding in the vaporization and withdrawal of any moisture content in the coal. Any water vapor passing out of the bin 10 is

condensed in the condenser and collects in the trap 33 from which it is conveyed through the pipe 32. In addition to condensing moisture in order that it may be collected, the condenser aids in the reduction of the pressure within the tank 10. After treatment of the coal within the bin 10 has progressed to a point where the moisture within the coal is substantially entirely removed, the pumps 16 and 17 are stopped, the doors 12 are opened, and the coal drops down into the crusher 13.

I find it advantageous to expose the coal to air after or during pulverization, as this treatment results in a powdered coal which has little if any tendency to spontaneous combustion. In carrying this out, I prefer to complete the pulverization of the coal in a ball and tube mill from which the powdered coal is removed in suspension in an air current, although any means may be employed which will enable the surface of the small coal particles to be exposed to air. Owing to the breaking up of the coal into fine particles, its surface area is greatly increased; and the action of the air on this relatively great surface area while the coal is being agitated, coupled with the preliminary treatment in the drying bin, has the effect of altering the character of the coal in such a manner that the well recognized tendency toward spontaneous combustion of finely powdered coal is practically eliminated. It is desirable that the steps of final pulverization and exposure to air follow shortly after the drying of the coal in the drying bin and before it has had an opportunity to re-absorb moisture; as otherwise the resulting product will not be so stable, and elaborate precaution must be taken to guard against the dangers of explosion and spontaneous combustion.

I am aware that it is old to dry materials by simultaneously heating them and reducing the pressure to which they are subjected. However, in addition to its stabilizing effect on coal, I have discovered that this process is of decided value in connection with the subsequent pulverization of coal or other lump material containing moisture. The simultaneous heating and reduction of pressure to which I subject coal appears to produce a vaporization of the mixture within the individual lumps, and the vapor so formed in escaping from the lumps tends to break them up or disintegrate them, and tends further to make such lumps as do remain more fragile and brittle. As a result, coal treated in my apparatus is much more readily pulverized than is untreated coal.

I claim as my invention:—

1. The process of treating coal, comprising enclosing the material in a chamber, heating it and reducing the pressure in the chamber to partially disintegrate the coal, and subsequently completing the pulverization initiated by the partial disintegration of the coal in the chamber.

2. The process of treating coal, comprising enclosing the material in a chamber, reducing the pressure in the chamber, to cause partial disintegration of the coal and subsequently completing the pulverization initiated by the partial disintegration of the coal in the chamber.

3. The process of treating coal, comprising enclosing the coal in a chamber, heating it and reducing the pressure in the chamber to cause partial disintegration of the coal, subsequently completing the pulverization of the coal, and after or during pulverization exposing the powdered coal to the action of air.

4. The process of treating coal, comprising enclosing the coal in a chamber, reducing the pressure in the chamber to cause partial disintegration of the coal, subsequently completing the pulverization of the coal, and after or during pulverization exposing the powdered coal to the action of air.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 14th day of July, A. D. one thousand nine hundred and twenty-seven.

FREDERIC I. BARROWS.