May 19, 1925. 1,538,192

V. G. LEACH

APPARATUS FOR CONDITIONING CRUSHED MATERIAL

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Fig. 1

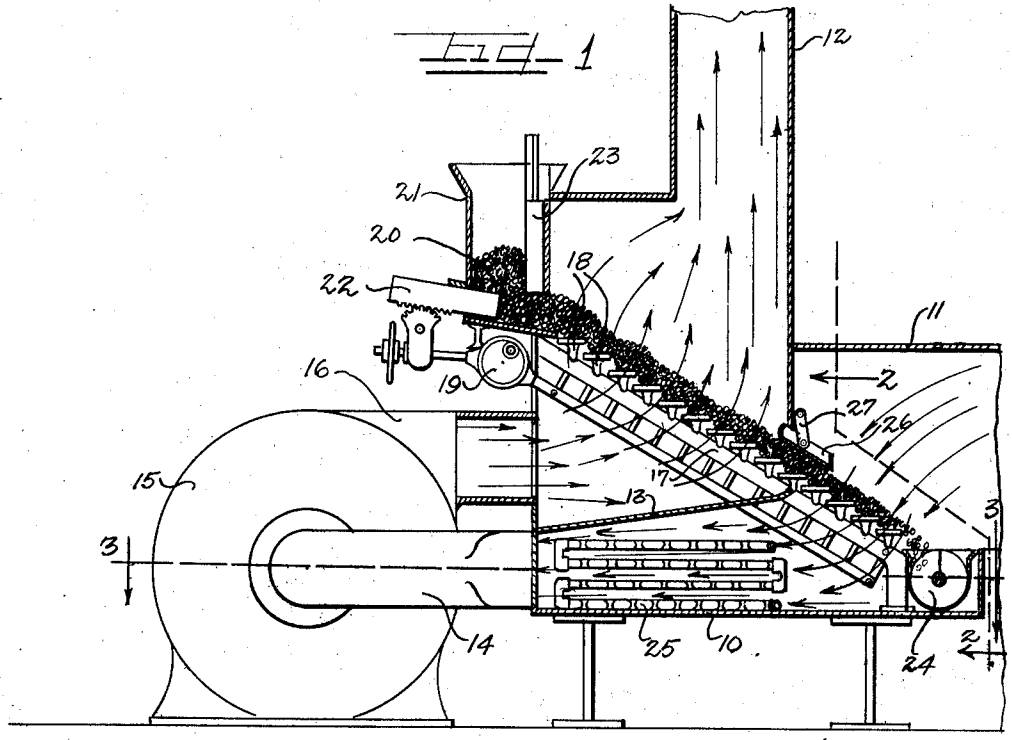


Fig. 4

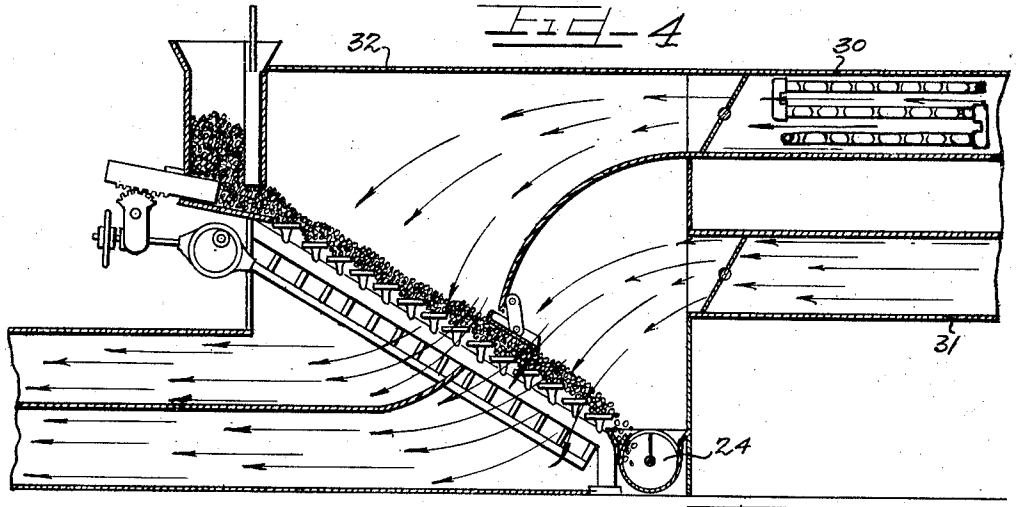


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FIG 2

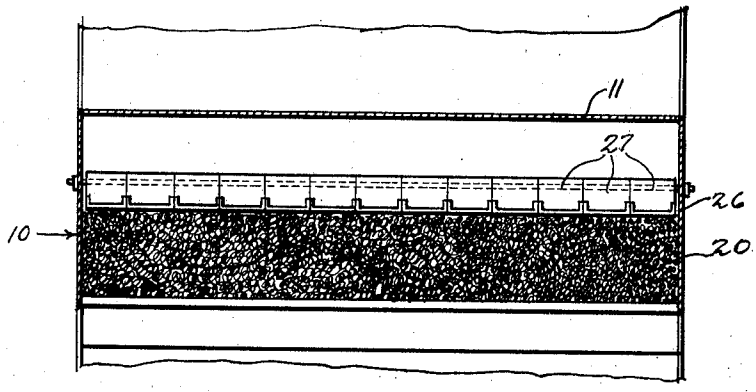
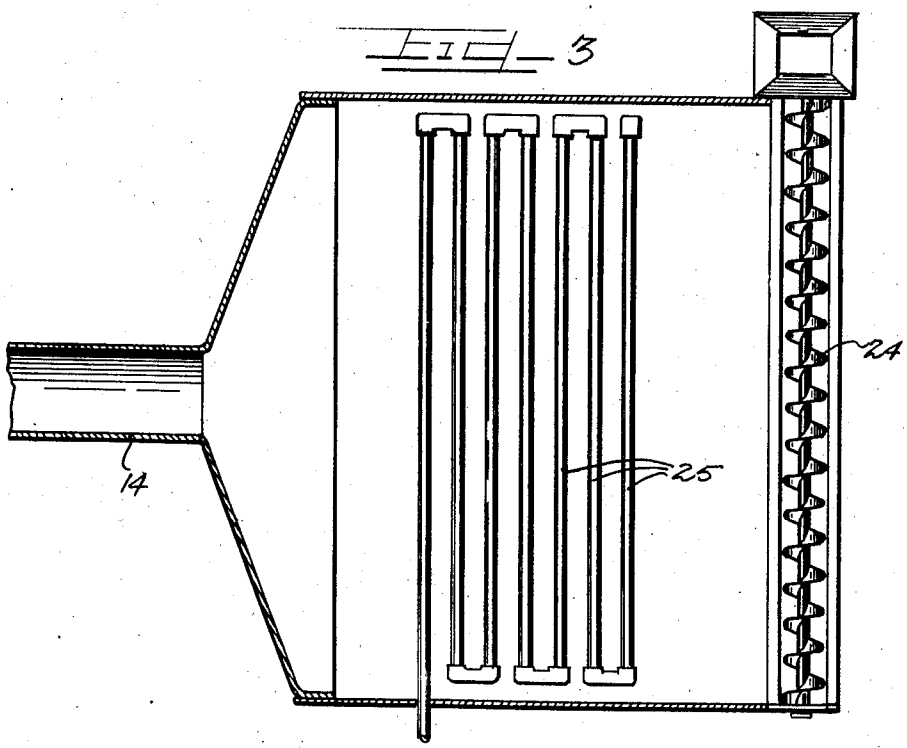



FIG 3

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# UNITED STATES PATENT OFFICE.

VERNON GARDE LEACH, OF CHICAGO, ILLINOIS.

## APPARATUS FOR CONDITIONING CRUSHED MATERIAL.

Application filed March 21, 1924. Serial No. 700,787.

*To all whom it may concern:*

Be it known that I, VERNON GARDE LEACH, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in an Apparatus for Conditioning Crushed Material; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to an apparatus for conditioning granular or pulverulent material more particularly crushed or powdered coal.

Powdered coal should be dry when used not only for the reason that the efficiency of combustion is increased but also because moisture in coal creates difficulties in conveying, handling, and storing.

Further, in pulverizing crushed or granular coal, more power is required if the coal is moist.

In addition to the desirability of low moisture content, it is advantageous to pass the coarsely crushed coal to the pulverizers cold. One of the great difficulties with all dryers on the market today is the fact that the coal is introduced into the pulverizer while hot. When hot, the particles of coal tend to adhere to each other and clog the pulverizer, transportation pipe lines, etc. Further, when a warm lump of coal is broken it steams as the result of the vaporization of the moisture contained in the interior of the lump. This steam or water vapor then condenses on the cold walls of the pulverizer, pipe line and so forth and causes the powdered coal to adhere thereto. If, however, the lump is cooled to atmospheric temperature this vaporization does not occur. Hence it is desirable not only to dry the coal but also to cool it nearly to atmospheric temperature before introducing it into the pulverizer. The coal should, therefore, be conditioned rather than merely dried.

Various methods and apparatus have been proposed for drying coal. Thus it has been proposed to use the heat from waste or chimney gases to dry the coal. This involves not only difficulties in controlling the heat used but also occasions loss of volatile constituents, danger of ignition of the powdered fuel and so forth.

Waste or chimney gases contain a considerable proportion of water-vapor so that when cooled to atmospheric temperature dew will be deposited with the result that if powdered coal dried by such gases is passed through a pipe line exposed to the atmosphere dew will deposit on the interior of the pipe which dew will cause the coal to adhere to the side of the pipe and clog the latter.

It is necessary, therefore, not only to vaporize the moisture carried by the coal, but also to reduce the moisture content of the air or gas entrained in the crushed mass below the dew point. This involves first the use of a gas having a moisture content below the dew point, and second, the displacement of gases heavily laden with moisture by gases which will not deposit dew on cooling to ordinary temperatures.

Coal when freshly mined may contain much water. Most of the water may be removed by air drying at ordinary temperatures, while the remainder (usually some 2 to 3 per cent) is almost completely lost at 105 degrees centigrade.

The moisture which air or other gases can take up is a function of temperature. Atmospheric air is rarely saturated but its capacity to take up additional moisture is small. If the air is heated, its capacity to absorb water vapor is greatly increased.

If heated air is passed through a mass of coal the air takes up a part at least of the moisture of the latter and simultaneously heats up the coal. If, therefore, air at atmospheric temperature is passed through such heated coal the air is warmed thereby and its moisture absorbing power is increased.

Very efficient drying may be obtained by first passing heated air through the mass to eliminate a part of the moisture and simultaneously heat the coal and then passing air at atmospheric temperature through the heated coal to utilize the heat of the latter in warming the air so that it is capable of readily absorbing the moisture in the coal in the first stage of the process or for other useful purposes such as air for combustion.

The passage of air at atmospheric temperature through the crushed coal sweeps

out of the interstices in the latter any air having a high moisture content so that the air entrained in the final product will not deposit dew in any subsequent operation. In this condition both the crushed coal itself and the air surrounding the particles and entrained therein are in substantial equilibrium with the prevailing atmospheric conditions so far as their temperature and moisture contents are concerned.

It is an object of the present invention, therefore, to provide efficient, simple and readily-controlled means for conditioning granular or pulverulent material such as crushed coal.

Other and further important objects of this invention will be apparent from the disclosures in the accompanying drawings and the following specification.

The invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a vertical section through an apparatus constructed in accordance with the present invention.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a section on the line 3—3 of Figure 1.

Figure 4 is a vertical section through a modified form of apparatus.

As shown on the drawings:

The form of apparatus shown in Figures 1, 2 and 3 comprises a casing 10 provided with an air inlet duct 11 and air discharge duct 12 and a partition 13 adapted to prevent air passing directly from the duct 11 to the duct 12. The lower chamber formed by the partition 13 is in communication with the intake 14 of a centrifugal fan 15. The discharge duct 16 of this fan is connected with the upper chamber of the casing.

Extending obliquely across the casing and through the partition 13 is a support 17 for the material to be treated. This support may conveniently be constructed on the principle of one or other of the well-known forms of mechanical stokers comprising a series of bars 18 arranged step-wise for simultaneous movement by an eccentric 19.

The crushed material 20 is fed onto this inclined support from a hopper 21 by means of a plunger 22 which is reciprocated by the eccentric 19. A gate 23 at the front of the hopper is provided to adjust the amount of fuel delivered to the support 17.

At the lower end of the support a screw or other suitable conveyor 24 is provided for discharging the material as it drops off the end of the support 17.

Below the partition 13 are arranged means for heating the air which is drawn through the bed of material from the duct 11. These means may be varied to suit varying conditions. In many cases it will be convenient to use heat exchangers, such for example as a series of coils 25 heated by steam, waste gases, etc. By this means the air discharged by the fan 15 and forced upwardly through the bed of material into the discharge duct 12 is heated first by the warm bed of material and second by the steam coils.

The passage of air directly from the duct 11 to the duct 12 over the layer of material passing down the support 17 is prevented by means of a series of shoes 26 pivotally supported by links 27. These shoes ride on the upper face of the layer of material and may rise and fall with it.

In the form of construction shown in Figure 4, the air is not passed twice through the bed of material with an intermediate heating operation. In this case there are two inlet ducts 30 and 31 leading to the casing 32, through which air may be passed by fans or blowers not shown. Where air is introduced through both ducts the upper duct 30 contains heat exchanging means such for example as a steam coil 33 for heating the air flowing therethrough. If waste hot gases are introduced through the duct 30, the heating means may be omitted. The air which passes through the lower duct may to advantage be used in combustion, in view of the heat it contains. In other respects, the construction is similar to that shown in Figures 1 to 3.

In the present art of furnace construction it has been found desirable to use hollow furnace walls, air cooled, largely for their protection. Such air is used to support combustion. In my invention I anticipate the use of such heated air for the conditioning of the fuel.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. An apparatus for conditioning crushed material, comprising a support, means for passing a continuous layer of material of substantial depth over said support, and means for passing first a current of heated gas and then a current of unheated gas through the material as it passes over said support.

2. An apparatus for conditioning crushed material, comprising a support, means for passing a continuous layer of material of substantial depth over said support, means for passing a current of unheated gas through the material as it passes over the last part of said support, means for heating the current of gas after it has passed

through the material and means for repassing the gas so heated through the material as it passes over the first part of said support.

3. An apparatus for conditioning crushed material comprising a casing, a support within said casing, means for passing a continuous layer of material of substantial depth over said support, a partition within the casing intermediate the ends of said support, a movable closure member adapted to rest upon said layer and rise and fall therewith to prevent the passage of gases between the lower edge of said partition and said layer of material.

4. An apparatus for conditioning crushed material comprising a casing, a support within said casing, means for passing a stream of material over said support, a partition within the casing intermediate the ends of said support, and means for passing currents of gases through said stream of material on either side of said partition.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

VERNON GARDE LEACH.

Witnesses:

RIDSDALE ELLIS,

HENRY WESCOTT WALKER.