Feb. 27, 1934. H. KREISINGER 1,949,279

SEPARATING SYSTEM

Filed March 3, 1931 2 Sheets-Sheet 1

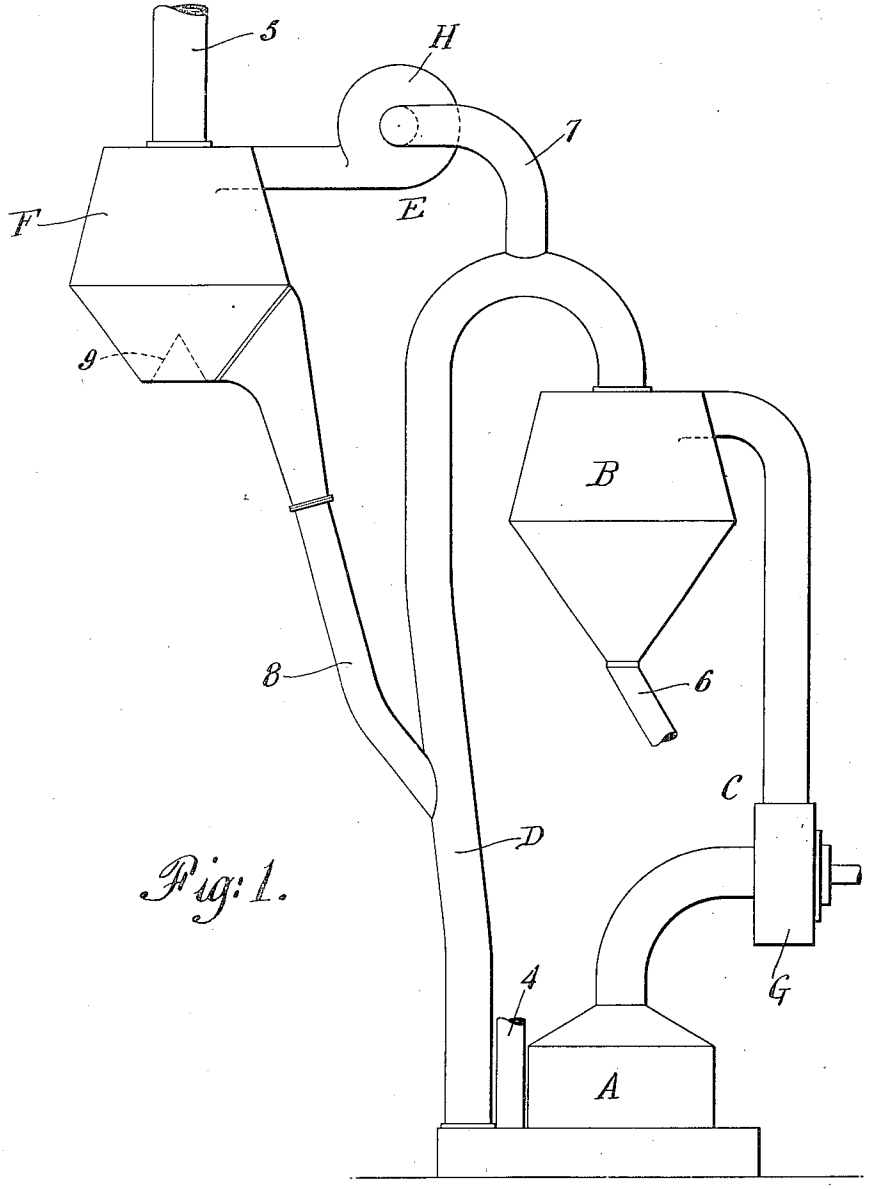


Fig. 1.

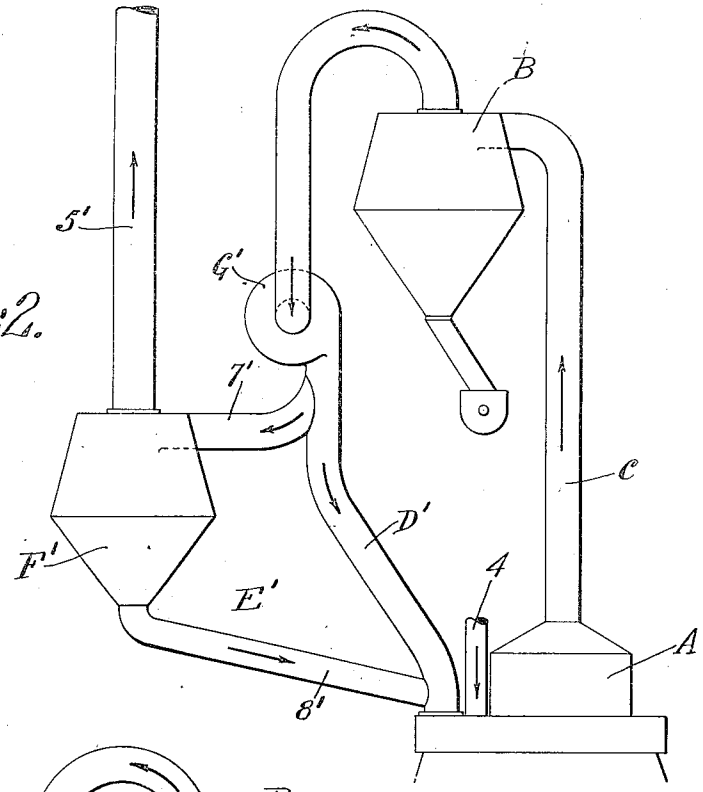
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Fig. 2.



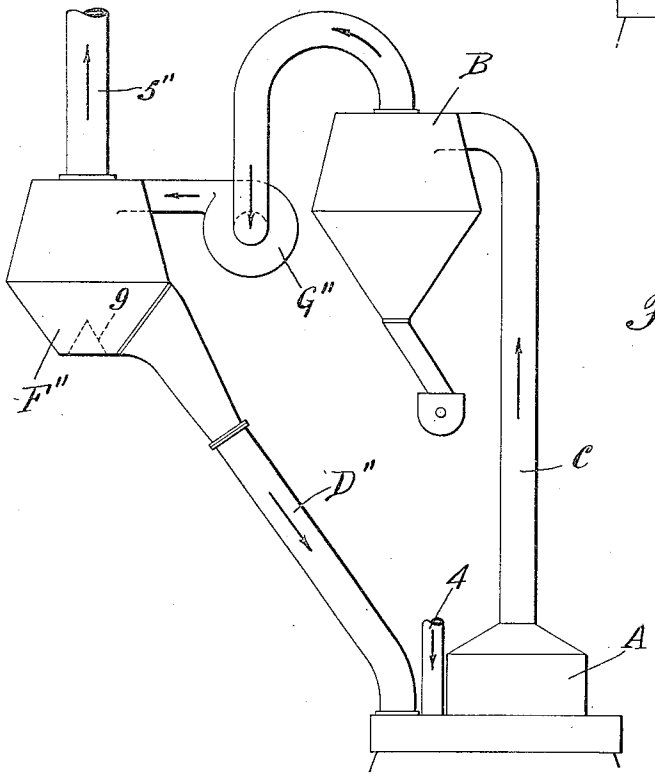


Fig. 3.

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SEPARATING SYSTEM

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Application March 3, 1931. Serial No. 519,798

7 Claims. (Cl. 209—144)

This invention relates to improvements in separating systems and is, in part, a continuation, and, in part, a division of my copending application Serial No. 334,592, filed January 23rd, 1929, on Fuel pulverizing system.

The invention is particularly useful in pulverized fuel separating systems of the so-called closed type in which gas is circulated to move a mixture leaving a mill to separating means and in which unseparated mixture is returned to the mill and from which gas is withdrawn or exhausted, the latter being necessary particularly where heated gas is introduced into the system for drying purposes.

The primary object of my invention is to provide an improved separating system in which gas may be withdrawn without difficulties because of the escape of pulverized material.

Another object of my invention is the provision of a separating system in which concentration of dust in gases is effected in a manner to enable clear gas to be discharged from the system.

How the foregoing, together with such other objects and advantages as may hereinafter appear or are incident to my invention are realized, is illustrated in preferred form in the accompanying drawings wherein—

Figure 1 is a more or less diagrammatic elevational view of a system embodying my invention; and

Figures 2 and 3 are similar views of modifications of the invention.

Referring now more particularly to Figure 1, it will be seen that the system comprises in general a pulverizer mill A, a centrifugal separator B, a delivery line C leading from the mill to the separator, a return line D leading from the separator B back to the mill, and a branch or bypass line E, in this instance leading from the upper portion of the line D and returning thereto at the lower portion thereof. A concentrator F is located in the line E. Heated air or gas is introduced into the system through a pipe 4, which pipe preferably discharges into the mill A at a point adjacent the return line D.

The system is provided with means such as a blower G for setting up a current of gas in the system, which blower may be located in the delivery line C as illustrated. Gas, preferably in an amount corresponding to the amount of heated gas introduced, is withdrawn from the system through a pipe 5 leading off from the concentrator F. An air or gas washer may be associated with the pipe 5.

The separator B is of the cyclone type in which the mixture is tangentially introduced so that the entering velocity of air and dust sets up a rotary motion of the mixture within the separator. Centrifugal force throws the dust toward the walls of the separator, leaving partly clean gases flow out through the outlet in the center at the top of the separator to which the return line D is connected. The separated dust is deposited in the spout 6 at the apex of the separator and is removed from the cyclone without practically any gases.

In systems of which I am aware, high pressure cyclone separators are employed so that fairly complete separation may be obtained. This type of separator requires a pressure drop of from six to eight inches through the separator, which causes high suction in the separator itself, making the removal of powdered material from the separator difficult.

I propose to employ a separator and a concentrator, preferably both of low pressure, so that a total pressure drop equal to the pressure drop of one high pressure separator is obtained.

The separator B separates most of the coal from the gases and discharges it through the spout 6 which may lead to a conveyor. The gases containing a very fine dust leave the separator B at the top, and some of these gases return directly to the mill A through the return line D, while the remainder of the gases are forced into the concentrator F as by means of a fan H located in the section 7 of the line E. The fine dust will be concentrated into a small volume of the gases in the concentrator F and is returned through the section 8 of the branch line E to a suitable point in the mill system, in this instance the delivery being into the lower portion of the return line D. The gas with the least concentration of dust discharges from the concentrator through the pipe 5.

I have found that it is easier to concentrate most of the dust in the gas to be returned to the mill than it is to separate it completely from the gas, the difficulty in the latter case being due to the fineness of the dust and to the commotion in the separator which keeps the fine particles in suspension, thus preventing a complete separation. Therefore, I prefer to take the air with the concentrated dust from the side of the separator for discharge back into the system, as above pointed out. A cone 9 may be provided at the bottom of the concentrator F, so that dust which may tend to deposit will be swept away by the moving gas into the section 8 of the branch line E.

If for example, 16,000 C. F. M. of gas is circulated in such a system, 8,000 C. F. M. is returned directly to the mill through the return line D, 8,000 C. F. M. enters the section 7 of the branch line E and is passed into the concentrator F, 2,000 C. F. M. with concentrated dust passes from the concentrator F to the mill through the section 8 of the branch line E, and 6,000 C. F. M. discharges from the concentrator F through the pipe 5, 6,000 C. F. M. of heated gas having been added to the system through the pipe 4.

The above figures are used merely as an illustration. If more drying is required, a greater volume of hot gases is added to the mill system and an equally greater volume of gas discharged from the system.

It is pointed out that through the arrangement just described, existing fuel pulverizing systems may be readily converted so as to have new advantages such as hereinbefore set forth.

Referring now to the modification illustrated in Figure 2, it will be seen that the blower G' is located in the return line D' of the system, i. e., it is located after the separator B so that the blower handles the gases after most of the dust has been separated from them by the separator. Part of the gases are returned from the blower G' directly to the mill A through the return line D', and another part, somewhat greater than the volume of heated gas introduced into the mill at 4, is forced into the concentrator F', located in the branch line E', which line comprises a section 7' leading from the return line D' to the concentrator, and a section 8' leading from the concentrator to the return line at a point adjacent the mill. This concentrator is of simple form and concentrates the fine dust with a small volume of gases and returns it to the mill system. The section or duct 8' is connected to any source of suction, in this instance to the return line at a point adjacent the mill, and therefore the concentrated mixture is removed from the concentrator and the nearly clean gases leave it through an outlet or vent pipe 5' which is provided at the top of the concentrator. Any energy that the rotating concentrated mixture may possess is dissipated in the section or duct 8'. In this arrangement only one blower is employed and it is so located that abrasion of the fan blades is minimized.

In the modification illustrated in Figure 3, I have shown a simplified arrangement in which all of the gases of the system pass through the concentrator F'', which arrangement is particularly well adapted to drying and pulverizing very wet coal. In such cases a large volume of heated gas is introduced into the system at 4 for drying purposes, so that by far the larger part of the gases must be vented through the vent 5'' of the concentrator and only that volume of gases in which the fine dust has been concentrated is returned to the system through the lower section of the return line D''. The arrangement of the mill A, separator B, and blower G'', is substantially the same as that described in connection with Figure 2.

I claim:—

1. In a separating system, a mill, a centrifugal separator, a conduit between the mill and separator, a return line leading from said separator to said mill, a branch line leading off from and returning to said line, a centrifugal concentrator in said branch line, means for introducing heated gas into the system, means for setting up a current of gas in the system, and means for exhausting gas in the system from said concentrator.

2. A concentrator for venting air from an air stream in which finely divided materials are suspended, comprising a closed housing of inverted conical form, an air inlet passage leading substantially tangentially into the larger upper portion of the housing, a relatively large air outlet leading vertically upward from the central portion of the top of the housing, there being an upwardly projecting cone positioned centrally in the smaller lower end of the housing, and a relatively small outlet passage leading from the lower portion of the housing at the side of the cone through which the material is withdrawn in suspension in an air stream.

3. In combination with a closed circulation system including a source of finely divided material, a separator, a conduit through which the material in suspension in an air stream is carried to the separator, a conduit through which the air stream relieved of the greater portion of the material is delivered back into the source, and means for propelling the air through the closed circulation system, means for introducing additional heated air into the system, and means for withdrawing and venting a portion of the original air stream comprising a concentrator in the form of a cyclone separator, a conduit through which air is withdrawn from the returning air stream between the first mentioned separator and the source and introduced into the concentrator, an outlet for venting air from the upper portion of the concentrator, and a conduit leading from the lower portion of the concentrator back into the main circulating system through which a portion of the air with the concentrated material suspended therein is returned to the closed circulation system.

4. In combination with a closed circulation system including a source of finely divided material, a separator, a conduit through which the material in suspension in an air stream is carried to the separator, a conduit through which the air stream relieved of the greater portion of the material is delivered back into the source, and means for propelling the air through the closed circulation system, means for introducing additional heated air into the system, and means for withdrawing and venting a portion of the original air stream comprising a concentrator in the form of a cyclone separator, said concentrator having an outlet for the air to be vented from the system, and means for positively withdrawing a portion of the returning air stream between the first mentioned separator and the source, circulating this withdrawn air through the concentrator, and returning a portion thereof to the main air stream with the finely divided material separated out in the concentrator.

5. In combination with a closed circulation system including a source of finely divided material, a separator, a conduit through which the material in suspension in an air stream is carried to the separator, a conduit through which the air stream relieved of the greater portion of the material is delivered back to the source, and means for propelling the air through the closed circulation system, means for introducing additional heated air into the system, and means for withdrawing and venting a portion of the original air stream comprising a concentrator in the form of a cyclone separator of inverted conical form, a conduit through which an auxiliary air stream is withdrawn from the returning air stream be-

tween the first mentioned separator and the source and introduced tangentially into the upper portion of the concentrator, an outlet for venting air from the upper central portion of the concentrator, a conduit leading from the lower portion of the concentrator back into the main circulating system through which a portion of the air with the concentrated material suspended therein is returned to the closed circulation system, and means for enforcing the circulation of this auxiliary air stream.

6. In a system for handling a mixture of gas and dust for the collection of the dust and the discharge of clear gas; a source of supply of the gas mixture; a conical cyclone concentrating device and a conical cyclone separating device, means connecting one of said devices to receive the gas mixture from the source of supply and to deliver to the other device only a part of the gas so received, means connecting said other device to return gas to the system for treatment in the device which first receives the gas mixture from the source of supply; said separator having a tangential inlet opening in the upper portion, an outlet at the bottom for discharge from the system of dust separated in the separator and having an outlet opening in the upper portion thereof for gas containing unseparated dust; said concentrator having a tangential inlet opening in the upper portion, a relatively large outlet opening in the top thereof for discharge of clear gas from the system, said gas constituting the major portion of the gas handled by the concentrator, and an outlet opening at the bottom thereof for the minor portion of the gas handled thereby and in which dust is concentrated; means for creating a flow through the concentrator; and means for creating a flow through the separator.

7. In a system for handling a mixture of gas and dust for the collection of the dust and the discharge of clear gas; a conical cyclone concentrator member and a conical cyclone separator member; means connecting each to deliver gas for treatment in the other and to receive gas for treatment from the other, one member having two points of delivery, one such point being the other member, whereby one member handles only a portion of the volume of the gas handled by the other; the concentrator having a tangential inlet in the upper portion, a relatively large central outlet in the top thereof for discharge from the system of clear gas therefrom, said gas constituting the major portion of the gas handled by the concentrator, and a relatively small discharge outlet at the lower part thereof for discharge of the minor portion of the gas handled thereby, said minor portion containing the dust concentrated therein for treatment in the separator; said separator having a tangential inlet in the upper portion, an outlet at the bottom for discharge from the system of the dust separated therein, and a central outlet in the top thereof for gas containing unseparated particles for further treatment; a source of supply of the mixture; means for causing a flow through the concentrator; and means for causing a flow through the separator.

HENRY KREISINGER.