

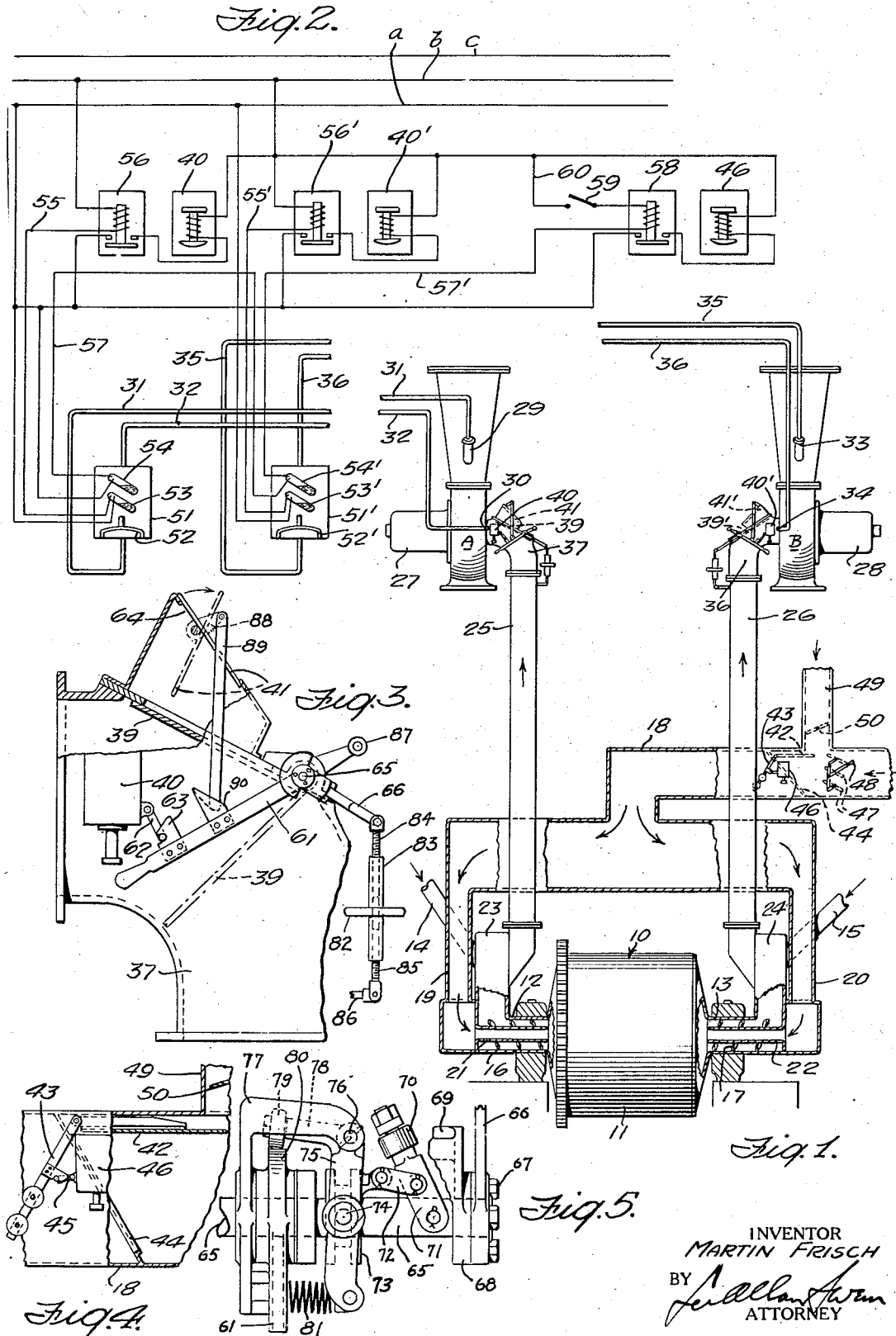
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PULVERIZING SYSTEM

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PULVERIZING SYSTEM

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This invention relates to pulverizing systems and more particularly pertains to systems for pulverizing fuel such as coal, and feeding the fuel to a zone of combustion such as the furnace of a steam generator, or the like.

In systems of this character, the fuel after having been pulverized to the desired fineness is ordinarily carried by a single current of air moving through a conduit directly to one or more fuel burners. This air is preheated to the desired temperature and is first conducted under pressure to the pulverizing means, such as a single ball mill, by an air duct, and the flow of air through this duct is controlled ordinarily by one or more dampers, the arrangement being such that when for any reason the burners or the mill are shut down, the flow of hot air to the mill will be stopped, as otherwise a serious explosion might occur. However, where a plurality of fuel-air streams flow from the mill to the combustion zone, it is desirable frequently to operate with less than all these fuel-air streams. In these circumstances, it is necessary to maintain the flow of preheated air to the mill so long as combustion is maintained, but to discontinue the supply of preheated air to the mill as soon as combustion entirely ceases to avoid the possibility of explosion in the system.

The present invention provides improved means for controlling the flow of preheated air to the pulverizer in pulverizing systems wherein a plurality of fuel-air streams flow from the pulverizer to the combustion zone and for controlling these fuel-air streams in response to varying operating conditions and fluctuations in pulverizer output requirements.

The particular features and advantages of the invention will be understood from the following description when considered in connection with the accompanying drawing forming a part thereof, and in which:

Fig. 1 is a more or less diagrammatic view, partly in elevation and partly in section, of a pulverizing and fuel feeding system embodying the invention;

Fig. 2 is a diagrammatic view of the automatic control means;

Fig. 3 is an enlarged elevational view of part of the apparatus shown in Fig. 1;

Fig. 4 is a partial elevational and longitudinal sectional view of a further part of the apparatus shown in Fig. 1, and

Fig. 5 is an elevational view of damper control means for controlling in part the output of the pulverizing means.

Like characters of reference refer to the same parts in the several views.

Referring to the drawing, reference character 10 designates generally a ball mill pulverizer comprising a cylindrical shell 11 which contains the material to be pulverized and grinding balls of various sizes. The shell is supported by hollow trunnions 12 and 13 and is adapted to be rotated about its horizontal axis. In the form of the invention chosen for illustration, the unground coal or other material, is introduced to the mill at both ends through feed conduits 14 and 15, which communicate with the hollow trunnions. Helical conveyors 16 and 17 within the trunnions, and connected to the shell for rotation therewith, convey the unground material into the shell. Air in sufficient quantity and at the proper temperature is conducted to the mill through a main air duct 18 and branch ducts 19 and 20 which communicate with the interior of the shell at both ends thereof by means of conduits 21 and 22 extending through the trunnions 12 and 13 respectively. As the material is pulverized, it is picked up by the air currents flowing into the shell and carried by the air from the shell in separate streams through each of the trunnions to classifiers 23 and 24 wherein undesirably coarse or oversize particles of the material are separated from the air streams, drop out of the classifiers, and are returned by the conveyors 16 and 17 to the interior of the shell. The material which has been pulverized to the desired extent is borne by the air streams through conduits 25 and 26 to a pair of similar exhausters individually designated A and B, which are driven by electric motors 27 and 28 respectively. It will be understood that each exhauster discharges through a suitable conduit to a separate burner or to separate burner groups, which may be employed in the firing of a single furnace or a plurality of separate furnaces.

Connected to exhauster A at points 29 and 30, are pressure tubes 31 and 32 respectively, while connected to exhauster B at points 33 and 34 are similar pressure tubes 35 and 36. The conduits 25 and 26 are respectively connected to the exhausters A and B through exhauster inlet elbows 37 and 38. In the elbow 37 is a damper 39 for controlling the flow of fuel to the exhauster, and the mill output is controlled in part by regulation of this damper. As shown in the drawing, the damper 39 is in fully opened position. The position of the damper 39 may be adjusted to points between fully opened and

fully closed positions, and maintained in any adjusted position in response to variations in combustion requirements by suitable means actuated either manually or automatically. One such means will be described hereinafter. When the exhauster is shut down, or ceases to operate normally due to emergency conditions, the damper 39 automatically closes, thereby shutting off completely the supply of fuel to the exhauster. The damper is held in the desired open position by the adjusting means referred to, and lever 61 which releases the damper from the adjusting means, is retained in the position to effect the release of the damper by a latch 62 which engages the keeper 63 thereon and is actuated by a solenoid 40. In normal operation, the solenoid 40 is deenergized and the latch is positioned to hold the lever 61 in the position shown in Fig. 3 for an open position of the damper. Upon failure of the exhauster for any reason, or upon normal shut down of the furnace or mill, the solenoid 40 will be energized and the latch 62 will be tripped to release the damper so that it will move to closed position by gravity. An air inlet 64 is provided in the elbow 37 which is controlled by a damper 41, and means are provided to cause this damper 41 to open when the damper 39 closes so that fresh air may be drawn into the elbow and the associated elements of the system to prevent explosions. Inlet elbow 38 of exhauster B is similarly constructed and is provided with similar dampers and control means therefor.

An emergency shut off damper 42 is disposed in the hot air duct 18 leading to the mill. Connected to this damper is a lever 43 for manually moving the damper to open position. Within the duct 18 is a vertically inclined seat 44 for the damper when it is in closed position. The damper is maintained in open position in normal operation by a latch 45 controlled by a solenoid 46 and which engages the keeper on the lever 43. The arrangement is such that when the solenoid is deenergized, the latch will hold the damper in open position, but when the solenoid is energized the latch will trip and the damper will move to closed position by gravity, it being understood that the damper is of greater weight than the lever 43. The hot air duct 18 is also provided with throttling dampers 47 for maintaining the desired suction on the mill. These dampers may be manually operated by a lever 48, or they may be automatically controlled by a mill suction regulator, if desired. Connected to the hot air duct between the emergency shut off damper 42 and the throttling dampers 47 is a tempering air inlet duct 49. Flow of air at atmospheric temperature through the duct 49 into the duct 18 is controlled by a damper 50.

In the present system, where one mill supplies fuel to two exhausters operating in parallel, it may be frequently desirable, or at times necessary, to shut down only one of the exhausters, in which case, the hot air supply must be maintained until the second exhauster shuts down and the mill operation ceases. In accordance with the present invention, the hot air damper is maintained in open position as long as one exhauster is operating and until both exhausters are shut down, and when both exhausters are no longer functioning the damper automatically closes to cut off the flow of hot air to the mill.

Referring to Fig. 2, an exhauster controller 51 is connected across the exhauster A by the pressure tubes 31 and 32, and a similar exhauster

controller 51' is connected across exhauster B by the pressure tubes 35 and 36. The exhauster controller 51 includes a mercury sealed bell 52 and mercoild switches 53 and 54 which are closed by downward movement of the bell and opened by upward movement thereof, and exhauster controller 51' includes a similar mercury sealed bell 52' and similarly operated mercoild switches 53' and 54'. Shut down or failure of either exhauster will cause pressure changes on the inlet and discharge sides of each exhauster which will be transmitted to the controller connected to the exhauster. The mercoild switches 53, 54 and 53', 54' which are all shown in open position, are connected to a three-phase electrical circuit *a*, *b*, *c* which is connected to a source of power. Assuming that both exhausters are operating, if exhauster A is shut down or fails, the pressure at 29 in the exhauster will decrease and at 30 will increase. This change in pressure lowers the bell 52 in the controller 51 and closes the switches 53 and 54. The switch 53 however, is mounted and actuated so that it passes through an open-close-open cycle upon downward movement of the bell 52, with the result that the damper 39 is caused to close by the momentary energization of the solenoid 40 through lead 55 and contactor 56. The switch 53 is arranged to move back to open position to prevent burning out of the coil of solenoid 40. The switch 54 remains in closed position until the bell 52 moves upwardly. When exhauster B is shut down, the pressure changes resulting will be transmitted to the controller 51', the bell 52' will move downwardly and the switches 53' and 54' will be moved to closed position. The switch 53' is mounted and actuated so that it passes from open to closed to open position upon downward movement of the bell 52', with the result that the solenoid 40' is momentarily energized through lead 55' and contactor 56'. The damper 39' is moved to closed position. The switch 54' remains closed, and since this switch is in series with the closed switch 54, the hot air shut-off damper circuit is closed through lead 57' and contactor 58, which energizes the solenoid 46 and thus permits the hot air shut-off damper 42 to close. As the damper 42 approaches closed position, a limit switch 59 in lead 60 is automatically tripped open by any suitable means, not shown, connected to and operated by the damper 42 or its associated mechanism. This opens the circuit to solenoid 46 and prevents burning out of the coil of the solenoid.

In starting the system, the several dampers are opened manually and latched in open position. After normal pressure is attained in the controllers by operation of the exhausters, the bells 52 and 52' in the controllers will move upwardly and will open the switches 54 and 54'. The limit switch 59 is then closed and the system will then operate normally with both exhausters functioning.

From the foregoing it will be perceived that with this arrangement, preheated air will continue to be supplied to the pulverizing means so long as any fuel-air mixture is flowing to the burners or to the combustion zone or zones supplied by the pulverizing means, but that as soon as the flow of fuel-air mixture is cut off entirely for any reason, the supply of preheated air to the pulverizing means is also cut off, thereby avoiding any chance of an explosion in the mill or in the system. This arrangement includes control of each fuel-air stream from the mill to

the extent that upon failure or shut down of any exhauster, that exhauster and the burners served thereby will be isolated from the mill by a cut-off damper such as damper 39 in elbow 37 which is connected to the exhauster A, thus avoiding explosion due to flame propagation to the mill.

The use of a plurality of exhausters with a single mill provides greater flexibility of control of the firing means and greater efficiency of operation of the pulverizing system.

Manually operated means are shown for regulating the position of the damper 39. The damper is fixed to a shaft 65 (Fig. 5) which extends beyond the elbow in which the damper is mounted, and on the outer end portion of the shaft 65, a control arm 66 is mounted for free movement with the shaft. Secured to the hub of arm 66 by bolts 67 is a clutch member 68 having a notch or recess 69 which is shaped to receive a roller dog 70 secured to the outer end of a clutch member 71 which is pivoted to the damper shaft 65. A link 72 is pivoted at one end to an intermediate point of member 71 and pivoted at its other end to one face of a circumferentially slotted collar 73 which is freely slidable on shaft 65. Oppositely disposed pins 74 on the inner forked legs 75 of a bell crank lever are received in the slot in the collar 73. The bell crank lever is pivotally mounted at 76 between the forked ends of a support 77 which is fixed to the elbow or to some other stationary member. The other arm 78 of the bell crank lever carries a roller 79 which is continually urged into engagement with a cam 80 or other part of the solenoid lever 61 upon which the cam is fixed, by a spring 81 which is disposed between the outer end of arm 75 and a stationary part of the elbow or other part of the apparatus. The solenoid lever 61 is mounted on and is freely movable with respect to the damper shaft 65. Control arm 66 is moved by any suitable means to adjust the damper 39 to the proper position. As shown, such means includes a hand wheel 82 fixed on an internally threaded sleeve 83, into one end of which is threaded one end of a rod 84, the other end of which is pivotally connected to the outer end of the arm 66 and into the other end of which is threaded a rod 85, the outer end of which is pivotally connected to a stationary member 86. Rotation of the wheel 82 in one direction causes the rods to move into sleeve 83, and rotation in the opposite direction causes the rods to move outwardly of the sleeve, thus causing the damper to move toward open and closed position respectively at such times as roller dog 70 engages the clutch member 68. A weighted arm 87 is fixed to the damper shaft 65 to counter-balance the weight of the damper. The damper 41 which controls the air inlet 64, has a link 88 fixed to the damper shaft and pivotally connected to one end of an arm 89, the other end of which rests in a recess in a lifting cam 90 on solenoid lever 61.

In operation of the damper control mechanism, assuming that the damper 39 is in closed position and the solenoid lever 61 is in a substantially vertical position, having been released by the energization of solenoid 40, to open the damper and to set the damper in the position initially desired, the solenoid lever 61 is moved in a clockwise direction until it is in the position shown in Fig. 3 with the solenoid latch 62 engaging the keeper 63 to retain the lever in the position shown. It will be understood that the solenoid 40 is deenergized, and that the lower

end of arm 89 is placed in the recess of the lifting cam 90 in order that the upward movement of the solenoid lever will cause damper 41 to close the auxiliary air opening 64. The cam 90 on solenoid lever 61 has a contour such that when the lever is in the latched position shown in Fig. 3, the clutch comprising the members 68 and 71 is engaged to connect the damper adjusting arm 66 to the damper, and when the solenoid lever is in a substantially vertical unlatched position the clutch will be disengaged so that the damper will be free of adjusting arm 66 and will move under its own weight to closed position. Accordingly, movement of the solenoid lever 61 from unlatched to latched position will cause the bell crank lever comprising arms 75 and 78 to move in a counter-clockwise direction about pivot 76 which will move collar 73 to the right, as seen in Fig. 5, and will cause clutch member 71 to move into engagement with member 68. With the clutch engaged, damper 39 is moved to the desired initially adjusted position by movement of the hand wheel 82. When the damper is to be closed for any reason, solenoid 40 is energized, latch 62 is tripped to free it from engagement with keeper 63, solenoid lever 61 is released and moves in a counter-clockwise direction to a substantially vertical position, during which movement of the lever cam 90 will cause clockwise movement of the bell crank lever about pivot 76, thereby sliding collar 73 on shaft 65 to the left as seen in Fig. 5, and disengaging clutch member 71 from member 68, so that the damper is freed from the adjusting means and moves to closed position under its own weight. During normal operation when the damper is connected to the adjusting means, the damper may be moved to any desired adjusting position between open and closed positions by proper movement of the hand wheel 82, thereby controlling the quantity of fuel-air mixture flowing from the mill through the exhauster to the one or more burners to control the rate of firing of the burners and the furnace temperature in consequence. Each damper 39 is adjusted independently so that the rate of firing of the burners served by each exhauster is independently controlled. Where the exhausters serve burners in different furnaces, the firing of the furnaces may be individually controlled.

In lieu of the manually operated means disclosed for regulating the position of each damper 39, automatic means may be employed. One such means suitable for the purpose is disclosed in "Heat Engineering," January, 1940, volume XV, number 1, pages 2 to 8, published by Foster Wheeler Corporation, 165 Broadway, New York city. It will be understood that separate regulating means are employed for each damper 39.

It is to be understood that changes may be made in the particular form, location and relative arrangement in the several parts of the apparatus disclosed without departing from the principles of the invention, which is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, means for withdrawing from the mill a plurality of streams of said medium with entrained pulverized material, flow controlling means in each of said streams, and means for controlling the

supply of said medium to the mill in response to the flow of said streams from the mill and operative to continue the flow of said medium to the mill so long as said flow from the mill continues in any stream.

2. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, means in each of said conduits for varying the quantity of said medium and pulverized material withdrawn in each stream, an exhaustor connected with each conduit, means for controlling the supply of said medium to the mill, and means operative in response to the difference in pressure produced by said exhaustor to actuate said controlling means so as to maintain the controlling means in operative position to admit the medium to the mill and responsive to a reduction in said pressure difference produced by the exhausters in all of said conduits to cut off the flow of the medium to the mill only when flow in all of said conduits is discontinued.

3. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, means in each of said conduits for varying the quantity of said medium and pulverized material withdrawn in each stream, an exhaustor connected with each conduit, means for controlling the supply of said medium to the mill, and means operative in response to the differential in the pressure between the inlet and discharge of each of said exhausters to actuate said controlling means so as to maintain the controlling means in operative position to admit the medium to the mill and responsive to a reduction in said pressure difference between the inlet and discharge of all of said exhausters to cut off the flow of the medium to the mill only when flow in all of said conduits is discontinued.

4. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, a conduit for supplying to the mill a medium for carrying a pulverized material, a damper for controlling the conduit, a plurality of separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each of said plurality of conduits, a damper for each of said plurality of conduits for closing said conduits at a point intermediate the mill and the exhaustor, electrically actuated means operative in response to the differential in the pressure between the inlet and discharge of each of said exhausters for controlling the operation of the damper in each of the conduits through which said medium is withdrawn from the mill to maintain the damper in each of the conduits in operative position to permit the flow of medium through said conduits and responsive to a reduction in said pressure difference between the inlet and discharge of each of said exhausters to cut off the flow of the stream in said conduits, and electrically actuated means operative in response to the difference in pressure between the

inlet and discharge of each of said exhausters for controlling the operation of the first-mentioned damper to maintain said damper in operative position to admit the medium to the mill and responsive to a reduction in said pressure difference between the inlet and discharge of all of said exhausters to cut off the flow of the medium to the mill when the flow in all of said conduits is discontinued.

5. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, control means for controlling the supply of said medium to the mill, separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each conduit, a damper for controlling each conduit, means for regulating the position of the damper in each conduit to vary the quantity of medium and suspended pulverized material flowing through the conduit, and means responsive to the flow of said streams through the separate conduits adapted to operate said first-mentioned control means to cut off the flow of the medium to the mill when flow from the mill in all of said separate conduits is discontinued.

6. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, control means for controlling the supply of said medium to the mill, separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each conduit, a damper for controlling each conduit, means for regulating the position of the damper in each conduit to vary the quantity of medium and suspended pulverized material flowing through the conduit, means for disconnecting the regulating means from the damper to permit the damper to move to closed position, and means responsive to the flow of said streams through the separate conduits adapted to operate said first-mentioned control means to cut off the flow of the medium to the mill when all of said dampers are moved to closed position and flow from the mill in all the separate conduits is thereby discontinued.

7. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, a conduit for supplying to the mill a medium for carrying a pulverized material, a damper for controlling the conduit, a plurality of separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each of said plurality of conduits, a damper for each of said plurality of conduits, means for regulating the position of the damper in each of said plurality of conduits to vary the quantity of medium and suspended pulverized material flowing through the conduits, means for disconnecting the regulating means from the damper in each of said plurality of conduits to permit the damper to move to closed position, and means for controlling the damper in the conduit through which medium is supplied to the mill operative to maintain said damper in an open position so long as at least one of said other dampers is

open and to close said damper when all of said other dampers are closed.

8. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, a plurality of means for causing said medium to flow through and out of the mill in a plurality of streams carrying pulverized material in suspension, means in each of said streams for varying the quantity of said medium and suspended pulverized material withdrawn in each stream, and means for controlling the supply of medium to the mill in response to the flow of the streams from said mill operative to continue the flow of said medium to the mill so long as said flow from the mill continues in any stream.

9. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, a conduit for supplying to the mill a medium for carrying a pulverized material, a damper for controlling the conduit, a plurality of separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each of said plurality of conduits, a damper for each of said plurality of conduits, means for regulating the position of the damper in each of said plurality of conduits to vary the quantity of medium and suspended pulverized material flowing through the conduits, and means for controlling the damper in the conduit through which medium is supplied to the mill operative to maintain said damper in an open position so long as at least one of said other dampers is open and to close said damper when all of said other dampers are closed.

10. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, a plurality of means for causing said medium to flow through and out of the mill in a plurality of streams carrying pulverized material in suspension, flow controlling means in each of said streams operative to cut off the flow of any stream from the mill when the flow of said stream decreases, and means for controlling the supply of said medium to the mill in response to the flow of said streams from the mill and operative to cut off the flow of said medium to the mill when all flow from the mill stops.

11. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, control means for controlling the supply of said medium to the mill, means for withdrawing from the mill a plurality of streams of said medium with entrained pulverized material, flow controlling means in each of said streams operative to cut off the flow of any stream from the mill when the flow of said stream decreases, and means responsive to the flow of said streams from the mill adapted to operate said first-mentioned control means to cut off the flow of the medium to the mill when flow from the mill in all of said streams stops.

12. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, a conduit for supplying to the mill a medium for carrying a pulverized material, a damper for controlling the conduit, a plurality of separate conduits connected to the mill through

each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each of said plurality of conduits, a damper for each of said plurality of conduits, flow controlling means in each of said separate conduits operative to cut off the flow of medium and pulverized material through any one of said separate conduits when the flow therein decreases, means for regulating the position of the damper in each of said plurality of conduits to vary the quantity of medium and suspended pulverized material flowing through the conduits, and means for controlling the damper in the conduit through which medium is supplied to the mill operative to maintain said damper in an open position so long as at least one of said other dampers is open and to close said damper when all of said other dampers are closed.

13. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, a conduit for supplying to the mill a medium for carrying a pulverized material, a damper for controlling the conduit, a plurality of separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each of said plurality of conduits, a damper for each of said plurality of conduits for closing said conduits at a point intermediate the mill and the exhaustor, and electrically actuated means operative in response to the differential in the pressure between the inlet and discharge of each of said exhaustors for controlling the operation of the damper in each of the conduits through which said medium is withdrawn from the mill to cut off the flow of the stream in any one conduit when the flow of said stream in that conduit decreases, and electrically actuated means operative in response to the differential in pressure at the inlet and discharge of each of said exhaustors for controlling the operation of the first-mentioned damper to cut off the flow of the medium to the mill when flow in all of said plurality of conduits is discontinued.

14. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, control means for controlling the supply of said medium to the mill, means for withdrawing from the mill a plurality of streams of said medium with entrained pulverized material, flow controlling means in each of said streams, and electrically actuated means responsive to the flow of said streams from the mill adapted to operate the first-mentioned control means to cut off the flow of the medium to the mill when flow from the mill in all of said streams is discontinued.

15. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying a pulverized material, control means for controlling the supply of said medium to the mill, means for withdrawing from the mill a plurality of streams of said medium with entrained pulverized material, electrically actuated means operative in response to the flow of said streams from the mill for controlling the operation of the flow controlling means in each of said streams, and electrically actuated means responsive to the flow of said streams from the mill adapted to operate the first-mentioned control means to cut off the flow of the medium to

the mill when flow from the mill in all of said streams is discontinued.

16. Pulverizing apparatus comprising a mill, means for supplying to the mill material to be pulverized, means for supplying to the mill a medium for carrying pulverized material, separate conduits connected to the mill through each of which a stream of said medium and suspended pulverized material is withdrawn from the mill, an exhaustor connected with each conduit, flow controlling means in each of said conduits responsive to the difference in pressure produced by the exhaustor connected to the conduit and operative to maintain the flow controlling means in each of said conduits in operative position to permit the flow of medium through said conduits

and responsive to a reduction in said pressure difference between the inlet and discharge of each of said exhaustors to cut off the flow of the stream in said conduits, means for controlling the supply of said medium to the mill, and means operative in response to a difference in pressure produced by said exhaustors to actuate said means for controlling the supply of said medium so as to maintain said means for controlling the supply of medium in operative position to admit the medium to the mill and responsive to a reduction in said pressure differences produced by the exhaustors in all of said conduits to cut off the flow of the medium to the mill only when flow in all of said conduits is discontinued.

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