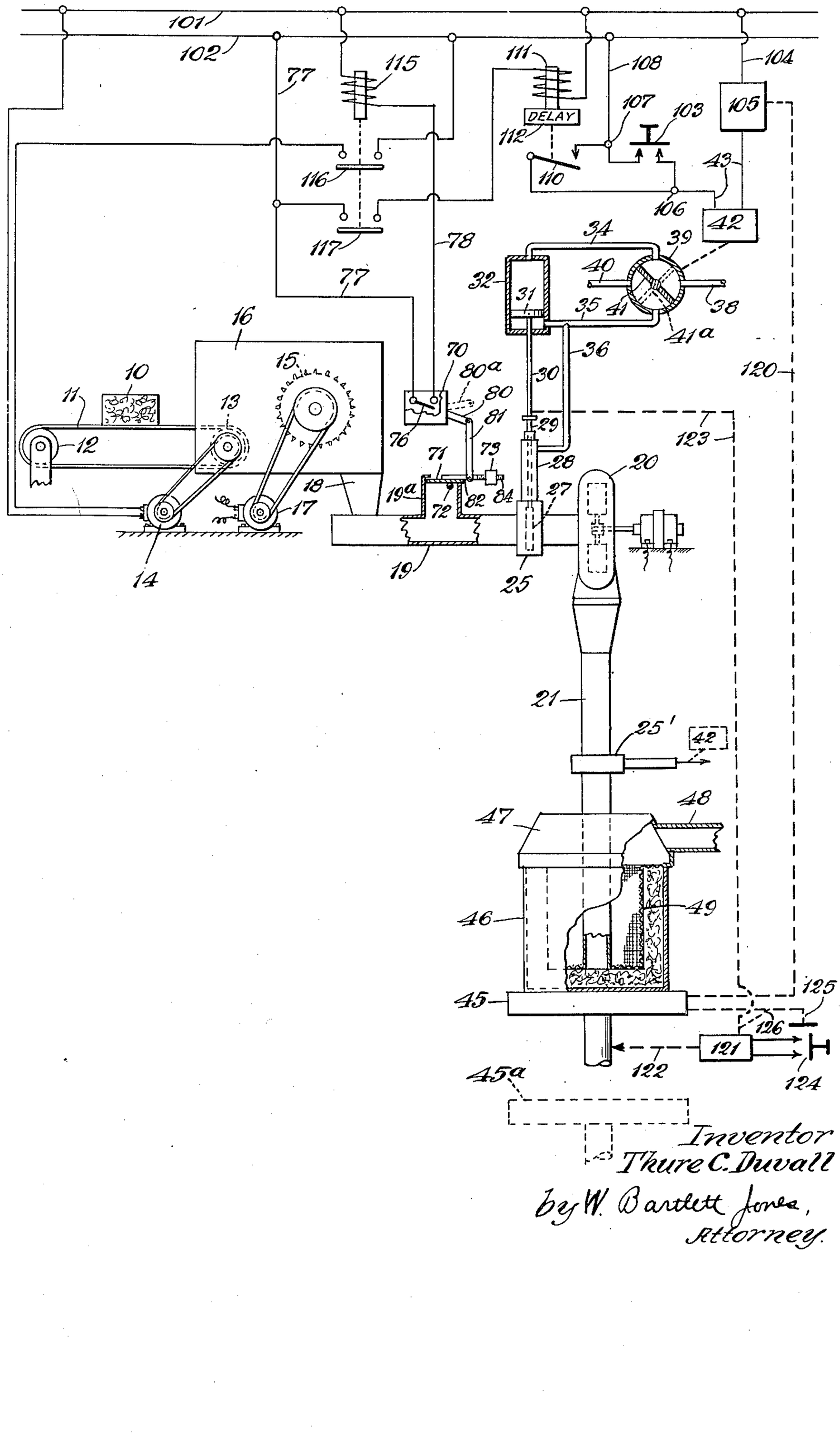
March 6, 1951 T. C. DUVALL 2,544,011

CONTROL FOR PNEUMATIC PACKING SYSTEMS

Filed Dec. 2, 1946



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Patented Mar. 6, 1951 2,544,011

UNITED STATES PATENT OFFICE

2,544,011

CONTROL FOR PNEUMATIC PACKING SYSTEMS

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Application December 2, 1946, Serial No. 713,428

14 Claims. (Cl. 302—35)

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The present invention relates to pneumatically conveying and depositing solid materials, and in general to means and controls for automatically cutting off operation at a predetermined cut-off point. In particular, the invention relates to pneumatic packing systems used for depositing insulating material pneumatically into spaces to be insulated, and to equipment and controls for automatically stopping the operation of the system when the space is adequately filled.

Recently, systems have been developed for pneumatically packing insulating material, such as fiber, into insulating spaces exemplified by refrigerator cabinets. The systems referred to have been developed for use in assembly-line manufacturing operations wherein cabinets, or doors therefor, to be filled, move in succession past a filling station. In such operations the cabinet or other article to receive particles, such as insulating fiber, is arrested at the filling station for and during the filling operation. Certain mechanical operations may or may not be manually required, but where this is not so the operation may be completely automatic after initiation.

The present invention provides an automatic cut-off control for such systems, to be operated by differential air pressure and adjustable to effect the stoppage at a proper point in the completion of a filling job.

In experimenting with pneumatic conveying and depositing systems of the kind herein described, it has been determined that upon completion of a filling operation the discharge conduit of the system becomes effectively blocked to the extent that a quick change in differential pressure at the intake end is produced. Advantage is taken of this quick change of pressure to operate a responsive device which in turn operates suitable controls, preferably electric.

The kind of apparatus to which the present invention applies is one having a fan-type blower and a conduit system receiving air from the atmosphere and ultimately discharging air to the atmosphere, while leaving the insulating material behind. A receptacle to be filled is suitably located with respect to the conduit system and is adequately vented by filtering means so that air passes on while the suspended particles are retained in the desired space. The arrangement is such that when the space is filled, the said filtering means is wholly covered and the conveying system becomes rather suddenly blocked, not perfectly, but sufficiently to reflect a quick change in pressure at the suction end.

Means is provided for feeding solid material

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into the system to form a suspension for delivery, and then separation at the space being filled. Also, adequate valve or gate means is provided in the conduit system to accommodate the system to continuous rotation of the blower therein. Such a system requires that the valve means in the conduit system be closed when the receiving station is open and not ready for delivery. Consequently, means must be provided for stopping the feed of solid material into the system when the valve means is closed and also when there is no delivering flow of air, and to start such feed when there is a delivering flow of air.

It is an object of the present invention to provide a suction-operated damper at the intake end of a fan blower system and to use the responsive movements of the damper to operate certain controls.

It is a particular object of the invention to provide a damper responsive to differential pressure with an adjustment regulating its response to certain predetermined differentials of pressure in order to adjust the operation to the particular conditions elsewhere prevailing in the system.

It is a particular object of the invention to provide a suction-operated cut-off device which so regulates the feed of material that feeding is limited to an operative flow of air through the system.

Another object is to provide for automatic closure of the conduit valve means upon return movement in operation of the cut-off damper, and to provide if desired, a predetermined time delay before initiation of valve closure after the stoppage of feed in order to purge the system of residual solid material.

Numerous other objects and advantages of the invention will become apparent from the following description and explanation of the invention as it is shown in connection with the accompanying drawing showing a preferred application of the invention.

In the drawing, there is shown more or less diagrammatically, certain units of the system as they are combined and controlled by the included electric circuits and devices.

In the drawing, numeral 10 represents an opened previously-wired bale of fiber resting on an endless belt conveyer 11 operating over the pulleys 12 and 13, one of which is suitably driven, as by the electric motive means 14. The belt 11 travels slowly in order gradually to feed the bale to a bale-breaking device, such as a rotor 15 within a housing 16. The rotor 15 is operated by powered means 17. The bale-

breaking means 15 is effective to disintegrate the compacted fiber of bale 10 into a loose and fluffy form which is discharged from the housing 16 through outlet 18 opening into an intake conduit 19 of a fan blower 20. The arrangement of the foregoing parts is such that both the blower 20 and the rotor 15 may operate continuously so that by arresting the travel of the conveyer 11 and the bale 10 into the housing 16, the feeding of fluffed fiber to the blower 20 is also arrested. Since the invention involves means to stop the feeding of the fiber or like material, it is preferred to have such means operate upon the electric motive means 14 to arrest the feeding mechanism. This control will be later described.

The fan blower 20 discharges centrifugally and, as shown, discharges preferably downwardly from the blower through conduit 21 to a discharge or depositing or filling station at the lower end of conduit 21. It is desirable to have means to control the flow in the blower conduit system. Such flow control involves a valve or gate which functions to stop the delivery through conduit 21 of air during operation of fan blower 20. Such a valve or gate may be placed either in the intake conduit 19 or in the discharge conduit 21, or in both places. For the purpose of simplifying the description, such valve means is illustrated in both places and described with reference to that one which is in the intake conduit 19 wherein such valve is designated 25. Where two are used they are preferably operated together and by the same means. A second valve is shown at 25'.

Valve 25 is preferably operated by fluid control, for example, by compressed air. There is a movable gate 27 in the valve casing and a gate-holding chamber 28 outside the valve proper, in which chamber the gate 27 is housed when the gate is in open position. The gate carries an operating stem 29 projecting from the housing 28 and movable into and out of the housing 28 to close and open the gate. The operating stem 29 is connected to a piston rod 30 having a piston head 31 operating in cylinder 32. The two ends of the cylinder 32 each have a connection to a compressed air supply so that by introducing air into the one connection and exhausting it from the other, the piston is moved to operate the gate. Numeral 34 represents the connection for supplying air to close the gate and numeral 35 represents the connection supplying air to open the gate. It is also to be observed that there is a connection 36 between the connection 35 and the gate housing 28 so that when the gate is being opened and is open, an air stream passes through connection 36 into the gate housing and along into the blower system. This is for the purpose of keeping the gateways and seat free from fiber and to avoid the accumulation of fiber in the air spaces of the gate valve where it would eventually impede its proper operation.

Further means for controlling the operation of the gate 27 involve control of the air supply to the cylinder 32. The numeral 38 represents a pipe line supply of air under pressure (greater than in conduit 19 or 21) as a connection to a control valve housing 39 which housing has discharge outlet 40. The illustrated control valve 39 is merely a conventional representation of any suitable valve for the purpose, and in such representation the diagrammatic rotary valve member 41 is moved to shift the air supply from one to the other of the connections 34 and 35

to the cylinder 32. Diagrammatically represented, the aforesaid connections of the valve housing 39 are arranged 90° apart in the following order, 34, 38, 35, and 40. When the valve element 41 is in the full-line position shown, air pressure passes through connection 34 to hold piston 31 down and hence hold the gate 27 closed. By turning the valve element 41 through 90° to dotted-line position 41*a*, the supply of air and the exhaust connection are shifted and the piston 31 is moved to open the gate 27 and to hold the gate open. The present invention involves electrically controlled means to move the valve member 41 from one of its two positions to the other. Such control means is designated by the numeral 42 and has the electrical wires 43 leading to it to energize the device 42 to open gate 27. The device 42 may be a solenoid-operated device controlling the position of valve member 41.

The discharge station may be such as to receive a receptacle to be filled, such as a refrigerator cabinet, and such as to establish operating connection to it. This is preferably accomplished by moving the receptacle onto a platform section which moves into a connecting position, preferably as a lift. Control means is provided for raising and lowering such a lift to effect connection of the receptacle to suitable fixture means on the end of discharge conduit 21. The lift is preferably operated by fluid pressure such as pneumatic pressure in suitable means, and such means may be of the type used to raise and lower the gate valve 27. However, such means forms no part of the present invention.

Numeral 45 represents a lift having a platform for a receptacle 46 thereon to be connected to a fixture 47 placed directly above the lift at the end of conduit 21. Numeral 48 represents a conduit through which air is discharged after having been freed from the fiber or the like deposited in the receptacle, suitable screening or filtering means 49 being operatively associated with the fixture 47 and the receptacle 46. Numeral 45*a* represents the position of the lift when it is out of operating position, as for example, when it is being loaded with a receptacle to be filled. It is important at this time when the lift 45 is out of indicated full-line position, that the conduit system 19—20—21 be free from fiber and that it not discharge air, nor air and fiber, into the atmosphere when conduit 21 is open to the atmosphere by reason of there being no receptacle 46 in place to receive the fiber. Consequently, it is important under these conditions that there be no feed of fiber 10. It is also important that the feed of fiber be prevented except when the conduit system is open to carry it away and the lift 45 is in raised or receiving position, of course with a receptacle 46 in place.

In the intake conduit 19 there is a lateral duct 19*a* opening from the atmosphere to the interior of conduit 19. At the end of the lateral duct 19*a* there is a swinging damper 71 rotating on axis 72, urged into normal and static position (as shown) by means such as counterweight 73. The arrangement is such that a predetermined degree of suction in duct 19*a* resulting from movement of air by the blower when the gate 27 is open, draws in the damper against the counterweight 73, thereby operating a control mechanism 70.

The control mechanism 70 is represented as a simple switch box containing a single point switch 76 for the two wires 77 and 78 leading to it.

Said switch is directly operated to close it by the projecting arm 80 when it moves from full-line position 80 to dotted-line position 80*a*. Said arm 80 is connected by a link 81 pivotly secured at its respective extremities to the arm 80 and to a stem 82 on the damper 71 which stem carries the counterweight 73. The stem 82 is threaded over a long region designated 84 and the counterweight 73 is threaded thereon in order to adjust the effect of counterweight 73 and predetermine the degree of suction to which it responds.

The numerals 101 and 102 represent electric power lines for operating the lift 45 by means not shown, for operating the valve control means 42, for operating the bale-breaker motor 17, and for operating the motive means 14 to feed fiber 10. Means is provided for placing under manual operation a control to open the gate 27. The cut-off control 70 is arranged automatically to effect closure of the gate 27 by de-energizing the valve opening means 42. To simplify the representation of controls, the valve-opening operation is illustrated as initiated by holding down push button switch 103 thereby completing a circuit from power line 101, through connection 104, through one or more controls diagrammatically represented at 105 and for the present purposes to be considered as constituting a closure of the circuit from connection 104 to the valve opening means 42, thence to the junction 106, thence through the push button operated switch 103 to junction 107, and then by a connection 108 to the power line 102. By-passing the said push button switch 103, is a solenoid-operated switch 110 between the junctions 106 and 107. Switch 110 is normally open and is closed only when solenoid 111 is energized. Thus, when solenoid 111 is energized the open gate 27 is held open by closure of switch 110, and during this status the push button switch 103 may be opened by the operator. Numeral 112 represents conventional timing means capable of being set to vary the time interval from 0 to any predetermined time, after de-energizing solenoid 111 to its action to open switch 110, this action being suitably indicated in the drawing.

The energization of solenoid 111 is not intended to open the gate 27 but only to hold it open after it has been opened by manual push button 103. Hence, the effect of having opened the gate 27 is relied upon to energize solenoid 111, and this is accomplished by the suction in duct 19*a* on opening the gate.

The suction in duct 19*a* draws in damper 71, and closes switch 76. This energizes solenoid 115 by completing the circuit: power line 102, connection 77, switch 76, connection 78, solenoid 115, and thence to power line 101. Solenoid 115 is employed as a convenient device to cause the suction to perform more than one function. Therefore, by operating the one switch 76, the solenoid 115 extends the effect by operating more switches, such as relay switches 116 and 117 which are closed by energizing the solenoid 115, and opened by de-energizing it. Switch 116 is in the circuit from lines 101 and 102 to the feeding motive means 14, so that fiber 10 is fed only when the damper 71 is in its suction-operated position. Switch 117 is in series with solenoid 111 across the lines 101 and 102, so that solenoid 111 is energized only when the damper 71 is in suction-operated position.

Accordingly, as soon as the suction fails, the switch 76 is opened, and the fiber feed 14 is thereby cut-off immediately by opening switch 116. Residual fiber in the system may be cleaned out by delaying closure of the gate 27, as by the adjustment of the timing device 112 to control the time of opening switch 110 after the damper 71 moves to its cut-off position.

The present invention is one feature of a more complex control system in which there are other means associated with the means of the present invention. For example, broken line 120 running from the lift 45 in its raised position to the control means 105, represents a control of the circuit to the gate-opening device 42 such that the gate 27 may be opened only when the lift is in the raised position shown. Numeral 121 represents operating means to raise and lower the lift by the indicated connection 122. Broken line 123 running from the lift-operating means 121 to the gate stem 29 represents a control to prevent lowering the lift when the gate 27 is open. Numeral 124 represents a manual push button switch to operate device 121 initially to raise the lift. Numeral 125 represents means electrically by-passing switch 124 to permit its release only when the lift is in raised position and to hold it raised. Such control 125 may be additionally rendered inoperative for said purposes until the gate 27 is open, as for example by a control indicated by broken line 126 from the control 125 to the control 123 under influence of the gate position.

The operation of the device in the preferred manner described can best be understood by explaining how such a blower system operates when the discharge end 21 is wholly blocked or only partially blocked. The deposition of fibers in receptacle 46 involves the passage of air through the filter means 49 as the receptacle is filled. The velocity will decrease as the escapement area for air is lessened. When the blower 20 positively feeds into conduit 21 more air than can escape through outlet 48, some of it channels back in conduit 21, through the blower housing 21 and back into intake conduit 19, this being a well-known result called "back-pressure." Thus, conduit 19 may exhibit first a lessening of suction, and later a positive back pressure at the conduit walls, while the core of the conduit 19 still draws in air.

The damper 71 may be adjusted to move inwardly initially by attaining a predetermined suction in duct 19*a*, and to move back when less than said predetermined suction exists, and this may include reversal of the differential by back-pressure. The construction and adjustment may be such that back-pressure is no more effective on the damper than a static condition of no differential at all.

The delay in closing the gate after cut-off of feed results in the fiber already in the system and not deposited, being carried to the fixture 47 where it is deposited by its own inertia as the vehicular air is either filtered through the already deposited fiber or turned back in said channelling effect, or both. Experience has shown that at the end of an operation such as one filling the receptacle 46, continued supply of air and fiber effects a growing deposit in conduit 21 accompanied by back-pressure. Thus, fiber may be deposited after the damper operates to open switch 76. The adjustment of counterweight 73, and of the timing device 112 of relay having solenoid 111, are such with respect to the prevailing conditions of the apparatus, that the deposition may be halted automatically so as to control the end point, leaving the receptacle short of full, just

full, or over full, as desired, and uniformly so in successive operations.

The damper-type of cut-off is to be distinguished from the manometer type moving in response to all differential pressure changes. The damper-type moves with snap action from one to the other of its two limiting positions in passing through critical changes in differential pressures. This motion is accompanied by appreciable mechanical movement and power available for mechanically operating one or more controls. The extent of movement and the inertia in the moving parts minimizes fluttering as the differential pressure may flutter above and below the desired critical point, thus giving positive actions in the controlling operation.

The invention is capable of numerous departures from the illustrative use thereof, and these and other modifications are contemplated as falling within the scope of the appended claims.

I claim:

1. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein, a feed-control device comprising a suction duct leading from the atmosphere to the intake conduit and subject to suction to admit air into the system, a moving member associated with said duct and responsive to suction of a predetermined value to move from normal static position to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving member to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

2. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein, a feed-control device comprising a suction duct leading from the atmosphere to the intake conduit and subject to suction to admit air into the system, an adjustable moving member associated with said duct and responsive to suction of a value predetermined by its adjustment to move from normal static position to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving member to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

3. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein, a feed control device comprising a suction duct leading from the atmosphere to the intake conduit and subject to suction to admit air into the system, a pivoted damper associated with said duct and responsive to suction of a predetermined value to move from normal static position to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving damper to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

4. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein,

a feed-control device comprising a suction duct leading from the atmosphere to the intake conduit and subject to suction to admit air into the system, a pivoted damper associated with said duct and adjustably responsive to suction of a value predetermined by its adjustment to move from normal static position to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving damper to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

5. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein, a feed-control device comprising a suction duct leading from the atmosphere into the periphery of the intake conduit and subject to suction to admit air into the system, a moving member associated with said duct and responsive to suction of a predetermined value to move from normal static position to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving member to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

6. In an intake conduit to a fan-blower system arranged for drawing air from the atmosphere and having means to feed solid material into said system for suspension in air therein, a feed-control device comprising a suction duct leading from the atmosphere into the periphery of the intake conduit and subject to suction to admit air into the system, an adjustable moving member associated with said duct and responsive to suction of a value predetermined by its adjustment to move from normal static to abnormal operating position and to admit air to said duct when air is moving through the system, and means arranged for operation by said moving member to effect operation of said feeding means in said abnormal position and non-operation of said feeding means in said normal position.

7. Apparatus comprising in combination a centrifugal fan blower drawing air from the atmosphere and ultimately discharging air to the atmosphere, a conduit system for said blower including an intake conduit, valve means in said conduit system to open and close the system against the flow therethrough of air during operation of the blower, means to feed particles of solid material into said conduit system for forming and conveying an air-suspension of said particles, a lateral duct connected to and opening into said intake conduit and also opening to the atmosphere and subject to suction by operation of the blower to admit air into the system, a movable member associated with said duct and movable to enlarge the effective passageway through said duct and responsive to suction of a predetermined value to move the member from a normal position occupied in the absence of a predetermined value of suction to a suction-operated abnormal position, control means arranged for operation by said member to effect operation of said feeding means only during the suction-operated abnormal position of the member, and means arranged to be operated by the member in motion to the normal position to effect closure of the opened valve means, whereby an effective resistance to flow of suspended material in the

conduit system effects movement of the member to normal position and thereby effects cut-off of the feed and closure of the valve means, the arrangement thus being such that material can be fed into the conduit system only during the flow of air therein to suspend it.

8. Apparatus comprising in combination a centrifugal fan blower drawing air from the atmosphere and ultimately discharging air to the atmosphere, a conduit system for said blower including an intake conduit, valve means in said conduit system to open and close the system against the flow therethrough of air during operation of the blower, means to feed particles of solid material into said conduit system for forming and conveying an air-suspension of said particles, a lateral duct connected to and opening into said intake conduit and also opening to the atmosphere and subject to suction by operation of the blower to admit air into the system, a movable member associated with said duct and movable to enlarge the effective passageway through said duct and responsive to suction of a predetermined value to move the member from a normal position occupied in the absence of a predetermined value of suction to a suction-operated abnormal position, control means arranged for operation by said member to effect operation of said feeding means only during the suction-operated abnormal position of the member, and timed means arranged to be operated by the member in motion to its normal position thereafter at a controlled time to effect closure of the opened valve means, whereby an effective resistance to flow of suspended material in the conduit system effects movement of the member to normal position and thereby effects cut-off of the feed and thereafter closure of the valve means, the arrangement thus being such that material can be fed into the conduit system only during the flow of air therein to suspend it, and such that after stoppage of feed the conduit system remains open for a time to clear it of residual particles.

9. Apparatus comprising in combination a centrifugal fan blower drawing air from the atmosphere and ultimately discharging air to the atmosphere, a conduit system for said blower including an intake conduit, valve means in said conduit system to open and close the system against the flow therethrough of air during operation of the blower, means to feed particles of solid material into said conduit system for forming and conveying an air-suspension of said particles, a lateral duct connected to and opening into said intake conduit and also opening to the atmosphere and subject to suction by operation of the blower to admit air into the system, a movable damper associated with said duct and movable in response to suction in the intake conduit into an abnormal position to enlarge the effective passageway through said duct during suction therein, means normally acting against suction to move the damper into a normal position in the absence of a predetermined value of suction, control means arranged for operation by said damper to effect operation of said feeding means only during the suction-operated abnormal position of the damper, and means arranged to be operated by the damper in motion to its normal position to effect closure of the opened valve means, whereby an effective resistance to flow of suspended material in the conduit system effects movement of the damper to normal position and thereby effects cut-off of the feed and closure of the valve means, the arrangement thus being such that material can be fed into the conduit system only during the flow of air therein to suspend it.

10. Apparatus comprising in combination a centrifugal fan blower drawing air from the atmosphere and ultimately discharging air to the atmosphere, a conduit system for said blower including an intake conduit, valve means in said conduit system to open and close the system against the flow therethrough of air during operation of the blower, means to feed particles of solid material into said conduit system for forming and conveying an air-suspension of said particles, a lateral duct connected to and opening into said intake conduit and also opening to the atmosphere and subject to suction by operation of the blower to admit air into the system, a movable damper associated with said duct and movable in response to suction in the intake conduit into an abnormal position to enlarge the effective passageway through said duct during suction therein, means normally acting against suction to move the damper into a normal position in the absence of a predetermined value of suction, control means arranged for operation by said damper to effect operation of said feeding means only during the suction-operated abnormal position of the damper, and timed means arranged to be operated by the damper in motion to its normal position thereafter at a controlled time to effect closure of the opened valve means, whereby an effective resistance to flow of suspended material in the conduit system effects movement of the damper to normal position and thereby effects cut-off of the feed and thereafter closure of the valve means, the arrangement being such that material can be fed into the conduit system only during the flow of air therein to suspend it, and such that after stoppage of feed the conduit system remains open for a time to clear it of residual particles.

11. Apparatus comprising in combination a centrifugal fan blower arranged to draw air from and ultimately to discharge air to the atmosphere, a conduit system therefor including an intake conduit and a discharge conduit, valve means in said conduit system for cutting off flow through said conduit system during the operation of said blower and closure of the valve means, means providing a control opening into said intake conduit, said opening being exposed to the atmosphere for the admission of air by suction from the blower, a damper member arranged to move with respect to said opening by suction therein resulting from operation of the blower, adjustable means to urge said damper member into normal position against suction of value less than a value predetermined by the adjustment of said means, means to feed solid particles of material into said intake conduit for suspension in the air stream and for movement of an air-suspension of said material in said conduit system, valve-control means arranged when energized to open said valve means and when de-energized to close said valve means and thereby during operation of the blower and with open valve means to establish a flowing stream of air and thereby to cause movement of the damper member with respect to said opening, said feeding means being arranged to operate to feed said material by movement of said damper member under the influence of suction and not so to operate when the damper member is in normal position, receiving means associated with said discharge conduit to receive said solid material from the air stream up to a cut-off

point such that the flow of said air stream is resisted to an extent permitting movement of said damper member into its said normal position, and means associated with and operated by return of the damper member to normal position to cause de-energizing of said valve-control means, whereby at said cut-off point the damper member operates to effect stopping of said feed and closure of the conduit system.

12. Apparatus comprising in combination a centrifugal fan blower arranged to draw air from and ultimately to discharge air to the atmosphere, a conduit system therefor including an intake conduit and a discharge conduit, valve means in said conduit system for cutting off flow through said conduit system during the operation of said blower and closure of the valve means, means providing a control opening into said intake conduit, said opening being exposed to the atmosphere for the admission of air by suction from the blower, a damper member arranged to move with respect to said opening by suction therein resulting from operation of the blower, adjustable means to urge said damper member into normal position against suction of value less than a value predetermined by the adjustment of said means, means to feed solid particles of material into said intake conduit for suspension in the air stream and for movement of an air-suspension of said material in said conduit system, valve-control means arranged when energized to open said valve means and when de-energized to close said valve means and thereby during operation of the blower and with open valve means to establish a flowing stream of air and thereby to cause movement of the damper member with respect to said opening, said feeding means being arranged to operate to feed said material by movement of said damper member under the influence of suction and not so to operate when the damper member is in normal position, receiving means associated with said discharge conduit system to receive said solid material from the air stream up to a cut-off point such that the flow of said air stream is resisted to an extent permitting movement of said damper member into its said normal position, and time-delay means associated with and operated by return of the damper member to normal position to cause subsequent de-energizing of said valve-control means, whereby at said cut-off point the damper member operates to effect stopping of said feed and at a predetermined time thereafter closure of the conduit system.

13. A blower system having in combination a fan blower, an intake conduit therefor open to the atmosphere, an outlet conduit therefor for the discharge of air-suspension of solid material against a growing resistance to flow in said system, a duct tapped into the periphery of the intake conduit for admitting a portion of the air for the intake conduit, a movable damper associated with said duct and arranged to move from normal and closed static position to suction-operated abnormal and open position upon attaining a predetermined suction in the intake conduit and to move back to normal and closed position at differential pressures less than that of said predetermined suction, and controllable means affecting operation of the blower system arranged to be controlled by the two movements of said damper, the location of the opening of said duct at the periphery of the intake conduit effecting return of the damper to normal and closed position by both reduction of flow through the blower and back-pressure in the inlet conduit.

14. A blower system having in combination a fan blower, a conduit system therefor including an intake conduit opening to the atmosphere, said system being arranged for delivering an air-suspension of solid material against a growing resistance to flow in said system, a duct tapped into the periphery of the intake conduit for admitting a portion of the air for the intake conduit, a movable damper associated with said duct and arranged to move from normal and closed static position to suction-operated abnormal and open position upon attaining a predetermined suction in the intake conduit and to move back to normal and closed position at differential pressures less than that of said predetermined suction, and controllable means affecting operation of the blower system arranged to be controlled by the two movements of said damper, the location of the opening of said duct at the periphery of the intake conduit effecting return of the damper to normal and closed position by both reduction of flow through the blower and back-pressure in the inlet conduit.

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