

July 10, 1934.

E. B. TOLMAN, JR

1,965,866

FLUID ACTUATED CONTROL DEVICE FOR PNEUMATIC CONVEYERS

Filed April 19, 1933

2 Sheets-Sheet 1

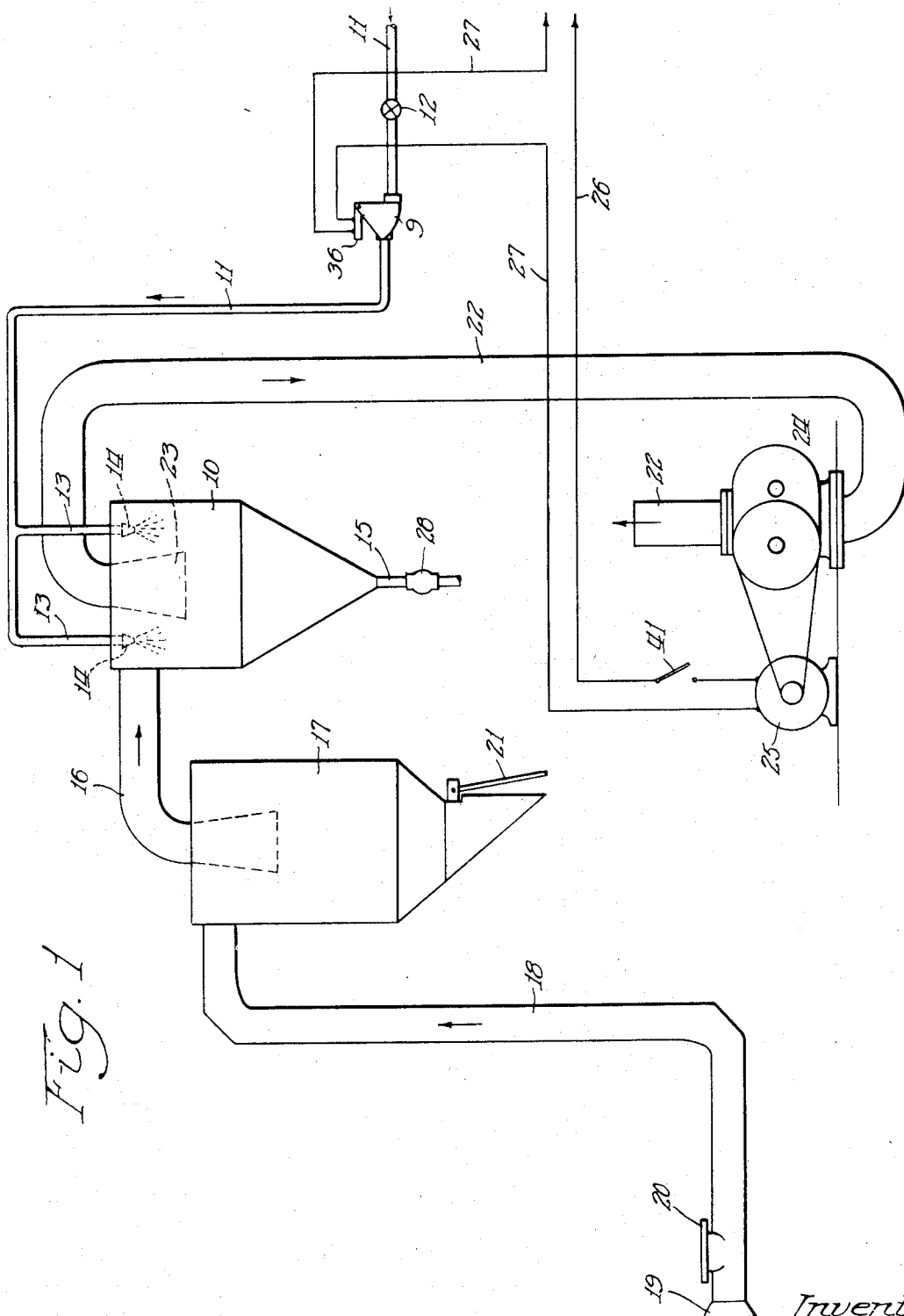


Fig. 1

Witness:
V. Silfander

Inventor
Edgar B. Tolman, Jr.
By: Still and Still

Cliffs
22

July 10, 1934.

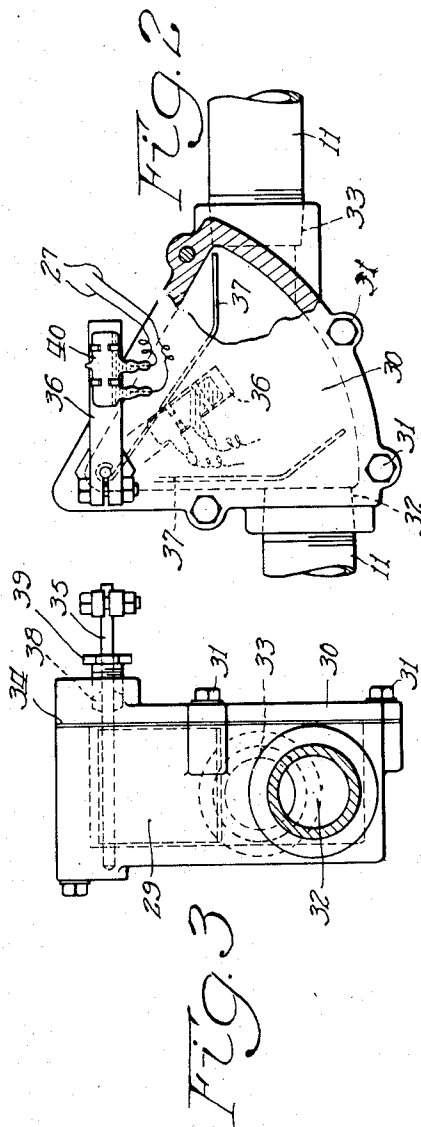
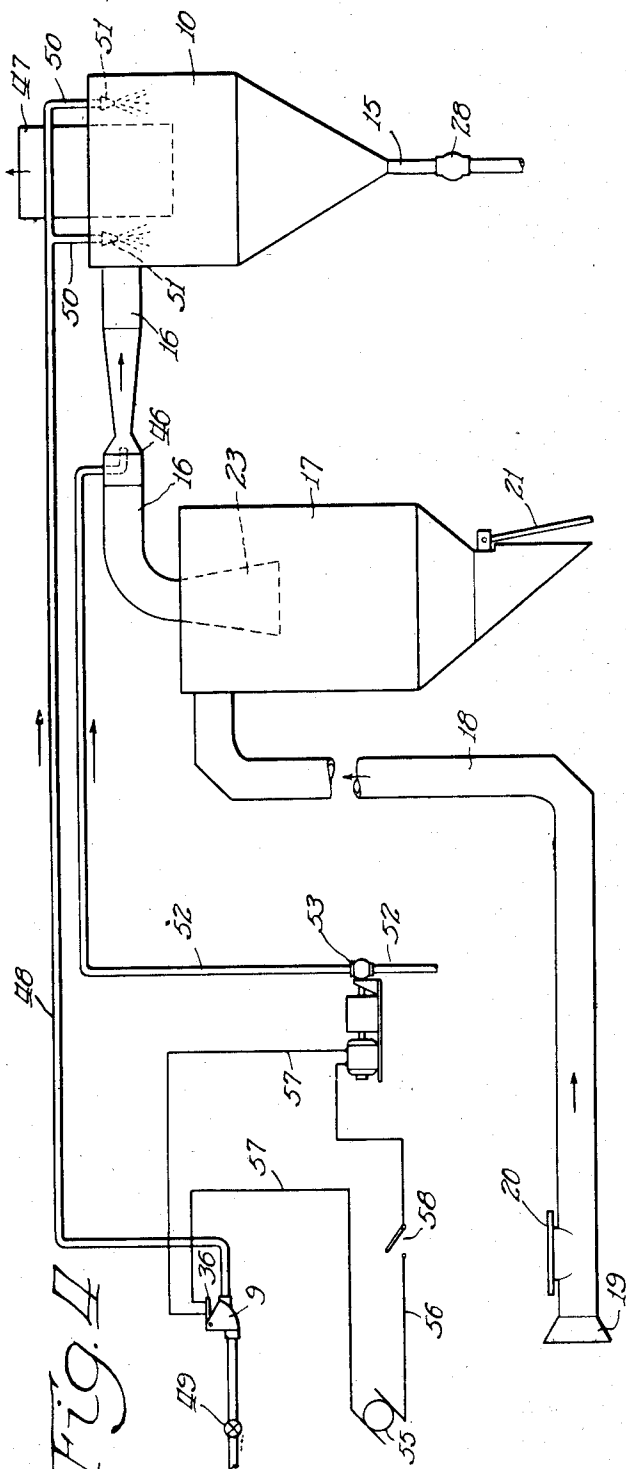
E. B. TOLMAN, JR

1,965,866

FLUID ACTUATED CONTROL DEVICE FOR PNEUMATIC CONVEYERS

Filed April 19, 1933

2 Sheets-Sheet, 2



Witness:
V. Silander

Inventor
Edgar B. Tolman, Jr.
By: Still and Still

Att'y

UNITED STATES PATENT OFFICE

1,965,866

FLUID ACTUATED CONTROL DEVICE FOR
PNEUMATIC CONVEYERS

Edgar B. Tolman, Jr., Chicago, Ill.

Application April 19, 1933, Serial No. 866,850

8 Claims. (Cl. 183-21)

The invention relates in general to a safety control device for regulating an electrically energized mechanism by the flow of fluid through a conduit and the invention is illustrated herein in connection with the air washing apparatus of pneumatic systems for conveying ashes and similar material.

In pneumatic conveyor systems of this type, the air discharging the material into a bin or receptacle is filled with dust and it is desirable that such dust laden air be washed before it is discharged into the atmosphere and for this purpose, the conveying system includes a chamber in which the air is washed by water sprays. It is important that there be an uninterrupted flow of water during operation of the conveying system as otherwise the air washing device soon becomes clogged with the fine dust and is ineffective when water is later turned on.

The invention contemplates the provision of a flow contacting apparatus in the pipe, supplying water to the air washing device, which will prevent the pneumatic conveyor from operating when there is a total or partial failure of the water supply to the air washing chamber.

The invention is illustrated in connection with a motor actuated exhaustor operable to cause dust laden air to flow into the washing chamber and its removal therefrom after being washed and is also illustrated in connection with an electrically controlled steam exhaustor which delivers dust laden air into the washing chamber and the primary object of the invention is the provision of a simple form of circuit closer operable to break the electrical circuit used in operating the systems and thereby prevent the motor or steam exhaustor from operating when there is less than a predetermined flow of water through the supply pipes.

Another object of the invention is the provision, in combination with pneumatic conveyor systems of the kind described, of an improved fluid actuated flow contacting apparatus which is responsive to the flow of fluid through a pipe or conduit and is automatically operable by such flow to maintain the circuit closed and to permit operation of the conveyor system when the rate of flow of fluid through the pipe is equal to or greater than a predetermined amount, the apparatus being also operable to open the circuit and prevent operation of the system when the rate of fluid flow through the pipe falls below such predetermined amount.

A further object of the invention is the provision, in pneumatic conveyor systems having air

washing devices of the kind described, of means adapted to automatically prevent the conveyor systems from operating except when there is a substantial flow of water to the air washing device.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art.

To this end, my invention consists in the novel construction, arrangement and combination of parts herein shown and described and more particularly pointed out in the appended claims.

In the drawings, wherein like reference characters indicate like or corresponding parts:

Fig. 1 is a diagrammatic view of a pneumatic conveyor system operated by an electrically driven mechanical exhaustor embodying the devices of the invention;

Fig. 2 is a side elevational view of a flow contactor embodying the principles of the invention, the same being partially broken away to show the interior;

Fig. 3 is an end view of the device shown in Fig. 2; and

Fig. 4 is a diagrammatic view of a pneumatic conveyor system operated by a steam exhaustor and embodying the devices of the invention.

Referring now more particularly to Fig. 1 of the drawings, the numeral 10 generally designates an air washing chamber forming part of a pneumatic system for conveying ashes and other more or less finely comminuted material. Water is delivered to the chamber 10 through a pipe line 11 connected with a source of supply (not shown). The pipe 11 is controlled by means of a valve 12 and terminates in a plurality of branch pipes 13 each projecting into the chamber 10. A plurality of spray nozzles 14, mounted one on each end of the branch pipes 13, are arranged about the chamber 10 and the water discharged therefrom in the form of sprays collects in the bottom of the chamber. A conduit 16 connects the chamber 10 with an air tight material bin 17 into which ashes or other material is discharged from a conduit 18. The conduit 18 terminates in an open end member 19 adjacent to which is a section providing an aperture 20 by means of which material to be conveyed is permitted to enter the conduit. The material bin 17 is provided with a discharge gate 21 shown in open position but which normally remains closed by vacuum during operation of the device and opens at intervals by pressure resulting from the weight of the material con-

tained in the bin, when the partial vacuum in the bin is relieved.

A conduit 22 has one expanded end 23 terminating in the air washing chamber 10 between 5 and preferably projecting below the nozzles 14. An exhaustor 24, actuated by a motor 25 and interposed in the conduit 22, creates a vacuum and causes a flow of air through the conduit 18, the material bin 17, the conduit 16, the air washing chamber 10 and the conduit 22. The exhaustor 24 is adapted to create sufficient vacuum in the chamber 10 and bin 17 to cause ashes and similar material to be conveyed through the conduit 18 and discharged into the bin 17. The major portion of the material so carried by the conduit 18 is sufficiently heavy that it remains in the bin 17. However, a considerable portion of fine dust particles remains suspended in the attenuated air and are drawn through the conduit 16 into the air washing chamber 10 where the air is washed free from dust by the sprays coming from the nozzles 14. The discharge end of the pipe 16 is so positioned that the dust laden air in moving to the inlet end of the conduit 22 necessarily passes through the water sprays provided by the nozzles 14 and is thoroughly washed before entering the conduit 22. The water from the sprays collects in the bottom of the chamber 10 and is released at intervals by means of the check valve 23. The side and bottom walls of the chamber 10 are kept washed free from silt by the action of the sprays and if for any reason the supply of water should stop during operation of the exhaustor, the fine dust particles would collect on the damp side and bottom walls of the chamber. Conductors 26 and 27 provide a circuit connecting the motor 25 with a source of electrical energy (not shown) and means is provided for breaking the circuit should there for any reason be a failure to deliver water through the pipe 11 into the chamber 10 since otherwise the dust discharging into the damp chamber will adhere to the wet surfaces and render the washing device ineffective by reason of the resultant clogging and choking thereof.

The means provided for preventing such clogging or choking of the air washing device comprises apparatus, generally designated by the numeral 9, interposed in the water pipe 11 between its discharge end and the valve 12. An operating switch 41 interposed in the conductor 26 is operable to normally open and close the circuit for operating the motor. The apparatus 9 is operable, independently of the switch 41, to break the circuit and prevent the motor 25 from operating the exhaustor 24 should the flow of water through the pipe 11 stop altogether or fall below a predetermined minimum amount by reason of complete or partial closure of the valve 12 or by reason of exhaustion of the water supply, choking of the pipe, or the like.

The apparatus 9 is shown in Figs. 2 and 3 as comprising a body or casing 29 having a side or cover 30 removably fastened thereon by a plurality of bolts 31. An inlet opening 32 and an outlet opening 33 are respectively adapted to receive the adjacent ends of the pipe sections 11. A gasket 34 is positioned between the casing 29 and the cover 30 to prevent leakage of water through the walls of the contactor 9.

A shaft 35, pivotally mounted in the upper portion of the casing 29, has one end projecting from the casing and providing a mounting for an arm 36. Packing 38 is compressed by a gland 39 in proper position to prevent leakage of water around

the shaft 35. A plate 37, positioned inside the casing 29, is fixedly mounted on the shaft 35. The weight of the plate 37 tends to keep it in vertical position adjacent the inlet opening 32 as shown in dotted lines in Fig. 2 and the plate is of sufficient length so that it partially covers the inlet opening when in such vertical position. The outlet opening 33 is preferably opposite to and slightly above the inlet opening 32 and flow of water through the pipe 11 and the casing 29 in volume sufficient to supply the nozzles 14 and provide sprays effective to wash the air in the chamber 10 will also be sufficient to maintain the plate 37 and the shaft 35 in their respective full line positions wherein the arm 36 is horizontal. A complete cessation of flow of water through the casing 29 or a partial cessation of flow resulting in an insufficient delivery of water to provide proper sprays in the chamber 10, will permit the plate 37 to move back towards its vertical or dotted line position. The lower end of the plate 37 is preferably inclined to the main body thereof in order that it will not impede the flow of water through the casing. In its elevated position, the lower end of the plate 37 provides a surface approximately parallel to the direction of flow of the current, this arrangement being effective to hold the plate out of the path of the water when flowing in volume sufficient to supply the sprays.

A mercury switch 40, mounted on the arm 36, is so arranged as to complete the circuit through the conductors when the arm is in its full line horizontal position corresponding to the elevated position of the plate 37 and to break the circuit when the arm is inclined by reason of the plate moving towards its vertical position upon partial or complete cessation of the flow of water through the casing 29. The described movement of the plate 37 thereby automatically operates to break the circuit and prevent operation of the motor 25 except when the flow of water through the pipe 11 and casing 27 is sufficient to meet the predetermined requirements of the sprays in the chamber 10 and the exhaustor and the conveyer system actuated thereby are inoperable except when water is flowing through the pipe 11 ample for the purpose desired.

Fig. 4 illustrates a conveyer system wherein the vacuum for conveying material is provided by a steam jet air exhaustor generally designated by the numeral 46 and positioned in the conduit 16 between the material bin and the air washing chamber 10. The vacuum created in the material bin 17 by the exhaustor 46 is sufficient to draw material through the conduit 18 and to convey the dust laden air into the air washing chamber 10 in the same manner as described for the motor actuated exhaustor 24. Water is delivered into the chamber 10 through a pipe 48 terminating in a plurality of branch pipes 50 each having a spray nozzle 51 mounted on the end thereof. The pipe 48 is connected with a source of water supply (not shown) and the flow of water is controlled by means of a valve 49.

A pipe 52 connected with a source of steam supply (not shown) supplies the exhaustor 46 with steam in sufficient quantities to produce the required vacuum in the bin 17 and conduit 18. The dust laden air discharged into the chamber 10 from the conduit 16 passes through the sprays provided by the nozzles 51 and escapes from the chamber 10 into the open air through a conduit 47 projecting from the top of the chamber.

A motor or solenoid operated steam valve 53 controls the flow of steam through the supply line

52. A pair of conductors 56 and 57 provide a circuit connecting the electrically operated valve 53 with a source of electrical energy 55. A switch 58 interposed in the conductor 56 is normally operable to open and close the circuit provided by the conductors 56 and 57. The circuit through the conductors 56 and 57 is also controlled by a mercury switch 36 interposed in the conductor 57 and mounted on a flow contactor 9 of the kind described for the embodiment shown in Fig. 1. The apparatus 9 is interposed in the water supply pipe 48 and operates the switch 36 to break the circuit when the flow of water through the pipe 48 is inadequate and to close the circuit when sufficient water is delivered to the chamber 10 to wash the air.

Thus, it will be seen that I have provided in combination with conveyer systems of the kind described, novel means for preventing the operation of such systems except when there is flow of water into an air washing chamber in an amount to adequately wash the dust laden air.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the scope of the invention; hence I do not wish to be limited to the precise construction, arrangement and combination of parts herein shown, or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, an air washing chamber, apparatus for inducing a flow of air through said chamber, means for delivering water into said chamber to wash the air passing therethrough, and means operable to actuate said apparatus during delivery of water into said chamber, said means being inoperable to actuate said apparatus when the flow of water into the chamber ceases.

2. In combination, an air washing chamber, apparatus for inducing a flow of air through said chamber, means for delivering water into said chamber to wash the air passing therethrough, and means operatively connecting the water delivery means with said apparatus adapted to prevent the actuation of said apparatus except when water is being delivered into said chamber.

3. In combination, an air washing chamber, apparatus for inducing a flow of air through said chamber, means for delivering water into said chamber to wash the air passing therethrough, and means operatively connecting the water delivery means with said apparatus adapted to prevent the actuation of said apparatus when water is being delivered into said chamber at less than a predetermined rate.

4. In combination, an air washing chamber, electrically controlled apparatus for inducing a flow of air through said chamber, means for delivering water into said chamber to wash the air passing therethrough, and means operable by the flow of water to said chamber to start the electrically controlled apparatus and to stop said apparatus upon cessation of the flow of water to said chamber.

5. In combination, an air washing chamber, electrically controlled apparatus operable to induce a flow of air through said chamber, a pipe for delivering water into said chamber for washing air passing therethrough, an electric switch controlling said apparatus, and a device interposed in said pipe and operable by the flow of water therethrough to close said switch, said device being operable by the cessation of said flow to open the switch and stop the operation of said apparatus.

6. In combination, an air washing chamber, apparatus for inducing a flow of air through said chamber, a conduit for delivering water into said chamber to wash the air, an electric circuit for controlling the operation of said apparatus to induce a flow of air through said chamber, a plate pivotally mounted in the conduit and operable by the flow of water to be swung out of the path thereof, a mercury switch operable to open and close said circuit, and means connecting said switch with said plate in a manner whereby the switch is moved to circuit closing position by the movement of said plate resulting from the flow of water through the conduit, said switch being moved to circuit breaking position by the return movement of the plate resulting from the cessation of flow of water through the conduit.

7. In combination, an air washing chamber, apparatus for inducing a flow of air through said chamber, a conduit for delivering water into said chamber to wash the air, an electric circuit for controlling the operation of said apparatus to induce a flow of air through said chamber, a shaft mounted in the conduit with one end projecting therefrom, a plate fixedly mounted on the shaft with one end normally positioned in the path of water flowing through the conduit and operable by said flow of water to be swung out of the path thereof and to thereby rotate the shaft, and a mercury switch mounted on said projecting end of the shaft, said switch being in circuit breaking position when the plate is in its normal position and in circuit closing position when the plate is swung out of the path of the fluid.

8. In combination, an air washing chamber, a pipe operable to discharge water into said chamber, a conduit operable to convey air through said chamber, apparatus operable to move air through said conduit, a motor operable to actuate said apparatus, an electric circuit connecting said motor with a source of electrical energy, a switch operable to open and close said circuit, a device comprising a casing having oppositely positioned inlet and outlet openings with which said pipe is connected, a pivotally mounted plate suspended in the casing between said openings, said plate being movable from its normal suspended position to a position inclined thereto upon flow of water through the casing, and means operatively connecting said plate with said switch whereby the switch opens the circuit when the plate is in its normal suspended position and closes the circuit when the plate is in said inclined position.

EDGAR B. TOLMAN, JR.