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W. T. S. MONTGOMERY

REGULATING MEANS FOR PNEUMATIC CONVEYING SYSTEMS

Filed June 6, 1925

Fig. 1.

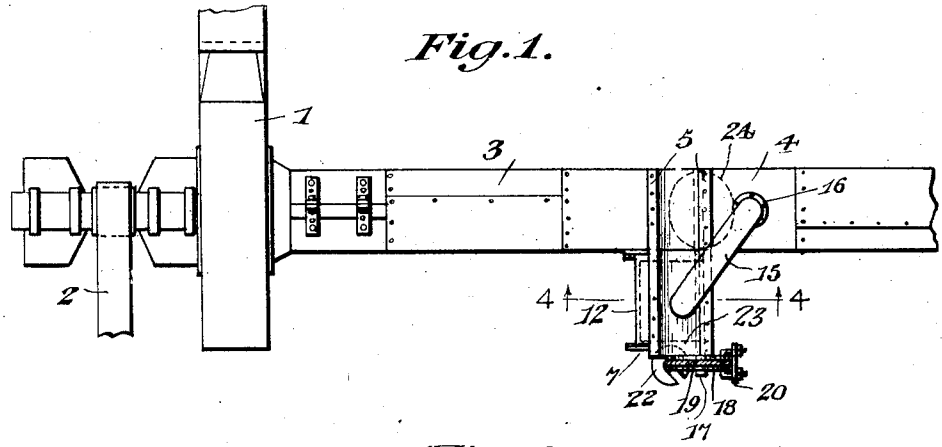


Fig. 2.

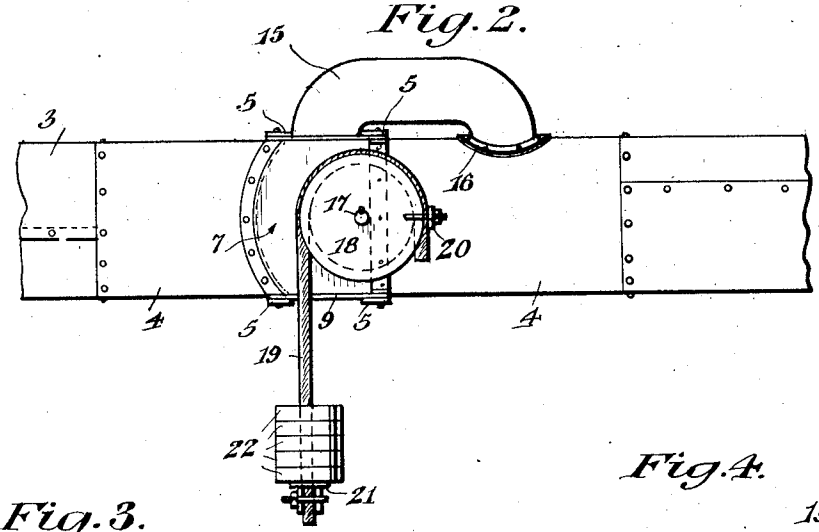


Fig. 3.

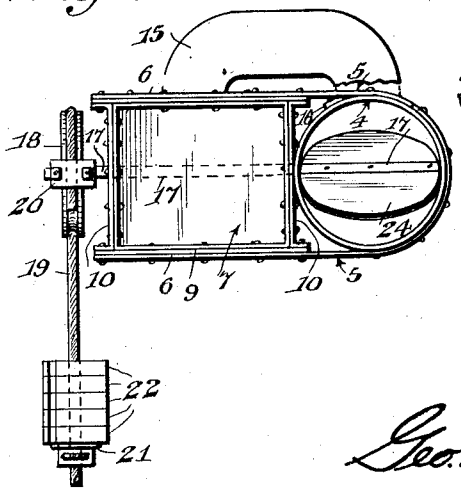
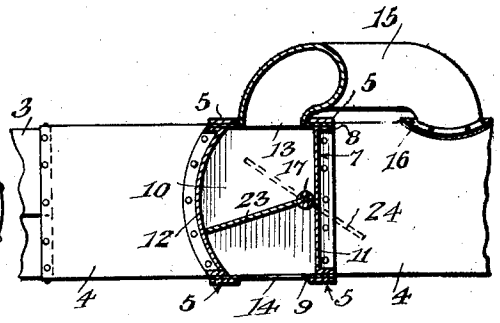


Fig. 4.



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REGULATING MEANS FOR PNEUMATIC CONVEYING SYSTEMS.

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This invention relates to a regulating means for pneumatic conveying systems.

The primary object of this invention is the provision, in a manner as hereinafter set forth, of a suction regulating device designed to be installed in the main suction pipe of a pneumatic conveyer, to regulate and maintain a suction or vacuum of constant quality throughout the various ramifications of the piping system irregardless of whether one suction pipe or all of the suction pipes of the system are open and in operation.

This controlling device is designed to be used in all pneumatic piping systems which have for their driving force an exhaust fan or blower, such as shaving conveying systems in planing mills, pneumatic conveying systems for all classes of material such as cotton, grain, peanuts, or anything that can be conveyed by a blast of air through a pipe line.

In the present air conveying systems in use, as for example shavings conveying systems in planing mills, there may be normally five machines in use in the plant and when all of these machines are in use at the same time, sufficient blow pipe capacity must be provided to handle all machines properly and if no provision is made for cutting off the pipes used on the machines when one or more of the same are idle, the power used for the blower system would be always the maximum whether the machines were operating or not, since the material handled does not affect the power consumption of the system. The only method now in use to try to overcome this difficulty is that each pipe to each machine is provided with a blast gate and when the machines are not in use, the blast gate in the pipe line running to each of the machines which are idle, is closed with a view to restricting the amount of air which the suction fan will take. The effect of closing a blast gate under present methods, is to raise the vacuum in the main suction pipe and in the other pipes that are left open so that they draw in more air and, although some power is saved by this present method, it is comparatively little and is a very inefficient method at best.

With the regulator embodying this invention, the vacuum in the main suction pipe of the system is determinable solely by the application or removal of weights to a part of the regulator so long as the vacuum in the pipe line lying between the blower fan and this regulator exceeds the normal vacuum in the main suction pipe beyond the regulator, and this being the case, no matter how many pipes are cut off, so long as there is any flow of air through the main suction pipe at all, the strength of the vacuum in this pipe will remain constant. This being the case when a blast gate is closed under this method on one or more of the branch pipes, it will cause no change in the vacuum in the main suction pipe and therefore no more air will be handled through the other branch pipes which remain open than they were handling before closing any of the blast gates, or in other words, when a blast gate is closed, under this method, the amount of air that this closed pipe had been handling in cubic feet per minute is actually to be deducted from the total number of cubic feet per minute the system was handling when the blast gate was opened. In this manner a constant suction is maintained in all of the pipes of the system which are open, regardless of the closing of certain of the pipes or of the opening of additional ones in the system.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawing forming a part of this specification, with the understanding that the invention is not confined to any strict conformity with the showing of the drawing but may be changed and modified so long as such changes and modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawing:—

Figure 1 shows the regulator embodying this invention, in plan view, and in position in the main suction pipe of a vacuum piping system.

Figure 2 is a side elevation of the device embodying this invention.

Figure 3 is an end view of the regulator and,

Figure 4 is a section taken transversely through the body of the regulator, upon the line 4—4 of Figure 1.

Referring now to the drawing in detail wherein like numerals of reference indicate corresponding parts throughout the several views the numeral 1 indicates conventional-

ly a suction or blower fan having connected therewith a drive belt 2. Running from the fan 1 is a main suction pipe 3 from which there runs a number of branch or auxiliary pipes (not shown) to various points in the system.

The device embodying this invention is interposed in the main suction line 3, usually adjacent to the fan as is shown in the drawing. The regulator comprises a casing secured in the line in the same manner as an ordinary pipe section of the line as shown in the figures of the drawing.

Passed about the casing 4, in spaced relation, is a pair of substantially U-shaped supporting elements 5, the yoke of these elements being of the proper diameter to fit snugly over the casing, and the legs 6 of these supporting elements extend in parallel spaced relation laterally of the casing when the same is in position in a pipe line as indicated in the drawing.

Secured between the legs of the supporting members 5 is a casing indicated generally by the numeral 7 and this casing comprises top and bottom members 8 and 9 respectively, end members 10 and front and rear panels 11 and 12 respectively. The rear panel 12 of the casing is of arcuate contour as is shown in Figure 4 and the purpose in curving this panel will become apparent as the description proceeds.

The top and bottom 8 and 9 of the casing have apertures 13 and 14 therethrough, the aperture 14 in the bottom being permanently open and the aperture 13 in the top of the casing having connected thereinto one end of a pipe 15, the other end of this pipe being secured to and opening through the pipe section 4 as indicated at 16. A passageway is thus set up from the pipe sections 4 to and leading into the top of the casing 7 as shown in Figure 4.

Extending longitudinally of the casing 7 adjacent the front panel 11, through the end walls 10 thereof and at one end into and through the pipe casing 4 to the opposite side thereof, is a revoluble shaft 17 carrying upon that end which extends beyond the outer end of the casing 7, a sheave 18. Passing over this sheave 18 is one end of a short cable 19, which cable is secured to the sheave by a securing element 20 while the other end thereof depends from the opposite side of the sheave and has secured therethrough a washer or plate 21 which is adapted to support weight members 22, of the type which are slit to enable them to be passed about the cable 19.

Mounted upon the shaft 17, in the housing 7, is a blade 23, the forward and end edges of which fit respectively against the curved panel 12 and the ends 10 of the casing, in such a manner as to prevent air which may enter the lower portion of the casing through the aperture 14, passing into the upper portion of the casing above the blade.

Upon the other end of the shaft 17, within the pipe casing 4 is mounted a butterfly valve 24 which is of the proper diameter to enable it to be positioned transversely of the pipe casing to tightly close the same, upon the proper revolution of the shaft 17. The butterfly valve 24 and the blade 23 are thus mounted to move simultaneously upon revolution of the shaft 17.

The operation of this regulator is as follows:—

The fan 1 would be run at sufficient speed to create a vacuum in that portion of the main pipe line 3 lying between the fan and the regulator, in excess of the vacuum to be maintained in the main suction pipe lying beyond the regulator. The fan is started up and weights 22 applied to the cable 19 until sufficient weight has been applied to bring the vacuum in the main pipe line beyond the regulator up to the strength at which it is to be maintained permanently. The vacuum in the main pipe line is transmitted to the casing 7, on the inside above the blade 23, through the pipe 15, and since this vacuum is less than the atmospheric pressure, and since the pressure above the blade 23 is therefore less than the atmospheric pressure below the blade 23, the atmospheric pressure creates a force acting upwardly on the blade, tending to revolve the same upward about the axis of and turning the shaft 17, but this force acting upward revolving the shaft clockwise, is resisted by the force of the weights 22 acting downwardly and tending to revolve the shaft and sheave 18 in a counter-clockwise direction.

When the vacuum in the main pipe line rises to a point where its force acting clockwise on the blade 23 inside of the casing 7, exceeds the force of the weights 22, it will lift the weight by revolving the blade upward on the shaft 17 and winding up the cable 19 upon sheave 18 carried upon the shaft. The shaft 17 also turns the butterfly valve 24 so as to have effect of restricting the flow of air through the pipe 3. The further the blade 23 is revolved upward by the force of the vacuum in the pipe 3 exceeding the force of the weights 22, the more the butterfly valve will restrict the flow of air through the casing or pipe casing 4 until it reaches a point where this restriction to the flow of air through this pipe section causes a reduction of the vacuum in the main pipe line and likewise in the chamber above the blade 23 and this reduction in the vacuum in the chamber reduces the force acting to revolve the shaft 17 in a clockwise direction until it becomes less than the force of the weights 22 acting to turn the shaft in a counter-clockwise direction. This then has the effect of opening the butterfly valve 24

to allow freer passage of air through the pipe casing 4 which in turn increases the strength of the vacuum in the pipe line and likewise in the chamber 7 of the blade 23 increasing the force acting upward upon the underside of the blade until it exceeds the force of the weight carried by the cable 19 and tending to turn the shaft in a counter-clockwise direction, when the blade 23 would move clockwise again and so on until the real effect of the regulator will be to balance or equalize the forces acting against each other to maintain a constant suction in the main pipe line 3 in proportion to the weights applied to the cable 19, and the volume of air whether great or small would not cause any difference in the vacuum being maintained in the main pipe line by the weights 22, and when a very small volume of air is being handled, the butterfly damper would remain nearly closed all of the time whereas if the full capacity of air were being handled the butterfly valve would be very nearly wide open.

From the foregoing description it will be readily seen that there has been provided a very novel and necessary regulator for maintaining an even vacuum or suction in all of the branch pipes and the main pipe line of an air conveying system, under all the conditions of use to which the system is subjected.

Having thus described my invention what I claim is:—

A regulator for a blower system of the character set forth, including a blower fan and a main air pipe line leading thereinto, comprising a casing secured to said pipe line and having a vertical rear wall and an arcuate front wall and further having an open bottom and an aperture through the top thereof, a shaft extending longitudinally along the back wall of said casing through and beyond each end thereof, one end extending through the diametrical center of said pipe, a butterfly valve on said shaft in the pipe, a valve blade on said shaft and fitting snugly in said casing, an air by pass extending from said top aperture to said pipe line upon the side of said butterfly valve remote from said fan, and adjustable means upon the other end of said shaft for controlling the movement of said blade.

In testimony whereof, I affix my signature hereto.

WILLIAM T. S. MONTGOMERY.