May 28, 1929. C. E. BILLINGS 1,715,273

DUST ARRESTER

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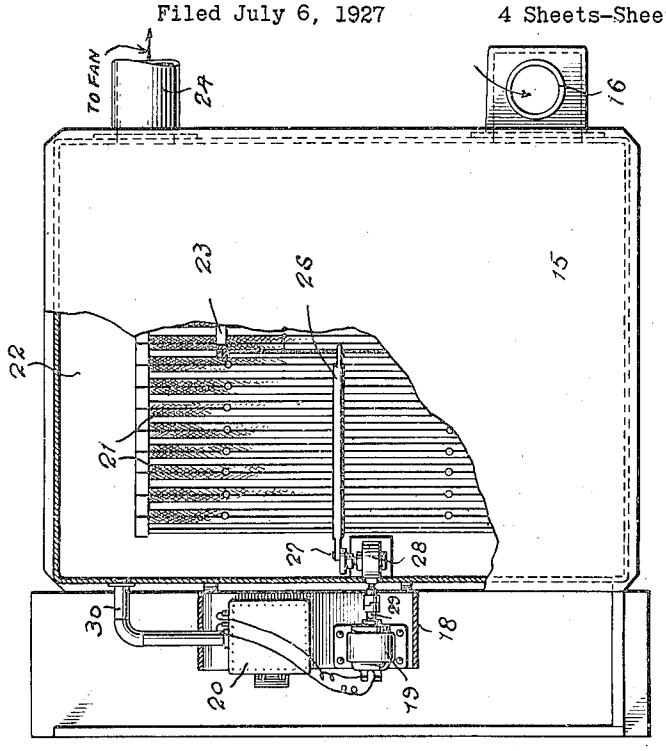


Fig. 2.

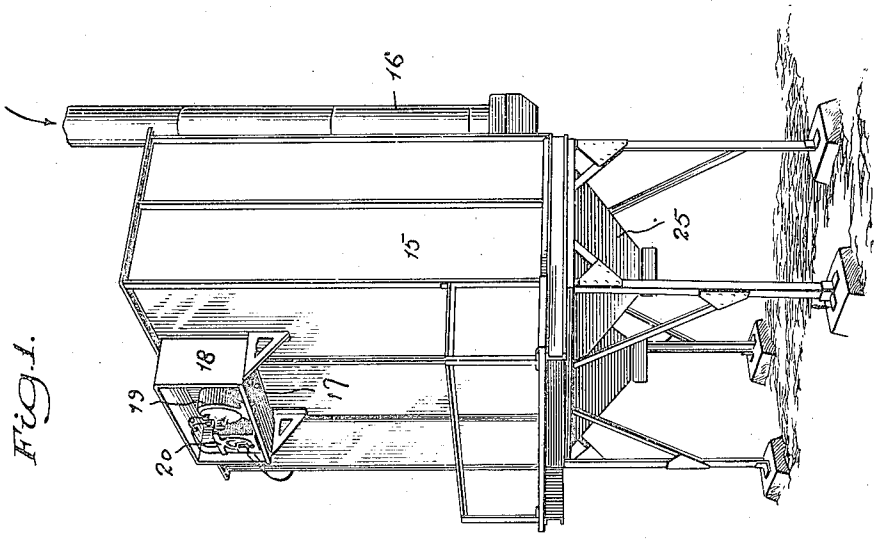


Fig. 1.

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Fig. 4.

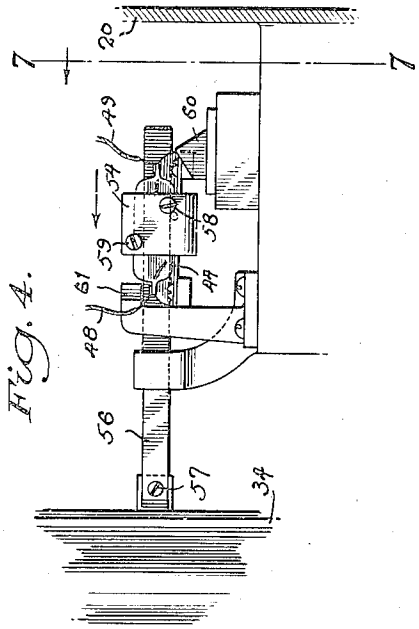


Fig. 5.

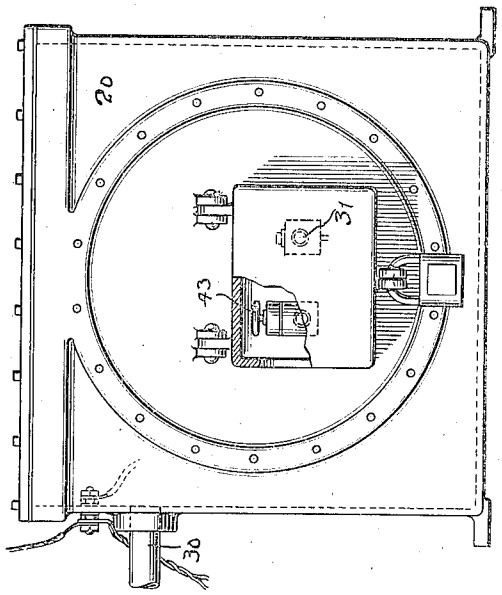
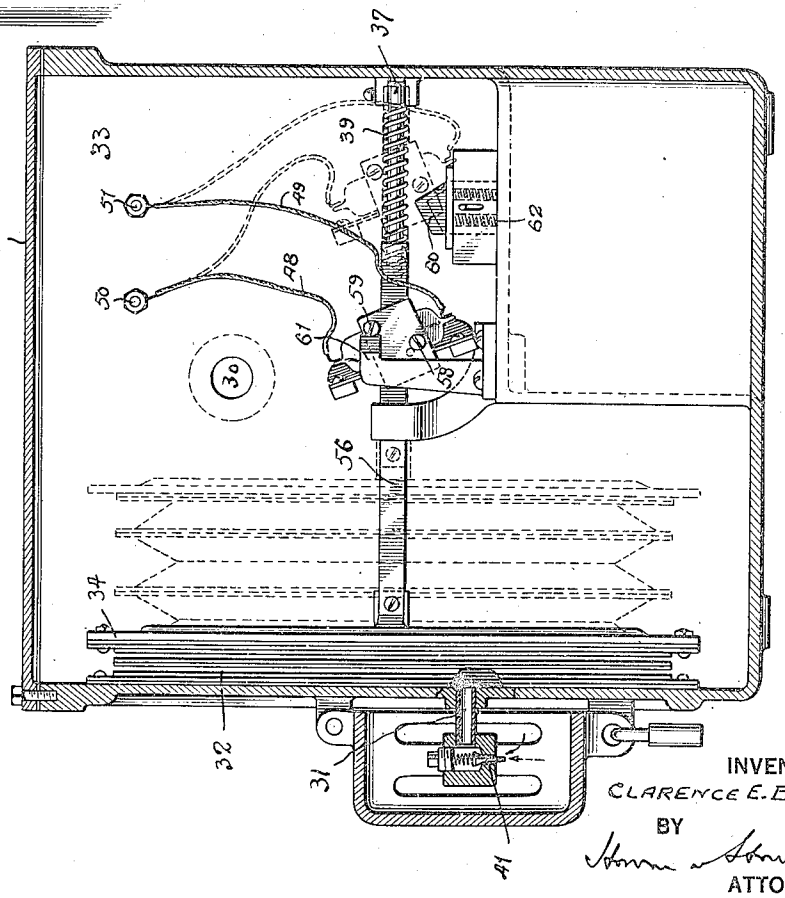


Fig. 3.



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Fig. 10.

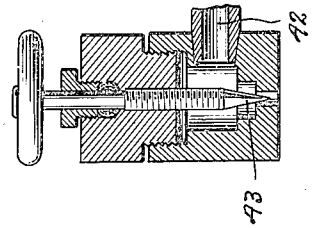


Fig. 9.

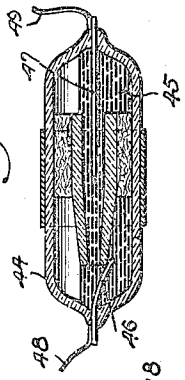


Fig. 8.

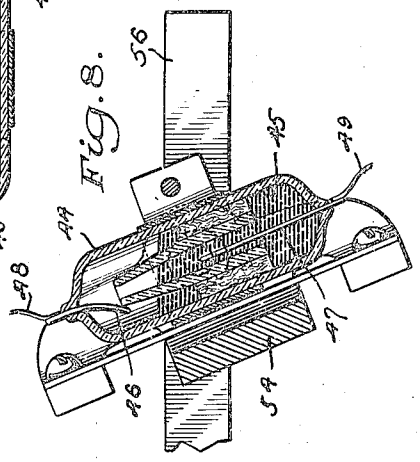


Fig. 7.

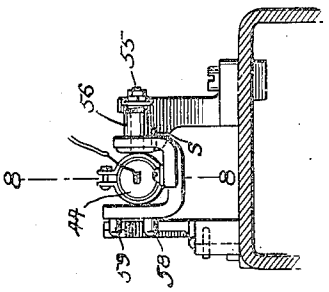
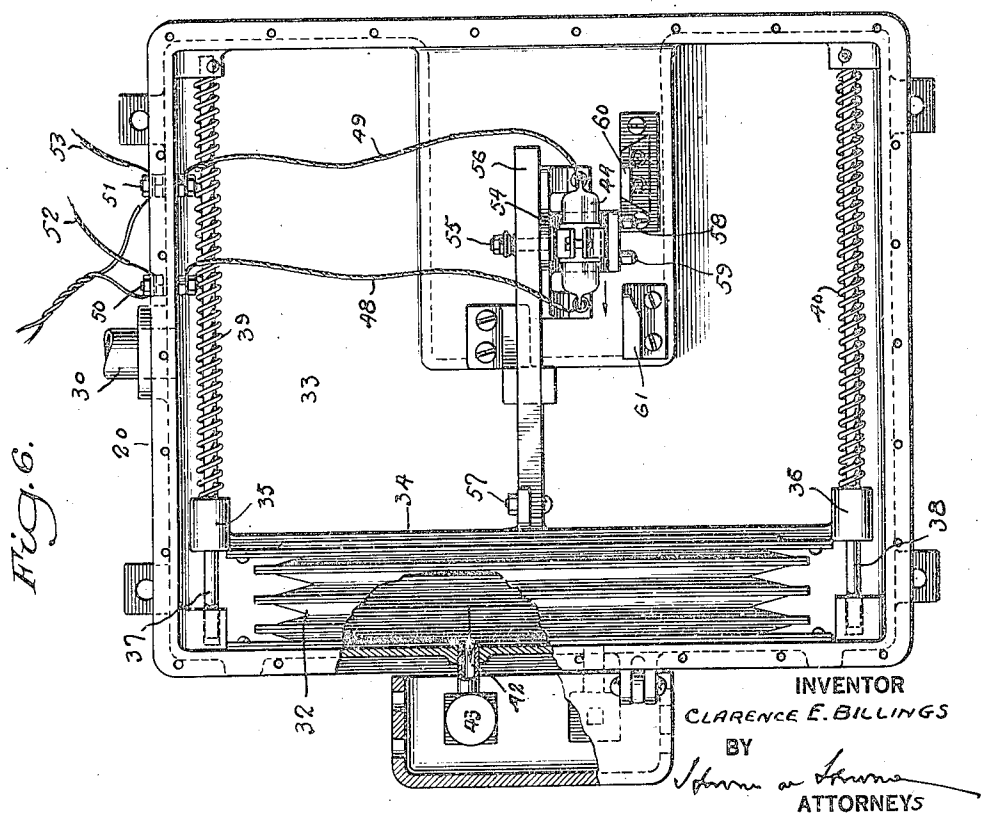


Fig. 6.



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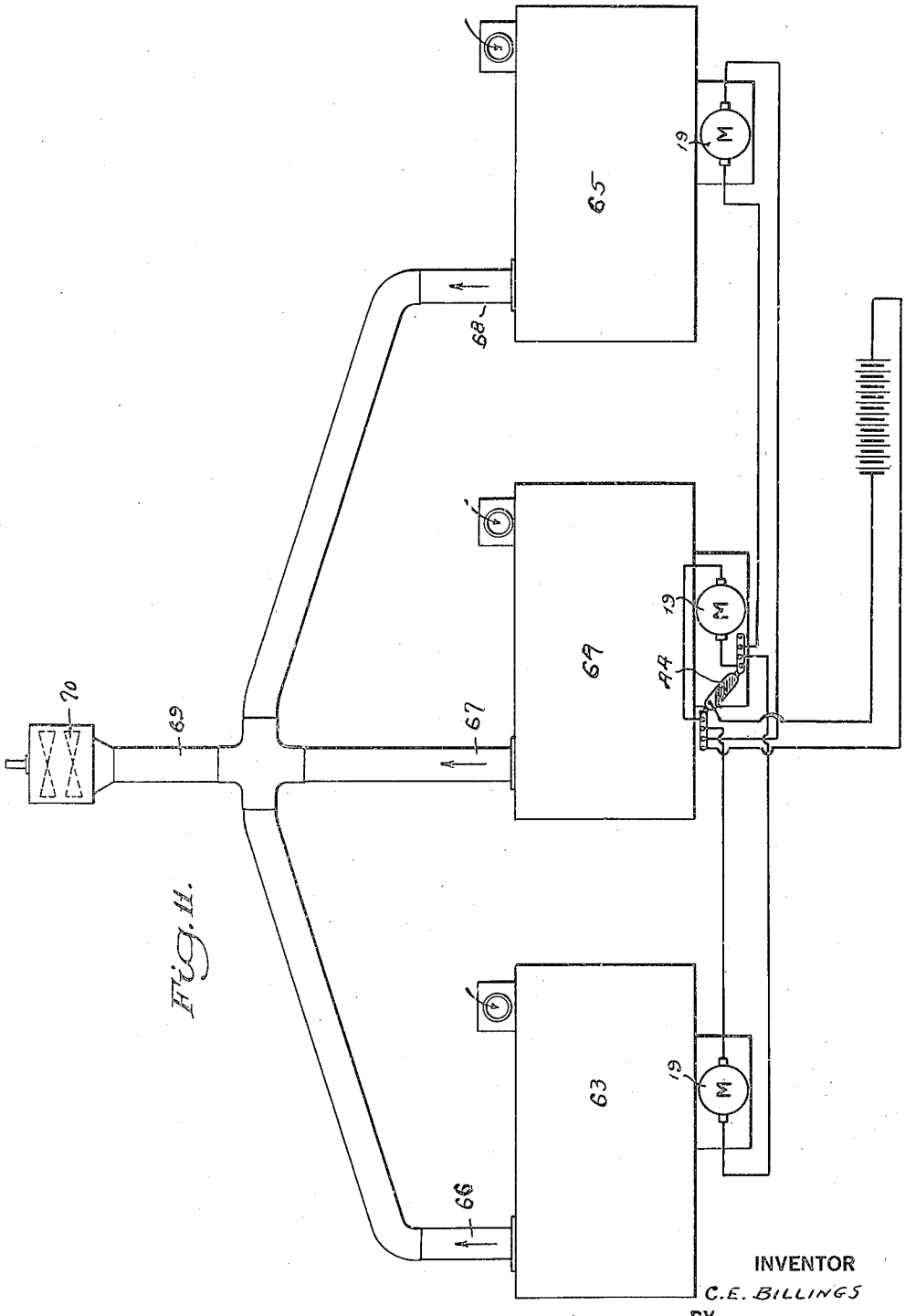


Fig. 11.

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Patented May 28, 1929. 1,715,273

UNITED STATES PATENT OFFICE.

CLARENCE E. BILLINGS, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE NEW HAVEN SAND BLAST COMPANY, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF CONNECTICUT.

DUST ARRESTER.

Application filed July 6, 1927. Serial No. 203,769.

My invention relates to dust arresters, and particularly to arresters of the filter-bag type. The object of my invention is to provide means for automatically cleansing the filter bags when the draft therethrough is interrupted. My invention contemplates not only the automatic initiation of the cleaning operation, but the automatic stopping thereof after predetermined duration.

In the accompanying drawings—

Fig. 1 is a perspective view of a dust arrester to which my invention is applied;

Fig. 2 is a broken plan view thereof to a larger scale;

Fig. 3 is a vertical section showing the control switch in one position;

Fig. 4 is a partial view similar to Fig. 3, showing the switch in another position;

Fig. 5 is a broken front elevation of the control box;

Fig. 6 is a horizontal section through the control box;

Fig. 7 is a section on the line 7—7, Fig. 4;

Fig. 8 is a section on the line 8—8, Fig. 7 but showing the switch in open-circuit position;

Fig. 9 is a section of the switch shown in circuit-closing position;

Fig. 10 is a section through the regulating valve; and

Fig. 11 is a diagram illustrating a plurality of arresters operated from a single control station.

Dust arresters of the type with which my invention is particularly concerned, commonly comprise a chamber in which a group of filter bags is arranged, and through which the dust-laden air is drawn. The dust which accumulates on the bag walls must be shaken free from time to time. Ordinarily it suffices to perform this operation twice a day, for example at noon and again at the end of the day. This operation is generally accomplished by vibrating the bags in some fashion, and it is common to perform this operation by means of a motor. So far as I am aware, the motor has heretofore been controlled only by hand valve or switch—that is to say, the operation of the motor has been dependent upon personal supervision both for starting and stopping. This has required attendance of an operator, and it is a common experience that the bag-cleaning operation is frequently neglected entirely, or insufficiently performed, or the operation of the motor forgotten, so that it continues for a period prolonged beyond that necessary to effect its purpose. From the standpoint of the efficiency of the separator, however, the most serious difficulty comes from neglect of the cleansing operation, since the choking of the bags with dust greatly increases the necessary draft effort to force the air through the filter bags, and may even choke the latter so completely that the arrester fails to function at all.

My invention provides means for automatically effecting the bag cleaning operation upon the interruption of the draft through the bags, and automatically stops the operation after a predetermined period. No personal attention is required to start and stop the bag cleaning operation since the mere cutting off of the draft through the arrester automatically starts the cleaning mechanism, and the latter stops automatically after sufficient operation.

Referring to the drawings, I have indicated in Fig. 1 a dust arrester casing 15 and an inlet pipe 16 which conveys to the lower portion of the chamber the dust-laden air. Mounted on a bracket 17 on the exterior of the casing 15 is a housing 18 for an electric motor 19 which operates the bag-shaking mechanism. Arranged within the housing 18 is an automatic control device 20, by which my invention may be carried out.

The type of filter employed may be of any appropriate character, as well as the cleansing mechanism. I have, however, shown in Fig. 2 a group of elongated, more or less rectangular filter bags 21 arranged within the chamber 22 and supported at their upper ends by a shaker frame 23. The dust-laden air entering by pipe 16 is drawn upward through the bags 21 by which the dust is filtered out, while the clean air escapes to the chamber 22 and exits from the casing 15 through the outlet 24. After the draft fan has been stopped, the vibration of the bags 21 frees the dust from the inner faces of the bag walls so that it settles by gravity into the hoppers 25, and may be removed therefrom at will.

To operate the shaker frame 23 and thus vibrate the bags to free them of their adherent dust, I provide a connecting rod 26 operated by a crank 27 driven through reduction gear-

ing 28 from motor shaft 29. The circuit of the latter is automatically made and broken, in accordance with my invention, thus automatically starting and stopping the vibration of the bags.

The automatic control device 20 which I have provided for this purpose, comprises a closed box placed in communication with some part of the system subject to the suction effort of the draft fan—for example, the interior of the chamber 22, by a pipe 30. A port 31 opens through the side of the box to the interior of a bellows 32 adapted to expand and collapse within the chamber 33. The inner end of the bellows 32 is closed by a cross head 34 rigid with sleeves 35 and 36 which slide on guide rods 37 and 38 at opposite sides of the chamber 33. Coil springs 39 and 40 arranged on these guide rods oppose the expansion of the bellows 32 and thus automatically tend to collapse the latter when the opening effort thereon is removed. The bellows is expanded by the air at atmospheric pressure entering the bellows through port 31, when the automatic depression in chamber 22 of the dust arrester is communicated to chamber 33 through the pipe 30. Consequently when the dust arrester is functioning, the bellows 32 is extended and held in extended position against the action of the springs 39 and 40 by atmospheric pressure. The aperture 31 is controlled by the one-way inlet valve 41. An outlet port 42 opens from the bellows and is controlled by an adjustable needle valve 43 which regulates the escape of air therethrough.

It will thus be seen that during normal operation the fan maintains a low pressure in the chambers 22 and 33. The low pressure within the chamber 33, combined with the pressure exerted upon the cross head 34 by the springs 39 and 40, is less than atmospheric pressure and, therefore, the bellows is expanded. This low pressure within the chamber 33 is maintained while the fan is in operation, but when the fan stops, the pressure within the chamber 33 rises to atmospheric pressure and the springs 39 and 40 collapse the bellows. Thus this action is automatic, depending merely upon whether the fan is in operation or not.

Operated by the movable head 34 of the bellows is a switch which controls the circuit of motor 19, and thus determines the period of vibration of the bags 21. This switch may be of any suitable character. I have illustrated, however, a mercury switch comprising an insulating tube 44 within which a quantity of mercury 45 is contained and electrically connects the switch contacts 46 and 47 when the tube is in horizontal position, and breaks the connection therebetween when the tube is in upright position. The contacts 46 and 47 are respectively connected by flexible leads 48 and 49 to terminals 50 and 51 mounted on, but insulated from, the casing 20, and to which the motor leads 52 and 53 are respectively connected.

The switch tube 44 is mounted in a yoke 54 pivoted on an axis 55 on the slide bar 56 which is connected at 57 to the movable head 34 of the bellows 32. Pins 58 and 59 slide with the yoke 54 and cooperate respectively with the stops 60 and 61 to tilt the switch tube and thus to make or break the circuit. The operation is indicated in Figs. 3, 4, 6, 8 and 9. The parts are shown in open-circuit position in Fig. 3 in full lines, the bellows 32 being now fully collapsed by the action of the springs 39 and 40. As the bellows expands the bar 56 is shifted longitudinally to the position indicated in dotted lines (Fig. 3). The pin 58 has ridden over the stop 60, depressing the latter against the action of its springs 62. Circuit is still open since the tube 45 occupies an upright position (Fig. 8) in which the contact 46 is out of engagement with the mercury 45. As the bar moves in the opposite direction under the collapsing pressure of the springs 39 and 40, (when the depression within the chamber 20 has been removed by stopping of the suction fan) the pin 58 engages the sharp incline of the stop 60 and causes the tube 45 to swing on its axis 55 to the horizontal position indicated in Figs. 4 and 9. The tube continues in this position during the collapsing movement of the bellows 32, the period of which is governed by the setting of the outlet control valve 43. As the bar approaches the end of its travel that is to say to fully collapsed position of the bellows, the pin 59 engages the stop 61 which causes the tube 45 to tilt to upright position again (Fig. 8), thus breaking the connection between the contacts 46 and 47. During the period of travel between the stops 60 and 61 the circuit of the motor 19 is closed, and during this period therefore the bag frame is vibrated to free the dust from the interior of the bag walls. The bag cleaning operation is thus automatically begun and ended, and is initiated by the cutting off of the draft through the dust arrester.

A stop pin S (Fig. 7) on the yoke 54 bears against the lower face of the bar 56 as the pin 58 rides over stop 60 during the opening movement of the bellows 32, and prevents angular displacement of the switch tube 44 by the stop. Similarly at the opposite end of the stroke of the bar, the pin S limits the up-swing of the switch tube by the engagement of pin 59 against stop 61.

In Fig. 11 I have indicated a single switch controlling a battery of arresters 63, 64 and 65, the outlets 66, 67 and 68 of which are connected to a common suction line 69 and draft fan 70. Since the draft through each of the dust arresters is caused by a suction fan common thereto, its stopping affects all

of the arresters simultaneously. The control switch may therefore be connected to any one of the dust-arrester chambers, or anywhere in the suction line 69.

I have indicated a particular form of switch and a bellows for operating the same. This is but a single illustrative embodiment of the broader thoughts which underlie my invention. It is perfectly possible to similarly control pneumatic or other motors by which the bags are vibrated, and to use other types of switches. So far as I am aware, it is new to provide a bag-cleaning mechanism which is automatically actuated when the draft through the arrester is cut off and stops after a predetermined period of operation. Other arrangements for accomplishing this embody what I claim as my invention.

I claim—

1. In a dust arrester, an air filter, means for passing dust-laden air therethrough, means for freeing the filter of accumulated dust, and means dependent upon the stopping of the filter operation for automatically initiating the actuation of the filter-cleaning means upon stopping of the filtering operation.

2. In a dust arrester, an air filter, means for passing dust-laden air therethrough, means for freeing the filter of accumulated dust, and means automatically setting the latter in operation for a predetermined period upon stopping of the filtering operation.

3. In a dust arrester, an air filter, means for drawing dust-laden air therethrough, means for freeing the filter of accumulated dust, and means automatically operative upon stopping of the air drawing means, to cause the actuation of the filter cleaning means.

4. In a dust arrester, an air filter, means for drawing dust-laden air therethrough, means for freeing the filter of accumulated dust, and means automatically operative upon stopping of the air drawing means, to cause the actuation of the filter cleaning means, for a predetermined period.

5. In a dust arrester, an air filter, means for causing dust-laden air to pass therethrough at a pressure other than atmospheric, means for freeing the filter of accumulated dust, and means responsive to air pressure for causing actuation of the filter cleaning means at atmospheric pressure.

6. In a dust arrester, an air filter, means for causing dust-laden air to pass therethrough at a pressure other than atmospheric, means for freeing the filter of accumulated dust, and means responsive to air pressure for causing actuation of the filter cleaning means at atmospheric pressure and for only a predetermined period.

7. In a dust arrester, a filter bag, means for drawing dust-laden air therethrough, a motor for vibrating the bag to free the latter of accumulated dust, and a motor control device comprising a bellows subject to the dust arrester draft, means for collapsing the bellows when the draft is stopped, and means controlled by the bellows for energizing the motor.

8. In a dust arrester, a filter bag, means for drawing dust-laden air therethrough, a motor for vibrating the bag to free the latter of accumulated dust, and a motor control device comprising a bellows subject to the dust arrester draft, means for collapsing the bellows when the draft is stopped, and means controlled by the bellows for energizing the motor only during the period of bellows collapse.

9. In a dust arrester, a filter bag, means for drawing dust-laden air therethrough, a motor for vibrating the bag to free the latter of accumulated dust, and a motor control device comprising a bellows subject to the dust arrester draft, means for collapsing the bellows when the draft is stopped, and means controlled by the bellows for energizing the motor only during the period of bellows collapse, together with means for regulating the rapidity of said collapse.

10. In a dust arrester, a bag filter, a fan for causing the flow of dust-laden air through the bag, an electric motor for shaking the bag to free it of accumulated dust, and means automatically operative on stopping of the fan, for closing the circuit of said motor.

In testimony whereof I have signed my name to this specification.

CLARENCE E. BILLINGS.