

Dec. 9, 1969

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3,482,378

TRAVELING PURGE HEAD DUST FILTER

Filed May 15, 1968

3 Sheets-Sheet 1

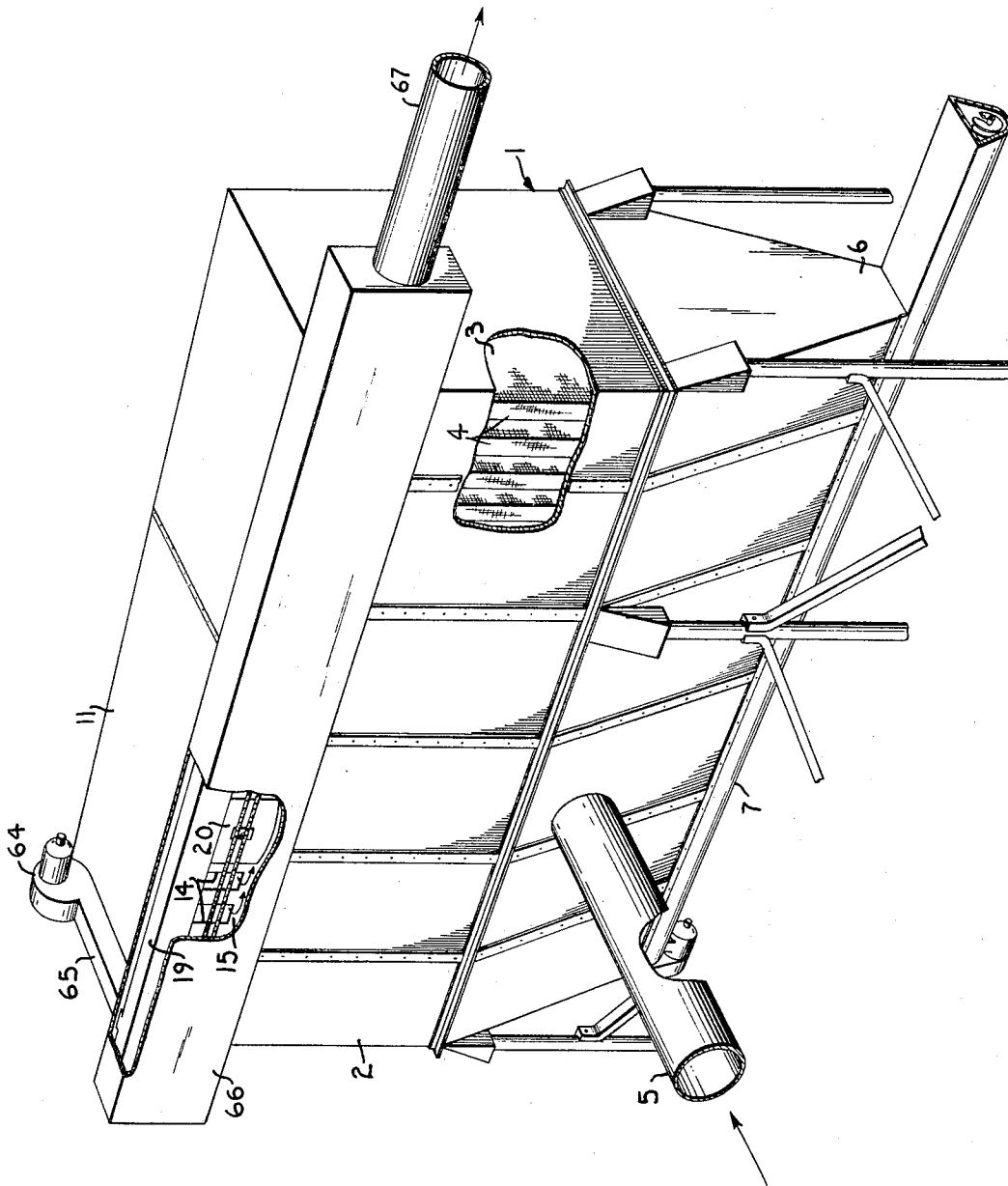


Fig. 1.

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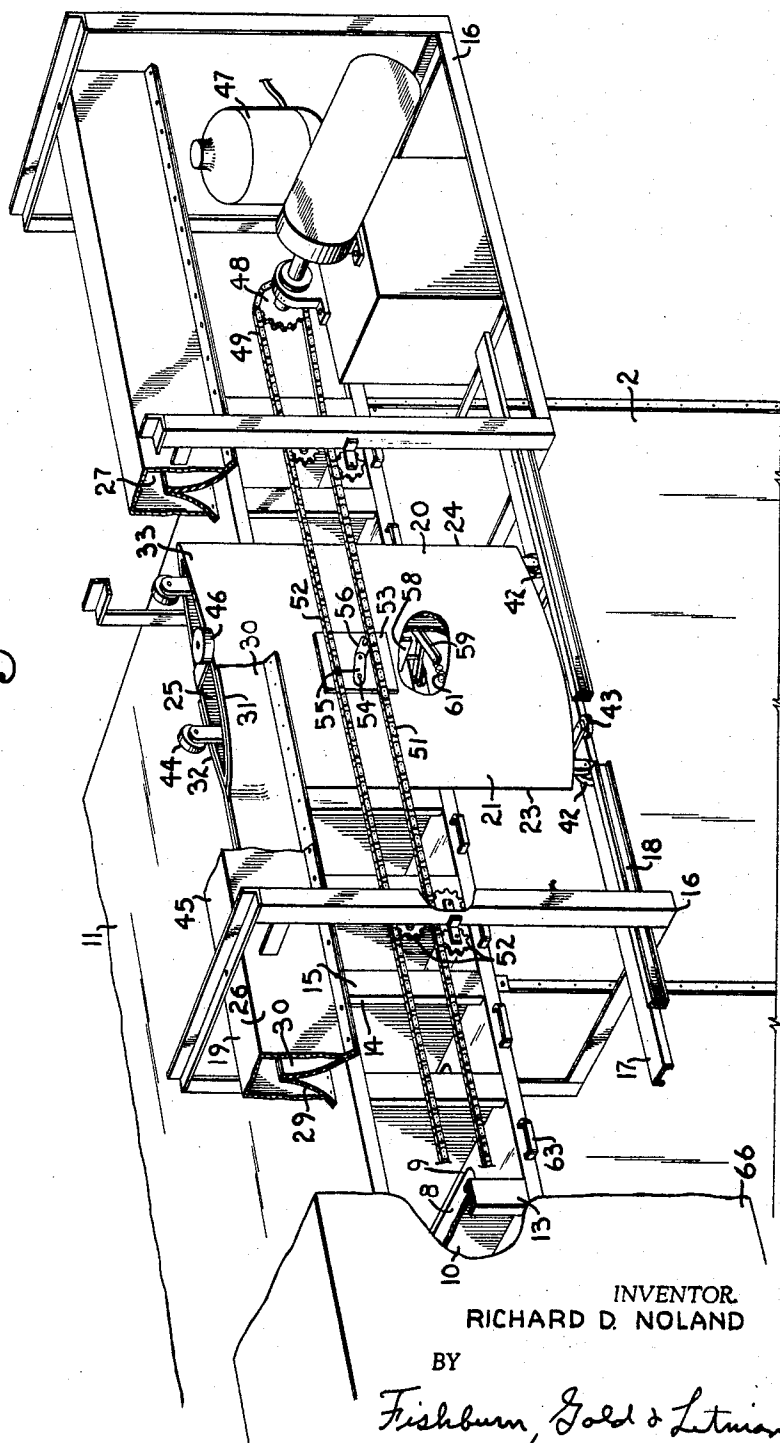
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3 Sheets-Sheet 2

Fig. 2.



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1

2

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TRAVELING PURGE HEAD DUST FILTER
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Filed May 15, 1968, Ser. No. 729,167

Int. Cl. B01d 35/22

U.S. Cl. 55—283

7 Claims

ABSTRACT OF THE DISCLOSURE

The filter bags of a multiple bag air filter are sequentially cleaned through periodic individual reverse flow by means of a traveling purge head continuously communicating into a stationary pressure duct. This communication is achieved through slidable engagement with a pair of flexible strips mounted on walls of the duct and having portions thereof normally extending into engagement with each other. The purge head locally separates the flexible strips near the bag being subjected to the reverse flow, the strips automatically closing the pressure duct in other positions.

This invention relates to dust control equipment and more particularly to improvements in the reverse flow cleaning of individual filter elements during normal equipment operation. More specifically, this invention relates to multiple filtering element dust control equipment having a traveling purge head providing continuous communication with a reverse flow pressure duct and sequential communication with respective filter elements.

Several types of dust control apparatus are available which provide sequential reverse flow cleaning of filtering elements. These include purge heads which rotate about a central axis to service circularly disposed filter elements, multiple valve systems programmed to sequentially operate in response to remote control devices which may include electrical, pneumatic, hydraulic and/or mechanical means, and travelling flow head systems which move along the surface of the filter elements generally trailing a flexible reverse air supply tube. These systems tend to be expensive to build, difficult to maintain, inefficient, and often result in preventing the most desirable configuration of the equipment for ease of manufacture and/or installation. Construction of such equipment on a simple modular basis for flexibility and economy in manufacture, installation and subsequent capacity expansion presents a particularly difficult problem.

This invention contemplates a reverse flow filter element cleaning arrangement for dust control equipment which permits a purge head to travel from element to element in a straight path during operation; does not require a multiplicity of valves and associated control members; does not require flexible hoses to carry the flow; and is efficient and well adapted to permit modular construction. These and other advantages are obtained through the use of a stationary pressure duct having a pair of flexible strips respectively mounted along the walls thereof normally closing an otherwise open slot except where separated by the moving purge head.

The principal objects of the present invention are: to provide reverse flow cleaning dust control equipment which is simple and inexpensive in construction, installation and later expansion, reliable and efficient in operation, easily maintained and long lived in use.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a fragmentary perspective view illustrating dust control equipment embodying this invention with portions broken away to show interior parts.

FIG. 2 is a fragmentary perspective view on a scale greater than FIG. 1 particularly showing the relationship between the travelling purge head, pressure duct and filter element exhaust passageways.

FIG. 3 is a fragmentary cross-sectional view, on a scale greater than FIG. 2, through the pressure duct and particularly illustrating the flexible strips normally sealing an otherwise open slot formed by the duct.

FIG. 4 is a fragmentary cross-sectional view, on a scale greater than FIG. 2, through the purge head and particularly showing a valve containing conduit connecting the interior of the head to filter element exhaust passageways.

FIG. 5 is a fragmentary cross-sectional view somewhat similar to FIG. 4 but showing a cam follower controlling the conduit valve and cams associated with the respective filter exhaust passageways.

Referring to the drawings in more detail:

The reference numeral 1 generally indicates filtering apparatus embodying this invention for use with dust laden air or the like. The apparatus 1 includes a housing 2 enclosing a separating chamber 3 which contains a plurality of filter elements, in this example, relatively flat, elongated, spaced-apart filter bags 4. A conduit 5 communicates through the housing 2 into the chamber 3 for carrying the dust laden air into the apparatus. The lower portion 6 of the housing 2 is in the shape of a bottom discharge hopper for collecting filtered dust particles disengaged from the exterior of the bags and a suitable air-lock conveyor 7 is adapted to transport the dust particles for continuous discharge from the apparatus.

The bags 4, in this example, are open only at the top, forming elongated open portions or mouths 8. The bags 4 are suitably mounted within the housing 2 whereby the mouths 8 engage a sealing plate 9. Air entering the chamber 3 through the conduit 5 is discharged upwardly through the bag mouths 8 but dust particles carried by the air into the chamber are trapped on the exterior surface of the bags 4.

Suitable spaced-apart vertical walls 10 are placed between the respective mouths 8 and a roof plate 11 engages the upper edges of the walls 10 whereby a horizontal passageway 12 is created above each of the bags 4 providing communication thereinto. The passageways 12 each terminate in a lateral faceplate 13 forming a plurality of mouths 14 respectively positioned in side-by-side adjacent relation along a path 15 and forming individual ports which normally function to discharge clean air.

Frame structure 16 is mounted on the housing 2 adjacent the path 15 and supports a horizontal track 17, a vertical track 18 and a pressure duct 19. The tracks 17 and 18 extend in parallel relation to the path 15 and movably support a purge head 20 for successive alignment with the respective passageway mouths 14.

The purge head 20 comprises a pair of co-extensive, relatively thin side walls 21 and 22 spaced apart centrally and converging into contact with each other at opposed ends 23 and 24 which are directed parallel to the path 15. The walls 21 and 22 thus form a hollow, double wedge structure with an upper peripheral edge opening 25 between the ends 23 and 24.

The pressure duct 19 extends along the path 15 and has a pair of opposed walls 26 and 27 spaced apart to form an elongated slot 28 therebetween directed longitudinally of the duct and, in this example, opening downwardly. A pair of flexible strips 29 and 30, for example, of heavy fabric reinforced rubber belting, are respectively mounted on the duct walls 26 and 27 in inwardly directed interfering positions, whereby portions 31 and 32

3

of the strips extend into engagement with each other between the walls 26 and 27, normally closing the slot 28.

The upper portion 33 of the purge head 20, which defines the opening 25, slidably projects into the pressure duct 19, between the strips 29 and 30 providing travelling communication between the interior of the duct and the purge head by forcing the strip portions 31 and 32 apart only at the existing position of the purge head 20.

Referring to FIGS. 4 and 5, a conduit 34, at one end 35 thereof, is connected to and projects from the purge head side wall 22 and has the other end 36 surrounded by a sliding seal plate 37 adapted to movably engage the face plates 13. The conduit 34 includes a flexible bellows portion 38 permitting the extension and retraction of the seal plate 37 toward and away from the purge head 20. Suitable supporting studs 39 project from the purge head wall 22 and slidably receive brackets 40 which support the seal plate 37 and, therefore, the conduit end 36 against sagging out of position by virtue of the flexible bellows portion 38. In this example helical compression springs 41 surround the respective supporting studs 39 and bear against the purge head wall 22 and the brackets 40, whereby the seal plate 37 is always maintained in slidably engaging relation with the face plates 13 aligned therewith.

The purge head 20 is supported for movement along the path 15 by downwardly directed bottom wheels 42 engaging the track 17, laterally directed lower wheels 43 engaging the track 18, upwardly directed top wheels 44 which roll against the upper wall 45 of the pressure duct 19 and a laterally directed upper wheel 46 which projects over the strip 30 into contact with the interior of the duct side wall 26. The purge head 20 is thereby free to move along the path 26 while resisting any reaction due to the pressure exerted by the seal plate compression springs 41.

A gear motor 47 is mounted on one end of the frame structure 16 and continuously drives a sprocket 48 in one direction during operation of the apparatus 1. An endless chain 49 is engaged with the sprocket 48 and supported in generally parallel forward and return flights 50 and 51 by suitable idling sprocket sets 52 spaced along the path 15.

A mounting plate 53 is secured on the side wall 21 of the purge head 20 and supports an anchor stud 54 projecting outwardly therefrom. A link 55 is pivotally mounted at one end thereof on the stud 54 and at the other end is pivotally connected to one end of a link 56. The other end of the link 56 is pivotally engaged with a link of the chain 49. The links 55 and 56 form a flexible elbow construction through which the continuously moving chain 49 drives the purge head 20 back and forth along the path 15. This is the result of the link 56 automatically switching chain flights at the ends of chain travel.

The purge head 20, as noted above, has an opening 25 defined at the upper peripheral edge between the ends 23 and 24. The purge head 20 also has a bottom wall 57 blocking the lower end whereby the only other outlet therefrom is through the conduit 34. A butterfly valve 58 is pivotally mounted within the conduit 34 whereby, upon rotation thereof through a predetermined angle, the conduit is selectively opened and closed to control air transmission past the seal plate 37. The operation of the butterfly valve 58 is controlled through a cam follower 59 mounted on the shaft 60 supporting the butterfly valve 58. The cam follower 59 is resiliently urged into a neutral or intermediate position by suitable tension springs 61 whereat the cam roller 62 projects toward the housing 2. Individual cams 63 are spaced apart along the path 15 beneath the passageway mouths 14 for successive engagement with the cam roller 62. As the conduit 34 aligns with a passageway mouth 14, the valve 58 is moved to an open position, however, when the conduit 34 is positioned between adjacent passageway mouths 14, the valve 58 closes the conduit 34. The cam follower

4

59 is operably symmetrical whereby the same control action is obtained regardless of the direction of travel of the purge head 20.

A suitable pressure blower 64 is provided in any convenient position to supply a volume of clean air under suitable pressure into the pressure duct 19, in this case through a conduit 65, FIG. 1. The pressure duct 19 is closed at opposite ends thereof whereby air under pressure therein cannot escape except by the separation of the strip portions 31 and 32. If desired, a housing 66 may be provided to surround the passageway mouths 14 for collecting the filtered air so as to discharge same through a suitable clean air conduit 67. The housing 66 and conduit 67, however, may be eliminated when the filtered air is to be discharged into the room containing the filtering apparatus 1.

In operation, the pressure blower 64 maintains clean air in the pressure duct 19 at a suitable pressure above the pressure within the chamber 3. Dust laden air is introduced into the chamber 3 through the conduit 5 and exits through the passageway mouths 14 after depositing the dust particles on the exterior surface of the bags 4. As the filtering apparatus operates, the purge head 20 is reciprocally driven along the path 15 as noted, successively aligning with the passageway mouths 14 in a continuous motion. Upon aligning with a passageway mouth the valve 58 opens, introducing a blast of air from the pressure duct 19 into the respective filter bag, causing the dust deposited on the exterior surface of the bag to be dislodged to fall down into the lower portion 6 of the housing 2 where it is removed by the air-lock conveyor 7. Communication between the pressure duct 19 and the conduit 34 is provided through the opening 25 about which the strip portions 31 and 32 are separated locally, but immediately close upon passage of the purge head further along the path 15.

Due to the configuration of the reverse air cleaning system above described, it is a simple matter to increase the capacity of the filtering apparatus by merely adding a module containing additional filter bags at the end of the existing housing, extending the chain 49, frame structure 16 and pressure duct 19, and, if necessary, increasing the capacity of the pressure blower 64. Also, the lack of multiple valves and rotating purge head permits the convenient use of large surface, inexpensive flat filter bags and large flow passageways which provide improved filtering capacity and efficiency as well as easy maintenance.

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

1. Fluid filtering apparatus comprising:

- (a) a plurality of exterior deposit filter bags with mouths, a housing having a dust laden gas inlet and a clean gas outlet and containing and supporting said filter bags and having means forming individual passageways respectively communicating with said filter bag mouths, said passageways having linearly aligned, normally unobstructed mouths spaced from said respective bag mouths,
- (b) a fixed fluid pressure duct extending longitudinally along said passageway mouths, means providing a positive gas pressure in said duct, a longitudinally elongated slot formed in said duct, flexible strip means on said duct adjacent said slot and having portions thereof normally extending into resilient sealing engagement along said slot normally sealing said slot,
- (c) a purge head comprising side walls spaced apart centrally thereof and converging at opposite ends forming a hollow, double wedge structure, said hollow wedge structure having an opening defining a flow entrance thereinto between said opposite ends, a portion of said hollow wedge structure including said flow entrance being slidably received within said duct through the slot and against said strip means at said purge head, thereby providing travel-

- ing flow communication between said pressure duct and the interior of said hollow wedge structure,
- (d) a flow exit opening in said hollow wedge structure spaced from said flow entrance opening, the double wedge structure being impervious to gas flow except through the flow entrance and flow exit openings for passing fluid received through said flow entrance, nozzle structure on said hollow wedge structure and joined with said flow exit opening for directing fluid into one of said passageways, said nozzle structure having an outlet opening and seal means adapted to sequentially seal said housing passageway mouths with said nozzle structure opening upon movement of said hollow wedge structure along said slot, means for reciprocatingly driving said hollow wedge structure along said slot and said passageway mouths, and
- (e) valve means in said nozzle structure and closing the nozzle structure opening, and means to automatically open said valve means upon flow communication between said nozzle structure opening and a housing passageway mouth.
2. The apparatus set forth in claim 1 wherein:
- (a) said flexible strip means comprises a pair of flexible strips respectively having edges normally contacting each other and spread apart by said hollow wedge structure.
3. The apparatus as set forth in claim 1 wherein:
- (a) said nozzle structure includes an extendable portion between said hollow wedge structure and said seal means, and
- (b) resilient means urging said seal means against said housing passageway mouths.
4. The apparatus as set forth in claim 1 wherein:
- (a) said seal means comprises a plate slidably engaging said respective passageway mouths.
5. The apparatus as set forth in claim 1 wherein said valve means includes:
- (a) a shaft supporting a valve flow control member for movement between a closed position and an open position,
- (b) a cam follower means associated with said shaft for moving said shaft between said positions, and

- (c) cam means positioned along said passageway mouths and cooperating with said cam follower means to open said valve flow control member during sealing of said means to said respective passageway mouths and close said valve flow control member during transit between said passageway mouths.
6. The apparatus as set forth in claim 5 wherein:
- (a) said cam means includes means forming cam actuating surfaces projecting into opposed directions and operative with said cam follower during travel of said purge head in opposite directions along said passageway mouths.
7. The apparatus as set forth in claim 6 wherein:
- (a) said valve means includes resilient means associated with said shaft and urging said cam follower means including means forming cam actuating surfaces toward the passageway mouths.

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U.S. Cl. X R.

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