May 5, 1959 S. SYLVAN 2,885,028

MECHANICAL DRY TUBULAR-STOCKING DUST COLLECTOR OF THE TRAVERSING REVERSE-JET BLOW RING OR SELF CLEANING TYPE

Filed May 7, 1956 2 Sheets-Sheet 1

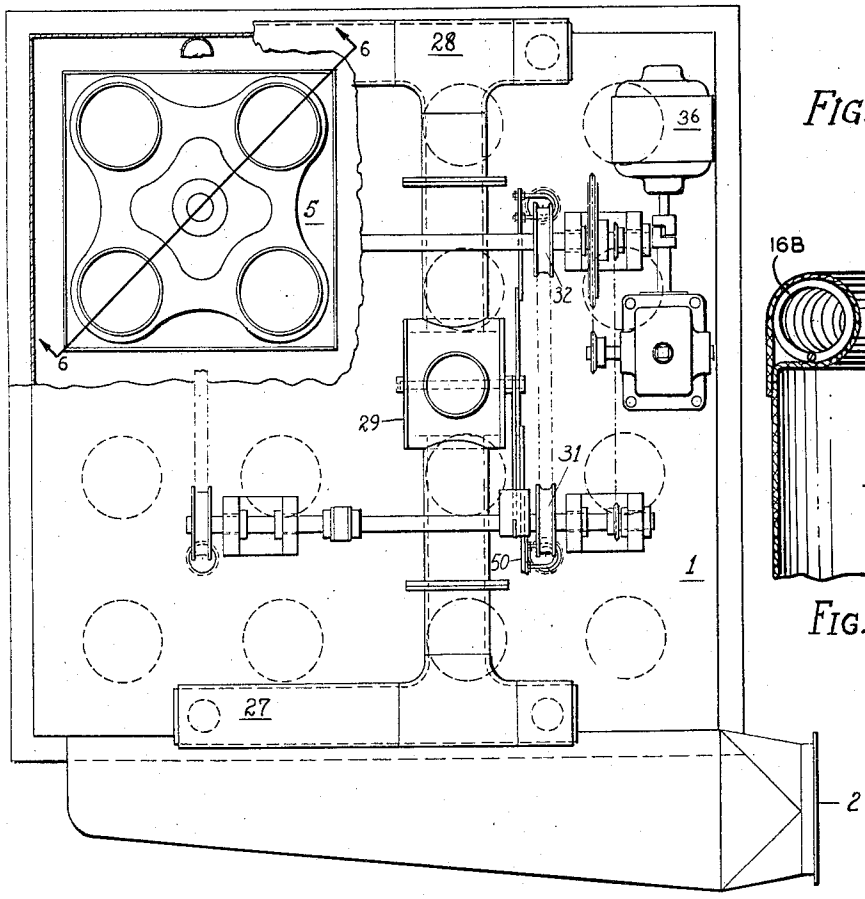


FIG. 1

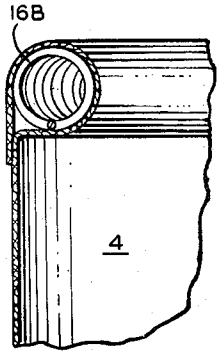


FIG. 8

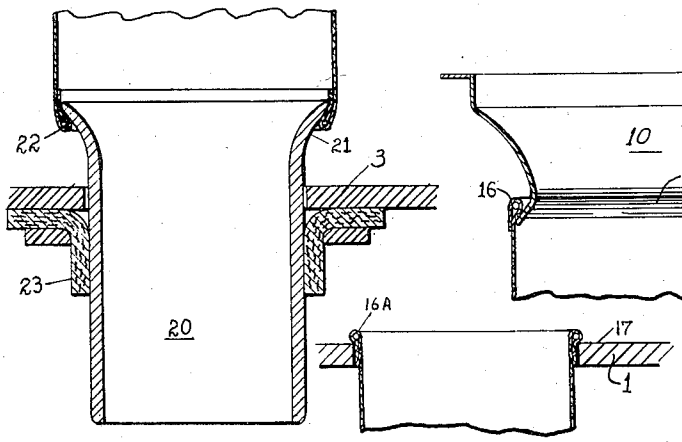


FIG. 5

FIG. 4

FIG. 3

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FIG. 2

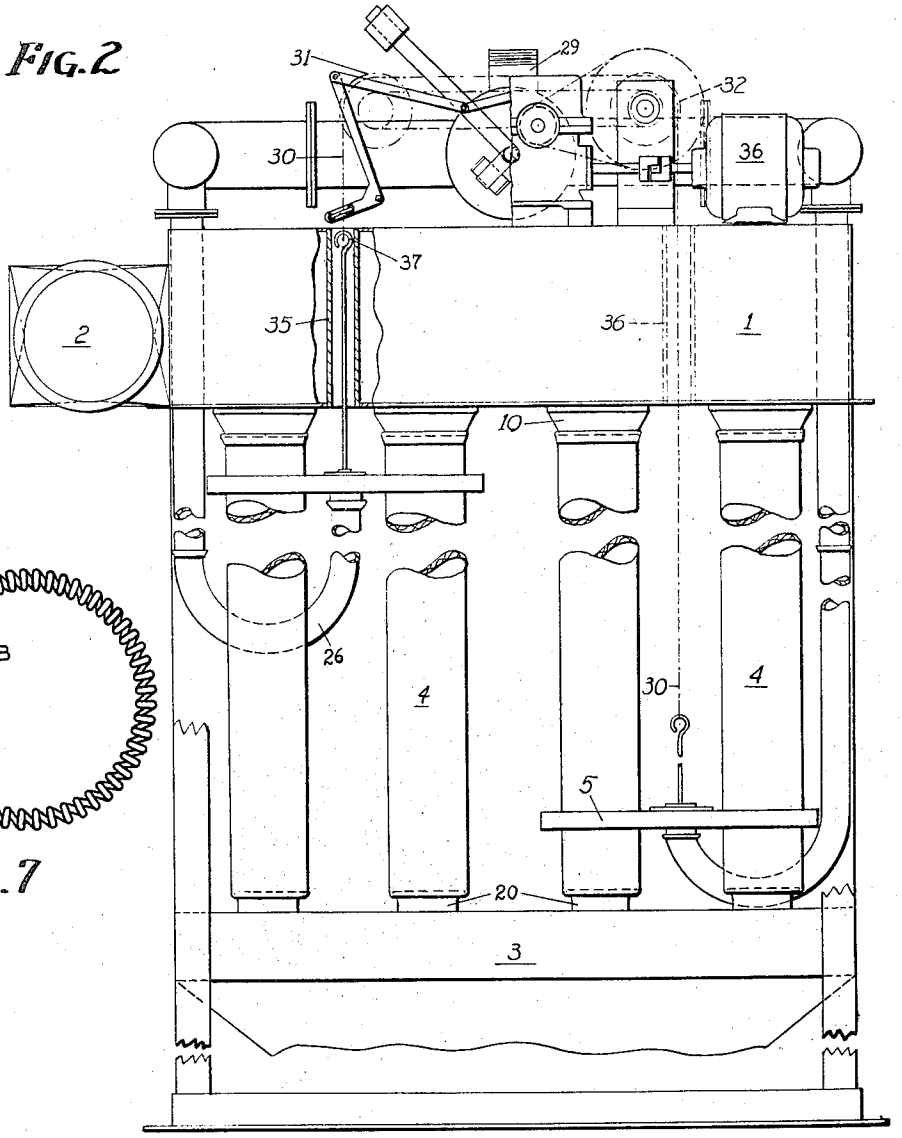


FIG. 7

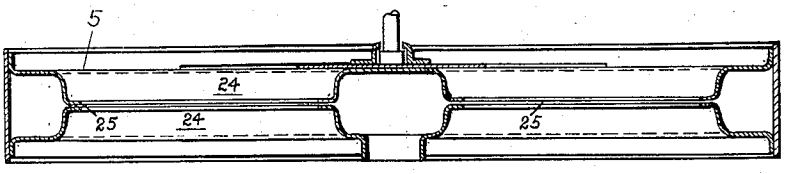


FIG. 6

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MECHANICAL DRY TUBULAR-STOCKING DUST COLLECTOR OF THE TRAVERSING REVERSE-JET BLOW RING OR SELF CLEANING TYPE

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Application May 7, 1956, Serial No. 583,312

2 Claims. (Cl. 183—51)

This invention relates to mechanical dry tubular-stocking dust collectors of the traversing reverse-jet blow ring or self-cleaning type, and is a continuation-in-part of my application Serial No. 363,322, filed June 22, 1953, which issued as Patent No. 2,751,042 on June 19, 1956.

In dust collectors of this type, the air enters a vertically arranged tube or stocking axially, usually at the upper end, and is cleaned as it discharges radially outward through the fabric of the tube. As the air flows, the tube is traversed back and forth along its length by an encircling blow ring which jets an annular sheet of high pressure gas into the tube to force the accumulated dust from its inner surface, the dust thus removed ultimately being discharged axially from the lower end of the tube into a hopper or other dust receiving system.

The principal object of this invention is to improve this jet type of cleaner in a manner such as to facilitate its manufacture, improve its operation and reduce its maintenance.

More specifically the objects are: to improve the connections between the ends of the tube and the header and hopper respectively to facilitate the installation and removal of the tubes; to reduce the wear on the inlet end of the tubes; and to improve the connection between the lower end of the tube and the hopper while accommodating lengthwise expansion and contraction of the tube and maintaining an adequate seal at this connection.

The invention is illustrated in the accompanying drawings wherein:

Figure 1 is a partly broken view of a dust collector embodying the present invention;

Figure 2 is an elevational view looking at the right side of the collector as it appears in Figure 1;

Figure 3 is a detail view of the means by which the upper end of the tube is connected to the header;

Figure 4 is a detail view of a modified form of connection for the upper end of the tube;

Figure 5 is a detail view of means connecting the lower end of the tube to the hopper;

Figure 6 is a sectional view of the blow ring taken on line 6—6 of Figure 1;

Figure 7 is a plan view of a modified tube attachment ring; and

Figure 8 is a section of the ring of Fig. 7 in place in a tube end.

Dust collectors, of the type illustrated in the drawings, are exemplified by the collectors shown in U.S. patent to Hersey, 2,495,635. The collector, specifically illustrated in the drawings conventionally comprises: an upper sheet metal inlet header 1 having a side inlet opening 2 to receive the gas to be cleaned and a series of gas outlet openings in its bottom wall; a bottom sheet metal dust hopper 3, having, in its upper wall, a series of openings corresponding to the header outlet openings; a series of cylindrical fabric filter elements or tubes 4 extending from the header substantially to the hopper, each tube having a sealed connection at its upper

and lower ends with the header and hopper respectively and operating to receive dusty gas axially from the header and to discharge clean gas radially into the surrounding atmosphere or casing and ultimately discharging the separated dust axially downward into the hopper; one or more traversing reverse-jet blow rings 5 providing a nozzle for each tube, each nozzle being arranged to jet an annular sheet of high pressure gas reversely through the tube fabric in order to dislodge the deposited dust from the inner face of the tube; drive means for reciprocating the blow rings upwardly and downwardly along their respective tubes; means for supplying gas under relatively high pressure to the blow rings; and interrupting means for shutting off the flow of high pressure gas to each blow ring during its upstroke.

In service it is necessary to remove individual tubes from time to time for various purposes such as inspection, repair, replacement, etc. Heretofore, this has been a troublesome operation because the limited access to the upper ends of the tubes usually restricts the performance of this operation to a single person and normally requires that person to work at arm's length with his hands overhead while the heaviness of the tube makes it difficult for that person to support the tube in such position and at the same time manipulate even the simplest clamp or other mechanical fastening means normally employed to secure it to the header.

In accordance with one feature of the present invention, the foregoing difficulties are minimized by a very simple mounting arrangement which permits each tube 4 to be grasped at its mouth for supporting purposes and to be attached to or removed from the header by a simple manipulation of the mouth of the tube. The tube mounting arrangement employed for each tube consists of a gas outlet nipple or tube connector 10 rigidly mounted on the underside of the header 1 to provide an outlet opening therefor and which has an outwardly extending peripheral flange 11 at its upper end adapting it for connection to the header 1 by means such as welding. A cylindrical section 12 extends downwardly from the inner edge of the flange 11 and is connected at its lower edge to a venturi shaped throat section 13, the inner surfaces of which are smoothly curved downwardly and inwardly to a minimum throat area 14 where they are reversely curved outwardly to form an outwardly extending flange 15 terminating in a rim at the lower edge of the connector 10. The circumferential flange 15 provides a seat for the upper end of the filter tube 4, which has a flexible attachment ring 16 secured to it by means such as sewing. The diameter of the ring 16 is slightly smaller than the diameters of the cylindrical tube 4 and the rim of the flange 15.

The attachment ring 16 may be composed of any suitable material such as hemp, fabric, metal or plastic, fashioned in the form of an endless rope or chain. Preferably the mouth of the tube is folded, either inwardly or outwardly, over the ring and the folded material then sewn to the tube proper to enclose the ring.

Due to this construction, the flange 15 is adapted to support the tube 4 with the attachment ring 16 centered on its top surface. The rim of the flange 15 is made small enough so that the attachment ring 16 of the tube 4 can be readily mounted thereon in the same manner that an automobile tire is mounted on a wheel. This is accomplished by placing one portion of the ring 16 on the upper side of the flange 15 and offsetting it toward the opposite side of the connector 10 until the other portion of the ring 16 may be swung upwardly around and positioned on the upper side of the flange 15. Once the mouth of the tube 4 is seated, a downward pull on the tube will not affect its removal but will simply serve to increase the tightness of its sealed connection with

the connector 10. Obviously, this construction allows the upper ends of the tubes 4 to be mounted on or removed from the header 1 easily and quickly.

Further, the construction of the connector 10 provides still another advantage. Due to the venturi shape of the throat 13, the gas passing through the throat is directed toward the center of the tube 4. Since the speed of the gas entering a tube 4 may be as high as 1,000 ft. per minute, or even higher, its ability to abrade a tube is correspondingly high. It is, therefore, undesirable to have its dust content strike the surface of the tube until its speed has been reduced considerably. This is accomplished by the venturi shaped construction of the connector 10. It operates to direct the dust particles toward the axis of the tube and away from its walls at its upper end. Now by the time any of these particles reach the walls of the tubes 4, their speed is considerably decreased.

Figure 4 shows a reverse form of attachment for the upper end of the tube. In this modification, the tube sheet of the header 1 provides what may be called a circumferential flange 17 extending laterally inward and terminating in a rim which defines an air outlet opening of the header. The attachment ring 16A is made of a resilient material having self-sustaining rigidity, such as spring steel, and has a diameter slightly greater than the rim. The upper end of the tube is centered around the opening to rest on the inside of flange 17. To remove it, the upper end of the tube is lifted and the resilient ring 16A is flattened or compressed to an oval form permitting it to be slipped through the outlet opening. This structure is less desirable than that of Figure 3 because it subjects the fabric to the abrasive effect of the dust content of the air along an area, corresponding to the outlet opening of the header, where the air velocity is at a maximum.

However, the type of construction illustrated by Figure 4 is particularly desirable where the collector is used on the suction side of a blower fan thereby requiring a casing to be mounted about the tubes 4 which may make it inconvenient to replace the tubes from below the header 1. The top of the header 1 can then be provided with access ports where the tubes 4 can be inserted or withdrawn upwardly through the opening of the flange 17. The type of connection to be later described for the lower ends of the tubes 4 facilitates the mounting and removal of the tubes 4 by this method. A modified attachment ring construction is illustrated in Figure 7 and comprises an endless coil spring 16B which can be used with the tube connecting arrangement of Figure 3. Figure 8 illustrates the coil spring 16B enclosed in the upper edge of a tube 4 for use with the construction of Figure 3. The spring 16B is made so that it will be flexible and readily stretchable or expandable.

The bottom of each tube is yieldably connected to the hopper so as to accommodate the expansion and contraction of the tube and, at the same time, maintain it under uniform tension. While this can obviously be done in various ways, as by resilient means yieldably urging the lower end of the tube downwardly, I prefer to accomplish it by suitably weighting the lower end of each tube and slidably connecting it to the hopper.

Accordingly, the lower end of each tube 4 is terminated above its hopper opening at an elevation equal to or greater than its maximum expansion and contraction movement. The tube is slidably connected to the hopper through the agency of a hollow weight, in the form of a metal pipe 20, extending from the lower end of the tube downwardly through its hopper opening and having sufficient weight to maintain the tube under a desired degree of tension. The upper end of pipe weight 20 is flared outwardly to provide a flange 21 while the lower end of the tube is provided with an attachment ring 22 which reduces the bottom mouth of tube 4 to a diameter slightly smaller than the rim of the pipe flange 21. In other words, the lower end of the tube may be constructed and connected to the flange 21 of pipe weight 20 in the same manner as the upper end of the tube is constructed and connected to the flange 15 of the connector 10.

The pipe weight 20 extends downwardly through the appropriate hopper opening for a distance equal to or greater than the maximum expansion and contraction movement of the tube. A slidable sealed connection is provided between the pipe weight 20 and the hopper by means of a flexible tubular felt gasket 23 composed of felt, rubber or other flexible material and mounted on the hopper. Since the air pressure within the tubes and the hopper is the same, the pressure drop between the hopper interior and the atmosphere around the tubes will be the same as the pressure drop across the thickness of the tube fabric. Consequently, this pressure differential will serve to press the flexible gasket 23 into sealing relationship with the relatively movable pipe weight 20.

When the tubes 4 are adapted to be inserted or removed through the top of the header 1 by the method previously described in relation to the tube connection illustrated in Figure 4, the flange 21 of the pipe weight 20 and the ring 22 are provided with a smaller outside diameter than the opening in the flange 17, so that they will readily pass therethrough.

The illustrated dust collector contains a bank of sixteen tubes 4 and four separate blow rings 5, each accommodating four tubes. The blow rings 5 comprise a pair of similarly fabricated upper and lower metal sheets 24 (Figure 6), suitably joined together in spaced relation by a peripheral wall to enclose a chamber adapted to receive high pressure air and discharge it through the annular nozzles 25 formed by the spaced edges of the sheets 24 adjacent the tube openings. Thus the high pressure air discharged from the blow rings 5 separates the dust from the inner walls of the tubes 4 as the blow rings traverse the tube lengths.

Any tendency of the high pressure air jet to blow the tube fabric inwardly away from its contact with the edges of the nozzles 25 is overcome by the tension which pipe weight 20 exerts on the tube. For example a weight of 21 pounds produces adequate tension in the tube to prevent it from being blown inwardly away from the nozzle when the nozzle pressure is 13½ inches water gauge greater than the 4½ inches of water gauge pressure within the tube.

The high pressure air is supplied to the blow rings 5 through flexible hoses 26 connected at their opposite ends to suitable manifolds 27, 28 which are connected through piping, and a T 29 to a high pressure air source. A valve is arranged in the T to close off the supply of air to each blow ring 5 during its upward movement. This valve is actuated through suitable linkages from the mechanism which supports and moves the blow rings 5.

Each blow ring 5 is counterbalanced by an oppositely moving blow ring through a chain 30 connected to and extending upwardly from one blow ring and over a pair of laterally spaced pulleys 31, 32 and thence downwardly and connected to the opposite blow ring. The vertical portions of the chain 30 extend through conduits 35, 36 respectively, which provide chain passageways extending through the header.

A motor 36 is connected through suitable means to drive one of the pulleys 31, 32 and thereby drive the chain 30. A switch actuating element 37 at the ends of the chain 30 operates a switch to cause the motor 36 to reverse itself at the proper time and consequently reverse the directions of movement of the blow rings 5.

Having described my invention, I claim:

1. In a dust collector of the class described; an upper member; a lower hopper member; a gas cleaning tube arranged to extend vertically between said members; and means connecting the upper and lower ends of the tube to the upper and lower members respectively, said lower end connecting means including a tubular sealing member mounted on and directed downwardly into the hopper,

said sealing member having inner and outer surfaces and being positioned to extend around a tube receiving opening in the hopper, and a hollow pipe weight secured to the lower end of the tube to depend therefrom into said hopper opening and into sliding engagement with the inner surfaces of the sealing member.

2. A dust collector as specified in claim 1 wherein: said upper member is provided with an opening through which said gas cleaning tube projects; said upper projecting end of said tube has means attached thereto to support said upper end above said opening, said attached means being larger than said opening; and said hollow pipe weight is small enough to pass through said opening in said upper member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,461,809	Warner	July 17, 1923
1,776,805	Bragstad	Sept. 30, 1930
2,308,309	Ruemelin et al.	Jan. 12, 1943
2,576,310	Ruemelin	Nov. 27, 1951
2,620,893	Holt et al.	Dec. 9, 1952
2,769,506	Abboud	Nov. 6, 1956

FOREIGN PATENTS

485,039	Great Britain	May 13, 1938
488,129	Great Britain	July 1, 1938
597,378	Great Britain	Jan. 23, 1948