Sept. 13, 1966 P. DAUGE 3,271,936

APPARATUS FOR COLLECTING AUTOMATICALLY FIBROUS MATERIALS SUSPENDED IN AIR

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Fig. 1

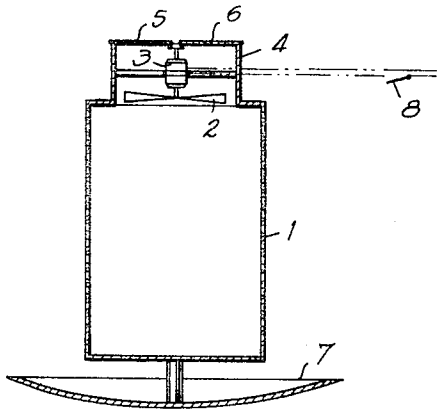


Fig. 2

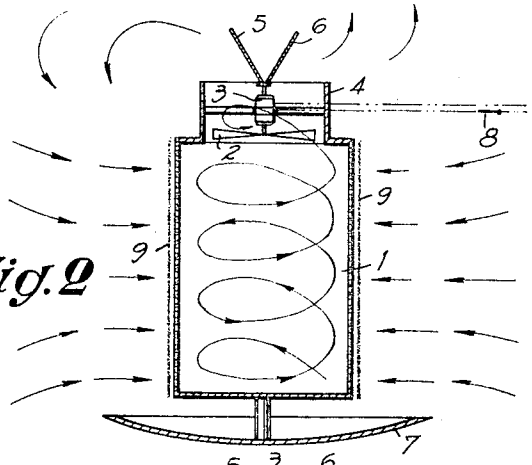
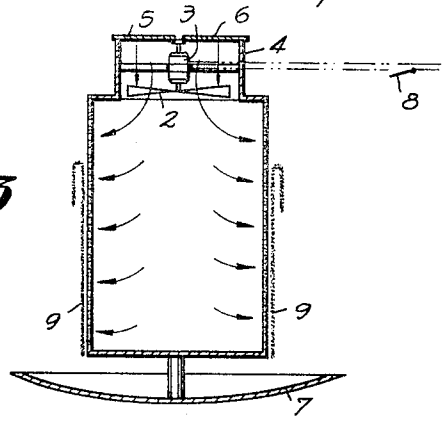


Fig. 3



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Fig. 4

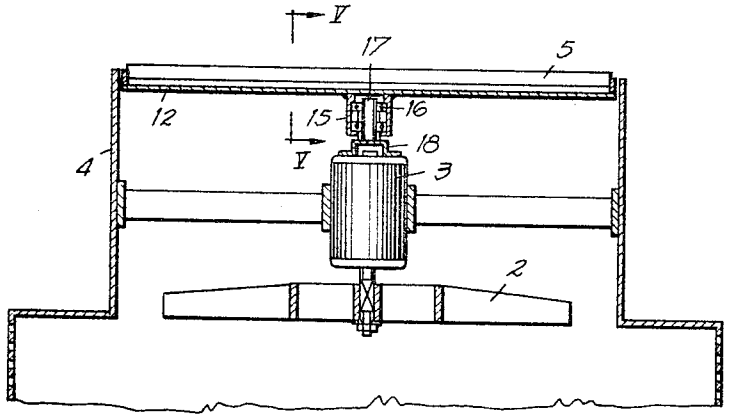


Fig. 5

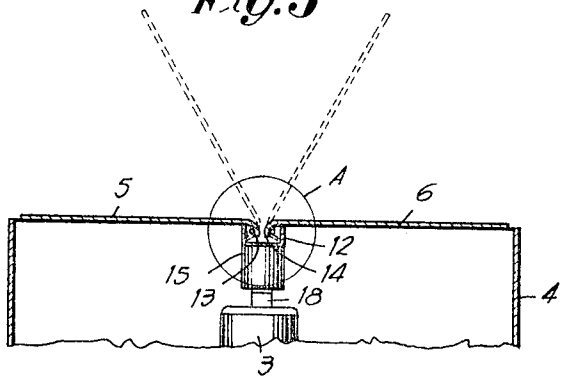
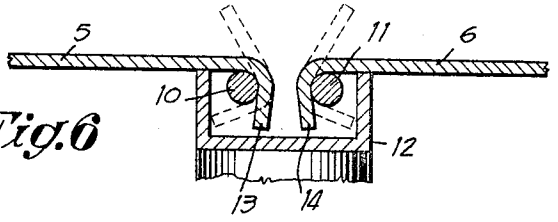


Fig. 6



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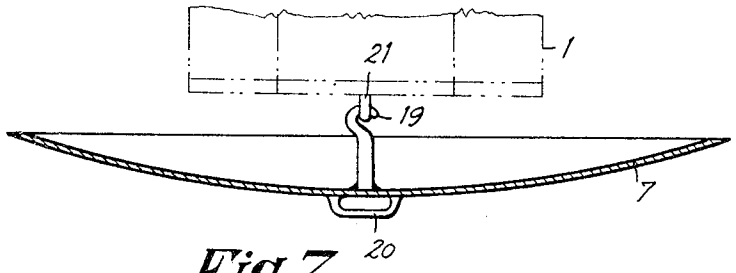
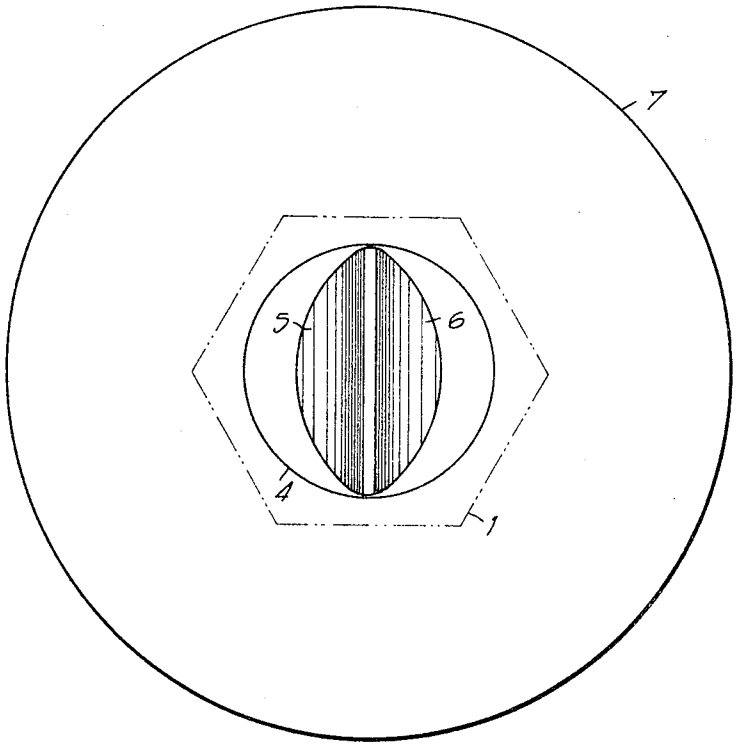


Fig. 7

Fig. 8



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3,271,936

APPARATUS FOR COLLECTING AUTOMATICALLY FIBROUS MATERIALS SUSPENDED IN AIR

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Claims priority, application Belgium, Jan. 30, 1963, 627,735
5 Claims. (Cl. 55—302)

This invention relates to an apparatus for collecting automatically and permanently the fibrous materials, dust and solid impurities of any kind suspended in air.

More specifically, an object of the invention is to provide a solution to the problem of the collection of fibrous materials in textile works, namely in the carding works, the twist mills and the like, for instance in the cotton spinning and weaving.

However, this concept of air purification may be applied to various other uses, the invention being concerned in general with the separation technique between a gaseous medium and a solid medium suspended in the said gaseous medium, the air purification in the textile works being referred to as a preferred application field of the said apparatus.

It has already been proposed for that purpose to employ different apparatus generally based upon the use of hollow bodies with air pervious walls and the internal faces of which are depressed to induce a displacement of air or the suspended fibers towards the said pervious walls, the air being sucked through the said walls and the so entrained fibrous and dusty materials being set automatically thereon.

The inventors have developed novel applications of these apparatus which comprises suspending the said hollow bodies at heights and intermediate distances according to the influence zones of each apparatus, the said influence zones providing the purification of the whole space determined by the intended room.

The suspended apparatus consist substantially of a framework, on which is stretched a web, the air permeability of which is duly determined, hollow body being surmounted by a fan capable of forming a depression within the said hollow body by setting up a helically moving air column, the said fan being itself surmounted by a vane, the rotation of which imparts a motion to the fibrous materials suspended in the area overlying the apparatus to prevent deposits thereof on the surrounding framework or machinery elements.

In such apparatus, the different faces of the hollow body are covered progressively with a thickness of fibrous materials forming a continuous coating similar to the veil formed in the carding machines.

To separate automatically the said fibrous materials from the walls to which they adhere, different means have been proposed. One of them comprises subjecting the said walls to a vibrating effect to loosen the fibrous materials therefrom. This device was found to be unsatisfactory.

Another procedure comprises reversing the rotation of the fan to modify the function and the effects thereof with respect to the inside of the hollow body with air pervious walls.

According to said procedure, the fan is caused to operate within the hollow body not as a suction fan any more, but as a propelling fan. The result is overpressure in the said hollow body, i.e. also a reversing of the air passage through the pervious wall. This overpressure is sufficient to separate the fibrous materials from the pervious walls to which they are adhering. This has the well known drawbacks inherent to any reversing machine.

Finally, it has been suggested to provide the apparatus with a removable skirt, which is retracted during the normal operation of the apparatus and is caused to surround the latter at a slight distance from its air pervious walls during the overpressure period, the said skirt preventing the projection of fibers into the atmosphere in case of excessive overpressure.

This means is truly efficient, but it makes the apparatus substantially more complex and more expensive.

It is an object of the invention to provide a novel apparatus carrying out a separation method.

This very simple method which can be controlled very readily and precisely comprises producing periodically within the hollow body and without reversing the rotation of the fan or the driving motor thereof, a relative overpressure with respect to the external surrounding air, while interposing at least one obstacle in the upward helical air stream coming from the said hollow body, the said overpressure being sufficient to automatically separate the fiber layer from the external walls of the said hollow body.

This obstacle periodically interposed in the upward column coming from the apparatus may be actuated either by individual means or by means directly connected to the apparatus itself.

The invention relates also to any apparatus of the above type, in which is provided at least one retractable obstacle which may be periodically brought into such position that it impedes the upward movement of the air column coming from the apparatus to create in the latter a duly controlled overpressure.

It is another object of the invention to make the movements of the said obstacle or obstacles strictly automatic in accordance with the steps of the method for purifying the surrounding air or collecting and setting the fibrous materials and dust suspended in the said surrounding air.

Another object of the invention is to operate the said obstacles in such manner that not only they are brought into a retracted or effective position under the thrust of the upward air column coming from the apparatus, but that these obstacles shall have as their second function that which is imparted in the said known apparatus to the ventilating vanes, namely, to prevent the bulky deposits of fibrous materials on the surrounding parts.

Still another object of the invention is to provide the rotation of the said obstacles by applying only the helical or whirling movement of the upward air column coming from the apparatus.

Still another object of the invention is to provide the easy and substantially instantaneous removal of the so collected fibrous materials by the particular assembly of the interlocking means between the proper collecting apparatus and the device collecting the fibrous materials and the dust separated from the said collecting apparatus.

Finally, another object of the invention is to allow, in order to complete the whole cycle of the air purification by collecting and removing the suspended fibrous materials and dust, the permanent visual control of the collecting to provide for the removal in good time and thereby to prevent some amounts of recovered materials from being projected again into the atmosphere.

These objects of the invention will appear more clearly from the following detailed description of an embodiment, which must be considered merely as a non limitating example and the characteristic elements of which are diagrammatically represented in the attached drawings, wherein:

FIGURES 1, 2 and 3 show diagrammatically the successive steps of the operating cycle featuring the method of the invention;

FIGURE 4 is a diagrammatic radial section of the upper part of the apparatus for carrying out the method of the invention;

FIGURE 5 is a section the line V—V of FIGURE 4 showing also in dash lines a second characteristical position of the moving obstacles;

FIGURE 6 shows on an enlarged scale the part indicated as A on FIGURE 5;

FIGURE 7 is a radial section of the lower part of the apparatus according to the invention;

FIGURE 8 is a plane view of the apparatus according to the invention.

In FIGURES 1 to 3, the apparatus for collecting and recovering the fibrous materials and dust suspended in surrounding air is, in order to show the application of the method according to the invention, represented substantially by the hollow body **1** with air pervious walls of a known type, the fan being represented by its screw **2** and its driving motor **3**, the ring casing **4** enclosing the fan. In the upper part of this casing, two shutters **5–6** may both swing about a diametrical or approximately diametrical axis disposed to the right of their lower edge and rotate about a coaxial axis with respect to the axis of the said motor **3**. In the lower part, a vessel or collecting bowl **7** is suspended from the body **1** of the apparatus.

The method of the invention is carried out as follows: the motor **3** being actuated for instance by the closing of the general switch **8** rotates at a predetermined normal speed and drives the screw **2** of the fan. Owing to the shape of the latter, there is created within the hollow body **1** a helical upward air column causing a depression within the hollow body **1**. The said depression induces a suction of the surrounding air towards and through the pervious side walls of the said hollow body **1**. All the solid bodies and more particularly the fibrous materials and the dust suspended in the said surrounding air will set upon the said pervious walls of the said body **1**.

The said helical upward air column actuates the said shutters **5–6** to bring and to keep them into the maximum opening position, while rotating the same about their vertical axis.

In this manner, during the whole normal operation of the apparatus, the said shutters **5–6** function as ventilating vanes causing in the surrounding air disturbance sufficient to prevent the bulky deposit of fibrous materials and dust upon the adjacent parts.

To separate the layers of fibrous materials and dust covering the pervious faces of the hollow body **1** of the apparatus, it is only necessary to lower by any suitable means the shutters **5, 6**, so that they will be interposed in the normal path of the upward air column coming from the apparatus to induce by a reaction in the latter a slight overpressure sufficient to cause the drop of the fiber and dust coating **9** surrounding the apparatus.

It will be observed that this separation is obtained without it being necessary to reverse the rotation of the fan. However, according to one of the most surprising features of the invention, the progressive lowering of the said shutters **5–6** may be carried out without any mechanism. In fact, it has been found that it is only sufficient to reduce the rotation speed of the motor. To this speed reduction corresponds a proportional reduction of the upward thrust of the air column coming from the apparatus and hence a progressively reduced actuation of the said shutters **5–6** to their top position.

Thus, these shutters are progressively lowering according to the reduction of the speed of rotation of the fan or the motor. The reduction of the fan speed is readily obtained by merely cutting off temporarily the supply of current to the motor by a break provided either periodically by hand or preferably through a timing apparatus.

The opening of the feeding circuit of the electric motor **3** will be thus extended for the time necessary to the drop of the said fiber and dust coating surrounding the apparatus and thereafter, when the feeding circuit will be closed again, the apparatus will substantially instantaneously resume its normal operating condition, since the shutters **5–6** will be brought back into their top position under the thrust of the upward air column coming from the apparatus, while being also rotated by the latter as described in the foregoing.

As represented in FIGURES 4, 5, 6 and 8, the said shutters **5–6** consist of semi-circular plates each fixed by its diametrical edge to an axle **10–11** respectively. Said axles engage by their ends the end of a crosshead **12** formed e.g. by an U-shaped beam, the side flanges of which constitute the stops of the said shutters in their completely closed position, their maximum opening position being for instance determined by the fact that an extension **13–14** respectively of their diametrical edge abuts against the corresponding portion of the internal face of the side of the crosshead **12**. A bushing **15** is secured to the lower face of the U-shaped beam **12** and is rotatably mounted through ball-bearings **16** on a vertical axle **17** which is integral with a bracket **18** secured to the casing of the motor **3**. Thus the shutters **5–6** are rotatably mounted about the axle **17** which is coaxial with the shaft of the driving motor **3** of the fan **2**.

As illustrated in FIG. 8, the hollow body **1** may be of hexagonal shape.

As may be seen in FIGURE 1 the hollow body **1** is provided with pervious walls prolonged by impervious walls and the fan **2** is mounted within the hollow body so as to separate a first chamber with pervious side walls and an impervious bottom from a second chamber with impervious side walls and normally closed by the movable shutters **5** and **6**. When the driving motor **3** of the fan **2** is operated the latter is driven in a predetermined direction and thus creates a stream of air from outside the hollow body towards the shutters **5** and **6** through the pervious side walls and the two chambers. A pressure is thus built up in the second chamber and when this pressure reaches a certain value the shutters **5** and **6** are gradually displaced towards the position shown in FIGURE 2. By this air stream dust is sucked through the pervious walls. When the driving motor of the fan is made inoperative the fan continues rotating by inertia but obviously its speed gradually decreases together with the pressure of the air stream. Also, the shutters **5** and **6** gradually move towards their initial or closed position. But at that moment the pressure in the second chamber is still considerably larger than the pressure outside the hollow body. Obviously this condition cannot last and air will flow from the second chamber towards the outside of the hollow body through the first chamber and the pervious walls. Thus dust will be removed from these walls.

It should be noted that as long as the fan continues rotating there is a small air flow, but as soon as the shutters **5, 6** are closed the fan speed is rapidly reduced to zero due to air streaming from the second chamber to the outside of the hollow body. Obviously, from that moment on, the air stream is terminated.

It is of course apparent that this embodiment does not limit the invention and it is only given to show that the method forming the essential object of the invention may be carried out by very simple, economic and systematically operating means.

With respect to the periodical removal of the collected fibers and dust and the visual control of the apparatus, both these problems are solved very simply according to further characteristics of the invention. As represented in FIGURE 7, the vessel or bowl **7** has an axial hook **19** and a gripping element, namely a handle **20**. Any of these elements could be of course replaced by similar members or members having a similar function. The said hook-shaped element **19** is provided to engage a hooking ring **21** disposed in the lower part of the hollow body **1**. Preferably, the handle **20** is disposed

directly below the hook 19 to provide for easier handling. This simple means makes it possible to remove very rapidly and readily the collected materials, since it is only sufficient to unhook the vessel 7, to pour the contents therefrom at the indicated location and to bring it nearly instantaneously to its normal position. This means promotes substantially the economy of the whole air purification method, namely in the high capacity zone. In addition, this means permits the utmost simplification of the shape of the said vessel 7, since it makes a depression and a central removing valve unnecessary, as generally proposed in the heretofore existing apparatus.

On the other hand, the permanent visual control of the apparatus condition is provided by the fact that the said vessel or bowl 7 is made of a transparent or translucent material and, preferably according to a feature of the invention, of a synethetic material such as reinforced or not reinforced polyester.

Such arrangement is very important for the suspended apparatus, since it permits not only to visually control the apparatus condition, but also this control prevents systematically the vessels or bowls 7 from overflowing with all the harmful consequences which would result therefrom. In addition, this construction of the said vessels of a translucent or a transparent material is important in that it reduces substantially the projected shades and, on the contrary, it may in some cases contribute to a better distribution of the machine lighting.

The invention covers any apparatus and parts thereof applying the said method as well as the different above described characteristics.

What I claim is:

1. Apparatus for automatically collecting dust in suspension in air, comprising in combination, at least one hollow body having a bottom, air pervious walls enclosing a first chamber, impervious walls constituting a continuation of said pervious walls and enclosing a second chamber, and a freely movable member for normal closing of said body, a fan mounted within said hollow body and separating said first chamber from said second chamber, a removable vessel mounted under said hollow body for collecting said dust, means for driving said fan in a predetermined direction, and control means for making said driving means operative and nonoperative, said fan and said means for driving said fan being so constructed

and arranged, that when said control means make said driving means operative, to flow a stream of air under pressure from outside said hollow body towards said movable member through said pervious walls and said first and second chambers to displace said movable member into a position wherein said hollow body is open and sucks dust against said pervious side walls, and whereby when said control means make said driving means inoperative, but before the fan becomes stationary, to reduce the pressure of the air stream to replace said movable member into its normal position and to force the remaining air stream flow within the body from said second chamber towards the outside of said hollow body through said first chamber and said pervious walls due to which dust is blown off said hollow body and falls in said vessel.

2. Apparatus in accordance with claim 1, comprising an electric motor with a feeding circuit for driving said fan, said control means having means for periodically opening said feeding circuit.

3. Apparatus in accordance with claim 1, having a plurality of said movable members, said movable members consisting of shutters each pivoted on a horizontal axle.

4. Apparatus in accordance with claim 3, wherein said shutters are semi-circular, said apparatus further comprising a U-shaped beam, said horizontal axles engaging with their ends the end of said beam.

5. Apparatus in accordance with claim 4, wherein said horizontal axles of said shutters are mounted above said fan, the longitudinal edges of said U-shaped beam constituting a stop for the closing position of said shutters, said shutters having extensions abutting against the internal side walls of said beam to limit the maximum opening position of said shutters.

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