Oct. 19, 1965 G. MAESTRELLI 3,212,239

APPARATUS FOR FILTERING AIR OR GASEOUS MIXTURES

Filed July 20, 1961

Fig. 2

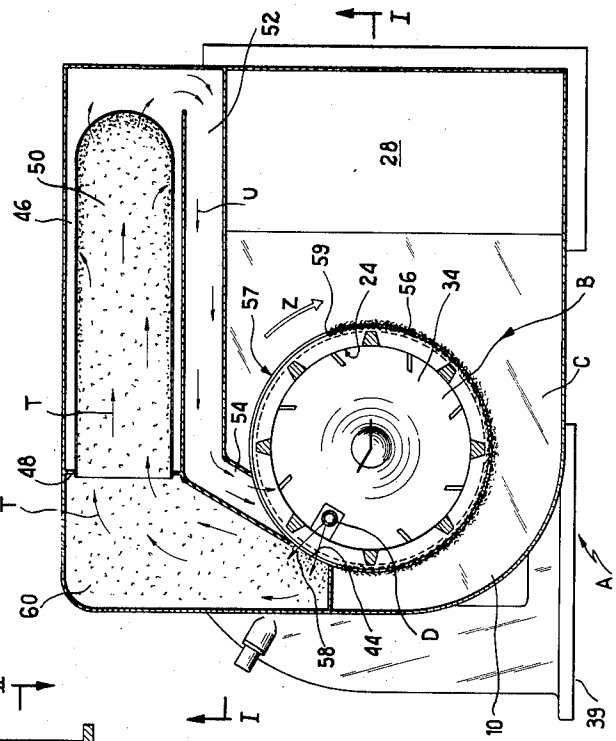
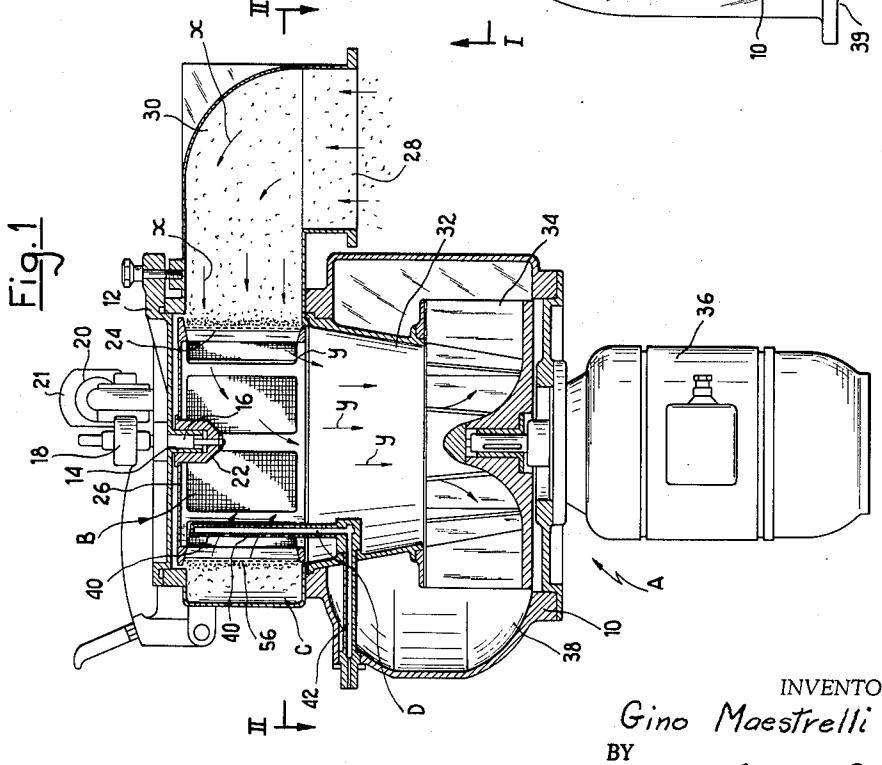


Fig. 1



INVENTOR.
Gino Maestrelli
BY
Wenderoth, Lind & Ponack
Attorneys

United States Patent Office 3,212,239 Patented Oct. 19, 1965

3,212,239

APPARATUS FOR FILTERING AIR OR GASEOUS MIXTURES

Gino Maestrelli, 55 Via B. Quaranta, Milan, Italy

Filed July 20, 1961, Ser. No. 125,462
Claims priority, application Italy, Apr. 27, 1961, 12,595, Patent 649,437
5 Claims. (Cl. 55—290)

The invention relates to apparatus for filtering air or gaseous mixtures and for automatically cleaning the means used for filtering, especially useful in dry cleaning installations.

It is known that material loaded into dry cleaning machines (clothing, bed covers and fabrics in general) sheds fibers due to the mechanical action which accompanies the chemical dry cleaning process, said fibers making up part of the material of which the fabric is composed, which fibers are carried by the gas current generated by the suction to recover the solvent and for drying, being deposited throughout the entire ventilating apparatus.

This is one of the greatest obstacles to maximum recovery of the solvent used, making itself evident as a lining or covering of fibers (which in time, build up to form a layer of soft wadding) on the cold surfaces of the recovery unit and the hot surfaces of the heater, the outcome being a decreased heat exchange efficiency, this latter being inversely proportional to the thickness of the layer of fibers. Moreover, said fibers cover the entire inside surface of the recovery and ventilation ducts and thus also absorb a considerable quantity of solvent. The layer of fluff or down can continue to build up until the passage for air or for the gaseous mixture is completely stopped.

To prevent this trouble from occurring, it has been thought, in the known types of dry cleaning installations to install a means used for filtering in the lines which come out of the dry cleaning machine body, this means of filtering consisting of a screen or fine metallic network or of cloth in general, held by a frame or box provided for same. Upon each recovery operation the filter box is removed and brushed in order to remove the layer of fluff which has built up. This operation causes a certain amount of inconvenience, both from the point of view of maintenance and because of the time lost in carrying out the operation, but it becomes impossible (in respect of the object which it is desired to attain) when the dry cleaning installation is completely automatic and those persons using the installation need only carry out the loading and unloading operations.

The invention embodied herein solves the problem of automatic cleaning of the air filter and comprises a special apparatus capable of filtering air or gaseous mixtures, equipped with an automatic cleaning device which goes into operation upon completion of the filtering. It is especially useful in dry cleaning installations and is characterized by the fact that it comprises: means of filtering, situated in the passage for the air or other mixture to be filtered between the point where said air arrives and the suction fan capable of putting said air in circulation; means for supplying motion to said means for filtering, coming into action as soon as the phase during which the air is drawn in has ceased, and capable of transmitting to said filtering means a desired motion; means for cleaning working together with said means for filtering and going into action during the motion of the latter; and means for collecting or holding a large quantity of material, capable of containing large quantities of removed fluff or down, said fluff or down being removed by the action of means for cleaning the means for filtering.

It is evident that the basic concept embodied in the invention herein explained can be applied to a wide range of different forms of embodiment as to its form, its structure, and the reciprocal arrangement of the means mentioned, as well as their operation.

According to one advantageous form of embodiment of the invention, the filtering means are composed of a cylindrical frame which holds a filter cloth, or the like, and which has a single solid base which is capable of being fixed to means of providing motion in such a way that the motion of the filter is caried out around the axis of the cylinder to which the rotary motion is applied while being cleaned, while during the passage of the air drawn in, which takes place radially, through the filtering partition from the outside towards the inside, the cylinder is stopped so the fluff will be deposited on the outside of said partition; the means for cleaning being composed of at least one pipe having a perforated area facing the filtering partition, through which a blast of compressed air is expelled against said partition during the rotation of the cylindrical frame, taking place after the suction phase, said blast removing the layer of fluff in the areas of the filter which are brought in line with the pipe one after another, said fluff being pushed into a large-capacity sack container, permeable to air.

These and other characteristics of the invention herein embodied will now be illustrated by means of the following description and drawing, given for illustrative purposes only and non-restrictive of the invention scope and spirit.

The apparatus according to the invention is particularly suitable for dry cleaning machines and installations as those described in applicant's copending application Ser. No. 125,587 filed July 20, 1961.

In the drawing:

FIG. 1 is an elevational sectional vertical view of the apparatus, certain parts being shown in side elevation, taken along section line I—I of FIG. 2.

FIG. 2 is a sectional view in the horizontal plane indicated at II—II in FIG. 1.

In reference to the drawing, apparatus A which can advantageously be connected up in a recovery and ventilation circuit for dry cleaning installations, particularly when functioning automatically, comprises a frame **10**, which is a part of the installation unit not shown and which, at its top supports a removable plate **12** the central area **14** of which supports a pin **16** free to turn when driven through transmission **18** which is driven, in turn, by speed reducer unit **20**, a sleeve **22** being fixed to said pin **16**, said sleeve **22** being fixed to cylindrical filter B, the latter being composed of a cylindrically framed partition **24** on which the filter cloth or the like is stretched, the upper base of cylinder **26** being fixed to sleeve **22** and being completely closed, while the lower base is open.

Beneath the removable plate **12** the frame **10** forms a chamber, generally indicated at C, wherein a cylindrical air filter, generally indicated at B is supported co-axially to the pin **16** for rotation therewith, upon activation of a motor **21** drivingly connected to the speed reducer unit **20**. Such motor and transmission means are conventionally constructed and arranged on the top of the plate **12** and therefore such components and the associated feed and control circuits will not be described in detail.

The assembly of such cylindrical rotatable air filter is conventionally constructed. It includes a cylindrical side wall **24** including a frame and wholly covered by known screening means, such as a filter cloth, and an upper wall **26** secured to said drive shaft or pin **16** by means of the sleeve **22**.

The axial dimension or height of the cylindrical wall corresponds to the height of chamber C and therefore the said screening wall of filter defines a space, within

the entire space defined by the chamber C, downwardly open and communicating with the intake passage **32** of a suction device including a conventional rotary impeller **34**, arranged coaxially to said air filter and driven by a motor **36**.

The impeller operates conventionally as a centrifugal fan driving outwardly into an outlet duct **38** having its outlet at **39** (FIG. 2) the air or filtered mixture.

The outlet **39** is conventionally connected to the solvent recovery unit (not shown) of the dry cleaning installation to which the apparatus is applied for operation. Upon activation of motor **36** and operation of said impeller **34**, in the said intake passage **32** a suction is therefore provided, such as to force the gaseous mixture to pass through the screening walls **24** of the filter assembly, as indicated by arrows *x* and *y*, upstream and respectively downstream to said filter wall **24**.

The gaseous mixture from which the fibers are to be removed by filtration is supplied into the chamber C through an intake duct **28** and, upon the suction provided in the space confined within the cylindrical walls of filter B, impinges on the screening wall **24** of said filter and is forced through said wall, while the fibers carried along with the gaseous stream are prevented from passing over said wall, and progressively form a layer of fibers on the outer face of the wall, as indicated at **56**.

As shown particularly in FIG. 2, the chamber C is arranged to fully confine the filtering assembly generally indicated at B. The upper and lower portions of cylindrical wall **24** are arranged adjacent to the upper and respectively lower wall of chamber C and conventionally constructed and arranged sealing means might be provided for preventing the gaseous mixture from passing from the chamber C into the intake passage **32** except than by traversing the porous filtering material of wall **24** and leaving the fibers on the outer face of the wall.

As shown in FIG. 2, the chamber C, in addition to being divided into two parts, inside and outside the screening wall **24** of the rotatable filter, has its part outside said filter further divided by properly arranged partitions. The region which communicates with the intake **28** encircles the greater part of the filter to form a screening passage impervious to fibers and said greater part acts as a filtering means.

A passage **44** is formed in faced relationship with a small arc portion of the cylindrical wall **24**, the passage **44** forming the inlet of a circuit passage including a first portion **60**, a middle portion **46** wherein a fiber collecting bag **50** is removably located and has its mouth secured at **48** to the entrance of said middle portion, and a return or feed-back passage **52** having an outlet at **54** in faced relationship with another small arc of said cylindrical wall **24** of the filter, adjacent to inlet **44** of said circuit passage. The bag **50** is conventionally constructed of cloth or other suitable porous material impervious to the fibers to be collected thereinto, and supported for removal from time to time, for dispensing of the collected fibers.

A length of pipe D is vertically supported from below within the space confined by the cylindrical wall **24** of the filter and it is upwardly extended the full height of such wall. Such pipe D is located near the inner face of the wall **24** of the filter and has a plurality of nozzle forming holes drilled through its wall and directed towards said wall and said intake passage **44** (FIG. 2) of said circuit passage. Pressurized air is fed within the pipe D, upon activation of suitable valve means (not shown), via a feed duct **42** (FIG. 1) conventionally connected to a source of pressurized air (not shown).

Therefore the pipe D provides, when pressurized air is supplied thereinto, a plurality of jets impinging on the inner face of the screening wall **24**. Because of the porosity of such wall, said jets pass through said wall into the passage **44** causing an air stream to circulate in the circuit passage, in the direction indicated by arrows T and U in FIG. 2. From FIG. 2, it will be readily apparent that the flow of pressurized air caused by said jets emitted by pipe D will detach the fibers which form the layer **56**, which has been formed during the operation of the filter as a gaseous stream is caused to pass from outside to inside the wall **24**, in front of passage **44**.

Such fibers are then carried along with said flow of air through portion **60** and then in the collecting bag **50**, which is impervious to the fibers and wherein such fibers would be therefore collected, while the flow of air will proceed in the feed-back portion **52**, as indicated by arrows U to be discharged again in the region of wall **24**, through the outlet portion **54** of the said circuit passage.

By providing air jets to be emitted by pipe D, an arc portion of cylindrical screening wall **24** of filter B, namely the portion which is comprised between pipe D and inlet passage **44** of the circuit passage, will be cleaned from the fibers adhering to the outer face of the wall **24**. Now, by causing the filter B to rotate in the direction indicated by the arrow Z in FIG. 2, upon activation of motor **21** (FIG. 1), any portion of said screening wall **24** of filter B will be sequentially brought in facing relationship with pipe D and therefore cleaned. In FIG. 2 a part of the wall **24**, which is supposed to be already cleaned as above, is indicated at **57**.

The above described construction and arrangement of the various passages inside chamber C, and in particular of the circuit passage including the portions **60**, **46**, **52** and **54**, having its inlet and outlet inside said chamber, embodies an important improvement in filters of the character described.

As shown in FIG. 2, the greater part of wall **24** may be traversed by the stream, caused by the suction exerted by impeller **34**, coming from intake **28** and exhausted through passage **38** and outlet **39**, so that the entire porous surface of the filter essentially acts as a screening means for liberating such stream from the fibers carried therewith.

The said circuit passage, having both an inlet at **44** and an outlet at **54** in a region outside the screening wall **24** of the filter, is subject to uniform pressure at any region thereof, when no jets are emitted by pipe D, so that the filtering operation might be kept on while the fibers collected in bag **50** will remain undisturbed in said bag.

When the filter requires cleaning thereof, from time to time, motor **21** is started for slowly rotating the filter and pressurized air is supplied pipe D. Such operation does not disturb the filtering action even if made while the impeller **34** is operated. The fibers are displaced in the circuit passage without interference with the action of the filter at the surface of the wall **24** where not facing the inlet and the outlet of said circuit passage. If some erratic fiber will not enter in inlet **44** of said circuit passage or miss being collected in bag **50**, such fiber will be carried again in chamber C, without detriment to the operation of the filter.

The above described structure is surprisingly adapted for automatic operation of the apparatus. Provided that the operation of most recent dry cleaning installations is fully automatic, and that the filtering apparatus is operated time-by-time at any cleaning step, upon the provision of conventionally constructed and arranged circuits including a suitable adjusted timer, electrically operated valve means to control the supply of pressurized air to pipe D, and relay means to control the operation of motor **21**, filter cleaning steps may be sequentially alternated to dry cleaning and filtering steps in the apparatus.

The operation of the apparatus as above described, both as to its filtering step and to its filter cleaning step, is the following:

During the intake phase when the air or gaseous mixture containing the fluff is sucked in, the air-suction unit **34–36** rotates and the fluid is made to move in the directions shown by the arrows X in FIG. 1, while the reducer unit **20** is stopped and, as a result, filter B is stopped.

The mass of air drawn in is filtered through filter cloth or network, held by the cylindrical partition **24** whereupon the fluff being left outside the filter, upon building up, takes on the appearance of a layer or carpet of fluff **56**, which layer also takes on, substantially, a cylindrical shape. The purified air downstream from the filter flows in the direction of arrows *y* inside intermediate chamber **32** and then into the impeller **34** and is thrust radially outwards into duct **38** and thence to the recovery and heater units not shown.

When the suction or intake phase stops, stopping exhaust fan unit **34–36**, the speed-reducer unit **20** starts up at once and, at the same time the compressed air source allows compressed air to enter line **42** and thus pipe D. Filter B thus turns during the cleaning phase in the direction shown by arrow *z*, while the compressed air issues from holes **40** striking one side of wall **24** in the direction of arrows **58**, giving rise in the successive portions of the layer of fluff **56**, which gradually is subjected to the blast of compressed air, to a detaching action, said air thereby thoroughly cleaning the cylindrical network of layer **56**. The numeral **57** in FIG. 2 indicates a portion of the filter which has passed the pipe D and has been cleaned.

The separated fluff is forced under the pressure of the blast of compressed air in the direction of arrows T into sack **50** where it collects, said sack being permeable to the flow of air, which air issues in the directions of arrows U, travelling along duct **52**, having left all the fluff inside sack **50**, and goes back to filter B thus being enabled to pass into the dry cleaning machine, connection to same being made by way of duct fitting **28**. The rotation of filter B and the resulting compressed air blast issuing from pipe D continue for at least one full turn of the filter to completely detach the fluff and clean the filter partition **24**.

Having finished the cleaning phase, which for example, may be time controlled, the apparatus A is once more ready for the successive intake stage, with improved condition of filter B which is completely free of fluff. Thereupon, a filter-cleaning stage follows upon each intake stage, without any operation whatever being necessary on the part of the user.

Naturally, when sack **50** becomes full of the detached fluff, which happens after a great number of cleaning stages, sack **50** will be removed by a person charged with periodic cleaning and maintenance, it will be emptied and it will then be mounted back in place.

Of course, as already mentioned, many forms of embodiment may be applied to the equipment and apparatus described herein as variants to same; for example, instead of having the compressed air acting directly on the rotating filter, the means for cleaning could consist of scrapers or the like which would detach the layer of fluff from the filter, causing it to fall into a suitable place where it would collect until at some later time it would be removed.

In the same way, instead of a single pipe D, a number of compressed air pipes or hoses could be provided with their nozzles or perforated opening situated or located in different ways. The direction too in which the air drawn in travels and that of the compressed air, which in the embodiment illustrated herein is, in for first direction from the outside towards the inside of the filter and for the second direction from the inside towards the outside, could be reversed.

What I claim is:

1. An apparatus for filtering air or gaseous mixtures having fibrous material dispersed therein and carried therewith, comprising: a casing forming a chamber having an inlet communicating with a region wherein a gaseous mixture having fibers dispersed therein is present, and a circular outlet passage for exhausting said gaseous mixture upon being freed from said fibers, motor driven suction means located downstream of said outlet passage for providing a flow of said gaseous mixture from said inlet to said outlet passages through said chamber, a filter located in said chamber between said inlet and outlet passages, said filter including a cylindrical porous wall arranged to be traversed by said flow and to act as a barrier for said fibers, whereby said fibers are prevented from reaching said outlet passage and are deposited on the outer face of said wall as said suction means causes said flow to traverse said wall, said filter being supported for rotation in said chamber about the axis of said cylindrical wall, a motor and power transmission means connected to said filter for rotating same about said axis, a circuit passage having an inlet and an outlet in said chamber and facing adjacent arc portions of the outer surface of said cylindrical wall of said rotatable filter, a fiber collecting bag of material porous to air and impervious to fibers, located within said circuit passage and having a mouth directed towards said inlet of said passage, whereby fibers carried along with a flow of air in said circuit are barred by said bag from reaching said outlet and collected in said bag, nozzle means arranged within said cylindrical wall, connected to a source of pressurized air and arranged for projecting air jets through said wall and into said inlet of said circuit passage, thereby causing a flow of air to circulate in said circuit carrying along therewith fibers from the outer face of said cylindrical wall until inside said bag, while by causing said filter to rotate about said axis whereby all arc portions of its cylindrical wall are successively brought in facing relationship with said inlet of circuit passage.

2. In the apparatus as set forth in claim **1**, wherein said cylindrical filter rotates about a vertical axis and said circuit passage is in a horizontal plane.

3. An apparatus as set forth in claim **1**, wherein said nozzle means comprises a pipe parallel to the axis of said cylindrical wall, adjacent to the inner face of said wall and provided with a plurality of jet emitting holes turned towards said wall.

4. An apparatus as set forth in claim **1**, wherein said chamber forming casing has an upper wall structure having an opening formed therein greater than the diameter of said cylindrical filter, wherein a cover structure is detachably secured to said upper wall to close said opening, and wherein said rotatable cylindrical filter is supported for rotation by a shaft rotatable into said cover, said shaft having a lower end secured to said filter and an upper end drivingly connected to said motor and transmission means.

5. An apparatus as set forth in claim **4**, wherein said motor and transmission means are arranged above and secured to said detachable cover structure.

References Cited by the Examiner

UNITED STATES PATENTS

1,837,836	12/31	Powell	55—302
1,886,884	11/32	Jones	55—288
2,178,481	10/39	Linderoth	55—302
2,364,877	12/44	Smellie	55—294
2,474,478	6/49	Hart	55—290
2,674,342	4/54	Antonelli	55—302
2,746,561	5/56	Beber et al.	55—302

FOREIGN PATENTS

1,231,871	4/60	France.

HARRY B. THORNTON, *Primary Examiner.*