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(54) GAS CLEANING DEVICE

(71) I, HUGO SCHMITZ, a German citizen, of 472 Beckum, Neubeckumer Str. 102, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a gas cleaning device and, in particular, a gas filter with a rotatable drum, at least a part of which is permeable to gas. In use, the gases to be purified pass from a region of high presure outside the drum through the said permeable part into a region of low pressure inside the drum so that substances to be separated are caught in the permeable part of the drum and removed therefrom by centrifugal force. The removal of the deposit from the permeable part may be aided by sprays or sprinklers operating on the inside of the cylinder. The sprays or sprinklers can direct jets of air or streams of liquid on to the drum wall.

a gas cleaning device which is relatively small yet capable of high flow rates, in-

An object of the invention is to provide volves low capital and running costs, and all demands with regard to purity of the gases are almost universally met.

One problem with conventional drum filters is that of providing an effective seal for the rotating drum. The nature of the seal depends upon the flow rate, the predetermined cross-section or diameter of the rotating drum, the required surface speed of the drum and the need to maintain the pressure difference between the interior and the exterior of the drum. Sealing rings cannot be used because the frictional resistance and the admission of highly abrasive materials would lead to rapid wear. The high frictional resistance would also make it necessary to provide an unreasonably powerful drive for the drum.

With conventional dust filters, for example fabric or hose filters, and electrostatic filters, it is necessary to reduce the speed of the gas in the actual separating zone to a few cm/sec. This predetermined rate of flow also determines the specific size of such devices (m^3 construction space/m^3 rate of flow). The mode of operation of devices according to the invention makes it possible to operate at several times the usual rate of flow, thus substantially reducing the required construction space and consequently reducing the investment and also the running costs.

In accordance with this invention, I propose a gas cleaning device comprising a rotatable filter drum having a continuous cylindrical wall at least a part of which is permeable to gas, and driving means for rotating the drum, the permeable part of the drum separating, in use, a region of relatively high gas pressure outside the drum from a region of relatively low pressure inside the drum and in communication with a gas outlet, the drum having an open end which is immersed in liquid to form a seal separating the two regions.

Devices according to this invention are also suitable for gas washing, i.e. for neutralising and separating acid or basic vapours, including flourine compounds. As far as vapour filtering with the aid of sprayed filters is concerned, the state of the art is greatly improved.

The filtering of vapours with the aid of sprayed filters is described for the first time in the VDI-Report No. 149 "Keeping the Air Clean", pages 372-376. Compared to the method described therein, a device according to this invention has several advantages, for example, the pores of the filter are kept continually free of deposit by the action of the centrifugal force. Furthermore, the gas flows in the opposite direction to the flow of the sprayed liquid in the apparatus according to the invention.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, of which:—

Figure 1 is a simplified illustration of one embodiment of the invention;

Figure 2 is a further example of the sealing of the filter drum;

Figure 3 is an embodiment of the invention with a spraying device inside the filter drum; and

Figure 4 is an embodiment of the invention in which the filter drum rotates on an horizontal axis.

Referring to the embodiment of the invention shown in Figure 1, the gases to be purified are drawn by the exhauster 8 into the suction channel 1 from where they spiral into the outer chamber 2. The passage through the rotating, porous filter drum 3 into the inner chamber 4 creates a pressure drop Δp, against which the chambers 2 and 4 are to be sealed. For the solution of this problem, within the scope of the invention, a liquid bath 5 (e.g. a water bath) is provided in which the lower end 3' of the filter drum is submerged. As a result of the pressure difference between the chambers 2 and 4, the level of the liquid in chamber 4 rises to the amount of Δh, (if in the first instance the pressures resulting from the liquid rotation are disregarded). Δh is proportional to Δp, i.e. the absolute pressure drop in chamber 4 compared to atmospheric pressure, has on influence on the fluid rise in chamber 4.

When the surface speed of the filter drum 3, 3' is high, however, the pressures resulting from the liquid rotation can no longer be disregarded. This finds consideration within the scope of the invention. By means of a construction as shown in Figure 2, a circulation (17 and 18) can be achieved in addition to the rotation of the sealing liquid 5. In the illustrated example, this circulation is achieved by means of a cone part 16 on the drum end 3'. The surface speed of the cone part 16 increases with the diameter, and the liquid molecules in contact therewith on both sides of the cone follow. Since the centrifugal force also increases with the diameter, and this is transferred to the nearest molecules of the liquid, a pressure difference is created which causes the liquid to roll in the manner indicated by the arrows. The sealing of the pressure difference between the chambers 2 and 4 by the liquid is not altered in any way by this. A further example of a construction for ensuring the sealing effect of the fluid is shown in Figure 3. This figure also shows the arrangement of a spraying device inside the filter drum 3, 3'.

According to this embodiment the gases to be purified are led tangentially through the channel 1, helically rotating into the housing 19. The rotation of the gases is aided by the drum 3, 3' rotating in the same direction. The centrifugal force acting on the gas within the chamber 2 causes even at this stage an initial separation of those particles by which the centrifugal force is greater than the drag of the current. The particles which follow the drag of the current when the gases pass through the wall of the drum 3 are deposited on the porous wall or in the pores thereof or, when the drum wall is of a fibrous material, the particles are deposited on the fibres. The gases, cleansed of impurities, after passing through the porous drum wall into the inner chamber of the drum 3, 3', continue from there through the stationary tube 6 and the cone 7 to the exhauster 8 from where they are finally expelled.

For those cases of gas purifying, in which centrifugal force alone is insufficient to ensure that the particles adhering to the porous wall of the cylinder are thrown off, a means is provided within the scope of the invention to improve the loosening of these particles. One such means is that the porous cylinder wall is sprayed from the inside with a suitable substance, for example, water. As a result of the centrifugal force, the water is urged through the porous wall of the cylinder and moistens the adhering particles, thus increasing the mass thereof. The water and particles are thrown off the porous drum wall in the form of a fine spray, and are finally separated from the stream of gas.

Figure 3 shows such an arrangement:

The filter drum 3, 3' rotates on bearings 20, 21 about the hollow shaft 9, driven by the motor 10. Fluid, e.g. water, enters at input 13, passes through the hollow shaft 9 to the stationary tubes 11 which are provided with spraying nozzles.

The fluid spray 12 continually wets the inside of the rotating drum wall 3, passes through and is thrown in the form of a fine spray through the chamber 2 onto the wall of housing 19. During transit through the chamber 2, the fine spray acts like a filter, capturing impurities in the oncoming stream of gases and transporting them to the wall of housing 19.

The fluid with the separated impurities running from both the wall of housing 19 and the filter drum 3, 3' is collected in the fluid bath 5. The silt in concentrated form can be led off at the outlet 14 to be further processed or to be dumped. The fluid which might be recovered by further processes not shown here, can be returned by means of the pump 15 to the fluid bath 5, or it can re-enter the system at inlet 13. The level of the sealing fluid 5 can be controlled by known technical means and kept at the required depth with the aid of the pump 15.

Figure 4 shows a device according to the invention, whereby the filter drum 3, 3' is horizontally arranged. With this embodiment, blades 22 are provided around the circumference of the open end of the drum, which ensure that the water bath is carried round to form a continuous annular body in the ring channel 23 by centrifugal force. Guide fins 24 in the upper half of the ring channel 23 lead returning fluid to the lower half of the ring channel. For the rest, the device operates in the same manner as described for Figure 3.

Devices according to the invention can also be so constructed that the removal of the particles which adher to the wall of the filter drum 3 is effected by means of electrical fields such as are known in connection with electrostatic filters. The poles for creating the electrical field can be stationary, with the emitting electrode inside the drum 3 and the gathering anode opposite, in the chamber 2. It is also possible to use the drum wall or a metal cage surrounding it as the emitting electrode.

Known technical means such as shaking or scraping means effect the removal of conglomerations of particles from the gathering anode, and the rotating currents of gas in the chamber 2 throw these particles finally out of the stream of gas onto the wall of housing 19.

WHAT I CLAIM IS:

1. A gas cleaning device comprising a rotatable filter drum having a continuous cylindrical wall at least a part of which is permeable to gas, and driving means for rotating the drum, the permeable part of the drum separating, in use, a region of relatively high gas pressure outside the drum form a region of relatively low pressure inside the drum and in communication with a gas outlet, the drum having an open end which is immersed in liquid to form a seal separating the two regions.

2. A device according to claim 1 comprising spray or sprinkler means, or means for generating an electrostatic field, arranged to remove solid particles from the filter drum.

3. A device according to claim 1 or claim 2, wherein means are provided for circulating the sealing liquid, such as a conveying or diverging shape of the part of the filter drum which is immersed in the liquid.

4. A device according to claim 2 and comprising means for controlling the depth or amount of the sealing liquid.

5. A gas cleaning device constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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1559530 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

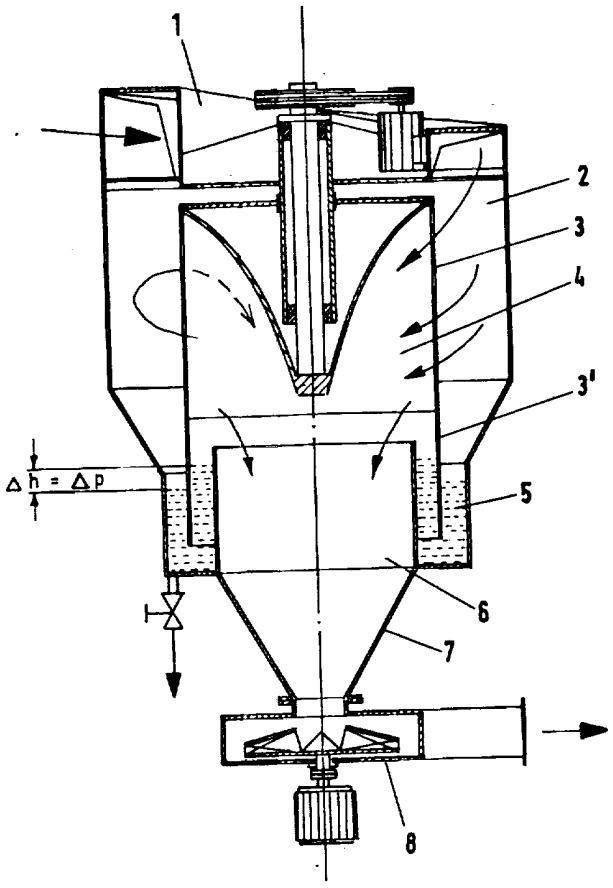


FIG. 1

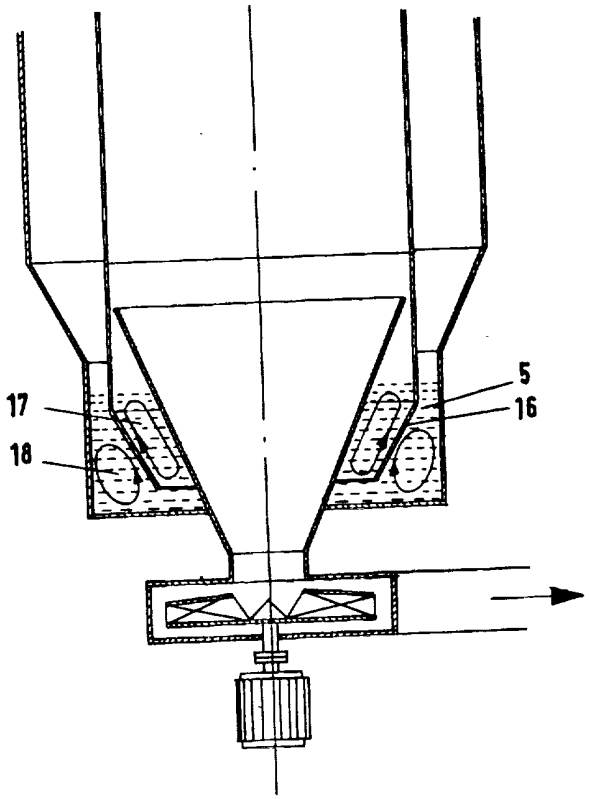


FIG. 2

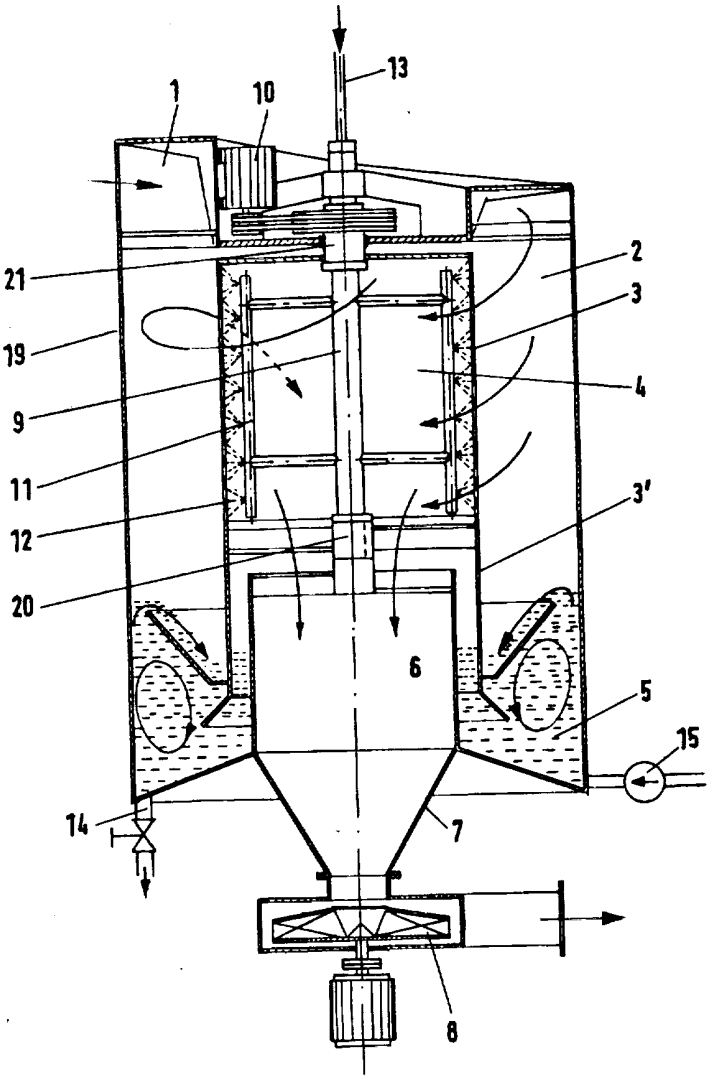


FIG. 3

1559530 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 4

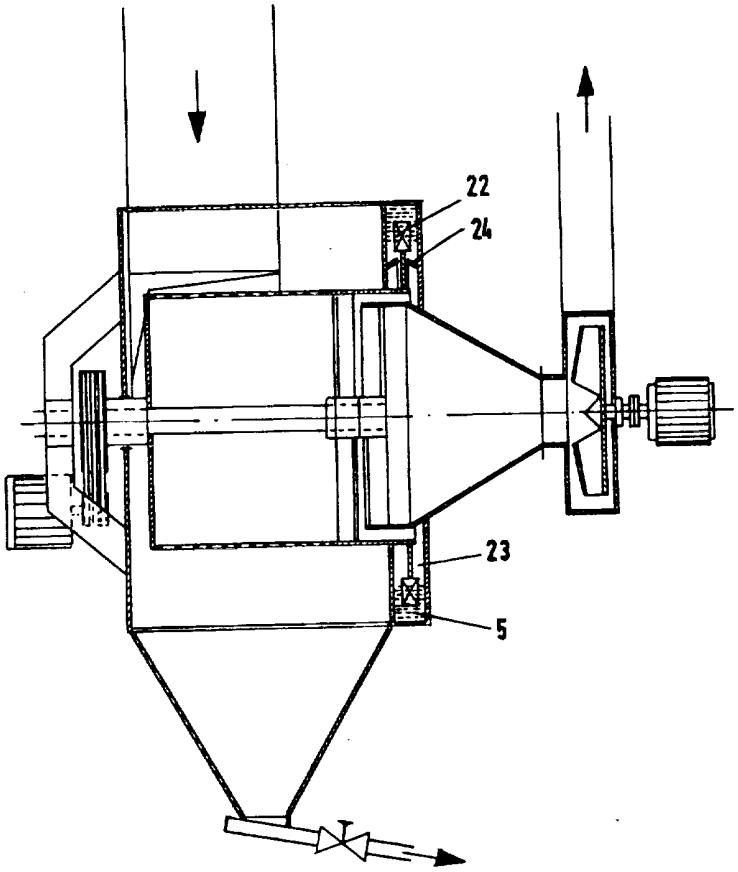


FIG. 4