(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 September 2006 (08.09.2006)

PCT

(10) International Publication Number
WO 2006/092702 A2

(51) International Patent Classification: Not classified

(21) International Application Number: PCT/IB2006/000418

(22) International Filing Date: 28 February 2006 (28.02.2006)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
RM2005A000087 1 March 2005 (01.03.2005) IT

(71) Applicants and
(72) Inventors: **CIRILLO, Francesco** [IT/IT]; Via G. Carini, 32, I-00152 ROMA (IT). **PIMPINELLI, Remo** [IT/IT]; Via A. Cesari, 26, I-00152 Roma (IT).

(74) Agent: **GERVASI, Gemma**; Notarbartolo & Gervasi S.p.A., Corso di Porta Vittoria, 9, I-20122 Milano (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2006/092702 A2

(54) Title: CLEANER FOR AIR POLLUTED BY FINE DUSTS AND RELATIVE PURIFYING PROCESS

(57) Abstract: A system for purifying air polluted by fine dusts (PMx) which implements, in an innovative and original way, a new process for laying of fine dusts suspended in polluted air. Its efficacy is limited neither by the concentration of the dusts nor by the characteristic diameter of the type of dusts to be removed. All gaseous emissions, both industrial and civil, in which fine dusts are present, represent possible applications of cleaner of the invention. A typical, although not exclusive, application consists of the treatment of air polluted by urban smog and motor vehicle traffic. Due to the almost total absence of maintenance and control, feature of its innovative purification process, the cleaner of the invention can be designed and sized from time to time, to operate in urban areas where atmospheric pollution is highest, installing it under the road surface or in other eventually available spaces (such as underpasses or in the basements of buildings), or inside kiosks or newsstands, or can even be produced in mobile form. This cleaner is particularly suitable for the laying of atmospheric pollution consisting of fine dusts produced by motor vehicle traffic in stretches of road with high traffic volumes: it can advantageously be installed both inside tunnels and along stretches of road in the open air.

CLEANER FOR AIR POLLUTED BY FINE DUSTS AND RELATIVE PURIFYING PROCESS

Field of the invention

The present invention refers to a cleaner of air polluted by fine dusts (PMx).

State of the art

The problem of reducing concentrations of fine dusts suspended in polluted air is the subject of studies by many primary international research centres. Today this research is essentially moving in two directions: the first one consists of reducing emissions of fine dusts into the environment, the other one of purifying to the greatest possible extent the already polluted environment by laying of the concentration of fine dusts therein. Both approaches suggest solutions based on the most effective filtration systems possible. However, the solutions currently offered by technological developments in this field are subject to limitations which make them somewhat impractical; in fact the physical principles underlying the operation of filters for the laying of fine dusts, currently available on the market, can be grouped into three separate categories: electrostatic filters, mechanical filters and dynamic filters.

To collect dusts from the air electrostatic or electronic filters employ an electrical field and the action of electrostatic forces. These filters can be divided into two types: electrostatic precipitators and electronic filters. The substantial difference lies in the values of voltages utilized, equal to 30-40,000 Volts for the ionizing section and 12,000 Volts for the dusts collection section in the first type of filter and equal to 10-12,000 Volts for the ionizing section and 5-6,000 Volts for the dusts collection section of the second type of filter. The ionizing section permits to electrically charge the dusts present in the air flow passing through the filter. Such a section is commonly produced through a tungsten wire utilized as positive electrode and a series of aluminium plates which act as negative electrodes. The dusts collection section is also produced by a series of positive and negative plates which, through the effect of the electrical field, capture the particles previously charged by the ionizing section. Sometimes, to increase the filtration capacity and the duration without maintenance operations, the electrostatic filters have a washing device for the dusts collection plates.

In standard technical production, the electrostatic or electronic filter is preceded by a mechanical pre-filter as a barrier for the larger particles of dusts and also to prevent foreign bodies, such as leaves, insects, paper which would catch fire and leave carbon residues causing loss of efficacy, from entering the sections at high electrical potential.

The filtering capacity of the electrostatic filters is indicated in the table below:

Type of particle	Dimensions (micron)	Removal %
Yarns	10÷100	100
Pollens	10÷150	100
Fogs	1÷50	80÷95
Fine ash	0.1÷50	75÷85
Dusts	0.1÷50	75÷85
Fungi	1÷10	80÷85
Bacteria	0.1÷10	75
Oil smoke	0.1÷10	75
Tobacco smoke	0.009÷1.0	75
Viruses	0.001÷1.0	75

The advantage of these filters is that they have a low head loss, which if on the one hand reduces energy consumption, on the other one causes difficulties in distribution of the air flows among the various plates resulting in a non-homogeneous treatment. In general, the head loss of an electrostatic filter provided with pre-filter can range from 35 to 70 Pa. The energy consumption is also quite low and can be estimated at 0.35÷0.5 W per m^3/h of treated air, however, the electronic part alone has somewhat high dimensions, requiring only for the electrical part cubic cells of approximately 0.5 metres per side to treat 1300 m^3/h. Another problem to be outlined is the presence of humidity in the air which, if high, creates electric discharges inside the filter with the risk of short-circuit, in which case operation must be stopped until a complete drying.

Mechanical filters are those that perform filtration by producing a physical barrier interposed in the air flow to be treated. The barrier can be produced with very different methods and materials, ranging from a simple grid to the use of suitably plaited fibres and having a spatial arrangement varying from one application to the other one. In this category of filters different operation mechanisms can be identified, at times present simultaneously in the same filter, such as:

- the sieve mechanism which is produced when the solid particles are greater in size than the distance between the fibres, or more generically than the free section present in the air flow. This system is effective for rough particles. The diameter of the fibres is also rough and can be of the same order of the captured particles. In practice, panel filters characterized by low percentage values of separation operate in this mechanism;
- the inertia or collision mechanism, where the air flow in proximity of the filter fibres tends to change direction following their edge, while by inertial effect the particles tend to follow their trajectory colliding with the fibres of the filter. Adhesion takes place through the effect of the presence of oils or other colloidal agents with which the fibres are treated. The efficacy of this mechanism increases as the air speed and the diameter of the particles increase and as the diameter of the filter fibres decreases. Filters based essentially on the inertia mechanism are those with a viscous surface, mounted on a panel or mobile sector and characterized by low or average percentage values of separation;
- the interception mechanism, where the air flow in proximity of the filter tends to follow the profile thereof, entraining in its direction the finest and lightest particles. If their trajectory passes at a distance from the fibre that is smaller than the radius of the particle, this latter will adhere to the fibre by the elementary forces of electrostatic attraction (Wan der Waal). The efficacy of this mechanism increases as the diameter of the particles increases (within a specific range), and as the diameter of the fibres and the distance in between decreases;
- the diffusion mechanism where the smallest particles, below one micron, and subject to Brownian motion, collide with the fibres of the filter and adhere to them by virtue of elementary electrical forces. The probabilities of a particle encountering the fibres increases as both the diameter of the particles and the diameter of the fibres decreases and as the air speed decreases.

In general, with filters of the mechanical type, extremely high degrees of filtration can be obtained, in particular with the so called "absolute" filters which are utilized where the need for pure air is an essential requisite, such as in operating rooms, nuclear centres, bacteriological research centres, etc.. On the other hand, these filters require a considerable head loss, as a function of the degree of filtration and require a periodic replacement. These filters are always used in cascade passing to an increasingly high degree of filtration in order to prevent the filters dedicated to the smallest particles from becoming rapidly clogged by larger particles. The greatest negative aspects of this type of filters lie in the need for continuous maintenance and in the head loss which is a function of the degree of filtration.

Dynamic filters are instead identified as filtration systems that utilize the forces field to which the dusts present in the gaseous current to be purified are subjected. The majority of dusts laying systems utilized in industry fall within this category. In general, these systems are known as cyclones or dust collectors. They force the air flow to be cleaned in a spiralling motion inside a chamber extending conically downwards. The most representative of this class is the so called cyclone. Air moved by a fan is fed from above, where it is forced into circular motion between two concentric walls. This creates vortical motion inside the cyclone. The solid particles of dusts are pushed by centrifugal effect towards the outer walls and descend downwards to fall into the hopper, while the cleaned air is extracted from above. In this case the centrifugal effect is created by the variation in direction of the gaseous current which arrives at a certain speed (energized) inside the cyclone. Dynamic centrifugal dust collectors, in which the air is kept in rotation by an impeller, also belong to this category of filter. Under the centrifugal action, the dust particles are concentrated and conveyed into a separate circuit, by virtue of the particular geometry with hyperbolic profile of the impeller blades the particles are pushed into the hopper below. The rotation speeds, necessary to impart an adequate centrifugal action, are very high, reaching up to 6000 rpm. To improve the efficiency of this type of filter in capturing the particles, a liquid, generally water, is also used, sprayed into the fluid stream. This gives rise to spray towers and Venturi scrubbers, which are capable of capturing particles in a very wide dimensional range from 0.3 to 50 micron. On the other hand, they require a considerable amount of energy, necessary to produce turbulence in the air to be treated.

Summary of the invention

The system forming the object of the present invention, in fact, does not belong to any of the filtration systems described above; combining both the mechanical filter and the dynamic filter, without any of the drawbacks thereof , such as replacement and continuous maintenance of mechanical filters, the high energy requirement of dynamic ones, and the limitations of electronic or electrostatic ones.

The invention, object of the present patent application, is a cleaner of air polluted by fine dusts according to claim 1.

By means of said cleaner is advantageously carried out a relative purifying process of air polluted by fine dusts according to claim 9.

Brief description of Figures

Purely by way of a non-limiting example, the accompanying figures show the functional diagrams of some embodiments preferred by the inventors.

In particular:

- Figure 1 shows according to two orthogonal projections the functional diagram of an embodiment characterized by the air flow to be treated parallel to the axis of rotation of the brush;
- Figure 2 shows according to two orthogonal projections the functional diagram of an embodiment characterized by the air flow to be treated orthogonal to the axis of rotation of more than one pair of brushes;
- Figure 3 shows according to two orthogonal projections the functional diagram of an embodiment characterized by the air flow to be treated orthogonal to the axis of rotation of more than one brush.

Detailed description of embodiments preferred of the invention

The purifying process, carried out by operation of the invention, is based on the effect of catching, entrainment and centrifugation caused by brushes with long strands or wires or threads kept in rotation in an environment through which the flow of polluted air passes and arranged so as to force the flow to pass through the space occupied by the strands of the rotating brushes. The particulate matter (fine dusts) contained in the flow of polluted air (energized, i.e. provided with sufficient speed and head) is entrained through the space occupied by the strands of the brushes which are kept in rotation, and therefore collides with the obstacles constituted by said strands. By effect of the rapid succession of impacts, the particles, which have a mass different with respect to air, are separated from the flow which entrains them, collected among the rows of the brushes and here entrained in the rotational motion imparted to the brushes; by effect of the centrifugal force the particles move towards the periphery and are projected through a perforated wall delimiting the route available to the air flow. Here the fine dusts are no longer conveyed by the flow as there is no consistent movement of air; the particles accumulate and by effect of gravity collect in a hopper from which they can be periodically discharged.

The purifying process carried out by the invention has no limitations to the type of rotating brushes to be utilized, nor to their dimension, number, length, position in the space through which the flow passes (axis of rotation parallel or orthogonal to the direction of flow). The pitch of the spiral of strands wound on the core to form the brush can also be any, as well as the number of revolutions imposed on rotation of the brushes. With regard to the strand forming the brushes, the purifying process carried out by the invention does not impose any limitations, either to the material forming them or to their dimensions (diameter, length).

The purifying process, carried out by operation of the invention, which, as stated above, is based on the effect of catching, entrainment and centrifugation caused by brushes with long strands kept in rotation in an environment through which the flow of polluted air passes and arranged in order to force the flow to pass through the space occupied by the strands of the rotating brushes, can be accelerated if the effects of catching, entrainment and centrifugation take place in a wet phase. This can be obtained by ensuring that the flow of polluted air passes through liquid barriers finely dispersed by suitable bank of spray nozzles. In this case the particles of liquid, in turn colliding with the fine dusts contained in the flow of polluted air, partly absorb them and entrain them in the centrifugation effect imposed on the liquid by the rotating brushes. This enhances both the effect of separation of the fine dusts from the polluted air and entrainment and final collection of the separated material in the storage volume. There are no limitations to the physical-chemical nature of the liquid to be utilized in order to obtain that the purifying process carried out by the invention takes place in wet phase: water can advantageously be utilized.

The purifying process characterizing the operation of the invention permits production solutions that overcome the limitations present in filtration systems currently available on the market.

In fact, the process does not require the action of any filtering element which can be subject to clogging and therefore require periodic maintenance or replacement. Also the perforated wall, which delimits the route of the flow of treated air, separating it from the storage volume, is not subject to the risk of clogging as it does not perform a filtering function, but only separates adjacent spaces; the holes can have a diameter many times greater than that one of the particles to be withheld, as they do not act as a sieve, but only as a compartment for passage of the fine dusts separated from the air flow treated in the storage volume; moreover, rotation of the brushes brings the strands into contact with the inner surface of the perforated wall and thus prevents accidental incrustations from forming.

The purifying process characterizing the operation of the invention does not pose any limitations to the dimensions of the corresponding embodying devices. As already said, the number, dimensions and position of the rotating brushes can be any, as well as the dimension of the strands and the material of which they are composed; in particular, there are no limitations to the dimensions of the storage volume of the separated dusts. This specific characteristic of the process involves that the resulting embodying devices can be advantageously utilized in a wide range of applications, without limitations to the flow rate of air to be treated or to its physical-chemical conditions: from the laying of fine dusts contained in urban smog, to the treatment of exhaust gases from industrial plants and industrial and civil thermal plants, until the laying of fine dusts introduced into atmosphere from internal combustion engine exhaust fumes. The process, according to which the invention operates, offers the solution to both approaches according to which International Research Centres seek the solution to the problem: both to reduce emissions of fine dusts into the atmosphere, and to purify the atmosphere already polluted by the presence of fine dusts.

The absence of limitations to the form and dimensions of the corresponding embodying devices involves the absence of limitations to the endurance of the system. This is confirmed also in the case of process accelerated by the action of entrainment liquid. In fact, said liquid can be separated from the dusts by decantation and recycled in the device, or, when the particular application justifies its utility and when a sufficient continuous flow rate of liquid is available, it can be utilized to entrain the dusts removed from the polluted air and convey them outside.

The process, according to which operation of the invention is carried out, does not pose any limitations either to the minimum diameter of dust particles to be laid, or to the percentage of laying to be obtained. It must, in fact, be considered that as the characteristic diameter of the particles to be laid decreases, the diameter of the strands that constitute the brushes can be reduced and the number of strands per unit of length of the spiral wound to form the brush can be increased, the pitch of the helix forming the brush can be reduced, the length of the brushes can be increased in the case of flow parallel to the axis of rotation, or the number of brushes can be increased in the case of flow orthogonal to the axis of rotation; in both cases the rotation rate of the brushes can be increased, until the laying of even finer dusts (PM 2.5) can be effective, with the desired percentage of laying.

The accelerating effect due to the optional (useful but not essential) presence of entrainment liquid can also be regulated as desired, varying the number of spray nozzles and of liquid barriers obstructing the air flow to be treated.

Figure 1 shows according to two orthogonal projections, the functional diagram of an embodiment characterized by the air flow to be treated parallel to the axis of rotation of the brush.

The polluted air to be treated, preferably energized by means of an external fan, connected to the inlet 1 of the cleaner that provides it with sufficient speed and head, enters the cleaner through said inlet 1, passes through the conveyor 2 and the separation volume 3, and then exits, purified from fine dusts, through the outlet 4. A motor 5 keeps in rotation at a preset speed a brush 6, composed of a spiral formed of long flexible strands 13 wound about the axis.. The movement of the polluted air through the cleaner is guaranteed by the difference in pressure between inlet and outlet and is favoured by the rotational motion of the brush. The separation volume 3 is delimited by a perforated wall 7 beyond which there is the storage volume 12, in communication with the hopper 10 equipped with discharge valve 11. The passage of the air to be treated into the storage volume 12 and in the hopper 10 is prevented by the rate of pressures due to the fact that these volumes are not communicating with the outside.

The fine dusts, entrained by the flow of polluted air, are catched by the strands 13 of the brush kept in rapid rotation and, by effect of the centrifugal force, are projected through the perforated wall 7 into the storage volume 12, where by gravity are collected in the hopper 10 and from here can be periodically discharged by the discharge valve 11.

In the alternative in which laying of the fine dusts is accelerated by entrainment of a fluid, one or more banks of nozzles 9, fed by the feeding circuit 8, form a same number of fluid barriers that obstruct the passage of air to be treated. When the same volume of fluid is to be re-utilized, a decantation system 14 and a pump 15 for recycling the accelerating fluid are provided.

By varying the dimensions of the separation volume 3 and of the rotating brush 6 the flow rate of polluted air that the device is capable of treating with the same difference in pressure between inlet and outlet is changed. Geometry and shape of the separation volume are determined as a function of the dimensions, of the nature and of the shape of the rotating brush in order to promote separation of the dusts.

By varying the length of the brush, the diameter of the strands, the number of strands per length unit of the spiral wound to form the brush, the pitch of the spiral and the number of revolutions of brush rotation, the desired levels of efficiency can be obtained both in relation to the characteristic diameter of the dusts to be laid (i.e. PM 2.5), and with regard to the desired percentage of laying.

Figure 2 shows, according to two orthogonal projections, the functional diagram of an embodiment characterized by an air flow to be treated orthogonal to the axis of rotation of more than one pair of brushes.

The polluted air to be treated (energized, i.e. provided with sufficient speed and head) enters the cleaner through the inlet 21, passes through the separation volume 22, to exit, purified from the fine dusts, through the outlet 23. A motorization system 25 keeps one or more pairs of brushes 24, composed of a spiral formed of long flexible strands 26 wound about the axis, in rotation at a preset speed. The pair or pairs of brushes are arranged on planes orthogonal to the motion direction of the air flow to be treated. The axes of rotation of the brushes lie on said orthogonal planes. The movement of the polluted air through the device is guaranteed by the pressure differential between inlet and outlet and is favoured by the rotational motion of the brushes. The separation volume 22 is delimited by a perforated wall 27 beyond which there is the storage volume 34 communicating with the hopper 30 equipped with discharge valve 31.

The passage of the air to be treated into the storage volume 34 and into the hopper 30 is prevented by the rate of pressures due to the fact that these volumes are not communicating with the outside.

The fine dusts, entrained by the flow of polluted air, are catched by the strands of the brushes 26 kept in rapid rotation and, by effect of centrifugal force, are projected through the perforated wall 27 into the storage volume 34, where by gravity are collected in the hopper 30 and from here can be periodically discharged by the discharge valve 31.

In the alternative wherein laying of the fine dusts is accelerated by entrainment of a fluid, one or more banks of nozzles 29, fed by the feeding circuit 28, form a same number of fluid barriers that obstruct the passage of air to be treated. When the same volume of fluid is to be re-utilized, a decantation system 33 and a pump 32 for recycling the accelerating fluid are provided.

By varying the dimensions of the separation volume 22 and of the rotating brushes 24 the flow rate of polluted air that the device is capable of treating with the same pressure differential between inlet and outlet is changed. Geometry and shape of the separation volume are determined as a function of the dimensions, of the nature and of the shape of the rotating brushes in order to promote separation of the dusts.

By varying the number of pairs of rotating brushes, the diameter of the strands, the number of strands per unit of length of the spiral wound to form each brush, the pitch of the spiral and the number of revolutions of brush rotation, the desired levels of efficiency are obtained both in relation to the characteristic diameter of the dusts to be laid (i.e. PM 2.5), and with regard to the desired percentage of laying.

Figure 3 shows according to two orthogonal projections the functional diagram of an embodiment characterized by the air flow to be treated orthogonal to the axis of rotation of more than one brush.

The polluted air to be treated (energized, i.e. provided with sufficient speed and head) enters the cleaner through the inlet 41, passes through the separation volume 43, and then exits, purified from the fine dusts, through the outlet 44. The movement of the polluted air through the cleaner is guaranteed by the difference in pressure between inlet and outlet. A motorization system 45 keeps one or more brushes 46, composed of a spiral formed of long flexible strands 47 wound about the axis, in rotation at a preset speed. The axes of rotation of the brush or brushes are orthogonal to the motion direction of the flow of polluted air to be treated. The separation volume 43 is delimited by a perforated wall 48 beyond which there is the storage volume 42, in communication with the hopper 53 equipped with discharge valve 54. The passage of the air to be treated into the storage volume 42 and in the hopper 53 is prevented by the rate of pressures deriving from the fact that these volumes are not communicating with the outside.

The fine dusts, entrained by the flow of polluted air, are catched by the strands of the brushes 47 kept in rapid rotation and, by effect of centrifugal force, are projected through the perforated wall 48 into the storage volume 42, where by gravity are collected in the hopper 53 and from here can be periodically discharged by the discharge valve 54.

In the version in which laying of the fine dusts is accelerated by entrainment of a fluid, one or more banks of nozzles 49, fed by the feeding circuit 50, form a same number of fluid barriers that obstruct the passage of the air to be treated . When the same volume of fluid is to be re-utilized, a decantation system 52 and a pump 51 for recycling the accelerating fluid are provided.

By varying the dimensions of the separation volume 43 and of the rotating brushes 46 the flow rate of polluted air that the device is capable of treating with the same difference in pressure between inlet and outlet is changed. Geometry and shape of the separation volume are determined as a function of the dimensions, of the nature and of the shape of the rotating brushes in order to promote separation of the dusts.

By varying the number of rotating brushes, the diameter of the strands, the number of strands per unit of length of the spiral wound to form each brush, the pitch of the spiral and the number of revolutions of brush rotation, the desired levels of efficiency are obtained both in relation to the characteristic diameter of the particles to be laid (i.e. PM 2.5), and with regard to the desired percentage of laying.

CLAIMS

1. Cleaner of air polluted by fine dusts comprising:

- an inlet (1, 21, 41) for conveying inside the cleaner a flow of polluted air to be treated;
- a separation volume (3, 22, 43) for the separation of fine dusts from said flow of air, said separation volume comprising
one or more brushes (6, 24, 46) suitable to rotate around their axis of rotation and comprising long and flexible strands (13, 23, 47) fixed around the axis of rotation;
- motor means (5, 25, 45) suitable to transmit a rotation to said one or more brushes;
- a storage volume (12, 34, 42) of the fine dusts separated;
- a perforated wall (7, 27, 48) delimiting the separation volume (3, 22, 43) and separating it from the storage volume (12, 34, 42);
- a hopper (10, 30, 53) for the collection of the dusts separated from the flow of polluted air.

2. Cleaner according to claim 1, wherein the rotating brushes (6) are arranged with their axis of rotation parallel to the motion direction of the air flow to be treated.

3. Cleaner according to claim 1, wherein the rotating brushes (24) are arranged in pair with axes of rotation laying on a plane orthogonal to the motion direction of the air flow to be treated.

4. Cleaner according to claim 1, wherein the rotating brushes (46) are arranged with their axis of rotation orthogonal to the motion direction of the air flow to be treated.

5. Cleaner according to anyone of the previous claims, wherein geometry and shape of the separation volume separation volume (3, 22, 43) are determined as a function of dimensions, nature and shape of the rotating brushes (6, 24, 46) in order to promote the dusts separation.

6. Cleaner according to anyone of the previous claims, wherein there are provided one or more banks (9, 29, 49) of spray nozzles (8, 28, 50), fed with a liquid by means of a feeding circuit and suitable to produce in the separation volume (3, 22, 43) respective barriers of liquid at the passage of the air flow to be treated for capturing said dusts.

7. Cleaner according to claim 6, wherein there are provided a decantation system (14, 33, 52) to separate the fine dusts from said liquid and a pump (15, 32, 51) suitable to suck in the liquid clarified from said decantation system and to send it in pressure to said feeding circuit.

8. Cleaner according to anyone of the previous claims, wherein there is provided ventilation means connected to the inlet (1, 21, 41) suitable to energize the air flow to be treated providing it with a determined speed and head.

9. Purifying process of air polluted by fine dusts, suitable to be carried out by means of a cleaner according to claim 1, comprising the following steps:

a) conveyance through an inlet (1, 21, 41) of a flow of air to be treated inside the cleaner;

b) separation of the fine dusts from the flow of air by impacts with strands of rotating brushes (6, 24, 46) placed inside a separation volume (3, 22, 43) and generating a centrifugal force;

c) passage through a perforated wall (7, 27, 48) of the fine dusts, separated by effect of said centrifugal force from the separation volume, to a storage volume (12, 34, 42);

d) collection by gravity of the dusts in a hopper (10, 30, 53), from which these dusts can be evacuated.

10. Process according to claim 9, wherein before step b) there is provided an absorption of part of the fine dusts by means of the passage of the air flow to be treated through one or more barriers of liquid, produced by means of one or more banks of spray nozzles (9, 29, 49) inside the separation volume.

11. Process according to claim 10, wherein there are provided a decantation to separate the fine dusts from the liquid that has absorbed them and a recycle of the clarified liquid in a feeding circuit of said nozzles.

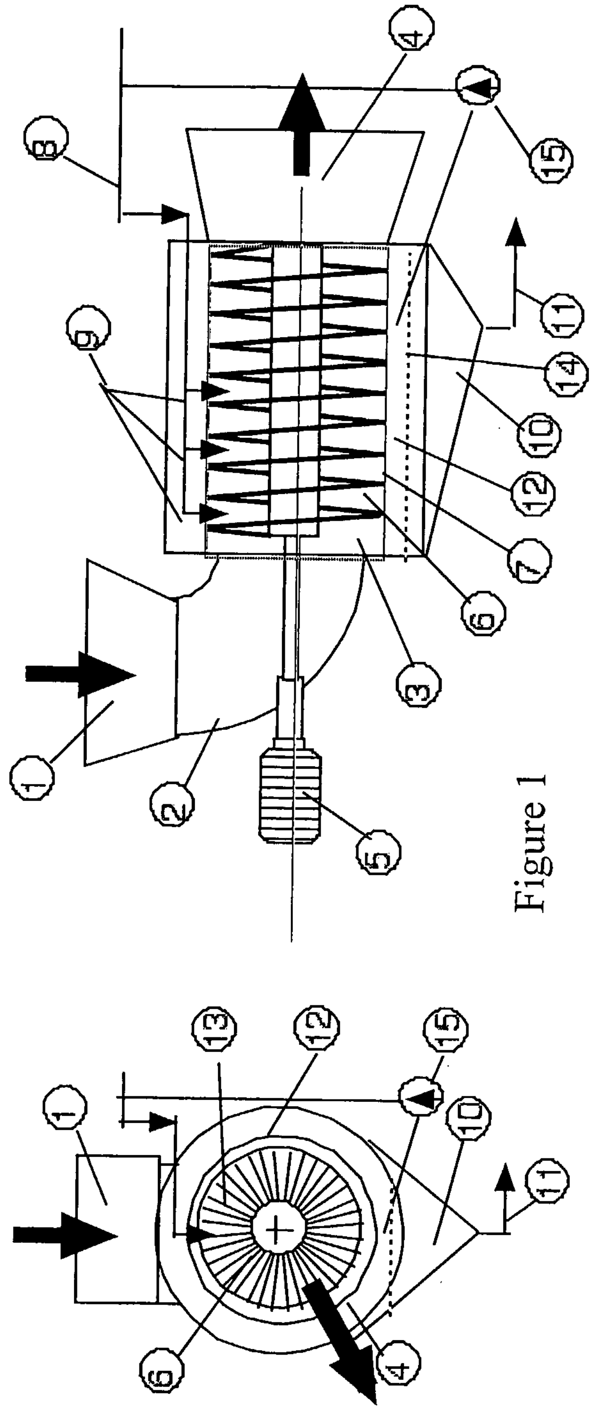

Figure 1

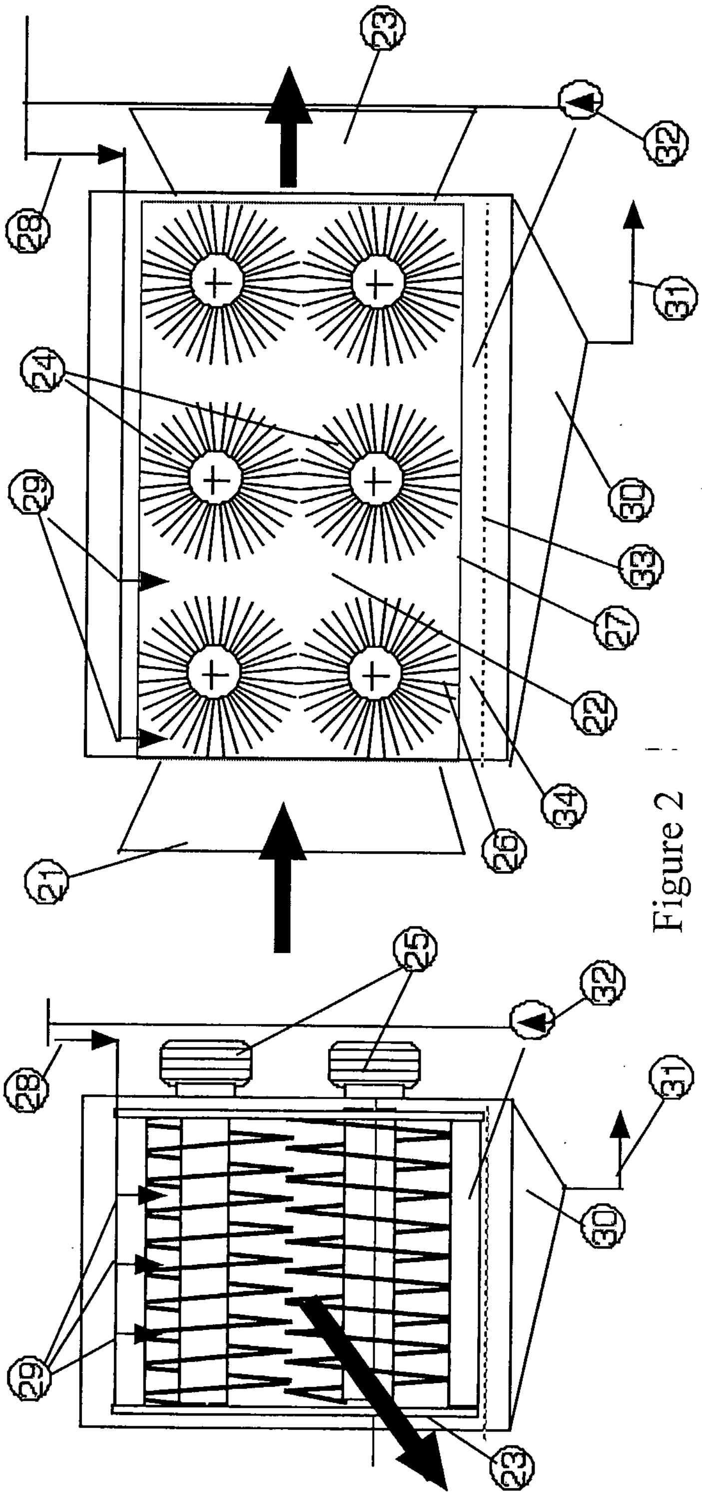

Figure 2

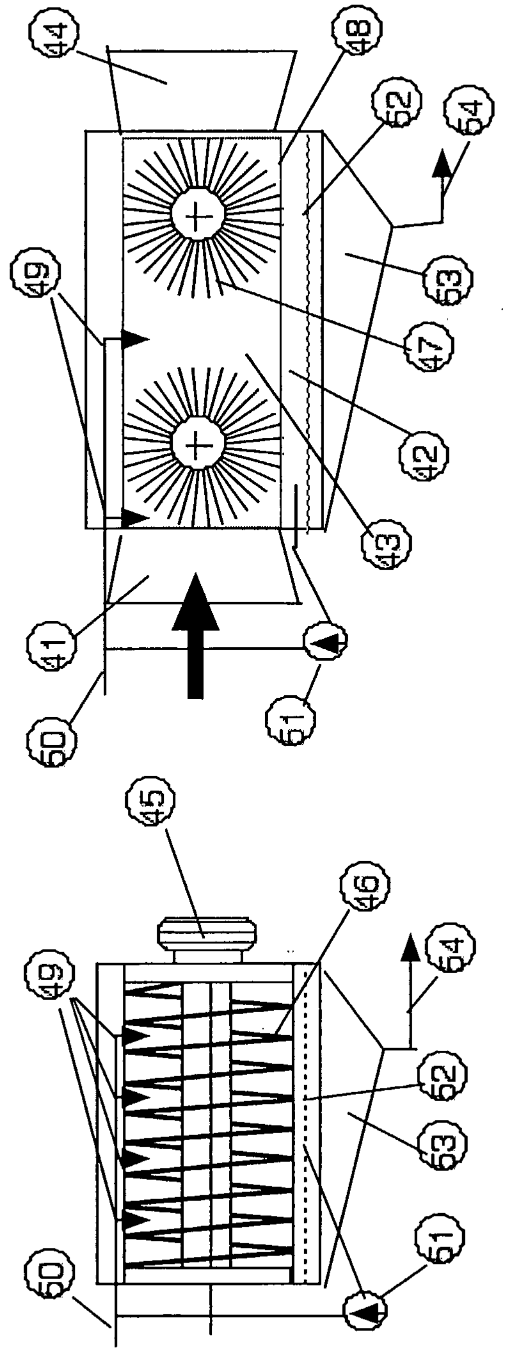

Figure 3