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(71) Applicant : **BELMEKO ENGINEERING NV**
Grasdreef 21
B-8200 Brugge (BE)

(72) Inventor : **Goemaere, Wilfried**
Amazonedreef 32
B-8200 Brugge (BE)

(54) **Apparatus for treatment with forced air circulation.**

(57) It concerns the invention of an installation for the treatment of an object in a processing zone (7) with forced air circulation including a three-dimensional framework (1) equipped near its underside with an exhaust channel (2) with a relatively large suction opening (3) for the air in the processing zone; the channel contains a fan (4) and is connected downstream the ventilator with an discharge channel (6) flowing into the same building; there is an outlet opening (8) for the recirculated air at the top of the discharge channel (6). The outlet opening can be covered with an air permeable filtering plate (9) which can be cleaned.

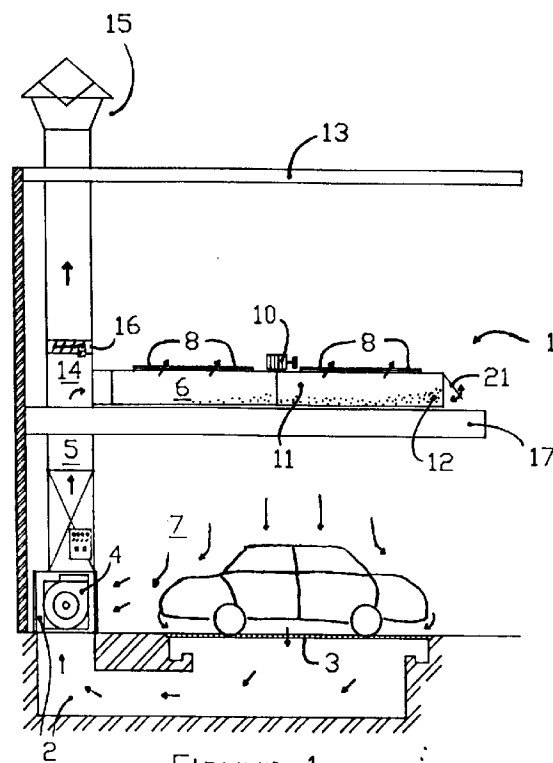


Figure 1

It concerns the invention of a processing installation with a forced air circulation for e.g. objects that have to be cleaned and/or covered with sprayed coatings.

Similar installations, e.g. spraying booths for objects that have to be painted such as cars or furniture and sanding booths equipped with a dust collection device are commonly known. Usually they include a three-dimensional arrangement comprising suction channels in or near the floor for the discharge of the air flow out of the processing zone. These channels are equipped with a fan which recirculates the exhaust air upwards through a channel situated above the object to be processed. The air flow leaves this channel downwards through an outlet opening covered with a filtering plate or a cloth.

This means that a downward air flow is created over or near the object to be treated in the processing zone of this commonly known installation. However this air flow often produces an unwanted draught near the operator and can reach a velocity of 0.5 m/s since the flow should be sufficiently intense (velocity of 0.3 m/s at the least) to guarantee a practically stable laminar regime. In case of painting in a spraying booth or blasting off abrasive powder on pre-treatment areas with compressed air, one should make sure, because of ergonomic reasons, that the sprayed paint solution or the dust does not flow back in a turbulent movement to the operator of the spray gun or compressed air gun: the air flow should disperse the spray rests downwards and away from the operator. The clouds of dust produced in the sanding areas should also be dispersed downwards.

In order to guarantee this protection it is necessary to realize a sufficiently important air flow discharge over the working area around the object that has to be treated, e.g. a car that has to be rubbed down. For a work station or work post with a floor space of e.g. 3.5m x 6m and a car of 1.6m x 4.2m, the working area is $(3.5 \times 6) - (1.6 \times 4.2) = 14.3\text{m}^2$. The corresponding required air discharge is $14.3 \times 0.3 \text{ m/s} \times 3,600 = 15,000 \text{ m}^3/\text{hour}$. In order to prevent underpressure in the workshop and/or cooling of the heated workshop, the exhaust air is recirculated upwards, sent through filters and dedusted. The purified air is blown back to the work post. (In case of spraying the solvents are either absorbed in a solvent filter or the solvent-loaded air is blown outwards.)

For the benefit of a practical and economic construction however, the same air discharge is blown back to the work post over a reduced filter area. With a filter surface of 2m^2 the downward air flow of the example through the filter diameter will be $15,000 : (3,600 \times 2) = 2 \text{ m/s}$. This outlet velocity of 2 m/s in the constructions known to this day is too important and produces an inadmissible draught effect (from velocities higher than 0.5 m/s). However, if the air discharge is adjusted at a lower rate, the operator is insufficiently pro-

ected because of a reduced exhaust velocity.

The commonly known processing installations present the disadvantage that it is very difficult to find a compromise between sufficient air flow velocity for the purpose of a laminar flow and the prevention of draught due to exaggerated velocity, since the exhaust area is always much larger than the blast air area.

Moreover the air flow to the processing zone moves downwards through the filter in the outlet opening so that this filter is loaded at its top and gets clogged. It is necessary to replace the filtering mats regularly when the installation is used e.g. as sanding area.

The present invention avoids these disadvantages and proposes an installation for the treatment of an object in a processing zone with forced air circulation including a three-dimensional framework equipped with a suction channel near its underside; this channel has a relatively large exhaust opening (because of the dimensions of the objects that have to be treated, such as cars). In this channel there is a fan connected downstream to a discharge channel which flows into the same building. At least one outlet opening for recirculated air is situated at the top of the discharge channel. Thus, in operation, at least part of the air flow leaves the channel preferably somewhat upwards, and preferably above the level of the processing zone and in particular above this zone itself. This measure prevents the creation of draught. Indeed, in blowing out possibly the entire air discharge at the top of the outlet channel with a velocity of e.g. 2 m/s, there is only draught in the top part of the building (higher than approximately 3m). In the work post only the homogeneous exhaustion at a velocity of approximately 0.3 m/s is perceptible. Since there is no more draught in the work post, the fan discharge can be increased in order to guarantee sufficient exhaustion and better protection of the operator against dust and solvent spray. At least the end of the outlet channel will preferably be situated over the processing zone of the object to be treated.

When the effluent air has to be filtered, the filtering plate will seal the outlet opening at the top of the channel. This means that the bottom of the filtering plate is loaded and can easily be cleaned in situ. Maintenance and replacement of filters is no longer necessary. Malfunctioning due to carelessness in replacing filters in the constructions known to this day is avoided. More in particular, the arrangement in accordance with the invention, i.e. with filters that no longer clog up, allows the air flow to go on circulating freely in the building. Underpressure and its consequent draught effects at doors, windows and gates in the building are avoided, and the heated air stays in the building.

The invention will now be illustrated with a number of possibilities of realization, with reference to the

enclosed figures.

Figure 1: side elevation of the processing installation in accordance with the invention.

Figure 2: front elevation;

Figure 3: view from above.

The three-dimensional arrangement of the framework 1 usually contains a couple of horizontally running and appropriately supported (e.g. suspended) girders 17 in which it is possible to mount i.a. the lighting 18 of the work post and from which curtains 19 are hung or to which other walls are fixed for the separation of neighbouring work posts. In the thus limited processing space or zone 7 at least one end of the vertical channel set-up 2, 5 is equipped with a fan 4 for the air circulation unit. The relatively large exhaust opening 3 is situated either in the floor under the processing zone 7 and above an underground channel 2 or against the floor near the exhaust fan 4.

In operation the fan drives the exhaust (dust- or spray-loaded) air upwards through the discharge channel 6. The horizontal section of channel 6 is equipped at the top with outlet openings 8 for the recirculated air. If necessary, these openings 8 are sealed by means of filtering plates 9. The outlet openings 8 are relatively small in comparison with the exhaust openings 3. This reduces the weight of the construction and increases the outlet velocity in opening 9 with respect to the exhaust velocity in opening 3. At the same time it increases the free access of natural light to the work posts through the building's skylights, making work more pleasant and reducing the use of artificial light. The downward air flow in opening 3, which has to be exhausted, consists of air situated above and in the work post space around the object to be processed in zone 7. In operation, part of the upwards going air coming out of opening 8 will be bent around the channel 6 (point/dash-arrows).

If the upwards going air coming out of opening 8, in operation, contains particles that have to be removed, e.g. in sanding areas, the filtering plate 9 will stop these (dust) particles at its underside. Thus it is easier to clean the filtering plate in situ than when the particles lie on the filter's upper surface as this is the case with the processing installations known to this day.

Certain means 10 such as vibrating motors make it possible for the filtering plates to vibrate from time to time; the particles collected at the underside of the filtering plate fall down into a receptacle 11 at the bottom of the section of the discharge channel 6 above the processing zone 7. The dust collected at the bottom of the air channel stays there in case of further use of the installation and will not soil the filter a second time since the air current moves over it. Now and then (e.g. annually) the collected particles 12 can be removed from this place 11, e.g. through a flap 21 near the end of the channel 6.

The filtering plate(s) 9 can be flat, corrugated or

composed of successive zigzag-folded strips. The latter guarantee a larger filter surface than flat plates. The proper filter is a surface filter and includes e.g. a non-woven fibrous web.

It is also possible not to have to recirculate the entire upward air flow in channel 6 over the processing zone 7; in that case the installation is equipped with a branch channel 14 with outlet 15. This channel 14 is connected with the channel 5 between the fan 4 and the outlet opening 8. Near the connection it is possible to mount certain means 16 such as a motor-controlled regulating valve for the distribution of the flow between outlet 15 and opening 8. A switch makes it possible to set the valves 16 in the position "rubbing" (air-flow direction to filter 8) or "spraying" (air-flow direction to outlet 15). If required, the outlet 15 can be connected through the roof to the outside atmosphere.

The installations in accordance with this invention can be set up in a fixed position or mounted on a mobile chassis. In both cases they are particularly suited for being used as sanding area, e.g. of vehicles.

It is obvious that the outlet opening 8 does not necessarily have to be situated in a horizontal plane. The openings 8 can also be located near the upper edge of the vertically standing side walls of the end 6 of channel 5. Vertically set-up filtering plates 9 can be connected to these side walls. The outlet openings 8 and filtering plates 9 can also be mounted in slanting side walls at the end 6 of channel 5. When the filter is loaded, the filtered dust can still fall down in the lower receptacle 11.

Claims

1. Installation for the treatment of an object in a processing zone (7) with forced air circulation including a three-dimensional framework (1) equipped near its underside with an exhaust channel (2) with a relatively large suction opening (3) for the air in the processing zone; the channel contains a fan (4) and is connected downstream the ventilator with a discharge channel (6) flowing into the same building; the distinctive feature of this installation is the presence of an outlet opening (8) for the recirculated air at the top of the discharge channel (6).
2. Installation in accordance with conclusion 1, the outlet opening (8) being covered with an air permeable filtering plate (9).
3. Installation in accordance with conclusion 2, the filtering plate (9) being a zigzag-folded fibrous web.

4. Installation in accordance with conclusion 2, including a number of means (10) allowing to clean the filtering plate (9) in situ.
5. Installation in accordance with conclusion 2: under the filtering plate, at the bottom of the discharge channel (6), there is a receptacle (11) for the particles collected by the filter (9). 5
6. Installation in accordance with conclusion 1: at least part of the air flow leaves the channel (6) upwards above or near the processing zone. 10
7. Mobile installation in accordance with conclusion 1. 15
8. Use of the installation as sanding area in accordance with conclusion 1 or 7.

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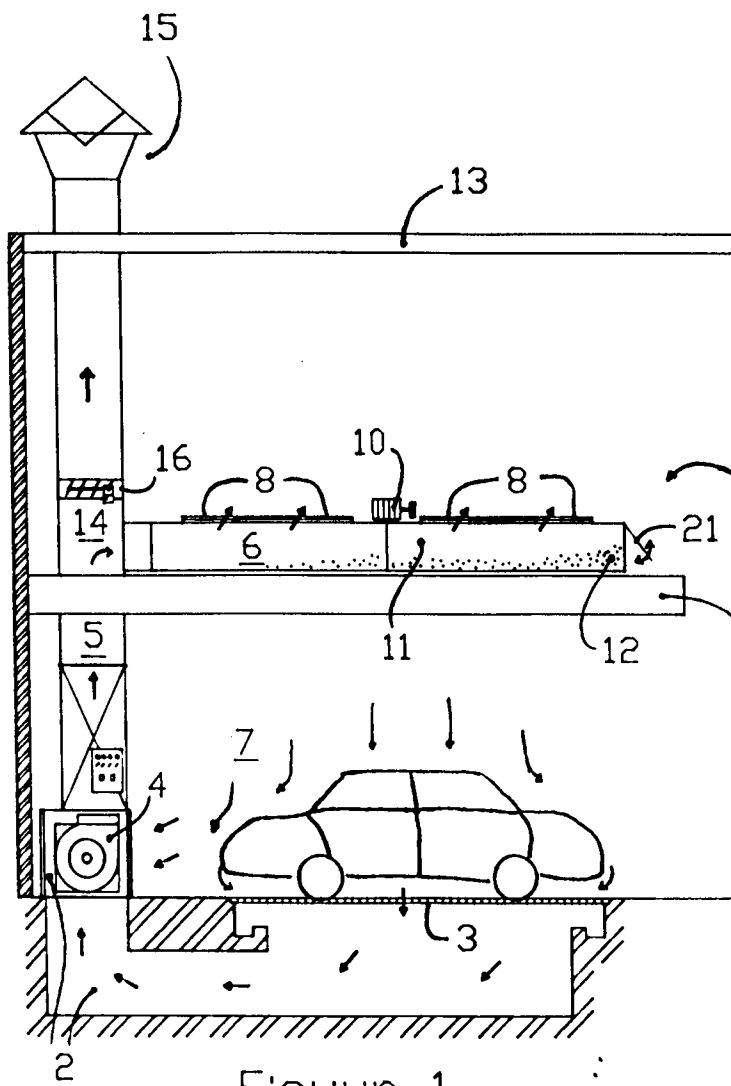
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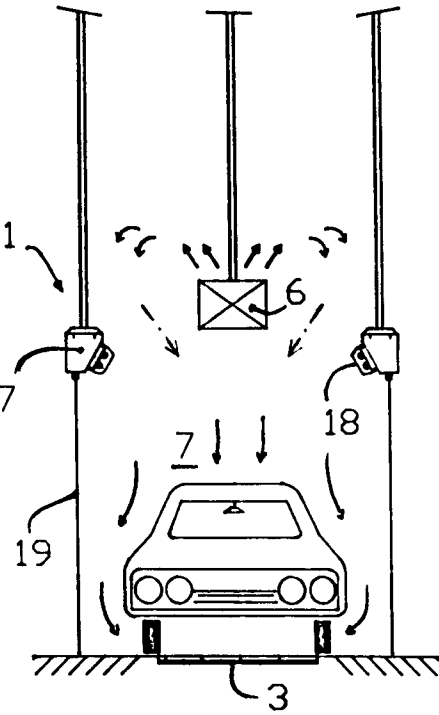
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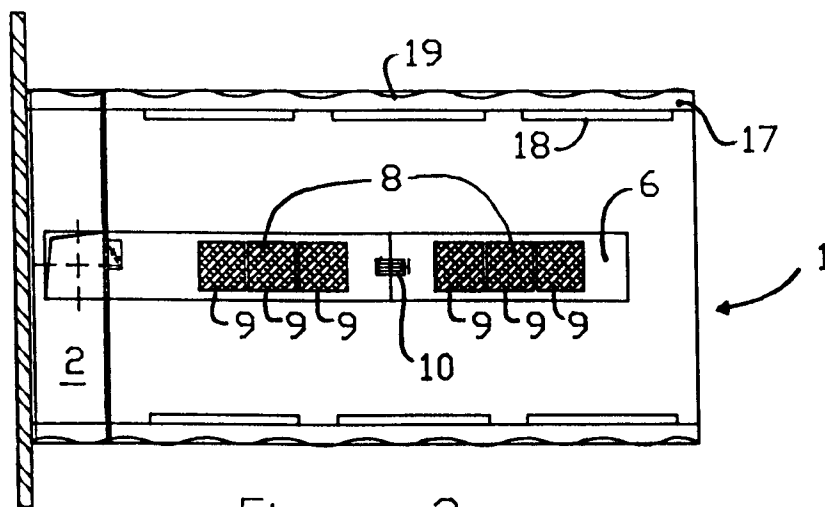
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Figuur 1



Figuur 2



Figuur 3