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(54) **Spray booth**

(57) The spray booth (1) can be notionally divided into a set of adjacent regions ($Z_1, Z_2, \dots, Z_n$) which can be ventilated independently of each other. As a function of the shape of the article (101, 103) to be sprayed, only the regions occupied by said article are ventilated. In this way, it is possible to ventilate only the regions (Z_i) wherein harmful volatile substances are released instead of ventilating the whole room of the booth, thereby obtaining a considerable energetic saving. (Fig. 3)

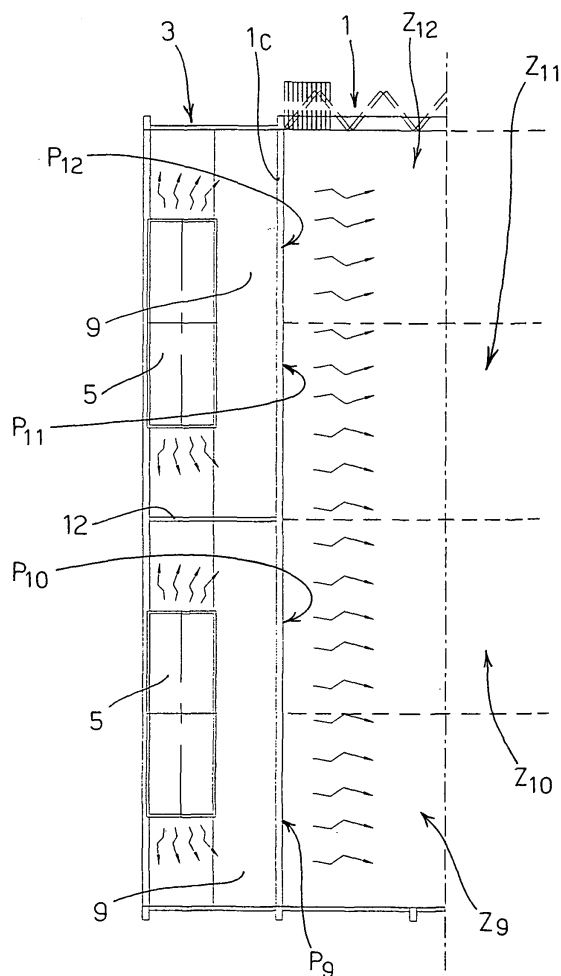


FIG. 3

Description

[0001] The present invention concerns a spray booth.

[0002] More particularly, the invention concerns a spray booth of the kind equipped with means for generating a forced airflow capable of avoiding inhalation of harmful volatile products by the operator.

[0003] Spray booths of the above kind are widely used for painting vehicle bodyworks, frames, aircraft parts and so on, but they can also be used for other processes, such as applying lutes and other protective materials involving volatile product exhalation.

[0004] It is known that particularly harmful volatile substances are used in all such processes. Although in industrial applications automatic robots are often used to operate inside the booth, resorting to one or more operators for the whole process or anyway for specific operations or final touches is not infrequent.

[0005] To avoid the risk that the operator(s) inhale(s) harmful substances, the present regulations require that a forced airflow is generated in the booth, with a suitable speed to quickly and constantly evacuate harmful substances.

[0006] Since the airflow is to be constantly maintained during the process and it must have a suitable speed (about 0,5 m/sec), it is necessary to provide suitably sized aspirators and/or fans that, of course, are strongly energy consuming.

[0007] To this it should be added that in many regions in the world and for several months in the year, the air introduced into the booth is to be heated or cooled to reach a comfortable temperature for the operator.

[0008] A further problem related with the use of spray booths of the described kind is the need to decontaminate the exhausted air before discharging it again into the outer environment.

[0009] Due to the considerable amount of air passing through the booth, decontaminating equipment capable of bearing so heavy a working load are therefore required.

[0010] Indeed, it is to be remembered that conventional spray booths have a great volume (e.g. in aerospace industry booths with a surface area exceeding 100 m² are used).

[0011] In order to limit the consumption of energy, while guaranteeing at the same time the respect of the present regulations in terms of operator safety, booths have been conceived wherein only the portion of booth occupied by the user is ventilated. An example of realisation of such booths is shown in the European patent application EP 1314484 in the name of the Applicant.

[0012] Said document describes a spray booth the floor and the ceiling of which are divided into a plurality of regions, each of said regions being provided with an independent ventilation system. Each region of the floor comprises a pressure sensor for detecting the presence of the operator in said region, so that only the ventilation systems relative to that region and to the adjacent re-

gions are actuated. This solution allows a considerable energy saving.

[0013] However, said solution can be applied only when vertical airflows are used, as the control of the ventilation systems is based on the detection of the weight of operator.

[0014] On the other side, it could be necessary to use a ventilation system with horizontal airflows, for instance when processing articles having a particular shape that, due to their intrinsic nature, would block vertical airflows.

[0015] In these situations, the use of a technique based on the detection of the position of operator would require the use of a complicated system of photoelectric cells or of transmitters/receivers.

[0016] It is therefore an object of the present invention to provide a spray booth that provides for a ventilation system having a limited energy consumption, while guaranteeing an optimal and effective evacuation of the harmful volatile materials according to the present regulations.

[0017] A further object of the present invention is to provide a spray booth the ventilation system of which can be effectively used for processing articles having any shape and size.

[0018] The above and other objects are achieved by the spray booth as claimed in the appended claims.

[0019] The invention is based on the assumption that it is not necessary to ventilate the whole of the spray booth at the above mentioned speed, but only those regions inside the booth where the emission of harmful substance is present.

[0020] Advantageously, according to the invention, only the regions of volume occupied by the article to be sprayed are ventilated, as only in such regions harmful volatile substances could be realistically released. To this end, said control device comprises a processing unit provided with a file wherein the size features of all the articles that could be sprayed and the corresponding instructions for the control system of the spraying system are stored.

[0021] As said control device is based on the shape and on the position of the article to be sprayed and not on the position of operator moving inside the booth, the selection of the regions to be ventilated is set only once at the beginning of the spraying operation and is not modified during the processing.

[0022] Advantageously, thanks to the splitting of the booth volume, a considerable energy saving is achieved with an important reduction in the operating costs, without thereby substantially adding to the booth manufacturing costs.

[0023] A preferred exemplary embodiment of the invention will now be better disclosed with reference to the accompanying drawings, in which:

- Fig. 1 is a schematic internal side view of the spray booth according to the invention;
- Fig. 2 is a particular of the cross-sectional view

along line II - II of the spray booth shown in Fig. 1;

- Fig. 3 is a cross-sectional view along line III-III of the particular shown in Fig. 2.

[0024] Referring to Fig. 1, there is shown a spray booth according to the invention, generally denoted by reference numeral 1 and comprising a base 1a, side walls 1b to 1e and a ceiling 1f. Inside booth 1 it is defined a substantially free room for housing one or more articles 101, 103 to be processed.

[0025] Two of the walls of the spray booth 1, in the illustrated embodiment the side wall 1c and the side wall 1e parallel to it, are subdivided into a plurality of square areas $P_1, P_2, \dots, P_i, \dots, P_{16}$ arranged as a matrix, which notionally divide the volume of said booth 1 into a plurality of adjacent parallelepiped regions $Z_1, Z_2, \dots, Z_i, \dots, Z_{16}$ comprised between said areas.

[0026] Each region Z_i can be independently ventilated, as it will be described more in detail in the following.

[0027] The ventilation of each region Z_i is controlled by a control system on the basis of the data concerning the shape and the position of the article 101, 103 to be sprayed or to be processed, so that the region Z_i is ventilated only if occupied by said article 101, 103. To this end, said control system is provided with a processing unit comprising a processing file, wherein the data concerning the geometric shape of the articles to be sprayed are stored.

[0028] Thus, with reference to Figure 1, in case of spraying the article 101, only the regions $Z_5, Z_8, Z_9, Z_{12}, Z_{14}, Z_{15}$ are ventilated, that is to say those regions from which it is necessary to remove the harmful volatile substances through the airflow. The ventilation system will be not actuated in the other regions, thereby allowing a considerable energetic saving.

[0029] Likewise, in case of spraying the article 103, the ventilation system will be actuated only in the regions Z_4, Z_7, Z_{11}, Z_{16} .

[0030] With reference to the Figures 2 and 3, it is schematically shown the ventilation system of the spray booth 1.

[0031] Said ventilation system is housed inside a room 3 adjacent to the side wall 1c and 1e of the spray booth 1 and comprises one or more vertical ducts 5 from which the air respectively blown and sucked comes. Said vertical ducts 5 are provided with a plurality of side openings 7 through which the air flow is introduced into a so called compensation "plenum" 9, that, if necessary, is divided by means of vertical 12 and horizontal 13 baffles.

[0032] Said "plenum" 9 are separated from the room inside the spray booth by a series of partitions $S_1, S_2, \dots, S_i, \dots, S_{16}$, respectively obtained in the wall 1c and in the wall 1e of the booth 1, one partition for each area $P_1, P_2, \dots, P_i, \dots, P_{16}$ of each wall.

[0033] Said partitions comprise some fins 15 that can be rotated thanks to leverages or gears so that said partitions can pass from an open to a closed position and

vice versa. The opening of said partitions $S_1, S_2, \dots, S_i, \dots, S_{16}$ is actuated by the control system on the basis of the information stored in the processing file and concerning the article to be processed and occurs through actuators acting on said leverages or gears which set into motion said fins.

[0034] In this way, only the partitions S_i corresponding to the regions Z_i occupied by the article to be processed are open, so that said regions Z_i are ventilated.

[0035] The air sucked through the areas of the wall 1e is then conveyed to suitable decontaminating equipment (comprising e.g. a set of carbon filters) before being exhausted into the outer environment.

[0036] It is evident that, in order that the ventilation system can work satisfactorily, the control device opens or respectively closes, for each partition S_i present on said wall 1c, the partition aligned with it and arranged on the opposed wall 1e.

[0037] It is further evident that the blowers and the aspirators, respectively used in correspondence with the walls 1c and 1e, are so sized that they ensure effective ventilation of each region Z_i , in the respect of the present regulations.

[0038] In correspondence with each partition S_i , on the wall 1c of the booth 1, filters 11 are mounted for preventing that impurities existing in the airflow coming from the blower penetrate inside booth 1. Similar filters are advantageously mounted on the opposed wall 1e for preventing that the volatile substances used in the spraying process contaminate the outer environment.

[0039] Said filters 11 are preferably inserted into frames hinged to said wall(s) so that they can pivot and can be easily inspected from the inside of booth 1.

[0040] In order to ensure satisfactory safety margins during the stay of operators inside the spray booth 1, some anemometers are arranged in suitably selected points inside said booth. Said anemometers provide to the control device the measurement of the airflow present in the booth 1; if said airflow is considered to be insufficient for ensuring the safety of operators inside the booth, the control device actuates the opening of further partitions S_i for increasing said airflow until optimal conditions for the operators are obtained.

[0041] Always according to the invention, it will be also possible to provide that each area P_i on the wall 1c is equipped with its own blower and, correspondingly, that each area in the wall 1e is equipped with its own aspirator. In this case the control device can be directly act on the control members of each blower and of each aspirator, for forcing the airflow in the desired region, according to the geometrical features of the article to be processed.

[0042] In the described embodiment, a ventilation system creating a side transversal airflow has been described; clearly, however, the spray booth according to the invention can be also used with ventilation systems generating a vertical ascending or descending airflow.

[0043] It is clear that the above description is purely

given as a non-limitative example and that variants and modifications are possible without departing from the field of protection of the present invention.

Claims

1. A spray booth (1) wherein it is defined a substantially free room for housing one or more articles (101,103) to be processed, said room being delimited by a series of walls, said booth (1) being equipped with means for generating inside said room a forced airflow capable of quickly changing air contained therein, **characterised in that** said booth is divided into adjacent regions ($Z_1, Z_2, \dots, Z_n$), each equipped with corresponding means for generating said forced airflow, said generating means being actuated so as to confine said flow in the regions occupied by said article(s) (101,103). 5
2. A spray booth (1) according to claim 1, **characterised in that** at least two of said walls are subdivided into a plurality of areas ($P_1, P_2, \dots, P_n$), each of them being provided with corresponding independent partitions ($S_1, S_2, \dots, S_n$), the opening of which is controllable, allowing to connect the room inside said booth (1) with the outer room. 10 20
3. Spray booth (1) according to claim 2, **characterised in that** said areas ($P_1, P_2, \dots, P_n$) are organised as a matrix. 25 30
4. Spray booth (1) according to claim 3, **characterised in that** said partitions ($S_1, S_2, \dots, S_n$) connect the room inside said booth with the outer room or compensation "plenum" (9) wherein the air coming from one or more blowers and directed to the room inside said booth or coming from said room and directed to one or more aspirators flows. 35 40
5. Spray booth (1) according to claim 4, **characterised in that** said "plenum" (9) comprises one or more vertical ducts (5) provided with a plurality of side openings (7) through which the air flow generated by said blowers or sucked by said aspirators is respectively introduced into said plenum or evacuated from it. 45 50
6. Spray booth (1) according to claim 5, **characterised in that** filters (11) are provided between said "plenum" (9) and said booth (1) for decontaminating the air coming into said booth or coming out from said booth. 55
7. Spray booth (1) according to claim 3, **characterised in that** the opening and the closing of each of said partitions ($S_1, S_2, \dots, S_n$) is actuated by a control device comprising a processing file wherein the ge-

ometrical features of said articles (101,103) to be processed are stored.

8. Spray booth (1) according to claim 7, **characterised in that** said at least two walls are two side parallel walls (1c,1e) and **in that** pairs of partitions that are opposed each other are actuated so that they are either both open or both closed.
9. Spray booth (1) according to claim 7, **characterised in that** said control device comprises means for measuring the airflow inside said booth (1) and can act on one or more partitions (S_i), thereby provoking its/their opening when said airflow is insufficient to guarantee safety conditions for the operators staying inside said booth (1).

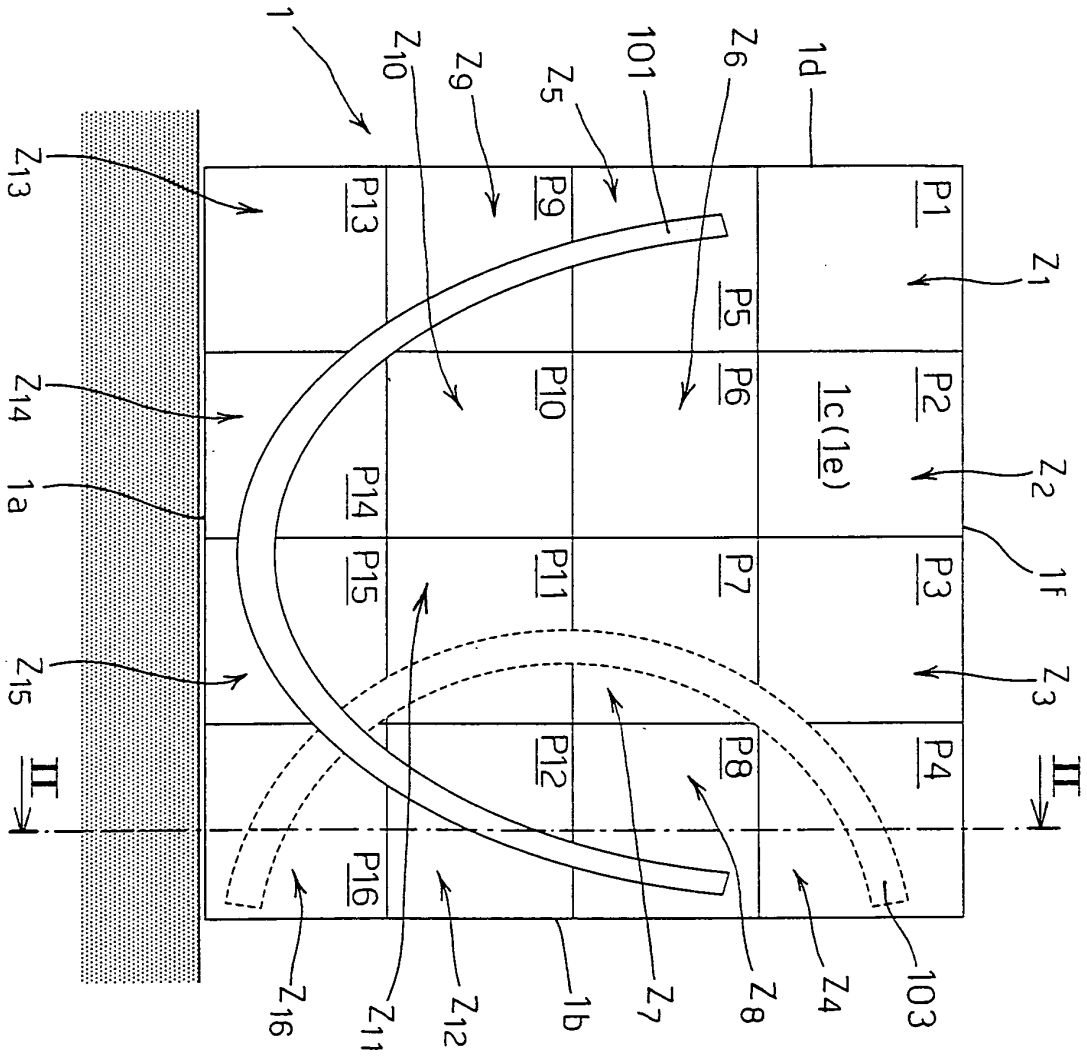
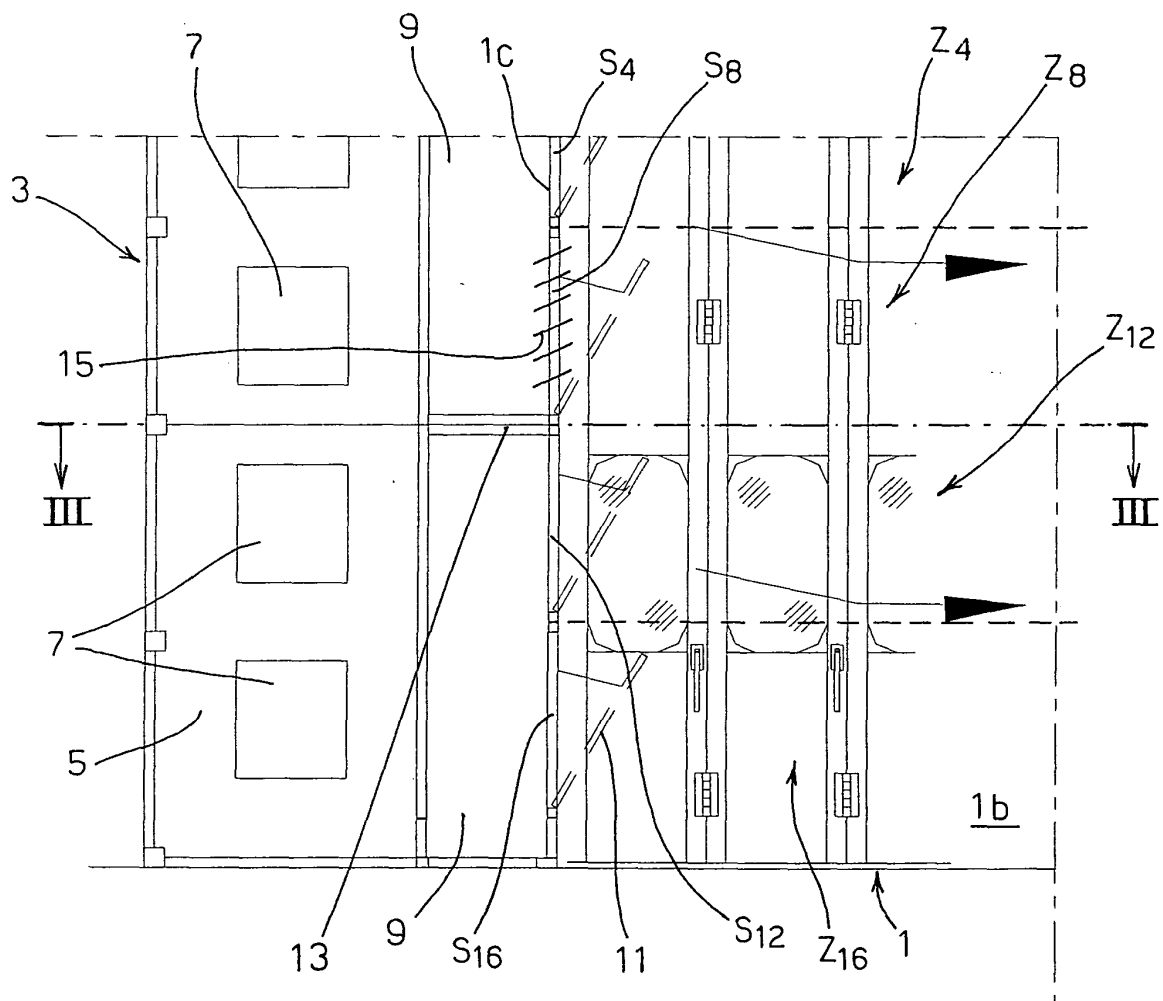


FIG. 1

FIG. 2



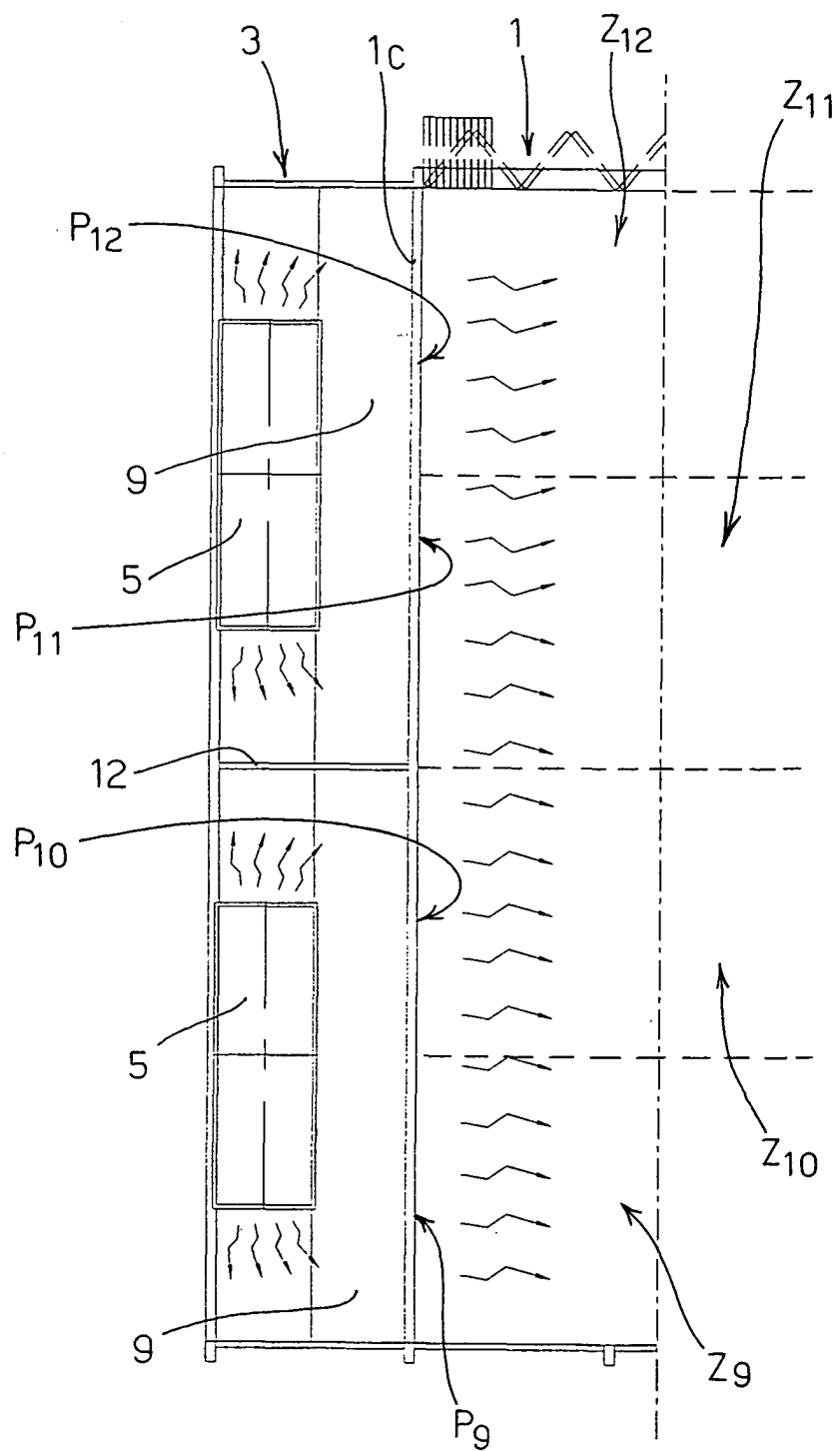


FIG. 3