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(54) **Automatic vending apparatus with improved cooling system**

(57) Automatic vending apparatus for goods of different kind, featuring an improved cooling system.

The items to be sold are arranged on the shelves (26) of a drum (25) adapted to rotate about a central hollow column (27).

The cooling medium is caused to flow through the column (27), while flow adjusting means (60-63) are provided in correspondence of the various shelves (26). The possibility is thereby provided to create zones at homogenous, but differentiated temperatures inside the vending apparatus.

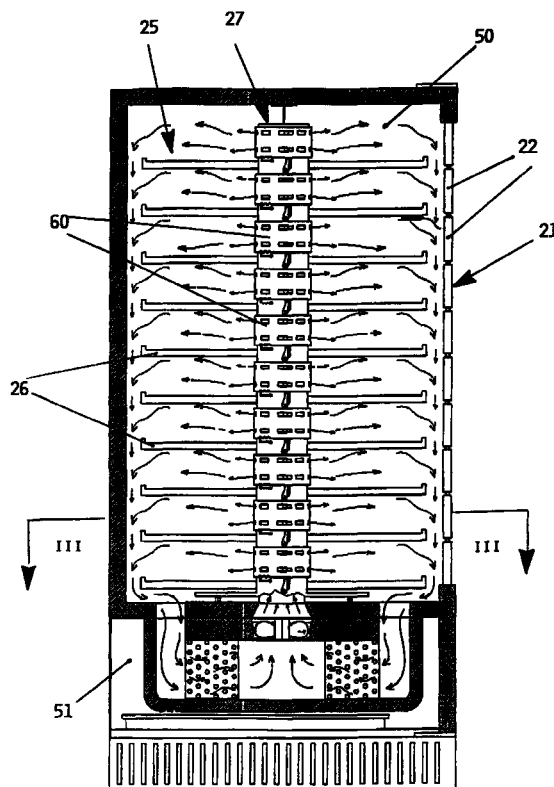


FIG. 2

EP 1 076 213 A2

Description

[0001] The present invention refers to an automatic vending apparatus for the sale of goods of various kind that require being stored and preserved under differentiated temperature conditions. In particular, it refers to an improved cooling system for an automatic vending apparatus of this kind.

[0002] An automatic vending apparatus has essentially the appearance of a cabinet, in the interior of which there is arranged a vertical-axis drum that is rotatably driven by an electric motor. Such a drum carries a plurality of horizontal shelves, which are in turn subdivided into individual compartments by vertical partitions: the items stored there for vending, and which require being preserved at adequately low temperatures, are arranged in such compartments on said shelves. The drum is mounted around a hollow central column, through which the cooling air is caused to flow upon being cooled down by a refrigeration arrangement contained in the cabinet and usually installed in the base thereof. Through proper apertures, the refrigerated air flows from the hollow space in the central column into the compartments containing the items to be sold. The return flow of the air towards the refrigeration arrangement is brought about by such an air being drawn in through appropriate channels defined by vertical walls provided in the cabinet between the drum and the side walls of the same cabinet.

[0003] An automatic vending apparatus of such a kind is described in the patent publication US 4,831,841. However, the purpose of the solution described in said patent is to ensure a uniform product storage temperature in all of the storage compartments of the apparatus. As a result, such a vending apparatus enables only products of a same kind, or at most products requiring to be stored under similar temperature conditions, to be stored there for vending purposes. Furthermore, it should be noticed that the technical solution described in the above mentioned publication cannot anyway ensure a uniform temperature throughout the storage compartments of the vending apparatus, since the flow of the cooling air is actually affected to a considerable extent by the hindrances it meets with, as represented in particular by the loads of products that are continuously varying in the various compartments owing to the successive product withdrawals.

[0004] It would on the contrary be desirable, and it actually is a main purpose of the present invention, to provide a much more versatile automatic vending machine that is capable of enabling products of different kinds requiring different storage temperatures to be sold therethrough. This is for instance the case of various food items, such as freshly prepared sandwiches or packaged snacks, which are contained in single-dose packages, and also drinks contained in cans or bottles. For the desired result to be obtained, the need arises for the possibility to be provided for the temperature to be

adjusted in a differentiated manner in the various compartments of the storage shelves, or at least in definite, preferably adjustable-volume zones inside the vending apparatus.

[0005] According to the present invention, this aim is reached in an automatic vending apparatus of the afore described kind, in which means are provided for adjusting the flow of refrigeration air, said means being mounted on the central hollow column and being adapted to create homogeneous, but differentiated temperatures in a plurality of zones arranged above each other in the storage room of the vending apparatus, as this is recited in the main appended claim.

[0006] As this will become apparent further on in this description, the basic idea behind the present invention may be implemented in a variety of different embodiments.

[0007] The features and advantages of the present invention will anyway be more readily and clearly understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which

- Figure 1 is a front elevational view of a vending apparatus according to the present invention;
- Figure 2 is a schematical side cross-sectional view of a first embodiment of the vending apparatus according to the present invention;
- Figure 3 is an enlarged cross-sectional view along the line III-III of the vending apparatus illustrated in Figure 2;
- Figure 4 is an enlarged partial view of a detail of the vending apparatus illustrated in Figures 2 and 3;
- Figures 5A to 5C are schematical cross-sectional views of the detail of Figure 4 as illustrated in three different operating positions;
- Figure 6 is an enlarged cross-sectional top view of the base of the vending apparatus illustrated in Figure 2;
- Figure 7 is an enlarged cross-sectional front view of the lower portion of the vending apparatus illustrated in Figure 2;
- Figure 8 is a cross-sectional side view of a second embodiment of a vending apparatus according to the present invention;
- Figure 9 is a cross-sectional side view of a third embodiment of a vending apparatus according to the present invention, in a first operating condition thereof;

- Figure 10 is a cross-sectional side view of the vending apparatus illustrated in Figure 9, in a second operating condition thereof;
- Figure 11 is an enlarged cross-sectional view of the lower portion of the vending apparatus illustrated in Figures 9 and 10.

[0008] An automatic vending apparatus for the sale of different products, which are usually contained in packages, cans or the like, is generally constituted by a parallelepiped cabinet 20 (Figure 1) which defines an inner storage room 50 and a base portion 51 (Figure 2). The storage room 50 is closed on its front side by a door 21, which is provided with a plurality of clear, ie. see-through glazed wickets 22 to ensure visibility of the products stored inside the vending apparatus and to enable the same products to be removed therefrom. On the door 21 there are provided selection means 23 (Figure 1) for the selection of the product to be dispensed, whereas payment means 24 are preferably arranged on a front panel of the cabinet. These means are of a kind that is generally known in the art, so that they do not require any further detailed description.

[0009] Inside the storage room 50, the products are arranged on a vertical-axis drum 25 (Figure 2) formed by a plurality of horizontal shelves 26, which are mounted on a central hollow column 27. The shelves 26 are subdivided into individual compartments by means of vertical partitions 28 (Figure 3). The drum 25 is rotatable owing to the action of an electric motor-reduction gear unit 29 (Figures 6 and 7) mounted in the base of the vending apparatus and provided with an output shaft 30. The latter carries a pinion 31 that is in gear with a toothed disk 32, which is attached to the lower end portion of the column 27 and which rests on the bottom 33 of the storage room by means of wheels 34. As a result, when a product is selected for vending, the motor-reduction gear unit 29 causes the drum to rotate until the compartment containing said product is brought into the product dispensing position in correspondence of the respective wicket 22 (Figure 3).

[0010] In the base 51 of the cabinet 20 there are installed the devices needed for cooling, ie. refrigerating the air and circulating it inside the vending apparatus to the purpose of preserving the products stored there at the required temperature. The refrigeration devices comprise a refrigerating circuit that is normally provided with a compressor 35, an evaporator 36, a condenser 37 and a fan 38 (Figures 6 and 7). The air circulation is on the contrary brought about by a fan 39 which delivers the air, through an aperture 40 provided in the bottom 33 of the storage room, into the central hollow column 27 of the drum 25. The air rises along the column 27 and distributes radially over the various shelves 26 by flowing through corresponding arrays of ports provided in the cylindrical wall of the column. The air then returns to the refrigeration unit in the base of the vending appa-

ratus by flowing back through the free space comprised between the periphery of the drum 25 and the inner walls of the storage room 50 (Figure 2).

[0011] In order to adjust the flow of the cooling air in such a manner as to create substantially homogeneous, but differentiated temperatures in various zones arranged above each other in the storage room 50, on the hollow central column 27 there are mounted a plurality of sleeves 60, which are provided with passing-through apertures 61, corresponding to a plurality of apertures 62 provided in the wall of the column 27 (Figure 4). Each one of said sleeves 60 is connected by pin-slot coupling means to a lever 63 which is pivotally hinged on to the wall of the column 27, in such a manner that a rotation of the lever 63 about its horizontal hinge-on axis translates into a rotation of the sleeve 60 about its vertical axis coinciding with the axis of the column 27. As a result, the apertures 61 of each sleeve 60 can take, relative to the corresponding apertures 62 of the column 27, a position of full closure (Figure 5A), or a position of partial opening (Figure 5B), or a position of full opening (Figure 5C). To each one of these positions there corresponds a different condition of the flow of cooling air, as this is best shown by the arrows in Figures 5A to 5C.

[0012] As an alternative thereto, it can be readily appreciated that the sleeves 60 can be mounted and actuated so as to slide longitudinally along the column 27, instead of rotating about the same column. This different mechanical solution can anyway be easily and readily implemented by anyone skilled in the art.

[0013] The sleeves 60 are actuatable manually and individually, but can clearly be provided with an automatic actuation system and controlled, for instance, by means of a thermostatic device. Furthermore, they can also be actuated in clusters or groups, for instance by connecting a plurality of levers 63 together by means of a bar.

[0014] In a preferred manner, to each such sleeve 60 there is associated an indicating device 64 (Figure 4), which may for instance be constituted by a jumper-type index, or the like, that is adapted to cooperate with corresponding reference nicks provided on the edge of the sleeve. The device 64 enables the precise, actual opening or closing condition of the apertures for the passage of the cooling air on the individual shelves 26 to be most conveniently and readily verified.

[0015] A second, more complete and sophisticated embodiment of the present invention calls for the addition of an intermediate partitioning diaphragm 42 (Figure 8) inside the storage room 50 (Figure 8). This diaphragm 42 is preferably constituted by a first portion attached to the central hollow column 27, and a second portion attached to the inner wall of the storage room 50. The position of this diaphragm 42 is variable along the height of the storage room 50 so as to create two distinct zones arranged above each other and kept at different temperatures. The lower zone may for instance

be used to store fresh products to be kept at a temperature of 3 to 4°C, whereas the upper zone may be used to store packaged products (ie. the so-called snacks) or drinks in bottles or cans to be kept at temperatures of anywhere between 8 and 15°C.

[0016] In order to prevent the lower zone to be negatively affected by a return flow of warm air, it may prove adequate to provide a channel 43, worked out in the wall of the storage room 50, for directly connecting the upper zone of the storage room with the refrigeration unit installed in the base 51 of the vending apparatus. Throttling the flow of cooling air circulating in the storage room 50 keeps of course being made possible thanks to the presence of the adjustable sleeves 60 mounted on the central column, in the same way as described afore with reference to the first embodiment.

[0017] The constructional configuration of this embodiment calls for the use of just a single temperature probe (not shown) to control the more sensitive zone of the storage room, ie. the lower zone holding the fresh food products.

[0018] This second solution is effective in ensuring that the return flow of the air from the upper zone of the storage room is fully separated from the flow of air circulating in the lower zone. This therefore enables a greater stability of the colder temperature, ie. the storage temperature actually required in the lower zone of the storage room, to be obtained. This solution is found to be of particular advantage in the case in which a distinct, clear differentiation is required among the temperatures prevailing in various zones of the storage room.

[0019] In a third embodiment of the vending apparatus according to the present invention (Figures 9 and 10), the differentiated-temperature zones in the storage room 50 are fed separately through at least two distinct channels 44 and 45 provided inside the central hollow column 27. In a preferred manner, these channels 44 and 45 are co-axial with the same column. The channel 44 forms the passage of the cooled air towards the upper zone of the storage room. The channel 45 is plugged on top, in correspondence of the intermediate diaphragm 42, so as to be able to deliver the cooling air into the lower zone of the storage room.

[0020] The channels 44 and 45 extend vertically starting from the aperture 40 in the bottom 33 of the storage room 50 and, at the inlet openings thereof, there are provided respective throttle valves 46 and 47 (Figure 11) that are arranged downstream of the delivery fan 39. By correspondingly selecting, either manually or by automatic control, the operating setting of the valves 46 and 47, it is therefore possible to allow for either the upper zone (Figure 9) or the lower zone (Figure 10) of the storage room 50 to be refrigerated. In this case, the need arises for two temperature probes (not shown) to be used to control the two zones at different temperatures.

[0021] Use of the throttling sleeves 60 of the afore described embodiments (not shown in Figures 9 and 10

for reasons of greater simplicity in the illustration) is made also in this third embodiment of the present invention. These sleeves make it possible for the air flow to be more specifically adjusted on the various shelves 26 so as to create further differentiated zones within each one of said two zones at different temperature.

[0022] It will of course be appreciated that the above described automatic vending apparatus may be the subject of a number of further modifications or variants without departing from the scope of the invention.

Claims

1. Automatic vending apparatus for selling different products capable of being stored at differentiated temperatures, comprising essentially a cabinet (20) that defines a storage room (50) provided with a door (21), inside this storage room there being rotatably provided a vertical-axis drum (25) on which there are mounted a plurality of horizontal shelves (26) containing the products, said drum (25) being provided with a central hollow column (27) through which a flow of air cooled by refrigeration means (35-38) contained in the cabinet is circulated, **characterized in that** means (60-63) for adjusting the flow of cooling air are mounted on said central hollow column (27) and are capable of creating homogeneous, but differentiated temperatures in a plurality of zones arranged above each other in the storage room (50).
2. Automatic vending apparatus according to claim 1, **characterized in that** said means for adjusting the flow of cooling air comprise a plurality of sleeves (60) provided with apertures (61), corresponding to apertures (62) provided in the wall of said central hollow column (27), in correspondence of each shelf (26), actuation means (63) being provided to displace said sleeves so as to throttle the passage of the cooling air through said apertures (61, 62).
3. Automatic vending apparatus according to claim 2, **characterized in that** said means provided to actuate each such sleeve (60) are constituted by a lever (63) pivotally hinged on to said central hollow column (27) and connected by pin-and-slot coupling means to the respective sleeve.
4. Automatic vending apparatus according to claim 2 or 3, **characterized in that** said sleeves (60) are associated to indicator means (64) provided to indicate the extent of throttling of the passage apertures of the flow of cooling air, said means being constituted by an index attached to the central hollow column and cooperating with a series of reference marks or nicks provided on the edge of the corresponding sleeve.

5. Automatic vending apparatus according to any of the preceding claims 1 to 4, **characterized in that** there are further provided partitioning means (42), whose position is adjustable along the central hollow column (27), to define at least two zones inside the storage room (50), each one of them comprising at least one of said shelves (26). 5
6. Automatic vending apparatus according to claim 5, **characterized in that** said partitioning means (42) 10 are constituted by at least a horizontal diaphragm including a first portion attached to the central hollow column (27), and a second portion attached to the inner wall of the storage room (50). 15
7. Automatic vending apparatus according to claim 5 or 6, **characterized in that** the upper zone of the storage room (50), which is held at a higher temperature than the zone therebelow, is connected to the refrigeration means (35-38), which is installed in the base (51) of the cabinet (20), through at least a channel (43) provided in the wall of the storage room (50). 20
8. Automatic vending apparatus according to any of the preceding claims 5 to 7, **characterized in that** inside the central hollow column (27) there are provided at least two delivery channels (44, 45) to separately feed the zones at different temperature of the storage room, said channels being controlled by means of respective throttle valves (46, 47). 25 30

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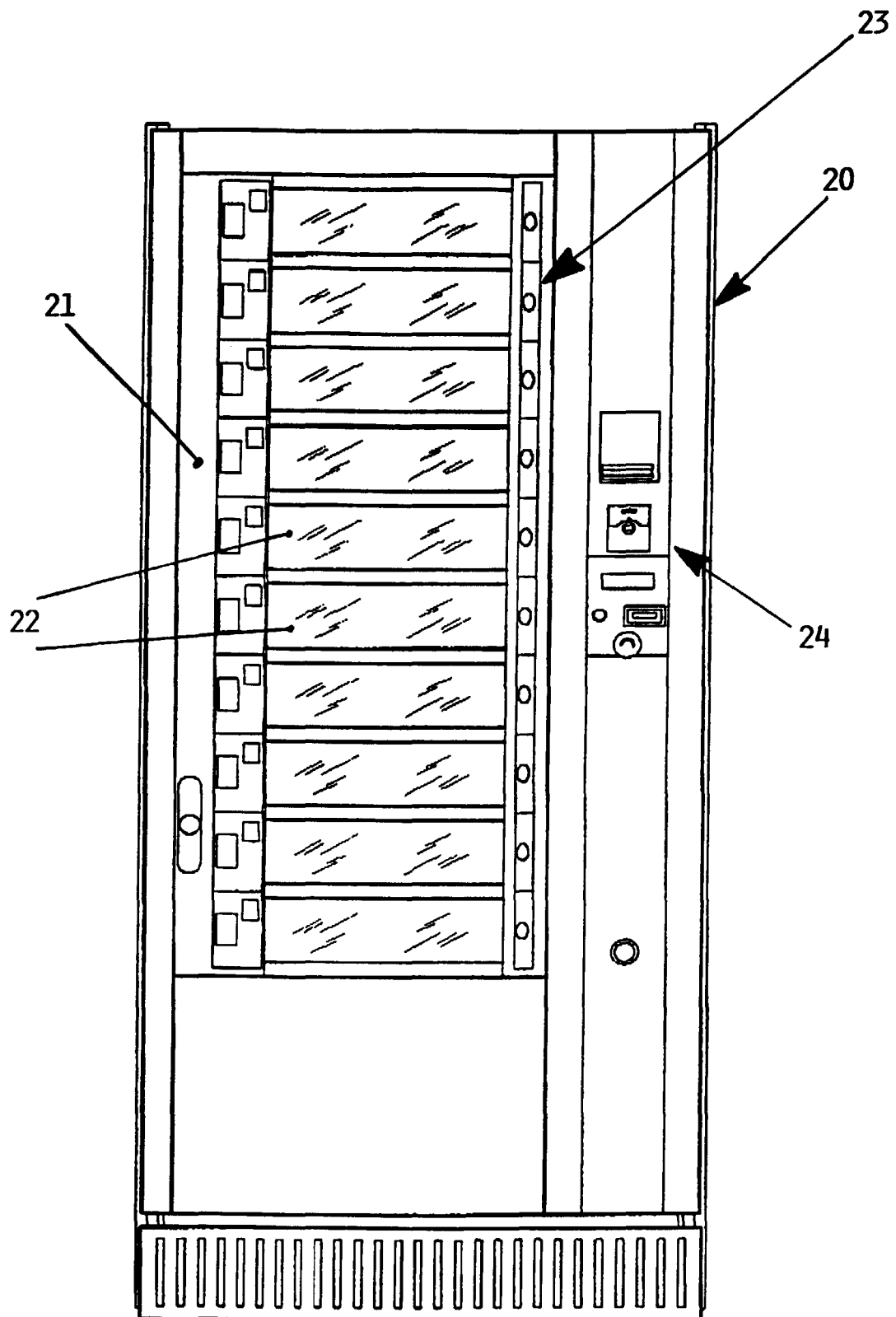


FIG. 1

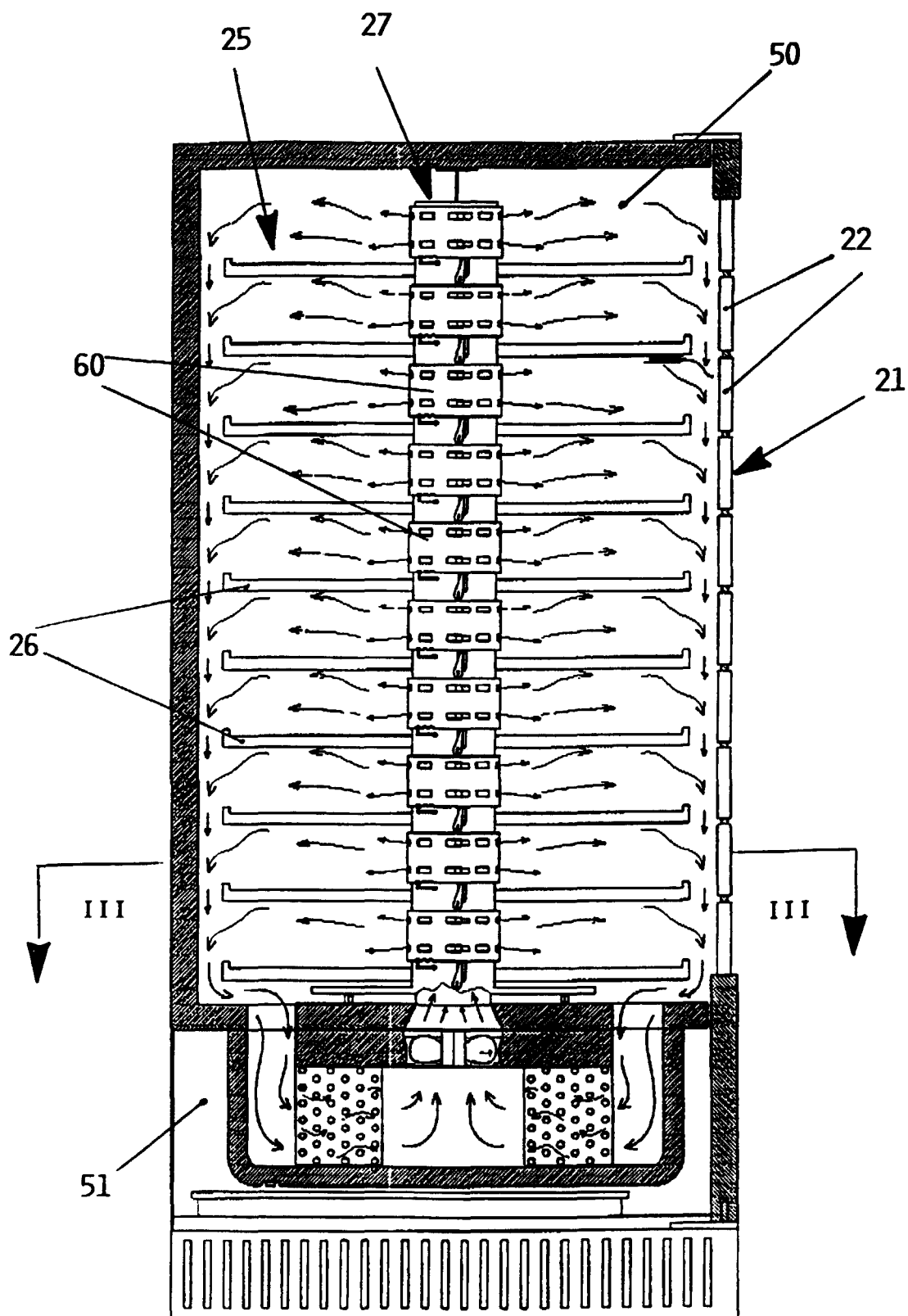


FIG. 2

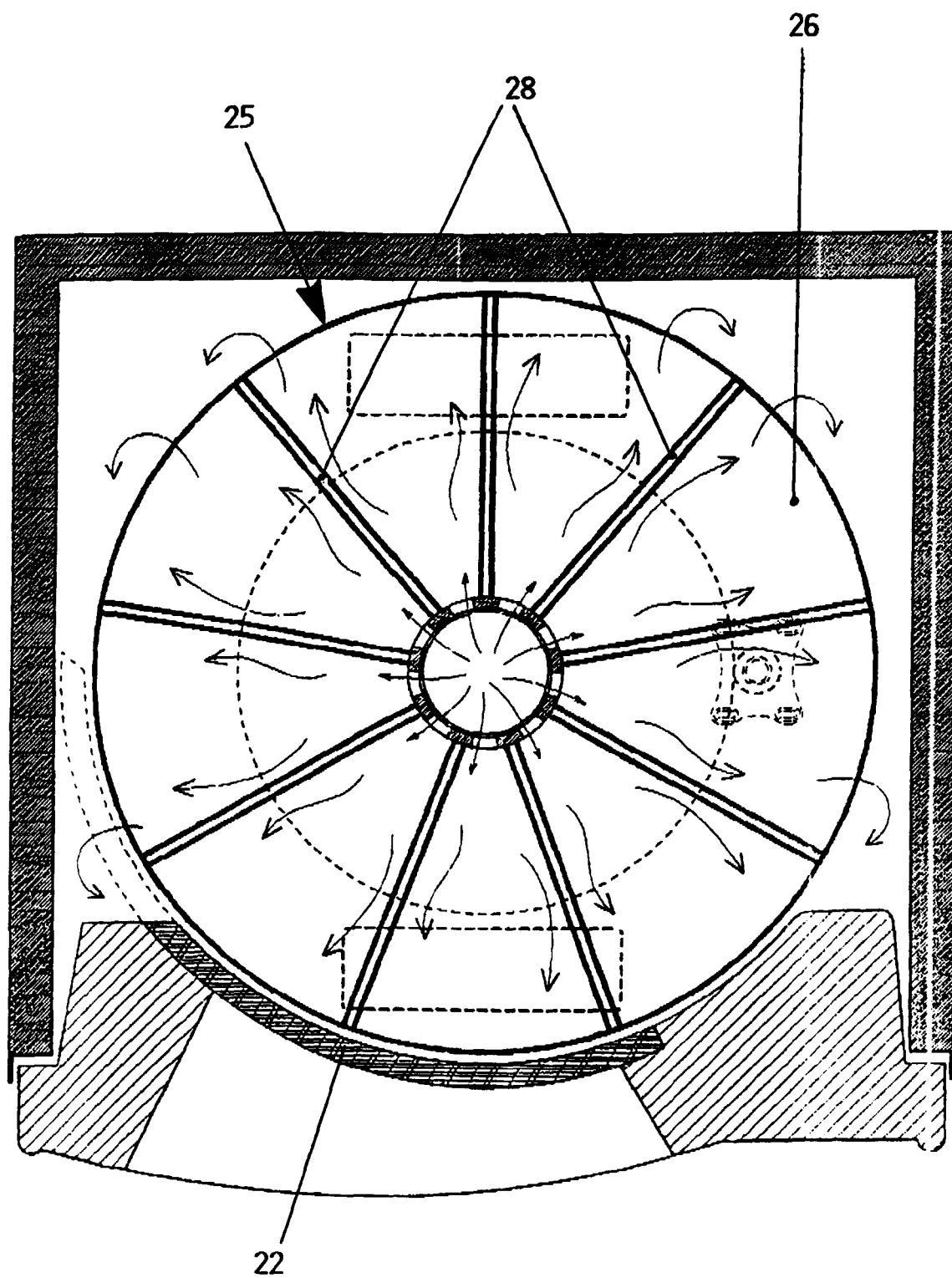


FIG. 3

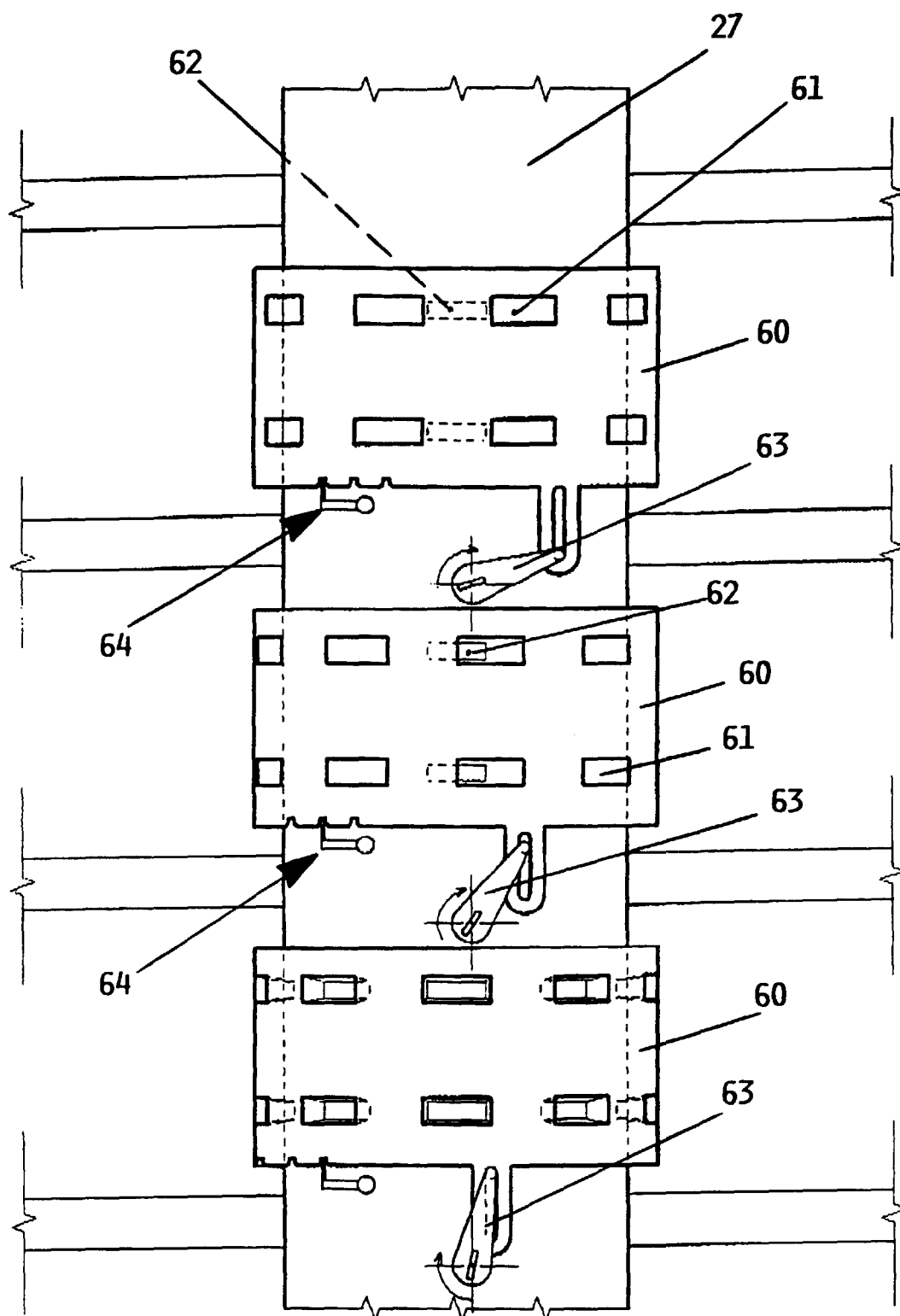


FIG. 4

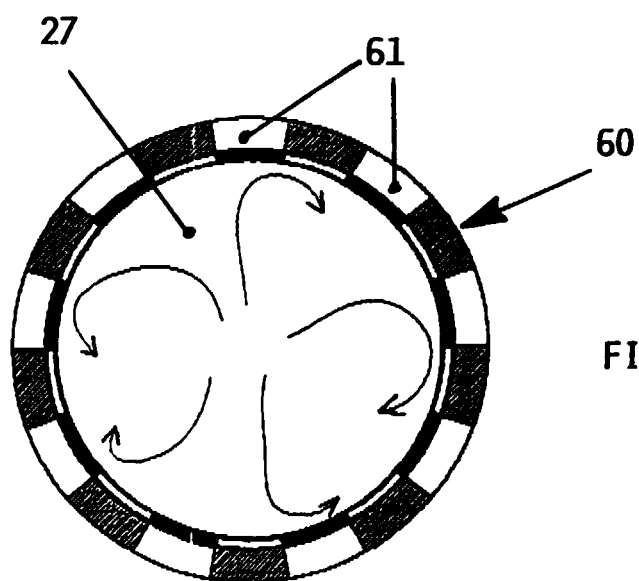


FIG. 5A

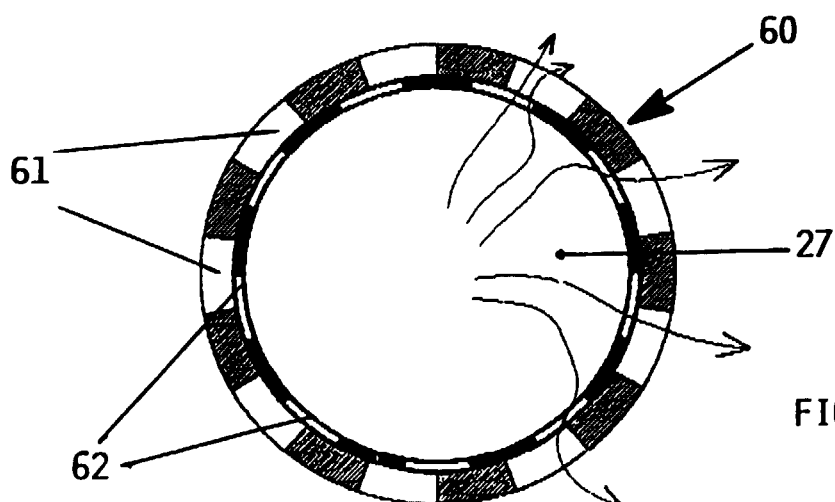


FIG. 5B

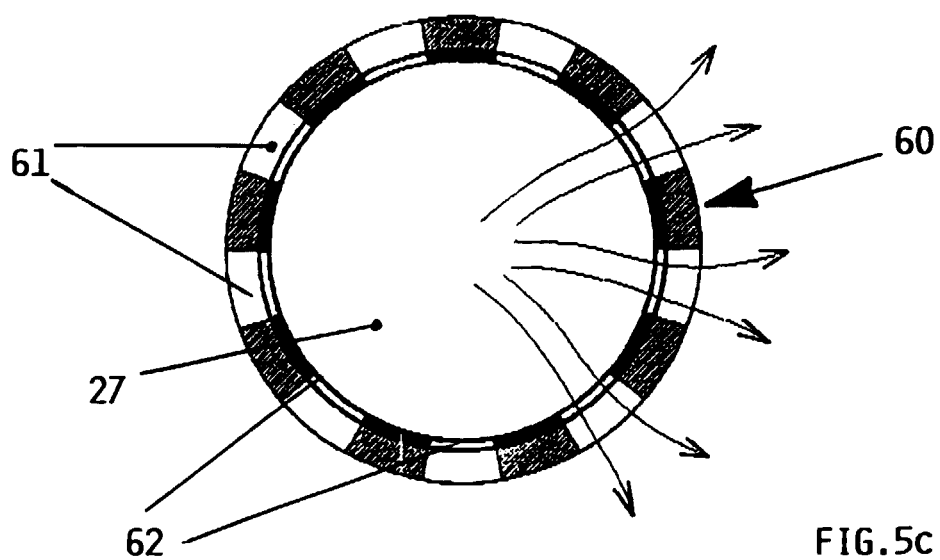


FIG. 5c

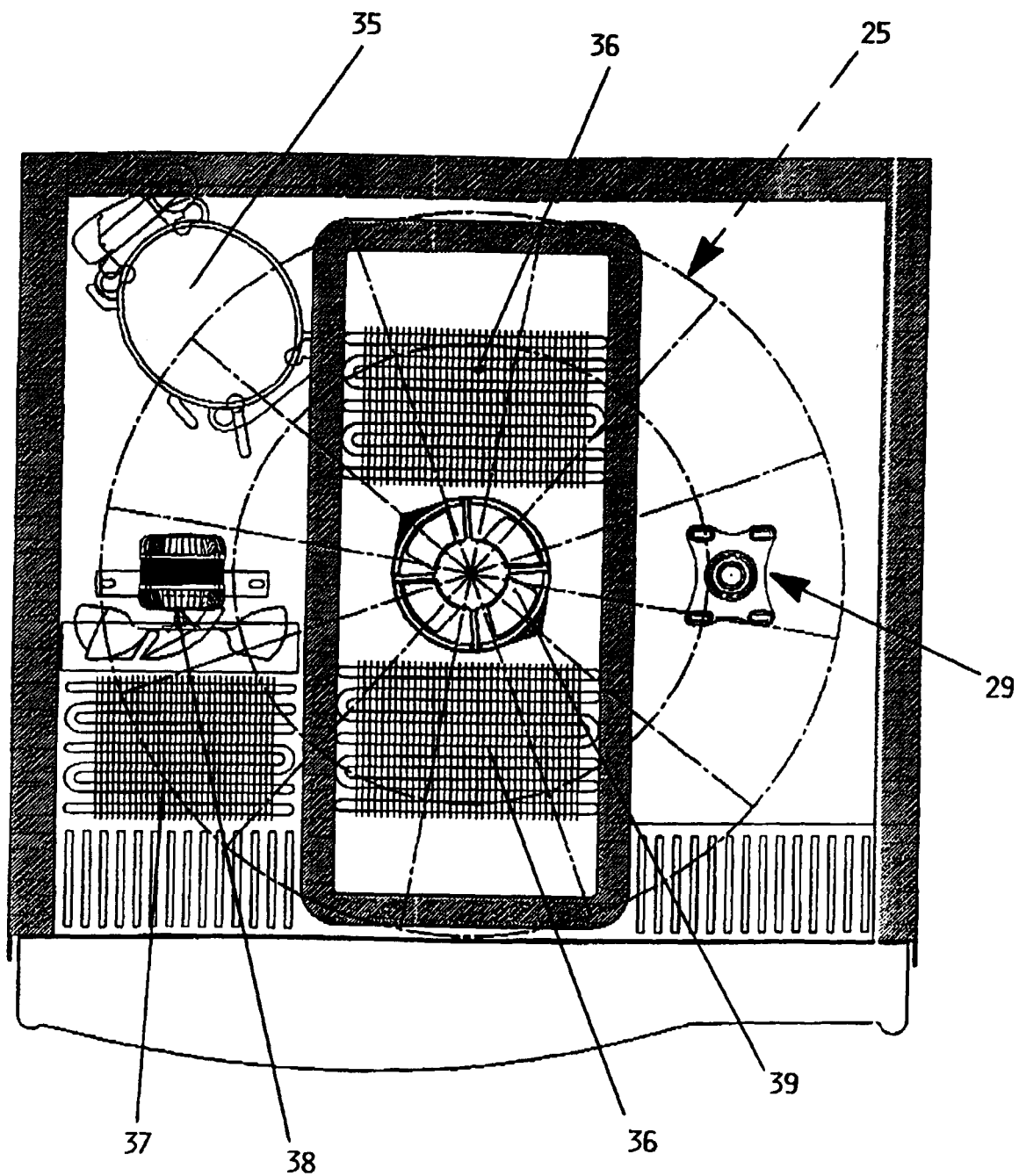


FIG. 6

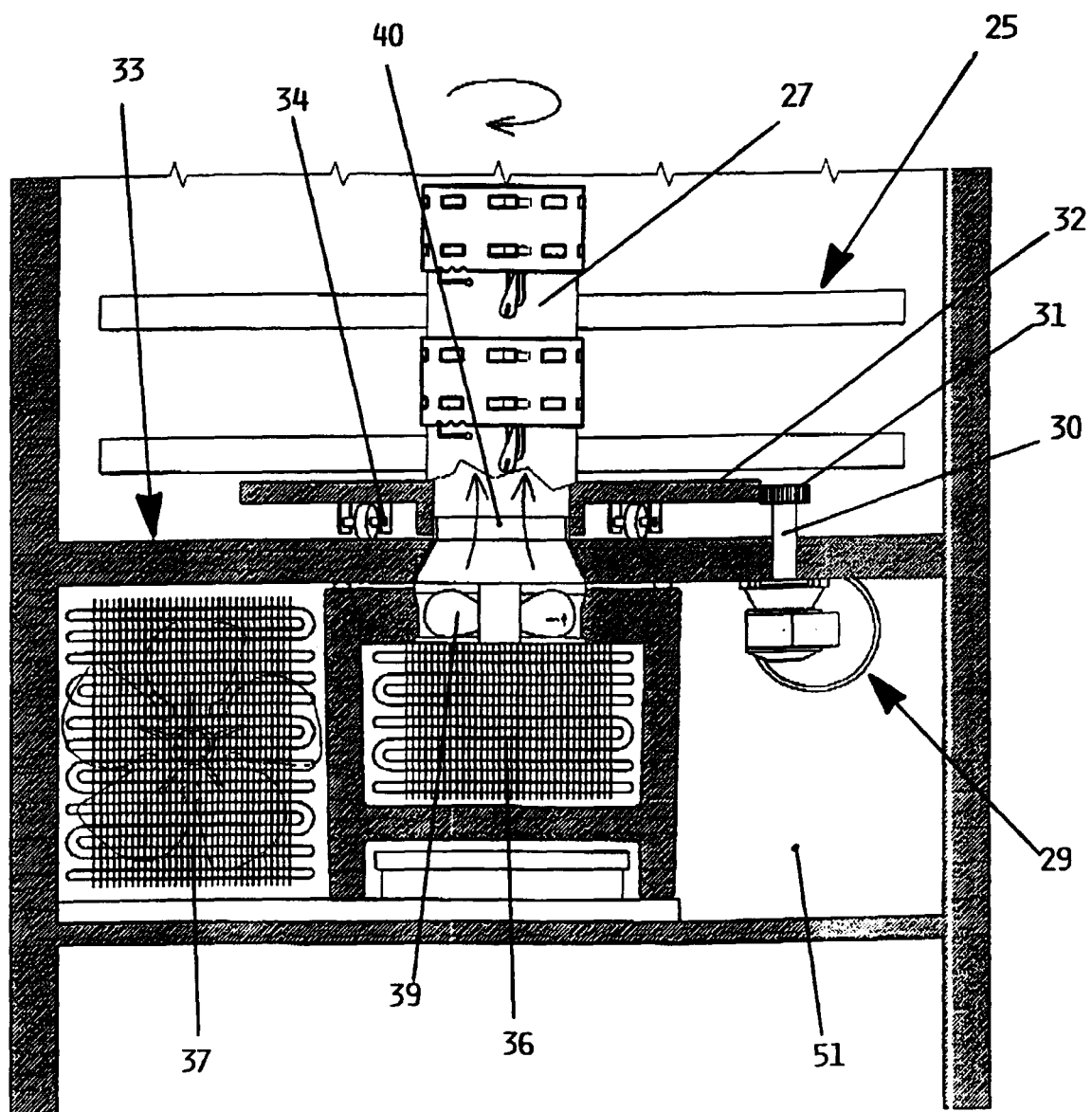


FIG. 7

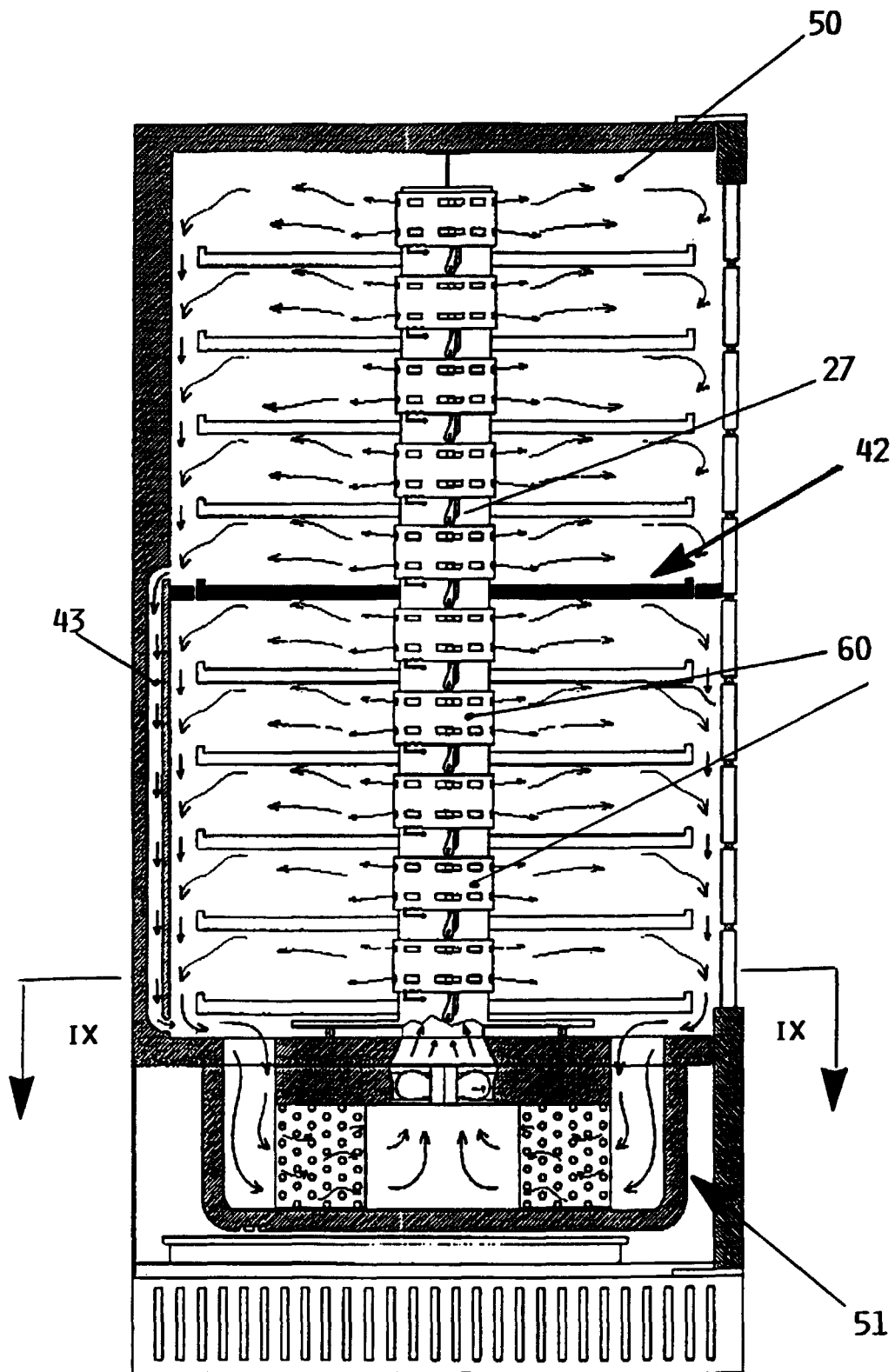


FIG. 8

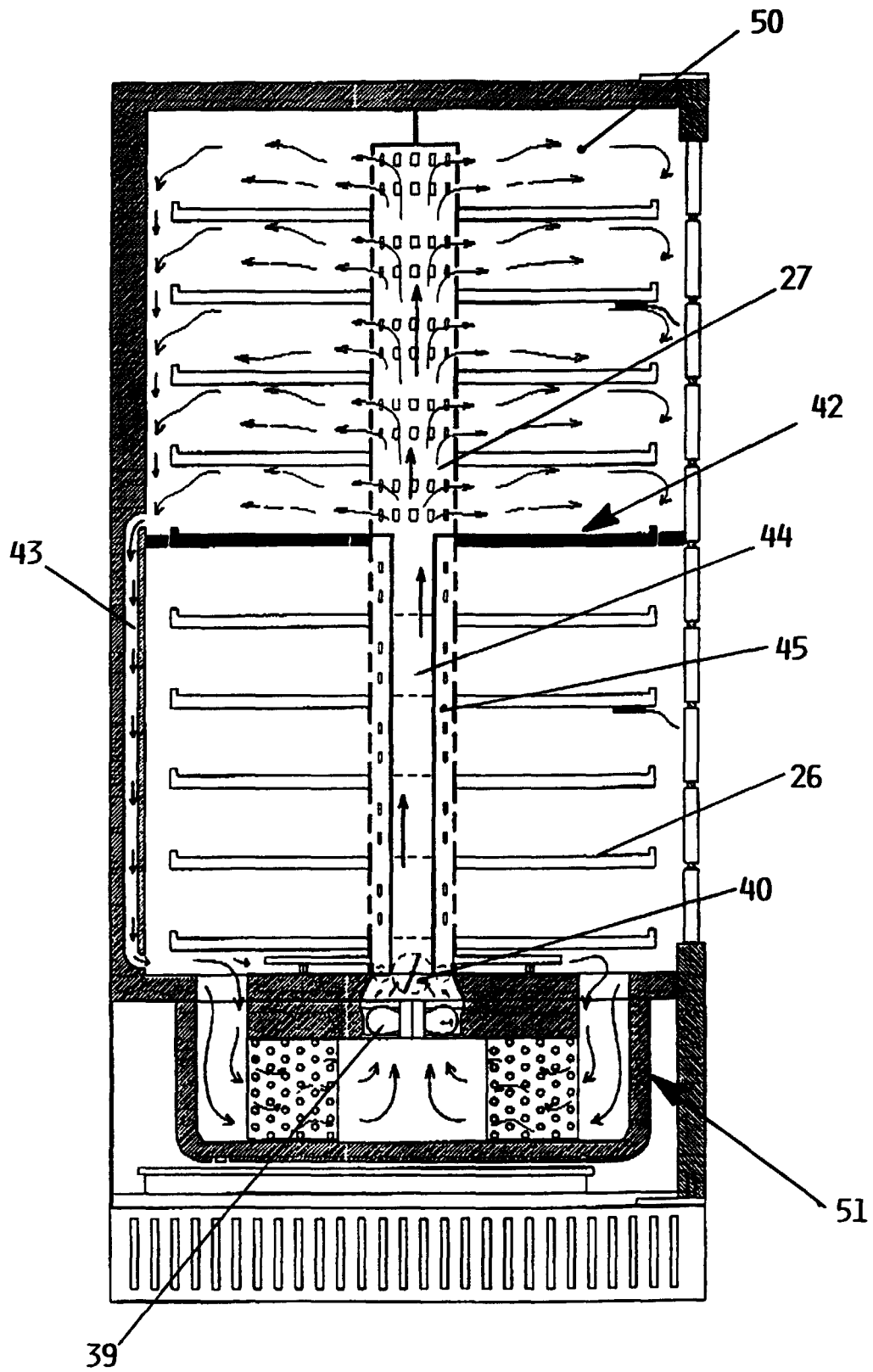


FIG. 9

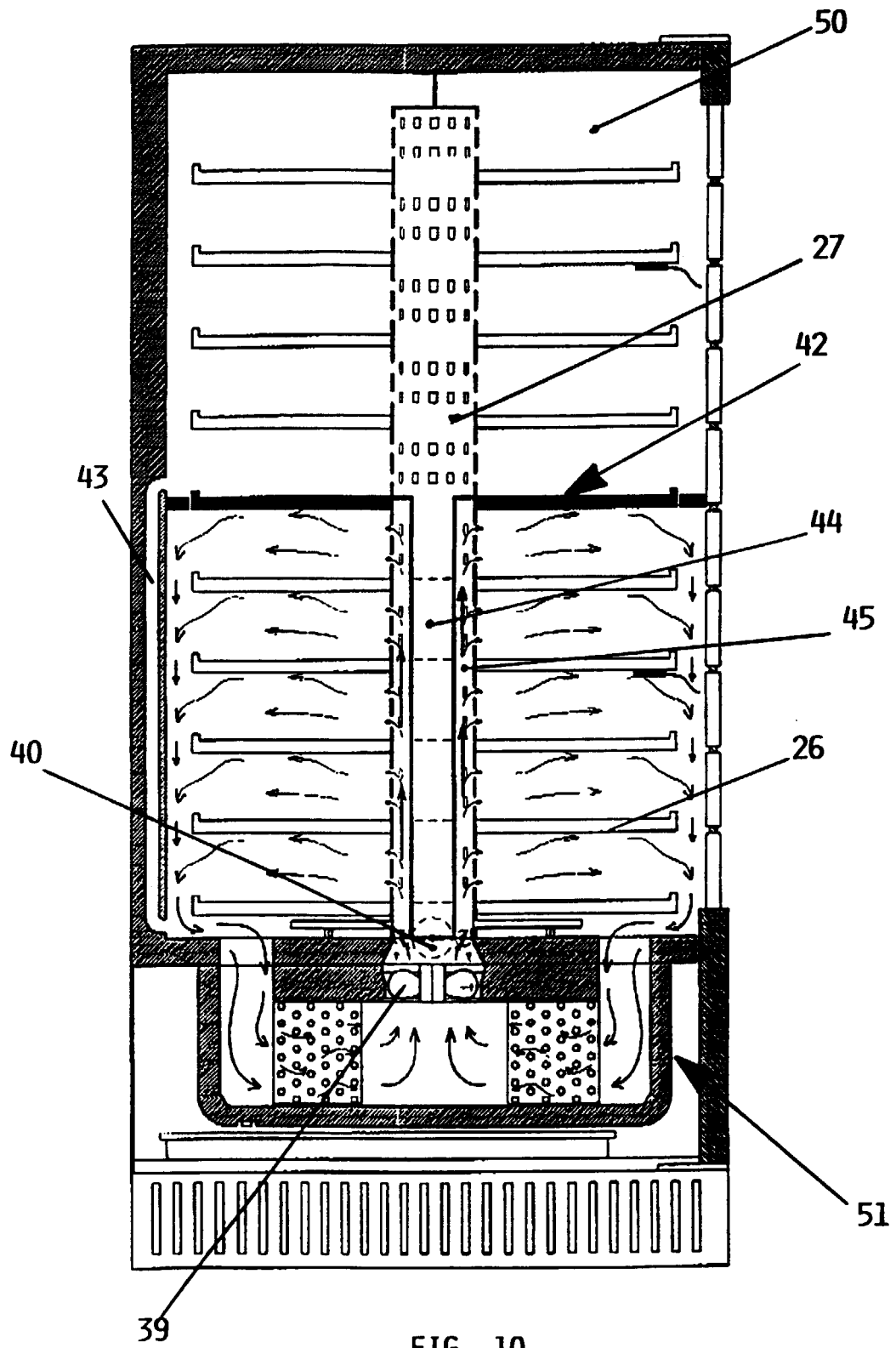


FIG. 10

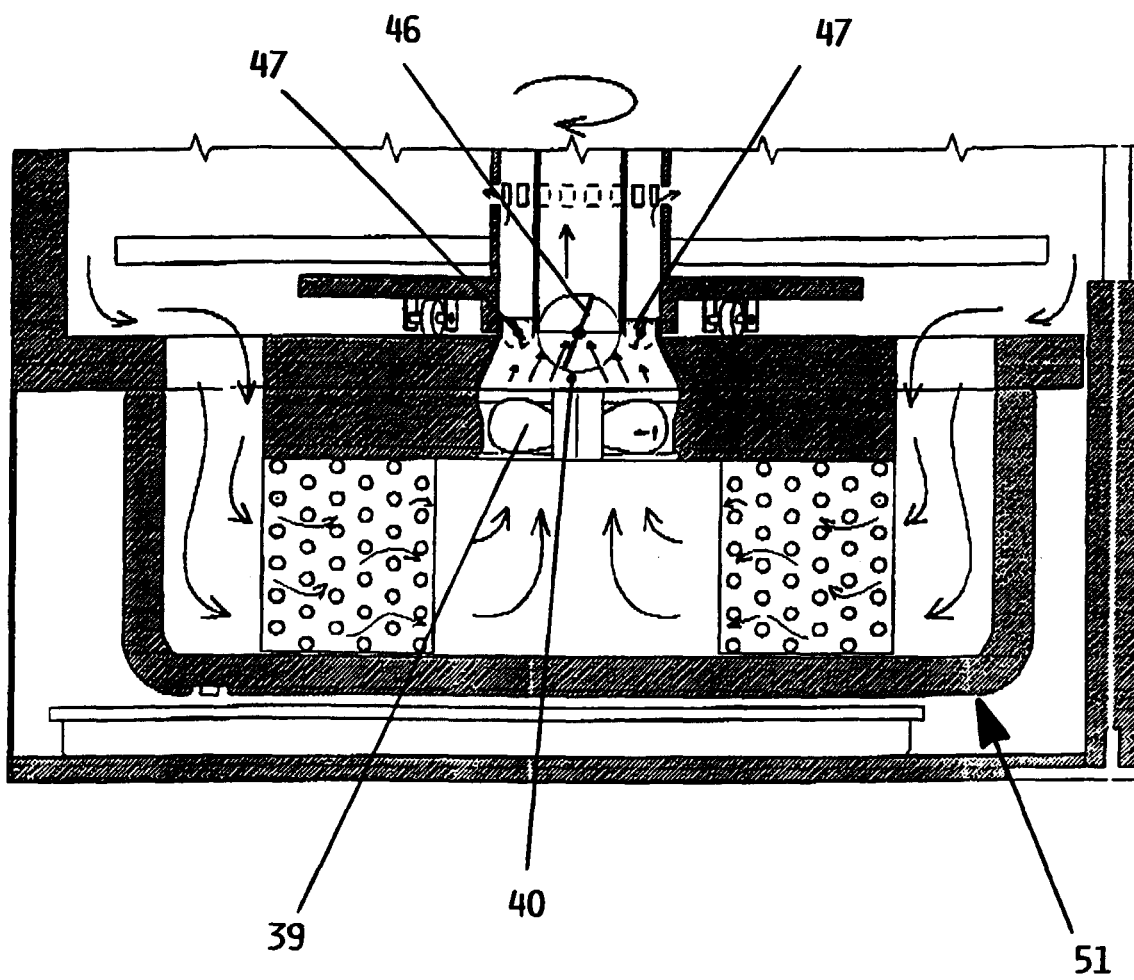


FIG. 11