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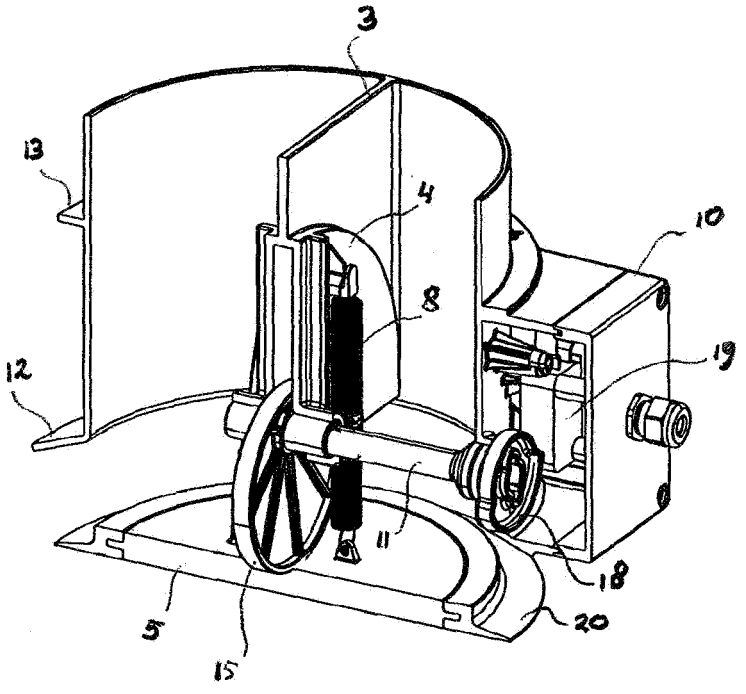
(54) Device and method for controlling airflow in an exhaust channel

(57) The invention relates to a device for controlling airflow through an exhaust channel, comprising an opening for passing through of air and an exhaust valve for shutting off the opening, said valve having a cross-section that is larger than a cross-section of said opening. The device further comprises driving means for moving said exhaust valve in a substantially rectilinear way from a closed state to an open state and back. By using a valve that has a larger cross section than that of the opening, the valve shuts off the opening completely when being in the closed state. There will be no, or hardly any, leakage of air.

FIG. 3



EP 2 383 526 A2

Description

[0001] The invention relates to a device and method for controlling airflow in an exhaust channel, such as a ventilation channel.

[0002] Electrical valves for application in cooker hoods for domestic purposes (kitchens) are known for years. More and more, in houses and apartment buildings, cooker hoods are mounted to a so-called Central Mechanical Ventilation system (CMV). The main function of the electric valve is to shut off this ventilation channel, so the ventilation system does not continuously extract warm air from the kitchen so as to save energy.

[0003] In the market, valves already exist in cooker hoods, which are either manually or electrically operated. Mostly these valves rotate and can not be closed completely. Due to the air pressure, the valves will deform and/or open a little, thereby creating a small slot. Air flowing through the small slot will cause an undesired high pitch whistling noise.

[0004] It is an object of the present invention to provide a device for controlling airflow through an exhaust channel that reduces the problem of the state of the art.

[0005] The object is achieved by a device for controlling airflow through an exhaust channel, comprising:

- an opening for passing through of air;
- an exhaust valve for shutting off the opening, said valve having a cross-section that is larger than a cross-section of said opening;
- driving means for moving said exhaust valve in a substantially rectilinear way from a closed state to an open state and back.

[0006] By using a valve that has a larger cross section than that of the opening, the valve shuts off the opening completely when being in the closed state. There will be no, or hardly any, leakage of air.

[0007] According to an embodiment, the driving means comprise:

- a rotatable driving axis;
- a pushing member mounted onto said driving axis, for pushing said exhaust valve into a first direction;
- a motor for rotating said driving axis and the pushing member, so as to force the pushing member against the exhaust valve, so as to move the exhaust valve.

[0008] The pushing member may comprise a cam mounted onto the driving axis, wherein an outer edge of said cam contacts the exhaust valve. In this way, the cam is used to transfer a rotational movement to a rectilinear. In this configuration a durable electric motor can be used, instead of a non-durable (translating) thermo-actuator used in the state of the art.

[0009] The cam may have an oval cross section and be fixed onto the driving axis in a centred way. Alternatively, it may have a circular shape and be fixed onto the driving axis in an off-centred way. In the latter case, the cam may as well be oval. The advantage of an excenter cam is that both the force on the exhaust valve, as well as the opening speed of the exhaust valve, can be defined precisely. The excenter cam will create a force on the exhaust valve which is the strongest when the valve is closed and the highest force is needed, to overcome 'sticking' of the exhaust valve, due to pollution with grease.

[0010] According to yet another embodiment, the pushing member comprises a push rod pivotably coupled to a driving shaft.

[0011] According to an embodiment, the device comprises a housing comprising a side wall, or a plurality of side walls, defining said opening. The advantage of the presence of the housing is that the device can be built-in easily in existing cooker hoods and other appliances.

[0012] In an embodiment, the device comprises a collar surrounding the opening. The collar may have a substantially conical shape. The exhaust valve may comprise an outer edge having a substantially conical shape for making contact with at least part of the collar.

[0013] The driving means may comprise at least one spring member arranged to force the exhaust valve in a second direction reverse to said first direction. The use of a spring results in a very simple and relatively cheap device, wherein the valve is pushed back by the spring. A spring is durable and easy to assemble.

[0014] In an embodiment, the device comprises a switch for switching off the motor, wherein the switch is activated by the motor via a flange, mounted around a rotatable axis.

[0015] The invention also relates to a method of controlling airflow through an exhaust channel, the method comprising:

- providing an opening in the exhaust channel for passing through of air;
- providing an exhaust valve for shutting off the opening, the valve having a cross-section that is larger than a cross-section of said opening;
- moving the exhaust valve in a substantially rectilinear way from a closed state to an open state and back.

[0016] Further details and advantages of the present invention will become clear to the reader after reading the description of the embodiments described below with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of a device for controlling airflow through an exhaust channel according to an embodiment of the invention;
Figure 2 shows a cut out view of the embodiment of figure 1 in which the valve is in its closed state;
Figure 3 shows a cut out view of the embodiment of figure 1 in which the valve is in its opened state;
Figure 4 shows a cross section of the device accord-

ing to another embodiment;
Figure 5 shows a top view of the device according to the embodiment of Figure 1;
Figure 6 is a perspective view of the embodiment of figure 4 and 5;
Figure 7 shows a perspective view of a switch and a flange and part of the rotatable driving axis according an embodiment;
Figure 8 depicts a scheme of an electrical circuit which may be used to operate the device according to an embodiment;
Figure 9 schematically shows a cooker hood with the device according to an embodiment installed in an exhaust channel;
Figure 10 shows a schematic cross section of a ventilation channel in which a device according to a further embodiment is installed.

[0017] Figure 1 shows a perspective view of a device 1 for controlling airflow through an exhaust channel according to an embodiment of the invention. The device 1 may be installed in existing exhaust channels such as an exhaust channel of a cooker hood, not shown in Figure 1. The device 1 comprises a housing having a cylindrical side wall 2 and a partition wall 3. The partition wall 3 transcends into two semi-disc shaped walls 4, only one of which is visible in Figure 1. The device 1 also comprises an exhaust valve 5 which is arranged to close off an opening in the bottom of the device 1. Attached to the valve 5 are two guiding members 6, only one of which is visible in Figure 1. In this embodiment, the guiding members 6 are angle bars sliding against an outer surface of the semi-disc shaped walls 4 and a rib 7 extending from said walls 4. Two spring members 8 are arranged between the exhaust valve 5 and extensions 9 attached to each of the semi-disc shaped walls 4.

[0018] Figure 1 further shows a second housing 10 for housing a motor, not shown in figure 1, which motor drives a rotatable axis 11. At the bottom of the device, a ring collar 12 is fixed to the cylindrical shaped wall 2. Near the top of the device 1 a second collar 13 is arranged for mounting the device 1 into an exhaust channel.

[0019] Figure 2 shows a cut out view of the embodiment of Figure 1. As can be seen from Figure 2, a cam 15 is mounted onto the driving axis 11. In this embodiment the cam 15 is a circular wheel that is mounted near an outer end of the driving axis 11 in an off centred way. At the other outer end of the driving axis 11, a flange 18 is arranged that makes contact with a switch 19 arranged in the second housing 10. In Figure 2, the motor is not shown for reasons of clarity. Figure 2 shows the device 1 in its closed state, wherein the valve 4 is pushed against the ring collar 12 of the housing of the device 1 by means of the spring members 8. When the driving axis 11 is rotated by 180°, the cam 15 is rotated in a state shown in Figure 3. By rotating the off centred cam 15, the valve 5 is pushed downward into an open state. Now, exhaust air can flow through the device 1.

[0020] In a preferred embodiment, the valve 5 comprises a rubber seal 20 to improve the closing of the opening in the device 1. It should be noted that the invention is not limited to the use of a seal made of rubber or any other flexible material. The use of such a seal is preferable, since it will better close off the opening.

[0021] Figure 4 shows a cross section of the device according to a slightly different embodiment, in which the bottom of the valve 40 is flat and a sealing ring 41 is arranged at the peripheral of the valve 40 as shown in figure 4. In figure 4, the conical shape of the outer edge of the valve 40 can be seen as well as the corresponding conical shape of the ring collar 12. Using a conical shape improves the sealing, and avoids the whistling noise from the exhaust air when the valve is in its almost closed state,

[0022] Figure 4 also shows a motor 44 which may be an electric motor for driving the rotatable axis 11. The motor 44 may be a grill motor and comprises a pin 45 that sticks into a channel of the driving axis 11. The driving axis 11 comprises a connection rod 70 that is stuck into a socket 42 coupled to the cam 15. By activating the motor 44, the driving axis 11 is rotated so as to rotate the cam 15. On its turn, the cam 15 then pushes the valve 40 open. If the cam 15 is rotated further, the valve 40 will be closed again due to the pulling force of the spring 8. As will be clear to the skilled person, the valve 40 will also be closed again if the cam 15 is rotated back to its original position shown in figure 4.

[0023] In the embodiment of figure 4, the second housing 10 has a lid 10' that can be detached from the second housing 10 so as to give access to the motor 44.

[0024] Figure 5 shows a top view of the device 1 according to an embodiment. As can be seen from figure 5, the device 1 comprises two springs 8, and two guiding members 6. The guiding members 6 make contact with the semi disc shaped walls 4 and the ribs 7. In this embodiment, the device 1 comprises four ribs 7, only two of which are in fact used. The reason for having four ribs 7 is that it makes the main part of the device more symmetric, which makes it easier to manufacture by means of a mould. In figure 5, a connecting socket 50 is shown for connecting a power cord for connecting the motor 44 to mains or other power source.

[0025] Figure 6 is a perspective view of the embodiment of figure 4 and 5, in which the housing of the device is removed except for the lid 10'. The motor 44 comprises two electrical connections 60, 61. The switch 19 comprises three electrical connections 62, 63, 64. In figure 7, only the switch 19, the flange 18 and part of the rotatable driving axis 11 are shown. At an outer end of the driving axis 11 the connection rod 70 is arranged which can be inserted into the socket 42 fixed to the cam 15, see also figure 4. When the motor 44 is activated, the flange 18 is rotated and will push a button 72 of the switch 19. In Figure 8 an electrical circuit is shown which may be used to operate the device 1. The circuit comprises a switch 80 which can be manually switched by means of a button. The switch 80 comprises three connection point

referred to as point 81, 82 and 83. In the situation of Figure 8, the motor is activated. Now when the button 72 of switch 19 is pushed by the co-rotating flange 18, the switch 44 is switched to its other state. Starting from the situation of Figure 8, the connection point 62 will be disconnected from connection point 64 and connection point 63 will connected to connection point 64. In this way the motor 44 is deactivated, as will be clear to the skilled person. Now the valve 5 will be in its open state or in its closed state. Once the user switches the switch 80, the motor 44 will be activated again, and will rotate the cam another 180, moving the valve into its other state (i.e. closed or open). Using the circuit of Figure 8 is advantageous because, a user only needs to push the switch 80 once, and the valve will open or close. This results in a very user friendly use of the device 1 and creates an energy-saving solution, because the motor is switched off and no power is needed.

[0026] Figure 9 shows very schematically a cooker hood 90 with the device 1 according to an embodiment installed in an exhaust channel 91. In figure 9 arrows indicate the air flow, which may result from a central mechanical ventilation system. However, it should be noted that the invention is neither limited to the combination with central mechanical ventilation systems nor to the use of it in cooker hoods. It should be clear to the skilled person that the device 1 may be used in any kind of ventilation channels. In may even be installed in front of a ventilation opening instead of inside a ventilation channel.

[0027] Figure 10 shows a schematic cross section of a ventilation channel 100 in which a device 102 for controlling airflow is installed according to an embodiment. In this embodiment the device 102 comprises a valve 103 that is movable is a rectilinear way to open and close an opening of a wall 104. The wall 104 is closing off the ventilation channel 100 except for the opening that is closed by the valve 103. The wall 104 may be arranged inside a tubular housing, not shown, that is arranged to be installed in a tubular ventilation channel.

[0028] In the embodiment of figure 10, the device 102 comprises a driving rod 105 that is moved by means of a rotatable gear wheel 106. By activating a motor, not shown, the gear wheel 106 is rotated thereby moving the rod 105 and the valve 103.

[0029] As will be clear to the skilled reader, other embodiments of the invention are conceivable in which the exhaust valve 5; 40 is moved by way of a push rod connected to a rotatable driving shaft driven by a motor. Furthermore, the device 1 of the invention can be configured to fit into non-tubular ventilation channels, such as rectangular shape channels, or any other shape.

[0030] It is emphasized that the present invention can be varied in many ways, of which the alternative embodiments as presented are just a few examples. These different embodiments are hence non-limiting examples. The scope of the present invention, however, is only limited by the subsequently following claims.

Claims

1. Device (1) for controlling airflow through an exhaust channel, comprising:

   - an opening (16) for passing through of air;
   - an exhaust valve (5) for shutting off the opening, said valve having a cross-section that is larger than a cross-section of said opening;
   - driving means for moving said exhaust valve (5) in a substantially rectilinear way from a closed state to an open state and back.

2. Device according to claim 1, wherein said driving means comprise:

   - a rotatable driving axis (11);
   - a pushing member (15) mounted onto said driving axis, for pushing said exhaust valve into a first direction;
   - a motor (44) for rotating said driving axis and said pushing member, so as to force said pushing member against said exhaust valve, so as to move said exhaust valve.

3. Device according to claim 2, wherein said pushing member comprises a cam mounted onto said driving axis, wherein an outer edge of said cam contacts the exhaust valve.

4. Device according to claim 3, wherein said cam is fixed onto said driving axis in an off-centred way.

5. Device according to claim 3, wherein said cam has an oval cross section.

6. Device according to claim 2, wherein said pushing member comprises a push rod pivotably coupled to a driving shaft.

7. Device according to any of the preceding claims, further comprising a housing comprising a side wall, or a plurality of side walls, defining said opening.

8. Device according to any of the preceding claims, further comprising a collar (12) surrounding said opening.

9. Device according to claim 8, wherein said collar has a substantially conical shape and said exhaust valve comprises an outer edge having a substantially conical shape for making contact with at least part of said collar.

10. Device according to any of the claims 2-9, wherein said driving means comprise at least one spring member (8) arranged to force the exhaust valve in a second direction reverse to said first direction.

11. Device according to any of the claims 2-9, further comprising a switch for switching off said motor, said switch being activated by said motor via a flange mounted around said rotatable driving axis.

12. Method of controlling airflow through an exhaust channel, said method comprising:

- providing an opening in said exhaust channel for passing through of air;
- providing an exhaust valve for shutting off the opening, said valve having a cross-section that is larger than a cross-section of said opening;
- moving said exhaust valve in a substantially rectilinear way from a closed state to an open state and back.

FIG. 1

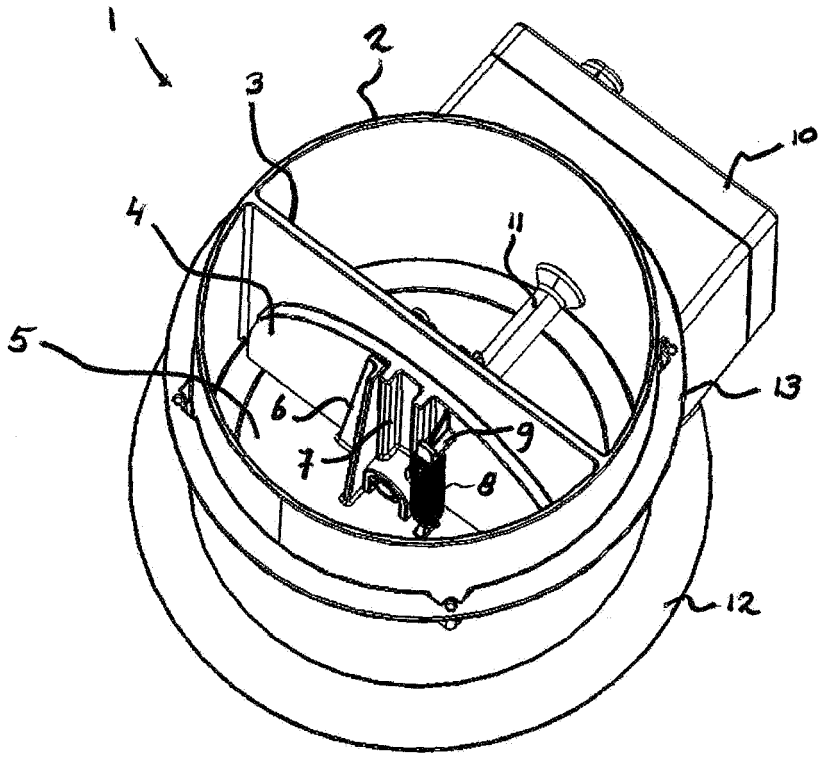


FIG. 2

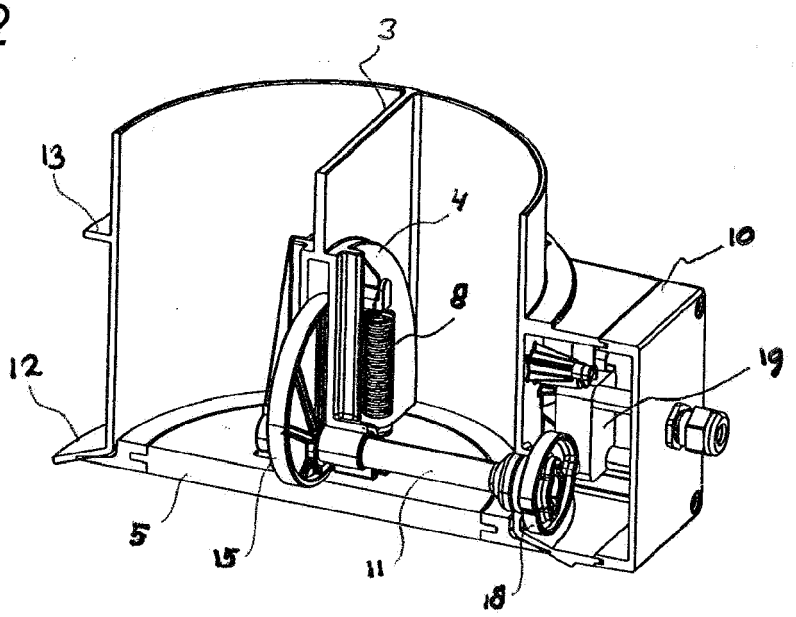


FIG. 3

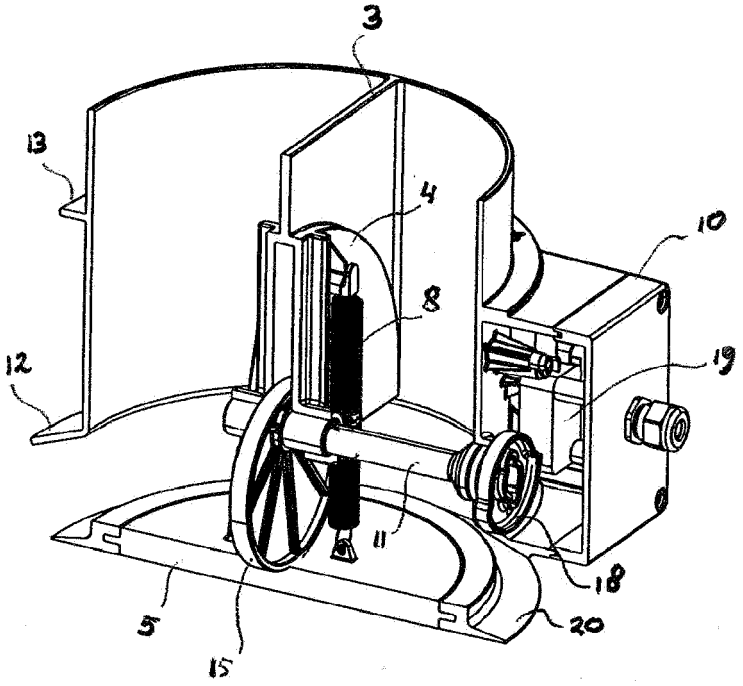


FIG. 4

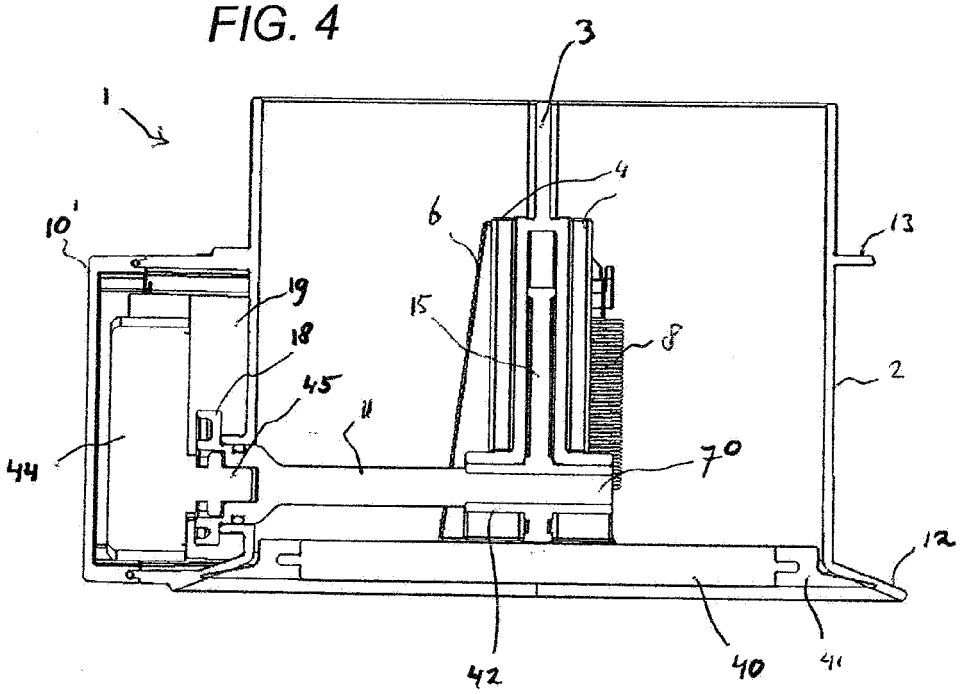

1
3
4
6
10'
13
19
15
18
8
45
2
11
44
70
12
42
40
41

FIG. 5

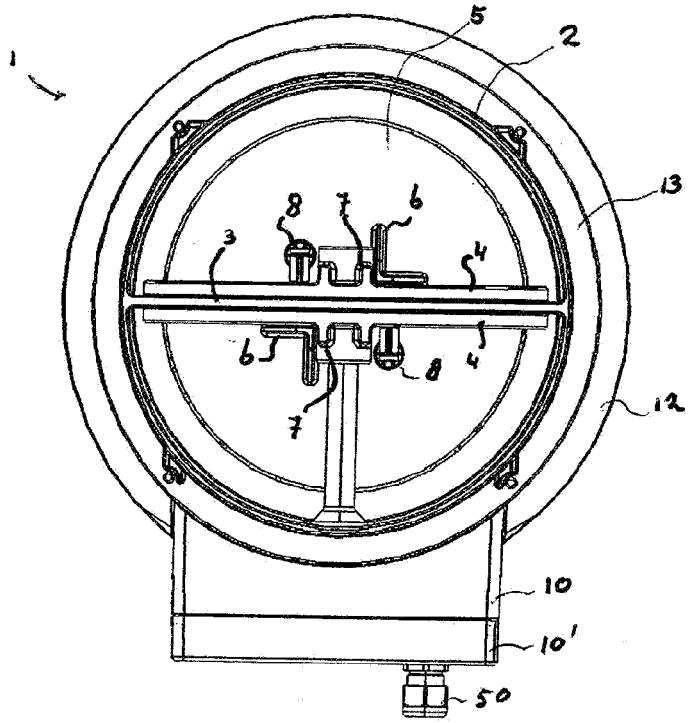
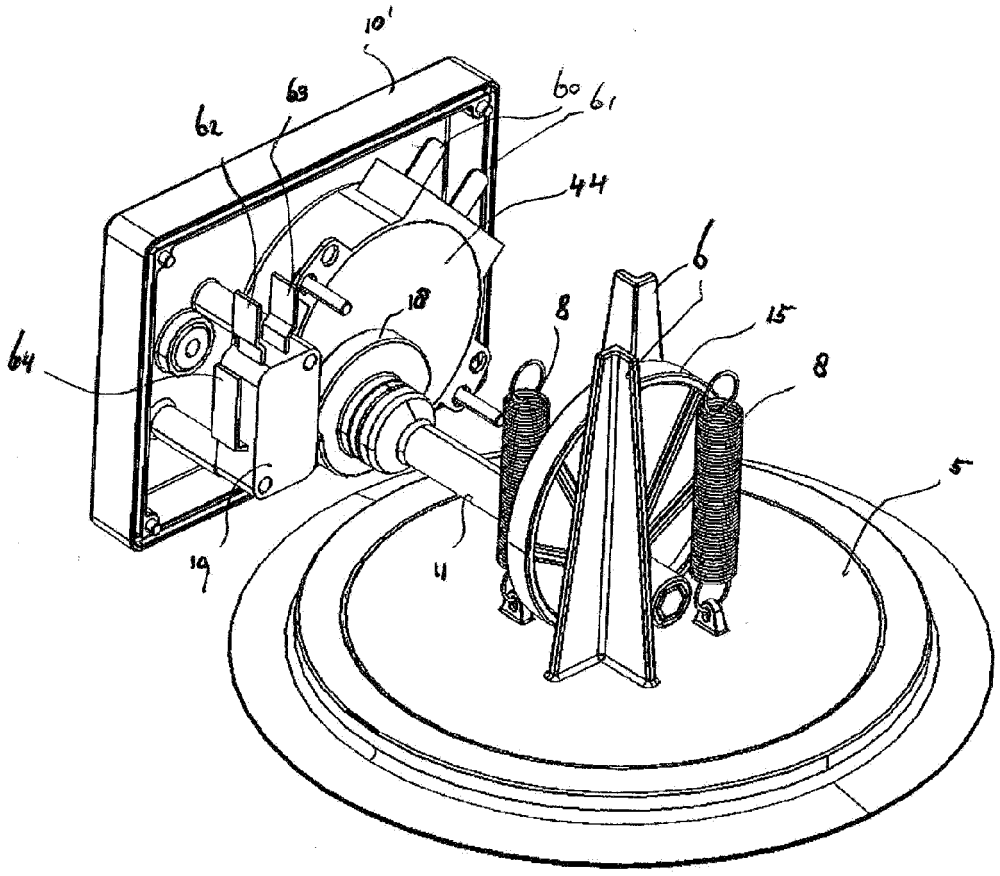

1
5
2
13
8
7
6
3
4
6
4
8
7
12
10
10'
50

FIG. 6



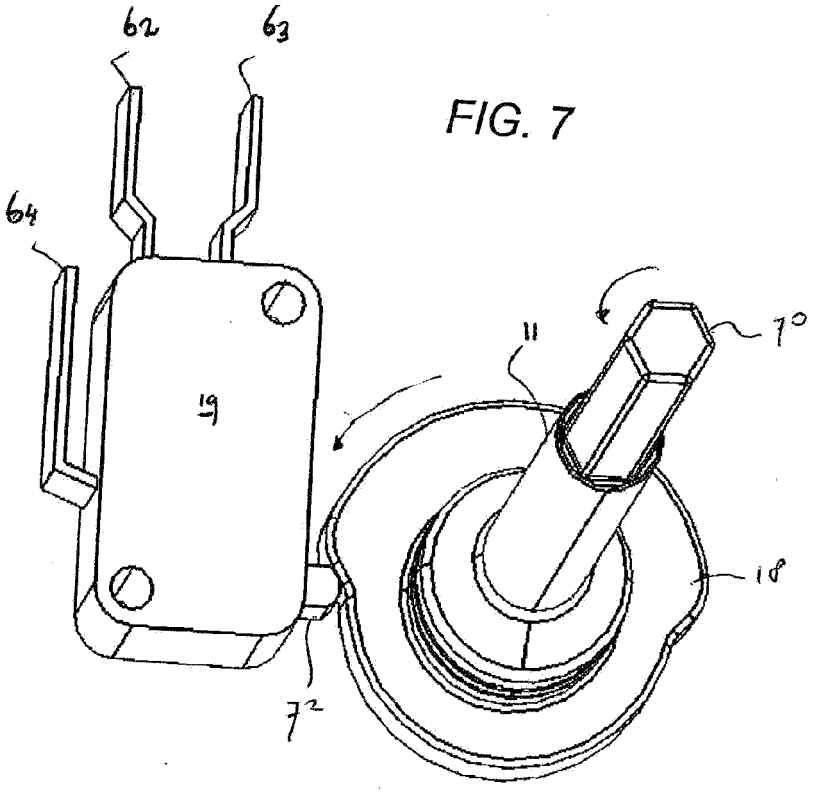
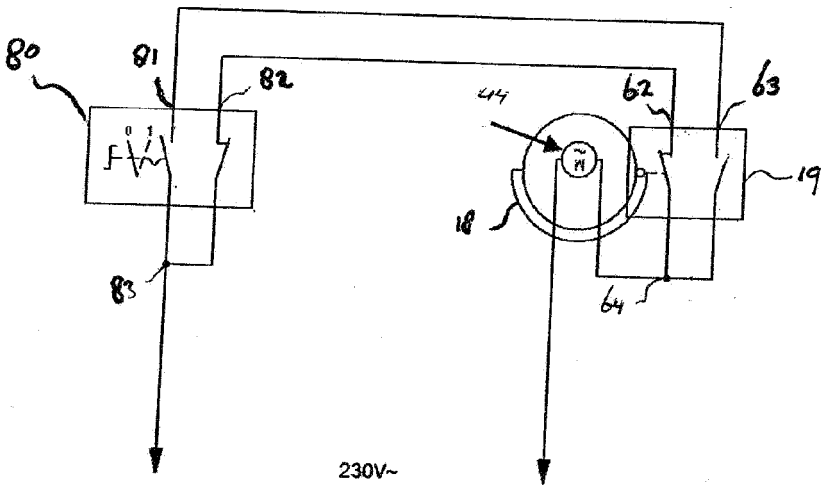


FIG. 7

FIG. 8



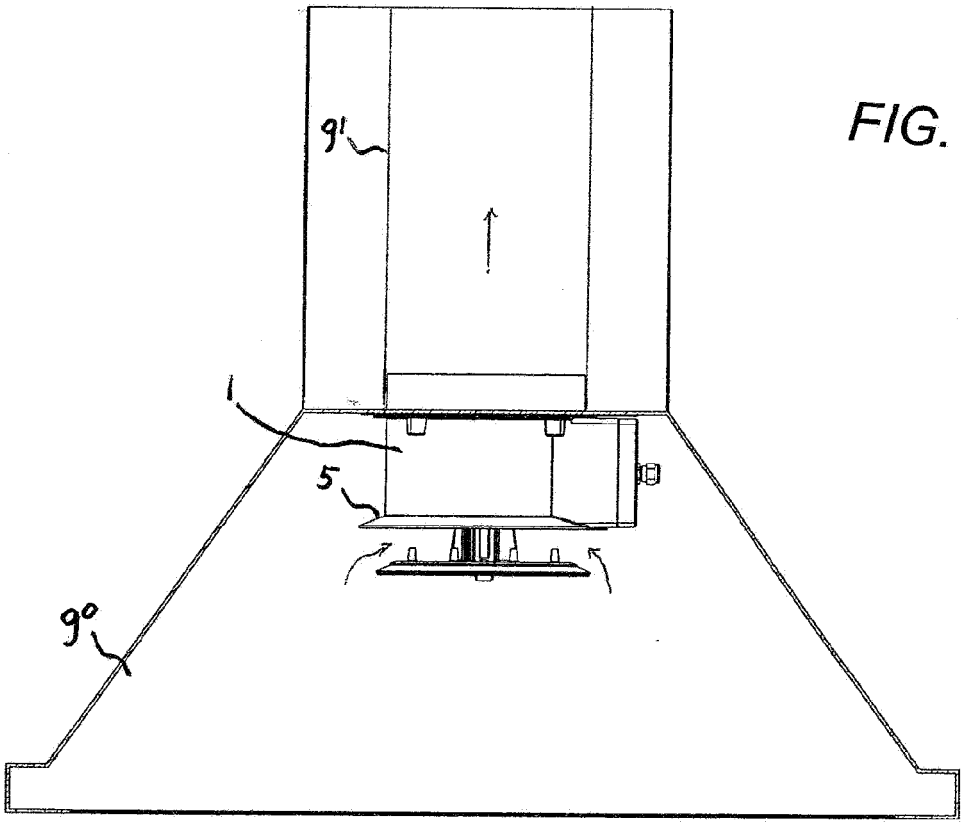


FIG. 9

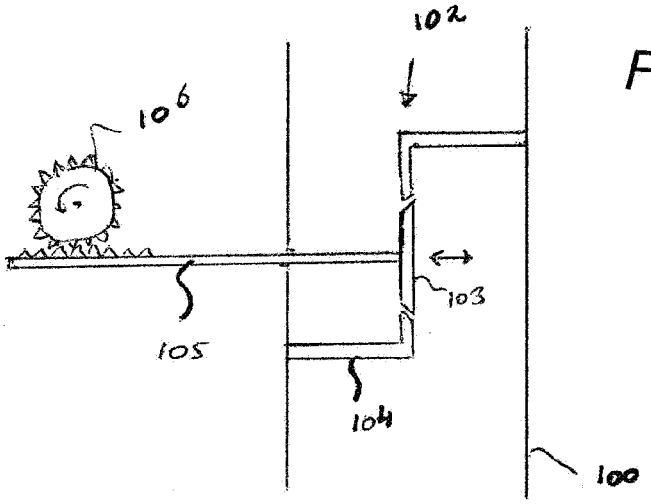


FIG. 10