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(54) AIR DISTRIBUTING APPARATUS FOR REDUCING ENERGY CONSUMPTION

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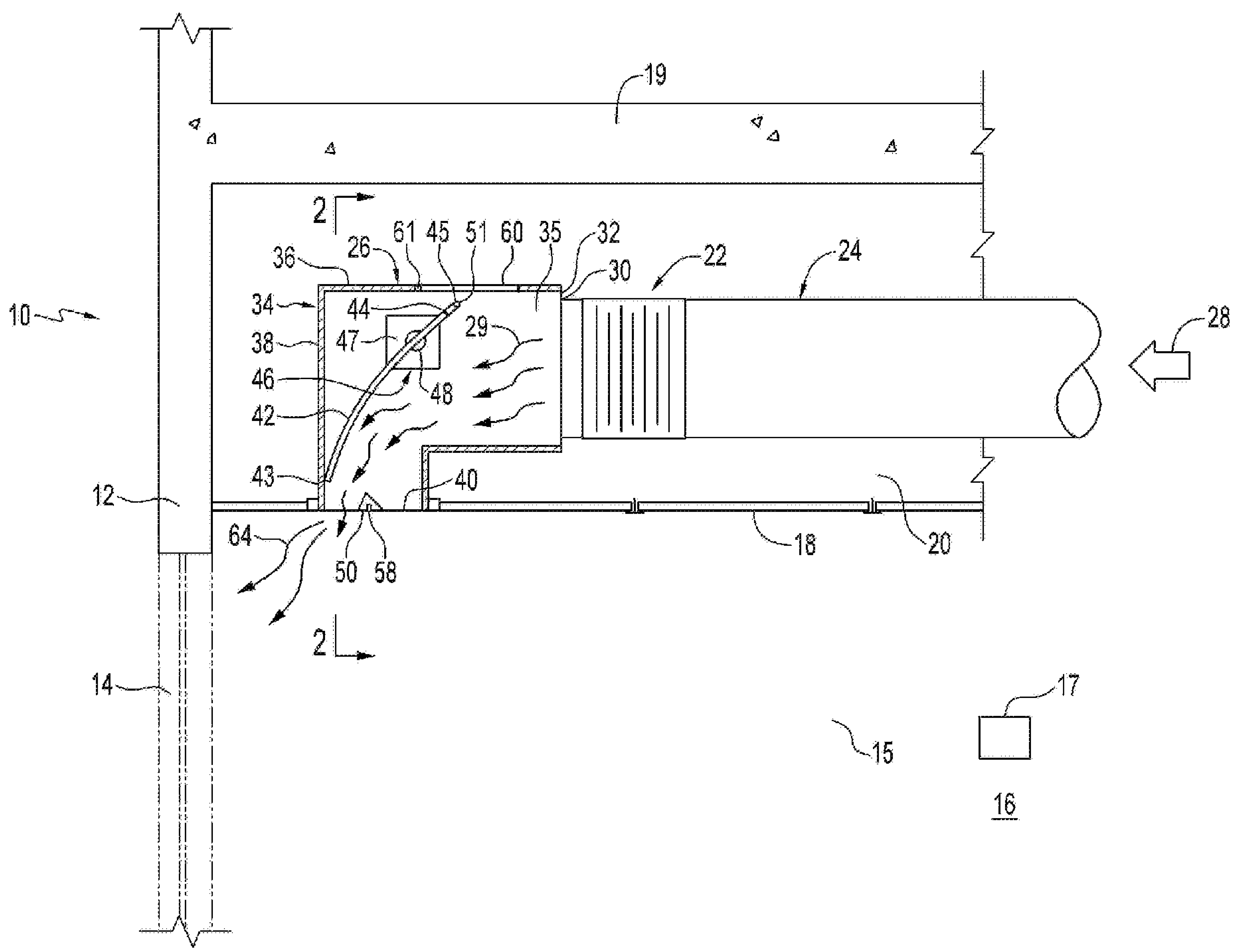
(57) ABSTRACT

The invention involves an air distributing apparatus for installation in a diffuser. The apparatus includes a first damper positioned within the diffuser. The first damper also has an open mode where a stream of air can exit the diffuser to a space. The first damper has a closed mode where the damper inhibits the stream of air from exiting the diffuser. The apparatus includes an actuator operatively connected to the first damper. There is an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person. The occupancy sensor is in communication with the actuator. When the space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode. When the space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode. A remote temperature sensor varies the volume of supply air entering the space depending on the prevailing air conditioning load.



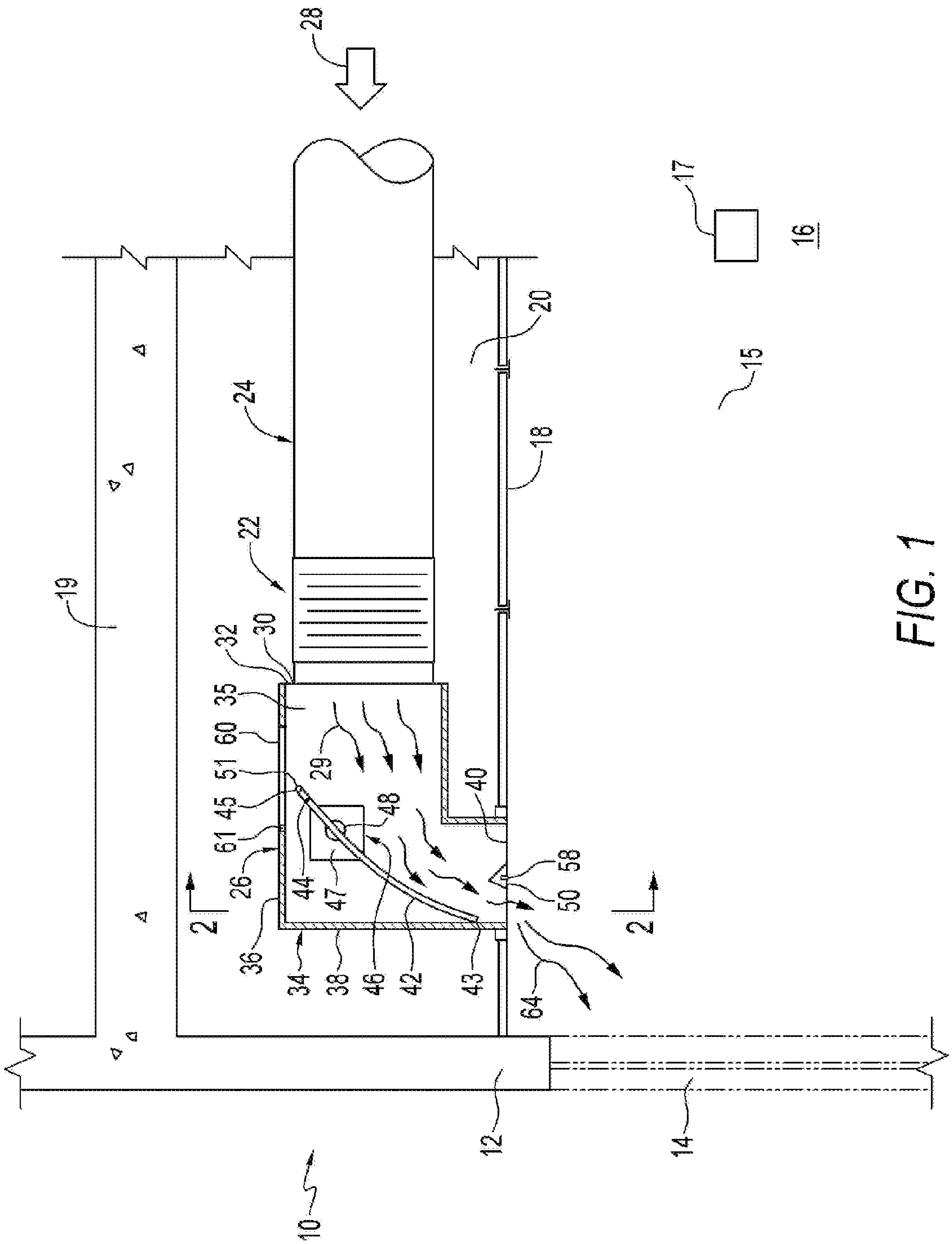

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FIG. 1

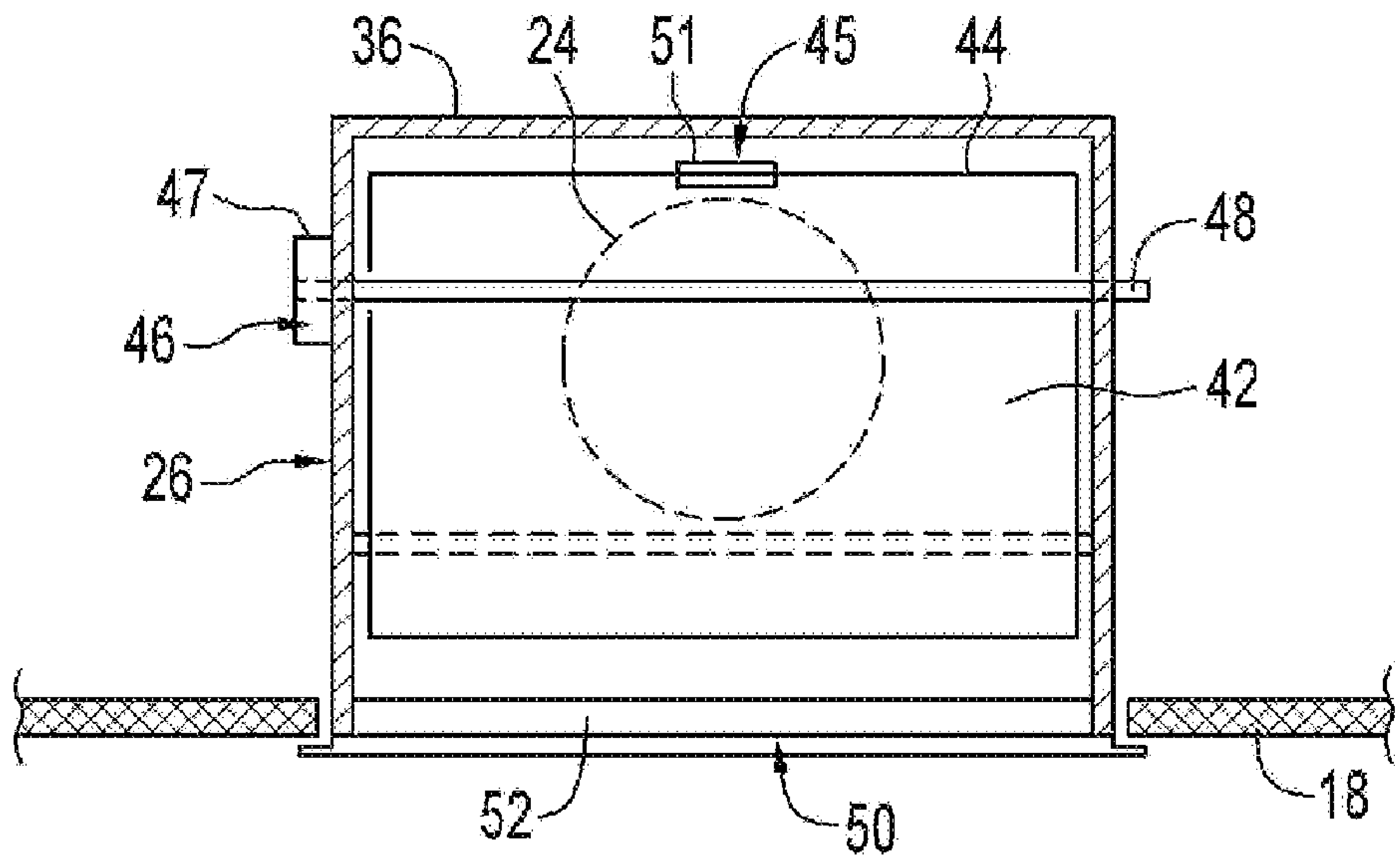


FIG. 2

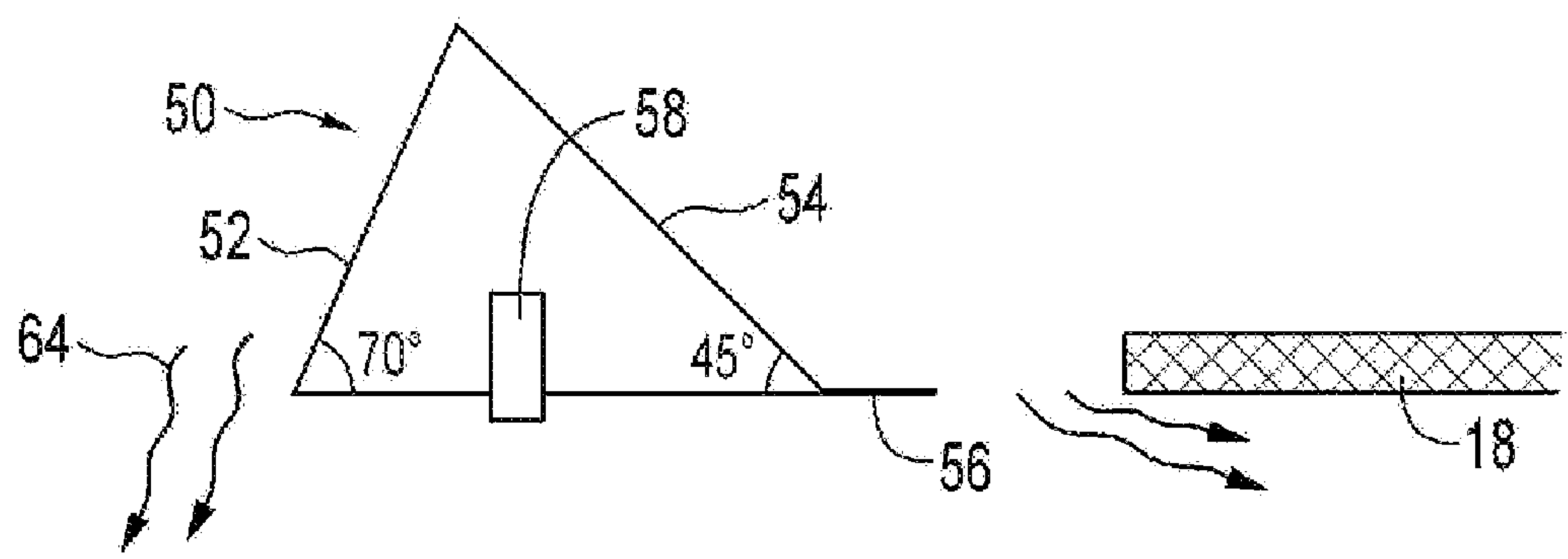


FIG. 3

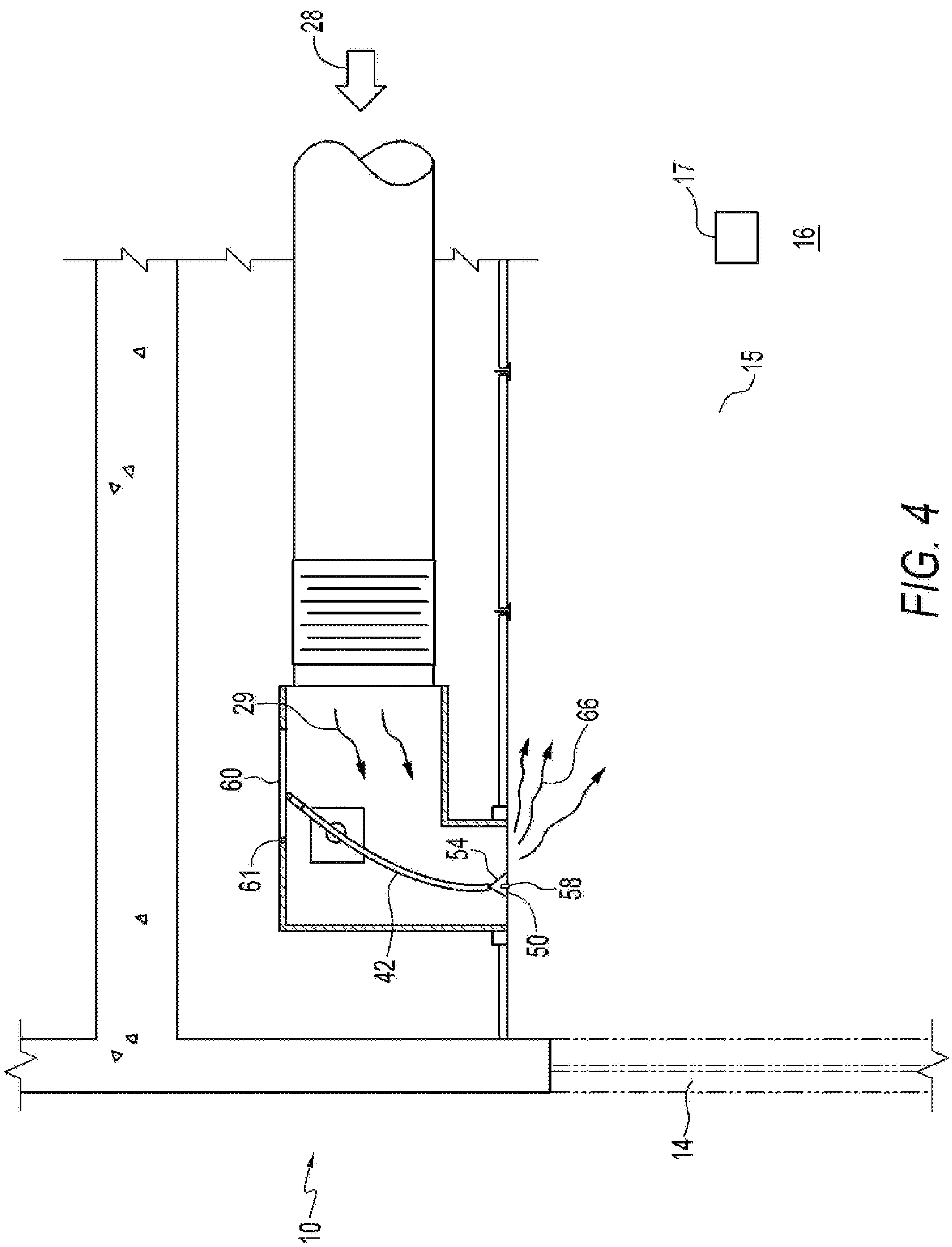


FIG. 4

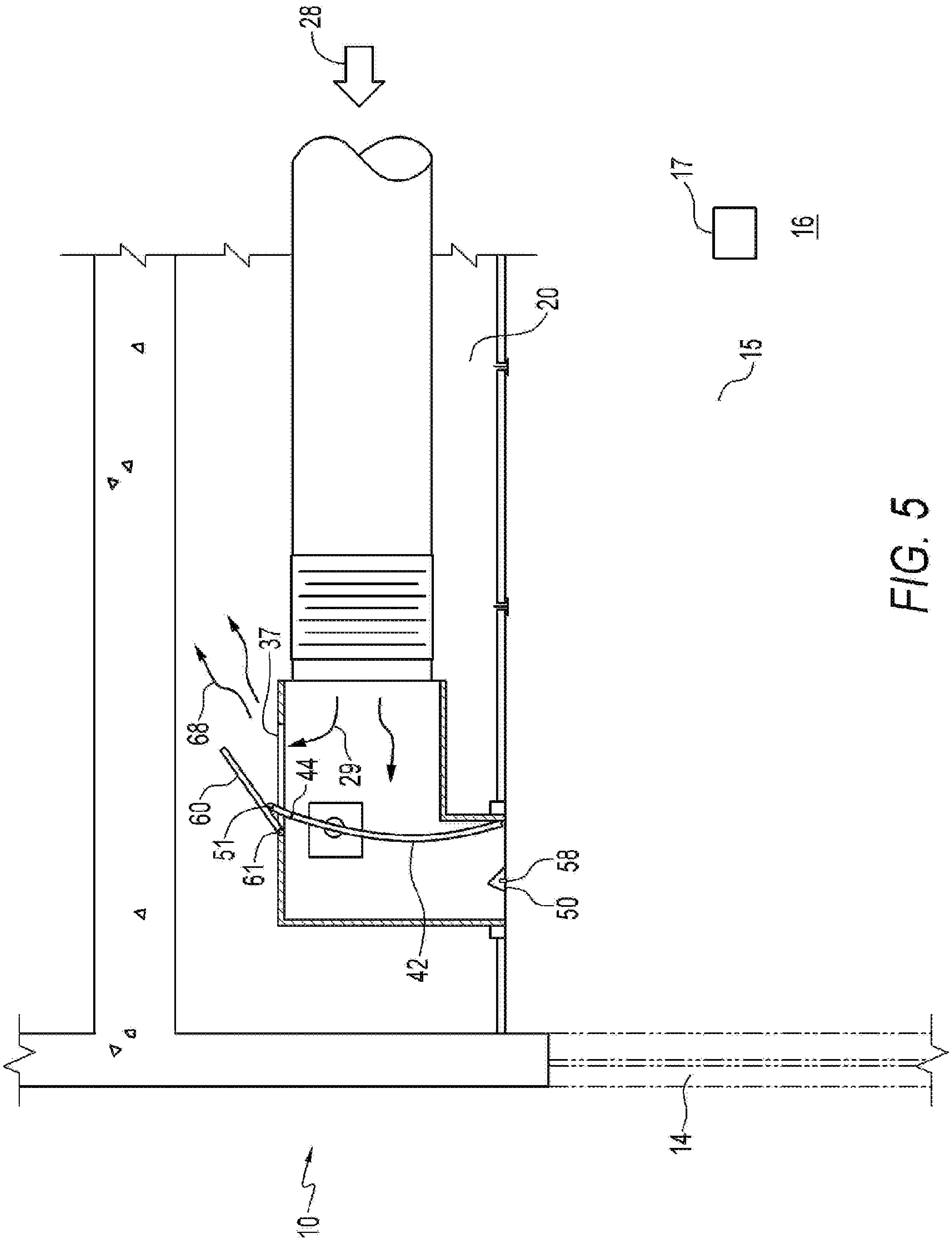
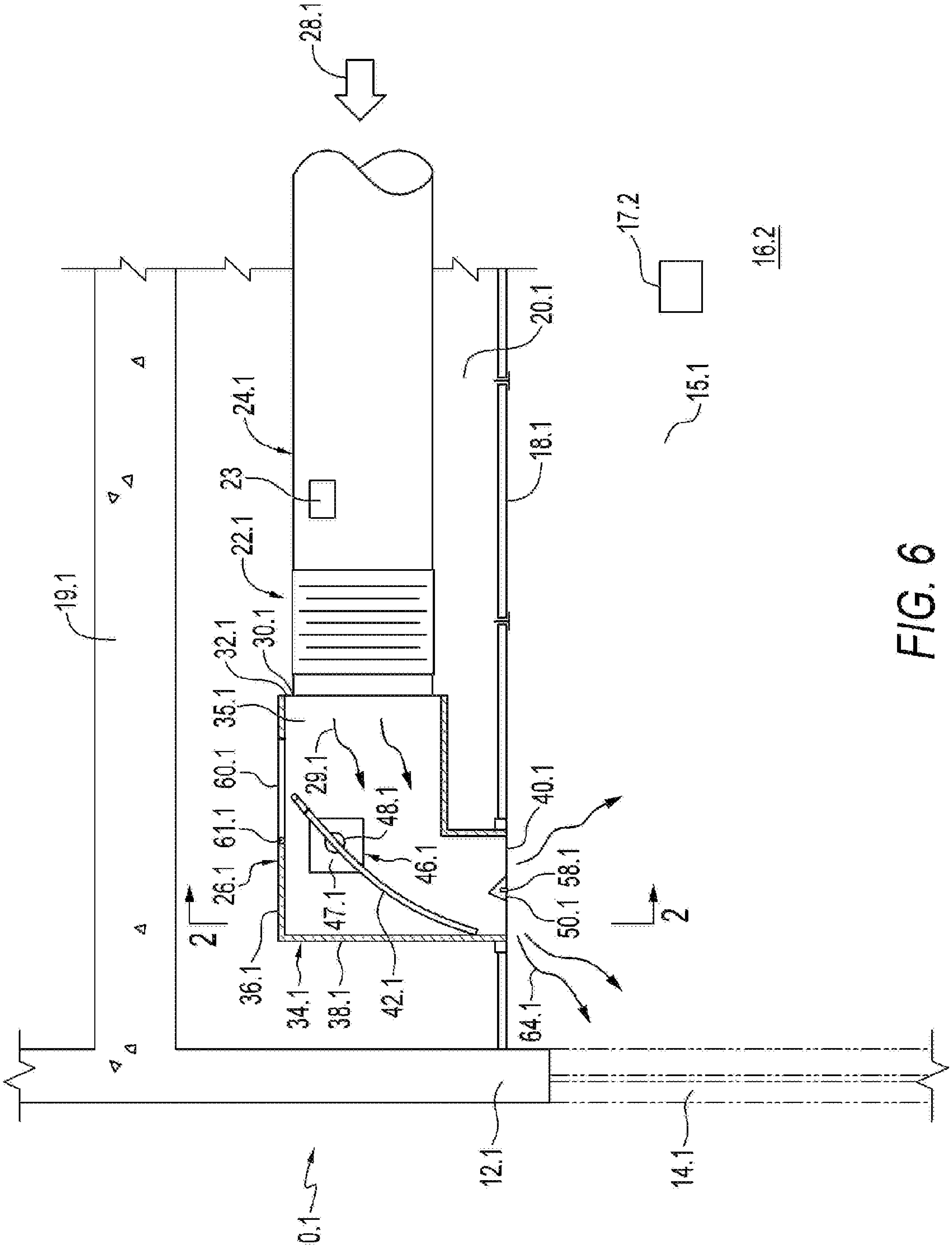


FIG. 5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20.1
15.1
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23
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19.1
32.1
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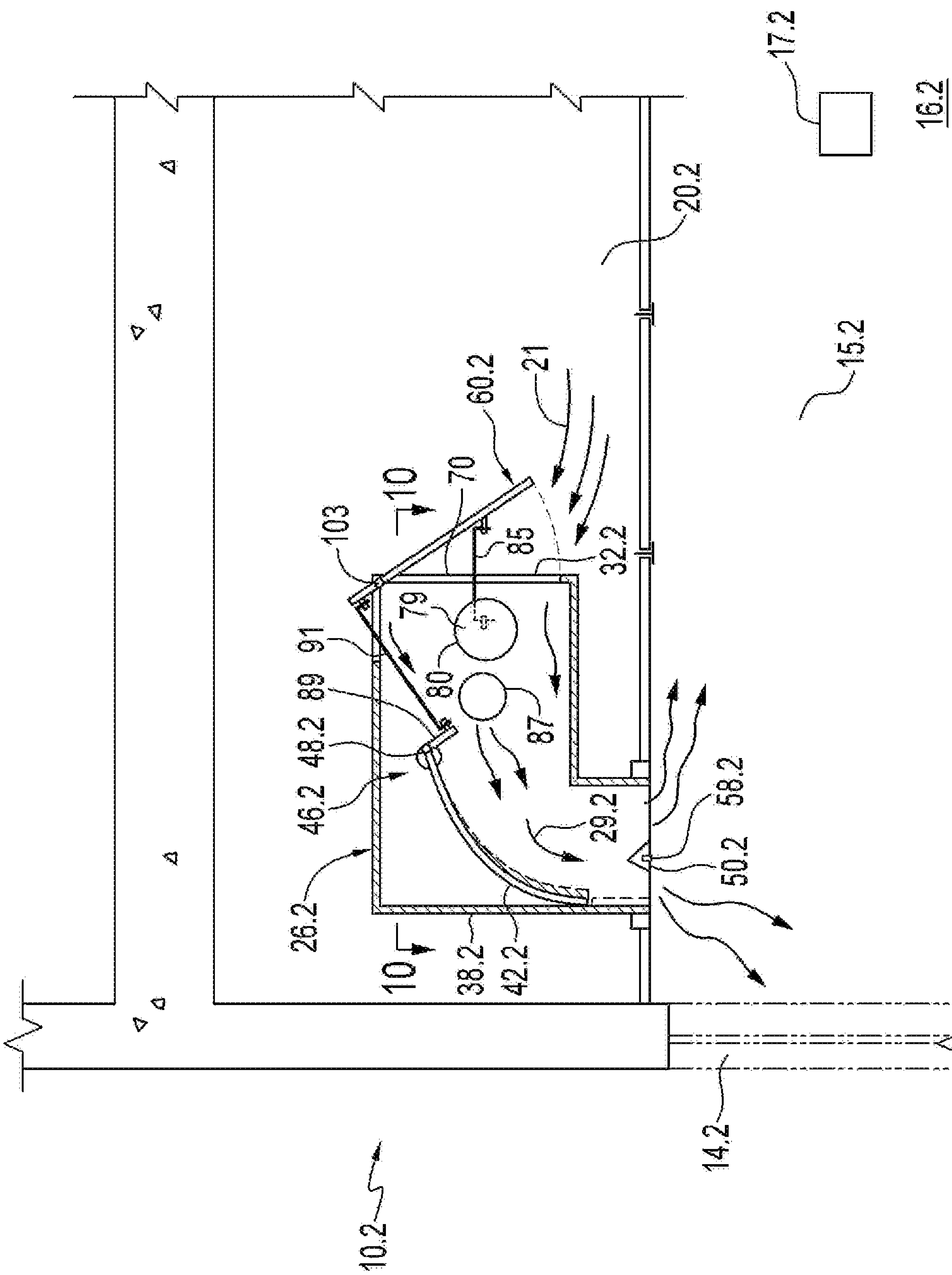
60.1
29.1
61.1
48.1
40.1
26.1
46.1
58.1
47.1
50.1
2
2
36.1
34.1
38.1
42.1
64.1
12.1
14.1
10.1

FIG. 6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16.2
20.2
15.2
21
60.2
70
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103
85
32.2
79
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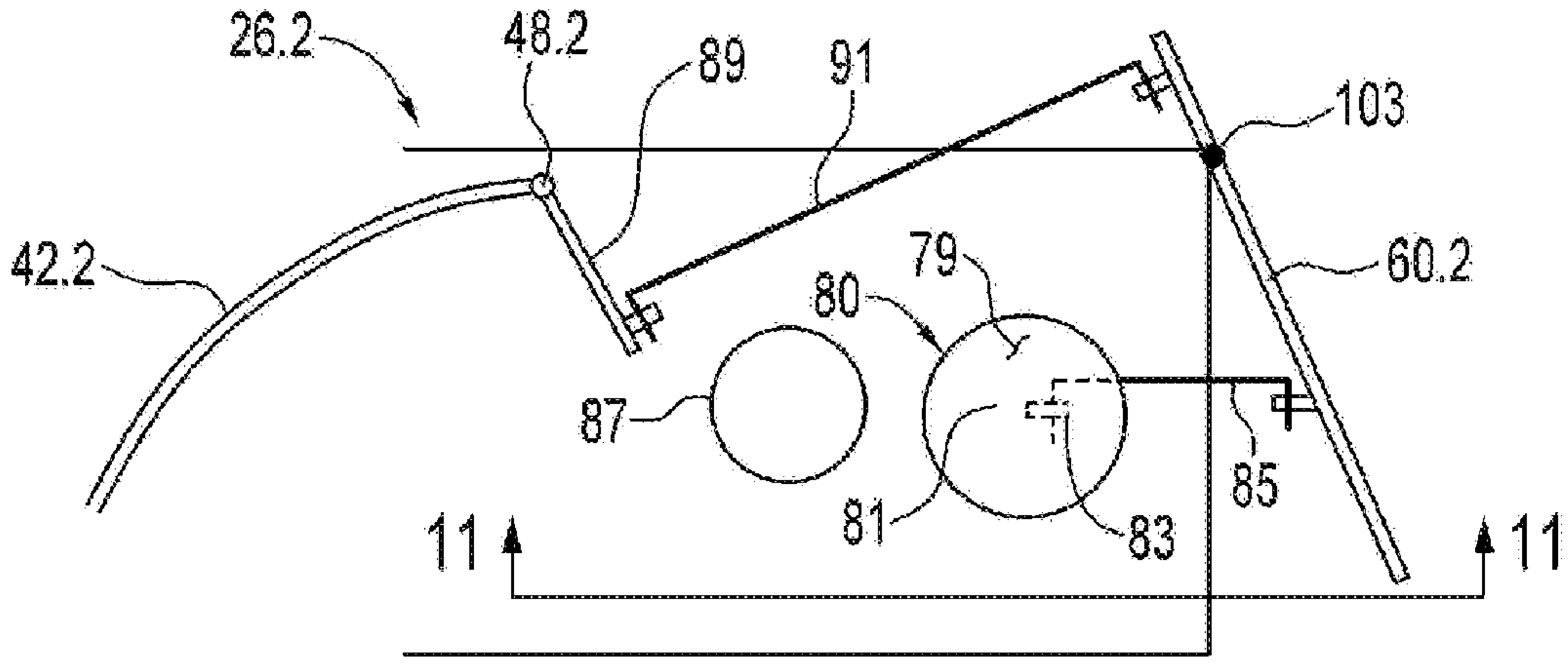
89
80
48.2
46.2
87
58.2
29.2
50.2
26.2
10
38.2
42.2
14.2
10.2

FIG. 7


26.2
48.2
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91
103
42.2
79
60.2
80
87
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81
83
11
11

FIG. 8

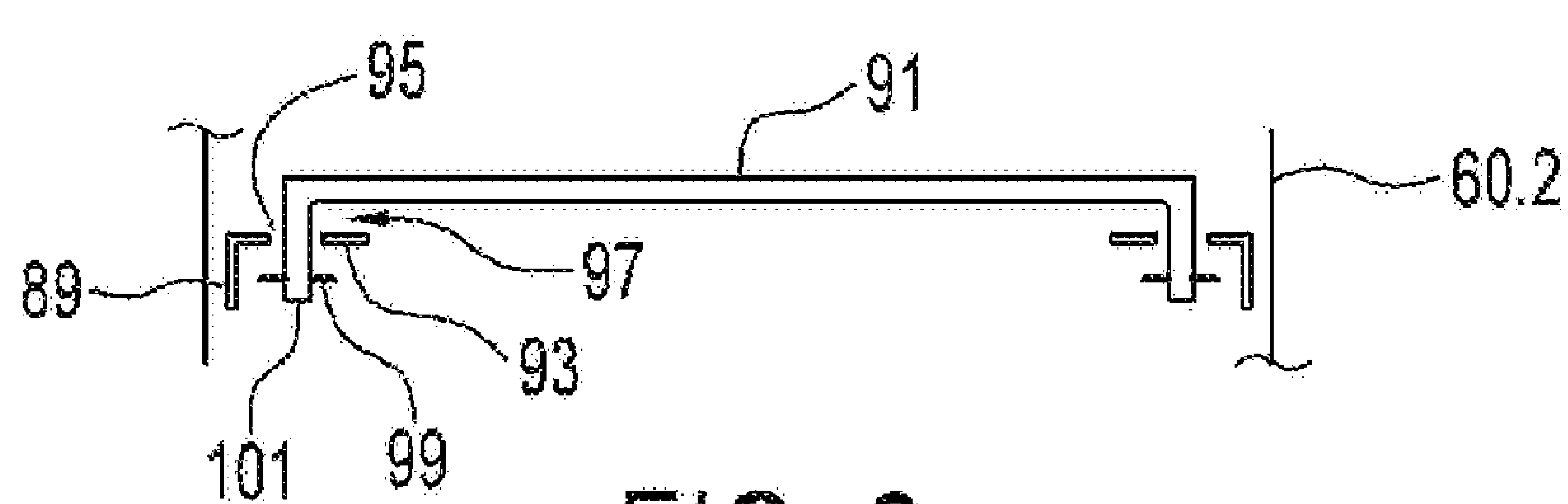

95
91
60.2
89
97
93
101
99

FIG. 9

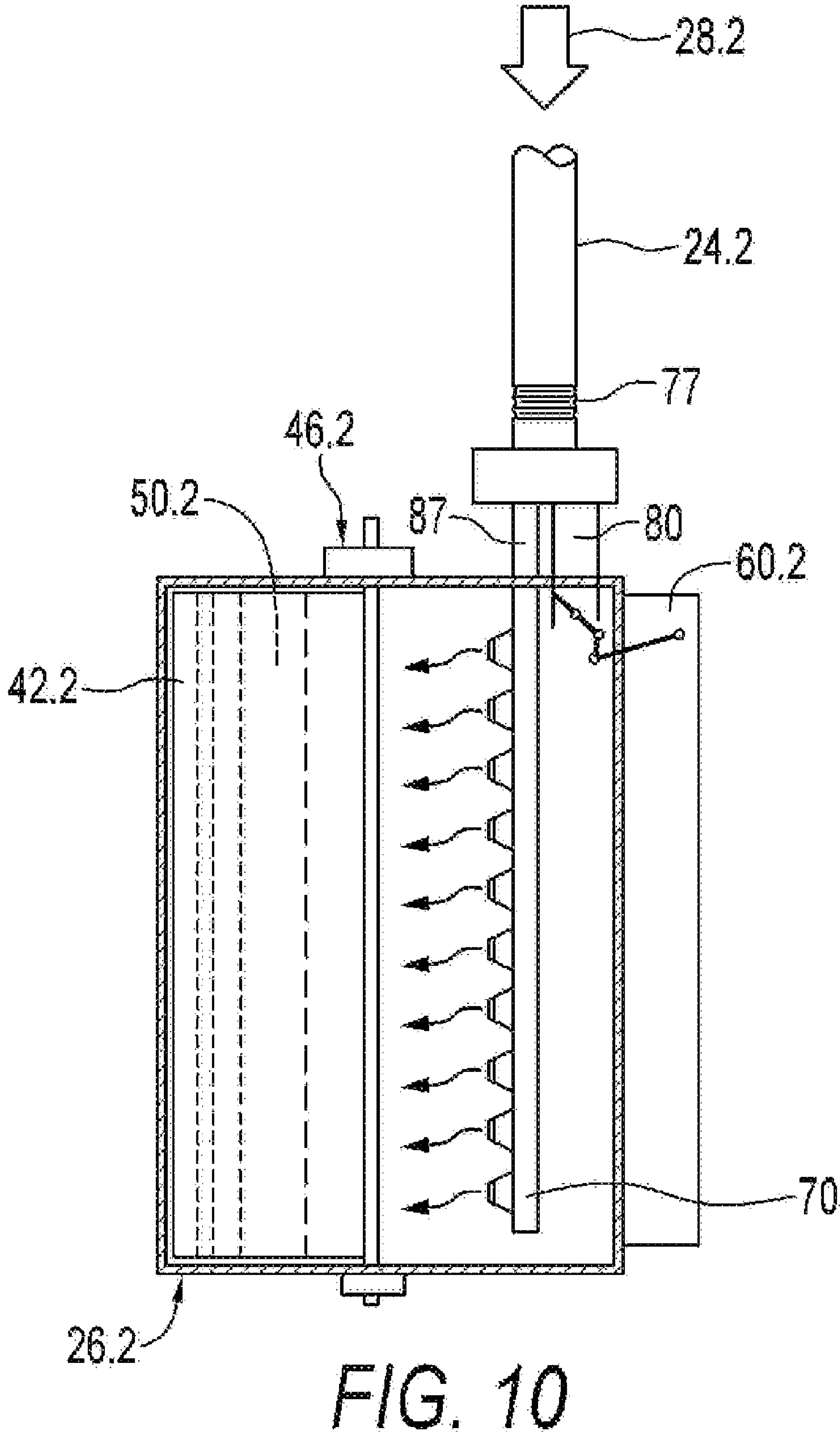


FIG. 10

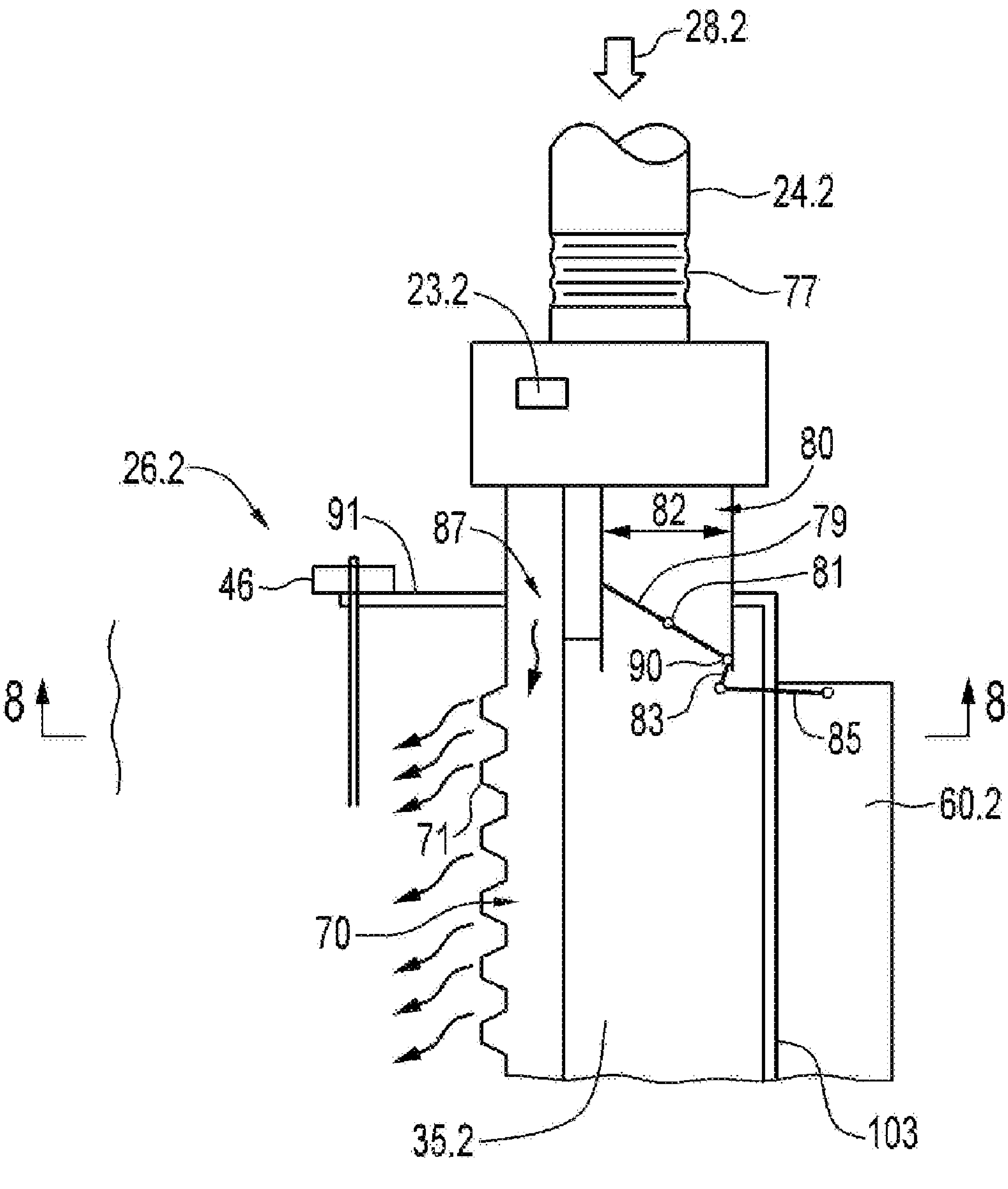
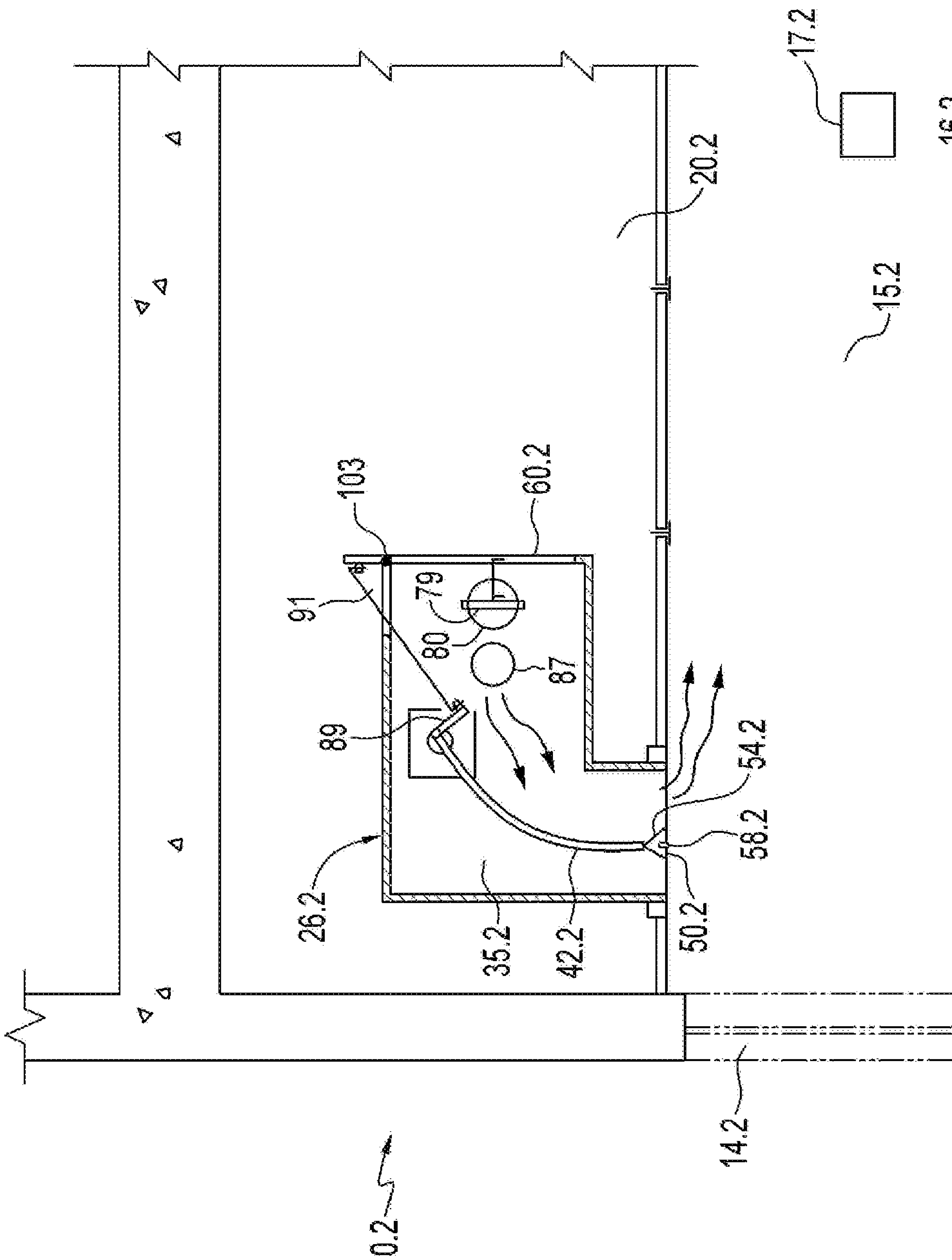


FIG. 11


17.2
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20.2
15.2
103
60.2
91
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42.2
50.2
14.2
10.2

FIG. 12

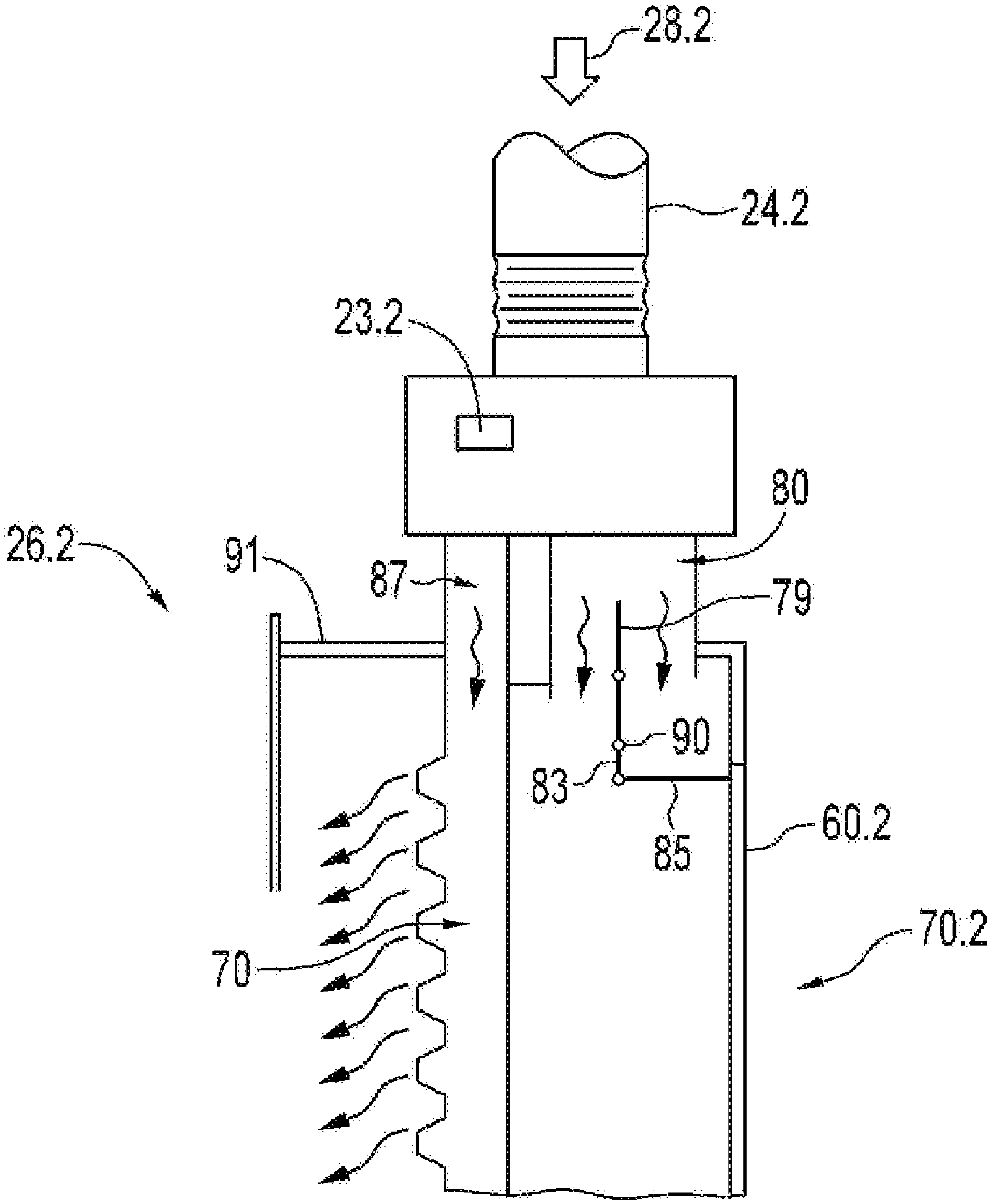

FIG. 13

AIR DISTRIBUTING APPARATUS FOR REDUCING ENERGY CONSUMPTION

BACKGROUND OF THE INVENTION

[0001] In keeping with today's demand for energy saving and sustainable buildings, more energy efficient designs are a necessity. The heating, ventilating, and air-conditioning ("HVAC") systems in large buildings are the main consumers of electricity, gas and water. These systems therefore need to be designed to incorporate equipment which will minimize not only the utilities consumed in their operation, but also the overall consumption of natural resources and environmental impacts associated with their manufacture and transportation. It is generally agreed that most office staff prefer to have a perimeter office with a window, and it is these perimeter spaces that have by far the greatest demand, based on an energy per square foot basis, on the building's HVAC system. Interior spaces usually have less occupancy density and are used for storage, filing, equipment rooms etc.

[0002] Traditionally in most HVAC systems conditioned air is delivered from a central mechanical plant to perimeter spaces with either varying temperatures or varying air volumes to satisfy the prevailing air conditioning load. After either picking up or giving off heat, the air is returned to the central mechanical plant where it is supplemented with fresh outside air, reheated or cooled, and then delivered back to the space for the repeat cycle.

[0003] In reviewing occupancies on any given day during regular hours, the number of office spaces that are empty due to the occupant being at other locations, out at meetings, on vacation, off sick, out for lunch etc. is quite significant. However, typically the buildings' air conditioning systems do not register which spaces are unoccupied and continue to supply heated or chilled air to cater for the perimeter external heat gains or losses so as to maintain space temperatures.

[0004] One response to the above is described in U.S. Pat. No. 5,819,840 to Wilson et al. Wilson discusses the use of a thermostat with a controller in combination with an occupancy detector. The controller is adapted to actuate a heating unit when a heating mode is selected or actuate a cooling unit when a cooling mode is selected. However, because Wilson merely suggests the addition of cool or hot air into a space, it suffers of a number of disadvantages. Wilson requires many parts and does not provide a means for a tailored distribution of air in a space. This lack of targeting results in wasted energy and therefore a less efficient system. Also, Wilson does not provide a means of re-using existing energy within a building and this further hinders the energy efficiency of such a device.

[0005] Another attempt to maximize energy savings within a building is described in U.S. Pat. No. 7,156,316 to Kates. This patent is directed towards a zone thermostat for zone heating and cooling. Kates is primarily directed to controlling the amount of air that flows from a duct into a series of different rooms or zones. Mention is made of the possibility of using an occupancy sensor; however Kates lacks a teaching of strategically tailored distribution of air in a given room.

[0006] There is therefore a need for a device having few parts, and therefore which is more economical to manufacture, and which better distributes air in a targeted manner within a building or space for enhanced energy use and savings.

BRIEF SUMMARY OF THE INVENTION

[0007] Accordingly, there is provided an air distributing assembly. More specifically, there is provided an air distributing assembly that combines an occupancy sensor and a damper for specifically directing air flow within a space so as to control space temperature and minimize energy consumption.

[0008] According to one aspect of the invention, there is provided an air distributing apparatus for installation in a diffuser. The air distributing apparatus includes a first damper positioned within the diffuser. The first damper has an open mode where a stream of air can exit the diffuser to a space. The first damper has a closed mode where the damper inhibits the stream of air from exiting the diffuser. The air distributing apparatus includes an actuator operatively connected to the first damper. There is an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person. The occupancy sensor is in communication with the actuator. When the space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode. When the space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

[0009] According to a further aspect of the invention, there is provided an air distributing assembly for installing in a plenum. The air distributing assembly includes a diffuser. The air distributing assembly includes a first damper positioned within the diffuser. The first damper has an open mode where a stream of air can exit the diffuser to a space. The first damper has a closed mode where the damper inhibits the stream of air from exiting the diffuser. The air distributing assembly also includes an actuator operatively connected to the first damper. There is an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person. The occupancy sensor is in communication with the actuator. When the space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode. When the space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

[0010] According to another aspect of the invention, there is provided an air distributing apparatus for connecting to a supply duct. The supply duct supplies a stream of air into a space having a window. The air distributing apparatus includes a diffuser connected to the supply duct. The air distributing apparatus includes a first damper positioned within the diffuser member. The first damper has a heating mode where the first damper is positioned to direct the stream of air at least in part towards the window. The first damper has a cooling mode where the first damper is positioned to direct the stream of air away from the window. The air distributing apparatus includes an actuator operatively connected to the first damper. There is an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person. The occupancy sensor is in communication with the actuator. When the space is occupied by the person, the occupancy sensor communicates with the actuator which thereby actuates the first damper to one of said heating mode and said cooling mode. When the space is unoccupied, the occupancy sensor communicates with the actuator to actuate the first damper to another of said heating mode and cooling mode.

[0011] According to yet a further aspect of the invention, there is provided a building structure having an enclosed space. The building structure includes a window, a plenum, a diffuser positioned within the plenum, and an air distributing apparatus. The air distributing apparatus includes a first damper positioned within the diffuser. The first damper has an open mode where a stream of air can exit the diffuser to the enclosed space. The first damper has a closed mode where the damper inhibits the stream of air from exiting the diffuser. The air distributing apparatus includes an actuator operatively connected to the first damper. There is an occupancy sensor positioned and configured to distinguish whether the enclosed space is occupied or unoccupied by a person. The occupancy sensor is in communication with the actuator. When the enclosed space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode. When the enclosed space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Referring to the drawings:

[0013] FIG. **1** is an elevation, partly in section view of the air distributing apparatus according to one embodiment of the invention illustrating the first damper in the open, heating mode.

[0014] FIG. **2** is a partial cross-sectional, end view along the lines **2-2** of FIG. **1** and illustrating of the first damper and the deflector.

[0015] FIG. **3** is an elevation view of the deflector of FIG. **1**.

[0016] FIG. **4** is an elevation view partly in section similar to FIG. **1** with the first damper in the cooling mode.

[0017] FIG. **5** is an elevation view partly in section similar to FIG. **1** with the first damper in the closed mode and the second damper being in an open mode, with no heating or cooling to the room.

[0018] FIG. **6** is an elevation view partly in section similar to FIG. **1** illustrating an interior temperature sensor.

[0019] FIG. **7** is an elevation view partly in section of the air distributing apparatus according to another embodiment of the invention illustrating the first damper and the second damper in the open, heating mode.

[0020] FIG. **8** is a partial elevation view of FIG. **7** shown in greater detail.

[0021] FIG. **9** is an elevation view of a rod illustrated in FIG. **8** but shown in greater detail.

[0022] FIG. **10** is a top plan partially in section along lines **10-10** of FIG. **7** illustrating the induction nozzle apparatus.

[0023] FIG. **11** is a partially in section plan view of FIG. **10** illustrating the induction nozzle apparatus in part and a pivot damper in an open mode, heating mode.

[0024] FIG. **12** is an elevation view partly in section of the air distributing apparatus according to the embodiment FIG. **7** but illustrating the first damper in the cooling mode.

[0025] FIG. **13** is a top plan view partially in section view of FIG. **12** illustrating the induction nozzle apparatus in part and the pivot damper in a closed, cooling mode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Referring to FIG. **1**, there is illustrated a building structure **10**. The building structure **10** has an exterior wall **12**, a window **14** and a back wall **16** on which may be attached a temperate sensor **17** having a target temperature setting. The building structure **10** defines a space **15**, which may be enclosed. The building structure **10** includes a ceiling **18** and a plenum **20** positioned perpendicular to the window **13**. The plenum **20** extends between ceiling **18** and floor **19** above.

[0027] An air distributing assembly **22** is located within the plenum **20**. The air distributing assembly **22** includes a supply duct **24** and an air distributing apparatus **26**. The supply duct **24** is in communication with a primary air supply as indicated by arrow **28**. The primary air supply **28** contributes to a stream of air **29** which in this example comprises heated air and which passes through the air distributing apparatus **26**. The supply duct **24** has a terminal **30**.

[0028] The air distributing apparatus **26** includes a diffuser **34** with an inlet **32** snugly connected to the terminal **30** of the supply duct **24**. The diffuser **34** has an interior **35**, a top wall **36** having a by-pass outlet **37** shown in FIG. **5**, an end wall **38** abutting the top wall **36**, and a primary outlet **40**. The primary outlet **40** is in communication with the space **15**. In this example, the primary outlet **40** is flush with the ceiling **18**.

[0029] A first damper **42** is positioned within the diffuser **34**. As illustrated in FIG. **1**, the first damper **42** is positioned to abut the end wall **38** in an open mode. The first damper **42** in this example is in the form of a curved plate, as best illustrated in FIGS. **1** and **2**. The first damper **42** has a first end **43** and a second end **44**. The first damper **42** has an arm **45** extending from the second end **44**. The arm **45** may have a roller **51** at its distal end. The first damper is operatively connected to an actuator **46**. Actuators are known in the art and therefore will not be described in detail. In this example, the actuator **46** includes a low voltage motor **47** and a pivot **48**. The pivot **48**, in this example a pivot bar, connects the first damper **42** to the air distributing apparatus **26**. The first damper **42** is so shaped as to allow the pivot **48** to pivotally rotate the first damper **42** across and along the primary outlet **40** of the diffuser **34**. The room temperature sensor **17**, if employed, is in communication with the actuator **46**.

[0030] Referring back to FIG. **1**, the air distributing apparatus **26** includes a deflector **50**. The deflector **50** is located adjacent to the primary outlet **40** of the diffuser **34**. The deflector **50** is so shaped as to enable the stream of air **29** to deflect laterally outwards from the primary outlet **40**. As illustrated in FIG. **3**, deflector **50** has a first side **52** shaped as to cause air coming down upon it to deflect towards and vertically downward across the window **14**. In this example, the first side **52** faces the window **14** and the plenum **20** at a slope of 20 degrees with respect to the window. The deflector **50** has a second side **54** so shaped as to cause air to coming down upon it to deflect into the space **15** and horizontally away from the window **14**. In this example of a preferred embodiment, the second side **54** faces away from the window **14** and faces towards the plenum **20**, with the second side **54** being positioned at a slope of 45 degrees with respect to the window **14**. The deflector **50** has a lip **56** extending from the second side **54**. The lip is also so positioned as to cause air coming down upon it to deflect in the space **15** away from the window **14**.

[0031] The air distributing apparatus **26** includes an occupancy sensor **58** positioned in communication with the space **15**. In this example, the occupancy sensor **58** is positioned along the primary outlet **40** of the diffuser **34** and along the deflector **50**. The occupancy sensor **58** is so positioned and configured to distinguish whether the space **15** is occupied or unoccupied by a person. In this example, the occupancy sensor **58** is a motion sensor, though those skilled in the art will appreciate that the occupancy sensor **58** could also be a heat sensor, motion sensor, infrared sensor or other such sensing device. The occupancy sensor **58** is in communication with the actuator **46**.

[0032] The air distributing apparatus **26** includes a second damper **60**. In this example, the second damper **60** is located adjacent to the top wall **36** and is in the shape of a plate. The second damper **60** is connected to the air distributing apparatus **26** via a pivot **61**. The second damper **60** is operatively engageable with the first damper **42** through the arm **45**. In FIG. **1**, the second damper **60** is illustrated in a closed mode. In the closed mode, the second damper **60** is interposed between the interior **35** of the diffuser **34** and the plenum **20**. The second damper **60** is so positioned and shaped as to cover the by-pass outlet **37** and thereby inhibit communication between the interior **35** and the plenum **20**.

[0033] In operation and referring first to FIGS. **1** and **3**, if a person occupies the space **15**, the occupancy sensor **58** detects that the space **15** is occupied. The occupancy sensor **58** communicates with the room sensor **17** which in turn controls the actuator **46** which operatively causes the first damper **42** to be positioned in an open mode. The primary air supply **28** passes through the supply duct **24**, and results in the stream of air **29** passing through the diffuser **34**. The occupancy sensor **58** is also operatively in communication with the second damper **60** via sensor **17** and actuator **46** and first damper **42**.

[0034] In order to determine whether a heating mode or cooling mode is required when the person occupies the space **15**, the room temperature sensor **17** having been initiated in conjunction with the occupancy sensor **58** for detecting occupancy. If the temperature in the space **15** is below the target temperature setting of the room temperature sensor **17**, room temperature sensor **17** may communicate to the actuator **46** that the heating mode is required.

[0035] In the heating mode, as illustrated in FIG. **1**, the first damper **42** is positioned to deflect the stream of air **29** towards the primary outlet **40** and deflector **50**. The first side **52** of the deflector **50** shown in FIG. **3** is shaped to deflect the stream of air **29** at least in part outwards towards the window **14**, as indicated by air arrows **64**. In one preferred embodiment, 80% of the stream of air **29** is directed against the window **14**. Warm air is thereby directed towards the window **14** and the exterior walls to neutralize or counteract heat loss. The second side **54** of the deflector **50** and the lip **56** are shaped and positioned to deflect the stream of air **29** at least in part inwards from the window.

[0036] In the cooling mode, as illustrated in FIG. **4**, the first damper **42** is so positioned to direct the stream of air **29** away from the window **14**. In this example, the first damper **42** is positioned to abut the deflector **50**. In a preferred embodiment, the second side **54** of the deflector **50** and the lip **56** are shaped to deflect 70 to 95% of the stream of air **29** away from the window. As a result, cool air as indicated by arrows **66** is directed towards occupants and increases the general air movement. Put another way, 70 to 95% of the stream of air **29** is directed inwards to cool with maximum air movement in the occupied space **15**.

[0037] If a person is not in the space **15**, the occupancy sensor **58** communicates with the actuator **46** which thereby operatively causes the first damper **42** to be positioned in a closed mode, as illustrated in FIG. **5**. The occupancy sensor **58** is operatively in communication with the second damper **60**. In this example, the occupancy sensor **58** communicates with the actuator **46** which operatively causes the second damper to be positioned in an unoccupied, open mode. In one preferred embodiment, when the first damper **42** is positioned in the closed mode, it engages the second damper **60** to open the second damper **60** as illustrated in FIG. **5**. As a result, the second damper **60** is positioned to allow communication between the interior **35** of the diffuser **34** and the plenum **20**. The primary air supply **28** passes through the supply duct **24**, and the stream of air **29** is inhibited from passing through the diffuser **34** by the first damper **42**. The closed mode of the first damper **42** therefore causes the stream of air **29** to deflect towards and through the by-pass outlet **37** and into the plenum **20**. In one preferred embodiment, all of the stream of air **29** is diverted to the plenum **20**, or ceiling void, via the by-pass outlet **37** as indicated by arrows **68**. This thereby reduces central loading on the central mechanical plant, as work is not done conditioning unoccupied space. The by-passed air **68** is returned to the central mechanical plant at a temperature closer to the temperature of initial supply air. This thereby reduces the energy needed for its re-cooling or re-heating when it returns in the form of the primary air supply **28**.

[0038] The bypassed air **68** acts to reset the temperature of the space **15** to night set back mode. In a preferred embodiment, the temperature of the night set back mode in the space **15** is approximately 5° C. above or below a set point. When the space **15** is re-occupied, the room temperature sensor **17** automatically communicates with the actuator **46** to revert the temperature in the space **15** to the target temperature by operatively adjusting the first damper **42** to the heating mode, cooling mode or variation thereof.

[0039] The above described structure and configuration of the air distributing assembly **22** result in a number of advantages. It automatically detects if spaces are occupied. It provides variable air volume ("VAV") benefits to perimeter zone areas by adjusting the heating/cooling capacity provided as the load varies throughout the day. It automatically changes the direction of the stream of air **29** depending on whether the demand is for heating or cooling. Using the diversity of the sum of all the instantaneous unoccupied spaces would allow the reduction in central mechanical plant capacity and to cut back energy demands considerably and thereby is a major factor in saving energy and reducing maximum demand loads.

[0040] Another embodiment of the present invention is illustrated in FIG. **6**, where like parts from the previous embodiment have like numbers with the addition of "**.1**". In this embodiment, in conjunction with room temperature sensor **17**, there is an interior temperature sensor **23** in communication with the actuator **47.1** and positioned to communicate with the primary supply air **28.1**. The interior temperature sensor **23** senses the temperature of the primary supply air **28.1**. If the temperature is at or above a first temperature, the air distributing apparatus **26.1** is deemed to be in the heating mode operation. In one example, the first temperature may be 72 degrees Fahrenheit. If the temperature is below a second temperature, the air distributing apparatus **26.1** is deemed to be in the cooling mode operation, which would be similar to the mode illustrated in FIG. **4**. In one example, the second temperature is 60 degrees Fahrenheit. Following mode settings, the actuator **47.1** modulates air volume control volumes subject to the prevailing load. If the interior temperature sensor **23** has a higher temperature than the space temperature i.e. heating mode, the unit will be in the heating setting.

[0041] A further embodiment of the present invention is illustrated in FIGS. **7** to **13**, where like parts from the previous embodiment have like numbers with the addition of ".**2**". In this case, the air distributing apparatus **26.2** further includes an induction nozzle apparatus **70** adjacent to its inlet **32.2**. The induction nozzle apparatus **70** is illustrated generally in FIG. **10**.

[0042] FIGS. **7** to **11** illustrate the heating mode. In this embodiment, the first damper **42.2** is connected to a second damper **60.2** via a bracket **89** and a rod **91**. The connection between the first damper **42.2** and the second damper **60.2** is best illustrated in FIG. **8**. The first damper **42.2** is pivotally connected to bracket **89** via the pivot **48.2**. Bracket **89** is connected to rod **91**. The connection between the bracket **89** and rod **91** is best shown in FIG. **9**. In this example, the bracket **89** has an L-shaped extension **93** that is clip spot welded to the bracket **89**. The L-shaped extension **93** has an open ended aperture **95** through which the rod **91** interengages via protrusion **97**. The rod **91** has a lock washer **99** affixed to its end **101**. The aperture **95** is so shaped as to allow the rod **91** to slidably connect and engage bracket **89**. The connection between the rod **91** and the second damper **60.2** is identical and therefore will not be described further.

[0043] Referring back to FIG. **8**, the second damper **60.2** is connected to the air distributing apparatus **26.2** via pivot **103**, in this example a pivot rod. The second damper **60.2** is operatively connected to a pivot damper **79**, via rod **85**, bracket **83**, and pivot **81**. This connection is best illustrated in FIG. **11**. The second damper **60.2** is pivotally connected to rod **85**, which is in turn pivotally connected to bracket **83**, which in turn is pivotally connected to the pivot damper **79** at end **90**.

[0044] FIG. **11** illustrates the pivot damper **79** in the closed, heating mode, where the primary air supply **28.2** is inhibited from directly entering into the air distributing apparatus **26.2**. The pivot damper **79** is located within the direct inlet **80** which connects the supply duct **24.2** directly to the interior **35.2** of the air distributing apparatus **26.2**. The direct inlet **80** has a cross-section **82**. The pivot damper **79** is configured to inhibit air from passing through direct inlet **80** in the closed, heating mode. The pivot damper **79** thereby promotes the primary air supply **28.2** to pass through the induction nozzle apparatus **70**.

[0045] FIG. **13** illustrates the pivot damper **79** in an open, cooling mode. The second damper **26.2** is in a closed mode. Air from the primary air supply **28.2** which passes through the supply duct **24.2**, flexible coupling **77**, the direct inlet **80**, and directly into the air distributing apparatus **26.2**, does not pass through the induction nozzle apparatus **70**.

[0046] Referring to FIG. **11**, the induction nozzle apparatus **70** receives air from the primary air supply **28.2** through an induction inlet **87**. The interior temperature sensor **23.2** is located within the supply duct **24.2** adjacent to the induction inlet **87**. Referring to FIGS. **7**, **10**, and **11**, the induction nozzle apparatus **70** is interposed between the first damper **42.2** and the second damper **60.2**. Induction nozzles are well known in the art and therefore will not be described in great detail. The induction nozzle apparatus **70** has nozzles **71**.

[0047] The induction nozzle apparatus **70** is positioned to cause the stream of air **29.2** to form in part from the primary air supply **28.2**. The plenum **20.2** defines a secondary, induced air supply **21**. The occupancy sensor **58.2**, the actuator **46.2**, the first damper **42.2** and the deflector **50.2** function in a manner similar to the previous embodiment and will therefore not be described in detail.

[0048] In operation and referring to FIGS. **7** to **11**, the heating mode is now described. The first damper **42.2** abuts end wall **38.2** and operatively engages the second damper **60.2**, which is thereby positioned to allow communication between the inlet **32.2** of the air distributing apparatus **26.2** and the plenum **20.2**. When the primary air supply **28.2** passes through the supply duct **24.2**, past the induction inlet **87**, and into the induction nozzle apparatus **70**, the induction nozzle apparatus **70** induces the secondary air supply **21** to pass through the air distributing apparatus **26.2**. The primary air supply **28.2** and secondary air supply **21** combine to form the stream of air **29.2**. Referring to FIG. **11**, the pivot damper **79** is operatively engaged by the second damper **60.2** to remain in the closed mode.

[0049] In one preferred embodiment, the induction nozzle apparatus **70** is configured to supply 25% of the stream of air **29.2** from the primary air supply **28.2** and the induction nozzle apparatus **70** is configured to induce 75% of the stream of air **29.2** from the secondary air supply **21**. These are only approximate numbers. The air distributing apparatus **26.2** is therefore configured for the re-utilization of the heat energy within the secondary air supply **21**, such as that generated by lights, equipment and people. This provides a significant energy-savings advantage stemming from the structure of the air distributing apparatus **26.2**. The heat energy recovered through the air distributing apparatus **26.2** accordingly supplements the primary air supply **28.2** in neutralizing the perimeter envelope heat loss, such as that otherwise lost through window **14.2** and exterior wall **12.2** of the building structure **10.2**.

[0050] Using primary air supply **28.2** at high pressure and at high or low temperatures (depending on load requirements), only approximately 25% of the standard air supply volume used for ventilation requirements would need to be delivered to the space **15.2**. This reduced air volume would enable the significant further advantage of a general reduction in size and capacity of all aspects of the ventilation and related systems, including ducts, fans, piping, motors, pumps, coils, heaters and other such parts and devices, with resulting savings in energy and basic material consumption.

[0051] In operation and referring now to FIGS. **12** to **13**, the cooling mode will now be described. The first damper **42.2** is positioned to abut the deflector **50.2** and operatively engage the second damper **60.2**. The second damper **60.2** is thereby positioned to inhibit communication between the interior **35.2** of the air distributing apparatus **26.2** and the plenum **20.2**. The second damper operatively engages the pivot damper **79** to be in an open position, as illustrated in FIG. **13**. This allows primary air supply **28.2** to in part directly enter into the air distributing apparatus **26.2**. Referring back to FIG. **12**, the primary air supply **28.2** passes through the air distributing apparatus **26.2**, is deflected first by the first damper **42.2**, is then deflected by the second side **54.2** of the deflector **50.2**, and is next directed inwards and away from the window **14.2**.

[0052] The variations already described in the previous embodiments illustrated in FIGS. **1** to **6** involving the room temperature sensor and interior temperature sensor may equally apply in the present embodiment described in FIGS. **7** to **13**, and therefore will not be further described in detail.

[0053] In all of the above embodiments, it is anticipated that acoustic lining may be needed on the interior surfaces of the air distributing apparatus to minimize noise emissions and to limit heat transfer through the unit casing.

[0054] Those skilled in the art will appreciate that a number of different variations of the invention are possible.

[0055] For example, the damper could have a wide variety of shapes in functioning to deflect or inhibit the stream of air **29**.

[0056] The plenum **20** may be set up to be in communication with air outside of the building structure **10**. When the second damper **60** is in the open mode, the air distributing assembly **22** may operatively promote flushing of the building structure **10** at night using "free cooling" from outside air. "Free cooling" is an industry term describing the use of cool outside air to achieve cooling in lieu of operating refrigeration machinery. The operation of "free cooling" is at the discretion of the Systems Operating Engineers based on the time of year and outside night time temperatures. In this example and where appropriate, "free cooling" would occur by having the 100% outside air directed to supply air **28** and pass through the by-pass outlet **37**, pass through the plenum **20** and thereby lower concrete floor slab temperatures. This occurs by the movement of cool air across the underside of concrete surfaces. This would in turn lower return air temperatures to the central mechanical plant during initial periods of morning systems start up hence reducing the demand for mechanical cooling equipment.

[0057] The air distributing apparatus **26** could be interconnected to a lighting circuit within the space **15** and cause the lights to turn off when the space **15** is unoccupied to thereby garner further energy savings and reducing heat gain.

[0058] The air distributing apparatus **26** is set up such that it may be readily retrofitted, bought as a kit and connected to the terminal **30** of a variety of ducts and ventilation systems for existing and/or older buildings. In the case of the induction nozzle unit being applied in an existing system retrofit upgrade, an additional "booster" fan may be needed within the upstream ducting to provide the required air pressure.

[0059] Depending on the type of system application, the second damper **60** may not be incorporated into the operations if chilled water cooling is provided and/or duct static pressure control measures are included.

[0060] The exterior wall **12** and window **14** may be exposed to the outside ambient. One skilled in the art will appreciate that a window is not necessarily required. Alternatively, the building structure **10** may be a room within a larger building or structure. Also, a master unit may control several slave units. In this regard, each air distributing apparatus **26** would require individual independent occupancy sensors **58**, but may share one common temperature sensor or thermostat for multiple spaces having common solar external exposures and air conditioning zone requirements.

[0061] Any and all of the arrangements can be fitted with electric or hot water heating coils (located at the air distribution device inlet) to provide additional heating of the supply air.

[0062] It will be understood by someone skilled in the art that many of the details provided above are by way of example only and are not intended to limit the scope of the invention which is to be determined with reference to the following claims.

What is claimed is:

1. An air distributing apparatus for installation in a diffuser, the air distributing apparatus comprising:

a first damper positioned within the diffuser, the first damper having an open mode wherein a stream of air can exit the diffuser to a space, and a closed mode wherein the damper inhibits the stream of air from exiting the diffuser;

an actuator operatively connected to the first damper for positioning the first damper in the open mode or the closed mode; and

an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person, the occupancy sensor being in communication with the actuator;

whereby, when the space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be in a position determined by the temperature sensor, and when the space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

2. The air distributing apparatus as claimed in claim **1**, the diffuser being located within a plenum, the diffuser having an interior, the air distributing apparatus further comprising:

a second damper operatively positioned between the interior of the diffuser and the plenum, the second damper being operatively engageable with the first damper, the second damper having an unoccupied mode wherein the second damper is positioned to allow communication between the interior of the diffuser and the plenum,

whereby, when the space is unoccupied, the occupancy sensor communicates with the actuator to operatively cause the second damper to be positioned in the unoccupied mode and thereby enable the stream of air to pass through to the plenum.

3. The air distributing apparatus as claimed in claim **2**, the stream of air being heated air, and the second damper further having an occupied mode wherein the second damper is positioned to inhibit communication between the stream of air and the plenum.

4. The air distributing apparatus as claimed in claim **2**, wherein the occupancy sensor is an infrared detector.

5. The air distributing apparatus as claimed in claim **2**, wherein the occupancy sensor is a motion sensor.

6. The air distributing apparatus as claimed in claim **2**, wherein the first damper is a plate.

7. The air distributing apparatus as claimed in claim **2**, wherein the actuator further includes a pivotal connector, the first damper connecting to the actuator via the pivotal connector.

8. The air distributing apparatus as claimed in claim **1**, the stream of air being heated air, the space further having a window, the open mode of the first damper further including a heating mode wherein the first damper is positioned to direct the stream of air at least in part towards the window and a cooling mode wherein the first damper is positioned to direct the stream of air away from the window, the air distributing apparatus further comprising an interior temperature sensor positioned in communication with the actuator and in communication with the stream of air entering the air distributing apparatus, the interior temperature sensor having a first temperature setting, whereby, when temperature of the stream of air as sensed by the interior temperature sensor matches or is above the first temperature setting, the air distributing apparatus is deemed to be in the heating mode, and the interior temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the heating mode, and when temperature of the stream of air as sensed by the interior temperature sensor is below a second temperature setting, the air distributing apparatus is deemed to be in the cooling mode, and the interior temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the cooling mode, following mode settings the actuator modulates air volume control volumes subject to a prevailing load.

9. The air distributing apparatus as claimed in claim **1**, the stream of air being heated air, the space being separated from ambient, outside air by an exterior wall, the open mode of the first damper further including a heating mode wherein the first damper is positioned to direct the stream of air at least in part towards the exterior wall and a cooling mode wherein the first damper is positioned to direct the stream of air away from the exterior wall, the air distributing apparatus further comprising a room temperature sensor in communication with the actuator, the room temperature sensor having a target temperature setting, whereby, when temperature as sensed by the room temperature sensor is below the target temperature setting, the room temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the heating mode, and when temperature as sensed by the room temperature sensor is above the target temperature setting, the room temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the cooling mode.

10. An air distributing assembly for installing in a plenum, the air distributing assembly comprising:

a diffuser;

a first damper positioned within the diffuser, the first damper having an open mode wherein a stream of air can exit the diffuser to a space, and a closed mode wherein the first damper inhibits the stream of air from exiting the diffuser;

an actuator operatively connected to the first damper for positioning the first damper in the open mode or the closed mode; and

an occupancy sensor positioned and configured to distinguish whether the space is occupied or unoccupied by a person, the occupancy sensor being in communication with the actuator;

whereby, when the space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode, and when the space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

11. The air distributing assembly as claimed in claim **10**, the stream of air being heated air, the space further having a window, the open mode of the first damper further including a heating mode wherein the first damper is positioned to direct the stream of air at least in part towards the window and a cooling mode wherein the first damper is positioned to direct the stream of air away from the window, the air distributing assembly further comprising an interior temperature sensor positioned in communication with the actuator and in communication with the stream of air entering the air distributing assembly, the interior temperature sensor having a first temperature setting, whereby, when temperature of the stream of air as sensed by the interior temperature sensor matches or is above the first temperature setting, the air distributing assembly is deemed to be in the heating mode, and the interior temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the heating mode, and when temperature of the stream of air as sensed by the interior temperature sensor is below a second temperature setting, the air distributing assembly is deemed to be in the cooling mode, and the interior temperature sensor communicates with the actuator which thereby causes the first damper to be positioned in the cooling mode, following mode settings the actuator modulates air volume control volumes subject to a prevailing load.

12. The air distributing assembly as claimed in claim **11**, wherein the first temperature setting corresponds to a value of 72 degrees Fahrenheit and the second temperature setting corresponds to a value of 60 degrees Fahrenheit.

13. The air distributing assembly as claimed in claim **11**, the diffuser having a primary outlet through which the stream of air can exit, the air distributing assembly further comprising a deflector adjacent to the primary outlet, the deflector being so shaped as to cause the stream of air to deflect laterally outwards from the primary outlet.

14. The air distributing assembly as claimed in claim **13**, wherein during the cooling mode, the first damper is so positioned as to abut the deflector, the deflector being shaped to direct the stream of air away from the window.

15. The air distributing assembly as claimed in claim **14**, wherein during the heating mode, the deflector is shaped to direct the stream of air at least in part towards the window.

16. The air distributing assembly as claimed in claim **13**, wherein during the cooling mode, the first damper is so positioned as to abut the deflector, the deflector being shaped to direct the stream of air away from the window.

17. The air distributing assembly as claimed in claim **13**, the deflector having a first side facing towards the window and the plenum, the first side being positioned at a slope of 20 degrees with respect to the window.

18. The air distributing assembly as claimed in claim **13**, the deflector having a second side facing towards the plenum and facing away from the window, the second side being positioned at a slope of 45 degrees with respect to the window.

19. The air distributing assembly as claimed in claim **13**, wherein during the heating mode, the deflector is positioned and shaped such that 80% of the stream of air is directed against the window.

20. The air distributing assembly as claimed in claim **13**, wherein during the cooling mode, the deflector and first damper are positioned such that 70 to 95% of the stream of air is directed away from the window.

21. An air distributing apparatus for connecting to a supply duct, the supply duct communicating with a primary air supply which contributes to a stream of air passing into a space having a window, the air distributing apparatus comprising:

a diffuser connecting to the supply duct;

a first damper positioned within the diffuser, the first damper having a heating mode wherein the first damper is positioned to direct the stream of air at least in part towards the window and a cooling mode wherein the first damper is positioned to direct the stream of air away from the window;

an actuator operatively connected to the first damper to position the first damper in the heating mode or the cooling mode; and

an occupancy sensor positioned and configured to distinguish between whether the space is occupied or unoccupied by a person, the occupancy sensor being in communication with the actuator, whereby, when the space is occupied by the person, the occupancy sensor communicates with the actuator which thereby actuates the first damper to one of said heating mode and said cooling mode, and when the space is unoccupied, the occupancy sensor communicates with the actuator to actuate the first damper to another of said heating mode and said cooling mode.

22. The air distributing apparatus as claimed in claim **21**, the air distributing apparatus being located within a plenum and having an inlet in communication with the plenum, the air distributing apparatus further comprising an induction nozzle apparatus positioned adjacent to the inlet of the air distributing apparatus, the induction nozzle apparatus connecting to the supply duct, the induction nozzle apparatus being positioned to cause the stream of air to form in part from the primary air supply, the plenum defining a secondary air supply, the induction nozzle apparatus inducing the secondary air supply to result in the stream of air forming in part from the secondary air supply.

23. The air distributing apparatus as claimed in claim **20**, further having means for varying the stream of air entering into the apparatus from the primary air supply when operating in the cooling mode.

24. The air distributing apparatus as claimed in claim **22**, wherein the air distribution apparatus allows varying amounts of the primary air supply into the air distribution apparatus when operating in the cooling mode.

25. The air distributing apparatus as claimed in claim **22**, the induction nozzle apparatus being configured to supply 25% of the stream of air from the primary air supply when the first damper is in the heating mode.

26. The air distributing apparatus as claimed in claim **22**, the induction nozzle apparatus being configured to induce 75% of the stream of air from the secondary air supply when the first damper is in the heating mode.

27. The air distributing apparatus as claimed in claim **22**, the air distributing apparatus further comprising:

a second damper adjacent to the induction nozzle apparatus and positioned between the interior of the air distributing apparatus and the plenum, the second damper being operatively engageable with the first damper, the second damper being positioned to inhibit communication between the interior of the air distributing apparatus and the plenum when the first damper is in the cooling mode.

28. A building structure having an enclosed space and further comprising a window, a plenum, a diffuser positioned within the plenum, and an air distributing apparatus, the air distributing apparatus including:

a first damper positioned within the diffuser, the first damper having an open mode wherein a stream of air can exit the diffuser to the enclosed space, and a closed mode wherein the damper inhibits the stream of air from exiting the diffuser;

an actuator operatively connected to the first damper for positioning the first damper in the open mode or the closed mode; and

an occupancy sensor positioned and configured to distinguish whether the enclosed space is occupied or unoccupied by a person, the occupancy sensor being in communication with the actuator;

whereby, when the enclosed space is occupied by the person, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the open mode, and when the enclosed space is unoccupied, the occupancy sensor communicates with the actuator to thereby cause the first damper to be positioned in the closed mode.

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