Provisional Patent Application of

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For

LATCH-ABLE DOOR FAN

REFERENCES CITED

US Patent No. 7,182,805

ABSTRACT

A device to improve air circulation in an apartment is provided. The device may permit an apartment with inadequate air conditioning or heating to achieve a uniform temperature distribution for the occupant's comfort. The device consists of a tall structure with two centrifugal fans at the top and two at the bottom. The structure is mounted onto a door frame or wall on the side of the wall that the door swings into. The mount allows horizontal movement of the structure. Only a pair of fans run at a time, one at the top and one at the bottom. A switch controls which fan pair is active. Each pair is configured to displace air in opposite directions of the upper fan to displace hot air and the lower fan to displace cooler air. The device does not interfere with the door knob and has a notch for the door latch.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to fan appliances. Particularly, but not exclusively, the present invention relates to domestic fans for creating air circulation in a room and between adjacent rooms. More specifically, the invention allows a user to freely open and close a door while the invention operates. The invention also serves as a secondary door frame for the door to latch onto.

2. Description of the Related Art

Many homes and apartments have uneven heating or cooling within a room and between rooms. Trying to reach a more consistent temperature environment, either more air conditioners and heaters are used, or existing air conditioners are overused. This results in a waste of electricity, a decrease in the lifetime of an air conditioner or heater, and in some cases, still leaves the building unevenly heated or cooled. To save electricity, homeowners turn to domestic fans that take a fraction of the energy that air conditioners and heaters consume. These fans are often used to circulate air cooled by an air conditioner. By using fans to circulate air cooled by an air conditioner, the number of air conditioners needed for a home or apartment can significantly be reduced. Air conditioners use about 6% of all the electricity produced in the United States, at an annual cost of about $29 billion to homeowners. The present invention will create a more consistent temperature environment and reduce the number of air conditioners required to effectively cool homes, thereby reducing the amount of energy consumed to cool buildings.

To improve circulation within a room, many domestic fans are used. One such domestic fan is a ceiling fan that can be at least 1m in diameter. These fans, suspended from the ceiling, provide a downward spiral of air that circulates the air in the room. This spreads the cold or hot air from an air conditioner or heater, respectively. However, ceiling fans require heavy installations that may not be legal or feasible depending on building codes and infrastructure. These fans also do not circulate air between two adjacent rooms.

Tower fans or pedestal fans are usually freestanding and portable. In order to circulate air between rooms, these fans are placed by an open door. Because of their size and shape, these fans make it difficult for the user to move freely between rooms. Such fans also fail to circulate air between rooms when the door is closed. Locating such fans to blow air between rooms is not always possible as the bulky shape and structure mean that the fan occupies a significant amount of the user's workspace area. In the particular case of a fan placed in the doorway, the fan obstructs the users passageway through the door. If the fan is not placed in the doorway, insufficient air is blown between rooms.

An alternative to unit AC or central air is the mini-split air conditioner. U.S. Patent No. 7,182,805 to Reaves shows a mini split unit installed into a building. The air conditioning device includes a heat exchanging apparatus, a passage, and a corona discharge apparatus. The passage is in thermal communication with the heat exchanging apparatus and extends between an inlet and an outlet. This device requires heavy renovations, as ducts are needed to transfer cool air between rooms. Individual mini-split units must also be installed in each room The Airframe T7 (available on acinfinity.com or amazon.com) is a product that utilizes fans built into the door to circulate air between rooms. However, the device does not come pre-installed into the door and requires a hole to be made in a door for the device to be installed by the user. The fan swings open with the door so when the door is opened, the fan is pointing in the wrong direction. The Suncourt Entree Air (available at Home Depot or amazon.com) is a fan that clips to the corner of a door frame. This however does not allow air to flow when the door is closed. Thus, there is a long-felt need to provide a method to circulate air between rooms when the doors are closed without requiring heavy installation.

Summary of the Invention

A device to improve air circulation in an apartment is provided. The device may permit

an apartment with inadequate air conditioning or heating to achieve a uniform temperature distribution for the occupant's comfort. The device consists of a tall structure with two centrifugal fans at the top and two at the bottom. The structure is mounted onto a door frame or wall on the side of the wall that the door swings into. The mount allows horizontal movement of the structure. Only a pair of fans run at a time, one at the top and one at the bottom. A switch controls which fan pair is active. Each pair is configured to displace air in opposite directions of the upper fan to displace hot air and the lower fan to displace cooler air. The device does not interfere with the door knob and has a notch for the door latch.

The door fan can be displaced between two positions. In a first position the door fan has been displaced in the direction away from the door, so it does not interfere with the ordinary motion of the door (i.e., the door may be fully opened or closed). In this position, the door fan is not operative. In a second position the door fan has been displaced towards the door. In this second position, the door fan is wedged between the door frame and the door. The angled door creates a triangular gap. To close the triangular gap for purposes of privacy, the door fan has a triangular flap. The triangular flap can be moved between two positions, independent of the position of the door fan. The first position has the large face of the triangular flap flat against the wall of the door fan. In the second configuration, the triangular flap is parallel to the top of the door frame and perpendicular to the door fan. This second configuration allows for the triangular gapto be sealed when the door is closed onto the door fan. Sealing the triangular gap increases security and privacy for the user. In one embodiment, locking hinges allow the user to manually push the triangular flap up and lock it into place. In another embodiment, a motor moves the triangular flap into its two positions.

In some preferred embodiments, the height of door fan matches the height of the door frame. Having the height of the door fan match that of the door frame effectively seals the door from light and sound to increase privacy and security. In this position, the door is effectively closed, however, the internal fans will drive a significant amount of air will be driven between the two rooms. When the door is closed onto the door fan, the door fan acts as an extension of the door frame. The door latch engages with the door fan's notch when the door is closed onto the door fan.

The door fan can operate in two modes. In a first mode, the door fan will displace hot air close to the ceiling of a given room into an adjacent room and simultaneously displace cold air close to the floor of the adjacent room into the given room. In a second mode, the door fan will displace hot air close to the ceiling of the adjacent room into a given room and simultaneously displace cold air close to the floor of the given room into the adjacent room. Changing between the two modes will generally be required when there is a change of seasons — e.g., from summer to winter. A mode change occurs when the user flips switch. In either mode, only one pair of internal fans is active. In other words, to change the direction of circulation, there is no reversal of the fan blades. Instead, there is a selection of internal fans whose blades are oriented oppositely.

To initially install the door fan, the user installs a slider, which is a small, rectangular plate with two protruding cylinders. The slider is a separate entity from the door fan. The slider may be affixed to the user's door frame or wall on the side of the room that the door swings into. In one embodiment of the slider, the slider is preferably made of strong metal penetrated by holes (not shown) where screws will affix the slider to the door fan. In another embodiment, the mount frame has a larger surface area. This allows an adhesive to more effectively join the slider and the door frame. The cylinders on the slider connect the slider to the door fan. The slider acts as an intermediary connection between the door fan and the door frame. There is a mounting track embedded in the door fan. The mounting track restricts the displacement of the door fan to be parallel to the door frame or wall. The shape of the mounting track permits two positions of the door fan. The first position is a fixed distance towards the door. This first position moves the door fan towards the door. This first position enables the internal fans to displace air into the adjacent room. The first position also enables the user to easily position the door fan to allow the door be closed onto the door fan. The second position dispaces the door fan away from the door. This second position displaces the door fan as to not interfere with the ordinary motion of the door. The second position also prevents the door fan from obstructing light switches that are commonly found next to doors.The user may install the slider such that the door fan's bottom section touches the floor. In this embodiment, the user must lift the door fan up from the floor

and then slide the door fan into one of it's two ending positions. Alternatively, the user may install the slider such that the door fan does not rest on the floor.

Because the door fan may come into contact with the door frequently, the door fan may experience large forces, which may tend to harm the door fan. To reduce the impact, the door fan has a layer of soft material, such as sponge or foam. The soft material would cover door the side of the fan that the door comes into contact with. The soft material reduces the impact of the door onto the door fan. The soft material also reduces the noise produced from the door closing onto the door fan to increase comfort for the user. The soft material also serves to allow slightly different door angles to still be effectively closed onto the door fan because the soft material will mold to fit a door's varying angled positions.

When a door closes onto the door fan, the door is said to be "effectively closed." Perpendicular to the face of the fan that comes into contact with the door is a face that comes into contact with the door's latch. This face has a rectangular hole called the notch. The notch is has the width of standard door latches. When the door comes into contact with the door fan, the door latch compresses. The door continues its motion until the door's latch reaches the notch, at which point the door latch springs out and wedges itself into the door latch. When the door latch is wedged in the door fan's notch, the door is effectively closed. In preferred embodiments, the door fan has a long, vertical notch to match the height of standard door knob placements. The notch is lined with soft materials such as foam in order to reduce motion of the door that tend to be caused by drafts or other small forces. The soft material also door latches of various similar sizes to fit into the fan's notch.

When the door is effectively closed onto the door fan, a triangular gap exists at the top of the door. The top section of the door fan is a hollow chamber. In some embodiments, there are two fans in the top section that are each half the size of the top section. In this embodiment, each internal fan There are two slits in the door fan. One exists on the face of the door fan that faces the wall. The other face exists on a face perpendicular to the wall and away from the door. In one preferred embodiment, HEPA filters may be installed into the slits to increase air quality for the user. In another embodiment, the height of these fans is the entire height of the top section. This

allows for more air to be displaced by the internal fans. Another embodiment includes grills on the opposite side slit and the mounting side slit. Because the slits lead directly to the internal fans, the grills would protect the user. In some embodiments, there is only one internal fan in the top section. The entire face would turn as to allow air to move in the opposite direction.

The bottom section may be a mirrored version of the top section as described previously. In the preferred embodiment, the bottom section also has two internal fans. The internal fans in the bottom section work in opposite directions as the fans in the top section. The speed of these fans are the same, allowing for an equal intake of air into a room and output of air out of the room. An equalization of air pressure prevents pressure from building up within a given room. An increase in pressure may result in cool air leaking from cracks in the building. In another embodiment, the internal fans in the bottom section run at a reduced speed as to not blow up dust that clings close to the floor. The user may also choose to not use these fans, which saves electricity and reduces noise. The bottom section then serves as a vent for air to pass through rooms as a consequence of pressure building up in the room that is receiving air from the top section.

The center section contains the fan controls. One preferred embodiment has a dial that allows the user to control the internal fan speeds. Below the dial is a switch that allows the user to reverse the direction of the internal fans. The switch enables the user to ensure that the room lacking circulation can get improved circulation regardless of which side the door opens into.

To power the door fan, there are multiple power ports on the door fan. The ports connect to a wall outlet. These multiple ports in the top section and the bottom section allow power to be routed from multiple locations. The multiple ports give the user more options when deciding how to power the door fan.

To use the door fan, the user first installs the slider onto his door frame or wall on the side that the door closes. The user then mounts the door fan onto the slider. The user then powers the door fan by connecting a power source to the most convenient port on the door fan. The user activates the door fan by turning up the dial. If the user wishes, he may use the switch to control the

direction of airflow. To close the user's door onto the door fan, the user first shifts the door fan to its side position towards the door. The user then closes the door as he normally would until the door latch wedges itself into the notch. To cover the top section left by the angled door, the user opens the triangular flap. If the user desires to use his door as he normally would, the user can open the door and reposition the door fan away from the door fan. The door fan will not interfere with the motion of the door.

Brief Description of the Drawings

FIG. **1**: A front view of the invention attached to the door frame in a given room which the door opens into with the invention displaced out of the way of the ordinary movement of the door.
FIG. **2**: A side view of the device from the side that is mounted onto the door frame.
FIG. **3**: A top down view of the device with the device displaced parallel to the wall and out of the way of the ordinary movement of the door.
FIG. **4**: An isometric view of the center section of the device.
FIG. **5**: An isometric view of an embodiment of a mount that connects to the mount track.
FIG. **6**: An isometric view of center section of the device.
FIG. **7**: A side view of the device from the side of the door fan that is perpendicular to the door frame and is on the far side of the door.
FIG. **8**: Front view of the invention attached to the door frame in a given room which the door opens into, and the device is in the way of the ordinary movement of the door.
FIG. **9:** A top down view of the device installed onto the door frame with the door closed onto the door fan.
FIG 10: An isometric view of a three roomed apartment with only an air conditioner, the colors indicating air velocity with blue being the slowest and red being the fastest.
FIG 11: An isometric view of a three roomed apartment with an air conditioner and the invention in the doors between the two rooms, the colors indicating air velocity with blue being the slowest and red being the fastest.

Detailed Description

Description of the invention will now be given with reference to the attached FIGS. **1-9**. It should be understood that these figures are exemplary in nature and in no way serve to limit the scope of the invention, which is defined by the disclosure of this application appearing hereinbelow.

A door fan **1** to improve air circulation in an apartment is provided. The door fan permits an apartment with inadequate air conditioning or heating to achieve a more uniform temperature distribution, increasing the occupant's comfort. To prove the effect of this invention, fluid dynamics simulations were run using a program called Fluent by Ansys. FIG. **10** shows a simulation of air flow in a typical three roomed apartment building with the different colors representing air velocities. There is an active air conditioner **1000** pushing around air in front room **1001**. This means that the room is being efficiently cooled by the air conditioner. FIG. **11** is a simulation of the same three roomed apartment and air conditioner but with the door fan (not shown) in between front room **1000** and left room **1003** and between left room **1003** and right room **1002**. Compared to FIG. **10**, the air velocities in FIG. **11** shows higher velocity air in all three rooms **1001-1003**, which means that there is more circulation in all three rooms. As seen in FIG. **1** and **2**, the door fan consists of a tall structure containing a total of four internal fans: two center fans **41** and two edge fans **42**. One center fan and one edge fan are disposed in top section **8** and similarly in bottom section **80**.

The door fan can be displaced between two positions. In a first position, shown in FIG. **1**, the door fan has been displaced in the direction away from the door, so it does not interfere with the ordinary motion of the door (i.e., the door may be fully opened or closed). In this position, the door fan is not operative. In a second position, shown in FIG. **8**, the door fan has been displaced towards the door. In this second position, shown in FIG. **9**, the door fan is wedged between door frame **3** and door **4.**. The angled door creates a triangular gap **101.** To close the triangular gap for purposes of privacy, the door fan has a triangular flap **10**, shown in FIG. **6**. The triangular flap can be moved between two positions, independent of the position of the door fan. The first position has the large face of the triangular flap flat against the triangle wall **12** as shown in FIG. **3**. In the second configuration, as shown in FIG. **6**, the triangular flap is parallel to the top of the door frame and perpendicular to the triangle wall. This second configuration allows

for the triangular gap **101** to be sealed when the door is closed onto the door fan. Sealing the triangular gap increases security and privacy for the user. In one embodiment, locking hinges allow the user to manually push the triangular flap up and lock it into place. In another embodiment, a motor moves the triangular flap into its two positions.

In some preferred embodiments, the height of door fan **1** matches the height of the door frame as seen in FIG. **1**. Having the height of the door fan match that of the door frame effectively seals the door from light and sound to increase privacy and security. In this position, the door is effectively closed, however, the internal fans will drive a significant amount of air will be driven between the two rooms. When the door is closed onto the door fan, the door fan acts as an extension of the door frame. The door latch **6** engages with the door fan's notch **28** when the door is closed onto the door fan as shown in FIG **9**.

The door fan can operate in two modes. In a first mode, the door fan will displace hot air close to the ceiling of a given room into an adjacent room and simultaneously displace cold air close to the floor of the adjacent room into the given room. In a second mode, the door fan will displace hot air close to the ceiling of the adjacent room into a given room and simultaneously displace cold air close to the floor of the given room into the adjacent room. Changing between the two modes will generally be required when there is a change of seasons — e.g., from summer to winter. A mode change occurs when the user flips switch **35,** shown in FIG. **4**. In either mode, only one pair of internal fans is active, e.g., upper center fan **41** and lower edge fan **42**. In other words, to change the direction of circulation, there is no reversal of the fan blades. Instead, there is a selection of internal fans whose blades are oriented oppositely.

To initially install the door fan, the user installs slider **59**, shown in FIG. **5**. The slider may be affixed to the user's door frame or wall on the side of the room that the door swings into. In one embodiment of the slider, the slider's mount frame **50** is preferably made of strong metal penetrated by holes (not shown) where screws will affix the slider to the door fan. In another embodiment, the mount frame has a larger surface area. This allows an adhesive to more effectively join the slider and the door frame. Slider mounting cylinders **51**, shown in FIG. **5**, connect the slider to the door fan. The slider acts as an intermediary connection between the door fan and the door frame. Mounting track **21** restricts the displacement of the door fan to be parallel to the door frame or wall. The shape of the mounting track permits two positions of the door fan. The first position is a fixed distance towards the door. This first position moves the

door fan towards the door. This first position enables the center fans **41** to displace air into the adjacent room as seen in FIG. **8**. The first position also enables the user to easily position the door fan to allow the door be closed onto the door fan. The second position dispaces the door fan away from the door. This second position, shown in FIG. **1**, displaces the door fan as to not interfere with the ordinary motion of the door. The second position also prevents the door fan from obstructing light switches **7** that are commonly found next to doors.The user may install the slider such that the door fan's bottom section touches the floor. In this embodiment, the user must lift the door fan up from the floor and then slide the door fan into one of it's two ending positions. Alternatively, the user may install the slider such that the door fan does not rest on the floor.

Because door **4**, shown in FIG. **8**, may come into contact with the door fan frequently, the door fan may experience large forces, which may tend to harm the door fan. To reduce the impact, the door fan has a layer of soft material, such as sponge or foam. The soft material would cover door slamming wall **17**, shown in FIG. **3**. The soft material reduces the impact of the door onto the door fan. The soft material also reduces the noise produced from the door closing onto the door fan to increase comfort for the user. The soft material also serves to allow slightly different door angles to still be effectively closed onto the door fan because the soft material will mold to fit a door's varying angled positions.

When door **4** closes onto the door fan as shown in FIG. **8**, the door is said to be "effectively closed." On latch side wall **16** is notch **28**. The notch is a rectangular hole that has the width of standard door latches. When the door comes into contact with the door fan's latch side wall **16**, the door latch compresses. The door continues its motion until the door's latch reaches the notch, at which point the door latch springs out and wedges itself into the door latch. When the door latch is wedged in the door fan's notch, the door is effectively closed. In preferred embodiments, the door fan has a long, vertical notch to match the height of standard door knob placements. The notch is lined with soft materials such as foam in order to reduce motion of the door that tend to be caused by drafts or other small forces. The soft material also door latches of various similar sizes to fit into the fan's notch.

When the door is effectively closed onto the door fan as shown in FIG. **8**, triangular gap **101** exists at the top of the door. Top section **8**, shown in FIG. **6**, is a hollow chamber. FIG. **7** shows an embodiment of top section **8**. In this embodiment, each internal fan, the center fan **41**

and the edge fan, **42** is the height of half the top section. The edge fan is attached to the top of the top section **18** and the center fan is attached to the lower half of the top section. As seen in FIG. **7**, there are two slits— an opposite side slit **43** that is on the opposite side wall, shown in FIG. **3**, and a mounting side slit **44** that is on the mounting side wall, shown in FIG. **3**. In one preferred embodiment, HEPA filters may be installed into the slits to increase air quality for the user. When the edge fan **42** is active, the edge fan pulls in air from the opposite side slit **43** and out through the mounting side slit **44**. When the center fan **41** is active, the center fan pulls in hot air from the mounting side slit **44** and out through the opposite side slit. In another embodiment, the height of these fans is the entire height of the top section. This allows for more air to be displaced by the internal fans. Another embodiment includes grills on the opposite side slit and the mounting side slit. Because the slits lead directly to the internal fans, the grills would protect the user.

The bottom section **80** may be a mirrored version of the top section as described previously. In the preferred embodiment, the bottom section **80** also has two internal fans, the central fan **41** and the edge fan **42**. The internal fans in the bottom section work in opposite directions as the fans in the top section — eg. the center fan in the top section is active while the edge fan in the bottom section is active. The speed of these fans are the same, allowing for an equal intake of air into a room and output of air out of the room. An equalization of air pressure prevents pressure from building up within a given room. An increase in pressure may result in cool air leaking from cracks in the building. In another embodiment, the internal fans in the bottom section **80** run at a reduced speed as to not blow up dust that clings close to the floor. The user may also choose to not use these fans, which saves electricity and reduces noise. Bottom section **80** then serves as a vent for air to pass through rooms as a consequence of pressure building up in the room that is receiving air from the top section.

Center section **9** contains the fan controls. As seen in FIG. **4**, one preferred embodiment has a dial **32**. The dial allows the user to control the internal fan speeds. Below the dial is a switch **35** that allows the user to reverse the direction of the internal fans. The switch enables the user to ensure that the room lacking circulation can get improved circulation regardless of which side the door opens into.

To power the door fan, there are multiple power ports **31** on the door fan, shown in FIG, connects to a wall outlet **7**. These multiple ports in top section **8** and bottom section **80** allow

power to be routed from multiple locations. The multiple ports give the user more options when deciding how to power the door fan.

To use the door fan, the user first installs the slider **59** onto his door frame or wall on the side that the door closes. The user then mounts the door fan onto the slider. The user then powers the door fan by connecting a power source to the most convenient port **31** on the door fan. The user activates the door fan by turning up the dial **34**. If the user wishes, he may use the switch **35** to control the direction of airflow. To close the user's door onto the door fan, the user first shifts the door fan to its side position towards the door. The user then closes the door as he normally would until the door latch wedges itself into the notch **28**. To cover the top section left by the angled door, the user opens the triangular flap **10**. If the user desires to use his door as he normally would, the user can open the door and reposition the door fan away from the door fan. The door fan will not interfere with the motion of the door.

The examples presented herein are intended to illustrate potential and specific implementations of the invention. It can be appreciated that the examples are intended primarily for purposes of illustration of the invention for those skilled in the art. There may be variations to these diagrams or the operations described herein without departing from the spirit of the invention. For instance, in certain cases, method steps or operations may be performed or executed in differing order, or operations may be added, deleted or modified. Furthermore, whereas particular embodiments of the invention have been described herein for the purpose of illustrating the invention and not for the purpose of limiting the same, it will be appreciated by those of ordinary skill in the art that numerous variations of the details, materials and arrangement of elements, steps, structures, and/or parts may be made within the principle and scope of the invention without departing from the invention as described in this provisional application. Variations, modifications, and other implementations of what is described herein will occur to those of ordinary skill in the art without departing from the spirit and scope of the invention as claimed. Accordingly, the invention is to be defined not by the preceding illustrative description, but instead by the spirit and scope of this provisional patent application.

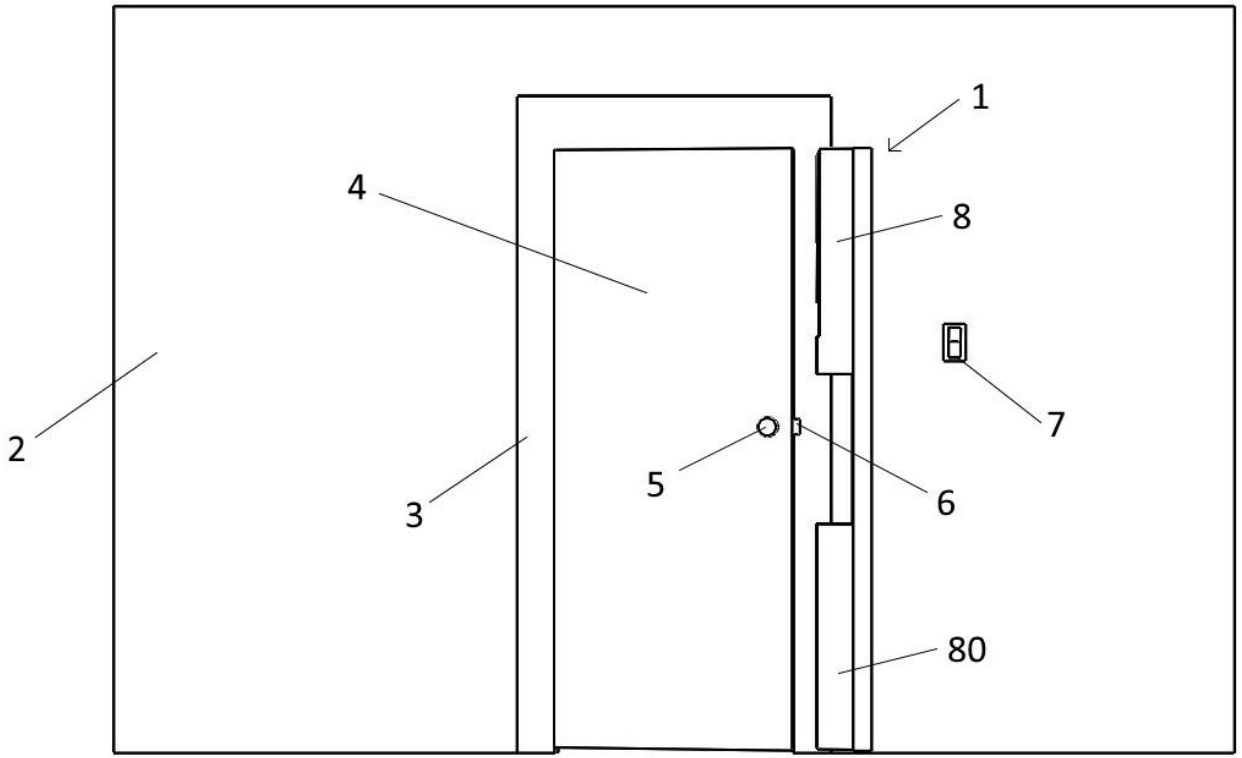


FIG 1

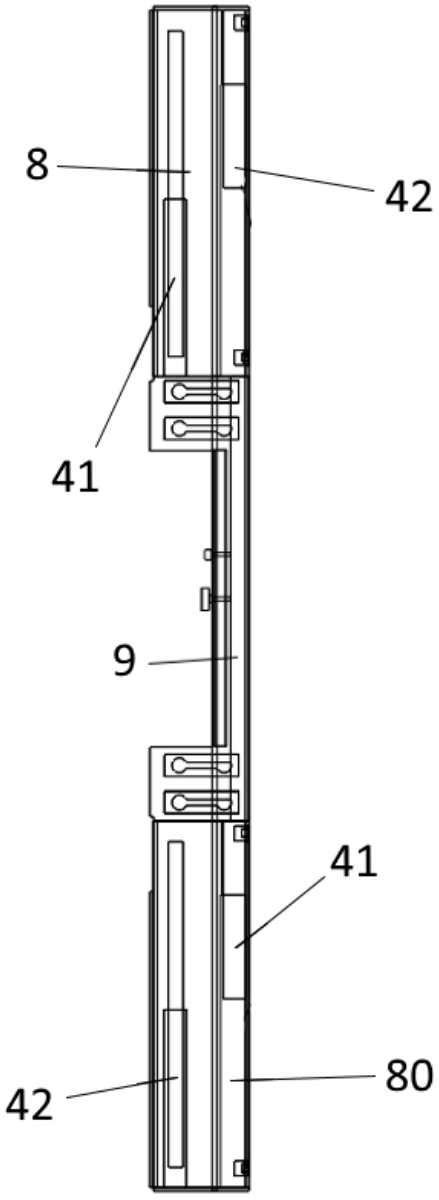


FIG 2

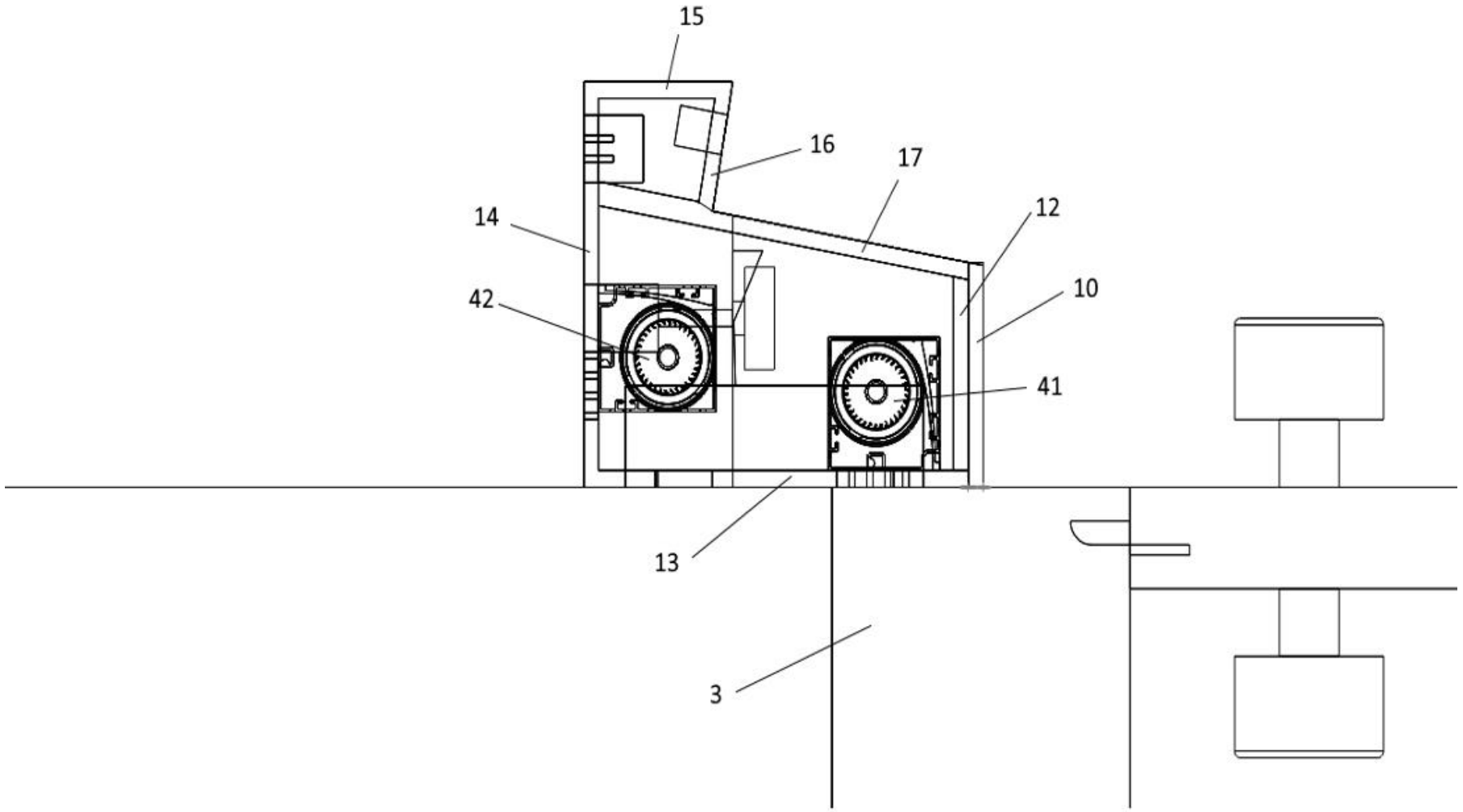


FIG 3

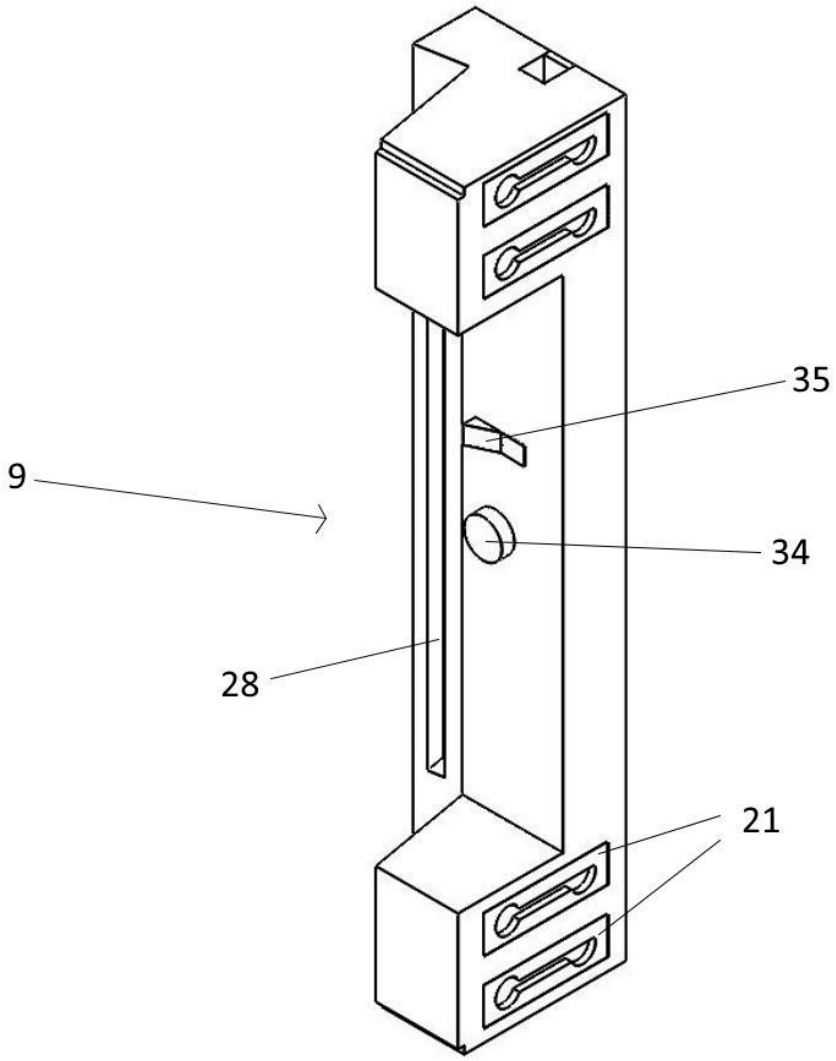


FIG 4

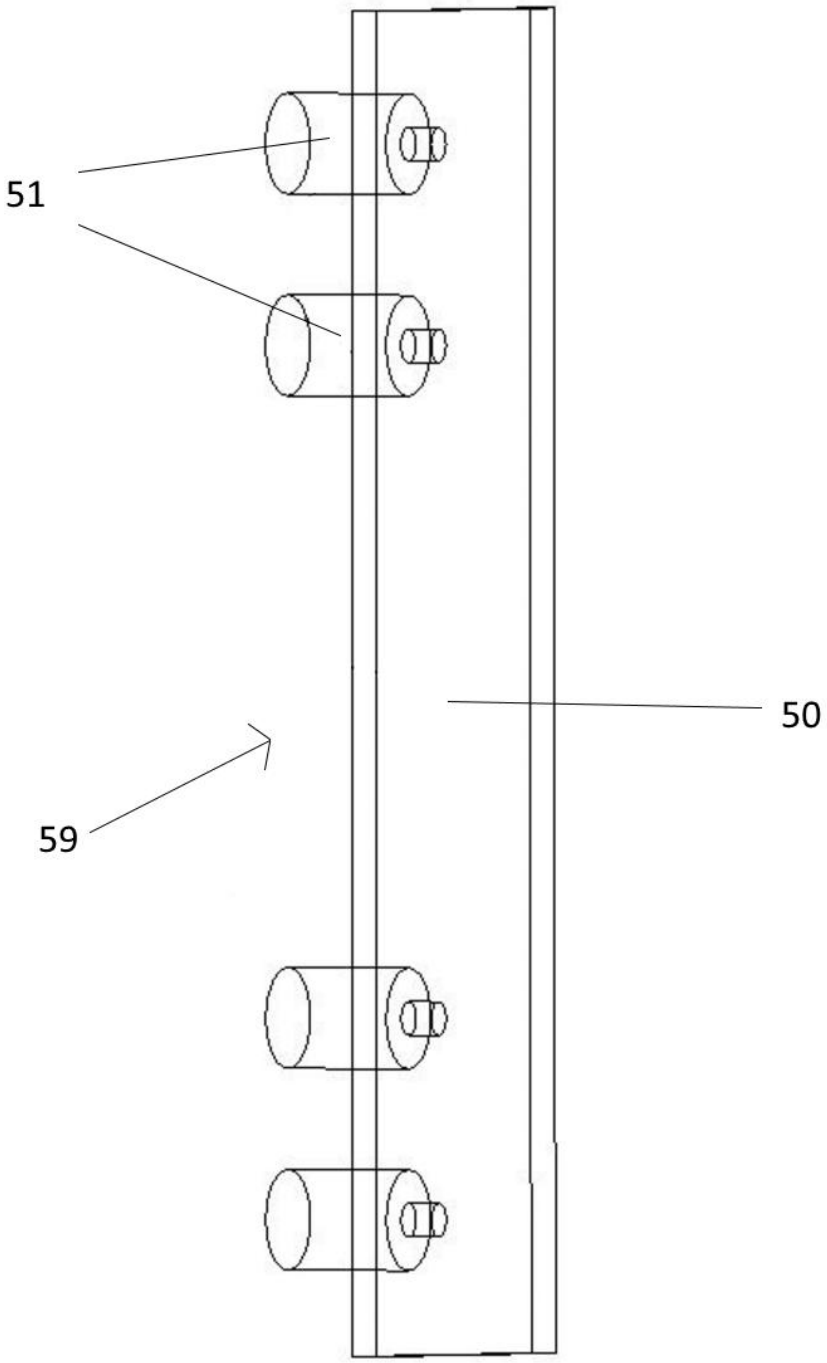
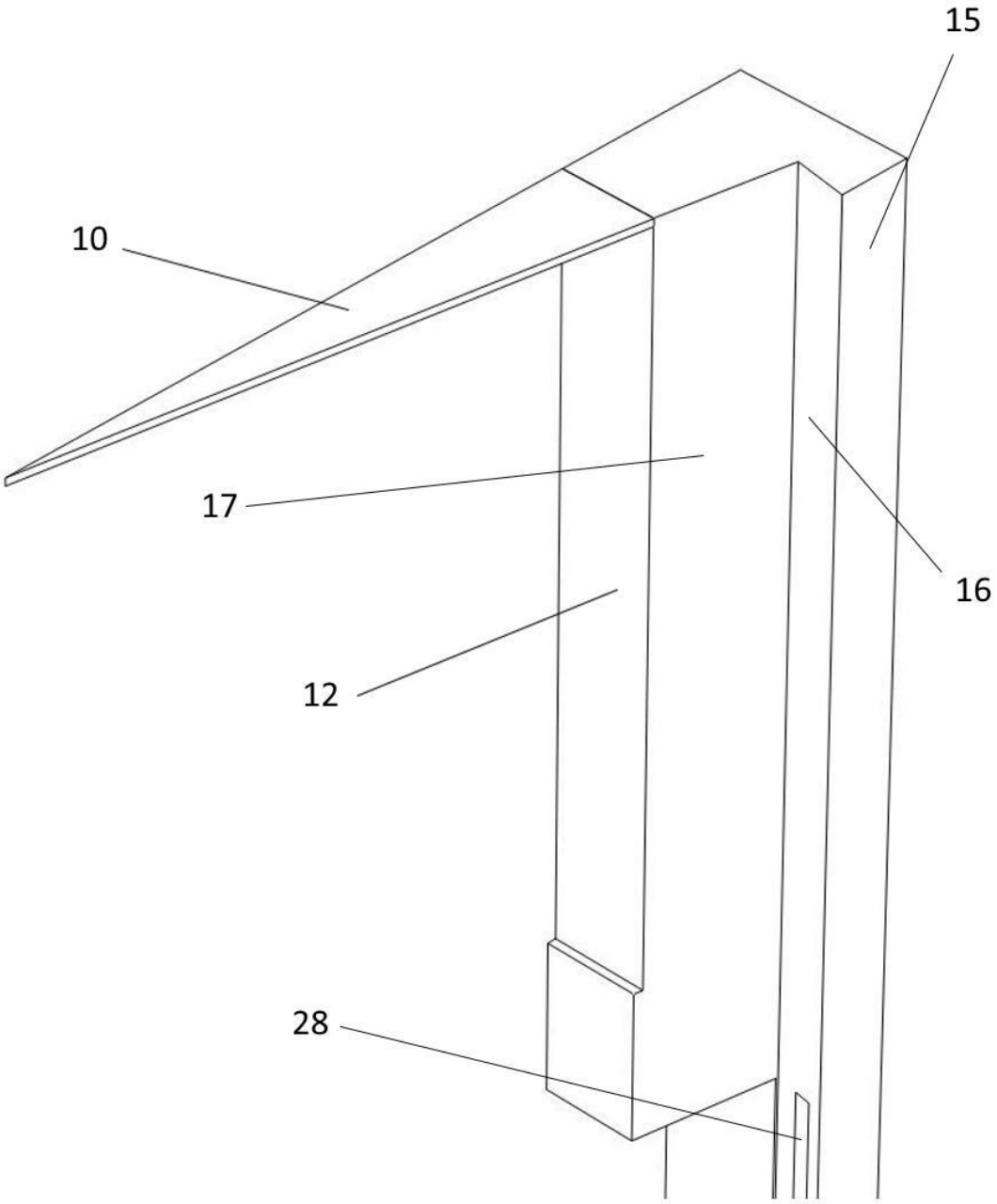


FIG 5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10
17
16
12
28

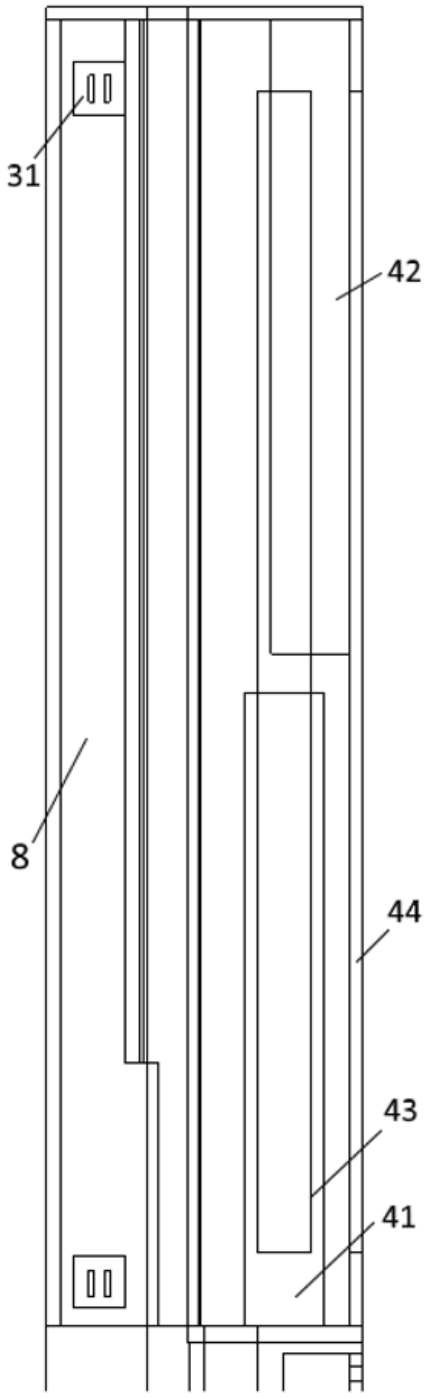


FIG 7

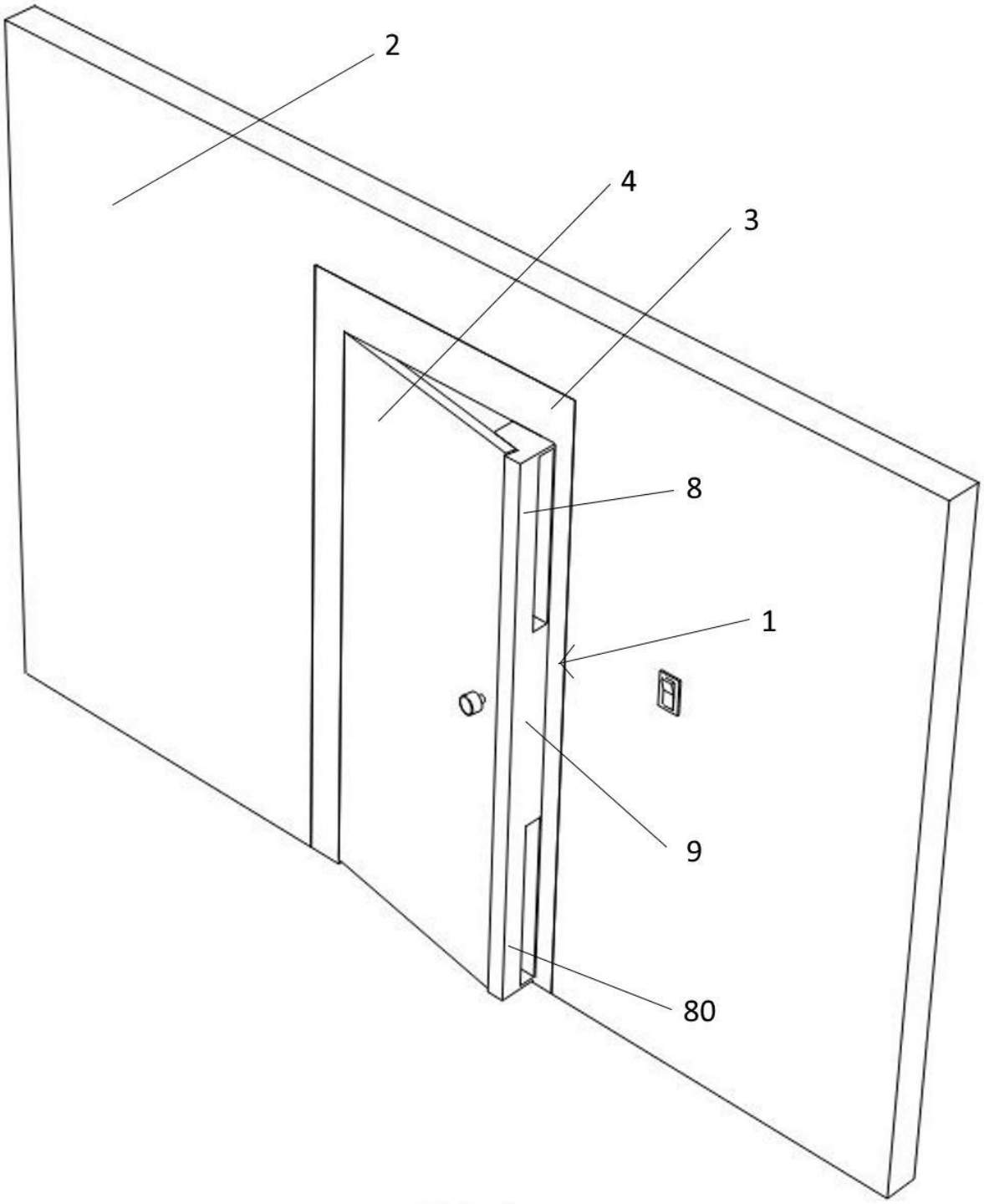


FIG 8

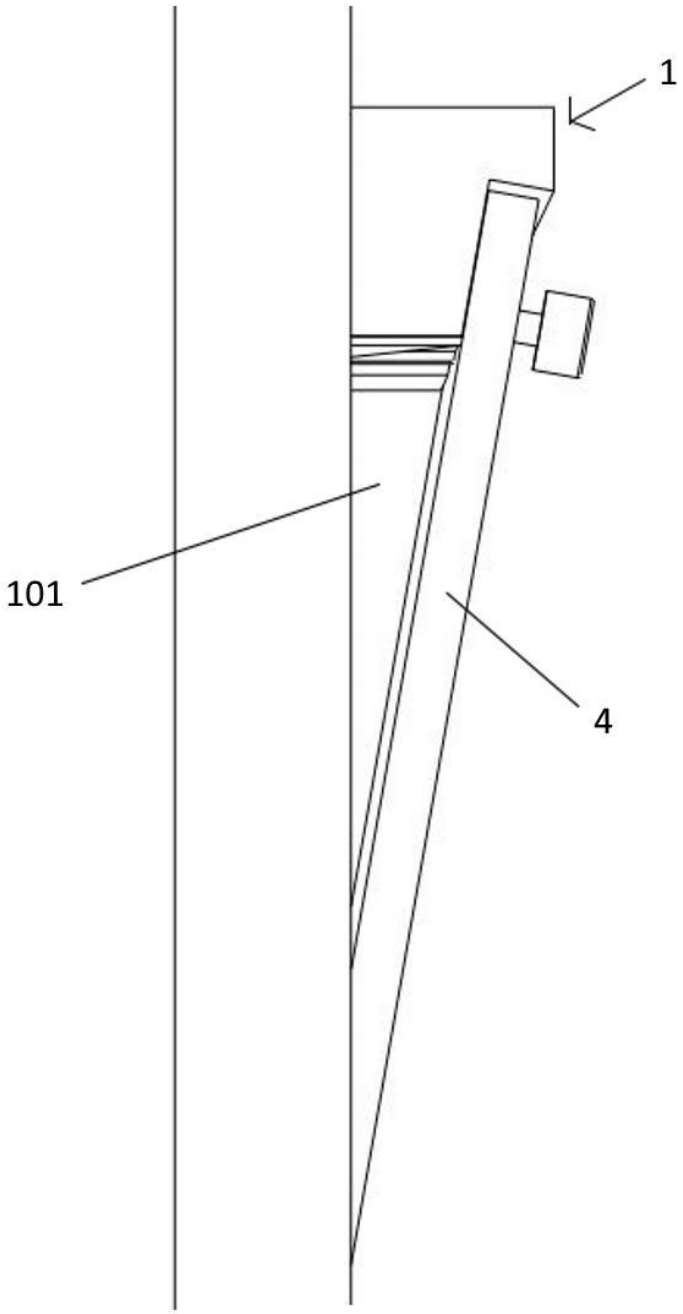
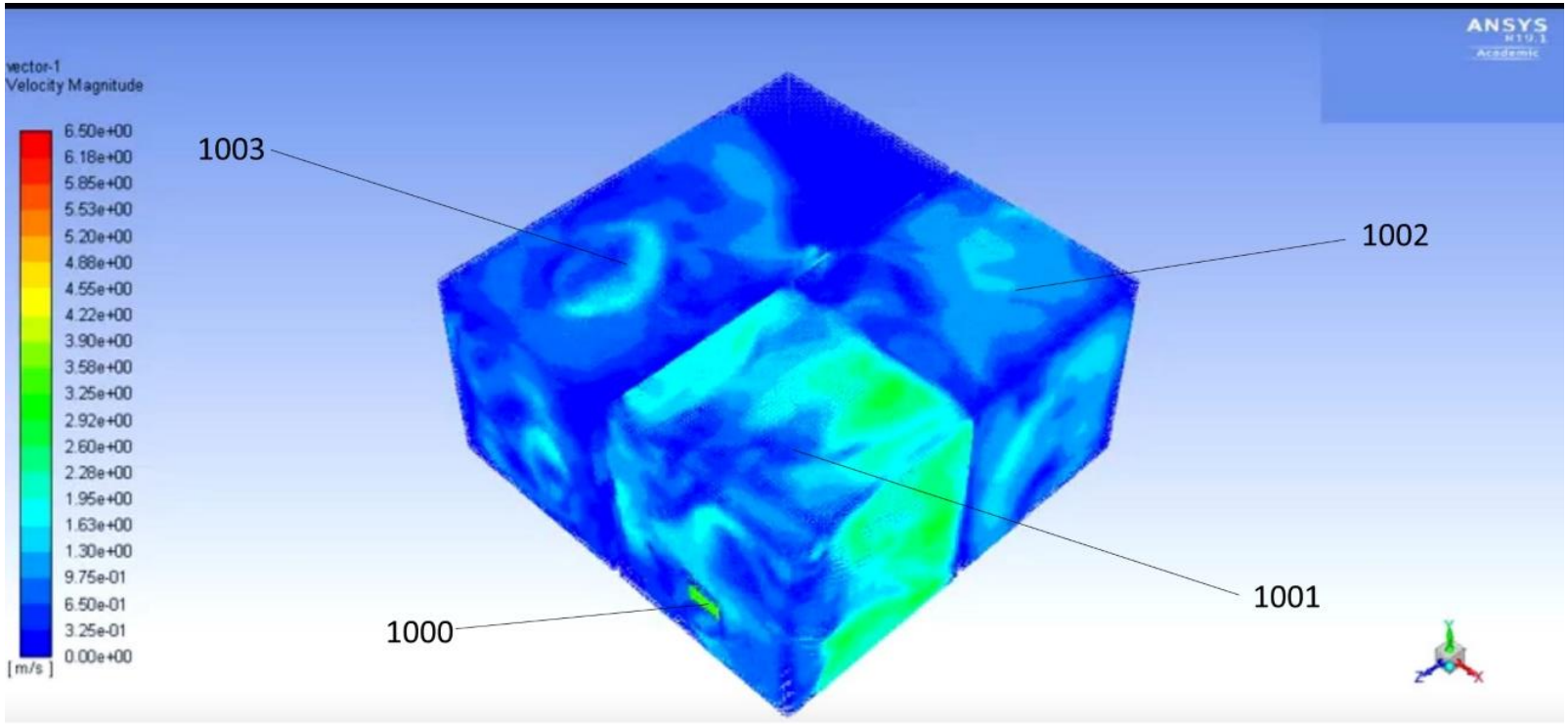


FIG 9


ANSYS
Academic
vector-1
Velocity Magnitude
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9.75e-01
6.50e-01
3.25e-01
0.00e+00
[m/s]
1003
1002
1001
1000

FIG 10

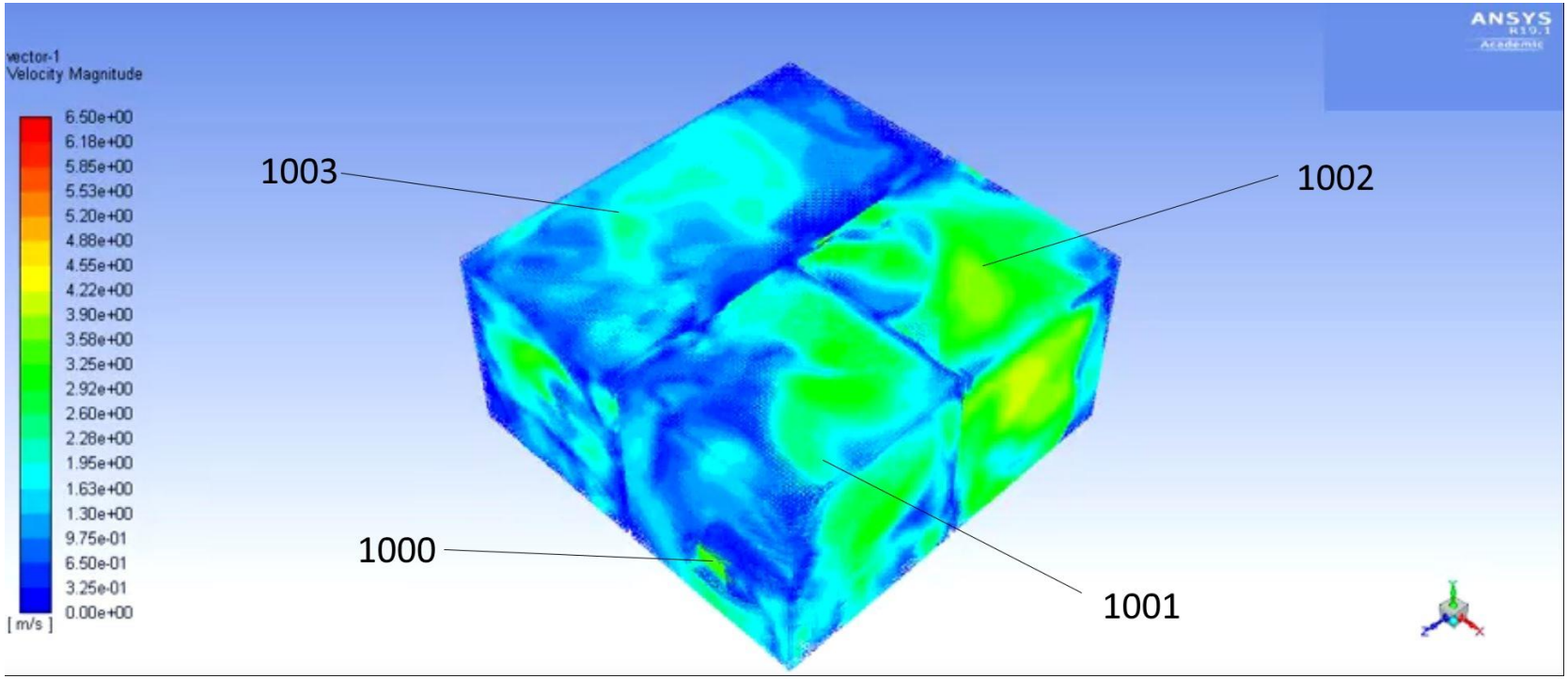
ANSYS
R19.1
Academic
vector-1
Velocity Magnitude
6.50e+00
6.18e+00
5.85e+00
5.53e+00
5.20e+00
4.88e+00
4.55e+00
4.22e+00
3.90e+00
3.58e+00
3.25e+00
2.92e+00
2.60e+00
2.28e+00
1.95e+00
1.63e+00
1.30e+00
9.75e-01
6.50e-01
3.25e-01
0.00e+00
[m/s]
1003
1002
1000
1001

FIG 11