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(54) **BUILDING FIRE LIFE-SAVING SYSTEM AND USE METHOD THEREOF**

(57) The present invention provides a building fire life-saving system and the using method thereof. The system comprises: at least one forced ventilation device (13, 11), at least one main air supply pipe (2) communicating with at least one compartment (6), and at least one main air exhaust pipe (9) arranged to separate from said main air supply pipe, wherein each main air supply pipe is equipped with at least one branch air supply pipe (3), each main air exhaust pipe is equipped with at least one branch air exhaust pipe (7), and said at least one

forced ventilation device is installed at a main air exhaust opening (12) of the main air exhaust pipe and/or a main air supply opening (10) of the main air supply pipe. The present invention proposes a new strategy referred to as "the nearest evacuation" to deal with a fire, achieving benefits superior to that of the prior art, such as, getting into a safe place as soon as possible in the event of fire, reducing harm of toxic gas caused by the fire, reducing the possibility of suffocation, avoiding casualties, as well as providing security.

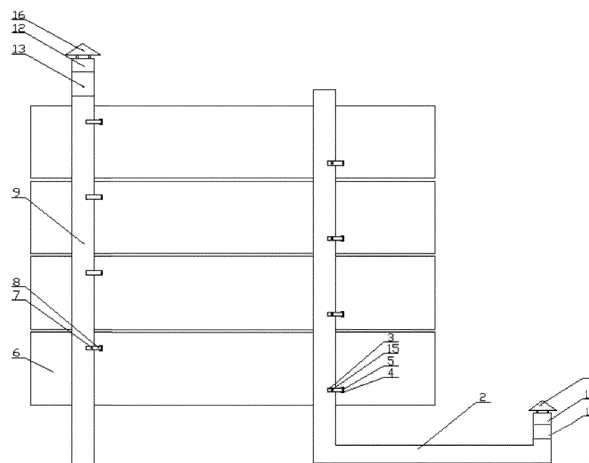


Fig. 4

Description

Technical Field

[0001] The present invention relates to the field of rescue in a building fire hazard, particularly to a rescue device and method, and more particularly to a life-saving system used in a building fire and the using method thereof, that is, a building fire life-saving system and the using method thereof.

Background Art

[0002] Along with the development of national economy of China, more and more buildings are constructed in urban and rural, with the height larger and larger. A high-rise building has a lot of advantages, such as, high rate of land usage and better visual field. However the high-rise building also has its inherent fatal disadvantages, among which the most significant one is that, in the case of fire in a high-rise building, it is difficult for people inside the building, especially those in the higher stories, to be effectively evacuated, and they can only wait for rescue from outside. Further, since the high-rise building has many floors to be very high and at the same time the effective height of rescue facilities (such as, water cannons, fire ladders) is limited, sometimes the rescue facilities cannot reach the height of the floor on which the fire occurs, which makes rescue from outside very difficult. Because of these difficulties, rescue time tends to be prolonged, making injuries and deaths in a fire hazard increased.

[0003] In addition, according to past experiences, the most important cause for injuries and deaths in a fire hazard is suffocation induced from fume, instead of fire burn. In the event of fire, people often attempt to evacuate to outside from the building. At the time of escaping to outside, injuries and deaths from suffocation often occur possibly because of fume produced by the fire, or people might be fell unconscious and burned to die on the way of escaping to outside.

[0004] Therefore, there exists a need to design a system (that is, a building fire life-saving system, which can effectively guarantee safety of people trapped in a fire) or a method, so that in the event of fire (especially a fire in a high-rise building), people can be effectively evacuated, preventing occurrence of injuries and deaths.

Disclosure of the invention

[0005] In order to solve the problems existing in the prior art, the present invention is proposed.

[0006] According to one aspect of the present invention, a building fire life-saving system is provided, comprising at least one forced ventilation device, at least one main air supply pipe communicating with at least one compartment, and at least one main air exhaust pipe provided separately from said main air supply pipe, wherein

each main air supply pipe is equipped with at least one branch air supply pipe, each main air exhaust pipe is equipped with at least one branch air exhaust pipe, and said at least one forced ventilation device is installed at a main air exhaust opening of the main air exhaust pipe and/or a main air supply opening of the main air supply pipe.

[0007] Further, in the building fire life-saving system according to the present invention, the at least one compartment includes a plurality of compartments, the at least one branch air supply pipe of the main air supply pipe and the at least one branch air exhaust pipe of the main air exhaust pipe are installed in each compartment.

[0008] Further, in the building fire life-saving system according to the present invention, the branch air supply pipe is provided with an air supply port located outside the main air supply pipe and an air inlet located inside the main air supply pipe, and the air supply port of the branch air supply pipe is arranged higher than the air inlet of the branch air supply pipe; the branch air exhaust pipe is provided with an air exhaust port located outside the main air exhaust pipe and an air outlet located inside the main air exhaust pipe, and the air exhaust port of the branch air exhaust pipe is arranged higher than the air outlet of the branch air exhaust pipe.

[0009] Further, in the building fire life-saving system according to the present invention, the forced ventilation device is an air-blower located at the main air supply opening and communicated with the main air supply pipe and/or an exhaust fan located at the main air exhaust opening and communicated with the main air exhaust pipe.

[0010] Further, in the building fire life-saving system according to the present invention, in each compartment, the branch air supply pipe and the branch air exhaust pipe are arranged to separate from each other as far as possible, and there is height difference between the position of the air exhaust port of the branch air exhaust pipe and the position of the air supply port of the branch air supply pipe.

[0011] Further, in the building fire life-saving system according to the present invention, each compartment is provided with a sealing anti-fire door or with both a sealing anti-fire door and a sealing anti-fire window.

[0012] Further, in the building fire life-saving system according to the present invention, the main air supply opening and/or the main air exhaust opening is equipped with a protective cover.

[0013] Further, in the building fire life-saving system according to the present invention, a one-way control valve is equipped inside each of the branch air supply pipes and the branch air exhaust pipes.

[0014] Further, in the building fire life-saving system according to the present invention, the number of the branch air supply pipes is equal to the number of the branch air exhaust pipes.

[0015] According to another aspect of the present invention, a using method of the above building fire life-

saving system is provided, comprising:

- 1) hiding in the compartment when a fire happens;
- 2) closing all the doors and windows of the compartment, so that the fire and fume outside cannot spread to the compartment; and
- 3) starting the forced ventilation device.

[0016] In order to achieve the above objects, the present invention uses the following technical solution in which: a building fire life-saving system comprises one main air supply pipe, one main air exhaust pipe and a forced ventilation device, wherein the main air supply pipe is equipped with branch air supply pipes, the branch air supply pipes have air supply ports located outside the main air supply pipe and air inlets located inside the main air supply pipe, the main air exhaust pipe is equipped with branch air exhaust pipes, the branch air exhaust pipes have air exhaust ports located outside the main air exhaust pipe, and air outlets located inside the main air exhaust pipe.

[0017] Preferably, the forced ventilation device is an air-blower, which is connected to the main air supply pipe, and a protective cover is installed at an air supply opening.

[0018] Preferably, the forced ventilation device is an exhaust fan, which is connected to the main air exhaust pipe, and a protective cover is installed at an air exhaust opening.

[0019] Preferably, the forced ventilation device includes an air-blower and an exhaust fan, wherein the air-blower is connected to the main air supply pipe, a protective cover is installed at an air supply opening, the exhaust fan is connected to the main air exhaust pipe, and a protective cover is installed at an air exhaust opening.

[0020] Preferably, a one-way control valve is equipped inside each of the branch air supply pipes and the branch air exhaust pipes.

[0021] Preferably, the number of the branch air supply pipes is equal to the number of the branch air exhaust pipes.

[0022] Preferably, the system further comprises compartments, each of which is provided with a sealing anti-fire door and a sealing anti-fire window, and inside which an air supply port of the branch air supply pipe and an air exhaust port of the branch air exhaust pipe are provided, and there is height difference between the position of the air exhaust port of the branch air exhaust pipe and the position of the air supply port of the branch air supply pipe.

[0023] When a fire occurs in a high-rise building where people engage all kinds of activities, they can quickly go into compartments, such as, bathrooms, washrooms or storage rooms, which are installed with the building fire life-saving system according to the present invention, and at the same time, close the doors and windows (if any). In order to ensure enough oxygen supply to the

compartments, the air supply ports of the branch air supply pipes and the air exhaust ports of the branch air exhaust pipes need to be opened. At this time, since the sealing doors and windows in the bathrooms prevent fume and fire from entering while the branch air supply pipes supply fresh air continuously to the compartments and the branch air exhaust pipes discharge polluted air, the life safety of people in the compartments can be ensured, and the risk that people are suffocated due to inhalation of toxic fume can be avoided.

[0024] In addition, the fire life-saving system according to the present invention proposes a novel principle of evacuation (which is named as a principle of "nearest evacuation"), that is, in case of fire, people can evacuate to a safe place using a way of the nearest evacuation in the shortest time, avoiding hazards of toxic fume to the utmost, and protecting life safety of people to the greatest degree. In the prior art in the world, people usually use a principle of "farthest evacuation" to deal with a fire in a building, that is, people usually move towards a place far away from the fire, however, during the process of moving away from the fire, they will be harmed by toxic fume, and even unconsciousness and life-threatening, due to a long distance (especially when in higher floors of a high-rise building) of moving. The inventor of the present invention designs the principle of "nearest evacuation" as well as the life-saving system for fire and its using method realizing the principle in an innovative way through creative work.

Brief Description of Drawings

[0025]

- Fig. 1 is a structural schematic view of Embodiment 1 of the present invention;
 Fig. 2 is a structural schematic view of Embodiment 2 of the present invention;
 Fig. 3 is a structural schematic view of Embodiment 3 of the present invention; and
 Fig. 4 is a structural schematic view of a preferred embodiment of the present invention.

Detailed Description of Embodiments

[0026] Below, exemplary embodiments of the present invention are described in detail with reference to the figures. These exemplary embodiments are provided for the purpose of making those ordinary skilled in the art clearly understand and implement the present invention according to the description herein. The figures and the exemplary embodiments as well as the preferred embodiment are not intended to limit the present invention, and the scope of the present invention is defined by the appended claims.

[0027] Referring to Figs. 1 to 4, the present invention provides a building fire life-saving system, which may comprise at least one forced ventilation device, and two

forced ventilation devices 13, 11 are shown in the figures. The building fire life-saving system further comprises at least one main air supply pipe communicating with one or more compartments 6 and at least one main air exhaust pipe provided separately from the main air supply pipe. Herein, one main air supply pipe 2 and one main air exhaust pipe 9 are shown as an example. As shown in the figures, each main air supply pipe 2 is equipped with at least one branch air supply pipe 3, and correspondingly, each main air exhaust pipe is equipped with at least one branch air exhaust pipe 7. As an example, two forced ventilation devices are respectively installed at a main air exhaust opening 12 of the main air exhaust pipe and/or a main air supply opening 10 of the main air supply pipe.

[0028] Preferably, the main air supply pipe and the main air exhaust pipe as well as the branch air supply pipe and the branch air exhaust pipe may be made of or coated with fire protection and/or thermal insulation material.

[0029] Generally, referring to Figs. 1-4, a plurality of the compartments can be provided, each compartment is installed with at least one branch air supply pipe of the main air supply pipe and at least one branch air exhaust pipe of the main air exhaust pipe, and thus each compartment can be subjected to ventilation and air-change. The compartments can be original spaces inside the building, such as bathrooms, storage rooms etc., so that the building fire life-saving system can provide shelters for people during a fire, without modifying the original architectural construction in the building.

[0030] Preferably, in the building fire life-saving system of the present invention, each branch air supply pipe is provided with an air supply port 5 located outside the main air supply pipe and an air inlet located inside the main air supply pipe.

[0031] Meanwhile, preferably, each branch air exhaust pipe is provided with an air exhaust port 8 located outside the main air exhaust pipe and an air outlet located inside the main air exhaust pipe.

[0032] Preferably, in the building fire life-saving system of the present invention, the forced ventilation device may be an air-blower 11 located at the main air supply opening 10 and communicated with the main air supply pipe 2 (referring to Fig. 2), or the forced ventilation device may be an exhaust fan 13 located at the main air exhaust opening 12 and communicated with the main air exhaust pipe 9 (referring to Fig. 3). Furthermore, preferably, the forced ventilation device may include both the air-blower 11 located at the main air supply opening 10 and communicated with the main air supply pipe 2 and the exhaust fan 13 located at the main air exhaust opening 12 and communicated with the main air exhaust pipe 9 (referring to Figs. 1 and 4).

[0033] Preferably, in the building fire life-saving system of the present invention, when each compartment is provided with the branch air supply pipe 3 and the branch air exhaust pipe 7, in order to provide the best ventilation

effect for each compartment, the branch air supply pipe and the branch air exhaust pipe may be arranged to separate from each other as far as possible (as best shown in Fig. 4), and there is height difference between the position of the air exhaust port of the branch air exhaust pipe and the position of the air supply port of the branch air supply pipe (referring to Figs. 1 to 4), so that ventilation efficiency of each compartment can be improved.

[0034] Preferably, in the building fire life-saving system of the present invention, the compartments are required to have sealing anti-fire doors (not shown) or have both sealing anti-fire doors and sealing anti-fire windows (not shown), so that in the event of fire, fire and fume will not spread into the compartments through the doors or windows, ensuring life safety of people evacuated into the compartments.

[0035] Preferably, in the building fire life-saving system of the present invention, referring to Figs. 1 to 4, in order to prevent external dust or foreign matters from falling into the main air supply opening and/or the main air exhaust opening, the main air supply opening and/or the main air exhaust opening may be equipped with protective covers 1, 16, keeping cleanness inside the main air exhaust pipe and the main air supply pipe, and thus ensuring good ventilation effect.

[0036] Preferably, in the building fire life-saving system of the present invention, referring to Figs. 1 to 4, the branch air supply pipe 3 may be equipped therein with a one-way control valve 15, which is used to ensure gas to flow through the control valve in one direction, and thus ensure the gas in the branch air supply pipe to flow into the bathroom, however block the gas in the bathroom from flowing into the main air supply pipe, so as to ensure the quality of the air in the bathroom to meet the normal oxygen need of persons in the bathroom.

[0037] Preferably, in the building fire life-saving system of the present invention, the number of the branch air supply pipes may set as equal to the number of the branch air exhaust pipes (referring to Figs. 1-4), but this is not necessary. The branch air supply pipe(s) and the branch air exhaust pipe(s) are correspondingly mounted in each compartment, and the number of the branch air supply pipes and the number of the branch air exhaust pipes may be set differently, which can also achieve the technical effect of the present invention.

[0038] Optionally, in order to provide a water source to the compartment in the event of fire for the purpose of lowering temperature and extinguishing fire, the original water source in the compartment may be used, or a water tank at the top of the building or another water source in other positions may be introduced into the compartment by additional pipes (or the original air exhaust pipes).

[0039] In order to better achieve the technical effects of the present invention, preferred embodiments of the present invention are provided in the following, for the purpose of clearly illustrating the present invention, instead of limiting the protection scope of the invention.

Embodiment 1:

[0040] A building fire life-saving system as shown in Fig. 1 comprises one main air supply pipe 2, one main air exhaust pipe 9 and forced ventilation devices, wherein the main air supply pipe 2 is equipped with branch air supply pipes 3, air supply ports 5 of the branch air supply pipes 3 are located outside the main air supply pipe 2, air inlets of the branch air supply pipes 3 are located inside the main air supply pipe 2, and each of the branch air supply pipes 3 is equipped therein with the one-way control valve 15. The main air exhaust pipe 9 is equipped with branch air exhaust pipes 7, air exhaust ports 8 of the branch air exhaust pipes 7 are located outside the main air exhaust pipe 9, and air outlets of the branch air exhaust pipes 7 are located inside the main air exhaust pipe 9.

[0041] The forced ventilation devices are an air-blower and an exhaust fan. The air-blower 11 is located at an air supply opening 10 of the main air supply pipe 2 to supply gas, such as air and oxygen, to the main air supply pipe, and a protective cover 1 is provided. The exhaust fan 13 is located at an air exhaust opening 12 of the main air exhaust pipe 9, which is equipped with a protective cover 16.

[0042] The branch air supply pipes and the branch air exhaust pipes are equal and corresponding to each other in terms of number and position. The function of the branch air supply pipes and the branch air exhaust pipes is to create air exchange inside the bathroom.

[0043] The life-saving system further comprises compartments 6 with sealing anti-fire doors and windows. The main air supply pipe 2 and the main air exhaust pipe 9 are communicated with the compartments respectively through the branch air supply pipes 3 and the branch air exhaust pipes 7 therein, and there is height difference between the position of the air exhaust port 8 of the branch air exhaust pipe and the position of the air supply port 5 of the branch air supply pipe. The air supply port 5 of each branch air supply pipe is equipped with a seal cap 4, and the air exhaust port 8 of each branch air exhaust pipe is also equipped with a seal cap.

[0044] Diameters of the main air supply pipe and the main air exhaust pipe can be selected properly according to height of a building. The main air supply pipe, the branch air supply pipes, the main air exhaust pipe and the branch air exhaust pipes are all made of various non-toxic and odorless materials, such as plastic, metal, glass steel, fiber, wood and bamboo.

[0045] During the usage of the present invention, preferably the toilet, bathroom or storage room in a building is used as the compartment. The doors and windows are treated with fire protection material for sealing. The air supply opening of the main air supply pipe is located on the lawn, parterre and grove around the building where the air is fresh, or on a position away from fire, such as a gable wall or basement of the building. The air exhaust port of the branch air supply pipe is located inside the

bathroom. The air exhaust opening of the main air exhaust pipe is located at the gable wall on the top of the building or at the top of the building, and the air exhaust port of the branch gas air exhaust pipe is located inside the bathroom.

[0046] Based on the performance of air, when a fire occurs, the forced ventilation device is immediately started by a rescue personnel on the ground outside the building, that is, the multi-functional air-blower or ventilator for air or oxygen located at the air supply opening of the main air supply pipe is started, and the air is delivered through a pipeline network consisting of the main air supply pipe and the branch air supply pipes to every bathroom of the building, which can improve and replenish fresh air in the bathroom in time; and at the same time, the multi-functional exhaust fan or suction fan located at the air exhaust opening of the main air exhaust pipe is started, such that the foul air in the bathroom is forcibly removed through the ports of the branch air exhaust pipes in the bathrooms. Therefore, uninterrupted air exchange is supported by the air supply pipe and the air exhaust pipe in the bathroom. Alternatively, an automatic temperature sensing controller may be installed in a floor provided with the building fire life-saving system and connected with a starting system of the forced air exchange device. Under normal circumstances, the automatic temperature sensing controller is in a sleep state and almost does not consume energy. In the case of a fire occurring in a building, when the temperature inside the building reaches a set temperature value of the automatic temperature sensing controller, the automatic temperature sensing controller will start the forced ventilation device automatically. When the temperature in the building returns to normal, the automatic temperature sensing controller is restored to the sleep state automatically. The one-way control valve in the branch air supply pipe ensures the air in the main air supply pipe to flow into the bathroom and blocks the air in the bathroom from flowing into the main air supply pipe, so as to ensure the quality of the air in the bathroom to meet the normal oxygen need of persons in the bathroom.

[0047] When a fire occurs, people will quickly go into the bathroom, close the doors and windows, and open the air supply port of the branch air supply pipe and the air exhaust port of the branch air exhaust pipe. The doors and windows in the bathroom block fume and fire, the branch air supply pipe supplies fresh air, and the branch air exhaust pipe discharges the foul air, therefore the life safety of the people in the bathroom can be ensured.

Embodiment 2:

[0048] The present embodiment is the same as Embodiment 1, except that the forced ventilation device is merely an air-blower 11, which is located at the air supply opening 10 of the main air supply pipe 2.

Embodiment 3:

[0049] The present embodiment is the same as Embodiment 1, except that the forced ventilation device is merely an exhaust fan 13, which is located at the main air exhaust opening 12 of the main air exhaust pipe 9.

Embodiment 4:

[0050] This embodiment is essentially the same as Embodiment 1 except that in this embodiment, when each compartment 6 is provided with the branch air supply pipe 3 and the branch air exhaust pipe 7, in order to provide the best ventilation effect for each compartment, the branch air supply pipe 3 and the branch air exhaust pipe 7 in each compartment may be arranged to separate from each other as far as possible (as best shown in Fig. 4), and there is height difference between the position of the air exhaust port of the branch air exhaust pipe and the position of the air supply port of the branch air supply pipe, so that ventilation efficiency of each compartment can be improved.

[0051] The present invention discloses a building fire life-saving system and the using method thereof. The building fire life-saving system comprises one main air supply pipe, one main air exhaust pipe and a forced ventilation device, wherein the main air supply pipe is equipped with a branch air supply pipe, which is provided with an air supply port located outside the main air supply pipe and an air inlet located inside the main air supply pipe; and the main air exhaust pipe is equipped with a branch air exhaust pipe, which is provided with an air exhaust port located outside the main air exhaust pipe and an air outlet located inside the main air exhaust pipe. The building fire life-saving system is placed in bathrooms, washrooms and other compartments in a high-rise building where people reside and work and engage all kinds of activities. When a fire occurs, people will quickly go into the bathroom, close the doors and windows, and open the air supply ports of the branch air supply pipes and the air exhaust ports of the branch air exhaust pipes. The sealing doors and windows in the bathrooms block fume and fire, the branch air supply pipes supply fresh air, and the branch air exhaust pipes discharge foul air, therefore the life safety of the people in the bathroom can be ensured, and it can be avoided that people suffer the suffocation due to inhalation of toxic fume.

[0052] The building fire life-saving system and using method thereof according to the present invention changes the original principle of "escaping" in which people escape as far as possible away from a firing building in case of fire, and proposes a new fire evacuation strategy, namely, a novel principle of "nearest evacuation". The building fire life-saving system is installed in facilities of a building, allowing people to enter a safe place as soon as possible, avoiding danger of suffocation, reducing the extent of hazards from the toxic gas caused by fire, and

greatly improving life safety of people in case of fire.

[0053] Although the preferred embodiments of the present invention have been illustrated and described, various changes and variations may be made, without departing from the spirit and scope of the present invention. Thus, it should be understood that the present invention has been described by way of example, instead of limitation.

Claims

1. A building fire life-saving system, comprising at least one forced ventilation device (13, 11), at least one main air supply pipe (2) communicating with at least one compartment (6), and at least one main air exhaust pipe (9) arranged to separate from said main air supply pipe, wherein each main air supply pipe is equipped with at least one branch air supply pipe (3), each main air exhaust pipe is equipped with at least one branch air exhaust pipe (7), and said at least one forced ventilation device is installed at a main air exhaust opening (12) of the main air exhaust pipe and/or a main air supply opening (10) of the main air supply pipe.
2. The building fire life-saving system according to Claim 1, wherein the at least one compartment includes a plurality of compartments, and the at least one branch air supply pipe of the main air supply pipe and the at least one branch air exhaust pipe of the main air exhaust pipe are installed in each compartment.
3. The building fire life-saving system according to Claim 1, wherein the branch air supply pipe is provided with an air supply port (5) located outside the main air supply pipe and an air inlet located inside the main air supply pipe, and the air supply port of the branch air supply pipe is arranged higher than the air inlet of the branch air supply pipe; the branch air exhaust pipe is provided with an air exhaust port (8) located outside the main air exhaust pipe and an air outlet located inside the main air exhaust pipe, and the air exhaust port of the branch air exhaust pipe is arranged higher than the air outlet of the branch air exhaust pipe.
4. The building fire life-saving system according to Claim 1, wherein the forced ventilation device is an air-blower located at the main air supply opening and communicated with the main air supply pipe and/or an exhaust fan located at the main air exhaust opening and communicated with the main air exhaust pipe.
5. The building fire life-saving system according to Claim 1, wherein in each compartment, the branch

air supply pipe and the branch air exhaust pipe are arranged to separate from each other as far as possible.

6. The building fire life-saving system according to Claim 1, wherein each compartment is provided with a sealing anti-fire door, or with both a sealing anti-fire door and a sealing anti-fire window. 5
7. The building fire life-saving system according to Claim 1, wherein the main air supply opening and/or the main air exhaust opening is equipped with a protective cover. 10
8. The building fire life-saving system according to any of Claims 1 to 7, wherein each of the branch air supply pipes is equipped therein with a one-way control valve. 15
9. The building fire life-saving system according to any of Claims 1 to 7, wherein the number of the branch air supply pipes is equal to the number of the branch air exhaust pipes. 20
10. A using method of the building fire life-saving system according to any of Claims 1 to 9, comprising: 25
 - 1) hiding in the compartment in time in case of fire;
 - 2) closing all the doors and windows in the compartment, so that the fire and fume outside cannot spread to the compartment; and 30
 - 3) starting the forced ventilation device.

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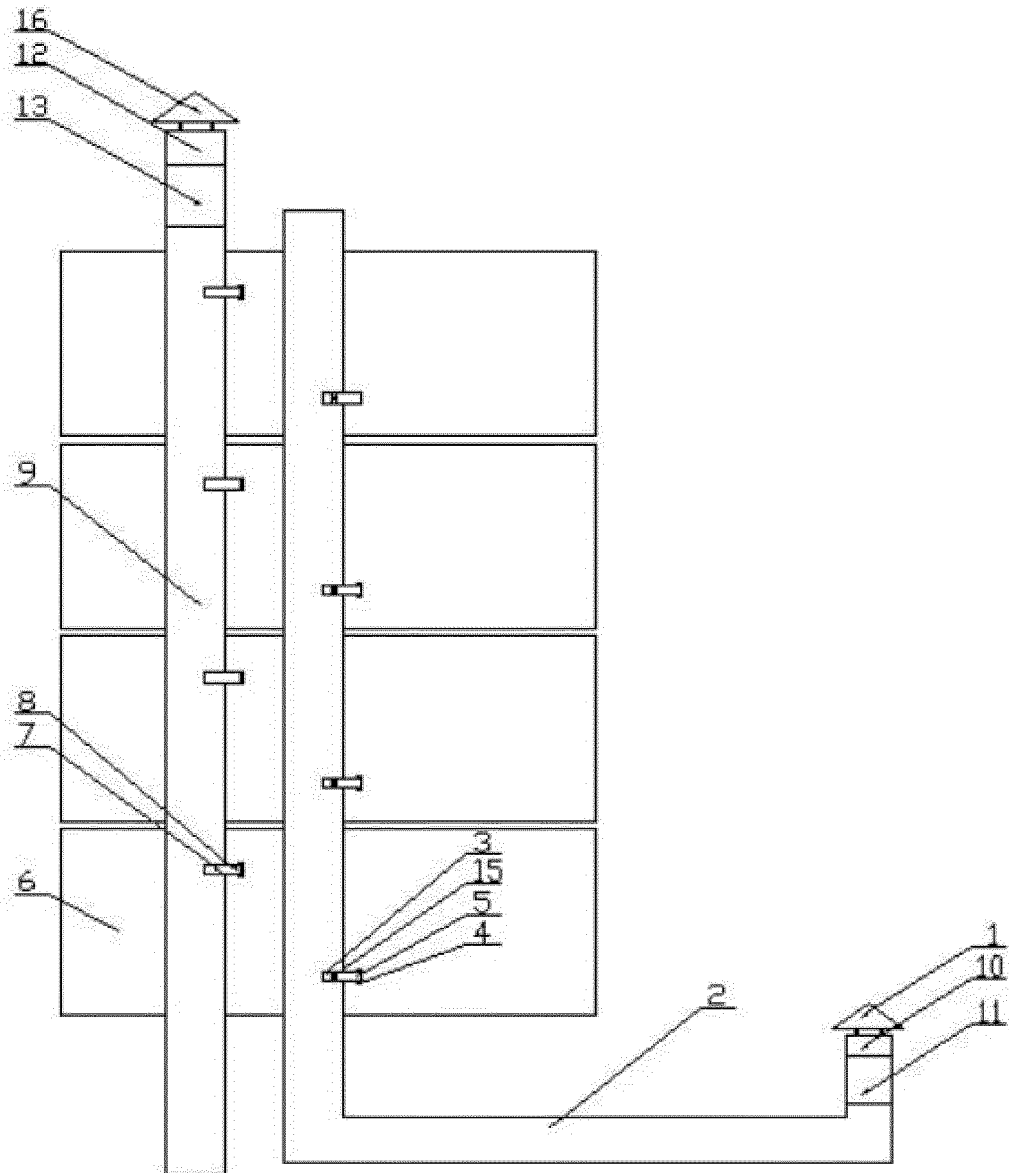


Fig. 1

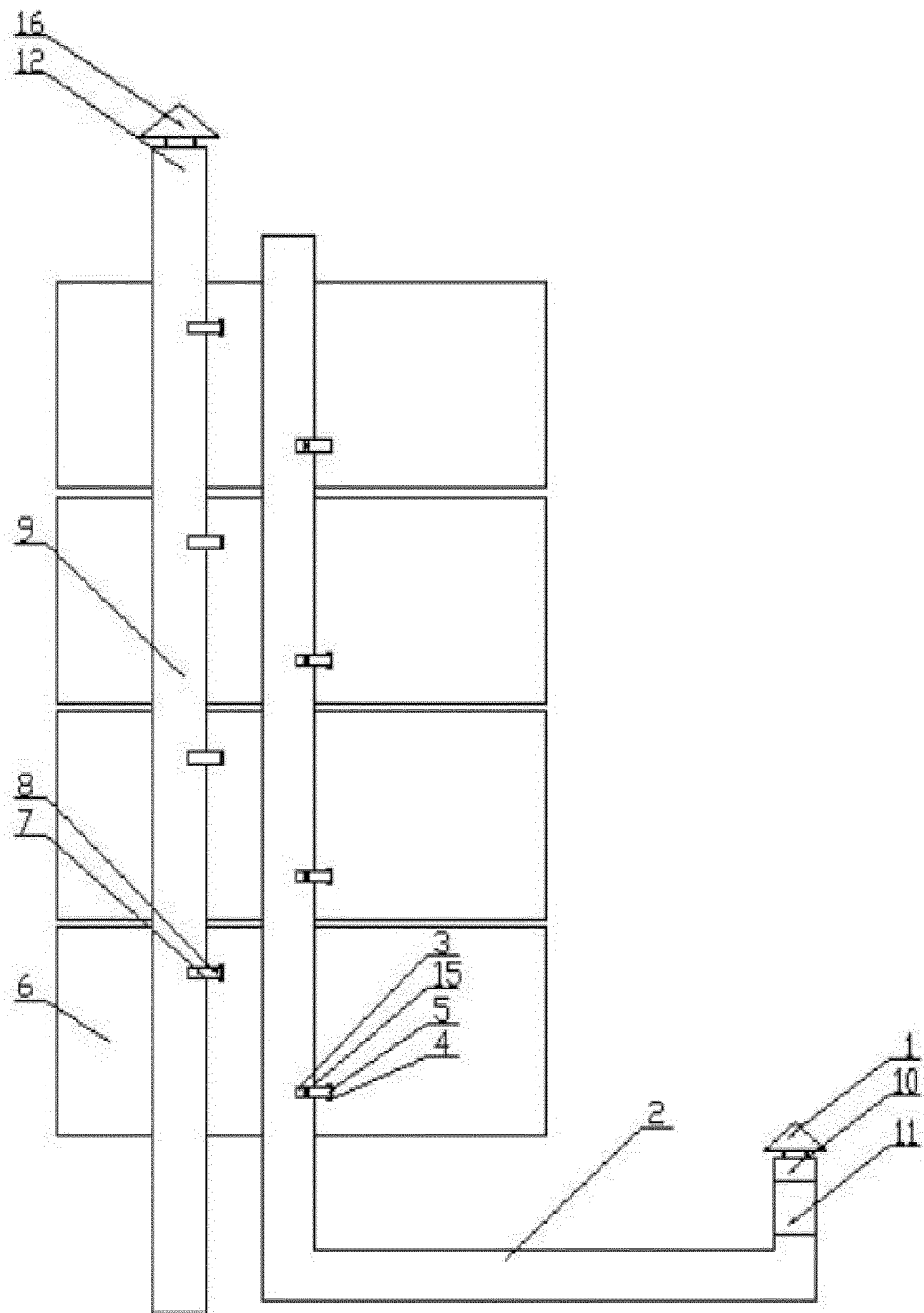


Fig. 2

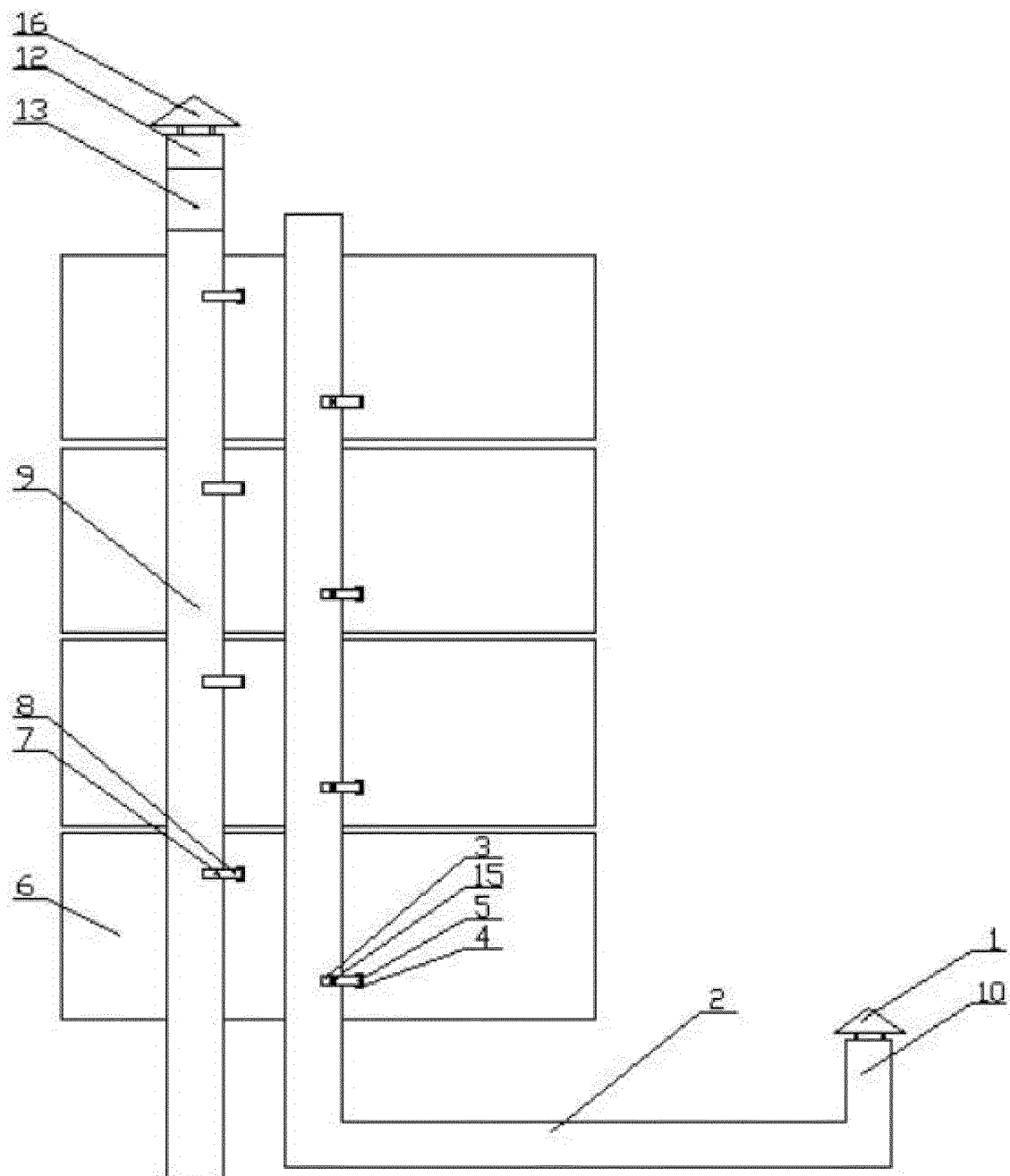


Fig. 3

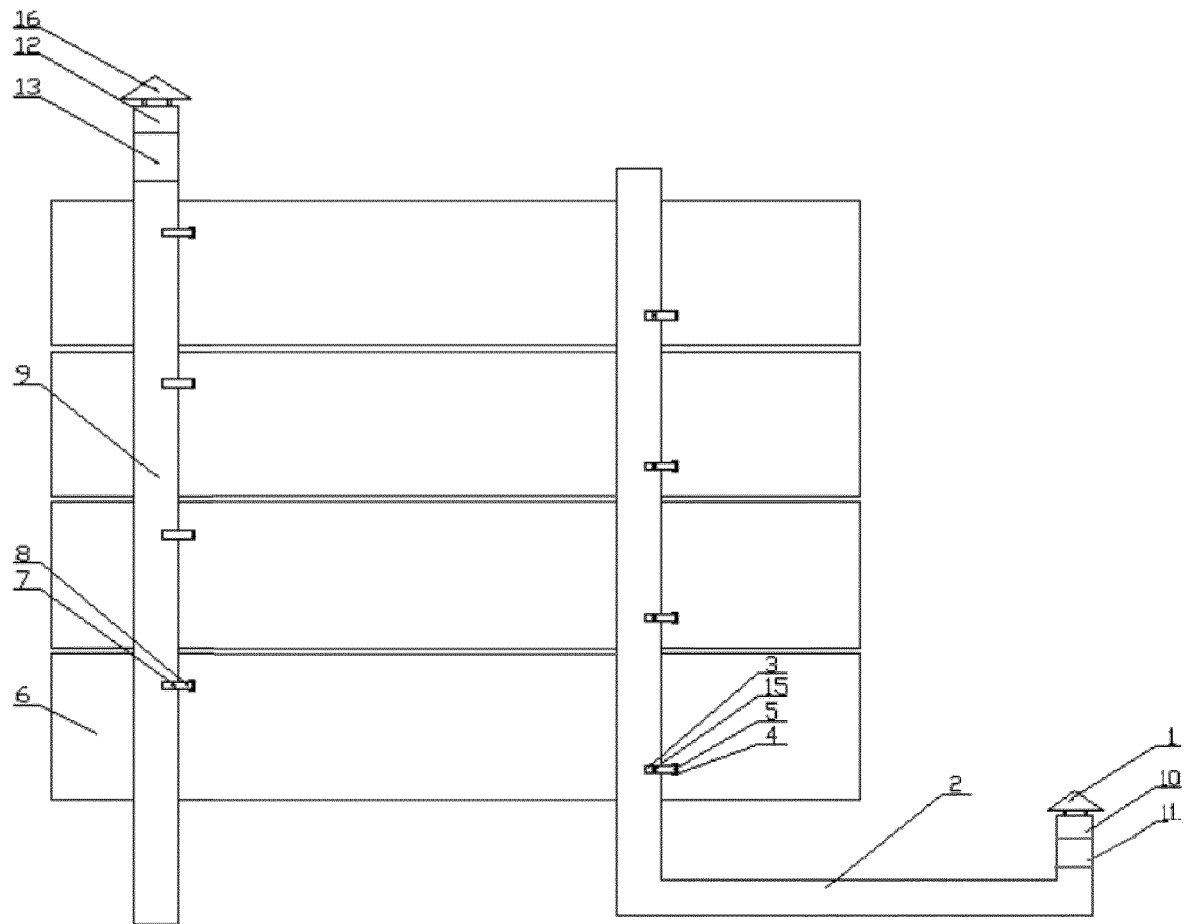


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/074541

A. CLASSIFICATION OF SUBJECT MATTER

A62B 11/00 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A62B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, VEN: blower, exhaust fan, air supply pipe, air exhaust pipe, building, mansion, hose, tube, pipe, duct, conduit, pipeline, fan, vane, lifesav+, escap+, shelter+, rescu+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 202682593 U (ZHAO, Jingcan), 23 January 2013 (23.01.2013), claims 1-4, particular embodiments, and figure 1	1-10
Y	CN 201276861 Y (TANG, Hui), 22 July 2009 (22.07.2009), claim 3, and figure 3	1-10
PX	CN 203169860 U (ZHAO, Jingcan), 04 September 2013 (04.09.2013), claims 1-7, and particular embodiments, figure 1	1-10
A	CN 101725242 A (ZHANG, Xiaoqiang), 09 June 2010 (09.06.2010), the whole document	1-10
A	CN 202005965 U (YUAN, Shizheng), 12 October 2011 (12.10.2011), the whole document	1-10
A	CN 102080457 A (XIA, Fengyi), 01 June 2011 (01.06.2011), the whole document	1-10

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 22 May 2014 (22.05.2014)	Date of mailing of the international search report 11 June 2014 (11.06.2014)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer JIN, Yong Telephone No.: (86-10) 62084461

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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