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(54) **HEATING APPARATUS AND COMBINED SYSTEM WITH AN IMPROVED CONTROL OF A HUMIDIFYING DEVICE**

(57) The invention concerns a heating apparatus (10) for regulating the temperature of a room, comprising:
- a housing (14) having a connecting portion (16) configured to be connected to a humidifying device (18) to humidify the room, and

- a control device (20) configured to control a humidifying device (18) connected to the connecting portion (16) depending on at least one parameter representative of a future need of humidity regulation in the room.

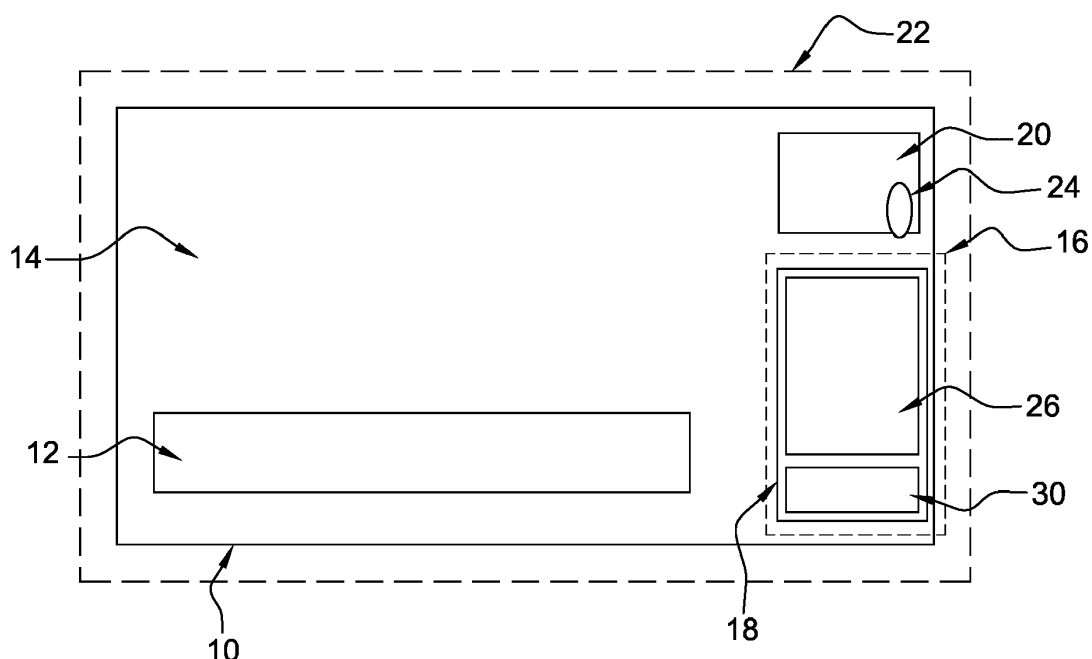


Fig. 1

Description

[0001] The invention concerns a heating apparatus and combined system with an improved control of a humidifying device.

[0002] When the humidity in a room or a building is considered to be low or unsatisfactory, it is known from the art to use a humidifier to increase the humidity in the room with steam or water particles diffusion. The humidifier may be an independent humidifier or an apparatus combining a humidifying function with one or more other function. As an example of such a combined apparatus, a heating apparatus may combine both heating and humidifying functions that can be independently or simultaneously operated to respectively change the temperature and the humidity in the room.

[0003] Document CN 201421135 Y is directed to such a heating apparatus including a humidifier and a humidity sensor able to perform humidity measurements in the room. The heating apparatus further comprises a microcontroller configured to switch off or switch on the humidifier depending on the humidity measurements performed by the humidity sensor. Particularly, when the humidity in the room reaches a predetermined low humidity value, the humidifier is switched on whereas when the humidity in the room reaches a predetermined high humidity value, the humidifier is switched off. Therefore, the humidification is controlled in a direct manner. In other words, the regulation of the humidity is operated in response to a real-time measurement.

[0004] A major drawback of an apparatus such as the heating apparatus described in document CN 201421135 Y is that the reactivity of the humidity regulation is unsatisfactory, notably when a quick change in humidity regulation is needed. Indeed, when an important variation of the humidity occurs in the room, the heating apparatus is unable to quickly regulate the humidity. Indeed, the humidity is regulated only after the unsatisfactory humidity variation is detected by the humidity sensor, the humidifier is controlled by the microcontroller and the action of the humidifier acts on the unsatisfactory humidity in the room.

[0005] There is therefore a need for a heating apparatus comprising a controlled humidifier able to satisfy a humidity regulation need in an improved efficiency and reaction time when a humidity regulation need occurs.

[0006] The invention thus provides a heating apparatus for regulating the temperature of a room, comprising:

- a housing having a connecting portion configured to be connected to a humidifying device to humidify the room, and
- a control device configured to control a humidifying device connected to the connecting portion depending on at least one parameter representative of a future need of humidity regulation in the room.

[0007] Providing the heating apparatus with a control

device able to control a humidifying device depending on at least one parameter representative of a future need of humidity regulation in the room allows the heating apparatus to improve the reaction time of the humidity regulation in the room when connected to the humidifying device. Indeed, in this case, the humidifying device can be controlled to regulate the humidity at a moment where an unsatisfactory variation of the humidity is suspected but not has yet occurred. Particularly, the humidity is regulated depending on a situation where the humidity is satisfactory but also where a parameter shows that a future humidity regulation will be needed later. Therefore, the heating apparatus is able to anticipate a future need in the humidity regulation to make the period during which the humidity is unsatisfactory as short as possible because the humidity regulation will have been started before the humidity is determined to be unsatisfactory.

[0008] According to an embodiment of the heating apparatus, the control device is configured to receive the at least one parameter from a sensing device.

[0009] According to an embodiment of the heating apparatus, the at least one parameter is one or more among: a presence detection, a humidification level, a brightness level or detection, an acoustic level or detection.

[0010] According to an embodiment of the heating apparatus, it further comprises a heating device, the control device being also configured to control the heating device to regulate the temperature in the room.

[0011] According to an embodiment of the heating apparatus, the heating device and the connecting portion are positioned such that heat generated by the heating device improves humidity generation when the humidifying device is connected to the connecting portion.

[0012] According to an embodiment of the heating apparatus, the connecting portion of the housing is configured such that the humidifying device is disposed inside the housing when the humidifying device is connected to the connecting portion.

[0013] According to an embodiment of the heating apparatus, the connecting portion of the housing is configured such that the humidifying device is disposed outside the housing when the humidifying device is connected to the connecting portion.

[0014] The invention also provides a combined system comprising:

- a heating apparatus according to any one of the preceding claims,
- a humidifying device connected to the connecting portion of the housing, and
- a sensing device configured to determine and transmit the at least one parameter to the control device.

[0015] According to an embodiment of the combined system, at least a part of the sensing device comprises on or more among: a presence sensor, a humidity sensor, a light sensor and an acoustic sensor.

[0016] According to an embodiment of the combined system, at least a part of the sensing device is positioned in the housing of the heating apparatus.

[0017] According to an embodiment of the combined system, at least a part of the sensing device is positioned in the humidifying device.

[0018] According to an embodiment of the combined system, the humidifying device comprises:

- a tank for storing water,
- a humidity generation area in fluid communication with the tank,
- a humidity generation device near the humidity generation area and configured to generate humidification from water located in the humidity generation area,
- a diffusing conduit communicating with the humidity generation area to release humidification outside the humidifying device.

[0019] According to an embodiment of the combined system, it further comprises an essential oil diffuser.

[0020] The invention is described in more detail below by way of the figures that show only one preferred embodiment of the invention.

Figure 1 shows a diagram of a heating apparatus according to the invention including a humidifying device within the housing of the heating apparatus.

Figure 2 shows a diagram of another embodiment of the heating apparatus according to figure 1 wherein the humidifying device is positioned outside the housing of the heating apparatus.

Figure 3 and 4 show perspective and face views of the humidifying device of figure 1.

[0021] As shown on figure 1, a heating apparatus 10 is provided for regulating the temperature of a room (not shown). The heating apparatus 10 comprises a housing 14 and a heating device 12 installed within the housing 14 to transfer heat to the room. The housing 14 forms an external cover in which all or part of the elements of the heating apparatus 10 are installed. The heating device 12 may be of any type of electrical heating devices. As an example, the heating device 12 may be a radiant heater or a convection heater.

[0022] The heating apparatus 10 is configured to be connected to a humidifying device 18 to humidify the room. Particularly, the housing 14 of the heating apparatus 10 has a connecting portion 16 that is configured to be connected to the humidifying device 18. As shown on figure 1, the connecting portion 16 of the housing 14 is configured such that the humidifying device 18 is disposed inside the housing 14 when the humidifying device 18 is connected to the connecting portion 16. The connecting portion 16 is formed on a side of the heating de-

vice 12. Preferably, the connecting portion 16 is formed at the periphery of the housing 14 to facilitate the installation of the humidifying device 18 in the connecting portion 16. Alternatively, the connecting portion 16 may be formed at any position allowing the humidifying device 18 to be connected to the housing 14. As shown on figure 2, the connecting portion 16 of the housing 14 may alternatively be configured such that the humidifying device 18 is disposed outside the housing 14 when the humidifying device 18 is connected to the connecting portion 16. In other words, the connecting portion 16 may alternatively be formed on a sidewall of the housing 14 to further facilitate the installation of the humidifying device 18.

[0023] Furthermore, to improve withdrawal of the humidifying device 18, the humidifying device 18 and the connecting portion 16 may be configured such that the humidifying device 18 is removable from the housing 14. In other words, the humidifying device 18 may be manually withdrawn from the connecting portion 16. Particularly, the humidifying device 18 may be withdrawn from the connecting portion 16 without disassembling or opening the entire housing 14, even when the connecting portion 16 is positioned inside the housing 14. In this case, the housing 14 may have a folding door or flap allowing to reach the connecting portion 16. Preferably, the connecting portion 16 comprises detachable fastening elements for maintaining the humidifying device 16 connected to connecting portion 16. When removable, the humidifying device 18 can be considered as a cartridge that can be inserted into or onto the connecting portion 16. To make the heating apparatus 10 more adaptable, the connecting portion 16 may be also configured to connect a conventional humidifying device. In other words, the connecting portion 16 may comprise connecting and fastening elements allowing humidifying devices with different shapes to be connected to the heating apparatus 10.

[0024] To regulate the humidity in the room, the heating apparatus 10 further comprises a control device 20 configured to control the humidifying device 18 connected to the connecting portion 16. Therefore, the connected portion 16 and the control device 20 allow the heating apparatus 10 to connect and control a humidifying device 18 even when no humidifying device 18 is connected to the connecting portion 16. As a consequence, the heating apparatus 10 forms a controlled heater configured to receive an accessory allowing to provide temperature and humidity regulation in the room where the heating apparatus 10 is installed.

[0025] Furthermore, the control device 20 may be also configured to control the heating device 12 to regulate the temperature in the room. Therefore, the control device 20 allows to regulate either simultaneously or independently the temperature and the humidity in the room where the heating apparatus 10 is installed. In other words, the heating device 12 and the humidifying device 18 may be used independently or simultaneously. In this purpose, the humidifying device 18 may comprise a pow-

er supply independent from the power supply of the heating device 12.

[0026] To improve the control of the humidity regulation, the control device 20 is configured to control the humidifying device 18 depending on at least one parameter representative of a future need of humidity regulation in the room. The expression "parameter representative of a future need of humidity regulation" means a parameter measured or detected at a first moment where the humidity is considered as satisfactory indicating that an unsatisfactory variation of the humidity, i.e. a humidity value outside a targeted humidity range, will occur at a second moment subsequent to the first moment. In other words, the control device 20 is able to anticipate a humidity regulation need even when the humidity in the room is satisfactory at a given moment. Therefore, the heating apparatus 10 is able to anticipate a future need in the humidity regulation to make the period during which the humidity is unsatisfactory as short as possible.

[0027] The accuracy of the humidity regulation need determination may be increased by considering more than a single parameter representative of a future need of humidity regulation in the room. Indeed, the control device 20 may consider a plurality of parameters representative of a future need of humidity regulation. Furthermore, the control device 20 may also consider a plurality of parameters or information which are not representative of a future need of humidity regulation if taken alone but that can be representative of a future need of humidity regulation if combined together or with other information. For example, the parameter may be one or more among a presence detection, a humidification level, a brightness level or detection and an acoustic level or detection. In the present application, a level is considered to be a measured or determined quantitative value transmitted to the control device 20 whereas a detection is considered to be a state or a non-quantitative information.

[0028] Furthermore, the control device 20 may be configured to store the at least one parameter obtained during a first situation and then use this stored parameter to improve the capacity of the control device 20 to anticipate a second situation. In other words, the control device 20 may be configured to learn from a first situation to then control more accurately the humidifying device 18 in a second situation subsequent to the first situation. Therefore, the control device 20 may be configured to perform a self-learning control. This allows the control device 20 to further improve the efficiency and the reaction time of the control of the humidifying device 18.

[0029] A combined system 22 is further provided and comprises the heating apparatus 10 and the humidifying device 18. The combined system 22 also comprises a sensing device 24 to determine and transmit the at least one parameter to the control device 20. In parallel, to make the communication possible between the control device 20 and the sensing device 24, the control device 20 is configured to receive the at least one parameter from the sensing device 24. Preferably, the sensing de-

vice 24 comprises at least one sensor able to detect or measure the at least one parameter. At least a part of the sensing device 24 may be positioned either in the housing 14 of the heating apparatus 10 or in the humidifying device 18. In other words, the sensing device may comprise a plurality of sensors positioned in the housing 14 of the heating apparatus 10 and/or in the humidifying device 18. The sensing device 24 comprises one or more among: a presence sensor, a humidity sensor, a light sensor and an acoustic sensor.

[0030] An embodiment of the humidifying device 18 is shown in more details on figures 3 and 4. Particularly, this embodiment is preferably to be positioned in the connecting portion 16 of the heating apparatus 10 of figure 1. Indeed, this embodiment of the humidifying device 18 is configured to be connected to a connecting portion 16 disposed inside the housing 14.

[0031] The humidifying device 18 comprises a tank 26 for storing water, a humidity generation area 28 in fluid communication with the tank 26 and a humidity generation device 30 configured to generate humidification from water located in the humidity generation area 28. The humidity generation device 30 is positioned near the humidity generation area 28 to increase the efficiency of the humidity generation. Preferably, the humidity generation device 30 comprises an ultrasonic diffuser comprising a membrane on which a quantity of water from the tank 26 is disposed and configured to vibrate at ultrasonic frequency to break the water into particles or droplets. Alternatively, the humidity generation device 30 may comprise other types of diffuser as for example evaporative humidifier or natural humidifier.

[0032] Furthermore, the humidifying device 18 comprises a diffusing conduit 32 communicating with the humidity generation area 28 to release humidity outside the humidifying device 18. To improve the release of the particles or steam, the humidifying device 18 may also comprise a fan 31 capable of guiding the particles or steam toward the diffusing conduit 32. The diffusing conduit 32 comprises a nozzle 34 through which the water particles or steam exit from the humidifying device 18. When the humidifying device 18 is positioned inside the housing 14, the nozzle 34 is preferably disposed within a hole formed on a sidewall of the housing 14 to evacuate the water particles or steam out of the heating apparatus 10. In doing so, the humidifying device 18 is fully integrated into the heating apparatus 10. To increase the diffusion of the water particles or steam out of the heating apparatus 10, the nozzle 34 is preferably disposed near an air outlet of the heating apparatus through which heat is provided by convection. This position of the nozzle 34 close to the air outlet allows the water particles or steam to be better diffused in the room.

[0033] To make the tank 26 easy to fill, the tank 26 may comprise a filling orifice reachable from the outside of the housing 14. In this case, the housing 14 preferably comprises an opening facing the filling orifice when the humidifying device 18 is connected to the connecting por-

tion 16. Alternatively, the tank 26 may be configured to slide with respect to a body of the humidifying device 18 to withdraw the tank 26 from the housing 14 through an opening facing the tank 26.

[0034] Furthermore, the humidifying device 18 may comprise a control element configured to control the humidity regulation of the room independently from the control device 20. Preferably, the control element is configured to communicate with the control device 20 to improve the control of the humidifying device 18, for example by considering more parameters or information. The communication between the control element and the control device 20 may be performed by electrical contact or remote communication.

[0035] Moreover, the combined system 22 may comprise an essential oil diffuser integrated within the humidifying device 24. In this case, the humidifying device 18 may be configured to receive essential oil in the tank to mix water and essential oil thereby providing essential oil diffusion along with humidification. In other words, the essential oil may be directly inserted within the tank 26.

[0036] Alternatively, the essential oil diffuser may be installed such that the essential oil is mixed with water particles or steam exiting from the humidity generation device 30. This latter configuration allows the essential oil to be replaced without the need to empty the tank 26 and avoid any premature damage to the humidity generation device 30.

[0037] Furthermore, as an alternative of the humidity generation, the humidifying device 24 may be replaced by an essential oil diffuser to provide a combined heating apparatus 10. In this case, the heating apparatus 10 may be the same as described above but configured to receive an essential oil diffuser controlled by the control device 20 as the humidifying device 18.

[0038] To this end, it is also provided a heating apparatus for regulating the temperature of a room, comprising:

- a housing having a connecting portion 16 configured to be connected to an essential oil diffuser to provide the room with essential oil, and
- a control device 20 configured to control an essential oil diffuser connected to the connecting portion 16 depending on at least one parameter representative of a future need of humidity regulation in the room.

Claims

1. A heating apparatus (10) for regulating the temperature of a room, comprising:
 - a housing (14) having a connecting portion (16) configured to be connected to a humidifying device (18) to humidify the room, and
 - a control device (20) configured to control a humidifying device (18) connected to the con-

necting portion (16) depending on at least one parameter representative of a future need of humidity regulation in the room.

2. The heating apparatus (10) according to claim 1, wherein the control device (20) is configured to receive the at least one parameter from a sensing device (24).
3. The heating apparatus (10) according to claim 1 or 2, wherein the at least one parameter is one or more among: a presence detection, a humidification level, a brightness level or detection, an acoustic level or detection.
4. The heating apparatus (10) according to any one of claims 1 to 3, further comprises a heating device (12), the control device (20) being also configured to control the heating device (12) to regulate the temperature in the room.
5. The heating apparatus (10) according to claim 4, wherein the heating device (12) and the connecting portion are positioned such that heat generated by the heating device (12) improves humidity generation when the humidifying device is connected to the connecting portion (16).
6. The heating apparatus (10) according to claim 4 or 5, wherein the connecting portion (16) of the housing (14) is configured such that the humidifying device (18) is disposed inside the housing when the humidifying device (18) is connected to the connecting portion (16).
7. The heating apparatus (10) according to claim 4 or 5, wherein the connecting portion (16) of the housing (14) is configured such that the humidifying device (18) is disposed outside the housing when the humidifying device (18) is connected to the connecting portion (16).
8. A combined system (22) comprising:
 - a heating apparatus (10) according to any one of the preceding claims,
 - a humidifying device (18) connected to the connecting portion (16) of the housing (14), and
 - a sensing device (24) configured to determine and transmit the at least one parameter to the control device (20).
9. The combined system (22) according to claim 8, wherein at least a part of the sensing device (24) comprises on or more among: a presence sensor, a humidity sensor, a light sensor and an acoustic sensor.

10. The combined system (22) according to claim 8 or 9, wherein at least a part of the sensing device (24) is positioned in the housing of the heating apparatus (10).
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11. The combined system (22) according to any one of claims 8 to 10, wherein at least a part of the sensing device (24) is positioned in the humidifying device (18).
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12. The combined system (22) according to any one of claims 8 to 11, wherein the humidifying device (18) comprises:
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- a tank (26) for storing water,
 - a humidity generation area (28) in fluid communication with the tank (26),
 - a humidity generation device (30) near the humidity generation area (28) and configured to generate humidification from water located in the humidity generation area (28),
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 - a diffusing conduit (32) communicating with the humidity generation area (28) to release humidification outside the humidifying device (18).
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13. The combined system (22) according to any one of claims 8 to 12, further comprises an essential oil diffuser.
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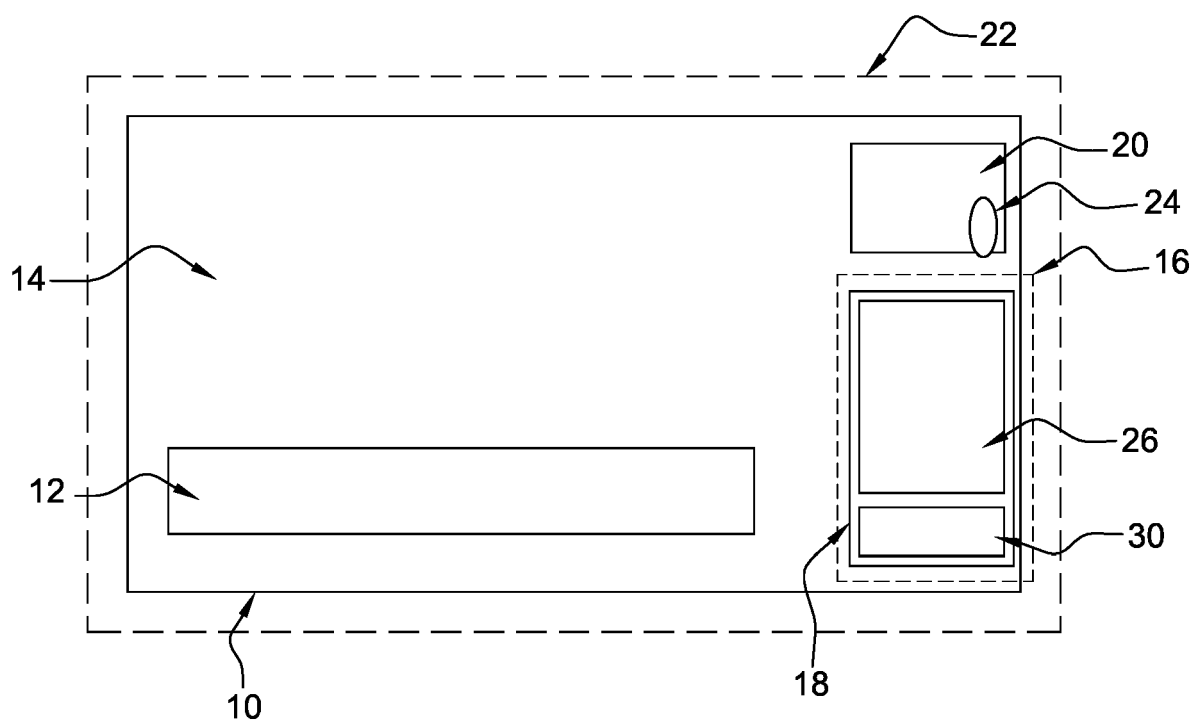


Fig. 1

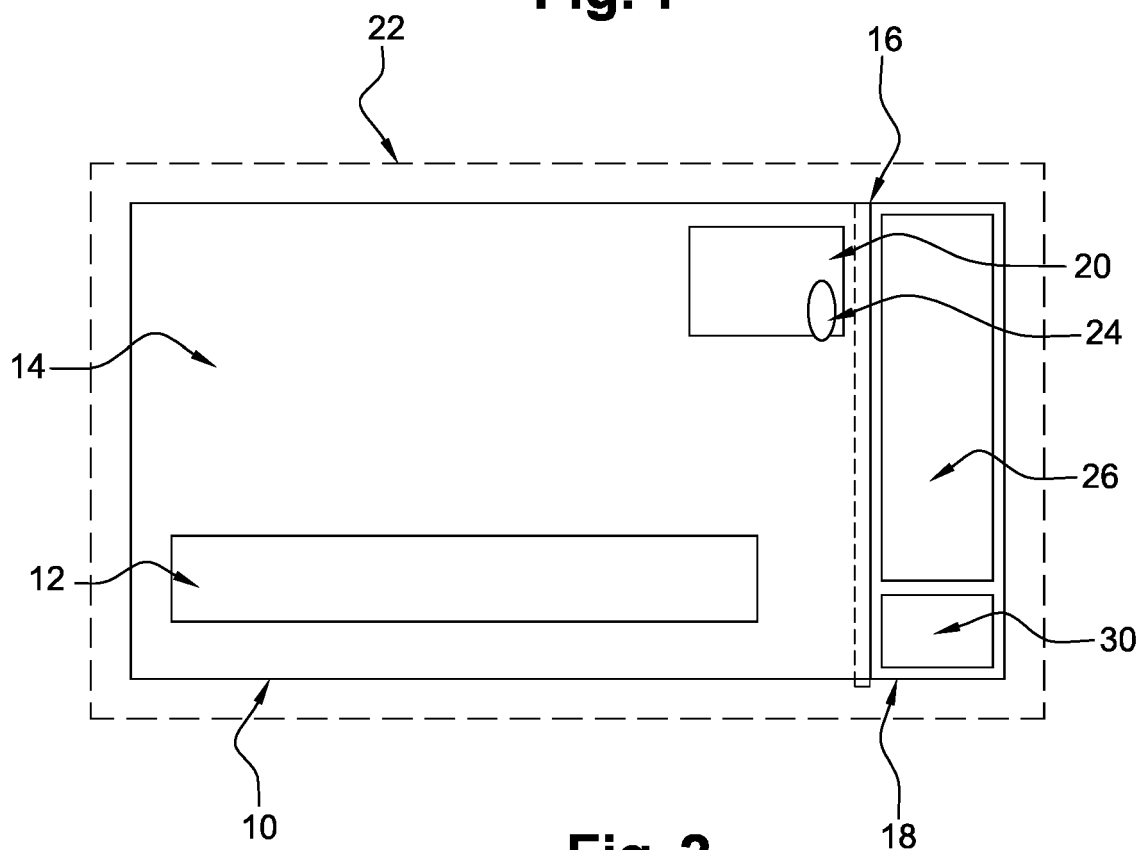


Fig. 2

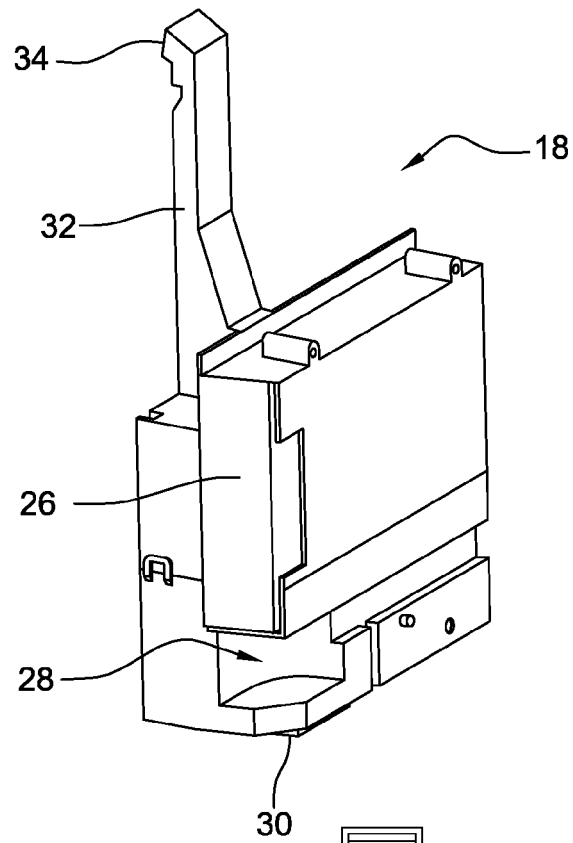


Fig. 3

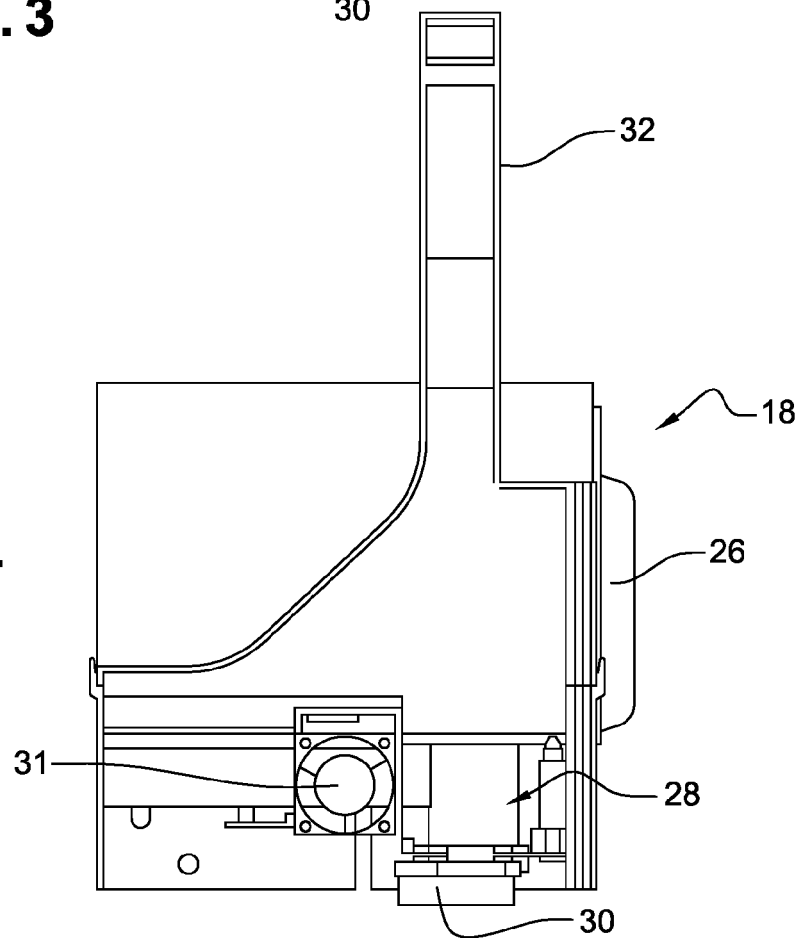


Fig. 4



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