(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 553 239 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.10.2019 Bulletin 2019/42

(51) Int Cl.:
E04B 1/70 *(2006.01)*

(21) Application number: **19175105.6**

(22) Date of filing: **23.12.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **30.12.2013 NL 2012035**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
14828350.0 / 3 090 105

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Remarks:
This application was filed on 17-05-2019 as a divisional application to the application mentioned under INID code 62.

(54) **DEVICE FOR EXTRACTING MOISTURE FROM A WALL**

(57) The present invention relates to a wall of a house or similar structure, the wall comprising a hole and a device for extracting moisture from a wall or similar structure, the device being positioned in the hole, the device being configured to be positioned in a hole in said wall, the device comprising:
- a front part which defines two openings which extend in different directions, the openings acting as an air intake and an air exit,
- a chamber which defines an inner space, wherein an air flow channel for a main air flow extends through the inner space between the air intake and the air exit,
- a housing which forms a housing wall of the chamber, the housing being connected to the front part,
wherein the main air flow that flows through the air flow channel carries off moisture from the wall,
wherein at a front section of the device a portion of the wall has been removed around the hole, resulting in a front outer hole having a larger diameter as the hole, wherein the front outer hole extends at a distance around or substantially around the front section of the housing and/or the intermediate part, the front outer hole forming a front outer channel which is in open communication with the outside and which acts as a second air flow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall.

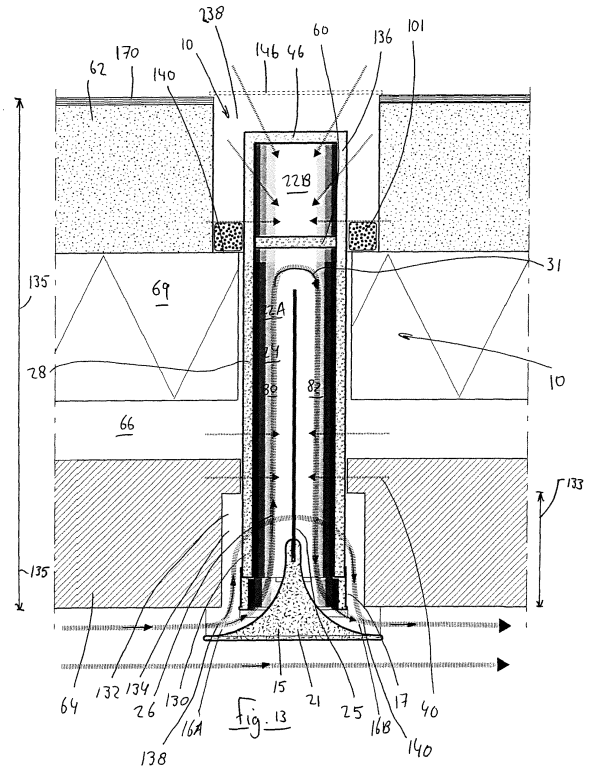

Fig. 13

EP 3 553 239 A1

Description

Field of the invention

[0001] The present invention relates to a device for extracting moisture from a wall or similar structure of a house or building. By extracting moisture from the wall or similar structure, the device regulates the humidity and reduces humidity problems.

Description of the prior art

[0002] Devices for extracting moisture from a wall or similar structure are known per se. EP0829587A1 (hereinafter: EP587) discloses an earlier device invented by the father of the inventor of the present invention.

[0003] EP587 discloses a device for extracting moisture from a wall or similar structure. The device, see in particular figure 1 of EP587, consists of air guide means 7 which can be applied in a hole 8 in a wall 2. The device defines an air guide channel 9 between two openings 10 - 11, which extend in different directions outside the wall 2. The air that flows through the air guide channel 9 carries off moisture originating from the wall 2. This device is characterized by means 13 which form a cover between the air guide channel 9 and a cavity 5, possibly present in the wall 2 or similar.

[0004] The device of EP587 is suitable to remove moisture from the wall, including extracting moisture from a cavity which exists between an inner wall and an outer wall. The cover 13 between the air guide channel and the cavity 5 in the wall is permeable to water but forms a seal against air.

[0005] NL2007920 (NL2007920) discloses a further device for extracting moisture from a wall of a building. The element comprises a pad 10 of a heat-insulating material at the back end of the element, see figure 2. The pad 10 is positioned against the inner wall of a cavity. The element further comprises grooves 81 for improving the moisture removal capacity.

[0006] FR2920796 discloses a device for extracting moisture from a wall. The device of FR2920796 is not very suitable for varying circumstances and is in particular not suitable for high temperature gradients.

[0007] EP0407290A1 discloses another device for extracting moisture from a wall. The device of EP0407290A1 is not very suitable for varying circumstances and is in particular not suitable for high temperature gradients.

Analysis and developed insights

[0008] In the present invention it was recognized that the required moisture removing capacity of such devices may vary widely in dependence on the circumstances in which they are applied.

[0009] For instance, a wall that is moist may initially require a high moisture removing capacity, but once the wall has been dried sufficiently, this capacity can and should be lower. A lower moisture removing capacity may result in lower heat loss of the building, which lowers the cost of heating.

[0010] Furthermore, the type of wall which is encountered may vary widely. Some walls have a cavity and other walls do not. The cavity may be partially or wholly filled with heat insulation or may be completely empty. The heat insulation may be fitted at the time of construction or provided in a later upgrade operation. Various kinds of heat insulation are encountered in cavities. In addition or alternatively, walls may also be covered with heat insulation on the inside, and the heat insulation may be of various kind of materials.

[0011] Some walls are made from masonry, other walls from concrete, and yet other walls are form natural stone or another material.

[0012] Even in one building, local conditions in the wall may be different. In some places, damp may rise from the foundation, while this does not occur in other places. Some parts of a wall may be moist as a result from leakage, other parts are drier. The side of the building which faces the prevailing wind direction has a different moisture condition than the other sides of the building.

[0013] Furthermore, the prevailing temperatures on the outside may vary enormously. In the south of Europe, Mediterranean climates occur, and the average outside temperature may lie between 15 and 25 degrees. In Scandinavia, the average outside temperature is much lower. In other countries other climate conditions may occur. The absolute and relative humidity of the air may also vary significantly.

[0014] In a cold climate, there is a large temperature difference between the outside and the inside of the house or building. If the lower outdoor temperature was to reach the inside of the inner wall, an uncomfortable cold (or loss of heat) would occur inside the house or building. This may happen in northern Europe. In other words, there is an excess temperature difference between the outside and the inside of the building.

[0015] However, in a warm climate, the difference between the outside temperature and the inside temperature is substantially smaller. Here, the full temperature difference may be necessary for sufficient moisture removal. This condition may in southern Europe.

[0016] Furthermore, it is recognized in the present invention that the wall itself has a temperature gradient, which can range from almost the outside temperature on the outer side of the wall to almost the inside temperature on the inner side of the wall. The moisture removing device of the invention works on the principle of providing a cold spot which attracts moisture and removes the moisture from this cold spot with an air flow.

[0017] The insight was developed that if the moisture removing device itself has a single temperature throughout the device, it works very well on the inside of the wall, but may not work very well on the outside of the wall. More in particular, the device extends into the wall and

comes into contact with a part of the wall which is heated from the inside. The heat coming from inside may heat up the entire moisture removing device, including an outer portion of the moisture removing device. This results in a situation wherein the outer part of the device becomes warmer than the outer portion of the wall which surrounds it. In such a situation, the moisture removing device locally no longer forms a cold spot in this area and locally stops functioning as a moisture removal device, or at least functions to a lesser degree.

[0018] A further problem occurs when the cavity between an inner and outer wall is filled with thermal insulation, humidity problems may occur in the cavity. The moisture in the cavity can result in various phenomena, such as repeated condensation in different places within the cavity. The moisture inside the cavity has the tendency to move about. The moisture condenses and appears as droplets on the thermal insulation. The moisture may evaporate again and move through the cavity to a different location where it again condenses and reappears as droplets.

[0019] EP587 and NL920 have as a stated goal that they are capable of removing moisture from a cavity which exists between an inner wall and an outer wall, but the capacity to do so was found to be quite low.

[0020] Furthermore, in newly built houses, there are often very few cracks. This is due to the improved quality of construction and the improved quality of the various parts which are used, such as frames for doors and windows. As a result, newly built houses often have less ventilation than required, which results in a lack of fresh air. This lack of fresh air often deteriorates the moisture situation. Moisture in the living environment cannot escape because of the lack of ventilation. If the living environment is used intensively, this problem can become more serious. The insight was developed that neither the device of EP587 nor the device of NL2007920 succeed very well in removing moisture from the living space.

[0021] To make matters more complex, the insight was developed that humidity problems in the living space due to lack of ventilation may be aggravated by a layer of insulation which is often applied on the inside of the wall. This is often done in a retrofit operation to decrease the heat loss and associated costs of heating. Although the heat loss is indeed reduced, the layer of insulation itself prevents humidity to exit the living space. This creates a variety of problems. The insight was developed that the devices of EP587 and NL2007920 do not work very well in preventing these humidity problems. In particular walls without a cavity but with insulation attached to the inside of the wall suffer from moisture problems.

[0022] Furthermore, the use of a house or building may also vary. In particular in rented houses the users often close ventilation means in order to reduce cold or draft. This deteriorates the moisture situation, because moisture is removed with draft. Furthermore, double glazing may be present or not, and this significantly influences the moisture situation. Double glazing may prevent condensation from occurring, but it does not remove moisture. The moisture just becomes invisible.

[0023] Furthermore, it was found that the installation of the known moisture removal device itself takes quite a long time. It was recognized that even though a solution to accelerate the installation is available, i.e. by using circular holes and circular moisture removal devices, this solution itself creates other problems related to the appearance of the moisture removal devices from the outside.

[0024] Furthermore, it was recognized that the moisture removing devices of the prior art may become a nest for animals or insects such as spiders or may become a gathering place for dust and dirt. This hampers the functioning of the moisture removal device.

[0025] All in all, the various phenomena are quite complex. The complexity is increased even further by the fact that in practice it is not always clear what the source of the moisture is. As mentioned, the moisture may be generated inside the house or building. Alternatively, the moisture may have been trapped and enclosed in a space without exit. Alternatively, the moisture may rise from the ground into the wall via capillary action. The moisture may also be a result from a leakage or from condensation of water from an unexpected source.

[0026] For instance, if rainwater is not discharged from a terrace, a puddle is formed on the terrace which forms a cold spot. If the terrace is located above a room, the ceiling of the room becomes cold and attracts moisture from the inside. This moisture condenses against the ceiling, giving the impression of a leak in the ceiling, where no leak exists.

[0027] The various aspects discussed above can occur in combination, resulting in compounded effects on the moisture situation and even more complex situations.

[0028] The insight was developed that the devices of EP587 and NL2007920 do not succeed in meeting these challenges and are based on a rather incomplete understanding of the various phenomena which occur and of the interdependence of these phenomena.

The invention

[0029] The invention aims to solve at least one of the problems mentioned above.

[0030] The invention provides a device for extracting moisture from a wall or similar structure, the device being configured to be positioned in a hole in said wall, the device comprising:

- a front part which defines two openings which extend in different directions the openings being configured to act as an air intake and an air exit,
- a chamber which defines an inner space, wherein an air flow channel for a main air flow extends through the inner space between the air intake and the air exit,
- a housing which forms a housing wall of the chamber,

the housing being connected to the front part,

wherein the main air flow that flows through the air flow channel carries off moisture from the wall.

[0031] The device may comprise at least one partition wall which divides the chamber into a first chamber which is in open connection with the outside via the openings and a second chamber which is substantially closed.

[0032] The partition wall reduces the heat loss of the device and creates different temperature zones inside the device. This improves the moisture removing capabilities near the outer side of the wall, because here the temperature of the device will be lower due to the fact that the partition wall prevents heat from inside from the building from warming up the entire device.

[0033] It allows the device to completely penetrate a wall without losing the capability of moisture removal for the outer part of the wall, or at least to penetrate the wall deeper than known devices. In this way the device can remove moisture better than known devices across the width of the wall.

[0034] The partition wall also allows the device to penetrate the entire wall or at least deeper than known devices, without creating excess heat loss and avoiding the dew point. This allows the device to be used to remove moisture from inside the living space.

[0035] Said partition wall may be movable in a longitudinal direction of the device in order to vary the size of the first and second chamber. This creates versatility, and makes the device customizable to varying conditions and demands.

[0036] The partition walls extend substantially transverse to a main longitudinal direction and can be indicated as a transverse partition wall.

[0037] In both FR2920796 and EP0407290, the airflow reaches the rear wall and creates an extreme cold spot on the rear end of the device. Moreover, in neither FR2920796 nor EP0407290 it is possible to create a temperature difference inside the device.

[0038] In FR2920796, a chamber 44 is located at the end of the device and is defined by a wall. The chamber 44 does not have a function with regard to the moisture, but only serves to store an electric cable. The chamber 44 does not create different temperature zones inside the device, because the air flow flows around the entire chamber both inside and outside of the housing. The air flow also reaches the back of the rear wall 17, see figure 2. The chamber 44 therefore is surrounded by the air flow on all sides and will adopt the temperature of that air flow.

[0039] EP0407290 at first sight appears to disclose a wall 18 (see fig. 3) and a separate chamber behind that wall. However EP0407290 discloses that channels (cannelures) extend through element 18, see column 4, lines 29-33. These channels put the space behind the element 18 in fluid communication with the space in front of element 18. Therefore, EP0407290 does not disclose a second chamber which is substantially closed.

[0040] For both these documents, the insights which form the basis of the present invention are lacking. It is not recognized in these documents that a temperature gradient in the wall exists and that a device which creates different temperature zones would be beneficial. It is also not recognized in FR2920796 or EP0407290 that if an extreme cold spot at the end is avoided, the device can be installed deeper, without losing the moisture removal capability for the outer part of the wall.

[0041] In an embodiment, the device further comprises an intermediate part which interconnects the housing and the front part, wherein the intermediate part is separate from the front part. The intermediate part allows a more cost-effective production, and/or better customization of the front part to match the colour of the building. The intermediate part may also provide easier placement and/or a better sealing of the hole around the device in order to prevent ventilation.

[0042] In an embodiment, the front part is connected to the rest of the device via a releasable coupling which allows the front part to be removed by a user, wherein in particular the front part is connected to the intermediate part via the releasable coupling.

[0043] The releasable coupling allows maintenance, inspection, cleaning and/or repositioning of the partition wall and/or exchanging the partition wall for one with a different insulation value.

[0044] In an embodiment, the device further comprises a flow controller for varying the airflow after installation of the device in a wall. The flow controller may be formed by a central air guide having a variable position.

[0045] The flow controller makes the device more versatile so that it can be customized to local requirements or requirements which vary in time.

[0046] In an embodiment, the device further comprises a second partition wall which together with the first partition wall divides the chamber into a first chamber, a second chamber and a third chamber part, and wherein in particular the first and second partition wall are movable.

[0047] This embodiment provides an advantage of creating a cold spot throughout the entire width of a wall.

[0048] In an embodiment, the device further comprises a first housing part and a second housing part which are coaxially arranged. This embodiment allow an easy adjusting of the length of the device to various widths of the wall. The first and second part may be two short parts, a long part and a short part or two long parts. Each combination results in a different total length.

[0049] A ring of a different material than the material of the housing parts may be provided between the first and second housing parts. The ring may be manufactured from a heat-insulating material. The ring may be provided with air channels which extend through the ring and allow moisture to travel from the second housing part to the first housing part.

[0050] In an embodiment, the housing wall is not only permeable to moisture but also comprises air channels which extend through the housing from the outside to the

inside in order to let an air flow permeate from the outside of the device through the housing wall into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm.

[0051] It was recognized that current devices for extracting moisture, such as the device disclosed in EP587, are very limited when it comes to removing moisture from a cavity. The device of EP587 requires moisture in the cavity to condense on outside of the housing wall. This condensed moisture may then travel through the housing wall by the capillary action and reach the chamber where it is re-vaporized by the main airflow and discharged with the main air flow through the air exit. In the device of the present invention, no condensation is required for removal of moisture from the cavity. The moisture can stay in vapour form and travel with the permeable air flow through the housing wall. When the permeable air flow reaches the chamber, it merges with the main air flow and is discharged through the air exit. The present invention provides an improvement in removing moisture from cavities which are filled with insulation. The permeable air flow takes along with it moisture inside the cavity.

[0052] The size of the pores which form the air channels may be chosen at the manufacturing stage of the housing. In this way the air permeability of the housing can be controlled at the manufacturing stage.

[0053] In an embodiment, the housing is provided with an endplate at an end thereof, wherein the endplate comprises air channels which extend through the end wall in order to let a second permeable flow of air flow through the endplate into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm. The endplate may be manufactured from the same material as the housing, however in some cases the endplate might be manufactured from aluminium when a maximal drop in temperature is required. The endplate may be integral with the housing.

[0054] The endplate allows moisture removal from inside the living space in addition to moisture removal from the wall, and allows a deeper penetration of the device into the wall, which improves moisture removal from the inner part of the wall.

[0055] In an embodiment, the housing has a circular cross-section and wherein the front part has a square cross-section or a rectangular cross-section, wherein in particular the intermediate part provides a transition from a circular cross-section to a rectangular cross section.

[0056] This combines a rapid installation by drilling a round hole with a nice appearance of the device. The device can have a similar form and colour as the bricks in the wall.

[0057] In an embodiment, in front view the front part overlaps the housing and any cement with which the housing is connected to the wall. This improves the visual characteristics of the device in that the cement is invisible from the outside. The cement used to fix the device often has a different appearance from the cement of the wall itself.

[0058] The device may comprise an annular outer front piece which in particular extends substantially around the housing and/or the intermediate part, wherein an air entry and an air exit of a front outer channel are defined between the annular outer front piece and the intermediate part, wherein the front outer channel extends around the housing and is in open communication with the outside and which acts as a second airflow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall, and wherein in top view the front outer channel traverses the main channel. This embodiment is especially suitable to dry the outer part of the wall.

[0059] In an embodiment, the device has no endplate and the second chamber has an open rear end. With this embodiment, the air inside a room can be dried, in particular of the open end is placed directly against an inner panel or cover layer which covers the inside of a wall.

[0060] In an embodiment, wherein the housing comprises an outer housing part and an inner housing part, wherein the outer housing part extends around the inner housing part and defines an annular space between them, wherein the annular space forms an ingoing part of the airflow channel and the inner housing part defines an outgoing part of the air flow channel, wherein a U-turn is defined at an end of the ingoing channel.

[0061] In an embodiment, the outer housing part is relatively short and is only provided at the front end of the device. In this embodiment, the wall forms the annular cavity around the inner housing and over the greater portion of the length of the device, there is no outer housing part. The incoming air directly dries the wall without a barrier of an outer housing part reducing the drying effect.

[0062] The device may comprise at least one support configured to support the inner housing part at a distance from the inner surface of the hole in order to create the annular space.

[0063] In an embodiment, the end wall of the device has a thickness of more than five times a thickness of a side wall of the housing. It was found that this embodiment may be an alternative to the partition wall, in that two temperature zones are created within the device, and the outside air is prevented from reaching the end wall. The moisture can travel through the thick end wall.

[0064] The present invention further relates to a wall of a house or similar structure, the wall comprising a hole and a device according to claim 1, the device being positioned in the hole.

[0065] In an embodiment, the wall is a double wall comprising a first, inner wall, a second, outer wall and a cavity between the inner and outer wall, and wherein the housing wall comprises air channels which extend through the housing and connect the cavity with the chamber, so that in use a permeable air flow flows from the cavity through the housing wall into the chamber.

[0066] The air channels allow a better moisture removal from the cavity than known devices achieve.

[0067] In an embodiment, the material of the housing

is pervious concrete, i.e. concrete with an open structure. Pervious concrete was found to enable good moisture removal from a cavity. Pervious concrete is a concrete in which a substantial part of the fine aggregates (i.e. the sand) has been left out. In an embodiment, 25 to 40 percent of the volume may consist of gaps. At least 25 percent of the volume may consist of interconnected gaps.

[0068] It was recognised that the material of the housing of existing devices such as the device of EP587 is a limiting factor in the lifespan of these devices. By using the above mentioned material for the housing, not only the humidity is improved, but the lifespan is also increased considerably.

[0069] The material of the housing may have a high thermal insulation value. The material of the housing may have a constant grain size. Generally, the material of the housing is durable and strong.

[0070] The material of the housing may be a natural material which can be produced in a sustainable manner.

[0071] In an embodiment, the device has an endplate at an end of it, wherein the endplate comprises air channels which extend through the end wall in order to let a second permeable air flow flow through the endplate into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm. This embodiment allows good moisture removal from the living space or from an inner part of a wall.

[0072] In embodiment, the endplate is manufactured from the same material as the housing.

[0073] In a further embodiment, a layer of insulation is connected to the wall, and the insulation has an opening near an end of the device so that air containing moisture can flow through the opening in the insulation and continue as a permeable air flow through the endplate and into the chamber. In this way moisture from inside the living space can advantageously be removed.

[0074] In an embodiment, a panel such as a gypsum panel comprising the layer of insulation is connected to the inside of the wall, the insulation engaging the wall, wherein the device extends through the wall, wherein the opening is provided in the insulation so that an end of the device directly engages the panel.

[0075] The present invention further relates to a method of improving the damp situation in a house or similar structure, the method comprising:

- creating a hole in a wall of the house,
- inserting the device according to claim 1 in said hole,
- removing moisture from the wall.

[0076] The method provides substantially the same advantages as the device.

[0077] In an embodiment, the device is initially installed with a partition wall in a first position or without a partition wall, and wherein after a certain time period the partition wall is moved to a second position, removed or inserted, such that in the second time period the device has a different moisture removing capacity than in the first time period.

[0078] In this way the device can be adjusted to varying requirements and circumstances.

[0079] In an embodiment, the device is initially installed with a first partition wall in a first position and second partition wall in a second position, and wherein after a certain time period at least one partition wall is moved or removed. In this way the device can be adjusted to varying requirements, in particular to a wall that becomes dry over time.

[0080] In an embodiment, the device comprises an intermediate part which interconnects the housing and the front part, wherein the intermediate part is separate from the front part, wherein the housing is manufactured from a ceramic material and wherein the front part and the intermediate part are manufactured from a synthetic material, and wherein the housing is fixed to the wall with cement and the intermediate part is fixed with a different connection method.

[0081] This embodiment provides amongst others the benefit of a good seal to prevent ventilation of the cavity.

[0082] The longitudinal partition wall or the partition wall may be provided with a spacer projection which prevents the partition wall to be positioned in direct contact with the longitudinal partition wall. If this would happen, the air flow channel would be closed at the U-turn, and the device would not work. The projection may have various forms and define an opening at the end of the longitudinal partition wall..

[0083] In an embodiment of the method, the front part is connected to the rest of the device via a releasable coupling which allows the front part to be removed by a user, wherein in particular the front part is connected to the intermediate part via the releasable coupling, and wherein the front part is removed from time to time for:

- inspection of the interior,
- cleaning the interior and/or for
- repositioning the at least one partition wall inside the chamber.

[0084] In an embodiment, the device comprises a flow controller for varying the airflow after installation of the device in a wall, wherein in particular the flow controller is formed by a central air guide having a variable position, and wherein after a certain time period the air flow is adjusted with the flow controller in order to increase or decrease the moisture removing capacity. Advantageously, the airflow can be adjusted to varying requirements.

[0085] In an embodiment, an air flow flows through the air channels in the housing wall from the cavity in the wall into the chamber, thereby removing moisture from the cavity. It is noted that the device of the prior art allow moisture to flow through the housing wall via the capillary action but at the same time block a direct air flow. It was found that a better result is obtained with the air channels.

[0086] In an embodiment, the housing is provided with

an endplate, wherein the endplate comprises air channels in order to let a second permeable flow of air flow from the outside of the device through the endplate and into the chamber, wherein a wall comprises a panel, in particular a gypsum panel, which is connected to the inside of the wall, wherein the hole extends all the way through the wall, wherein the endplate of the device directly engages the panel, and wherein moisture is removed from the panel by a second permeable air flow which flows through the endplate.

[0087] It was further found that many of the features disclosed above can provide a substantial improvement to known moisture removal devices independent of the partition wall of claim 1, i.e. without the partition wall. Therefore, the present invention further relates to a device for extracting moisture from a wall or similar structure, the device being configured to be positioned in a hole in said wall, the device comprising:

- a front part which defines two openings which extend in different directions, the openings being configured to act as an air intake and an air exit,
- a chamber which defines an inner space, wherein an air flow channel for a main air flow extends through the inner space between the air intake and the air exit,
- a housing which forms a housing wall of the chamber, the housing being connected to the front part,

wherein the main air flow that flows through the air flow channel carries off moisture from the wall, the device comprising one or more of the features of claims 2 - 11.

[0088] The same applies to the wall and the device, i.e. the wall of claim 12 and the method of claim 16 can also be provided with a device which does not comprises the partition wall but comprises one or more of the other features of the claims.

[0089] In a further invention, a device is provide for removing moisture from the air in a room in a house or building, the device comprising:

- a channel having a channel wall which is porous to moisture in order to allow moisture to travel through said channel wall, wherein the channel wall is at least partially exposed to the air inside said room,
- an air entrance being configured to be located on the outside of the house or building, and an entry tube which is constructed to extend through a first through hole in the outside wall of the house or building to the channel, wherein outside air is drawn in through the entrance and travels through the entry tube to the channel, and
- an air exit, the air exit being configured to be located on the outside of the house or building, where the air is released back into the outside via the exit, and an exit tube extending through a through hole in the outside wall from the channel to the exit.

[0090] This invention is suitable to remove moisture from the air inside the living space of a house. Many houses suffer from lack of ventilation. A result is that the air inside the house becomes moist, and condensates against the windows or even worse, against the walls. In particular, the inhabitants of a house may try to prevent loss of energy in order to save costs, and close existing ventilation ducts. This is in particular an issue in rented houses. With the invention, the channel forms a cold spot within the living space. Moisture condensates on the cold spot and travels through the channel wall. When the moisture arrives on the inside of the channel, it evaporates into the cold outside air which flows through the channel. Gradually, the air in the room becomes dry.

[0091] The channel wall may be relatively closed to air in order to prevent air from the living space to enter the channel.

[0092] The channel may have the appearance of a baseboard. In this way, the channel is invisible for a person inside the room.

[0093] The channel may comprise a fan for blowing outside air through the channel. The fan guarantees a certain discharge through the channel. Alternatively, an entrance and/or exit with a suitable shape to guide through the channel may be used. The device may comprise a filter at the entrance to keep out dirt. The fan might also create a vacuum effect which is beneficial for a drop in the temperature and attraction of humidity

[0094] The device is intended to be installed in a room of a house or building. The room comprises one or more walls comprising a device according to the invention. The channel may extend at least partially along a wall of the living space.

[0095] The appearance of the channel may be similar or the same as the appearance of the other baseboards in said room. The channel may extend at least partially in a horizontal direction along a foot of a wall of the living space where the wall meets the floor in the same way as the baseboards.

[0096] In an embodiment, the channel comprises one or more vertical sections and a horizontal section wherein said one or more vertical sections extend in particular along a vertical line where two walls of the house or building meet one another. In this way the vertical sections are made inconspicuous. The channel may extend along an upper end of a wall of the living space where said wall meets the ceiling.

[0097] The room may be a cellar of a house or building, wherein the entry tube and the exit tube are located near the ceiling of the cellar, so that they are near the ground on the outside of the house or building. The entry tube and exit tube may be located near the ceiling of the cellar, and the channel may comprise two vertical sections located at a distance from one another and extending along respective vertical lines where walls of the cellar meet to respective corners where the respective vertical lines meet the floor, and comprising a horizontal section extending along the foot of a wall between said corners.

[0098] In an embodiment, at least one wall comprises one or more holes which extend into the wall from the side of the room, wherein the channel comprises:

- one or more parallel channel sections which extend parallel to the wall and along the wall from one hole to a next hole, each parallel channel section having a channel wall which is porous to moisture in order to allow moisture to travel through said channel wall, and
- one or more wall piercing channel sections each of which is associated with one of said holes, wherein the one or more wall piercing channel sections are constructed to guide the air from a parallel channel section through said hole and from said hole back into a next parallel channel section in order to remove moisture from the part of the wall which surrounds said hole.

[0099] With this embodiment, both the air and the wall of the room can be dried with the same device. The parallel channel sections dry the air and the wall piercing sections dry the wall. The wall is dried from the inside.

[0100] The device may have multiple entrances and/or multiple exits.

[0101] The holes may be blind holes, wherein each of the wall piercing channel sections comprises an air guide which extends into the hole and divides the wall piercing channel section into an ingoing part and an outgoing part which are parallel to one another, and wherein the air guide defines a U-turn at the end of the hole.

[0102] The room may comprise a plurality of holes and a plurality of associated air guides. The holes may be positioned in a linear configuration along said wall in order to remove moisture from said wall. Typically, the holes will be located near the foot of the wall.

[0103] The invention also relates to a method of modifying an existing house or building in order to dry the air within a room of said house or building, the method comprising making at least a first through hole and a second trough hole in an outer wall of the house or building, placing the entry tube and exit tube in said through holes, installing the air entrance and the air exit on the outside of the house or building and installing the channel along a wall inside the room.

[0104] Existing houses or buildings having moisture problems in the living space can be treated with this method to improve the moisture situation.

[0105] In an embodiment, the method comprises drilling multiple holes in the wall from the inside, and installing multiple wall piercing channel sections inside said holes and multiple parallel channel sections which extend along the wall and interconnect the multiple wall piercing channel sections.

[0106] With this method, houses or buildings which suffer from both moisture problems in the air and moisture problems in the wall, in particular the inside of the wall, can be treated.

[0107] The invention further relates to a method of drying the air within a room of a house or building, the method comprising:

- installing the device of the invention in a room of a house or building, and
- blowing relatively cold air from the outside through said channel, causing moisture in the air of the room to condense in the wall of the channel as a result of the cold outside air, wherein the moisture travels as liquid particles through the channel from the outside of the channel wall to the inside of the channel wall and subsequently evaporates inside the channel into the cold outside air which passes through said channel, wherein said air including the moisture is subsequently discharged via the air exit.

[0108] These and other aspects of the invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description and considered in connection with the accompanying drawings in which like reference symbols designate like parts.

Brief description of the figures

[0109]

Figure 1 shows a cross-section in top view of a first embodiment according to the invention.

Figure 2 shows a cross-section in side view of the embodiment of figure 1, taken along the lines II in figure 1.

Figure 3 shows a cross-section in an isometric view of the embodiment of figure 1.

Figure 4 shows a front view of a wall comprising several devices according to the invention

Figure 5 shows a front view of a wall comprising several different embodiments of the device according to the invention.

Figure 6 shows an exploded isometric view of a device according to the invention.

Figure 7 shows a detail in side view of the connection between a front part, an intermediate part and a housing.

Figure 8 shows a detail similar to figure 7, wherein the front part has a different position.

Figure 9A shows a cross-section in an isometric view of another embodiment of the invention.

Figure 9B shows a cross-section in an isometric view of the embodiment of figure 9A in a wall having a cavity.

Figure 10 shows an isometric view of a detail of the embodiment of figure 9B.

Figure 11 shows a cross-section in an isometric view of another embodiment of the invention.

Figure 12 shows an exploded isometric view of another embodiment of the invention

Figure 13 shows a sectional top view of yet another embodiment of the invention.
Figure 14 shows a sectional top view of another embodiment of the invention.
Figure 15 shows an isometric view of another embodiment of the invention.
Figure 16 shows an isometric view of yet another embodiment of the invention.
Figure 17 shows a sectional top view of again another embodiment of the invention.
Figure 18 shows a sectional top view of another embodiment of the invention.
Figure 19 shows an isometric view of another embodiment of the invention.
Figure 20 shows an isometric view of yet another embodiment of the invention.
Figure 21 shows a sectional top view of another embodiment of the invention.
Figure 22 shows a top view of a second invention.
Figure 23 shows a front view of another embodiment of the second invention.
Figure 24 shows a sectional top view of the embodiment of figure 23.
Figure 25 shows a front view of another embodiment of the second invention.
Figure 26 shows a sectional top view of the embodiment of figure 25.
Figure 27 shows a sectional top view of another embodiment of the second invention.
Figures 28A-28E show cross-sections of a channel for removing moisture from air inside a room and/or from an inner side of a wall.
Figures 29A, 29B show a side view of another embodiment of the longitudinal partition wall.
Figures 30A and 30 show isometric views of another embodiment of the invention.
Figures 31A and 31B shown an isometric view and a cross-section of yet another embodiment of the invention.

Detailed description of the figures

[0110] Turning to figures 1, 2 and 3, a device 10 for extracting moisture from a wall 12 or similar structure is shown. The wall 12 comprises an inner wall 62, an outer wall 64 and a cavity 66 between the inner wall and the outer wall. The cavity is partially filled with thermal insulation 69. The wall 12 may also be a solid wall.

[0111] The device is configured to be positioned in a hole 14 in said wall. The device comprises a front part 15 which defines two openings 16 which extend in different directions 18, 19. The front part may be manufactured from a glass fibre reinforced composite or another suitable material. The front part 15 comprises a central air guide 21 which projects outwardly from the wall. The front part may mimic the appearance of a brick.

[0112] The central air guide defines the air intake 16A and the air exit 16B. The central air guide has a curved shaped to create a fluent air guide and to create dynamic overpressure on the side of the air intake 16A and dynamic underpressure on the side of the air exit 16B, thereby increasing the speed of the air flow through the device.

[0113] The air intake 16A and the air exit 16B have a same shape and are exchangeable in use, the function depending on the direction of the wind. The speed of the air flow within the chamber is considerable, and typically higher than the speed of the wind which flows along the openings, i.e. along the outside of the wall.

[0114] A housing 28 which forms a housing wall 30 of the chamber is connected to the front part 15 via an intermediate part 17. The housing wall 30 is air permeable. The air permeable housing 28 defines air channels 40 which extend through the air permeable housing wall 30 from the outside to the chamber 22, the air channels being configured to let a permeable air flow 42A flow from the outside 44 of the device through the housing wall into the chamber, where the permeable air flow merges with the main air flow.

[0115] The permeable airflow allows in particular the extracting of moisture from a cavity 66 of a wall 12 comprising an inner wall 62, an outer wall 64 and a cavity 66 between the inner wall and the outer wall. The cavity may be filled with thermal insulation 69. The air channels connect the cavity with the inner region 22 of the chamber, so that in use a permeable air flow flows from the cavity through the air channels into the chamber.

[0116] The housing may be manufactured from a porous material such as pervious concrete which defines air channels having an average diameter which lies between 0.05 mm and 1 mm and extend through the housing wall.

[0117] The housing defines a chamber 22 therein. The device further comprises a partition wall 60 which divides the inner space in a first chamber 22A and a second chamber 22B. The first and second chamber may also be indicated as first and second chamber part, but in this situation "chamber" is considered a clearer term than "chamber part".

[0118] The central air guide 21 projects into the chamber.

[0119] The partition wall 60 extends transverse to the longitudinal direction of the device. The partition wall 60 is manufactured from a ceramic material. The partition wall 60 may substantially close the second chamber 22B, so that the second chamber 22 is not fluidly connected to the first chamber 22A. A groove 55 extends longitudinally along the inside of the housing wall. A spacer element 56 is positioned in the groove 55 in order to keep the partition wall 60 at a defined distance from the end wall 46. When a spacer element of a different length is used, the partition wall can be positioned at a different distance from the end wall.

[0120] The air intake 16A and air exit 16B are channels extending through the front part 15 and being in open communication with the first chamber 22A.

[0121] The cross section of the inner space is circular,

i.e. the chamber 22 has a substantially cylindrical shape. An air flow channel 24 for a main air flow 26 extends through the first chamber 22A between the air intake and the air exit. A longitudinal partition wall 25 extends in a longitudinal direction from a rear end 78 of the central air guide 21 further into the chamber, and extends the length of the air flow channel 24. The air flow channel 24 has a general U-shape.

[0122] The air flow channel 24 comprises an ingoing part 80 and an outgoing part 82, wherein the flow has respectively an ingoing direction and an outgoing direction. The ingoing direction and the outgoing direction are roughly opposite to one another. The air flow channel 24 comprises a U-turn 31 at the end of the longitudinal partition wall 25, i.e. at the transition between the ingoing part and the outgoing part. The U-turn 31 is located between the end of the longitudinal partition wall 25 and the partition wall 60 which divides the chamber into two chamber parts.

[0123] In use, the main air flow 26 flows through the air intake 16A, through the air flow channel 24, carries off moisture from the wall 12, and exits the device through the air exit 16B.

[0124] The housing is provided with an air permeable end wall 46 at an end 48 which is opposite to the front part 15. The air permeable endplate defines further air channels 40 which extend through the air permeable endplate from the outside of the device to the inner space of the chamber. The air channels of the endplate connect the inner wall 64 with the inner region of the chamber, so that in use a second permeable air flow 42B flows from the inner wall through the air channels 40 into the chamber.

[0125] The air permeable end wall 46 allows a better controlled extracting of moisture from the wall 12 or from the living space inside the house or building. The air channels 40 of the end wall 46 may have an average diameter which lies between 0.05 mm and 1 mm. By varying the size of the channels, the extracting of moisture may be controlled.

[0126] With the device according to the invention, a wall of a house may be completely punctured. This means that the end wall 46 of the device according to the invention may become visible from the inside. The end wall 46 may also puncture the wall of the house, but not the insulation that is attached to the inside of the wall of the house.

[0127] The end wall 46 may be mounted flush or substantially flush with the inside of the wall. The endplate may be integral with the air permeable housing. In a different embodiment, the endplate may be a separate part.

[0128] In general, a wall becoming moist can be a fast process. The drying of a wall is generally a slow process. It generally takes a long time before a moist wall dries.

[0129] The distance between the end wall 46 and the partition wall 60 may variable by the user or by the installing company. This may be executed by taking the front part off the device, removing the partition wall, installing different spacer elements 56 having a different size and re-installing the partition wall. If desired, the movable partition wall can be positioned against the fixed end wall by the user.

[0130] The movable partition wall 60 allows the user to control the rate at with which the moisture is removed. This improvement is based on the insight that for houses and other buildings which have just been built, the moisture situation needs to be improved quite quickly. In this situation, the movable end wall will be positioned against or close to the fixed end wall so that the second chamber is relatively small. The first chamber is relatively large. The first chamber is in open connection with the outside and for this reason is relatively cold. The second chamber is substantially closed or entirely closed and for this reason is warmer than the first chamber.

[0131] The first chamber creates a cold spot 22A which attracts moisture. The second chamber 22B is also a cold spot, but a cold spot having a higher temperature than the first cold spot. For this reason the second chamber attracts moisture at a lower rate.

[0132] The second chamber has a benefit in that it protects the inner wall from an extreme cold spot which would otherwise be created with a single chamber which is in direct contact with the outside.

[0133] When the house or building becomes dry over time, the need to remove moisture remains, but to a lesser extent. In this situation the invention provides the option to reduce the moisture removing capacity of the device by increasing the distance 110 between the fixed end wall and the movable end wall. This increases the size of the second chamber which has a higher temperature and a lower moisture removing capacity and decreases the size of the first chamber which has a lower temperature and therefore a higher moisture removing capacity.

[0134] This brings along an advantage that the heat loss in the building as a result of the air flow is removed. The second chamber 22B is warmer than the first chamber 22A and therefore to a certain degree provides heat-insulation, thereby reducing the loss of heat.

[0135] The partition wall itself may be permeable to moisture and allows moisture to travel through the partition wall. The moisture also travels through the wall of the housing in a forward direction, i.e. towards the front where it is colder.

[0136] There may be two partition walls as will be discussed below.

[0137] The air channels 40 are defined by pores 50 in the chamber wall. The pores are connected to form the air channels. The air channels form a criss-cross network through the housing wall.

[0138] The porosity of the air permeable housing wall, and in case of an air permeable endplate, the air permeable endplate, may be at least twenty five percent. It was found in practice that above this limit, the effect of the air channels is in particularly good.

[0139] In use, the device 10 is positioned in an existing

wall of a house or similar structure. First a hole 14 is made by drilling with a drill to the desired depth and subsequently the device is inserted. The device is fixed with cement. The device 10 may also be positioned during the forming of a brick wall, and be positioned as a brick in the wall during the forming thereof.

[0140] Turning to figure 4, the housing 28 may have a rectangular cross-section as is indicated with dashed lines. Multiple devices 10 are provided in the wall at regular distances.

[0141] Turning to figure 5, the housing 28 may also have a circular cross-section as is indicated with dashed lines. The front part 15 has a rectangular or square cross-section. This provides the benefit that the hole in the wall can be manufactured with a conventional drill, which allows fast installation of the device. At the same time, the front part 15 can have the same shape as the surrounding brickwork, making the front part 15 less visible to the eye. This avoids the disadvantage of having circular front parts which is in particular disadvantageous with historic or monumental buildings.

[0142] The intermediate part 17 provides the transition from circular to square or rectangular.

[0143] Turning to figure 6, the device 10 according to the invention is shown in exploded view. The device comprises the housing 28, an intermediate part 17 and a front part 15. The housing is circular and made from a ceramic material or from pervious concrete.

[0144] In both figure 5 and 6, the front part overlaps the contour of the housing and the cement with which the device is connected to the wall. In this way the cement is invisible or less visible. The cement which connects the device to the wall often has a different colour texture or in general appearance than the cement which is present in the rest of the wall. By hiding the cement behind the front part, the appearance of the wall as a whole is improved.

[0145] The intermediate part 17 interconnects the front part 15 and the housing 28. The intermediate part 17 provides a transition from the circular cross section of the housing to the square or rectangular cross section of the front part 15. The intermediate part 17 has a circular connector 90 which connects with the housing 28. The circular connector 90 has grooves which enable a solid connection with the housing 28.

[0146] The intermediate part 17 has a square or rectangular connector 92 which connects with the front part 15. The connector 92 has a bottom plate and a top plate which project forward and a click coupling 100 which will be discussed in detail further below.

[0147] An advantage of the intermediate part 17 is that the installation of the device becomes easier. The housing 28 is installed with cement in the hole in the wall. The intermediate part 17 is connected to the housing once the housing is fixed in place. The intermediate part may be connected to the housing in various ways, for instance with an adhesive connection or with bolts or screws. No cement is needed. This is an advantage because cement is quite difficult to handle.

[0148] A further advantage of the intermediate part is that the front part becomes smaller. This makes it easier to provide various front part having different colors which are chosen to match prevailing colors of masonry. The intermediate part is not visible and can have a general color such as black or white or may be manufactured from a more cost-effective material. Only the front part needs to be customized to the actual color of the wall.

[0149] The front part 15 comprises the central air guide 21 which defines a curved intake and a curved exit. The longitudinal wall 25 extends through the intermediate part 17 and fits in a slot 106 at the end 78 of the central air guide 21.

[0150] The partition wall 60 is shown in dashed lines.

[0151] A sloping roof 120 may be provided above the openings in order to prevent rain from entering through the openings. The lower side 122 of the entrance may also be provided with a slope in order to prevent rain or in general water from flowing into the device.

[0152] Turning to figures 7 and 8, the intermediate part 17 is shown to abut a front face of the housing 28. The intermediate part 17 is fixed in place with glue 118 or in another way. The glue 118 acts as a seal. Sometimes, the cement with which the housing is cemented to the wall does not completely close off the hole. Then, the cavity may become ventilated, leading to a substantial heat loss. The glue 118 prevents any leakage around the outside of the device 10 into the cavity of the wall.

[0153] The connector 92 for the front part 15 comprises a click coupling 100 comprising two ridges 112 which mate with two indentations 114 in the front part 15. The front part can be clicked onto the intermediate part easily and also be removed easily. This allows easy inspection, cleaning, maintenance and repositioning of the partition wall 25. In particular it allows removal of dirt and insects such as spiders.

[0154] The two ridges 112 also allow the front part including the central air guide to be positioned in two different positions. In a first position shown in figure 7 the cross sectional area of the intake 16A and exit 16B is small. In a second position shown in figure 8 the cross sectional area of the intake 16A and exit 16B is larger, resulting in a greater airflow through the device and a greater moisture removing capacity.

[0155] The cross sectional area of the intake 16A and exit 16B varies because the central air guide tapers and defines the cross sectional area in cooperation with the intermediate part 17. In the first position, the central air guide is inserted into the intermediate part further, and the width of the intake and exit is rather small. In the second position, the width of the intake is rather large.

[0156] Therefore, the click-coupling 100 has a double function and acts at the same time as a flow controller with which the air flow through the device 10 can be controlled. This allows a same device to be produced and to be tuned to different circumstances and different requirements. Other kinds of flow controllers for varying the air-

flow are also possible, such as a removable insert which partially obstructs the air flow, or a gate, or by using different front parts having different central air guides

[0157] Turning to figure 9, the present invention is installed in a wall 12 without a cavity. The wall 12 comprises a panel 70 such as a gypsum panel which is placed against the inside 74 of the inner wall 62. The panel 70 comprises a layer of insulation 72 which engages the inside 74 of the inner wall 62 and is provided between the gypsum and the inner wall. The device 10 extends all the way through the inner wall. A part of the insulation 72 is removed so that a hole 75 is created.

[0158] The end wall 46 comprises small air channels to create air permeability. The end wall 46 extends through the layer 72 of insulation and directly engages the panel 70. The layer of insulation may have a thickness in the range of 30 mm.

[0159] The technical effect of engaging the end wall 46 with the panel 70 is that the damp from the interior climate can flow through the air permeable end wall 46 into the chamber 22 without hinder of damp blocking layers. The relative humidity indoor will drop as a result of this and moisture problems inside may be solved.

[0160] The device 10 further comprises a first partition wall 60A and a second partition wall 60B. The partition walls 60A, 60B create a first chamber 22A, a second chamber 22B and a third chamber part 22C. The second and third chamber parts are not in direct contact with the outside.

[0161] The three separate chambers have an advantage in that the heat loss from the building is reduced. Furthermore, the temperature in the different chambers increases stepwise form chamber 22A to 22B to 22C. This prevents a situation in which the outer part of the device 10 would become to warm to function locally as a cold spot. In other words, the compartments prevent the outer part of the device 10 from becoming warmer than the outer part of the wall, thereby losing its function as a cold spot.

[0162] Turning to figure 9B, the device can also extend completely through an outer wall 64 and inner wall 62 of a wall 12 having a cavity 66. A hole is made in the insulation 72 provided on the inside of the inner wall. The end wall 46 may contact a gypsum panel 70 provided against the insulation.

[0163] Turning to figure 10, it is shown that in use, air will flow through the gypsum panel 70 and through the air channels inside the end wall 46 of the device 10. In this way, moisture can be removed from inside a building. The device creates a cold spot 99 in the gypsum panel 70.

[0164] An annular insulation member 101 may be provided in order to prevent moisture coming from the inside of the building from entering the insulation 72.

[0165] Turning to figure 11, the wall 12 comprises a single wall and a layer of gypsum 170 provided against the inside. No insulation is present. The end wall 46 engages the layer of gypsum in order to remove moisture from the inside of the building.

[0166] Turning to figure 12, an exploded view of another embodiment is shown. This embodiment has a housing comprising a first housing part 28A and a second housing part 28B. The housing parts are arranged coaxially. A ring 104 is provided between the first and second housing parts. The ring 104 may be manufactured from a heat-insulating material, for instance a suitable synthetic material, in order to provide a temperature barrier between the first and second housing parts 28A, 28B. This further aids in creating a temperature difference between the first and second housing parts and between the first and second chambers 22A, 22B.

[0167] The ring 104 may also provide a protection against damage. The device may provide a rigid connection between the inner wall and outer wall of a cavity wall. When the inner wall of a cavity wall moves relative to the outer wall as a result of an earthquake, other kind of shock or as a result of setting of the walls, damage may occur due to the rigid connection. When the ring 104 is manufactured from a resilient material, some relative motion between the inner wall and the outer wall is allowed, thereby avoiding damage.

[0168] The ring may further be provided with small air channels which extend in the axial direction of the ring 104 in order to allow moisture which is present in the second housing part 28A to travel through the air channels of the ring 104 to the first housing part 28B.

[0169] The first and second housing parts have different lengths L1 and L2. This embodiment has an advantage in that with a limited number of housing parts, various combinations can be made resulting in a device 10 having each time a different total length. This makes the device 10 versatile for walls 12 having different thicknesses.

[0170] This embodiment substantially avoids any cutting of housings 28 which needs to be performed in case a wall having an unusual thickness is encountered. The cutting is generally performed on the job (also called in situ). The first housing part 28A may for instance have a length of 6 - 10 cm while the second part has a length of 2 - 6 cm. Other dimensions are also possible. It is also possible that three housing parts of a first, second and third length are provided in order to increase the versatility of the device 10. The embodiment thereby allows a faster installation process.

[0171] Turning to figure 13 another embodiment of the invention is shown. At a front section 130 of the device 10, a portion of the wall has been removed, resulting in a front outer hole 132 which extends around or substantially around the front section 130 of the housing. The front outer hole can be created by creating a wider hole around the hole 14 in which the device 10 is placed. The front outer hole 132 can have a limited depth 133.

[0172] The front outer hole 132 defines the front outer channel 134 which is in open communication with the outside and which acts as a second airflow channel. The front outer channel is a second air flow channel. The front outer channel 134 receives air via the common air intake

16A and air is discharged via the common air exit 16B. It is also possible that the front outer channel 134 has a separate air intake and a separate air exit.

[0173] When seen in top view the front outer channel 134 traverses the air flow channel 24, in particular below and above the airflow channel 24. This basically means that the front outer channel has an upper passage which extends above the air flow channel 24 and a lower passage which extends below the air flow channel 24. It is also possible to have either a upper or a lower passage.

[0174] The air intake 16A comprises a bifurcation zone 138 where the incoming air flow which enters via the common air entry 16A bifurcates in two flows, i.e. the main air flow which flows through the air flow channel 24 inside the housing, and an outer air flow which flows through said front outer channel 134 along the outside of the housing. The air exit comprises a merge zone 140 wherein the main air flow and the outer air flow merge and leave the air exit 16B as a single flow..

[0175] The front outer cavity 132 may have a length 133 of 5 to 30 percent of a total thickness 135 of the wall 12.

[0176] The advantage of the front outer cavity 132 is that the front part of the wall 12 around the device is dried faster.

[0177] At a rear section 136 of the device, a rear portion of the wall has been removed, resulting in a rear outer cavity 238 which extends around or substantially around the rear section of the housing. The hole may be created from the inside, for instance by drilling. The hole may be covered with a plate 141 in order to make the hole invisible from the inside..The rear outer cavity 238 may extend to about the partition wall 60, 60A.

[0178] An annular insulation member 101 is provided at an end 140 of the rear outer cavity. The annular insulation member 101 closes off the end 140 of the rear outer cavity.

[0179] Turning to figure 14, a similar embodiment as the embodiment of figure 13 is shown, but the device has an open end. In other words, there is no end wall 46. The device 10 is placed against the inner cover layer 170 (for instance a gypsum layer) with the open end. In use, the moisture will travel through the inner cover layer 170 on the wall as condense and evaporate in the second chamber 22B. The moisture will condense against the partition wall 60 and evaporate again on the other side of the partition wall 60. A part of the moisture will travel through the wall of the housing 28 around the second chamber 22B and evaporate in the first chamber 22A..

[0180] In the embodiments of figures 13 and 14 a cavity is present in the wall, and insulation 69 is provided in the cavity on the side of the inner wall 62.

[0181] Turning to figures 15 and 16, an embodiment of the device is shown in which the hole 14 in the wall has a larger diameter than the housing. Both the housing and the cavity may have a circular shape. The hole 14 extends fully through the wall 12, i.e. the cavity forms a through hole. An annular insulating member (101) separates a front part 14A of the hole from a rear part 14B of the hole.

[0182] In this embodiment, the device does not have a partition wall 60 and consequently no second chamber 22 B. The main air flow 26 inside the device reaches the end wall 46 of the device. The device has the second air flow which traverses the main airflow.

[0183] The device comprises an outer front piece 142 which extends substantially around the intermediate part 17, wherein an air entry 144 and an air exit 145 of the front outer channel are defined between the outer front piece and the intermediate part. In front view, the intermediate part 17 has a substantially same diameter as the housing. In other words, in front view the outer front piece 142 extends substantially around the housing and defines an annulus between the outer front piece and the housing. The annulus defines the air entry 144 and the air exit 145.

[0184] Turning to figures 30A and 30B, another embodiment is shown in which the housing or the intermediate part or the outer front piece comprises one or two breaking zones which allow an upper piece 260 and/or a lower piece 260 of the housing or the intermediate part or the outer front piece to be broken off. In this way, room which is occupied by the upper and lower piece can be filled with mortar or plaster. This improves the visual appearance of the device, because the housing or the intermediate part or the outer front piece does not protrude above or below the central air guide 21 in a visible way.

[0185] The outer front piece 142 is split in two pieces 142A and 142B which are connected to the front part 15 during installation by a horizontal insertion into a groove 262 as indicated by arrows 264. The intermediate part 90 fits over the mating projections 268 on the front part

[0186] Returning to figures 15 and 16, The rear part 14B of the hole 14 may be closed off with a plate 146 having holes 147, or with a gypsum panel 70 or gypsum layer 170.

[0187] The device does not comprise the at least one partition wall 60; 60A which divides the chamber into a first chamber 22A which is in open connection with the outside via the openings 16 and a second chamber 22B which is substantially closed. The end wall 46 of the device stays at a distance 93 from a plate 146 which closes off the hole 14. The rear part 14B can be regarded as a cavity which also extends behind the device 10. The distance 93 creates a clearance which performs the same function as the second chamber 22B of the embodiment having a partition wall 60.

[0188] Turning to figure 17, an embodiment is shown having a front outer hole 132 which has a depth 133. The depth may be at least seven centimetre. This embodiment has a partition wall 60. The hole 14 does not extend entirely through the wall 12 but ends at a relatively short distance of the wall. This embodiment is suitable for walls 12 without a cavity.

[0189] Turning to figure 18, an embodiment is shown in which the wall has a cavity 66 and an outer wall 64

and an inner wall 62. Insulation 69 is present in the cavity on the side of the inner wall. The device 10 extends through a hole 14 in the outer wall. The hole 14 does not extend into the inner wall 62. The housing has an end wall 46 but no partition wall 60.

[0190] A portion of the insulation is removed at the device. In this way, the device 10, i.e. the housing of the device has a greater outer surface area which is exposed to the air in the cavity. If there is excess moisture in the cavity, the greater surface area which is exposed to the air assists in the drying process.

[0191] A clearance 93 may be present at the rear end of the device, i.e. the rear end may stay at a distance 93 from the inner wall 62. The clearance may take away a need for the partition wall inside the housing, because the inner wall does not become very cold as a result of the clearance.

[0192] In a typical use situation, the outside temperature is 5 degrees Celsius. The inside temperature may be 20 degrees. The inner wall temperature may be 13 - 14 degrees. The outer wall temperature may be 6-7 degrees. The temperature of the outside of the rear end of the housing may be 5 degrees. The temperature of the inside of the housing may be 2 degrees as a result of the evaporation of moisture, which requires energy.

[0193] This embodiment is suitable for houses and building which have been insulated after constructions, i.e. as an upgrade operation. A considerable amount of moisture may be present in the cavity and in the inner and outer wall and may be removed with this embodiment. Currently for such cavities 66 having moisture an opening in the outer wall is created to introduce outside air into the cavity for drying the cavity, However, this cools the air inside the cavity which degrades the insulating function of the cavity. With this embodiment, this disadvantage is substantially avoided.

[0194] In another embodiment, the rear end may contact the inner wall.

[0195] Turning to figure 19, another embodiment is shown. In this embodiment. The device comprises an outer housing part 28A and an inner housing part 28B. The outer housing part 28A has a greater inner diameter as the outer diameter of the inner housing part 28B. In this way, an annular space is defined between the outer housing part 28A and the inner housing part 28B.

The outer housing part 28A and the inner housing part 28B may be coaxial. The outer housing part has an end wall 46. The wall 12 is provided with a through hole 14 which extends entirely through the wall 12. The end wall 46 contacts an inner cover layer 170 which is provided on the inside of the wall 12.

[0196] At the front of the housing, a front part 153 is provided which may be manufactured from plastic. The front part may comprises two concentric tubes 155A, 155B and which abut the outer housing part 28A and an inner housing part 28B .

[0197] A fan 150 is provided at the outer end of the inner housing part 28A. The fan may be powered by a battery or by an electric cable which is connected to the electricial system of the house or building.

[0198] The fan 150 is configured to blow air to the outside. The inner housing part 28A defines the outgoing channel and the annular space defines the ingoing channel.

[0199] This embodiment is particularly suitable for bedrooms upstairs in houses that have solid walls with no cavities and double glazing. On average a sleeping person produces 2 liter of moisture per night. If such a bedroom is not properly ventilated, mould and fungus may start to grow.

[0200] With this embodiment, this moisture is carried off. The device 10 creates a cold spot on the inner cover layer 170 (for instance a gypsum layer). The cold spot attracts moisture which condenses in the gypsum layer and subsequently travel through the gypsum layer 170 into the hole 14 where it evaporates and is carried off by the outside air. The fan 150 may be regulated in order to control the moisture removing capacity. The power source for the fan be a battery or a wired source of electric power. The fan 150 makes the working of the device independent from the wind.

[0201] Turning to figure 20, a variant of the embodiment of figure 19 is shown. The outer housing part is left out except for a short tube 155A at the front of the device. The hole 14 is a through hole and has a greater diameter than the inner housing part 28A. The inner housing part 28A is positioned centrally in the hole 14. The inner housing part is held in place by one or more supports which are provided underneath the inner housing part and which rest on the lower side of the hole 14.

[0202] The housing comprises an outer housing part 28A and an inner housing part 28B. The outer housing part extends around the inner housing part and defines an annular space 152 between them. The annular space 152 forms an ingoing part 80 of the air flow channel 24 and the inner housing part 28B defines an outgoing part 82 of the air flow channel 24, wherein a U-turn 31 is defined at an end of the ingoing channel. The ingoing part extends around the outgoing part and is coaxial with the outgoing part. The fan 150 is in the outgoing part so that any noise of the fan is directed outwardly.

[0203] The front part may have an outer concentric tube 155A which has a relatively short length. The remainder of the hole 14 is not covered by a housing, but the annular space 152 is defined between the inner housing 28B and the wall.

[0204] Turning to figure 21, an embodiment is shown wherein the end wall 46 of the device has a thickness 156 of more than five times a thickness 158 of a side wall 160 of the housing. The thick end wall removes moisture from an inner part of the wall 12 without making the inner part too cold. This embodiment provides an alternative to the embodiment having a partition wall 60, in the sense that the embodiment creates different temperature zones within the device and prevents the inner part of the wall from becoming too cold. The embodiment also has the

second air flow channel at the front of the device and on the outside of the housing.

[0205] Turning to figure 22, a further invention is shown which relates to a device 200 with which the air inside a room 201 of a house or building 202 can be dried in a simple and effective manner.

[0206] The device comprises a channel 204 having a channel wall 206 which is porous to moisture in order to allow moisture to travel through said channel wall. The channel wall is at least partially exposed to the air inside said room. The channel may extend through the room.

[0207] The device further comprises an air entrance 208 which is configured to be located on the outside of the house or building. The device further comprises an entry tube 210 which is constructed to extend through a first through hole 212 in the outside wall 214 of the house or building to the channel. In use, outside air is drawn in through the entrance and travels through the entry tube to the channel. The device may comprise a fan 220 for blowing outside air through the channel. The fan 220 may be provided at the downstream end of the channel. This results in an underpressure in the channel 204. The underpressure assists in letting the moisture travel through the channel wall 206 from the interior space into the channel A substantial air speed through the channel may assist in providing the required capacity and results in a shorter travel time of the air through the channel. This limits any warming up of the air inside the channel. The position at the downstream end also prevents noise from the fan from entering the house or building.

[0208] The device may comprise a filter 222 at the entrance.

[0209] The device further comprises an air exit 216 which is configured to be located on the outside of the house or building. In use, the air is released back into the outside via the exit. An exit tube 218 extends through a through hole 213 in the outside wall 214 from the channel 204 to the exit.

[0210] The channel wall is relatively closed to air in order to prevent air from the living space to enter the channel. In this way, moisture can be carried off without excessive loss of heat.

[0211] In use, relatively cold air is blown from the outside through said channel. Moisture in the air of the room condenses in the wall of the channel as a result of the cold outside air. The moisture travels as liquid particles through the channel from the outside of the channel wall to the inside of the channel wall and subsequently evaporates inside the channel into the cold outside air which passes through said channel. Next, the air including the moisture is discharged via the air exit.

[0212] The device can be installed in a room of an existing house or building in order to dry the air within a room of said house or building. The installation method comprises making at least a first through hole 212 and a second trough hole 213 in an outer wall of the house or building, placing the entry tube 210 and exit tube 218 in said through holes, installing the air entrance 208 and the air exit 216 on the outside of the house or building and installing the channel along a wall 214 inside the room. The method is in particular suitable for houses or buildings which do not have sufficient ventilation, or which have users who have the tendency to close the ventilation to save energy. With the method, excess moisture can be removed without excessive heat loss.

[0213] The channel has the appearance of a baseboard 211, in particular of other baseboards in the same room. In this way, the channel can be made invisible for a person inside the room. The channel is more or less camouflaged. The channel may extend along one or more walls 224 of the room.

[0214] The channel may comprise one or more vertical sections 226 and a horizontal section 228 wherein said one or more vertical sections extend in particular along a vertical line where two walls 224 of the house or building meet one another. In this way, the channel can be made inconspicuous.

[0215] The channel may extend along an upper end of a wall of the living space where said wall meets the ceiling.

[0216] Turning to figures 23 and 24, the channel may extend at least partially in a horizontal direction along a foot 225 of a wall of the living space where the wall meets the floor. The room may be a cellar of a house or building. The entry tube and the exit tube may be located near the ceiling of the cellar.

[0217] The channel comprises two vertical sections 226 located at a distance from one another and extending along respective vertical lines where walls of the cellar meet to respective corners where the respective vertical lines meet the floor. The channel comprises a horizontal section 228 which extends along the foot of a wall between said corners.

[0218] Turning to figures 25 and 26 an embodiment is shown wherein the channel is inside the room and surrounded on all sides by the air inside the room.

[0219] Turning to figure 27 another embodiment is shown which combines the drying of air inside the room with the drying of air in the inner part of a wall. At least one wall is provided with one or more holes 230 which extend into the wall from the side of the room. The holes can be blind holes and may be arranged in a row.

[0220] The channel comprises one or more parallel channel sections 232 which extend parallel to the wall and along the wall from one hole 230 to the next hole 230. Each parallel channel section has a channel wall 206 which is porous to moisture in order to allow moisture to travel through said channel wall. The channel wall is at least partially exposed to the air in the room.

[0221] The device 200 further comprises one or more wall piercing channel sections 234, each of which is associated with one of said holes 230. The one or more wall piercing channel sections are constructed to guide the air from a parallel channel section 232 through said hole and from said hole back into a next parallel channel section 232 in order to remove moisture from the part of

the wall which surrounds said hole. In this way both the room and the wall are dried.

[0222] Each of the wall piercing channel sections may comprises an air guide 235 which extends into the hole and divides the wall piercing channel section into an ingoing part 80 and an outgoing part 82 which are parallel to one another. The air guide defines a U-turn at the end of the hole.

[0223] The room may comprise a plurality of holes and a plurality of associated air guides, the holes being positioned in a linear configuration along said wall in order to remove moisture from said wall.

[0224] The method of installation may comprise drilling multiple holes in the wall 224 from the inside, and installing multiple wall piercing channel sections inside said holes and multiple parallel channel sections 232 which extend along the wall and interconnect the multiple wall piercing channel sections.

[0225] Turning to figures 28A, 28B, 28C, 28D and 28E different possible cross-sections of channels 204 of figures 22-27 are shown. Figures 28A, 28B show a channel 204 formed as a baseboard which can be positioned at the foot of a wall. In figure 28A the baseboard defines a single channel and in figure 28B the baseboard defines a double channel. Figures 28C, 28D show a channel 204 in the form of a wall ornament. This channel 204 can be positioned higher up against the wall. An embodiment which can be positioned where the wall meets the ceiling is also possible.

[0226] In the embodiment of figure 28E, the channel 204 is located in a groove 209 on the inside of the wall 214. The groove 209 and the channel 204 may be horizontal, vertical or diagonal and may comprise turns. An advantage of this embodiment may be that the channel is made completely invisible. To this end, the groove may be covered with a suitable material. Even if the channel is not covered, it may be inconspicuous. The channel 204 can be installed vertically at a corner of a room where two walls meet.

[0227] When this embodiment is made, the groove 209 is made in the wall first, and subsequently the channel 204 is installed. The embodiments of 28A-28E can be combined with the embodiment shown in figures 23, 24,25 26 and 27. It is also possible to place channel 204 partially in the groove 209 and to let the channel 204 partially protrude from the groove 209. This provides the benefit of needing a relatively small groove 209, but the channel will be less inconspicuous.

[0228] Turning to figures 29A, 29B, another embodiment of the longitudinal partition wall is shown. The longitudinal partition wall 25 is provided with at least one spacer projection 250 which prevents the longitudinal partition wall 25 from being positioned so close to the partition wall 60 that a U-turn 31 in the airflow channel 24 would be closed off. In the shown embodiment, two spacer projections 250 are provided, one near the top and another near the bottom of the longitudinal partition wall. A single spacer projection is also possible. The spacer projection(s) 250 define(s) an opening 252 together with the end ridge 255 of the longitudinal partition wall which opening always stays open. In this way it is impossible for the installation operator to make a mistake with the position of the longitudinal partition wall. The opening 252 may have the shape of a rectangle, a half circle or a half moon, and other shapes are also possible.

[0229] Since the position of the partition wall 60 may vary in dependence of the circumstances, the length L1 of the longitudinal partition wall may vary as well. Special breaking lines 254 are provided which extend across the longitudinal partition wall. The breaking lines are weakened lines of the longitudinal partition wall. The breaking lines allow a front part 256 to be broken from the rest of the longitudinal partition wall, thereby allowing the longitudinal partition wall to be set to the required length with ease.

[0230] It is noted that the spacer projections 250 comprise notches 258 for holding the partition wall 60. The notches cooperate with recesses in the partition wall 60. In this way a fixed distance between the partition wall 60 and the longitudinal partition wall is guaranteed. Alternatively, the notches 258 may not be present and the spacer projection on the longitudinal partition wall 25 or the partition wall 60 is of an abutting type.

[0231] Turning to figures 31A, 31B another embodiment is shown, in which the housing has breakable ridges 270 on the outside. The ridges may extend longitudinally. It was found that during the making of the hole 14 in the wall, the diamond core drill gradually wears off. The diamond core drill generally has an outer diameter of 78 mm. However, during the making of the holes 14, the diameter decreases from 78 mm to about 74 mm as a result of wear. The diameter of the hole 14 also decreases. If the housing fits in a hole of 78mm, it does not fit in a hole of 74 mm. If the housing fits in a hole of 74mm, it is too small to properly be installed in a hole of 78mm. It is not very attractive to replace the diamond core drill sooner, because they are very expensive.

[0232] The ridges project from the housing over a distance of a few millimetres. The outer diameter defined by the ridges may be in the order of 77-79mm. The inner diameter as defined by the outer wall of the housing 28

[0233] The ridges on the outside are strong enough to support the device 10 and weak enough to be broken if the housing is pushes into a hole which is smaller than the diameter defined by the ridges 274. The ridges may be applied for every embodiment which is configured to contact the wall.

[0234] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any

appropriately detailed structure. Further, the terms and phrases used herein are not intended to be limiting, but rather, to provide an understandable description of the invention.

[0235] The terms "a" or "an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms including and/or having, as used herein, are defined as comprising (i.e., open language, not excluding other elements or steps). Any reference signs in the claims should not be construed as limiting the scope of the claims or the invention.

[0236] The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Clauses:

[0237] The present disclosure relates to the following clauses:

1. Device (10) for extracting moisture from a wall (12) or similar structure, the device being configured to be positioned in a hole (14) in said wall, the device comprising:

- a front part (15) which defines two openings (16) which extend in different directions (18, 19), the openings being configured to act as an air intake (16A) and an air exit (16B),
- a chamber (22) which defines an inner space, wherein an air flow channel (24) for a main airflow (26) extends through the inner space between the air intake and the air exit,
- a housing (28) which forms a housing wall (30) of the chamber, the housing being connected to the front part,

wherein the main air flow (26) that flows through the air flow channel (24) carries off moisture from the wall (12).

2. Device (10) according to clause 1, **characterized in that** the device comprises at least one partition wall (60; 60A) which divides the chamber into a first chamber (22A) which is in open connection with the outside via the openings (16) and a second chamber (22B) which is substantially closed, wherein the partition wall reduces the heat loss of the device and creates different temperature zones inside the device.

3. Device (10) according to clause 2, wherein the device is constructed to prevent the air flow from reaching an end (48) of the device.

4. Device (10) according to clause 2 or 3, wherein a part of the housing which surrounds the second chamber (22B) is constructed to be in contact with the wall (12), in particular without an air flow passage being provided in between said part and the wall (14).

5. Device (10) according to any of the preceding clauses, wherein the air flow channel (24) comprises an ingoing part (80) and an outgoing part (82) which both are located inside the housing (26).

6. Device (10) according to any of clauses 2 - 5, wherein said partition wall is movable in a longitudinal direction of the device in order to vary the size of the first and second chamber.

7. Device (10) according to any of the preceding clauses, further comprising an intermediate part (17) which interconnects the housing and the front part, wherein the intermediate part is separate from the front part.

8. Device (10) according to any of the preceding clauses, wherein the front part (15) is connected to the rest of the device via a releasable coupling (100) which allows the front part (15) to be removed by a user, wherein in particular the front part is connected to the intermediate part via the releasable coupling (100).

9. Device (10) according to any of the preceding clauses, comprising a flow controller (100) for varying the airflow after installation of the device in a wall, wherein in particular the flow controller is formed by a central air guide (21) having a variable position.

10. Device (10) according to any of the preceding clauses, comprising a second partition wall (60B) which together with the first partition wall divides the chamber into a first chamber (22A), a second chamber (22B) part and a third chamber part (22C), and wherein in particular the first and second partition wall are movable.

11. Device (10) according to any of the preceding clauses, wherein the housing (28) comprises a first housing part (28A) and a second housing part (28B) which are coaxially arranged, and which in particular have different lengths (L1, L2).

12. Device (10) according to any of the preceding clauses, wherein the housing wall is not only permeable to moisture but also comprises air channels which extend through the housing from the outside to the inside in order to let an air flow (42A) permeate from the outside (44) of the device through the housing wall into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm.

13. Device (10) according to any of the preceding clauses, wherein the housing is provided with an end wall (46) at an end (48) thereof, wherein the endplate comprises air channels which extend through the end wall in order to let a second permeable air flow (42B) flow through the endplate into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm and wherein the endplate is in particular manufactured from the same material as the housing.

14. Device (10) according to any of the preceding

clauses, wherein the housing has a circular cross-section and wherein the front part has a square cross-section or a rectangular cross-section, wherein in particular the intermediate part provides a transition from a circular cross-section to a rectangular cross section.

15. Device (10) according to any of the preceding clauses, wherein in front view the front part overlaps the housing and any cement with which the housing is connected to the wall.

16. Device (10) according to any of the preceding clauses, wherein the device comprises an annular outer front piece (142) which in particular extends substantially around the housing and/or the intermediate part (17), wherein an air entry (144) and an air exit (145) of a front outer channel (134) are defined between the annular outer front piece and the intermediate part, wherein the front outer channel (134) extends around the housing and is in open communication with the outside and which acts as a second air flow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall, and wherein in top view the front outer channel traverses the main channel.

17. Device (10) according to any of the preceding clauses, wherein the device has no end wall and wherein the second chamber has an open rear end.

18. Device (10) according to any of the preceding clauses, wherein the housing comprises an outer housing part (28A) and an inner housing part (28B), wherein the outer housing part extends around the inner housing part and defines an annular space (152) between them, wherein the annular space forms an ingoing part (80) of the air flow channel (24) and the inner housing part (28B) defines an outgoing part (82) of the air flow channel (24), wherein a U-turn (31) is defined at an end of the ingoing channel.

19. Device (10) according to clause 18, wherein the outer housing part (28A) is relatively short and is only provided at the front end of the device, wherein over a large portion of the length of the device an annular space which forms the ingoing channel is defined by the wall and the housing.

20. Device (10) according to clause 18 or 19, wherein the device comprises at least one support (154) configured to support the inner housing part (28B) at a distance from the inner surface of the hole (14) in order to create the annular space (152).

21. Device (10) according to clause 1 or any of clauses 13 - 20 except clause 17, wherein the end wall (46) of the device has a thickness (156) of more than five times a thickness (158) of a side wall (160) of the housing.

22. Device according to any of the preceding clauses, wherein the longitudinal partition wall (25) or the partition wall (60) is provided with at least one spacer projection (250) which prevents the longitudinal partition wall (25) from being positioned so close to the partition wall (60) that a U-turn (31) in the airflow channel (24) would be closed off.

23. Device according to any of the preceding clauses, wherein the housing comprises ridges (274) on the outside, the ridges defining an outer diameter (D1) which is somewhat larger than the diameter defined by the outer wall of the housing in between the ridge, the ridges being made of a material which is strong enough to support the device when positioned in a hole and soft enough to break when the device is pressed into a hole (14) which is smaller than said outer diameter (D1).

24. Device according to any of the preceding clauses, wherein the front part comprises one or more breaking zones via which an upper piece (260) and/or a lower piece (260) of the housing or the intermediate part or the outer front piece can be broken off after insertion of the device into the hole, in order to improve the visual appearance of the device.

25. Wall (12) of a house or similar structure, the wall comprising a hole (14) and a device (10) according to any of the preceding clauses, the device being positioned in the hole.

26. Wall (12) according to clause 25, wherein the wall is a double wall comprising a first, inner wall (62), a second, outer wall (64) and a cavity (66) between the inner and outer wall, and wherein the housing wall comprises air channels which extend through the housing and connect the cavity with the chamber, so that in use a permeable air flow (42A) flows from the cavity through the housing wall into the chamber.

27. Wall according to clause 25 or 26, wherein the device has an end wall (46) at an end (48) thereof, wherein the end wall comprises air channels which extend through the end wall in order to let a second permeable air flow (42B) flow through the end wall into the chamber, and wherein the air channels have an average diameter of at least 0.5 mm and wherein the end wall is in particular manufactured from the same material as the housing wherein a layer of insulation (72) is connected to the wall (12), wherein the insulation has an opening (75) near an end (48) of the device so that air containing moisture can flow through the opening in the insulation and continue as a permeable air flow through the end wall and into the chamber.

28. Wall according to clause 27, wherein a panel (70) such as a gypsum panel comprising the layer of insulation (72) is connected to the inside (74) of the wall (12), the insulation engaging the wall, wherein the device extends through the wall, wherein the opening is provided in the insulation so that an end (48) of the device directly engages the panel (70).

29. Wall according to any of clauses 25 - 28, comprising a device according to any of clauses 17 - 21, wherein at a front section (130) of the device a portion of the wall has been removed around the hole (14),

resulting in a front outer hole (132) having a larger diameter as the hole (14), wherein the front outer hole extends at a distance around or substantially around the front section (130) of the housing and/or the intermediate part (17), the front outer hole forming a front outer channel (134) which is in open communication with the outside and which acts as a second airflow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall.

30. Wall according to clause 29, wherein when seen in top view the front outer channel (134) traverses the air flow channel (24), in particular below and above the air flow channel (24).

31. Wall according to clause 29 or 30, comprising a device according to any of clauses 16 - 24, wherein the air intake (16A) comprises a bifurcation zone (138) where the incoming airflow bifurcates in the main air flow which flows through the airflow channel (24) inside the housing and an outer airflow which flows through said front outer channel (134) along the outside of the housing and wherein the air exit comprises a merge zone (140) wherein the main air flow and the outer air flow merge.

32. Wall according to any of clauses 25 - 31, comprising a device according to any of clauses 16-24, wherein the front outer hole (132) has a length (133) which is 5 to 30 percent of a total thickness (135) of the wall.

33. Wall according to any of clauses 25 - 32, wherein the hole (14) is a through hole which extends through the wall, and wherein at a rear section (136) of the device a rear portion of the wall has been removed having a larger diameter than the hole (14), resulting in a rear outer hole (238) which extends around or substantially around the rear section of the housing.

34. Wall according to clause 33, wherein the rear outer hole (238) is closed off with a closing member (146;70), in particular with a plate (146) having holes (147) or with a gypsum plate (70) or inner cover layer (170).

35. Wall according to clause 34, wherein the rear outer hole (238) extends to about the partition wall (60, 60A).

36. Wall according to any of clauses 33 - 35, wherein an annular insulation member (101) is provided at an end (140) of the rear outer hole (238).

37. Wall according to any of clauses 25 - 36, wherein the hole (14) extends through the entire wall (12), wherein the hole has a larger diameter as the housing, wherein an annular cavity is defined around the housing, and wherein an annular insulating member (101) which extends around or substantially around the housing separates a front hole part (14A) from a rear hole part (14B).

38. Wall according to the previous clause, wherein the inner side of the wall is closed off by a plate (147) or a panel, and wherein an end wall (46) of the housing is located at a distance from the plate or panel, thereby creating a cavity behind the device (10).

39. Wall according to any of clauses 25 - 38, the wall comprising an outer wall and an inner wall and a cavity (66), in particular a cavity comprising thermal insulation (69), wherein the device (10) extends through the outer wall and to within the cavity, but does not extend into the inner wall.

40. Wall according to any of clauses 25 - 38, wherein the wall is a solid wall without a cavity, and wherein the wall has a panel (70) or inner cover layer (170) which covers the inner side, and wherein the hole (14) extends entirely through the wall but not through the panel or inner cover layer.

41. Wall according to clause 40, wherein an end wall (46) of the device engages the panel or inner cover layer.

42. Method of improving the damp situation in a house or similar structure, the method comprising:

- creating a hole (14) in a wall (12) of the house,
- inserting the device according to any of clauses 1 - 24 in said hole,
- removing moisture from the wall.

43. Method of clause 42, wherein the device is initially installed with a partition wall in a first position or without a partition wall, and wherein after a certain time period the partition wall is moved to a second position, removed or inserted, such that in the second time period the device has a different moisture removing capacity than in the first time period.

44. Method of clause 42 or 43, wherein the device is initially installed with a first partition wall in a first position and second partition wall in a second position, and wherein after a certain time period at least one partition wall is moved or removed.

45. Method of any of the preceding method clauses, wherein the device (10) comprises an intermediate part (17) which interconnects the housing and the front part, wherein the intermediate part is separate from the front part, wherein the housing is manufactured from a ceramic material and wherein the front part and the intermediate part are manufactured from a synthetic material, and wherein the housing is fixed to the wall with cement and the intermediate part is connected to the housing via a different connection method.

46. Method of any of the preceding method clauses, wherein the front part is connected to the rest of the device via a releasable coupling (100) which allows the front part (15) to be removed by a user, wherein in particular the front part is connected to the intermediate part via the releasable coupling (100), and wherein the front part is removed from time to time for:

- inspection of the interior,

- cleaning the interior and/or for
- repositioning the at least one partition wall inside the chamber.

47. Method of any of the preceding method clauses, wherein the device (10) comprises a flow controller (100) for varying the airflow after installation of the device in a wall, wherein in particular the flow controller is formed by a central air guide (21) having a variable position, and wherein after a certain time period the airflow is adjusted with the flow controller in order to increase or decrease the moisture removing capacity.
48. Method according to any of the preceding method clauses wherein a device according to clause 12 is provided, and wherein an airflow (42A) flows through the air channels in the housing wall from the cavity into the chamber, thereby removing moisture from the cavity.
49. Method of any of the preceding method clauses, wherein the housing is provided with an endplate (46), wherein the endplate comprises air channels in order to let a second permeable air flow (42B) flow from the outside (44) of the device through the endplate into the chamber, wherein a wall comprises a panel (14), in particular a gypsum panel, which is connected to the inside (74) of the wall (12), wherein the hole (14) extends all the way through the wall (12), wherein the endplate (46) of the device directly engages the panel, and wherein moisture is removed from the panel by a second permeable air flow which flows through the endplate (46).
50. Method of clause 49, wherein the panel (14), in particular a gypsum panel, comprises a layer of insulation (72) which is connected to the inside (74) of the wall (12), wherein near the endplate (46) a hole (75) is provided in the insulation (72), so that the endplate (46) of the device directly engages the panel, and wherein moisture is removed from the panel by a second permeable air flow which flows through the endplate (46).
51. Method according to any of the preceding method clauses, comprising removing a front portion of the wall at a front part of the hole (14), the front part having a larger diameter than the hole (14), resulting in a front outer cavity (132) which extends around or substantially around the front section (130) of the housing, the front outer cavity defining a front outer channel (134) which is in open communication with the outside and which acts as a second air flow channel (136).
52. Method according to clause 51, wherein the front outer cavity (132) has a length (133) which is 5 to 30 percent of a total thickness (135) of the wall.
53. Method according to any of clauses 51 - 52, wherein at a rear section of the hole (14) device a rear portion of the wall is removed, the rear portion having a larger diameter than the hole (14), resulting in a rear outer cavity (146) which extends around or substantially around the rear section of the housing.
54. Method according to any of clauses 51 - 53, wherein the front outer cavity and the rear outer cavity together extend through the entire wall (12), wherein the annular insulating member (101) separates the front outer cavity from the rear outer cavity.
55. Method according to any of clauses 51 - 54, wherein the device does not comprise the at least one partition wall (60;60A) which divides the chamber into a first chamber (22A) which is in open connection with the outside via the openings (16) and a second chamber (22B) which is substantially closed.
56. Device (200) for removing moisture from the air in a room (201) in a house or building (202), the device comprising:

- a channel (204) having a channel wall (206) which is porous to moisture in order to allow moisture to travel through said channel wall, wherein the channel wall is at least partially exposed to the air inside said room,
- an air entrance (208) being configured to be located on the outside of the house or building, and an entry tube (210) which is constructed to extend through a first through hole (212) in the outside wall (214) of the house or building to the channel, wherein outside air is drawn in through the entrance and travels through the entry tube to the channel, and
- an air exit (216), the air exit being configured to be located on the outside of the house or building, where the air is released back into the outside via the exit, and an exit tube (218) extending through a through hole (213) in the outside wall (214) from the channel (204) to the exit.

57. Device according to clause 56, wherein the channel wall is relatively closed to air in order to prevent air from the living space to enter the channel and/or to prevent air from the living space to enter the channel.
58. Device according to clause 56 or 57, wherein the channel has the appearance of a baseboard (211), the channel being invisible for a person inside the room.
59. Device according to any of clauses 56 - 58, wherein the channel has a substantially rectangular cross section, wherein the longer side is oriented substantially vertical.
60. Device according to any of clauses 56 - 59, comprising a fan (220) for blowing outside air through the channel.
61. Device according to any of clauses 56 - 60, comprising a filter (222) at the entrance.
62. Room of a house or building, the room comprising one or more walls (224) comprising a device according to any of clauses 56 - 61, wherein the channel

extends at least partially along a wall (224) of the living space.

63. Room according to clause 62, comprising a number of baseboards, wherein the appearance of the channel is similar or the same as the appearance of the other baseboards (211) in said room (201).

64. Room according to any of clauses 62 - 63, wherein the channel comprises one or more vertical sections (226) and a horizontal section (228) wherein said one or more vertical sections extend in particular along a vertical line where two walls (224) of the house or building meet one another.

65. Room according to any of clauses 62 - 64, wherein the channel extends along an upper end of a wall of the living space where said wall meets the ceiling.

66. Room according to any of clauses 62 -64, wherein the channel extends at least partially in a horizontal direction along a foot (225) of a wall of the living space where the wall meets the floor.

67. Room according to any of clauses 62 - 66, the room being a cellar of a house or building, wherein the entry tube and the exit tube are located near the ceiling of the cellar.

68. Room according to clause 67, wherein the entry tube and exit tube are located near the ceiling of the cellar, and wherein the channel comprises two vertical sections (226) located at a distance from one another and extending along respective vertical lines where walls of the cellar meet to respective corners where the respective vertical lines meet the floor, and comprising a horizontal section (228) extending along the foot of a wall between said corners.

69. Room according to any of clauses 62 -68, wherein at least one wall comprises one or more holes (230) which extend into the wall from the side of the room, wherein the channel comprises:

- one or more parallel channel sections (232) which extend parallel to the wall and along the wall from one hole (230) to a next hole (230), each parallel channel section having a channel wall (206) which is porous to moisture in order to allow moisture to travel through said channel wall, and
- one or more wall piercing channel sections (234) each of which is associated with one of said holes (230), wherein the one or more wall piercing channel sections are constructed to guide the air from a parallel channel section (232) through said hole and from said hole back into a next parallel channel section (232) in order to remove moisture from the part of the wall which surrounds said hole.

70. Room according to clause 69, wherein the holes (232) are blind holes, wherein each of the wall piercing channel sections comprises an air guide (235) which extends into the hole and divides the wall piercing channel section into an ingoing part (80) and an outgoing part (82) which are parallel to one another, and wherein the air guide defines a U-turn at the end of the hole.

71. Room according to clause 69 or 70, comprising a plurality of holes and a plurality of associated air guides, the holes being positioned in a linear configuration along said wall in order to remove moisture from said wall.

72. Room according to any of clauses 62 -68, wherein the channel (204) is partially or wholly positioned inside a groove (209) in the wall.

73. Method of modifying an existing house or building in order to dry the air within a room of said house or building with the device of any of clauses 56 - 61, the method comprising making at least a first through hole (212) and a second through hole (213) in an outer wall of the house or building, placing the entry tube (210) and exit tube (218) in said through holes, installing the air entrance (208) and the air exit (216) on the outside of the house or building and installing the channel along a wall (214) inside the room.

74. Method of clause 73, comprising drilling multiple holes in the wall (224) from the inside, and installing multiple wall piercing channel sections inside said holes and multiple parallel channel sections (232) which extend along the wall and interconnect the multiple wall piercing channel sections.

75. Method of clause 73 or 74, comprising making a groove (209) on the inside of the outer wall and positioning the channel (204) partially or wholly in the groove.

76. Method of drying the air within a room of a house or building, the method comprising:

- installing the device of any of clauses 56 - 61 in a room of a house or building, and
- blowing relatively cold air from the outside through said channel, wherein moisture in the air of the room condenses in the wall of the channel as a result of the cold outside air, wherein the moisture travels as liquid particles through the channel from the outside of the channel wall to the inside of the channel wall and subsequently evaporates inside the channel into the cold outside air which passes through said channel, wherein said air including the moisture is subsequently discharged via the air exit.

Claims

1. Wall (12) of a house or similar structure, the wall comprising a hole (14) and a device (10) for extracting moisture from a wall (12) or similar structure, the device being positioned in the hole, the device being configured to be positioned in a hole (14) in said wall, the device comprising:

- a front part (15) which defines two openings (16) which extend in different directions (18, 19), the openings being configured to act as an air intake (16A) and an air exit (16B),
- a chamber (22) which defines an inner space, wherein an air flow channel (24) for a main airflow (26) extends through the inner space between the air intake and the air exit,
- a housing (28) which forms a housing wall (30) of the chamber, the housing being connected to the front part,

wherein the main air flow (26) that flows through the air flow channel (24) carries off moisture from the wall (12),
wherein at a front section (130) of the device a portion of the wall has been removed around the hole (14), resulting in a front outer hole (132) having a larger diameter as the hole (14), wherein the front outer hole extends at a distance around or substantially around the front section (130) of the housing and/or the intermediate part (17), the front outer hole forming a front outer channel (134) which is in open communication with the outside and which acts as a second air flow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall.

2. Wall according to claim 1, wherein when seen in top view the front outer channel (134) traverses the airflow channel (24), in particular below and above the air flow channel (24).

3. Wall according to claim 1 or 2, wherein the air intake (16A) comprises a bifurcation zone (138) where the incoming air flow bifurcates in the main air flow which flows through the air flow channel (24) inside the housing and an outer air flow which flows through said front outer channel (134) along the outside of the housing and wherein the air exit comprises a merge zone (140) wherein the main air flow and the outer air flow merge.

4. Wall according to any of claims 1 - 3, wherein the front outer hole (132) has a length (133) which is 5 to 30 percent of a total thickness (135) of the wall.

5. Wall according to any of claims 1 - 4, wherein the hole (14) is a through hole which extends through the wall, and wherein at a rear section (136) of the device a rear portion of the wall has been removed having a larger diameter than the hole (14), resulting in a rear outer hole (238) which extends around or substantially around the rear section of the housing.

6. Wall according to any of claims 1 - 5, wherein the hole (14) extends through the entire wall (12), wherein the hole has a larger diameter as the housing, wherein an annular cavity is defined around the housing, and wherein an annular insulating member (101) which extends around or substantially around the housing separates a front hole part (14A) from a rear hole part (14B).

7. Method of improving the damp situation in a house or similar structure, the method comprising:

- creating a hole (14) in a wall (12) of the house,
- inserting a device in said hole, the device comprising:

◦ a front part (15) which defines two openings (16) which extend in different directions (18, 19), the openings being configured to act as an air intake (16A) and an air exit (16B),
◦ a chamber (22) which defines an inner space, wherein an air flow channel (24) for a main air flow (26) extends through the inner space between the air intake and the air exit,
◦ a housing (28) which forms a housing wall (30) of the chamber, the housing being connected to the front part,

- removing moisture from the wall by letting n the main air flow (26) flow through the air flow channel (24) to carry off moisture from the wall (12).

the method comprising removing a front portion of the wall at a front part of the hole (14), the front part having a larger diameter than the hole (14), resulting in a front outer cavity (132) which extends around or substantially around the front section (130) of the housing, the front outer cavity defining a front outer channel (134) which is in open communication with the outside and which acts as a second air flow channel (136).

8. Method according to claim 7, wherein the front outer cavity (132) has a length (133) which is 5 to 30 percent of a total thickness (135) of the wall.

9. Method according to any of claims 7 - 8, wherein at a rear section of the hole (14) device a rear portion of the wall is removed, the rear portion having a larger diameter than the hole (14), resulting in a rear outer cavity (146) which extends around or substantially around the rear section of the housing.

10. Method according to any of claims 7 - 9, wherein the front outer cavity and the rear outer cavity together extend through the entire wall (12), wherein the an-

nular insulating member (101) separates the front outer cavity from the rear outer cavity.

11. Device (10) for extracting moisture from a wall (12) or similar structure, the device being configured to be positioned in a hole (14) in said wall, the device comprising:

- a front part (15) which defines two openings (16) which extend in different directions (18, 19), the openings being configured to act as an air intake (16A) and an air exit (16B),
- a chamber (22) which defines an inner space, wherein an air flow channel (24) for a main air flow (26) extends through the inner space between the air intake and the air exit,
- a housing (28) which forms a housing wall (30) of the chamber, the housing being connected to the front part,

wherein the main air flow (26) that flows through the air flow channel (24) carries off moisture from the wall (12).

12. Device (10) according to the preceding claim, wherein the device comprises an annular outer front piece (142) which in particular extends substantially around the housing and/or the intermediate part (17), wherein an air entry (144) and an air exit (145) of a front outer channel (134) are defined between the annular outer front piece and the intermediate part, wherein the front outer channel (134) extends around the housing and is in open communication with the outside and which acts as a second air flow channel, wherein the front outer channel is configured to remove moisture from a front part of the wall, and wherein in top view the front outer channel traverses the main channel.

13. Device (10) according to the preceding claim, wherein the housing comprises an outer housing part (28A) and an inner housing part (28B), wherein the outer housing part extends around the inner housing part and defines an annular space (152) between them, wherein the annular space forms an ingoing part (80) of the air flow channel (24) and the inner housing part (28B) defines an outgoing part (82) of the air flow channel (24), wherein a U-turn (31) is defined at an end of the ingoing channel.

14. Device (10) according to claim 13, wherein the outer housing part (28A) is relatively short and is only provided at the front end of the device, wherein over a large portion of the length of the device an annular space which forms the ingoing channel is defined by the wall and the housing.

15. Device (10) according to claim 13 or 14, wherein the device comprises at least one support (154) configured to support the inner housing part (28B) at a distance from the inner surface of the hole (14) in order to create the annular space (152).

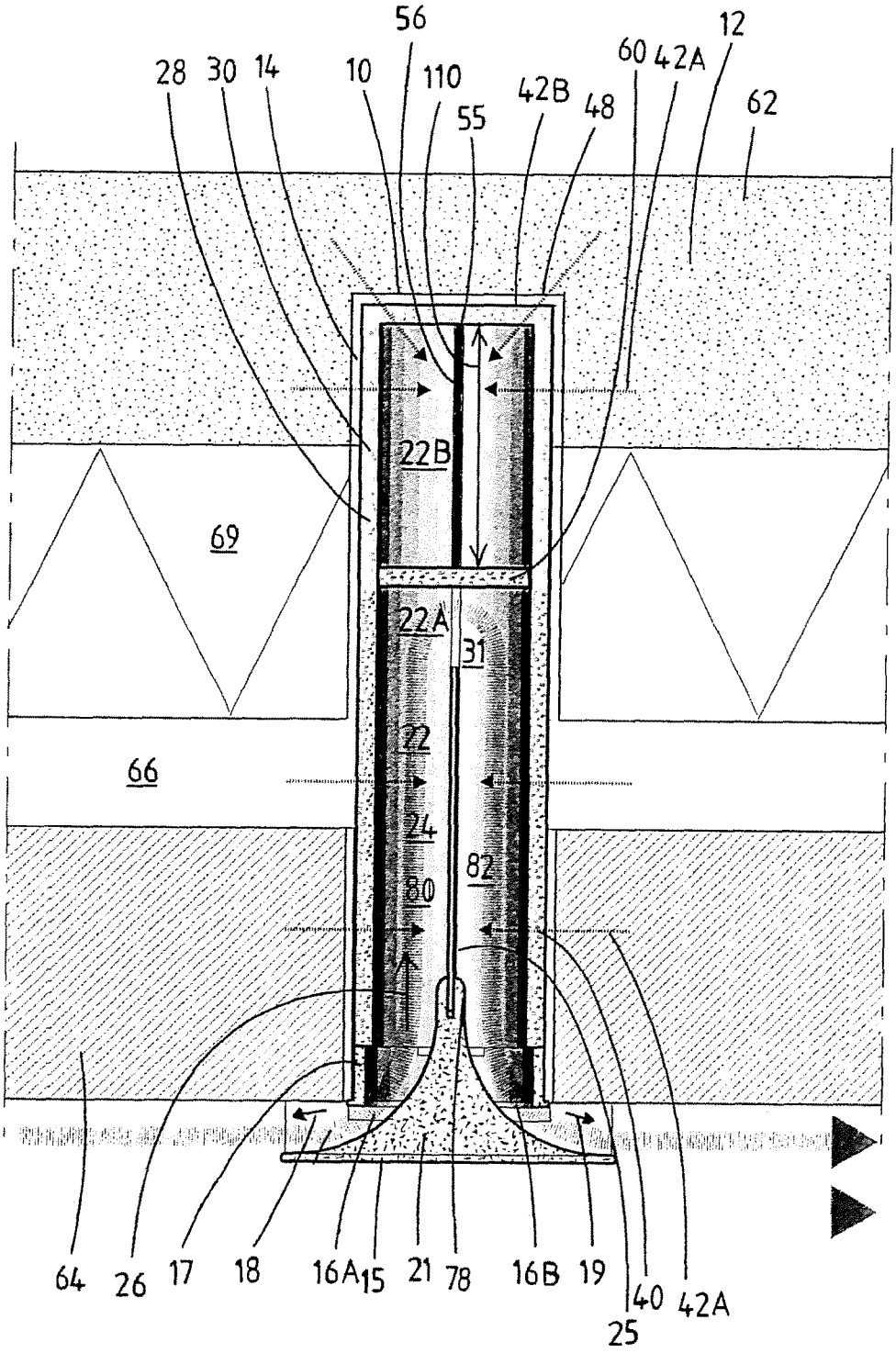
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Fig.1

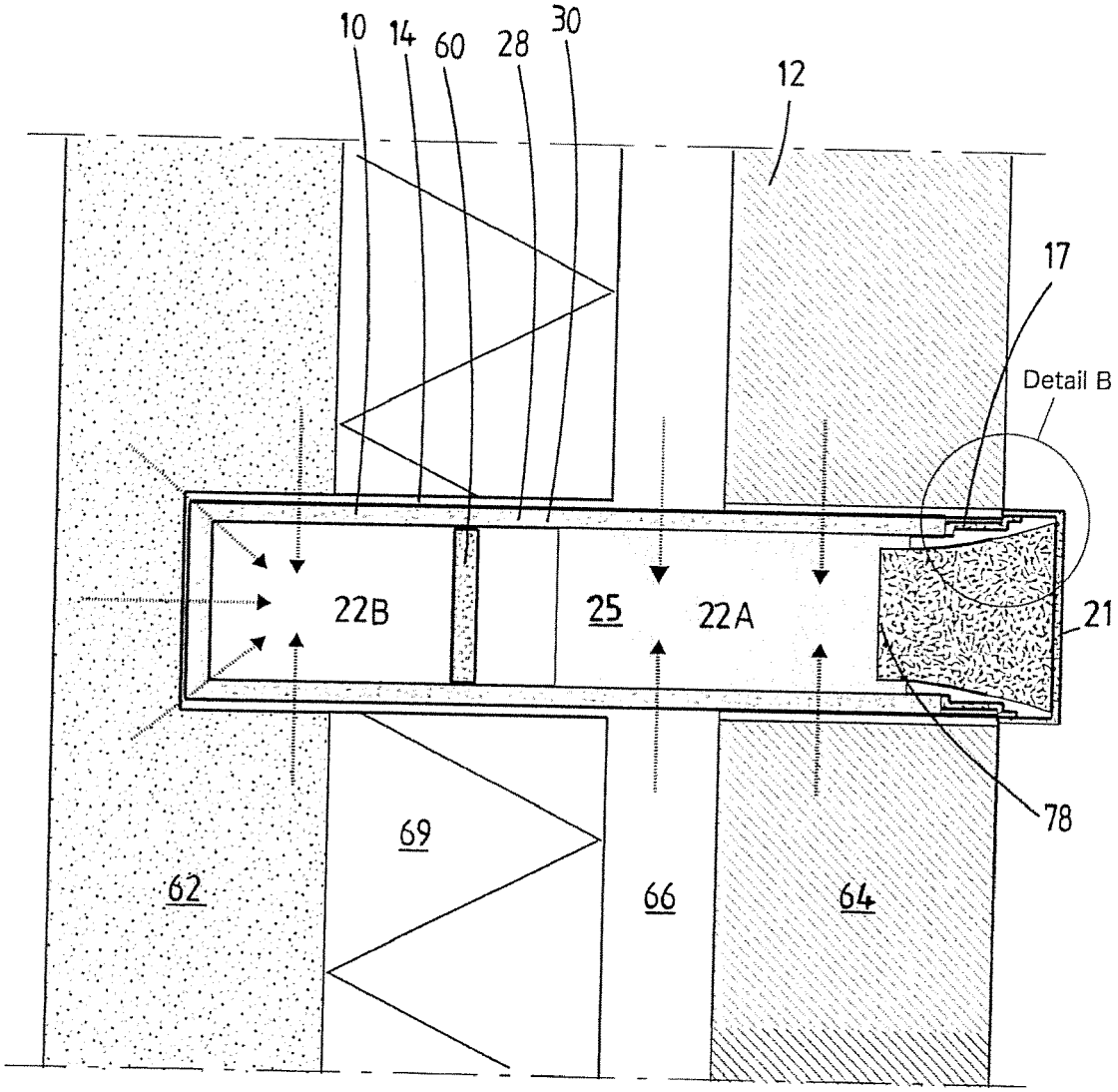

Fig.2

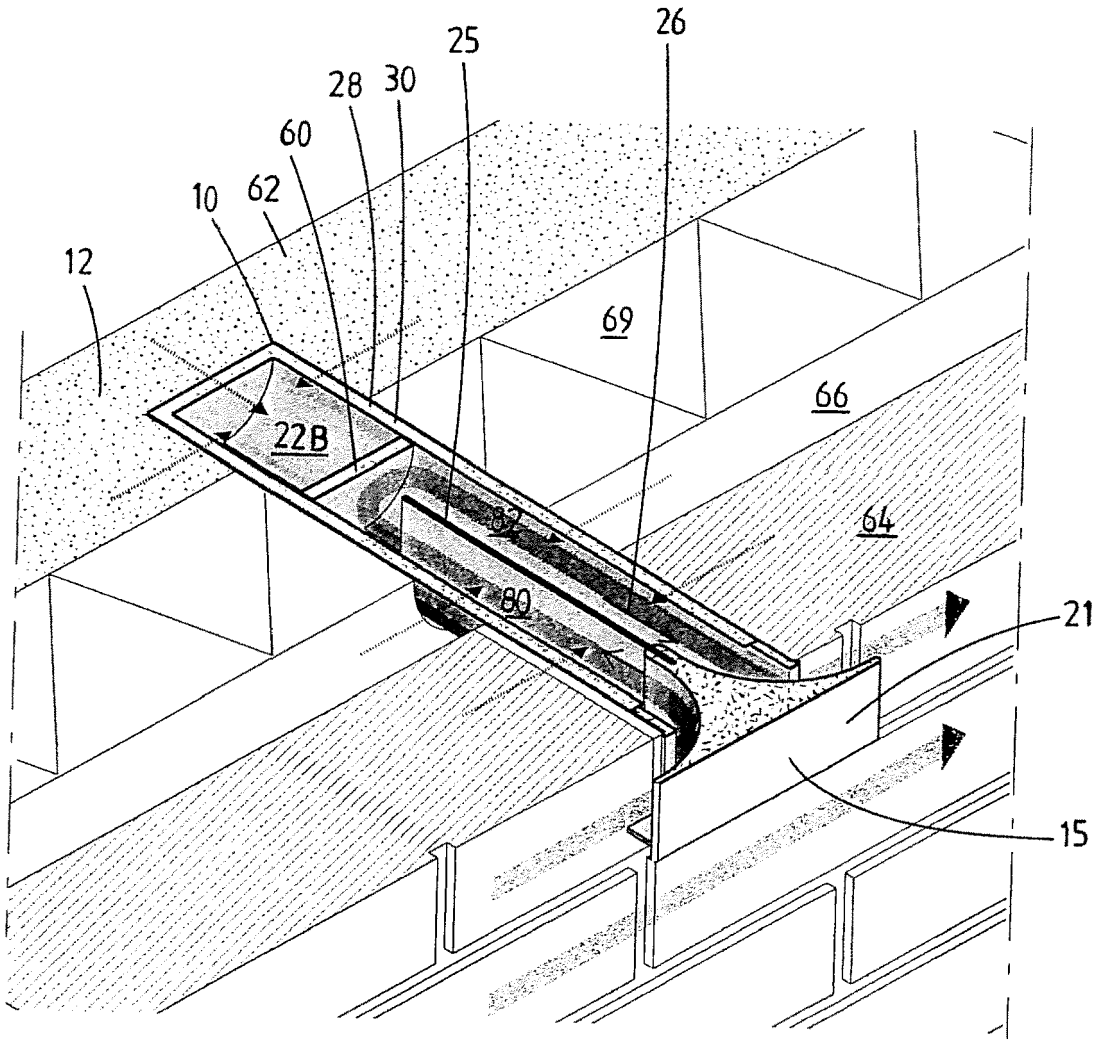

Fig.3

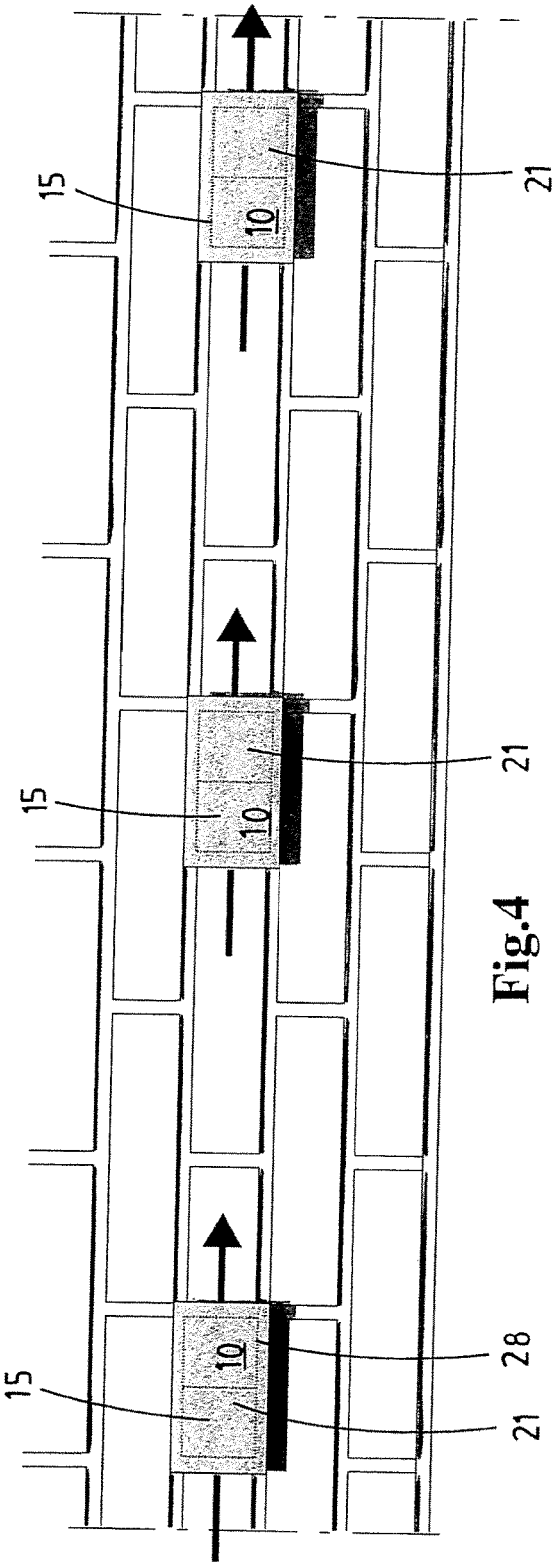

Fig.4

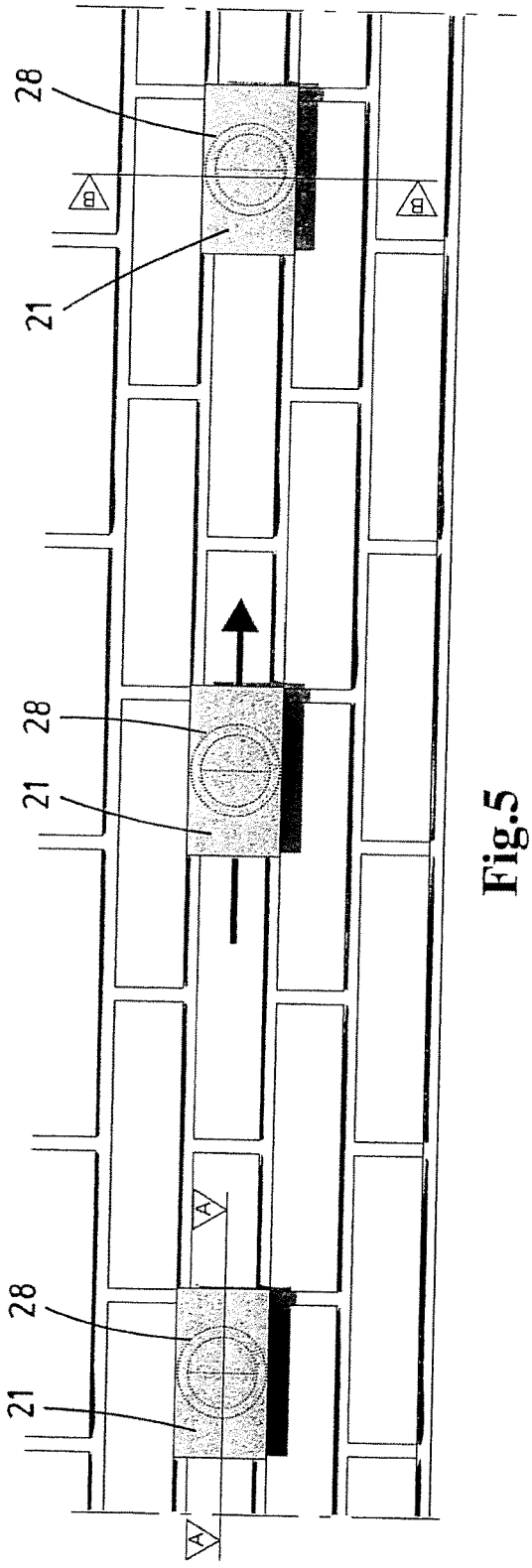

Fig.5

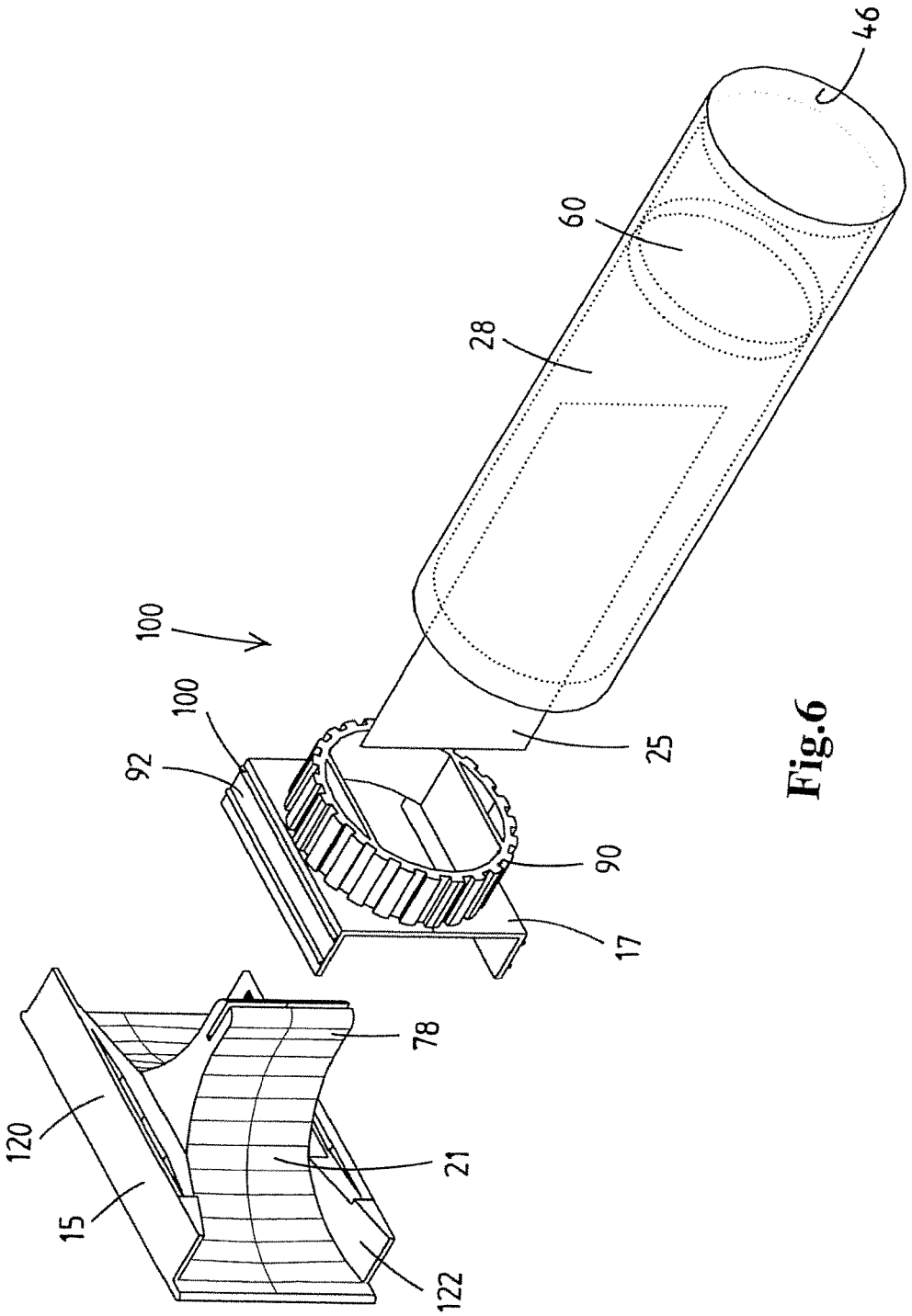

Fig.6

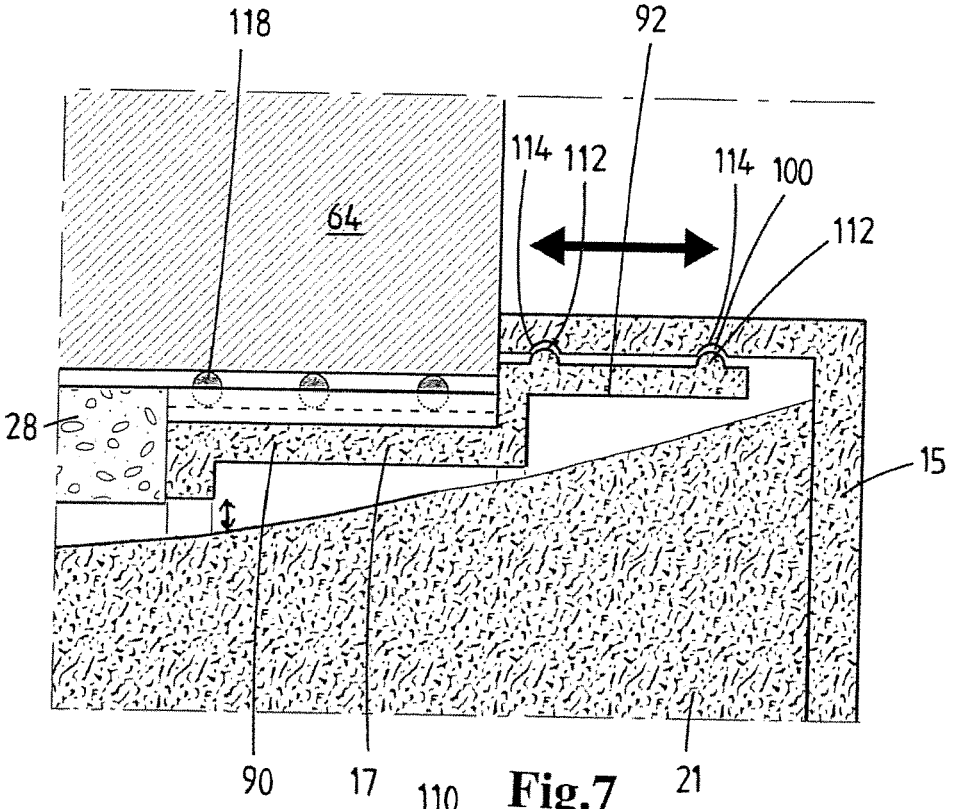
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Fig.7

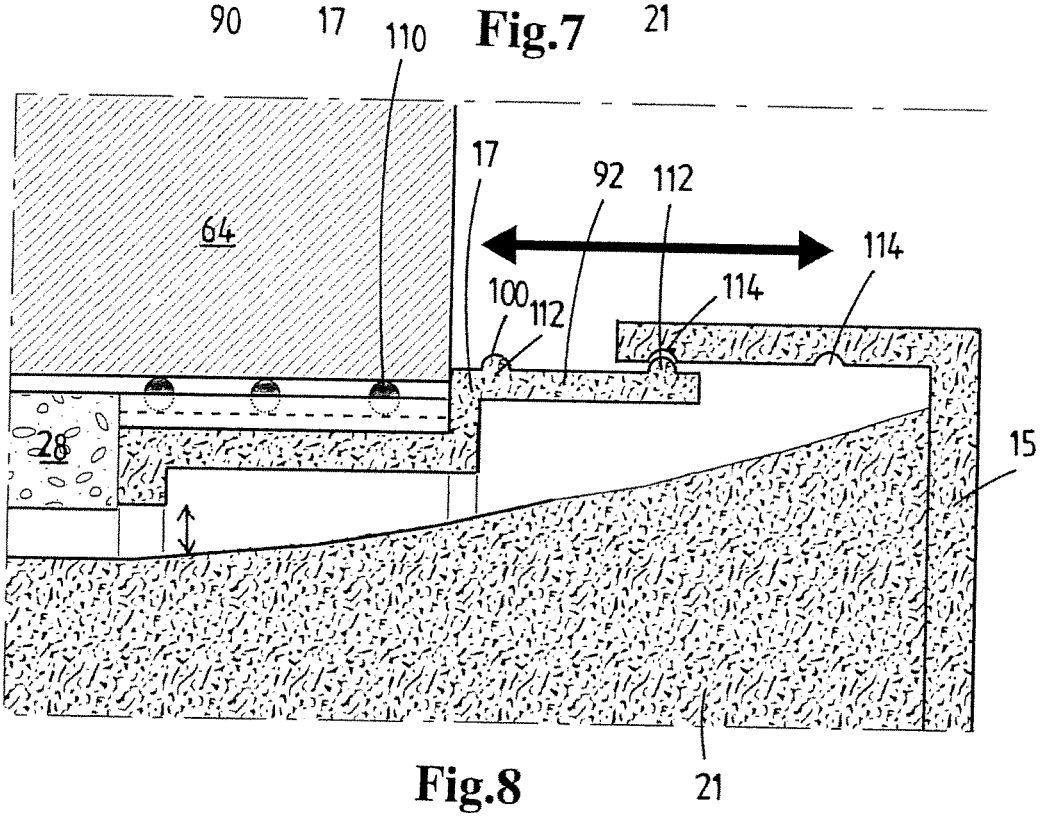
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Fig.8

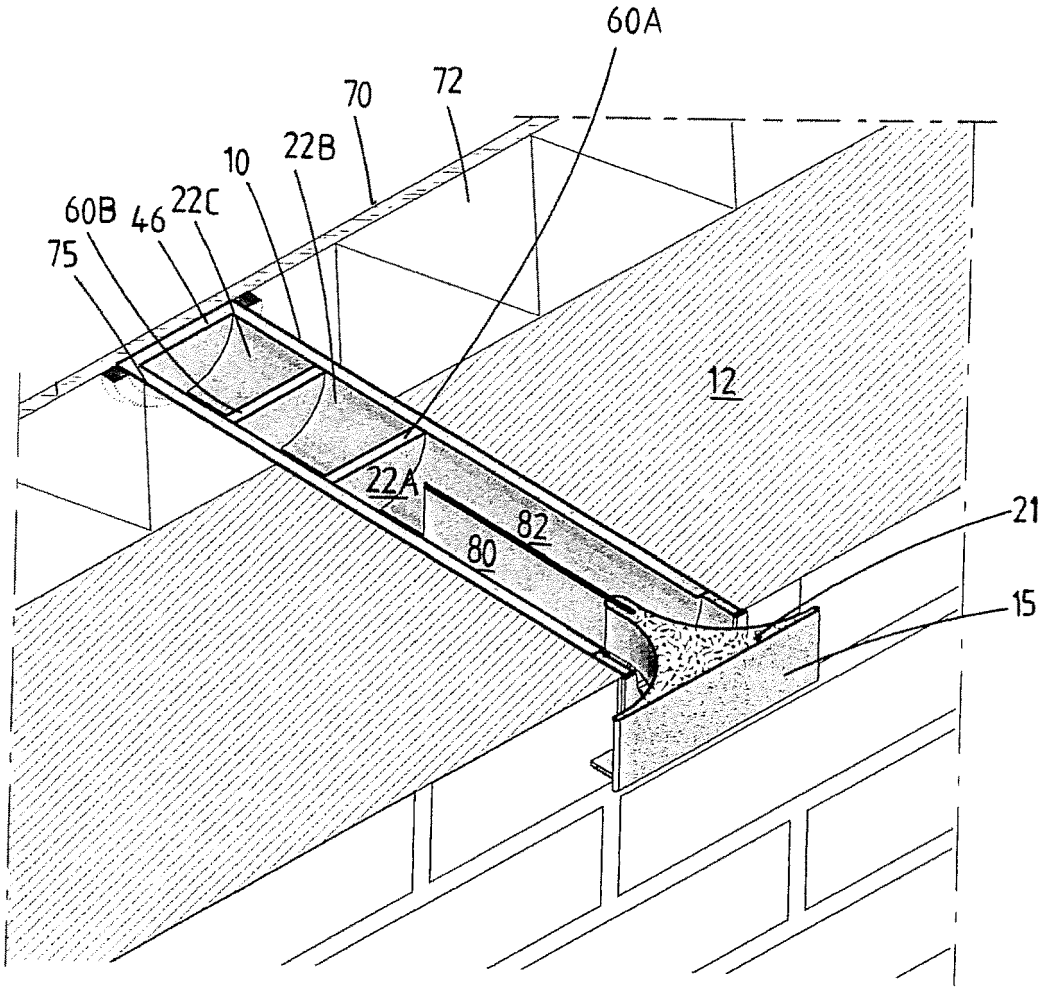

Fig.9a

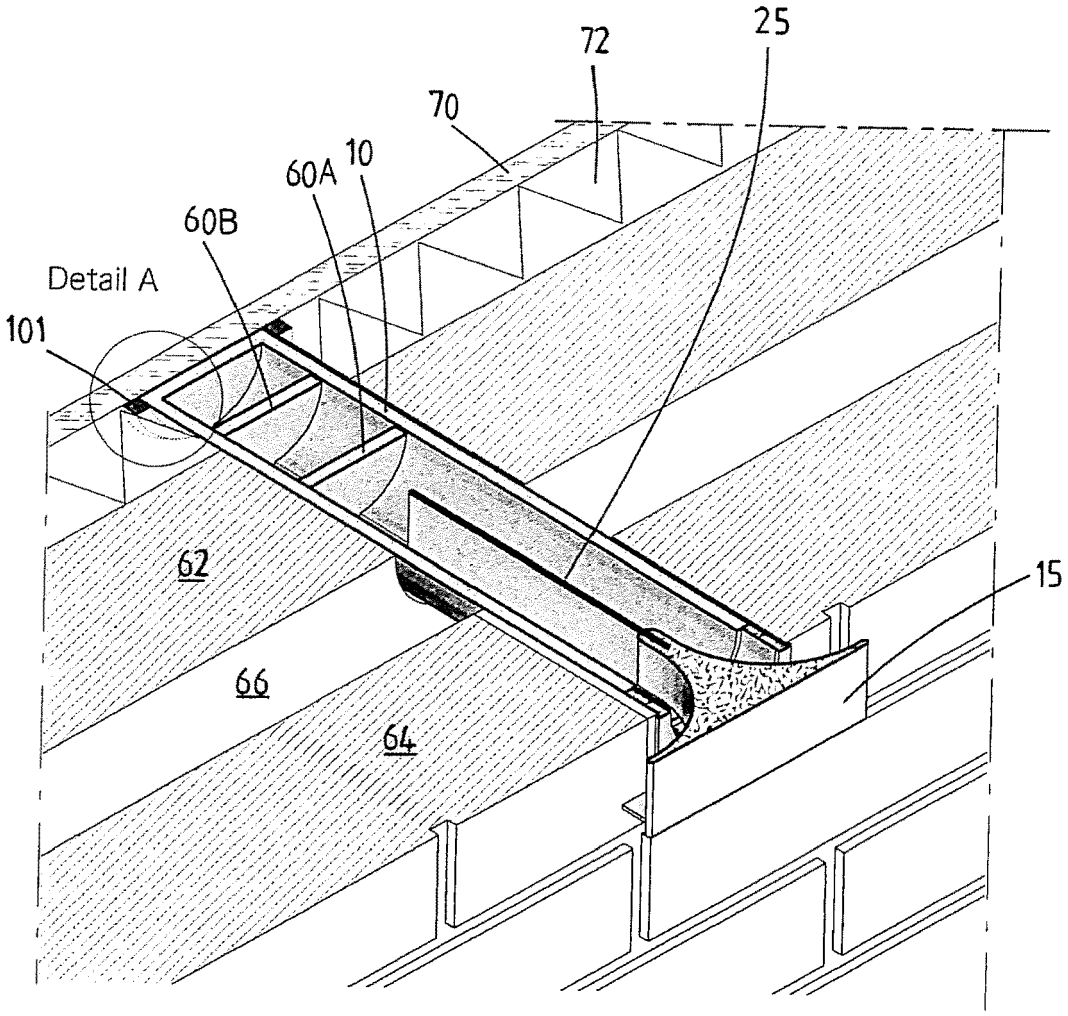

Fig.9b

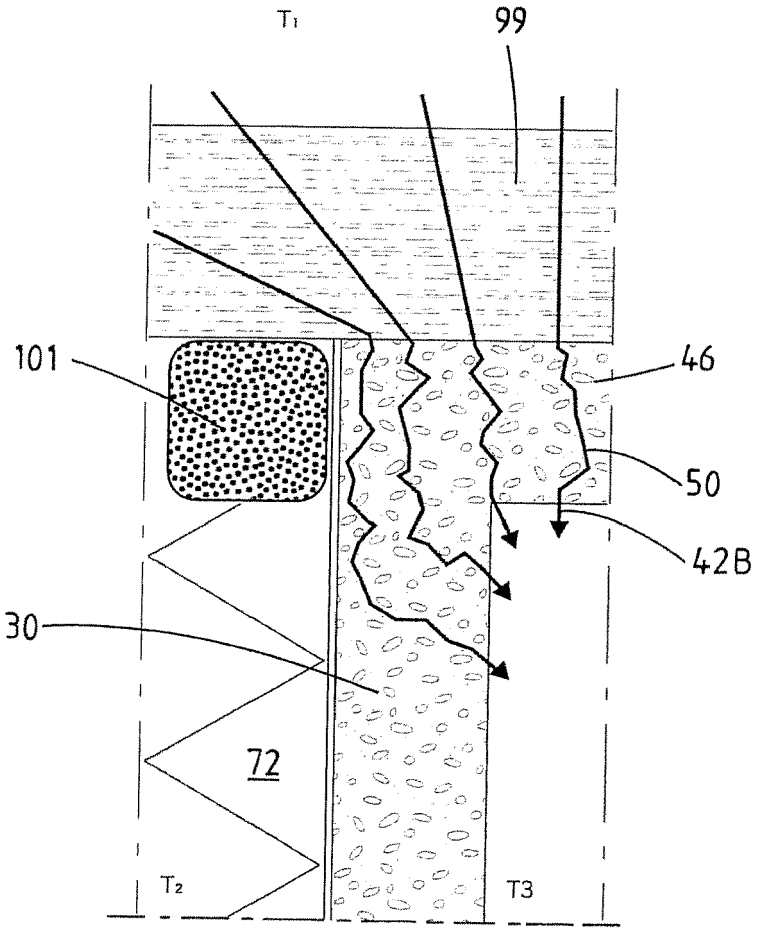

Fig.10

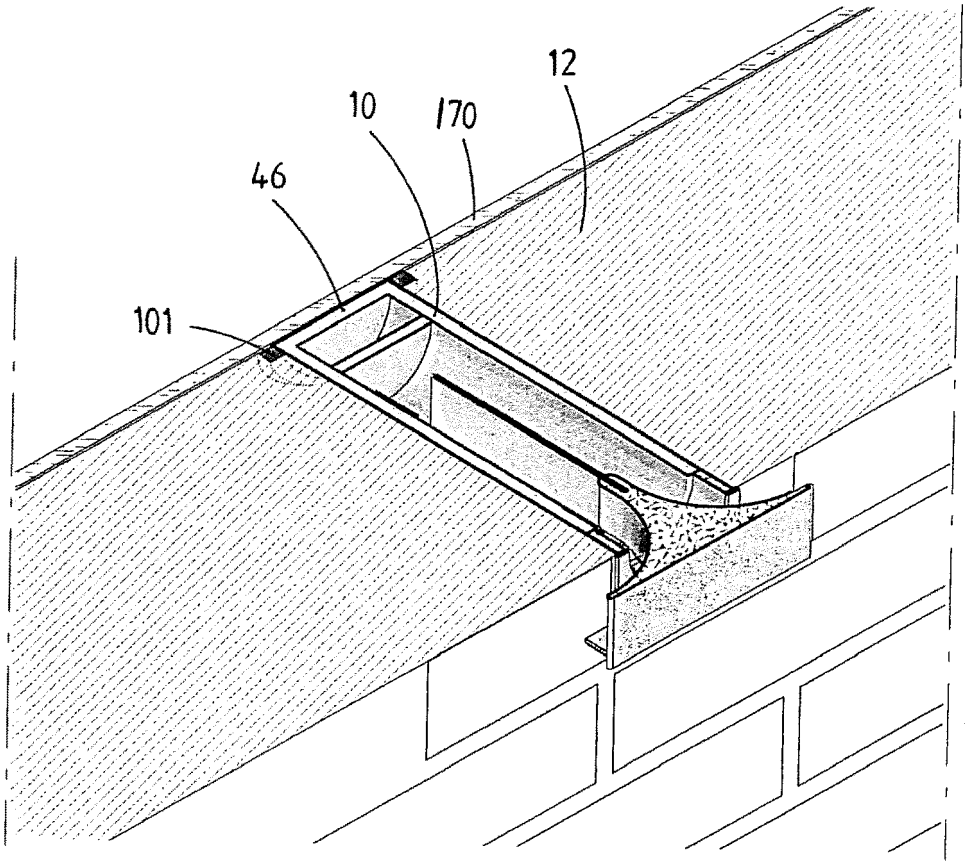

Fig.11

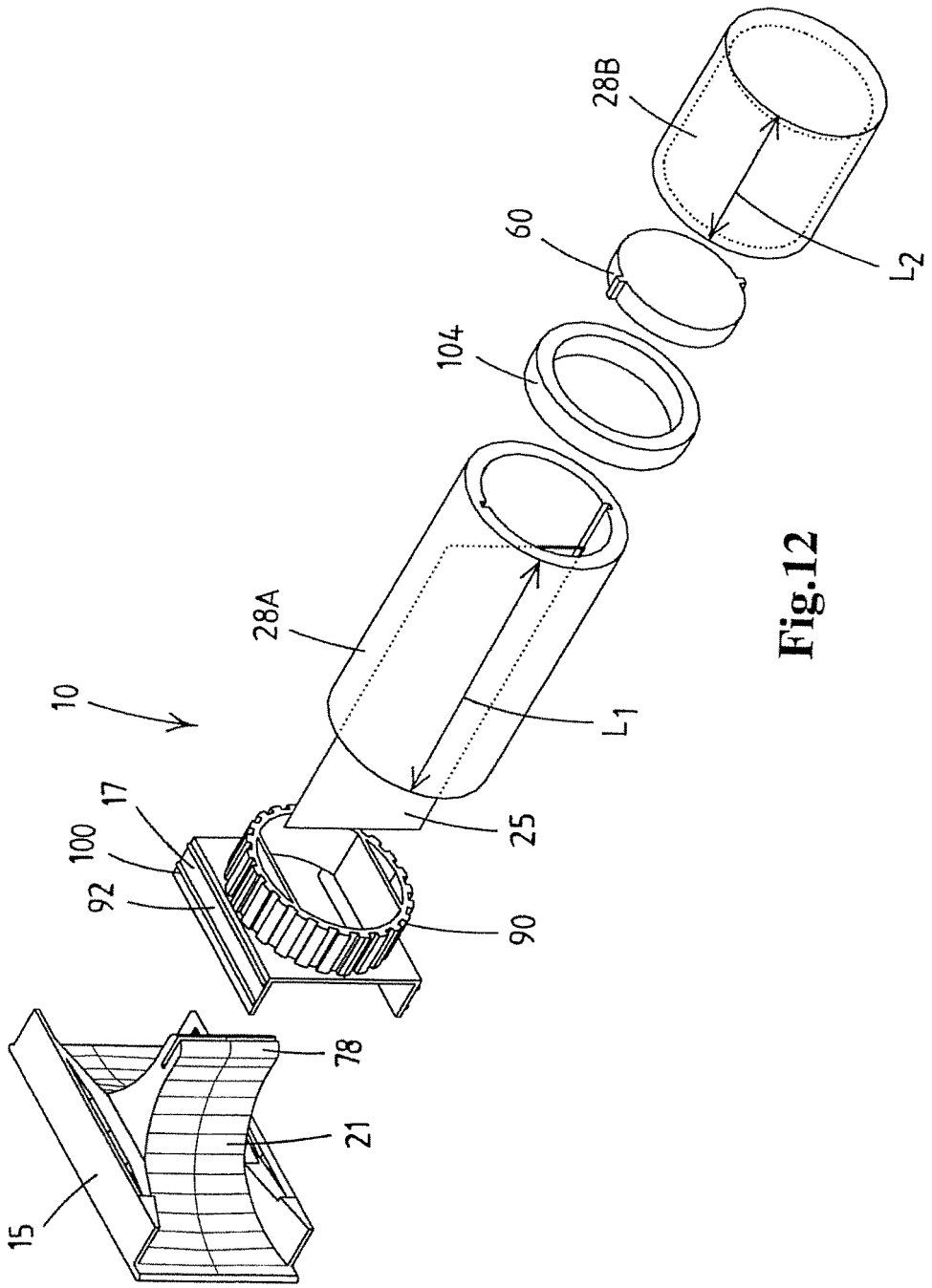

Fig.12

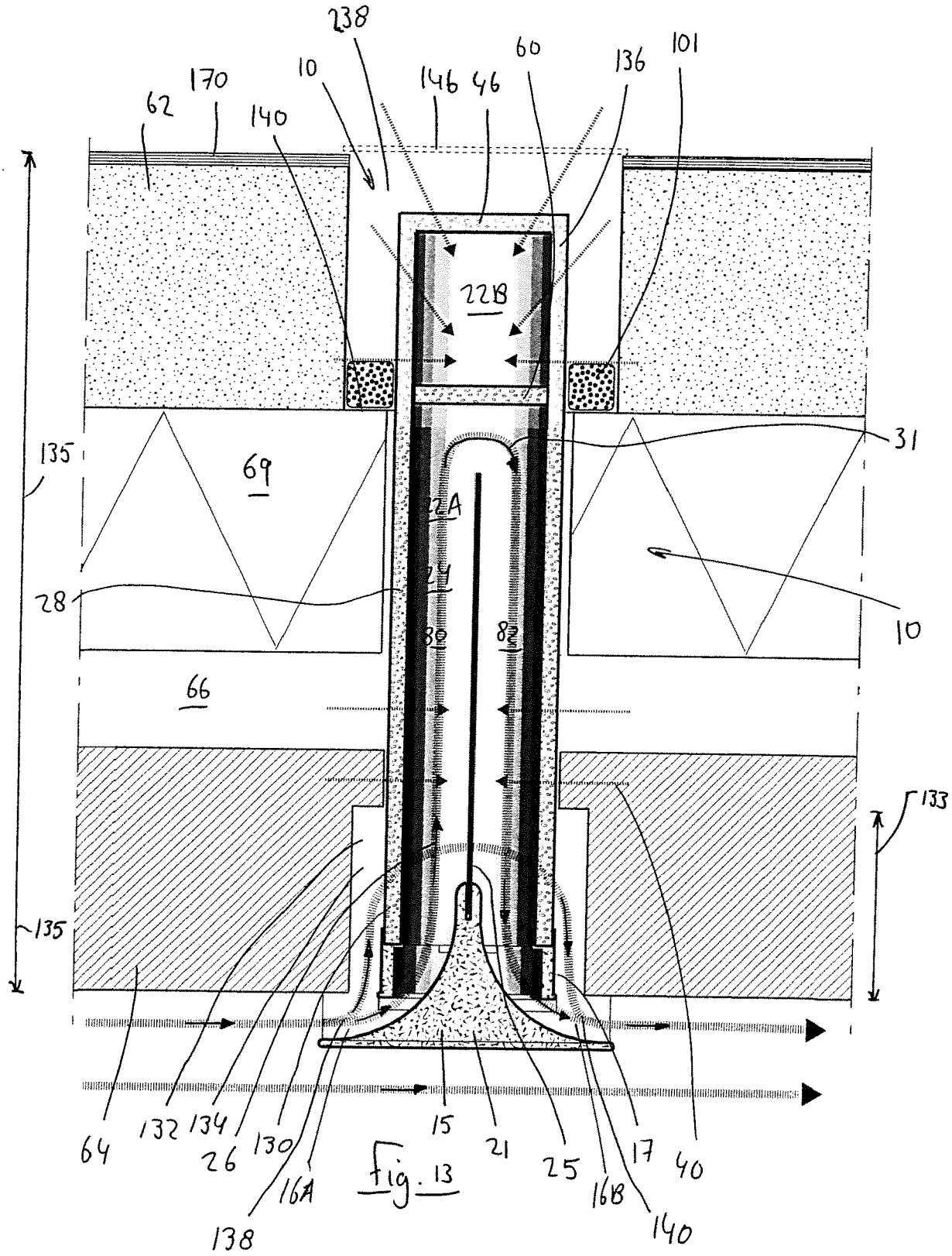
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Fig. 13

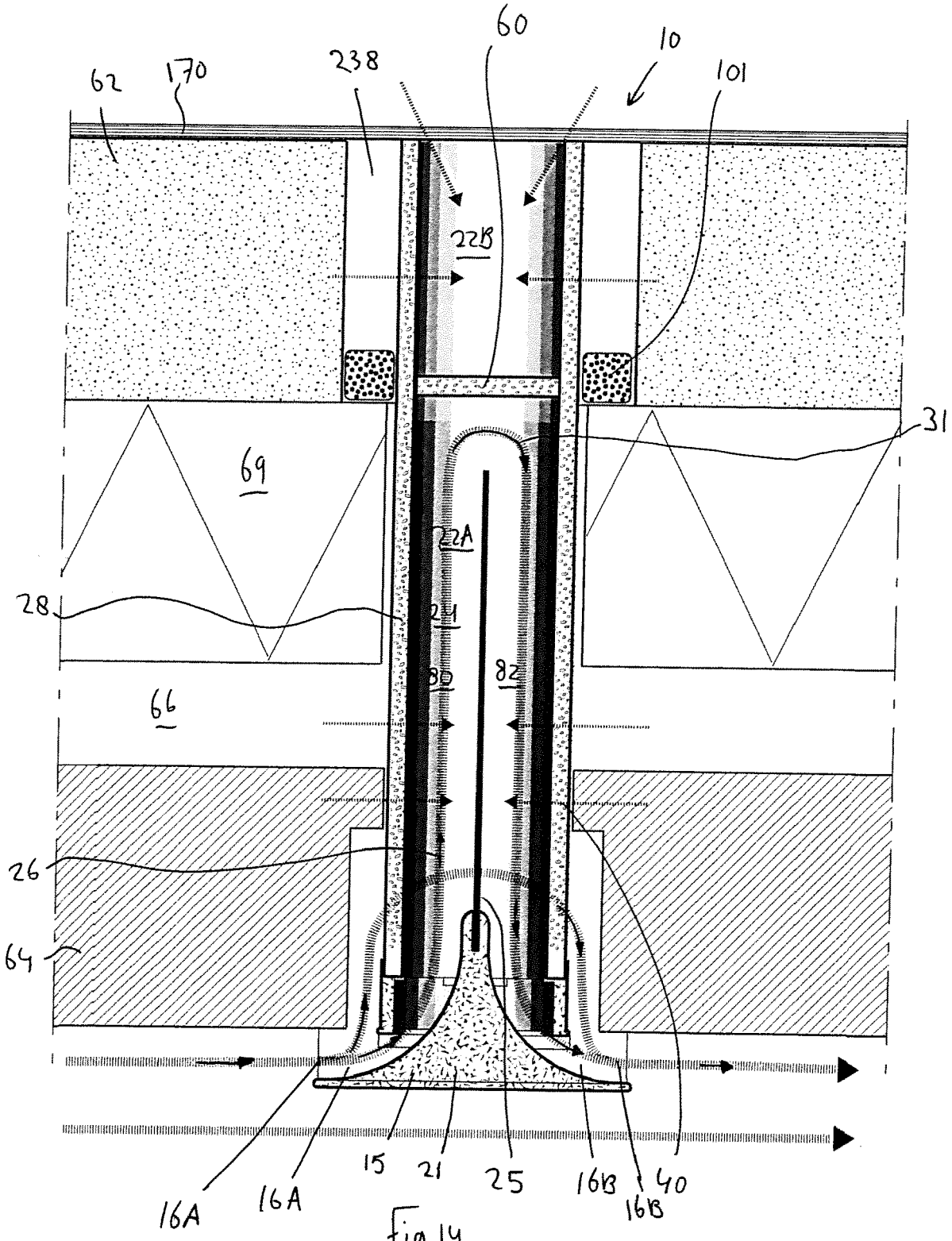
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Fig. 14

Fig. 15

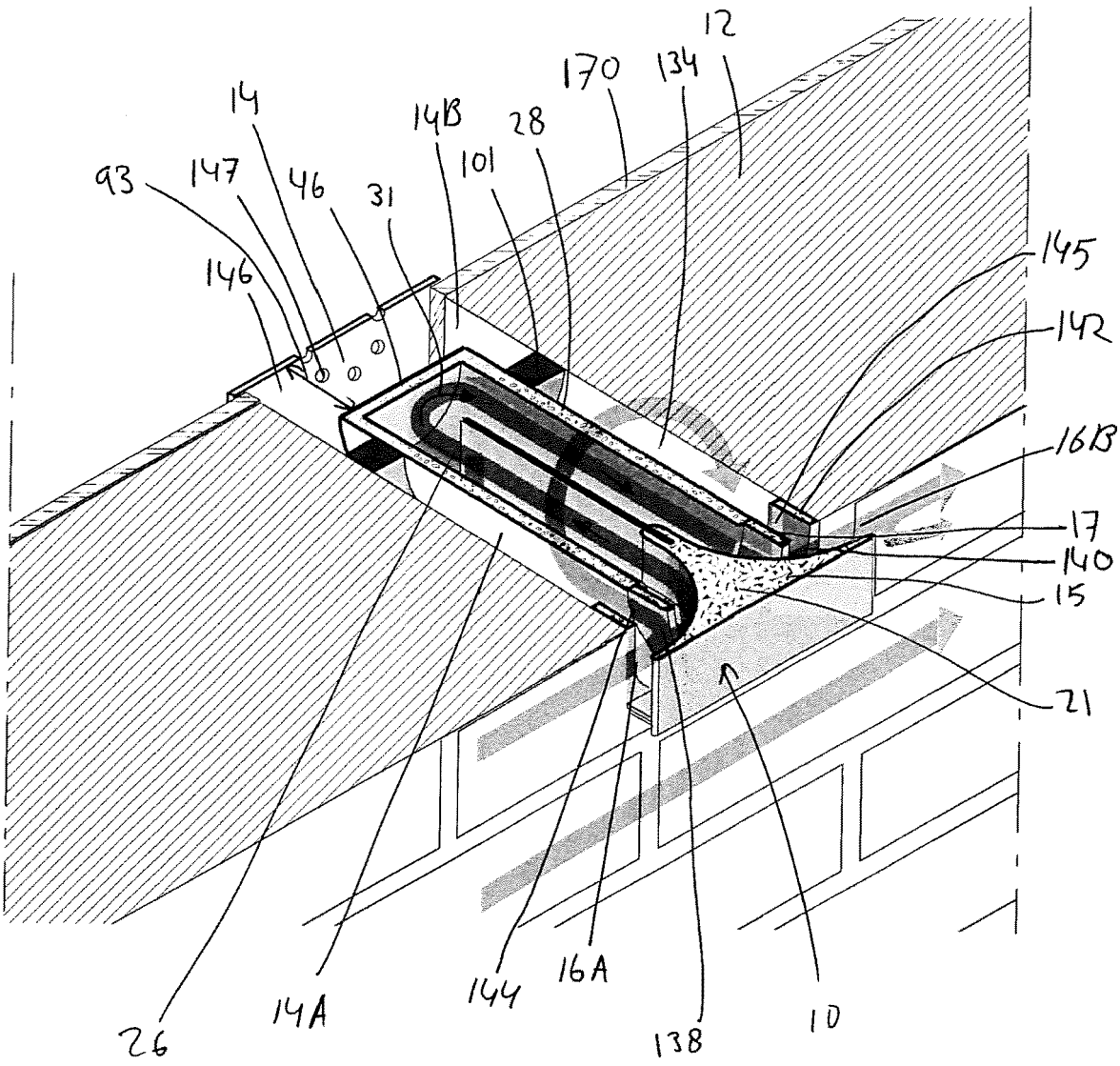
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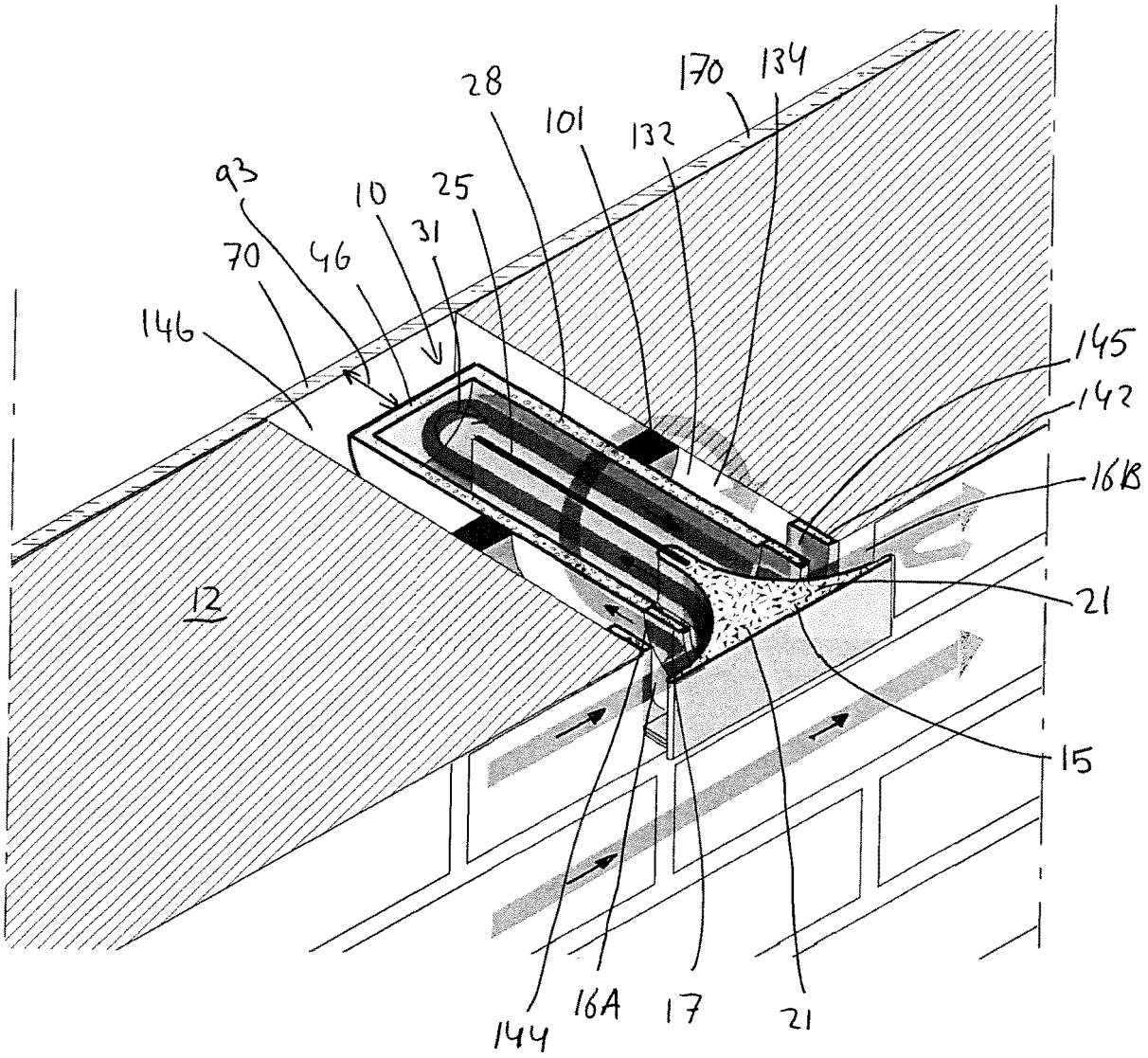
Fig. 16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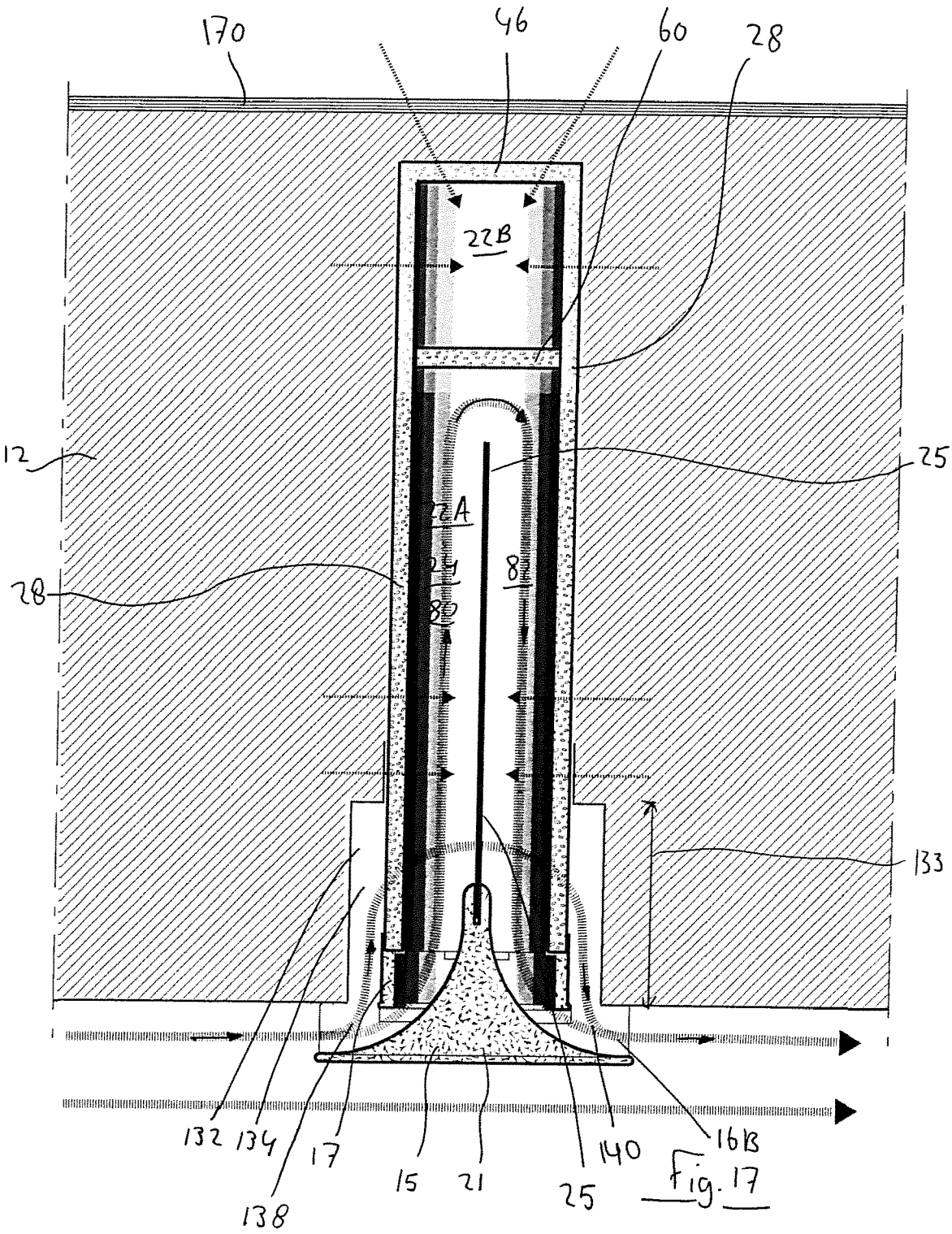
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Fig. 17

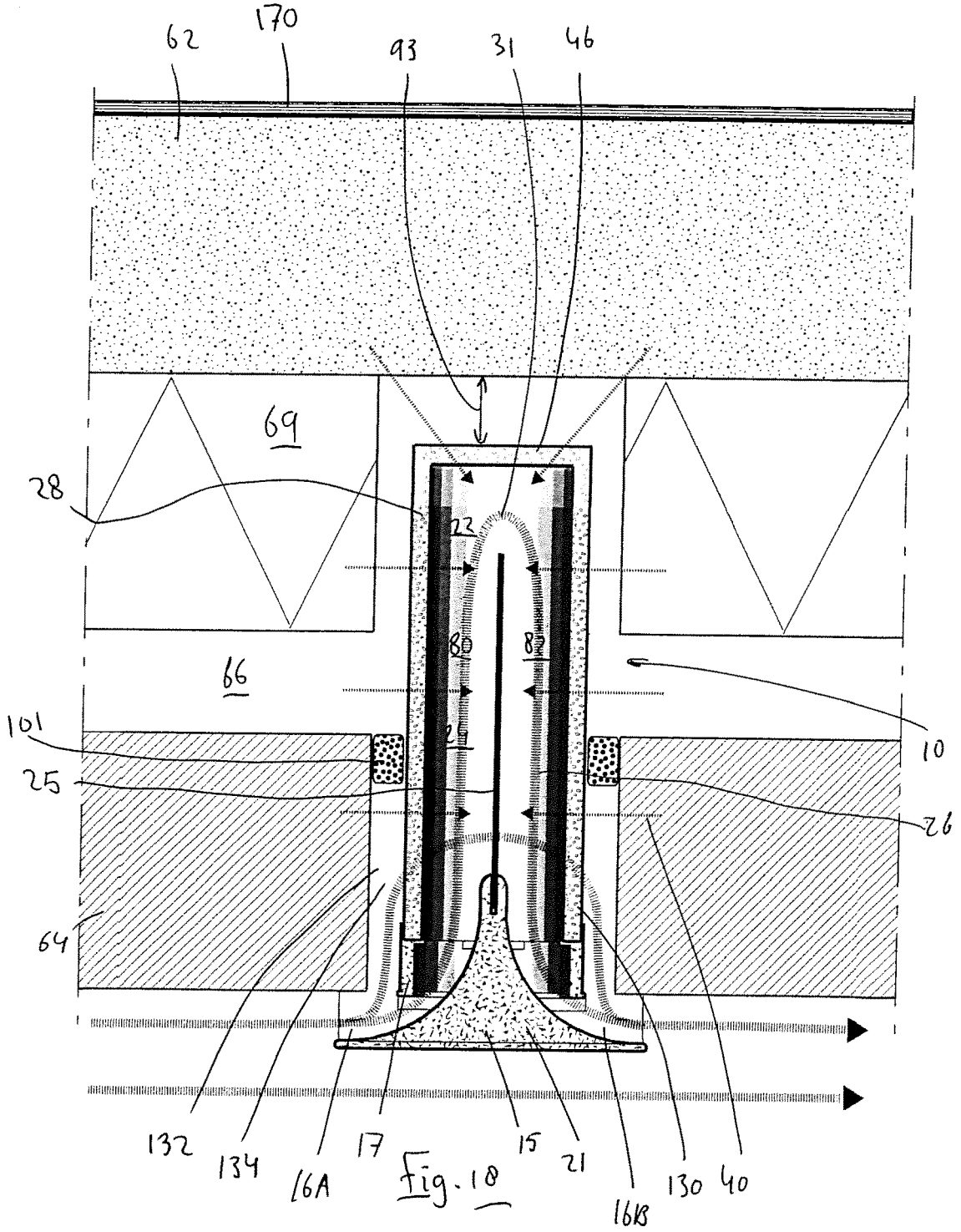
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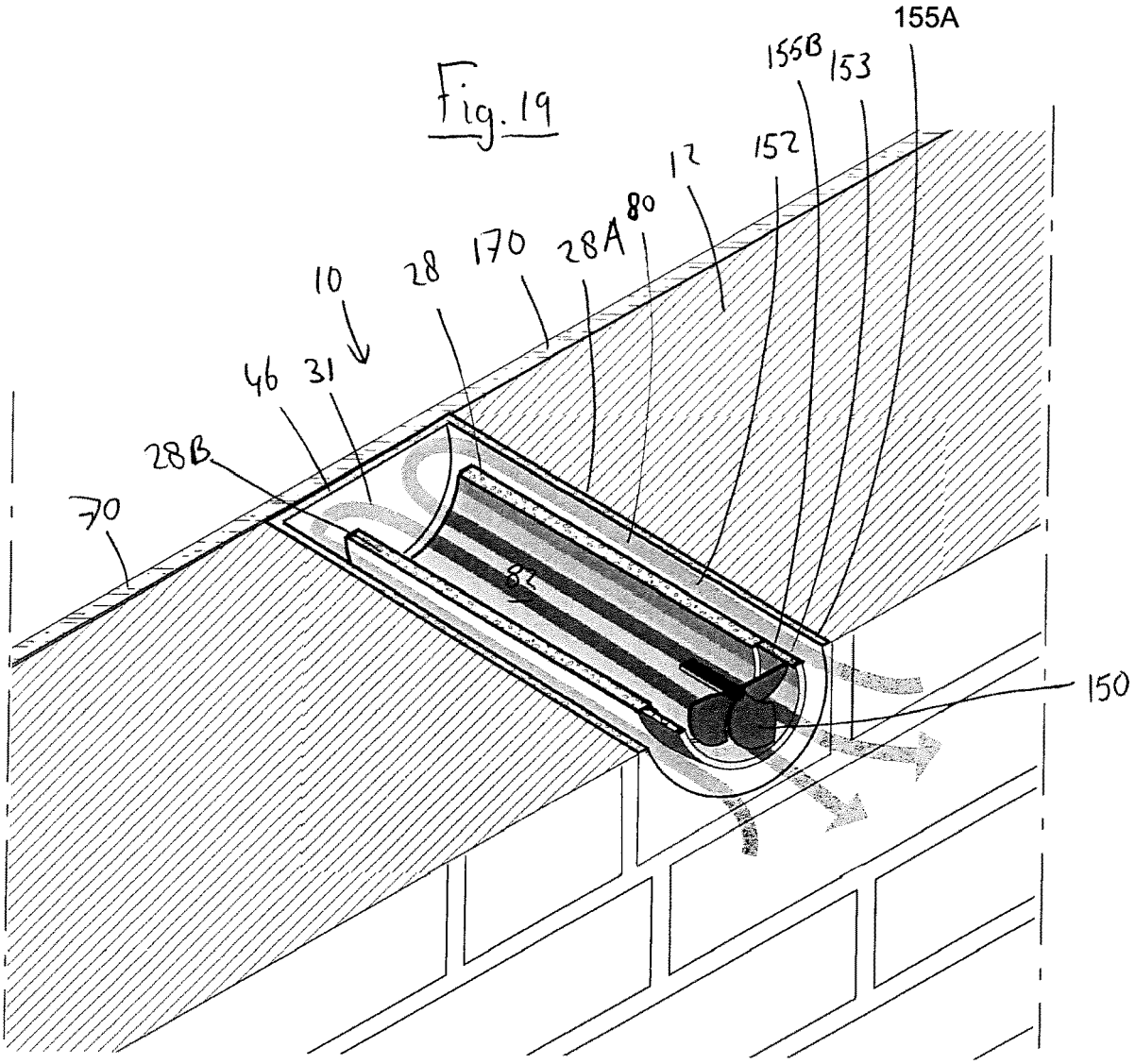
Fig. 18

Fig. 19



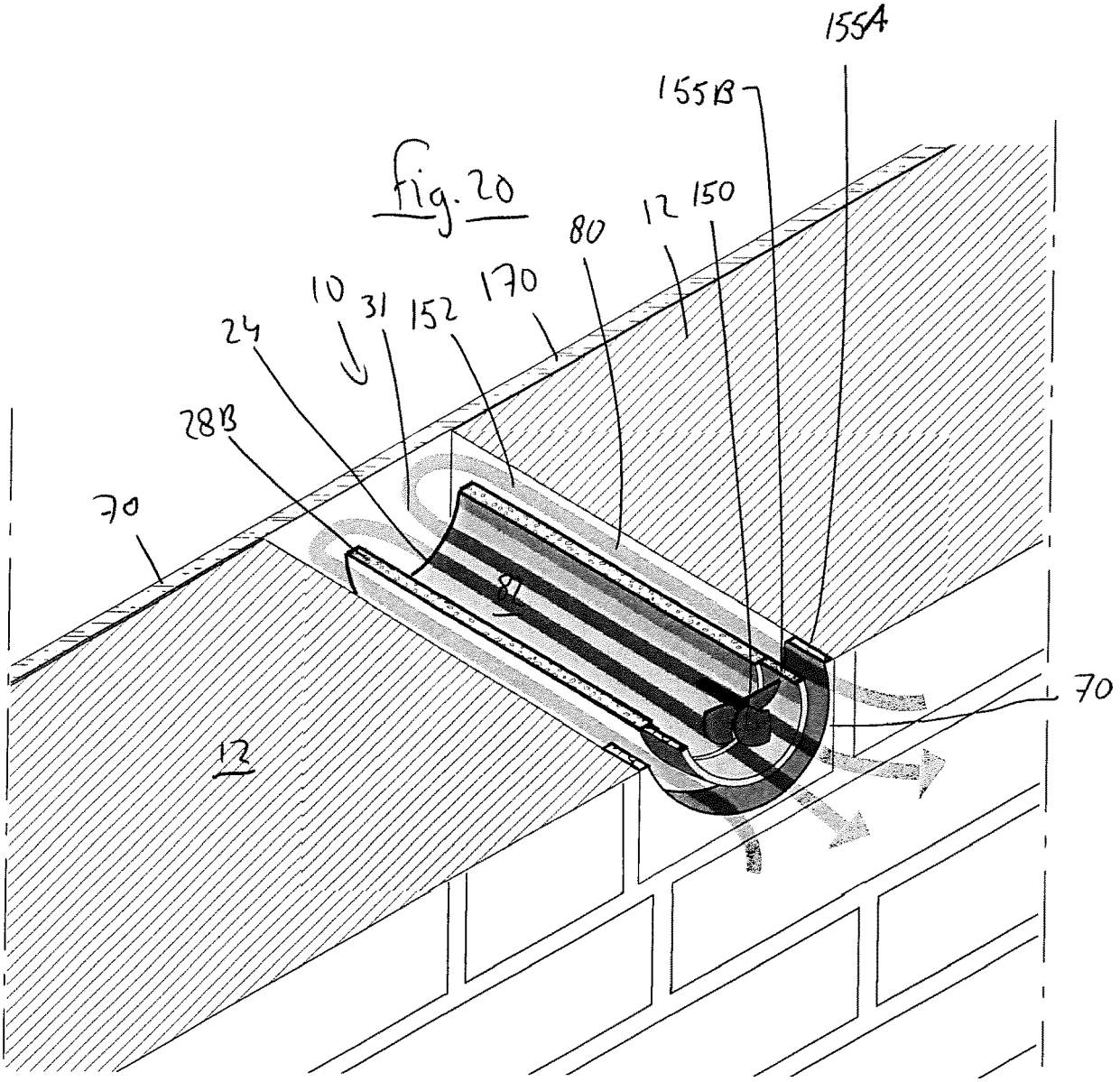


fig. 20

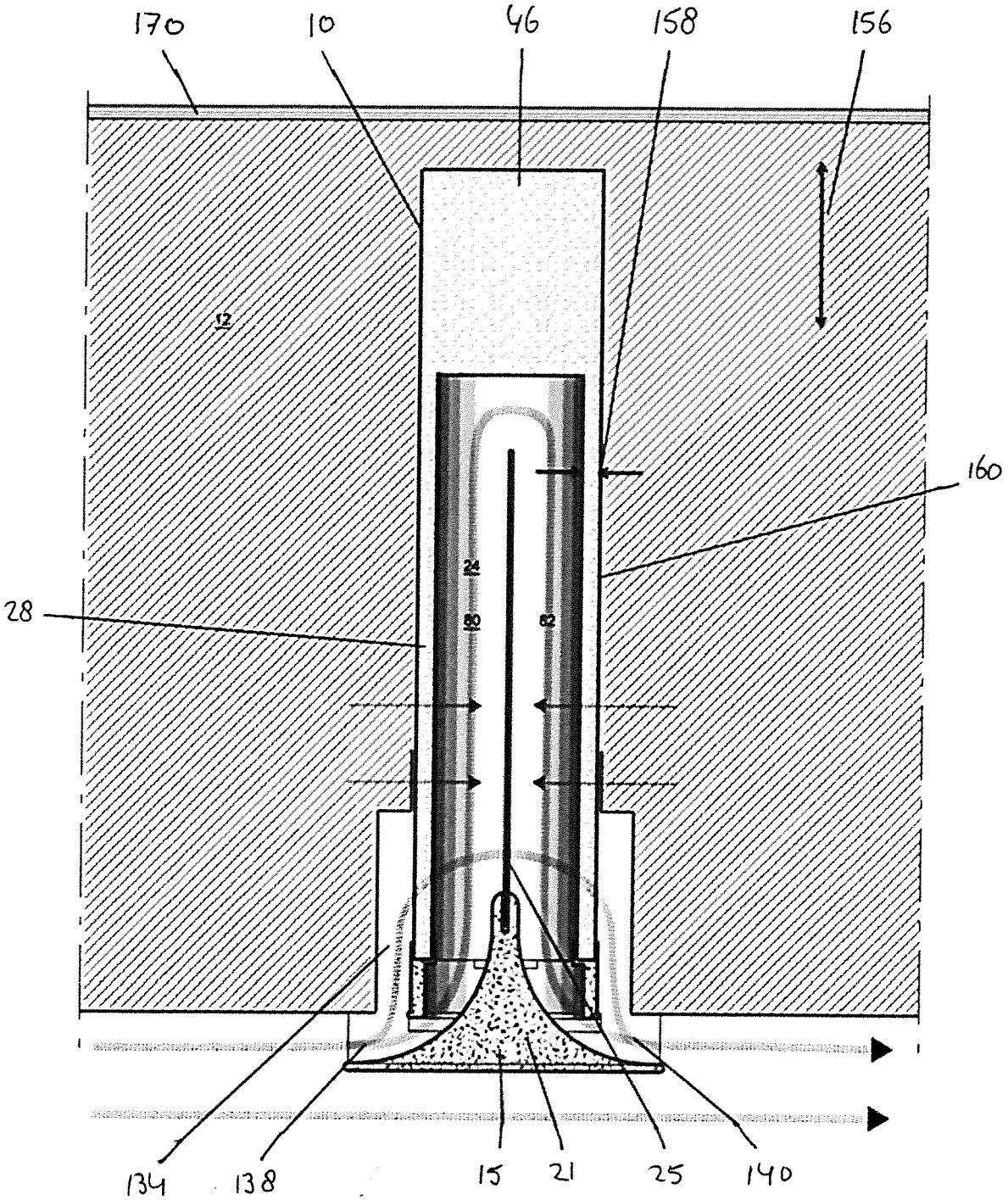


Fig. 21

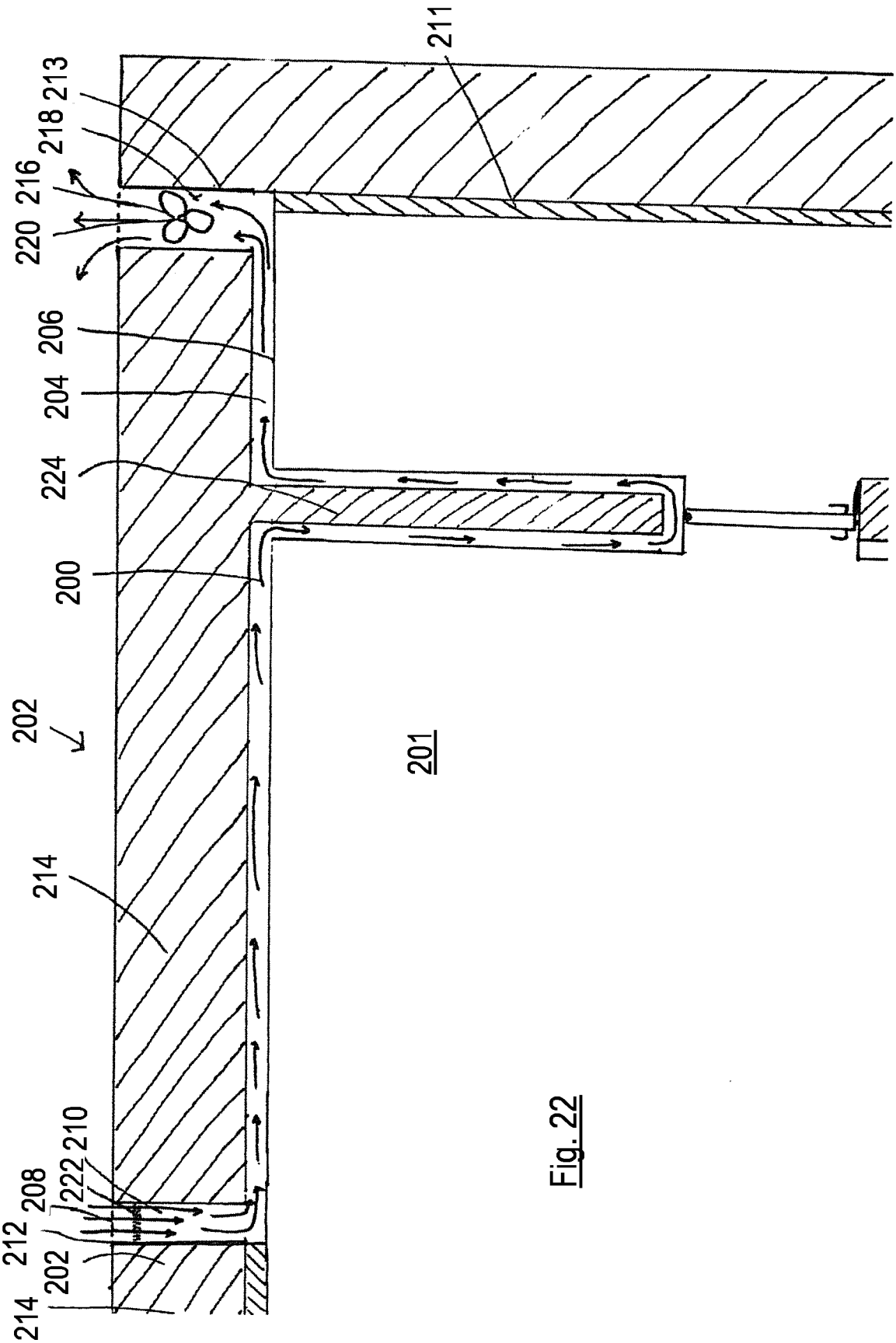

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Fig. 22

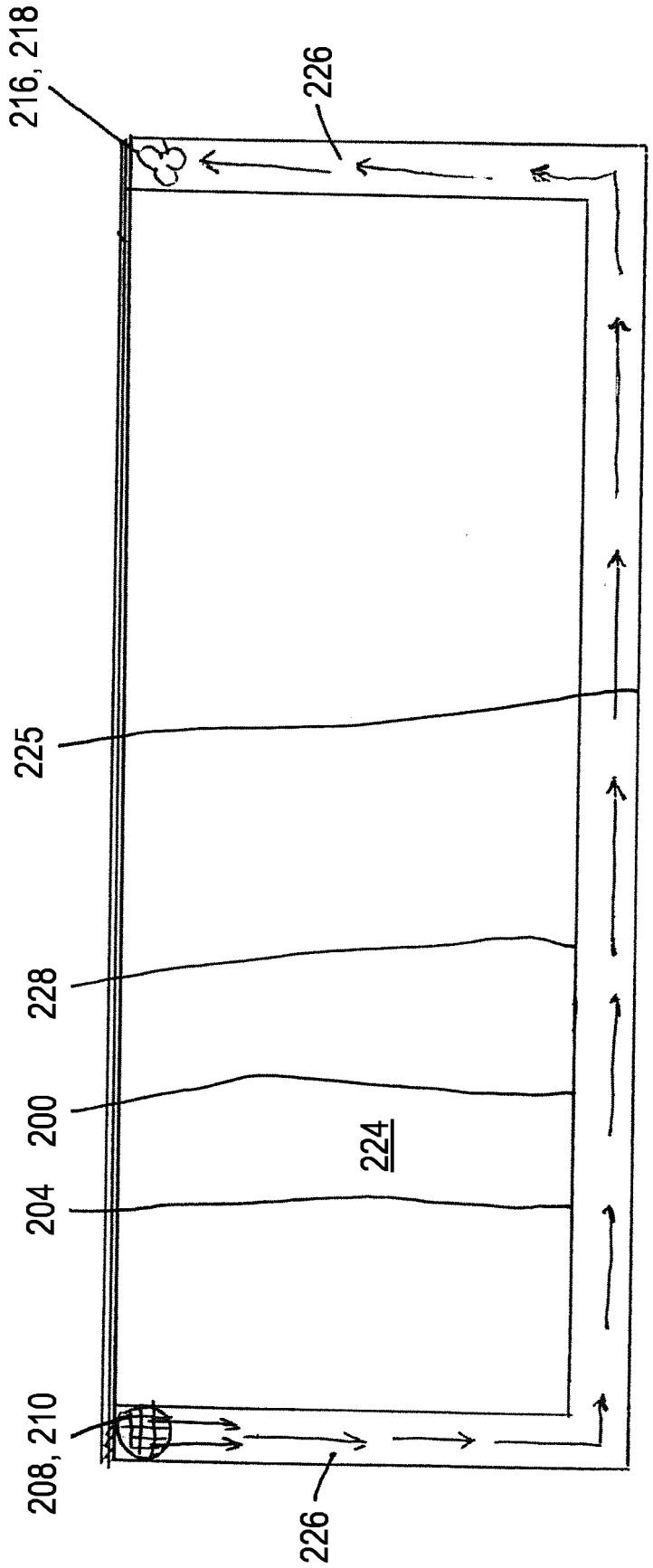


Fig. 23

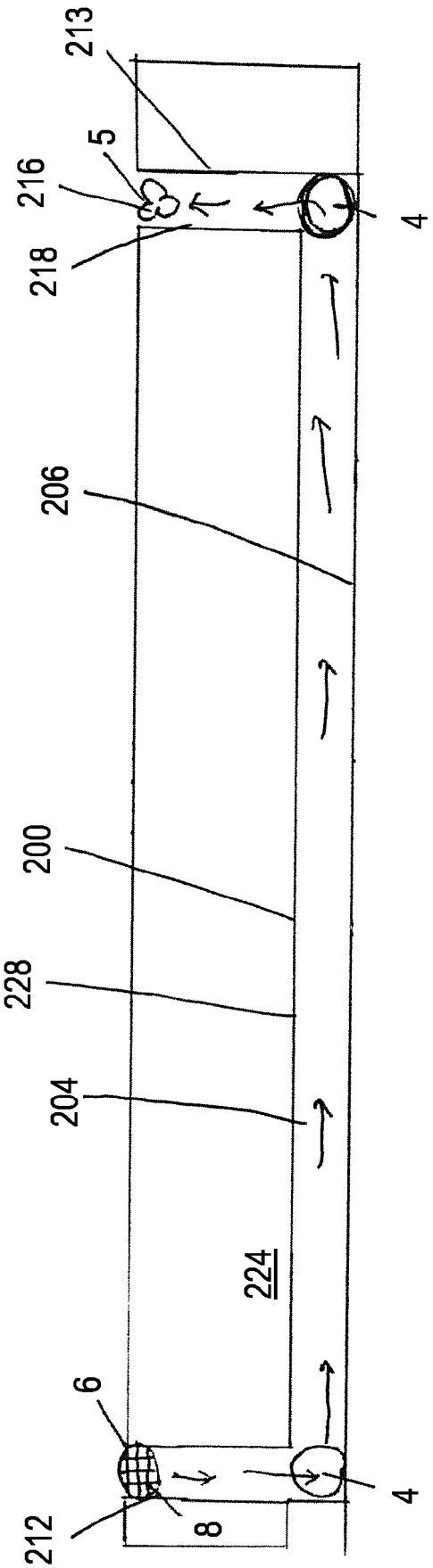


Fig. 24

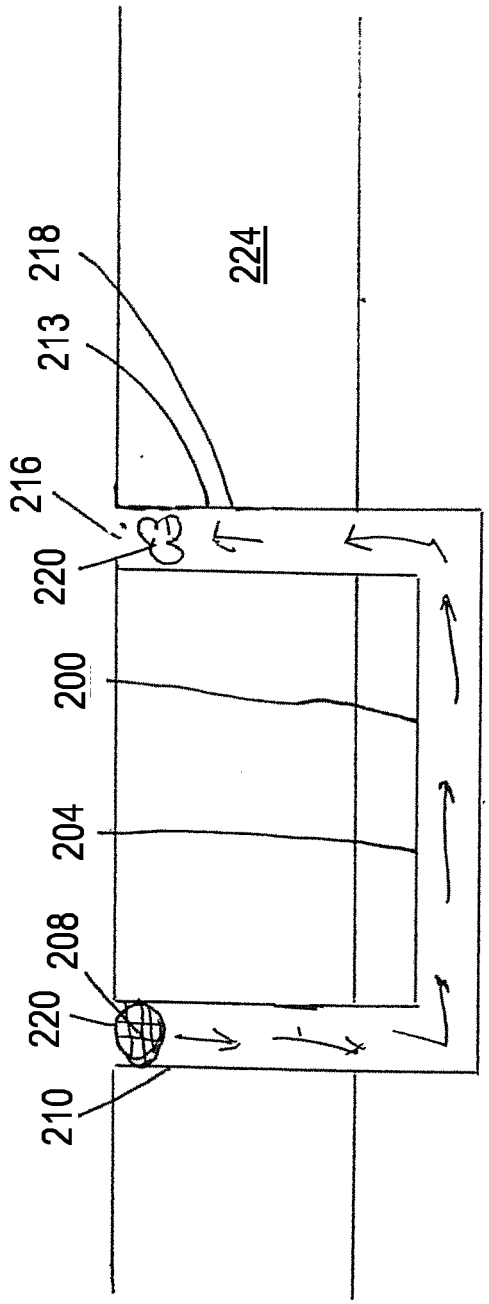


Fig. 26

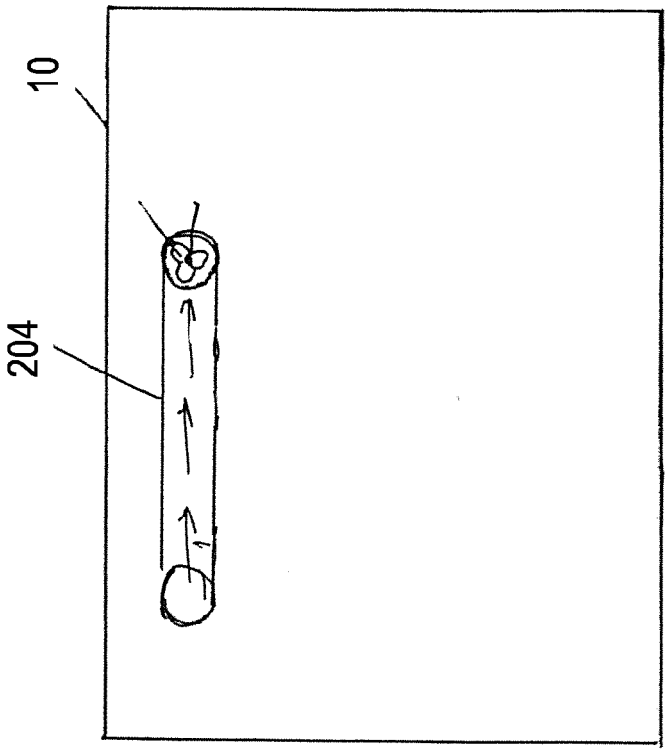


Fig. 25

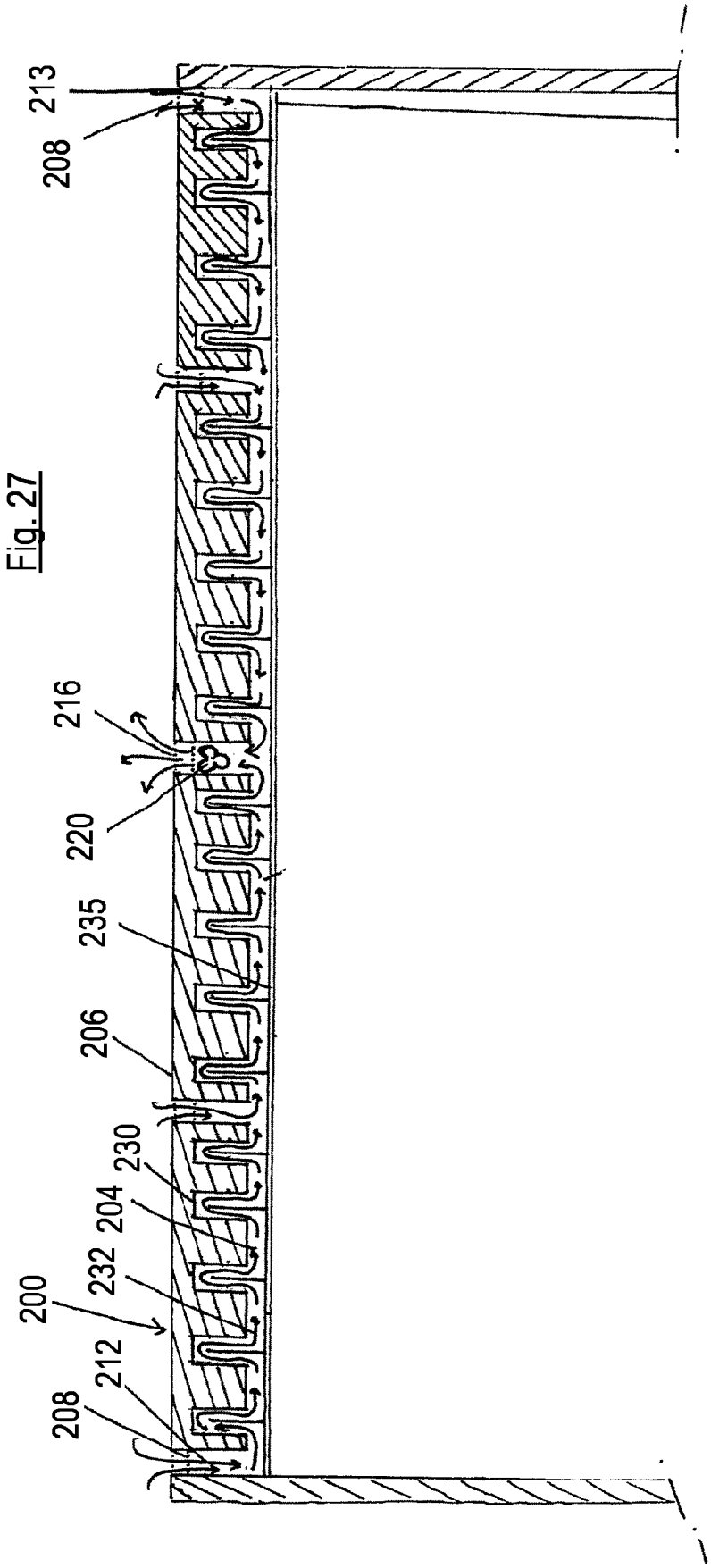


Fig. 27

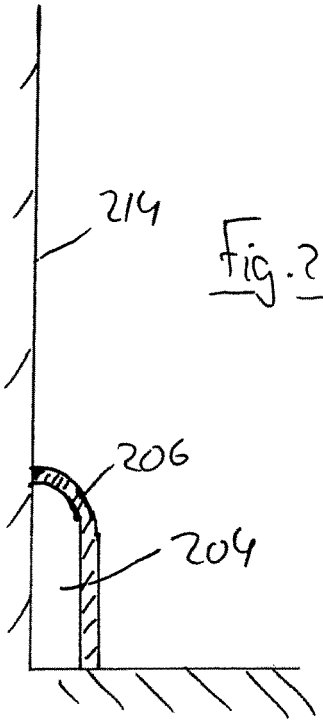


Fig. 28A

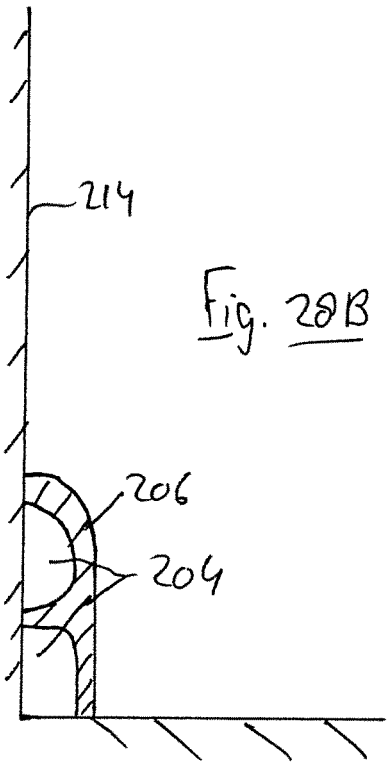


Fig. 28B

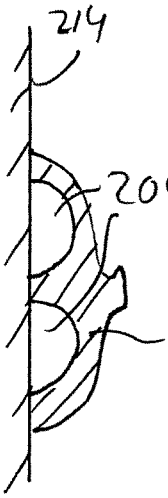


Fig. 28C

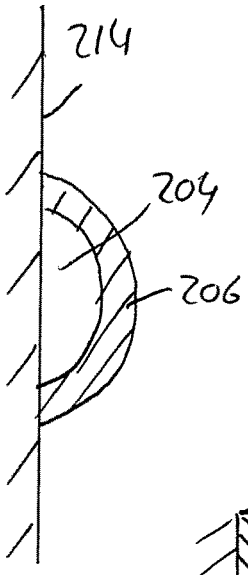


Fig. 28D

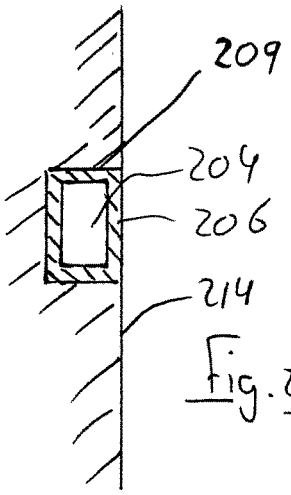


Fig. 28E

Fig. 29a

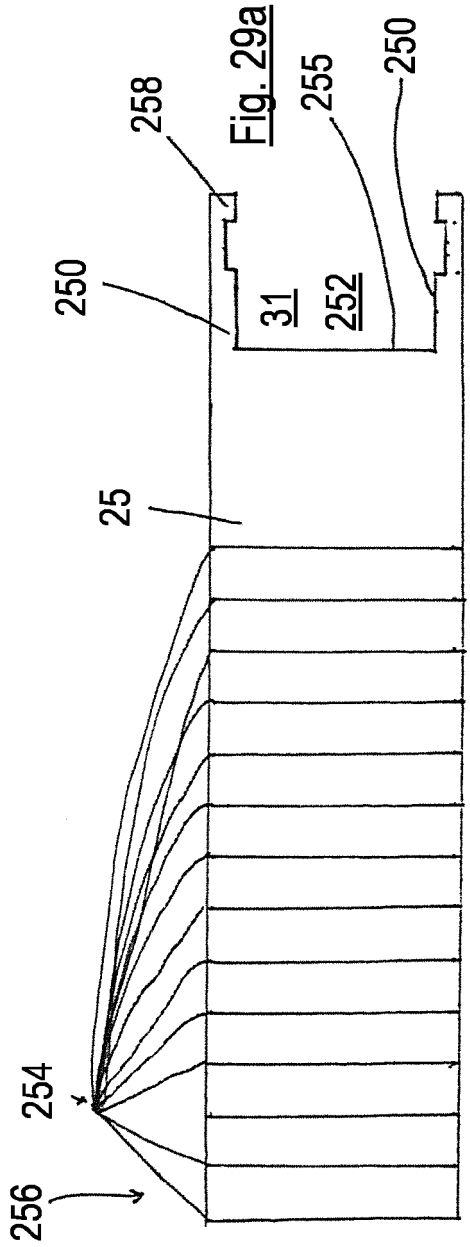
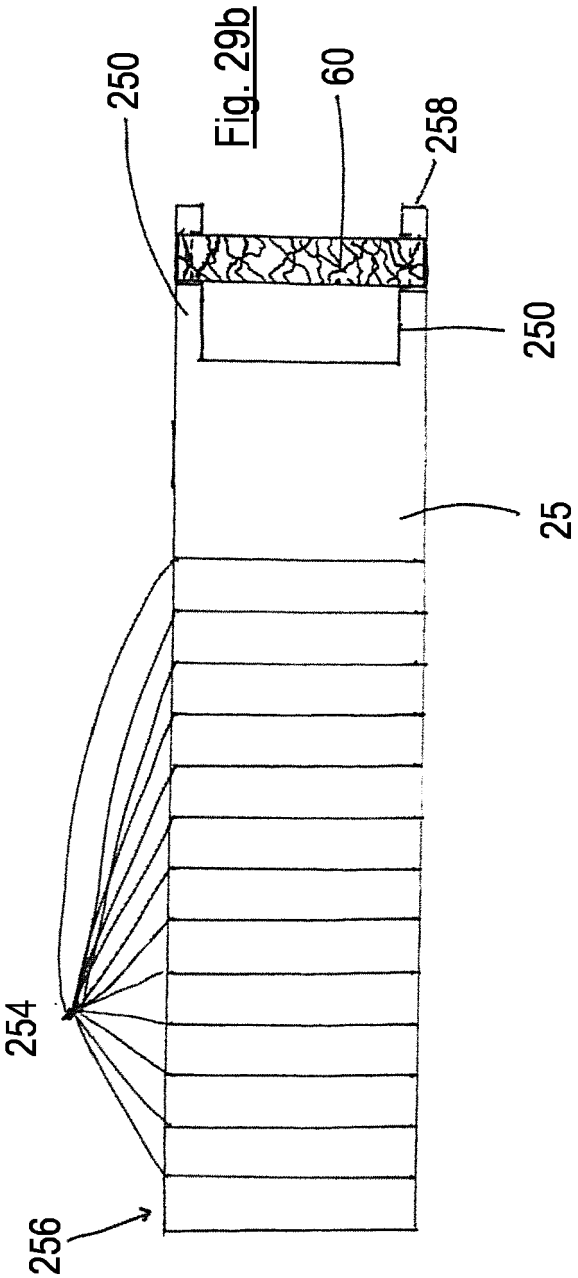


Fig. 29b



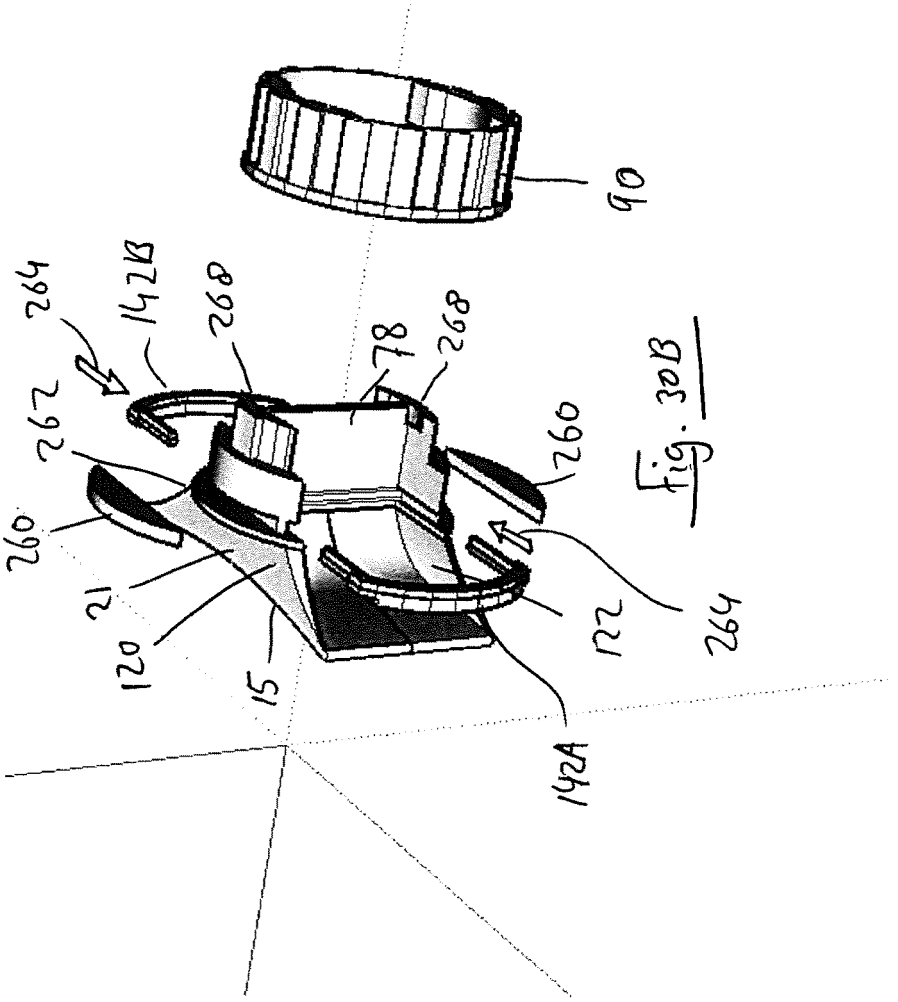


Fig. 30B

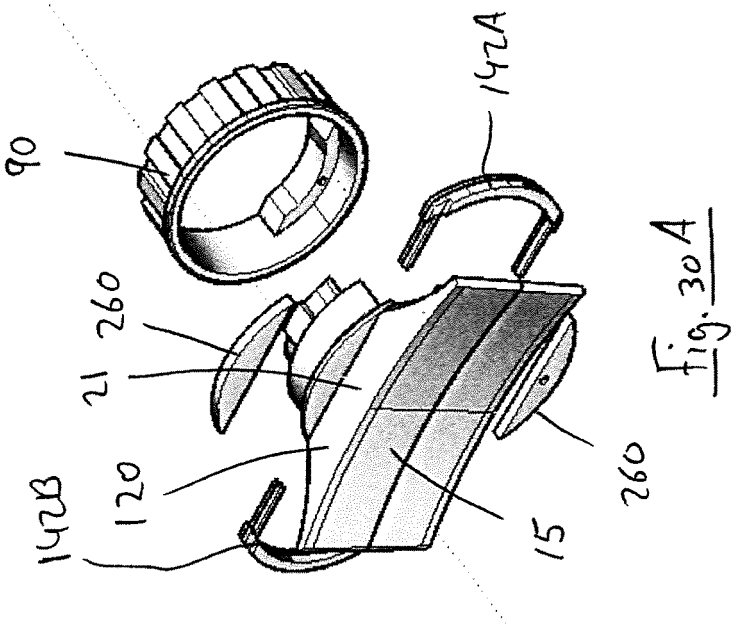


Fig. 30A

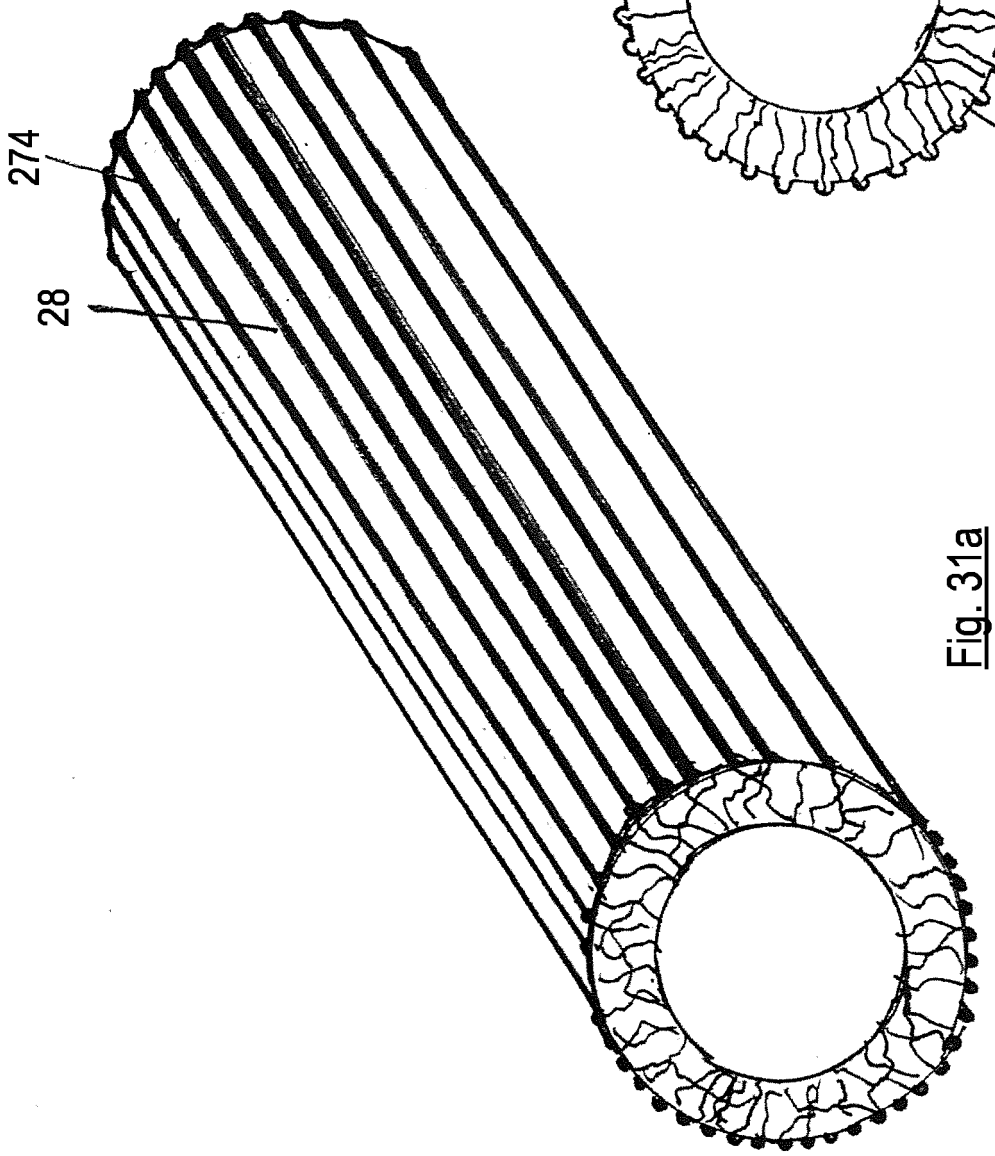


Fig. 31a

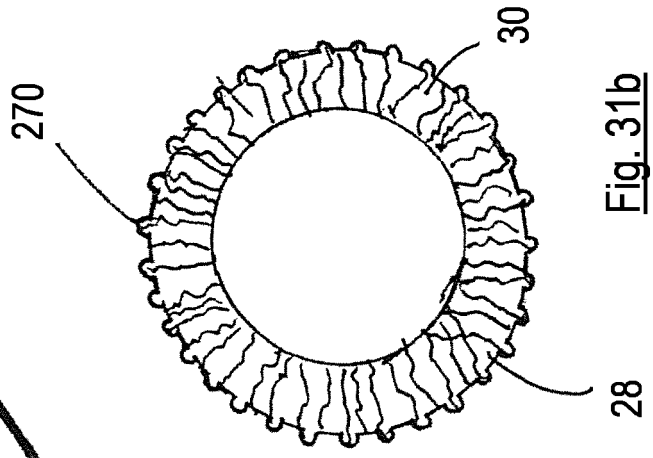


Fig. 31b

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 5105

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 August 2019	Zuurveld, Gerben

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