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

(11) **EP 4 357 705 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.04.2024 Bulletin 2024/17

(21) Application number: **23204102.0**

(22) Date of filing: **17.10.2023**

(51) International Patent Classification (IPC):
F25C 1/142 *(2018.01)* ***F25D 17/02*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25C 1/142; F25D 17/02

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **20.10.2022 IT 202200021633**

(71) Applicant: **Technoalpin S.p.A.**
39100 Bolzano (IT)

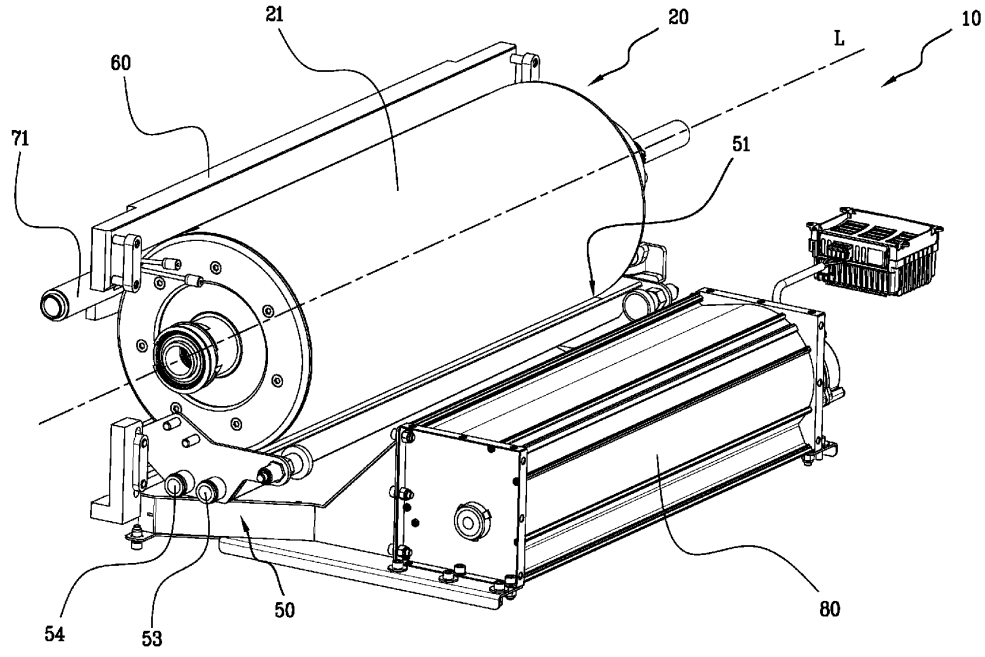
(72) Inventor: **RIEDER, Walter**
39100 Bolzano (IT)

(74) Representative: **Anselmi, Davide**
Bugnion S.p.A.
Via Pancaldo, 68
37138 Verona (IT)

(54) **ARTIFICIAL SNOWMAKING EQUIPMENT**

(57) Artificial snowmaking equipment (10), preferably indoor, comprises a refrigerating cylinder (20) rotating about a longitudinal axis (L); movement means configured to rotate the refrigerating cylinder (20); a cooling unit (40) configured to cool an outer side wall (21) of the refrigerating cylinder (20) to a freezing temperature; a water supply system (50) configured to wet at least part of the outer side wall (21) so as to create a layer of ice thereon; at least one scraper device (60) configured to scrape at least part of the ice layer so as to obtain an artificial snow fall. In particular, the refrigerating cylinder (20) internally has a gap (22) extending along an inner surface thereof opposite the outer side wall (21). The gap (22) is connected to the cooling unit (40) so as to receive a flow of a refrigerating substance to be conveyed therein to cool the outer side wall (21) of the refrigerating cylinder (20).

Fig.1a



EP 4 357 705 A1

Description

Technical field

[0001] The present invention relates to artificial snowmaking equipment, preferably indoor.

Prior art

[0002] Currently, within the context of indoor snow, it is known to use special snowmaking systems for making artificial snowfall in a closed environment or in a specific limited area of interest.

[0003] Such snowmaking systems can be used in environments with a large surface area for the preparation and fitting out of downhill slopes for skiers and snowboarders, or in rooms with more contained dimensions for therapeutic or well-being purposes, such as snow cabins in wellness centres in which a typically winter climate is recreated to offer guests a shiver of revitalizing cold after sauna heat treatments.

[0004] Generally, traditional snow cabins are defined by a room inside which the snowfall is recreated artificially, generated by a special snowmaking device arranged on the top of the room and generally comprising nozzles for the generation and dispersion of artificial snow.

[0005] However, the snowmaking systems present to date on the market must be activated with prior notice so as to be able to form a minimum accumulation of snow with which they can simulate the falling of snowflakes. In other words, at the time of their effective use by an operator, the current snowmaking systems must have already produced a minimum amount of snow accumulated on a support, so that a scraper device can be positioned in contact and perform scraping such as to produce the generation of snowflakes which are free to fall.

[0006] This entails a greater energy consumption for the activation of the systems for a longer time than that of actual use and, furthermore, to ensure that the snow does not melt during the storage period thereof.

[0007] Furthermore, such systems require the scraper device to comprise a complex and movable structure able to adapt its distance from the pile of snow accumulated in an optimal manner for generating snowflakes.

[0008] Additionally, such systems sometimes envisage that the snowfall takes place starting from snow already compacted in the accumulation step and that could be partially frozen (and therefore the particles that compose the snow fall are a set of "slivers" and not actually flakes). This leads to a drop in the quality of the snow that is generated below for the fall.

Summary

[0009] In this context, the technical task underlying the present invention is to propose artificial snowmaking equipment, preferably indoor, which obviates the drawbacks in the known art as described above.

[0010] In particular, an object of the present invention is to provide artificial snowmaking equipment (also called technical snowmaking) with a reduced energy consumption and, at the same time, with an optimised snowmaking system.

[0011] Another object of the present invention is to provide artificial snowmaking equipment which is capable of producing high-quality snow. Therefore, specifically, the invention has the object of providing artificial snowmaking equipment which is capable of making artificial snow with the same properties and quality of natural snow so as to simulate the fall of the snow or a snowfall in an indoor environment, where the cooling of the surrounding environment is not essential.

[0012] A further object of the present invention is to provide artificial snowmaking equipment which is configured to improve the effect of snow fall and, further, to bring the quality of artificially produced snow closer to that of naturally produced snow.

[0013] The stated technical task and specified objects are substantially achieved by artificial snowmaking equipment, preferably indoor, which comprises the technical features set forth in the independent claim. The dependent claims correspond to further advantageous aspects of the invention.

[0014] It should be understood that this summary introduces a selection of concepts in simplified form, which will be further expanded on in the detailed description given below.

[0015] The invention relates to artificial snowmaking equipment, preferably indoor.

[0016] In detail, the equipment comprises a refrigerating cylinder configured to rotate about a longitudinal axis thereof along which it extends, movement means configured to rotate the aforesaid refrigerating cylinder, a cooling unit operatively configured to cool the cylindrical wall of the refrigerating cylinder (i.e., an outer side wall) to a freezing temperature, a water supply system configured to wet at least part of the outer side wall of the refrigerating cylinder with a predetermined quantity of water so as to create an ice layer on the same outer side wall and, furthermore, at least one scraper device configured to scrape at least part of the ice layer so as to obtain an artificial snow fall. In particular, according to the present invention, the refrigerating cylinder internally has a gap or inner ducts extending along an inner surface of the same refrigerating cylinder, which is opposite the outer side wall. Such a gap or such inner ducts are connected to the cooling unit so as to receive a flow of a refrigerating substance to be conveyed inside the gap or inner ducts to cool the outer side wall of the refrigerating cylinder.

Brief description of the drawings

[0017] Further features and advantages of the present invention will become more apparent from the approximate and thus non-limiting description of a preferred, but

non-exclusive, embodiment of artificial snowmaking equipment, preferably indoor, as illustrated in the accompanying drawings, in which:

- figures 1a, 1b illustrate, according to two different perspective views, a possible embodiment of artificial snowmaking equipment;
- figure 1c illustrates, according to a side view, a section of the equipment illustrated in figures 1a, 1b;
- figure 2 illustrates, according to a side view, a section of a possible embodiment of the refrigerating cylinder;
- figure 3a illustrates, according to a perspective view, a possible embodiment of the scraper device;
- figure 3b illustrates, according to a side view, a section of the scraper device when installed on the equipment;
- figure 4 illustrates, according to a perspective view, a possible embodiment of the water supply system;
- figure 5 illustrates, according to a perspective view, a possible embodiment of a cooling device;
- figure 6 illustrates, according to a schematic view, a possible embodiment of an artificial snowmaking apparatus which, preferably, comprises the artificial snowmaking equipment illustrated in figure 1.

[0018] With reference to the drawings, they serve solely to illustrate embodiments of the invention for the purpose of better clarifying, in combination with the description, the inventive principles at the basis of the invention.

Detailed description of at least one embodiment

[0019] The present invention is directed to artificial snowmaking equipment, preferably indoor, which with reference to the figures, has been generically indicated with the number 10. Any modifications or variants which, in the light of the description, would be evident to the person skilled in the art must be considered as falling within the scope of protection established by the present invention, according to considerations of technical equivalence.

[0020] Figures 1a-1c show artificial snowmaking equipment 10, preferably indoor, which can also be used in outdoor contexts.

[0021] In detail, the equipment 10 comprises a refrigerating cylinder 20 configured to rotate about a longitudinal axis L along which it extends, movement means, preferably motorized, configured to rotate the same refrigerating cylinder 20, a cooling unit 40 (better illustrated in figure 6) operatively connected to the refrigerating cylinder 20 and, furthermore, configured to cool an outer side wall 21 (the cylindrical one) of the refrigerating cylinder 20 to a freezing temperature, preferably below 0° C, a water supply system 50 configured to bring a predetermined quantity of water in contact with at least part of the outer side wall 21 of the refrigerating cylinder 20 so as to wet it in order to create an ice layer on the same outer side wall 21, at least one scraper device 60 configured to scrape at least part of the ice layer so as to obtain an artificial snow fall.

[0022] In particular, the refrigerating cylinder 20 internally has a gap 22 (or inner ducts) extending along an inner surface of the same refrigerating cylinder 20, which is opposite the outer side wall 21. In addition, such a gap 22 is connected to the cooling unit 40 so that a flow of a refrigerating substance is conveyed inside the same gap 22 so as to cool the outer side wall 21 of the refrigerating cylinder 20.

[0023] That is, the equipment 10 is configured to make artificial snow fall by solidifying the water present on the outer side wall 21 of the refrigerating cylinder 20. In particular, the refrigerating cylinder 20 is connected to a cooling unit 40 so that its outer side wall 21 is at a temperature such as to allow the almost instantaneous freezing of the water which wets it, supplied by a water supply system 50. In addition, the refrigerating cylinder 20 is advantageously kept in rotation by a movement means about a longitudinal axis L thereof (preferably horizontal) so that the ice layer formed on the side wall 21 moves towards a scraper device 60 (integral with a support frame 11 of the equipment 10) with which it interacts. The mechanical contact between the scraper device 60 and the ice layer leads to the formation of artificial snow which, by gravity, is capable of falling into a predetermined collection zone.

[0024] Preferably, the movement means comprises a motor or a gear reducer operatively connected to the rotating shaft on which the refrigerating cylinder 20 is installed so as to rotate the latter about the longitudinal axis L.

[0025] It was described above that the refrigerating cylinder 20 internally has a gap 22 or inner ducts. In the following, for the sake of descriptive simplicity, only the preferred embodiment comprising the gap 22 and the features related to the latter will be mentioned. However, it is logical to think that the alternative embodiment comprising the inner ducts is achievable with the same concepts once the gap has been replaced with one or more inner ducts extending along the inner surface of the refrigerating cylinder 20, i.e., the surface opposite the outer side wall 21.

[0026] In accordance with a preferred aspect of the invention, the gap 22 extends internally to the refrigerating cylinder 20, parallel to the longitudinal axis L, continuously along the inner surface thereof.

[0027] As can be seen in figure 2, the gap 22 is substantially delimited between the surface of the refrigerating cylinder 20 (i.e., the outer side wall 21 and the inner surface, the two opposite faces of the same element) and a cylindrical partition arranged internally of the same refrigerating cylinder 21.

[0028] Thereby, the gap 22 defines a volume having the shape of a hollow cylinder having a reduced radial dimension with respect to the internal volume of the refrigerating cylinder 20. That is, the thickness of the gap 22 is less than the dimension of the radius of the refrig-

erating cylinder.

[0029] In fact, the operation of the gap 22 is to allow the flow of the refrigerating substance which, in contact with the outer side wall 21, is thus capable of refrigerating the latter to allow the freezing of the water. Consequently, the thickness of the gap 22 is preferably less than the entire radius of the refrigerating cylinder 20 so as to concentrate the refrigerating effect on the outer side wall 21.

[0030] In addition, maintaining a vacuum/air layer between the gap and the longitudinal axis L of the refrigerating cylinder 20 makes it possible to create a low heat exchange insulating layer. That is, almost all of the heat exchange of the refrigerating substance thereby advantageously occurs with the outer side wall 21 of the refrigerating cylinder 20.

[0031] In accordance with an aspect of the invention, the cooling unit 40 comprises a tank 41 for containing a refrigerating substance conveyable at least towards the refrigerating cylinder 20 to cool the outer side wall 21.

[0032] That is, the refrigerating substance is preferably contained in a special tank 41 so that control and maintenance operations can be carried out more easily.

[0033] In accordance with another aspect of the invention, the refrigerating cylinder 20 comprises a delivery duct 23 for the refrigerating substance interposed between the tank 41 and the gap 22 and an outlet duct 24 for the refrigerating substance.

[0034] Preferably, the delivery duct 23 and the outlet duct 24 are integrated parts of a rotating joint so as to allow the conveyance of the refrigerating substance to the gap 22 or from the gap 22.

[0035] Even more preferably, the delivery duct 23 (or, alternatively, the return duct 24) is obtained internally to the rotating shaft on which the refrigerating cylinder 20 is installed.

[0036] Thereby, the cooling unit 40 is capable of conveying the refrigerating substance towards the gap 22.

[0037] In accordance with a further aspect of the invention, the delivery duct 23 and/or the outlet duct 24 comprise a portion arranged inside the refrigerating cylinder 20 which extends substantially along the longitudinal axis L.

[0038] As already anticipated, figure 2 illustrates a possible embodiment of the refrigerating cylinder 20. In such a depiction it is possible to note that, for example, a part of the delivery circuit 23 is obtained along the rotating shaft of the refrigerating cylinder 20 itself, i.e., along the longitudinal axis L. Consequently, a part of the outlet duct 24 of the refrigerating substance also extends parallel to the aforesaid rotating shaft, along a circular section surrounding a part of the delivery duct 23.

[0039] The gap 22 is interposed in fluid communication with the delivery duct 23 and the outlet duct 24, preferably by means of a rotating joint. The inversion of the flow direction of the refrigerating substance necessarily entails the inversion between the delivery duct 23 and the outlet duct 24, keeping the structure illustrated in figure 2 unchanged.

[0040] As anticipated, the space between the rotating shaft and the gap 22 is empty or has only air so as to provide an insulating layer which greatly reduces a heat exchange with the gap 22 and the delivery duct 23/the outlet duct 24.

[0041] In addition, the refrigerating cylinder 20 comprises two thermally insulating head portions 25, 26. In particular, the head portions 25, 26 are arranged transversely to the longitudinal axis L and opposite with respect to the outer side wall 21.

[0042] Thereby, the cooling energy is advantageously transferred only along the outer side wall 21 to prevent a layer of ice from forming also on the two head portions 25, 26 and, therefore, optimising the exploitation of the energy used for cooling.

[0043] Preferably, the two head portions 25, 26 are made of Teflon or another material capable of ensuring thermal insulation. Instead, at least the outer side wall 21 of the refrigerating cylinder 20 is made of aluminium or any material (preferably metallic) having a thermal conductivity comparable to or better than that of aluminium.

[0044] In accordance with a preferred aspect of the invention, the outer side wall 21 of the refrigerating cylinder 20 has a rough conformation.

[0045] Preferably, the outer side wall 21 of the refrigerating cylinder 20 is sandblasted (other equivalent processing techniques can also be used) so as to create a wrinkled surface, having imperfections (in other words, not perfectly smooth) so as to improve the adhesion of the ice layer. In fact, it is preferable to prevent pieces of ice from detaching from the refrigerating cylinder 20 during the operation of the equipment 10. That is, during the cutting process the scraper device 60 mechanically stresses the ice layer present on the refrigerating cylinder 20 which must not detach.

[0046] In accordance with an aspect of the invention, the scraper device 60 is operatively connected to the cooling unit 40 to be maintained at a low temperature, preferably below 0° C.

[0047] Thereby, the scraper device 60 does not alter the temperature of the ice layer with which it comes into contact and, therefore, does not alter the quality of the snowflakes produced. In addition, maintaining the scraper device 60 at a low temperature, preferably below 0° C, allows to prevent the artificial snow produced by the same scraper device 60 from dissolving, forming liquid water which would tend to retain the same artificial snow produced (i.e., preventing the detachment thereof and, therefore, the fall by gravity).

[0048] That is, the artificial snow made by the scraper device 60 is obtained only thanks to its mechanical interaction with the ice layer and not due to an increase in temperature and, therefore, a partial melting of the ice.

[0049] In still other words, the scraper device 60 has the function of scraping at least a part of the ice layer which forms on the outer side wall 21 of the refrigerating cylinder 20, avoiding any local rise in temperature.

[0050] Preferably, the scraper device 60 is configured to remove only a reduced thickness of the ice layer present on the outer side wall 21 of the refrigerating cylinder 20. Thereby, therefore, the ice layer maintained on the refrigerating cylinder 20 is advantageously capable of providing a base on which a further ice layer is more easily formed which the scraper device 60 is capable of removing to generate artificial snow.

[0051] Even more preferably, the scraper device 60 comprises a support element 61 along which a cooling duct 62 is made and a cutting element 63 fixed to the support element 61 to be in contact with the cooling duct 62. In particular, the cooling duct 62 is in fluid communication with the cooling unit 40 so as to cool the cutting element 63.

[0052] Figure 3a illustrates a possible embodiment of the scraper device 60. Preferably, the cooling duct 62 is connected to the cooling unit 40 so as to receive a flow of refrigerating substance from the latter which is adapted to lower the temperature of the cutting element 63 with which it is in direct contact.

[0053] Even more preferably, the cutting element 63 is configured to be constrained to the support element 61 so that the blade of the cutting element 63 is free and faces the outer side wall 21 of the refrigerating cylinder 20.

[0054] The support element 61 is advantageously surface machined to contain the cooling duct 62 and coupling points adapted to fix the cutting element 63. In addition, the support element 61 has ends adapted to define the connection with a support frame 11 of the entire equipment 10.

[0055] Preferably, the support element 61, the cooling duct 62 and the cutting element 63 are made of metallic material to maximise the heat exchange therebetween.

[0056] Figure 3b illustrates the side section of the scraper device 60 when mounted on the equipment 10 in which the arrangement of the cutting element 63 with respect to the outer side wall 21 of the refrigerating cylinder 20 is visible.

[0057] In addition, as better described below, a cleaning element 71 is visible in such a figure, which is configured to carry out the cleaning of the scraper device 60. In accordance with another aspect of the invention, the water supply system 50 comprises a water containment tank 51 extending parallel to the longitudinal axis L. In particular, the tank 51 defines a containment volume adapted to contain a predetermined level of water and at least part of the refrigerating cylinder 21 so that the latter is at least partially immersed in the water.

[0058] Figures 1c and 4 illustrate a possible and preferred embodiment of the water supply system 50. In particular, in figure 1c, it can be noted that the refrigerating cylinder 20 is preferably immersed, at least in part, inside the containment volume of the tank 51. A quantity of water is advantageously conveyed inside the tank 51. The refrigerating cylinder 20 is therefore partially immersed in water and, therefore, its outer side wall 21 is wet. Advantageously, the movement by rotation of the refrigerating cylinder 20 involves the interaction with the water of the entire outer side wall 21 which, therefore, will be entirely wet at the end of an entire rotation of the refrigerating cylinder 20.

[0059] As explained above, thanks to the cooling of the outer side wall 21 induced by the cavity 22 (in which the refrigerating substance flows), the refrigerating cylinder 20 is advantageously configured to freeze the water present on its outer side wall 21 and, therefore, form an ice layer which the scraper device 60 is capable of removing at least in part so as to make artificial snow.

[0060] In accordance with a further aspect of the invention, the tank 51 comprises a water distribution channel 52 operatively connected to a water source (not illustrated) and, furthermore, configured to homogeneously distribute the predetermined quantity of water in the same tank 51. In particular, the distribution channel 52 is arranged on a bottom of the tank 51 and has an elongated shape along a direction parallel to the longitudinal axis L.

[0061] Preferably, the distribution channel 52 has a closed shape and there is a plurality of openings 55 useful for the distribution of water along its extension. Even more preferably, the distribution channel 52 also has a tapered conformation whereby its thickness (i.e., its section along which the water flows) is gradually reduced along the tank so as to obtain the same outlet pressure (and therefore also the same flow rate) of the water from the aforesaid openings 55.

[0062] Thereby, the water present inside the tank 51 is advantageously homogeneously distributed so that the temperature is also homogeneous for the entire containment volume and there are no points with different temperature gradients (higher and/or lower) along the tank 51.

[0063] In particular, the tank 51 has a supply opening 54 obtained laterally and at the distribution channel 52 so that the water flow can be conveyed there, for example, from a water source such as the water mains or a well.

[0064] Preferably, the water supply system 50 is configured to constantly supply water in the tank 51. In particular, the tank 51 has a water drain opening 53.

[0065] Even more preferably, the drain opening 53 is obtained above the supply opening 54. In accordance with an aspect of the invention, the water supply system 50 is operatively connected to the cooling unit 40 so as to perform a pre-cooling of the water to be conveyed in the tank 51 and/or directly on the outer side wall 21 of the refrigerating cylinder 20.

[0066] Thereby, the water present inside the tank 51 which will wet the outer side wall 21 of the refrigerating cylinder 20 will need a minor heat exchange with the same outer side wall 21 to form the ice layer.

[0067] In accordance with a preferred aspect of the invention (illustrated in figure 5), the equipment 10 can comprise a cooling device 90 configured to perform the pre-cooling of the water to be conveyed in the tank 51 and/or directly on the outer side wall 21 of the refrigerating

cylinder 20.

[0068] Preferably, the cooling device 90 comprises a heat exchanger.

[0069] The heat exchanger comprises a containment body 91 in which a plurality of plates 92 are arranged for the exchange of heat between the water and the refrigerating substance.

[0070] More precisely, on one side of the heat exchanger there are valves for the inlet of water and refrigerating substance 93,94, while on the other side there are valves for the outlet of cooled water and refrigerating substance 95,96.

[0071] Preferably, the refrigerating substance is configured to flow within the plates 92 arranged in fluid communication with each other and in sequence with each other. The water is instead configured to flow between the plates 92 and, more precisely, along the ribs 97 formed by the free space present between the plates 92. That is, the plates 92 are arranged so as to make the ribs 97 of free space therebetween, through which the water is capable of flowing and, therefore, perform the heat exchange with the refrigerating substance flowing inside the aforesaid plates 92.

[0072] In accordance with an aspect of the invention, the movement means is configured to rotate the refrigerating cylinder 20 at a constant speed and/or at a variable speed.

[0073] That is, the rotation speed of the refrigerating cylinder 20 can be varied as a function of the amount of artificial snow to be produced, i.e., as a function of the quantity of water to be adhered to the outer side wall 21 or also as a function of the context where the system is used (ambient temperatures and temperatures of the refrigerating substance).

[0074] In accordance with another aspect of the invention, the equipment 10 comprises an adjustment means operatively connected to the scraper device 60 and, in addition, configured to vary the distance and/or to vary the inclination of the same scraper device 60 with respect to the outer side wall 21 of the refrigerating cylinder 20.

[0075] Preferably, the scraper device 60 is configured to only cut a part of the ice layer present on the outer side wall 21. That is, the scraper device 60 is preferably configured to thin the ice layer and not to completely remove it from the refrigerating cylinder 20. Thereby, the ice layer remaining on the outer side wall 21 simplifies the absorption of the water provided by the water supply system 50 and, therefore, the formation of a new ice layer which the scraper device 60 can cut.

[0076] The adjustment means, therefore, is capable of varying the distance of the scraper device 60 from the ice layer as a function of the need and type of artificial snow to be made.

[0077] For example, it could be necessary to bring the scraper device 60 closer to the ice layer if many work cycles have been performed and, therefore, the blade is at least partially worn.

[0078] Even more advantageously, the adjustment means allows the variation of the inclination of the scraper device 60 with respect to the outer side wall 21.

[0079] In accordance with a further aspect of the invention better visible in figure 1b, the equipment 10 comprises a cleaning element 71 arranged frontally to the outer side wall 21, more precisely at the scraper device 60.

[0080] Preferably, the cleaning element comprises a rotating brush configured to prevent the formation and/or to remove any accumulations of snow at the cutting element 63 of the scraper device 60.

[0081] That is, the cleaning element 71 allows to remove the ice powder formed by the scraper device 60 which has not fallen by gravity and, therefore, has not been exploited for the formation of artificial snow.

[0082] Failure to remove such ice powder could affect the creation and quality of the new ice layer which must be formed on the outer side wall 21 of the refrigerating cylinder 20. In fact, coarser grains of ice may form around such ice powder which are not suitable for the intended purposes.

[0083] Preferably, the cleaning element 71 extends parallel to the longitudinal axis L substantially for an entire length of the outer side wall 21.

[0084] In accordance with an aspect of the invention visible in figure 1, the equipment 10 comprises a blowing device 80 arranged below the refrigerating cylinder 20 and the scraper device 60. In particular, the blowing device 80 is configured to blow the artificial snow produced by the scraper device 60, creating a snow flow outside the equipment 10 which is more uniform and similar to a natural flow of snow fall.

[0085] The blowing device 80 is advantageously configured to remove the artificial snow made by the scraper device 60 from the equipment 10. Preferably, the artificial snow produced falls by gravity from the scraper device 60 and is then moved by the blowing device 80 towards a collection area, for example a snow cabin, creating a snow flow which simulates the effect of a natural snowfall.

[0086] The present invention, as illustrated in figure 6, also relates to an artificial snowmaking apparatus 100, preferably indoor.

[0087] In detail, the apparatus 100 comprises an artificial snowmaking cabin 101 defining an inner volume W thereof and, furthermore, indoor artificial snowmaking equipment 10 having one or more of the features described above.

[0088] In particular, the equipment 10 is mounted on a frame 11 (visible in figure 1) constrainable to a wall 102 or to the ceiling 103 of said cabin 101 and, furthermore, raised from the ground, preferably at a ceiling 103 of the same cabin 101.

[0089] That is, in accordance with a preferred embodiment, the equipment 10 (or at least most of its components such as the refrigerating cylinder 20 and the scraper device 60) is arranged inside a frame 11 having the confirmation of an almost entirely closed box-like body and, furthermore, with a thermal insulation towards the

external environment. In fact, one face of the frame 11 is open and communicating with the inner volume W of the snow cabin 101 to allow the artificial snow produced to fall by gravity inside the same snow cabin 101.

[0090] Therefore, the equipment 10 is fixed to a wall 102 or to the ceiling 103 of the snow cabin 101 so that the communicating face of the frame 11 is in direct communication with the inner volume W for the fall of the artificial snow produced by the equipment 10.

[0091] In accordance with an aspect of the invention, the apparatus 100 may also comprise a spray system which, in turn, comprises a nucleator nozzle 111 fed with a flow of pressurised air 112 and a flow of cooled water 113.

[0092] Thereby, the air present in the inner volume W of the snow cabin 101 is advantageously maintained at a predetermined temperature and humidity value to allow the artificial snow produced by the equipment 10 to be preserved, i.e., not to melt, and thus to maintain its quality.

[0093] In accordance with a further aspect of the invention, the spray system comprises a heat exchanger 114 configured to cool the air flow to be conveyed inside the snow cabin 101. Preferably, the heat exchanger 114 is arranged in connection with the cooling unit 40.

[0094] Preferably, the spray system is connected with the cooling unit 40 to cool the water flow 113 to be conveyed towards the nucleator nozzle 111.

[0095] In accordance with another aspect of the invention, the blowing device 80 is configured to suck part of the nebulized and humid cold air from the artificial snow cabin 101 to blow the artificial snow produced by the scraper apparatus 60 into the same artificial snow cabin 101.

[0096] Thereby, the blowing device 80 is advantageously capable of reducing the energy expenditure of the equipment 10 since the air used to blow the artificial snow in the snow cabin 101 does not have to be cooled by the same blower but is recovered directly from the snow cabin 101 where a large amount thereof is already present.

Claims

1. Artificial snowmaking equipment (10), preferably indoor, comprising:

   - a refrigerating cylinder (20) configured to rotate about a longitudinal axis (L) along which it extends;
   - movement means configured to rotate said refrigerating cylinder (20);
   - a cooling unit (40) operatively connected to said refrigerating cylinder (20) and configured to cool an outer side wall (21) of said refrigerating cylinder (20) to a freezing temperature, preferably less than 0° C;
   - a water supply system (50) configured to bring a predetermined quantity of water in contact with at least part of said outer side wall (21) of said refrigerating cylinder (20) to wet it so as to create a layer of ice on said outer side wall (21);
   - at least one scraper device (60) configured to scrape at least part of said ice layer so as to obtain an artificial snow fall;

   characterised in that said refrigerating cylinder (20) internally has a gap (22) or inner ducts extending along an inner surface of said refrigerating cylinder (20) opposite said outer side wall (21) and connected to said cooling unit (40) so as to receive a flow of a refrigerating substance to be conveyed inside said gap (22) or inner ducts to cool said outer side wall (21) of the refrigerating cylinder (20);
   wherein said water supply system (50) comprises a water containment tank (51) extending parallel to said longitudinal axis (L), said tank (51) defining a containment volume adapted to contain a predetermined level of water and at least part of said refrigerating cylinder (20) so that the latter is partially immersed in water; said tank (51) further comprising a water distribution channel (52) operatively connected to a water source and configured to homogeneously distribute said predetermined amount of water in said tank (51).

2. The equipment (10) according to claim 1, wherein said gap (22) or inner ducts extend internally to the refrigerating cylinder (20), parallel to the longitudinal axis (L), continuously along the same inner surface.

3. The equipment (10) according to claim 2, wherein said cooling unit (40) comprises a tank (41) for containing a refrigerating substance conveyable at least towards said refrigerating cylinder (20) to cool said outer side wall (21).

4. The equipment (10) according to any one of the preceding claims, wherein said scraper device (60) is operatively connected to said cooling unit (40) to be maintained at a temperature below 0° C.

5. The equipment (10) according to claim 4, wherein said scraper device (60) comprises a support element (61) along which a cooling duct (62) is made and a cutting element (63) fixed to said support element (61) to be in contact with said cooling duct (62), said cooling duct (62) being in fluid communication with said cooling unit (40) so as to cool the cutting element (63).

6. The equipment (10) according to any one of the preceding claims, wherein said refrigerating cylinder (20) comprises two thermally insulating head portions (25, 26), said head portions (25, 26) being ar-

ranged transversely to said longitudinal axis (L) and opposite with respect to said outer side wall (21).

7. The equipment (10) according to any one of the preceding claims, wherein said distribution channel (52) is arranged on a bottom of said tank (51) and is elongated along a direction parallel to the longitudinal axis (L).

8. The equipment (10) according to any one of the preceding claims, wherein said water supply system (50) is operatively connected to said cooling unit (40) so as to perform a pre-cooling of the water to be conveyed in said tank (51).

9. The equipment (10) according to any one of the preceding claims, wherein said outer side wall (21) of said refrigerating cylinder (20) has a rough conformation.

10. The equipment (10) according to any one of the preceding claims, wherein said movement means is configured to rotate said refrigerating cylinder (20) at a constant speed and/or at a variable speed.

11. The equipment (10) according to any one of the preceding claims, comprising adjustment means operatively connected to said scraper device (60) and configured to vary the distance and/or to vary the inclination of said scraper device (60) with respect to said outer side wall (21) of said refrigerating cylinder (20).

12. The equipment (10) according to any one of the preceding claims, comprising a blowing device (80) arranged below said refrigerating cylinder (20) and said scraper device (60), said blowing device (80) being configured to blow the artificial snow produced by said scraper device (60), creating a snow flow outside the equipment (10).

13. An artificial snowmaking apparatus (100), preferably indoor, comprising:

- an artificial snowmaking cabin (101);
- indoor artificial snowmaking equipment (10) according to any one of claims 1 to 12,

wherein said equipment (10) is mounted on a frame (11) constrainable to a wall (102) of said cabin (101) and raised from the ground, preferably at a ceiling (103) of said cabin (101).

Fig.1a

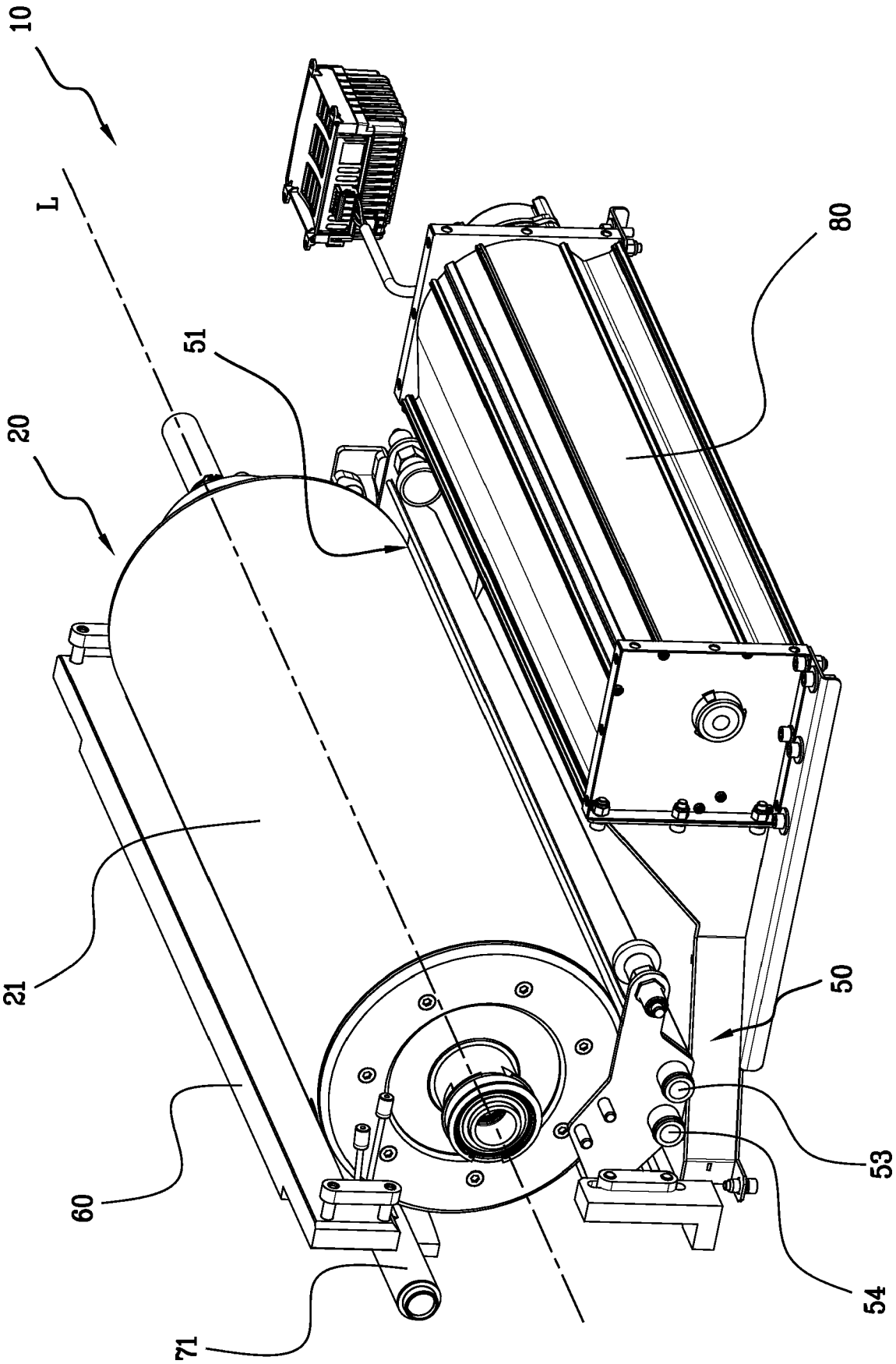


Fig.1b

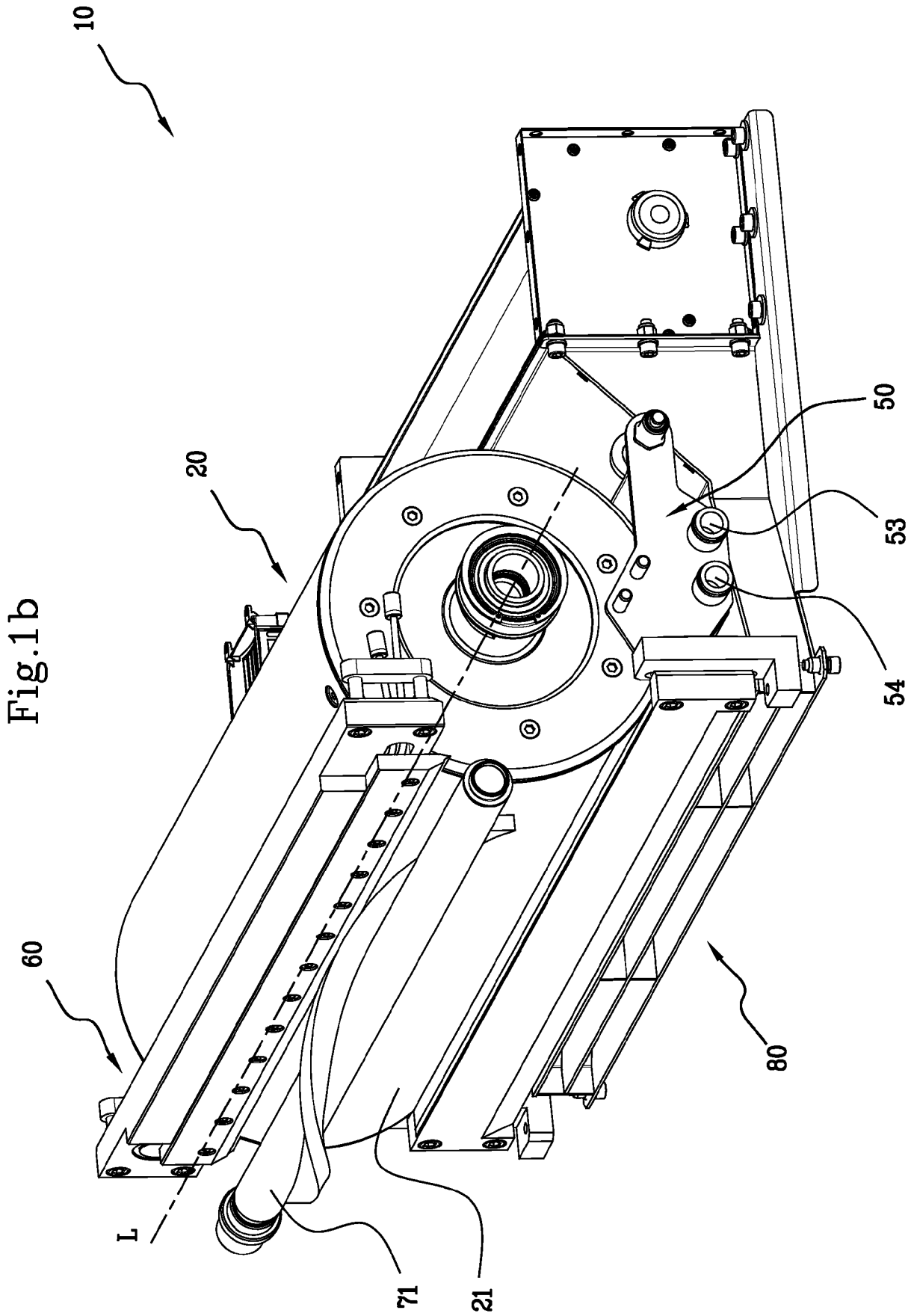


Fig.1c

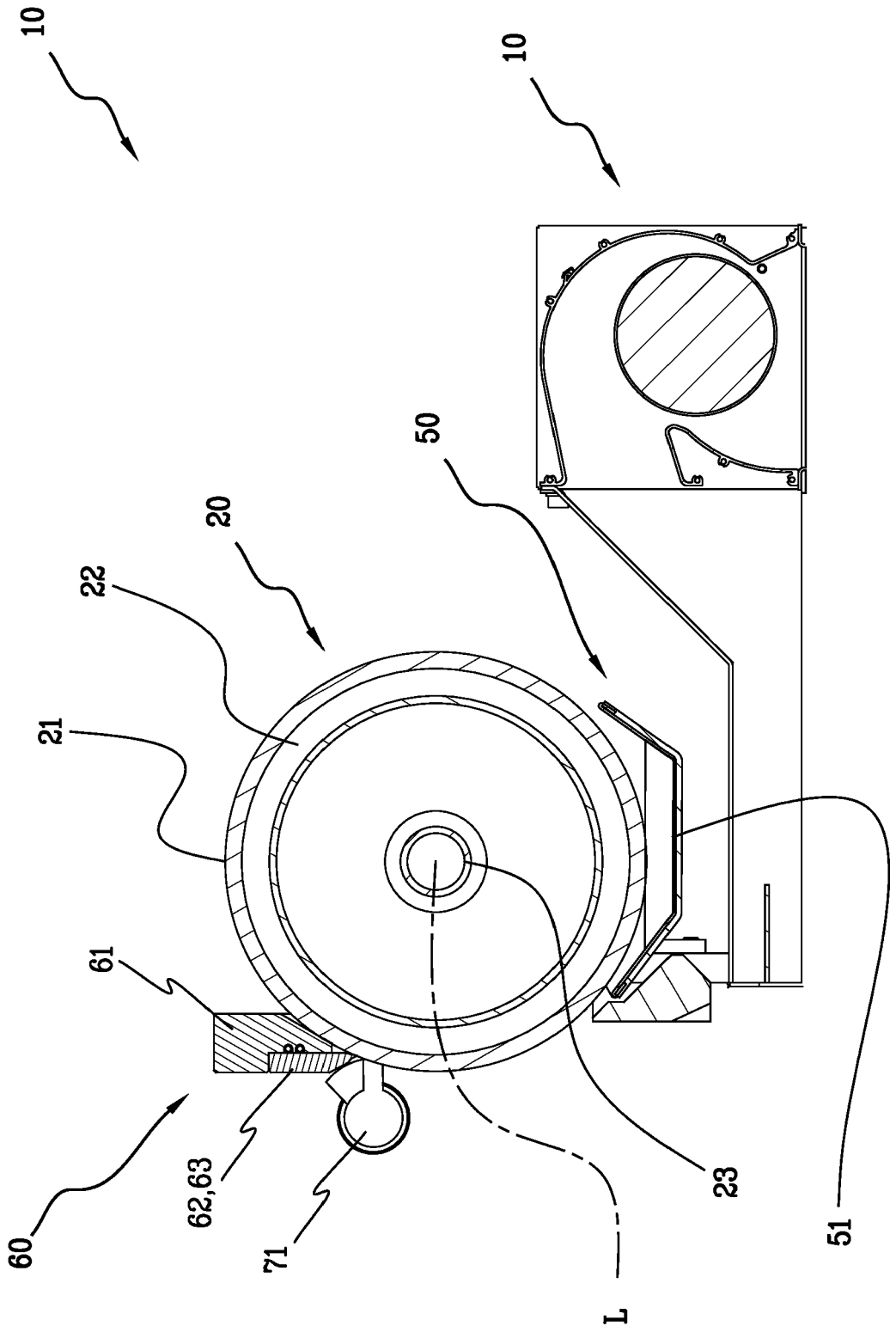
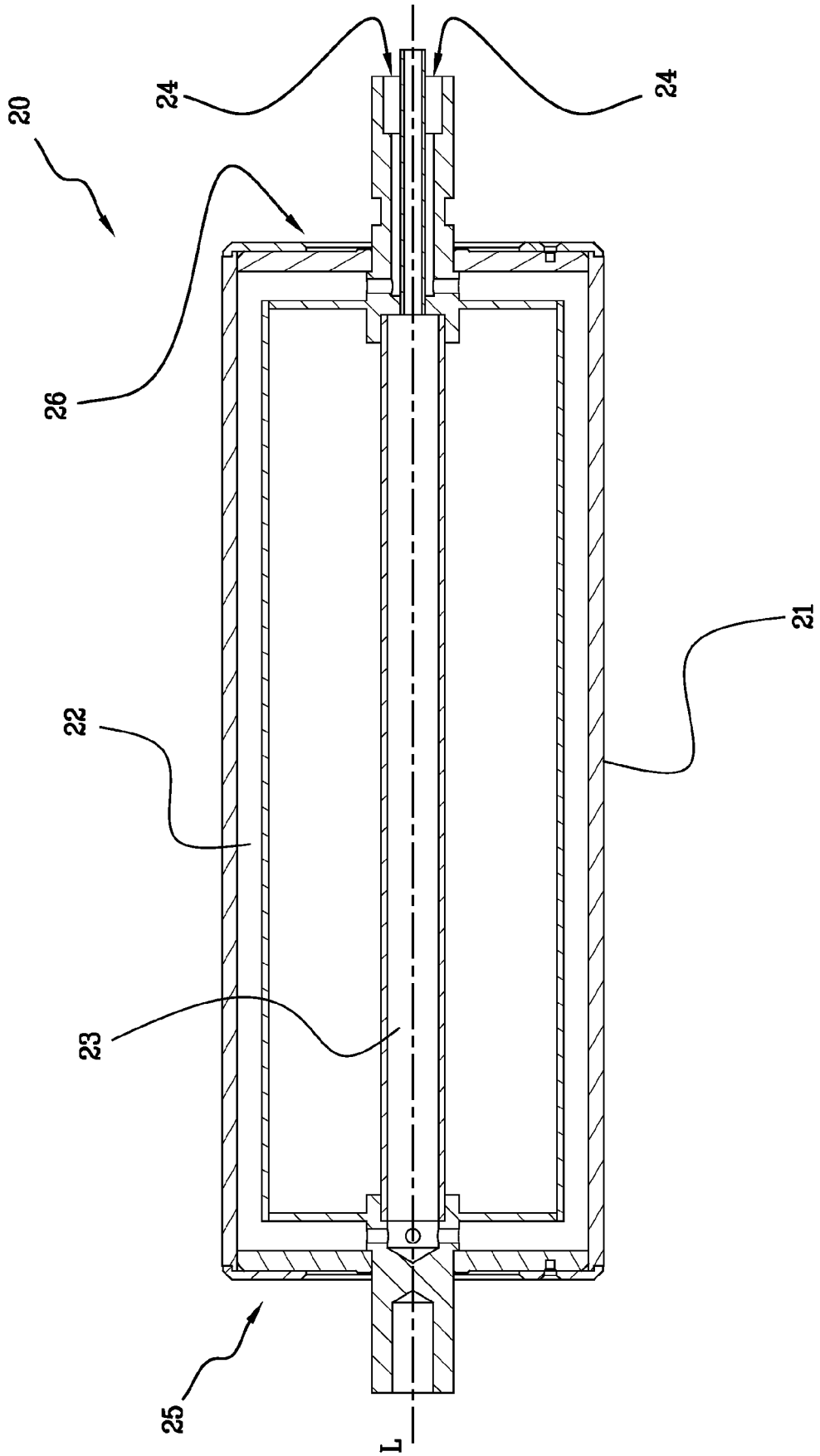


Fig.2



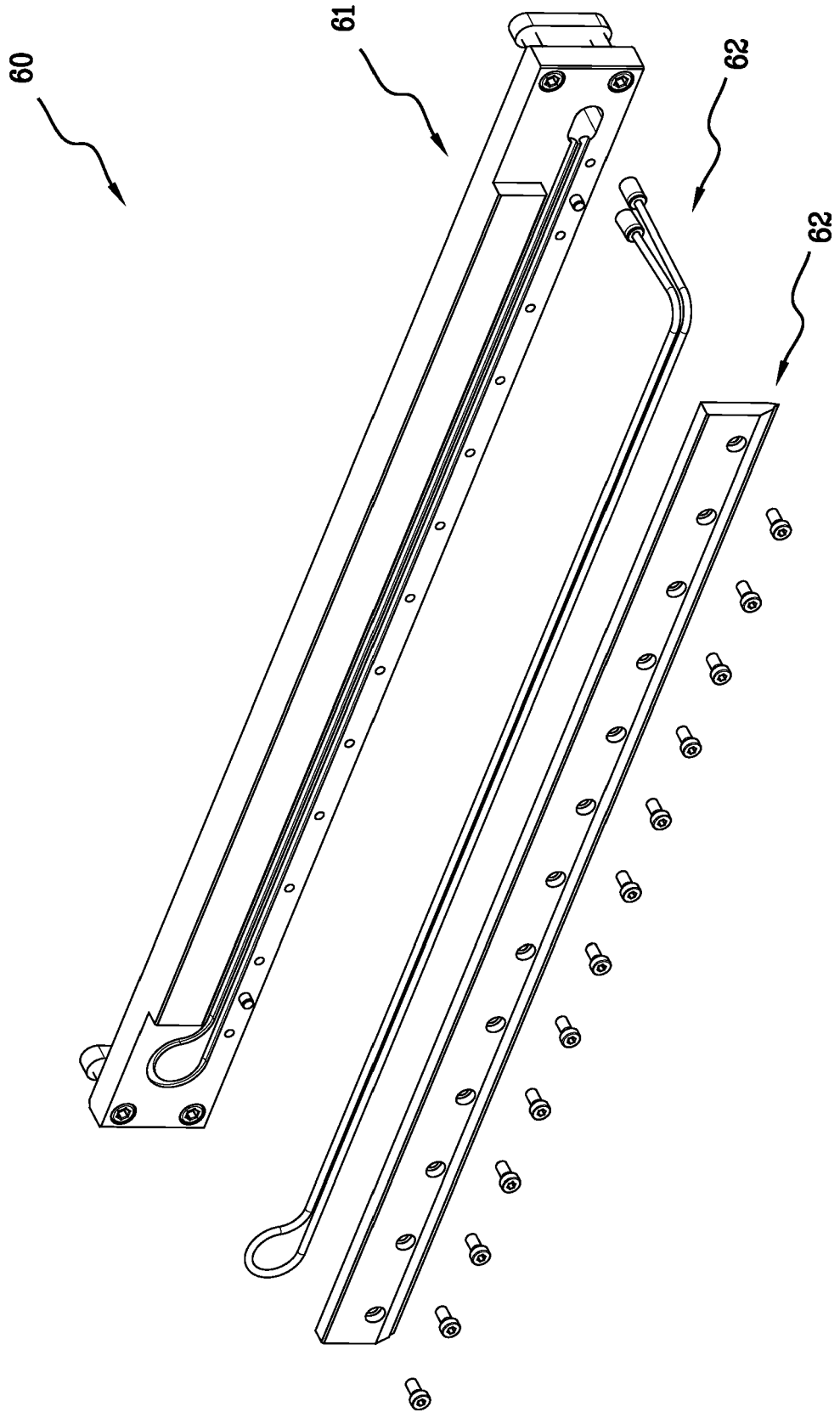


Fig.3a

Fig.3b

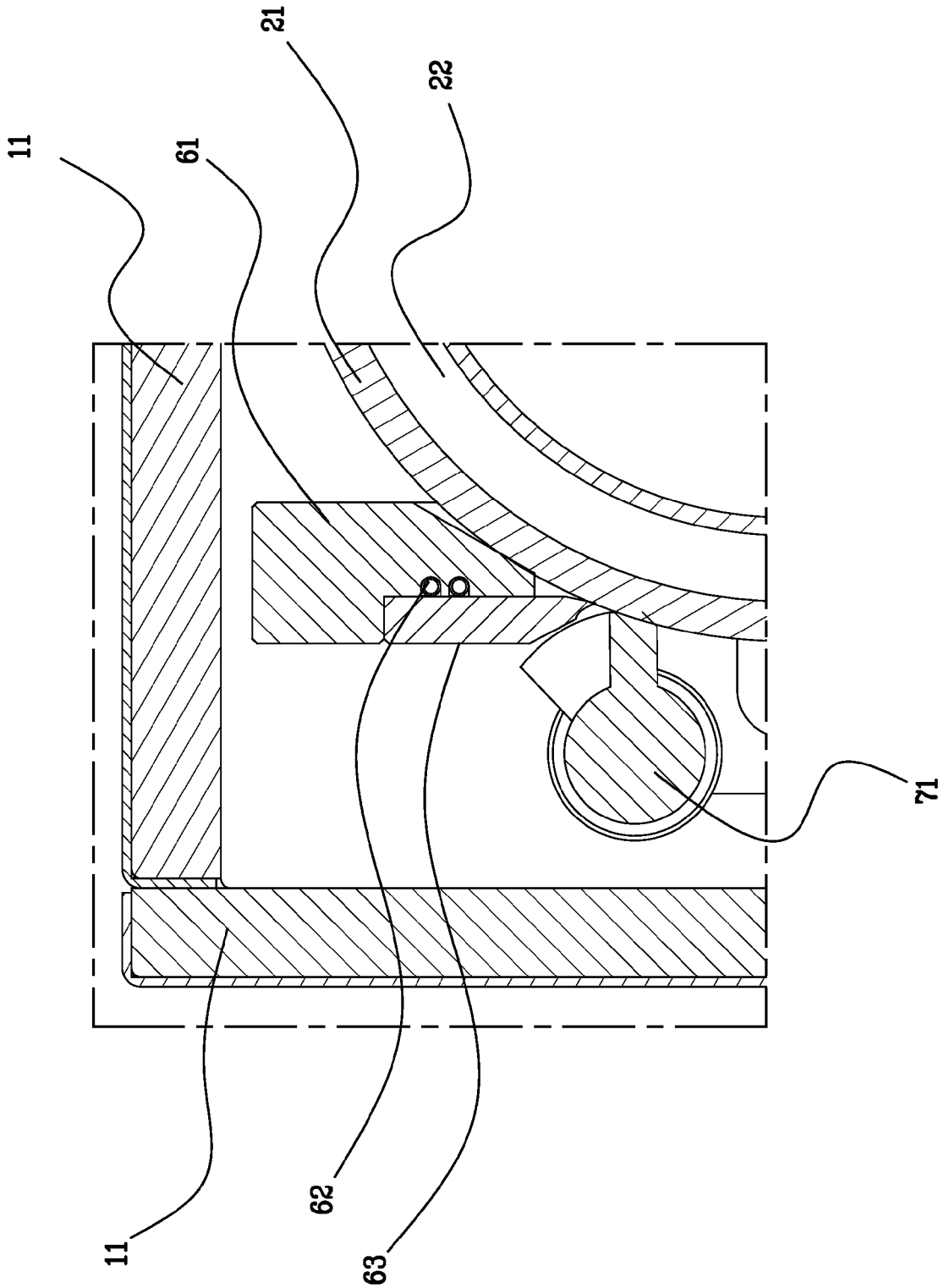


Fig.4

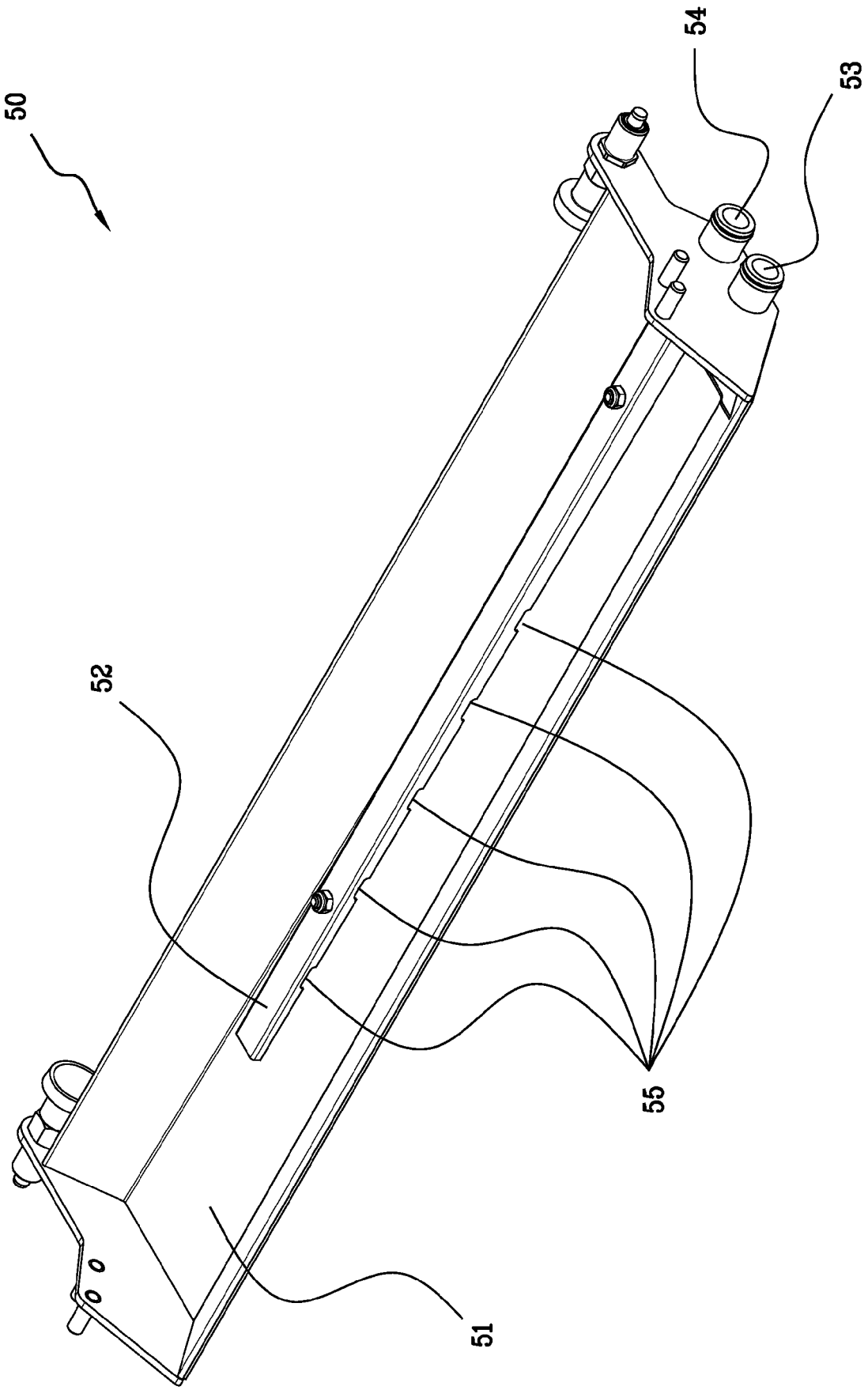


Fig.5

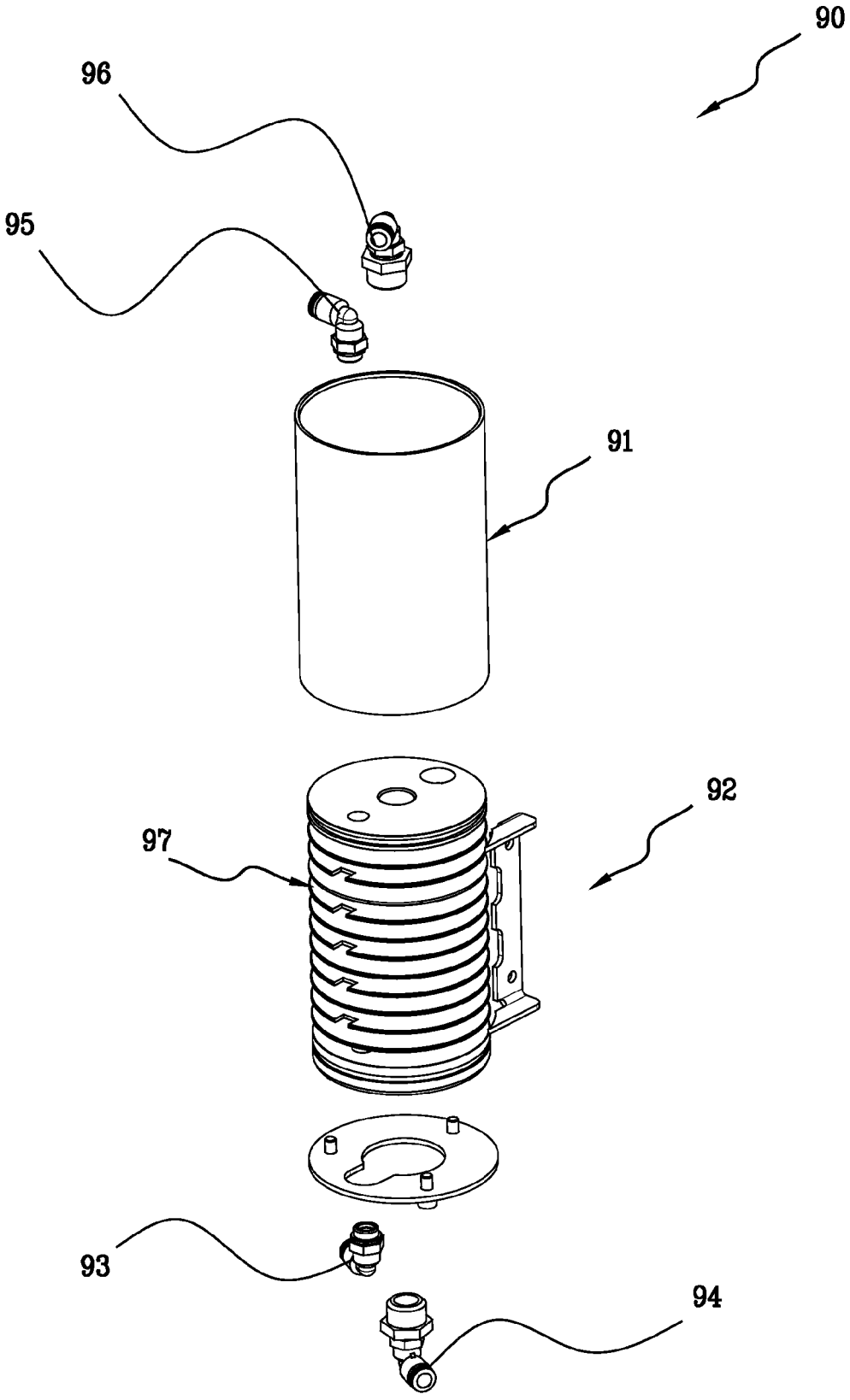
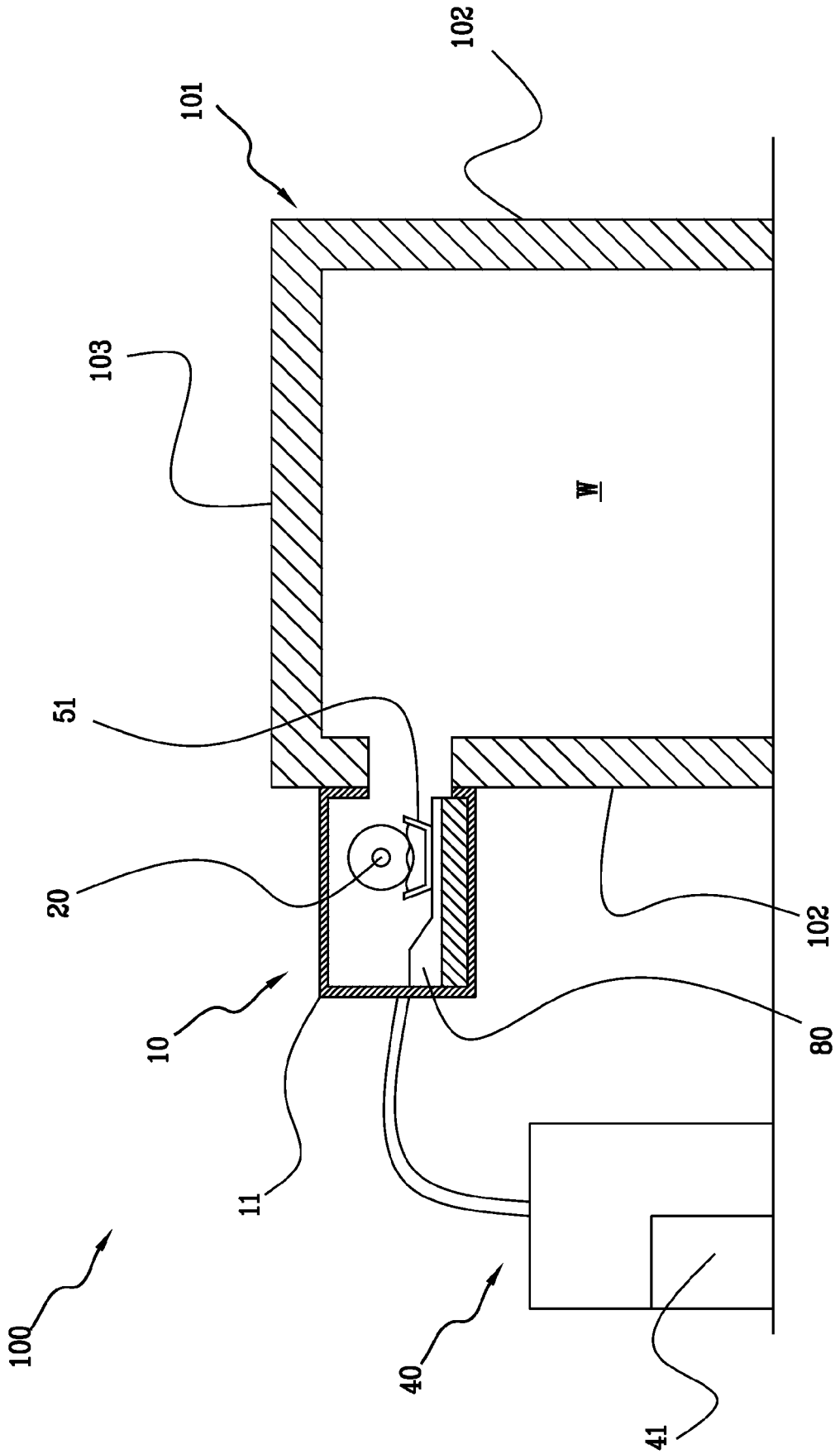


Fig.6



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 20 4102

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 10 2008 029695 B3 (HIGEL HARTMUT [DE]) 18 June 2009 (2009-06-18) * abstract; figures 1-7 * * paragraphs [0026], [0029], [0030], [0031], [0040], [0042], [0048] *	1-3,9-12 4,5	INV. F25C1/142 F25D17/02
X	US 1 823 725 A (CARNEY SAMUEL C) 15 September 1931 (1931-09-15) * Figures 1-2; page 2, line 39 - page 3, line 32 and page 3, lines 95-121 *	1-3,6-11	
X	WO 94/16861 A1 (ICE BLAST INT LTD [BB]) 4 August 1994 (1994-08-04) * Abstract, figures 1, 4 and 5, page 9, line 18-31 and page 11, lines 29-29 *	1,2,12, 13	
Y A	US 3 906 577 A (BRUCHER PETER) 23 September 1975 (1975-09-23) * abstract; figures 1-2 * * column 2, line 56 - line 60 *	4,5 1	
X	DE 22 42 024 A1 (KRAUSS MAFFEI AG) 28 February 1974 (1974-02-28) * Figures 1-3 and pages 5, 7 and 9 *	1	TECHNICAL FIELDS SEARCHED (IPC) F25C F25D
X	DE 10 2005 039989 A1 (HIGEL HARTMUT [DE]) 2 March 2006 (2006-03-02) * the whole document *	1	
A	US 5 187 947 A (BREUNIG TIMOTHY A [US] ET AL) 23 February 1993 (1993-02-23) * Abstract, figures 1-7; column 6, lines 18 - 65 *	1-13	
A	JP H10 68564 A (KEIGEN BUSSAN KK) 10 March 1998 (1998-03-10) * the whole document *	1-13	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 March 2024	Bejaoui, Amin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 20 4102

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	KR 101 544 154 B1 (LSMSNOWISE CO LTD [KR]; LEE SEOK LIM [KR]) 12 August 2015 (2015-08-12) * the whole document *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 March 2024	Bejaoui, Amin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 4102

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-03-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102008029695 B3	18-06-2009	NONE	
US 1823725 A	15-09-1931	NONE	
WO 9416861 A1	04-08-1994	AU 5842494 A	15-08-1994
		CA 2113291 A1	27-07-1994
		WO 9416861 A1	04-08-1994
US 3906577 A	23-09-1975	AU 5878773 A	06-02-1975
		CA 994965 A	17-08-1976
		DE 2248964 A1	25-04-1974
		ES 416226 A1	01-02-1976
		FR 2201449 A1	26-04-1974
		GB 1387786 A	19-03-1975
		IT 992962 B	30-09-1975
		JP S4972760 A	13-07-1974
		JP S5215820 B2	04-05-1977
		NL 7308466 A	05-04-1974
		RO 86223 B	31-03-1985
		US 3906577 A	23-09-1975
DE 2242024 A1	28-02-1974	NONE	
DE 102005039989 A1	02-03-2006	NONE	
US 5187947 A	23-02-1993	CA 2080202 A1	17-04-1993
		US 5187947 A	23-02-1993
JP H1068564 A	10-03-1998	JP H1068564 A	10-03-1998
		TW 341645 B	01-10-1998
KR 101544154 B1	12-08-2015	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82