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(54) Method and device for producing snow

(57) Method and device for producing snow (4) which consists of forming ice (2) on a wall (9) provided with cooling means (10,11,12) and water supply means (13,14,15,16), removing this ice (2) by a scraper (17) and subsequently transforming this ice (2) into snow (4) by two mutually cooperating crushing and/or breaking rollers (27,28).

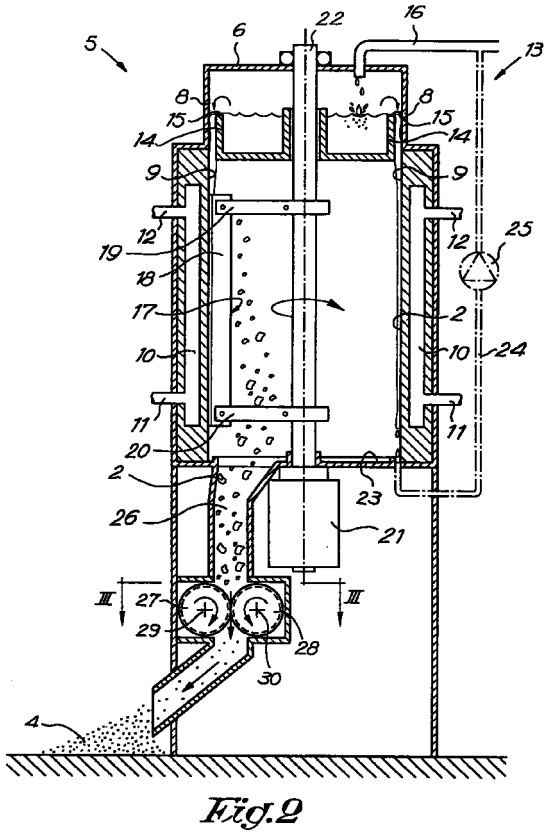

Fig.2

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Description

[0001] This invention relates to a method and device for producing snow.

[0002] More particularly, the invention aims at a method and device for artificially producing snow for covering snow pistes, ski courses and similar.

[0003] Thereby, under "snow" products have to be understood having the same structure as natural snow, as well as products which are comparable to natural snow and thus are suitable for application, as aforementioned, for covering snow pistes and similar.

[0004] Various techniques are already known for producing snow or products which, similar to snow, can be applied on ski courses and ski pistes.

[0005] According to a known technique, one starts with water or a kind of gel-like substance as a basic material, whereby these materials are processed in such a manner that finally one can speak of artificial snow.

[0006] According to another technique, use can be made of so-called snow cannons.

[0007] These techniques, however, require expensive and complicated devices which furthermore can only be applied in certain situations.

[0008] Thus, the present invention aims at a method for producing snow which is relatively simple and furthermore particularly suitable for producing a product comparable to snow which can be applied on ski courses, more particularly in-door ski courses.

[0009] To this aim, the invention aims at a method for producing snow, with as a characteristic that it consists of forming ice and subsequently transforming this ice into snow or similar. Due to the fact that one works in two stages, more particularly a stage in which ice is formed and a stage in which this ice is transformed into snow or a product comparable thereto, a relatively simple method is obtained.

[0010] In a preferred form of embodiment, the ice shall be formed by freezing water in a freezing device.

[0011] Preferably, this ice is formed in the shape of relatively thin pieces such as, for example, chips, with as an advantage that such pieces can broken up easily and can be transformed into snow or a product comparable thereto.

[0012] In a practical form of embodiment, to this aim water is directed over a wall cooled below the freezing point, in such a manner that a layer of ice is formed on this wall, whereafter this ice is removed regularly from this wall by means of milling or scraping. This technique has as an advantage that ice can be produced almost continuously.

[0013] Preferably, the ice is transformed into snow by crushing and/or grinding it.

[0014] Although, according to the invention, it is not excluded to perform the crushing and/or grinding by means of a device separated from the freezing device, preferably a crushing and/or grinding device shall be applied which is mounted together with the freezing device to a single unit.

[0015] In a particular form of embodiment, salt, preferably sodium chloride, is added to the water to be frozen. This has the advantage that the layer of ice which is formed on the aforementioned wall, is easier to remove, due to the less solid structure of the ice.

[0016] For the addition of sodium chloride to the water, use can be made of standard salt pastils which are put in a reservoir from which the water is brought onto the aforementioned wall.

[0017] Preferably, also at the location where the ice is transformed into snow, a stream of cold air shall be provided, for example, of approximately -5 degrees Celsius, in order to prevent the formation of water, on one hand, and/or the sticking together of the snow, on the other hand.

[0018] The invention also relates to a device which enables the production of snow according to the aforementioned method.

[0019] This device consists of a combination of a freezing device for forming ice out of water, and a device for transforming this ice into snow.

[0020] The freezing device preferably makes use of a wall cooled below the freezing point, of water supply means for bringing the water into contact with the aforementioned wall, and also of means for removing the ice formed at the wall from this wall.

[0021] The device for transforming the ice into snow, as already can be deduced from the method described heretofore, preferably consists of a grinding and/or crushing machine.

[0022] Both devices, namely, the freezing device and the device for transforming snow into ice, basically may be designed as separate units which either are installed at the same location or not, but preferably shall form one unit.

[0023] With the intention of better showing the characteristics of the invention, hereafter, as an example without any limitative character, several preferred forms of embodiment are described, with reference to the accompanying drawings, wherein:

figure 1 schematically shows the method according to the invention;
figure 2 represents a device according to the invention;
figure 3, on a larger scale, represents a schematized cross-section according to line III-III in figure 2.

[0024] As represented in figure 1, the method according to the invention substantially consists of two stages, whereby in a first stage 1, ice 2 is produced, whereafter in a second stage 3, this ice 2 is transformed into snow 4.

[0025] As represented in figure 2, to this aim a device 5 is applied which substantially consists in the combina-

tion of a freezing device 6 for forming the ice 2, and a device 7 for transforming the ice 2 into snow 4 or similar.

[0026] Although the freezing device 6 can be realized in various manners, preferably use shall be made of an embodiment as schematically represented in figure 2.

[0027] The freezing device 6 consists of a housing 8 in the shape of a vertical cylinder, provided with a wall 9 cooled below the freezing point. This wall 9 is provided with cooling means, such as a cooling circuit 10 with an inlet 11 and an outlet 12 for a cooling medium.

[0028] The freezing device 6 further is provided with water supply means 13 for bringing water into contact with the cooled wall 9. These water supply means 13 consist of an overflow reservoir 14, placed inside and in the upper part of the housing 8, with an overflow edge 15 which is situated at a small distance from the wall 9, as well as a supply conduit 16 for water.

[0029] Further, the freezing device 6 comprises means for removing the ice 2 formed at the wall 9 from this wall 9, which, in this case, consist of a scraper 17, formed of a scraping element 18 which, by means of two arms 19 and 20, is fixed at a rotating shaft 22 which extends through the housing 8 and is driven by means of a motor 21.

[0030] It is obvious that the means for removing the ice 2 formed at the wall 9, and more particularly the element moving along the wall 9, may also have another form and not necessarily have to consist of a straight scraping element 18. According to a not represented variant, the scraping element 18, for example, may be replaced by a milling cutter which then not only performs a rotation by means of the shaft 22, but, for example, also a rotation around its own axis.

[0031] Basically, it is also not excluded to let the housing 8 revolve, whereas the scraping element 18 is fixed, or, in the case of a milling cutter, to let this milling cutter revolve exclusively around its own axis.

[0032] At the bottom, a reservoir 23 for collecting surplus water may be provided. From this reservoir 23, a conduit 24, in which a pump 25 is provided, leads back to the supply conduit 16.

[0033] At the bottom of the housing 8, an outlet 26 is provided through which the scraped-off ice 2 leaves the freezing device 6.

[0034] The device 7 for transforming the ice 2 into snow 4 preferably consists of a grinding and/or crushing machine, whereby under a grinding and/or crushing machine any kind of device has to be understood in which the ice 2 is reduced in size.

[0035] In a practical form of embodiment, to this aim, as represented in figures 2 and 3, use can be made of two crushing and/or breaking rollers 27-28 which are placed horizontally next to each other and are rotatable in opposite directions around rotation axes 29 and 30 by means of a not represented motor.

[0036] Between the breaking rollers 27-28, preferably interspaces are present in such a manner that the ice 2 is not completely crushed and is transformed into water, but is broken up and crushed up to a form which is comparable to snow. As represented, these interspaces may be formed by grooves 31 and 32 which are provided in the respective surfaces of the rollers 27-28. It is, however, obvious that the interspaces concerned may also be created in another manner.

[0037] In order to counteract during grinding or crushing the formation of water and/or sticking together of the snow, preferably at the location of the rollers 27-28 a stream of cold air of -5 degrees Celsius shall be supplied.

[0038] The complete device 5 is carried by a stand 33.

[0039] The working of the device 5 is as follows.

[0040] Through the supply conduit 16, water is permanently supplied to the overflow reservoir 14, in such a manner that water permanently flows over the overflow edge 15 and runs down along the wall 9. Hereby, the supply conduit 16 can be fed in any manner, either by means of a connection to a conduit network, or from a storage tank.

[0041] As the wall 9 is cooled to below the freezing point by means of the aforementioned cooling means, the major part of this water will freeze and thus forms a thin layer of ice 2 at the interior side of the wall 9.

[0042] The surplus water which does not freeze is collected in the reservoir 23 and, by means of the pump 25, fed back to the supply conduit 16.

[0043] The scraping element 18 which performs a rotational movement by means of the shaft 22, driven by the motor 21, provides for that the thin layer of ice 2 is removed from the wall 9, as a result of which this ice 2 drops downward in chipped form and drops through the outlet 23 off the freezing device 6.

[0044] From the freezing device 6, the ice 2 automatically drops into the device 7.

[0045] By feeding this ice 2 subsequently through the device 7, it is reduced in size, and snow 4, or at least a product comparable thereto, is obtained. The size reduction is obtained as the ice chips are broken and ground between the rollers 27-28. As the rollers 27-28 are provided with interspaces, such as the grooves 31-32, it is obtained that the ice 2 is not completely crushed but that a structure is obtained which is comparable to that of snow.

[0046] The present invention is in no way limited to the form of embodiment described heretofore and represented in the figures, on the contrary may such method and device be realized in various variants without leaving the scope of the invention.

Claims

1. Method for producing snow (4), characterized in that it consists of forming ice (2) and subsequently transforming this ice (2) into snow (4) or similar.

2. Method according to claim 1, characterized in that the ice (2) is formed by freezing water in a freezing

device (6).

3. Method according to claim 1, characterized in that ice (2) is formed in the shape of relatively thin pieces, more particularly chips.

4. Method according to claim 3, characterized in that the thin pieces of ice (2) are formed by freezing water against a wall (9) and subsequently scraping or milling the ice (2) off this wall (9).

5. Method according to any of the preceding claims, characterized in that the ice (2) is transformed into snow (4) by crushing and/or grinding the ice (2).

6. Method according to any of the preceding claims, characterized in that salt is added to the water from which the ice (2) is formed.

7. Method according to any of the preceding claims, characterized in that, at the location of the crushing and/or grinding means, a stream of cold air of approximately -5 degrees Celsius is supplied.

8. Device for producing snow (4), more particularly according to the method of claim 1, characterized in that this device (5) consists in the combination of a freezing device (6) for forming ice (2) from water and a device (7) for transforming this ice (2) into snow (4) or a product comparable thereto.

9. Device according to claim 8, characterized in that the freezing device (6) at least consists of a wall (9) cooled down below the freezing point; water supply means (13) for bringing water into contact with the aforementioned wall (9); and means for removing the ice (2) formed at the wall from this wall (9).

10. Device according to claim 9, characterized in that the cooled wall (9) is designed in the shape of a vertical cylinder and that the means for removing the ice (2) formed at the wall consist of an element in the shape of a scraper (17) and/or milling cutter moving along the wall (9), to which aim the aforementioned cylinder and the aforementioned element perform a rotational movement in respect to each other.

11. Device according to any of the claims 9 or 10, characterized in that the water supply means (13) consist at least of an overflow reservoir (14) in which water is permanently supplied and which is provided in such a manner that the overflowing water runs downward along the aforementioned wall (9).

12. Device according to any of the claims 8 to 11, characterized in that the device (7) for transforming the ice (2) into snow (4) consists of a grinding and/or crushing machine.

13. Device according to claim 12, characterized in that the device (7) is provided with at least two mutually cooperating crushing and/or breaking rollers (27, 28) between which well-defined interspaces are left.

14. Device according to any of the claims 8 to 13, characterized in that the freezing device (6) and the device (7) for transforming the ice (2) into snow (4) consist of a single unit, whereby the ice (2) from the freezing device (6) is automatically transferred to the aforementioned device (7).

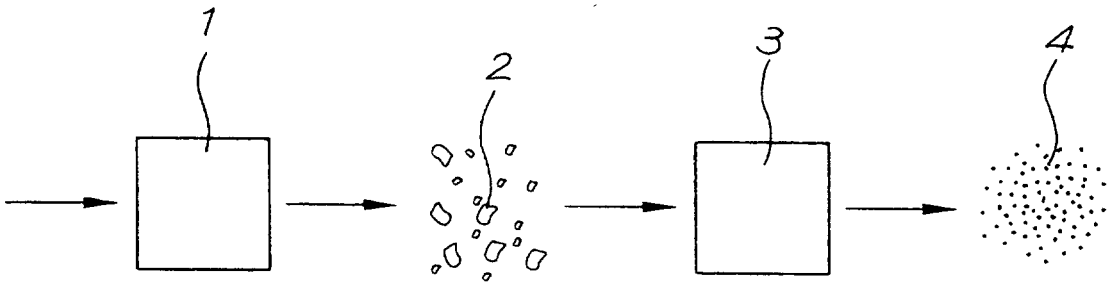

Fig. 1

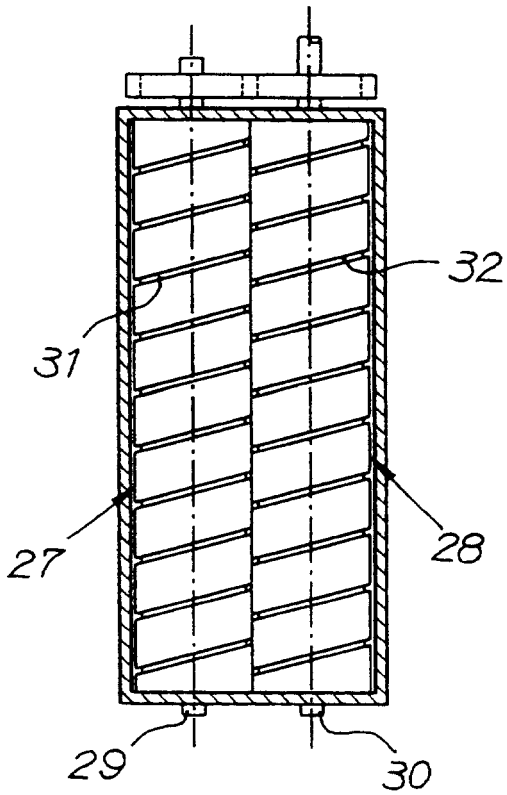

Fig. 3

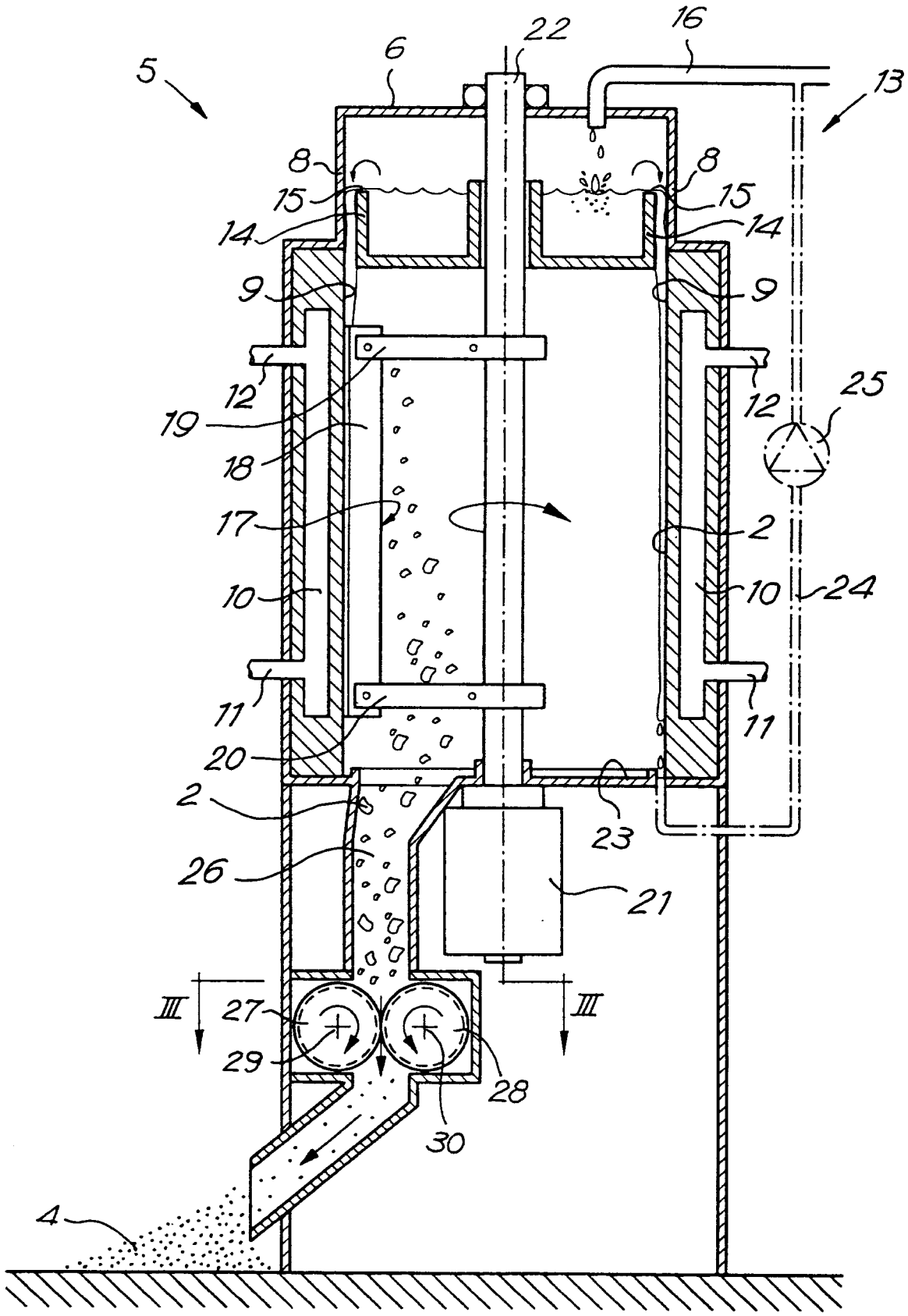
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Fig.2

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2598

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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	30 March 1999	Nuytens, S

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2598

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Place of search	Date of completion of the search	Examiner
THE HAGUE	30 March 1999	Nuytens, S

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