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(54) Benævnelse: **APPARAT OG FREMGANGSMÅDE TIL FREMSTILLING AF MINERALULD SAMT ET MINERALULDSPRODUKT**

(56) Fremdragne publikationer:
EP-A1- 1 086 054
US-A- 3 824 086
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DESCRIPTION

[0001] The present invention relates to an apparatus for manufacturing mineral wool according to the subject-matter of independent claim 1. The invention further relates to a method for manufacturing mineral wool according to the subject-matter of independent claim 10.

[0002] Such mineral wool manufacturing lines are implemented with various configurations. In order to manufacture mineral wool (rock wool and glass wool), the raw material is melted in a melting furnace and led into a fiberizing device, from which it is brought into the collecting apparatus. The manufacture of rock wool typically includes a collection chamber for the fibres formed, and means for collecting the fibres into a fibre mat or web. Such a fibre mat or web, which is often called a primary mat, is then brought into the pendulum apparatus, in which is formed a secondary mat of the desired thickness.

[0003] In the manufacture of glass wool, the fiberizing apparatus is typically a plate rotationally arranged around an axis, to the peripheral edge of which plate are arranged numerous small-diameter holes. The number of holes can be even tens of thousands and their diagonal can be, for example, in the range of 0.5 mm -1 mm. The molten material led onto the plate pushes through the holes under the influence of centrifugal force, forming fibres. Around the plate is led a blowing medium, oriented substantially parallel with the axis of rotation from above to below, which can be, for example, heated air. This blowing causes the fibres to orientate downwards and to stretch, thus thinning them. The fibres are led by the blowing medium to a transportation base passing the blowing medium through, onto which base the fibres are settled into a mat-like or a web-like product to be brought for further processing. Such a fiberizing plate is typically used in the manufacture of glass wool. Such a fiberizing plate is presented, for example, in US2991507.

[0004] In the manufacture of rock wool are typically used, arranged rotationally around a horizontal axis, a group of spinner discs (fiberization ring/spinner disc), in which material spins under the influence of centrifugal force and forms fibres. Around the spinner discs is led horizontally-oriented blowing medium to stretch and orient the fibres horizontally towards the collection chamber, into which are arranged collector elements to collect the fibres into a mat or web. Such an arrangement is known, for example, from WO87/06631.

[0005] A disadvantage, especially when using spinner discs, is a significantly great amount of non-fiberized material (shot), which can be as much as 40% by weight from the weight of the source material. There are various solutions for separating the shot from the fibres, but nonetheless a significant amount of them ends up in the final product, weakening its quality and increasing its weight.

[0006] The object of the present invention is to provide a solution, with which the creation of this shot can be effectively prevented and, at the same time, to provide an adequately high production output as well as high-grade and homogenous product quality.

[0007] In order to achieve this object, the apparatus according to the invention is characterized by the features presented in the characterizing part of independent claim 1. The method according to the invention is, in turn, characterized by the features presented in the characterizing part of independent claim 10.

[0008] In the following, the invention is described in more detail with reference to the accompanying figures, in which:

Fig. 1 shows a schematic principle illustration of an apparatus according to the invention,

Fig. 2 shows a schematic principle illustration viewed from above of one possible placement of fiberizing devices with their channels, and

Fig. 3 shows a schematic principle illustration of one placement of the channels in the mouth of the collection device, the channels being connected to the fiberizing devices.

[0009] Reference numeral 1 in Fig. 1 denotes a melting furnace, from which the molten material is led along a trough 2 into a fiberizing device 3. The fiberizing device 3 is equipped with a blower 4, which produces a flow 17 of blowing air, which transports the fibres 12 formed by the fiberizing device into the channel 5 and further into the collection device 6. The collection device 6 has a collection chamber 7 and collector elements 8, which, in this embodiment, comprise a collection drum 9 equipped with a perforated peripheral surface, inside which is a suction box 10. The blowing air moves through the holes of the drum 9 into the suction box and further away from the collection apparatus. This contributes to the collecting of the fibres 12 onto the surface of the drum 9 to form a primary fibre mat or web, which is then transported, for example, by a conveyor 11, to the pendulum device (not shown), in which it is formed into a secondary mat, which is then brought for further processing, for example, hardening. The collection chamber can as such be according to known art, or it can differ from known art. The feeding of binder is not shown in the figure. For example, the collection device can be a foraminous or perforated belt conveyor having suction boxes inside the belt loop.

[0010] The fiberizing device 3 comprises, rotating around a vertical axis 15, a cup-like plate 13, on the periphery of which are numerous small holes 14, through which the molten mass moves under the influence of centrifugal force forming fibres 12, which are stretched around the plate by vertically led blowing air 16, annularly surrounding the plate. In connection with the feeding of blowing air and the stretching of the fibres, binder and other necessary chemicals can be fed. Such a fiberizing plate and the production of blowing air, surrounding it annularly, in the manufacture of glass wool is prior known to the skilled person in the art, for example, from US4759974. The advantage in using such a fiberizing plate is that the majority of the mass can be fiberized. The disadvantage is that through one fiberizing device can be fed only approx. 400-500 kg molten mass per hour, which is significantly less than in solutions implemented with spinner discs, in which the fed amount of molten mass can be, for example, 5000-7000 kg per

hour. In the solution according to the invention, in connection with the fiberizing device 3, preferably below it, is arranged a relatively small-diameter, horizontal channel 5 leading to the collection device, the length of which channel can be several metres, for example, in the range of approx. 1 m - approx. 10 m. In connection with the channel 5 is arranged a blower 4, which creates a horizontal air flow in the channel 5 directing the fibres 12, oriented downwards by the vertical blowing air 16 in the fiberizing device, horizontally along the channel 5 towards the collection device 6. By means of this channel solution, it is possible to place several fiberizing devices 3 to feed one collection device 6, wherein the production output can be increased to a desired level. The fiberizing devices are placed at different height levels with each other and at different horizontal distance from the collection device 6, wherein only the channels 5 need to be adapted to the inlet port of the collection device. The channels 5 do not need to all be the same shape or size, and their location in relation to the collection apparatus can also be modified.

[0011] Fig. 2 shows as a schematic illustration viewed from above of one placement of the fiberizing devices 3 in relation to each other, as well as in relation to the collection chamber 7 and the collector elements 8. Fig. 3 shows schematically an example of one manner of placing the channels 5 in the mouth of the collection device 6 as viewed from the direction of the collection drum 9.

[0012] Fig. 4, which is not part of the invention, shows a schematic illustration of an apparatus wherein the conveying device comprises a belt 20 on which the fibres are deposited. The belt can be provided with suction boxes inside the belt loop to assist depositing of the fibres on the certain portion of upper run of the belt. For releasing the fibres into a collection device the belt is preferably without any suction means in the discharging area of the belt loop or there can be blower means for directing an air flow from inside the belt loop through the belt in the discharging area of the belt 20 to assist releasing of the fibres.

[0013] Fig. 5, which is not part of the invention, shows a schematic illustration of an apparatus wherein the conveying device 5 comprises a curved channel 5 through which the fibres are transported from a fiberizing device 3 to a collection device 6 by means of the blowing air directed vertically downwards around the fiberizing plate and/or by means of suction means arranged in the channel in the vicinity of the collection device.

[0014] Fig. 6, which is not part of the invention, shows a schematic illustration of an apparatus wherein the conveying device 5 comprises an inclined channel 5 through which the fibres are transported from a fiberizing device 3 to a collection device by means of the blowing air directed vertically downwards around the fiberizing plate and/or by means of suction means arranged in the channel in the vicinity of the collection device.

[0015] One or more fiberizing plates can be equipped with perforations of different size in relation to the other fiberizing plates, wherein different fiberizing plates can be used to produce fibres of different size. Furthermore, different fiberizing plates can be used to produce different fiberizing parameters, such as, for example, the rotation speed of the plate, the feeding rate of

the molten material and/or the flow rate of the vertical blowing air, to vary in a desired manner the characteristics of the intermediate product and/or final product to be manufactured by the apparatus.

[0016] In the solution according to the invention, the fiberizing plates can be similar to or different from each other, i.e. their dimensions, such as, for example, the diameters of the fiberizing plates may differ from each other, and the fiberizing plates may also differ in their design (for example, the height and shape of the edges of the fiberizing plate).

[0017] By using the method according to the invention, it is possible to create a mineral wool product having a fibre content in excess of 90%, preferably in excess of 95%, based on the following standards or specifications:

1. 1) Eurima 5 (10.5.1967), Determination of the content of non-fibrous material in mineral wool
2. 2) BS 2972:1975, Method of test for inorganic thermal insulating material, Section 14
3. 3) ASTM C 612-83, Annex, Shot content of unorganic fibrous thermal insulation
4. 4) JIS A 9504-1984, Heat insulation made of Rockwool.

[0018] The method according to the invention enables the manufacture of a mineral wool product having the desired tensile strength characteristics, i.e. the transverse tensile strength of which is greater than the linear tensile strength.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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Patent documents cited in the description

- US2991507A **[0003]**
- WO8706631A **[0004]**
- US4759974A **[0010]**

Patentkrav

1. Apparat til fremstilling af mineraluld, hvor apparatet inkluderer organ (1) til fremstilling af smeltet mineralmateriale, mindst en fiberdannelsesindretning (3) til dannelse af fibre, til hvilken fiberdannelsesindretning det smeltede mineralmateriale tilføres (2), og med hvilken fibre (12) dannes, idet fiberdannelsesindretningen (3) omfatter, rotationsmæssigt anbragt omkring en vertikal akse (15), mindst en fiberdannelsesplade (13) med en vertikal perifer kant, i hvilken der er dannet adskillige små huller (14), gennem hvilke det smeltede materiale ledes ved hjælp af centrifugalkraft til dannelse af fibre (12), hvor der til fiberdannelsesindretningen (3) er anbragt elementer til at frembringe et vertikalt flow af blæsemedium (16), der skal ledes rundt om fiberdannelsespladen (13), idet flowet får fibrene (12) til at dreje nedad og samtidig gør fibrene tyndere, samt en opsamlingsindretning (6) anbragt nedstrøms for fiberdannelsesindretningen (3), til hvilken de dannede fibre (12) føres og samles til et måttelignende materiale, **kendetegnet ved, at** apparatet inkluderer mindst to fiberdannelsesindretninger (3), som er placeret i forskellige højdeniveauer i forhold til hinanden og i forskellige horisontale afstande fra opsamlingsindretningen (6), og at i forbindelse med nævnte mindst ene fiberdannelsesplade (13) af hver fiberdannelsesindretning (3) er der indrettet en transportindretning (5), hvor fibrene (12) bringes til, før de når opsamlingsindretningen (6), og hvor transportindretningen (5) omfatter:

en horisontal kanal (5) placeret mellem fiberdannelsespladen (13) og opsamlingsindretningen (6), og

luftfrembringelsesorgan til at transportere fibre til opsamlingsindretningen (6).

2. Apparat ifølge krav 1, **kendetegnet ved, at** kanalen (5) er lige eller buet.

3. Apparat ifølge krav 1, **kendetegnet ved, at** transportindretningen omfatter et bånd.

4. Apparat ifølge et hvilket som helst af kravene 1 til 3, **kendetegnet ved, at** opsamlingsindretningen (6) har et opsamlingskammer (7) og opsamlingselementer (8), som omfatter en opsamlingstromle (9) udstyret med en perforeret

perifer overflade, indeni hvilken er en sugeboks (10), på hvilken tromle fibrene samles i en primær måtte eller bane.

5. Apparat ifølge krav 1 eller 2, **kendetegnet ved, at** længden af kanalen (5) er i området 1-10 m.

6. Apparat ifølge et hvilket som helst af kravene 1 til 5, **kendetegnet ved, at** diameteren af hullerne (14) på omkredsen af fiberdannelsespladen (13) er i området ca. 0,3 mm - ca. 2 mm, fortrinsvis ca. 0,5 mm - ca. 1 mm.

7. Apparat ifølge et hvilket som helst af kravene 1 til 6, **kendetegnet ved, at** mindst en fiberdannelsesplade (13) har huller (14) med forskellig størrelse i forhold til hullerne i mindst en anden fiberdannelsesplade til dannelse af fibre med forskellige tykkelser ved hjælp af forskellige fiberdannelsesplader.

8. Apparat ifølge et hvilket som helst af kravene 1 til 7, **kendetegnet ved, at** fiberdannelsespladerne ligner hinanden.

9. Apparat ifølge et hvilket som helst af kravene 1 til 7, **kendetegnet ved, at** fiberdannelsespladerne er forskellige fra hinanden.

10. Fremgangsmåde til fremstilling af mineraluld, hvor fremgangsmåden anvender et apparat, som inkluderer organ (1) til fremstilling af smeltet mineralmateriale, mindst en fiberdannelsesindretning (3) til dannelse af fibre, til hvilken fiberdannelsesindretning det smeltede mineralmateriale tilføres, og med hvilken fibre (12) dannes, idet fiberdannelsesindretningen (3) omfatter, rotationsmæssigt anbragt omkring en vertikal akse (15), mindst en fiberdannelsesplade (13) med en vertikal perifer kant, i hvilken der er dannet adskillige små huller (14), gennem hvilke det smeltede materiale ledes ved hjælp af centrifugalkraft til dannelse af fibre (12), hvor der i fiberdannelsesindretningen (3) er anbragt elementer til at frembringe et ringformet flow af blæsemedium (16) rettet vertikalt nedad omkring fiberdannelsespladen (13), idet flowet får fibrene (12) til at dreje nedad og gør fibrene tyndere, samt en opsamlingsindretning (6) anbragt nedstrøms for fiberdannelsesindretningen (3), til hvilken de dannede fibre (12) føres og samles til et måttelignende materiale, **kendetegnet ved, at** i fremgangsmåden er

mindst to fiberdannelsesindretninger (3) indrettet til at tilføre fibre til en fælles opsamlingsindretning (6), idet fiberdannelsesindretningerne (3) er placeret i forskellige højdeniveauer i forhold til hinanden og i forskellige horisontale afstande fra opsamlingsindretningen (6), og at der i forbindelse med fiberdannelsespladen (13) på hver fiberdannelsesindretning (3) er anbragt en transportindretning (5), hvor fibrene (12) bringes til, og ved hjælp af hvilken fibrene føres ind i opsamlingsindretningen (6) for at danne en primær fibermåtte eller bane, og hvor transportindretningen (5) omfatter:

en horisontal kanal (5) placeret mellem fiberdannelsespladen (13) og opsamlingsindretningen (6), og

luftfrembringelsesorgan til at transportere fibre til opsamlingsindretningen (6).

11. Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** med forskellige fiberdannelsesplader (13) anvendes forskellige fiberdannelsesparametre og/eller huller med forskellig størrelse (14) for på en ønsket måde at variere egenskaberne af mellemproduktet og/eller slutproduktet, der skal fremstilles af apparatet.

12. Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** blæsemedium anvendes til at transportere fibrene med transportorganet ind i opsamlingsindretningen (6).

13. Fremgangsmåde ifølge krav 10, **kendetegnet ved, at** fiberdannelses-indretningerne (3) installeres i stedet for et eksisterende fiberdannelsesapparat i en eksisterende produktionslinje.

DRAWINGS

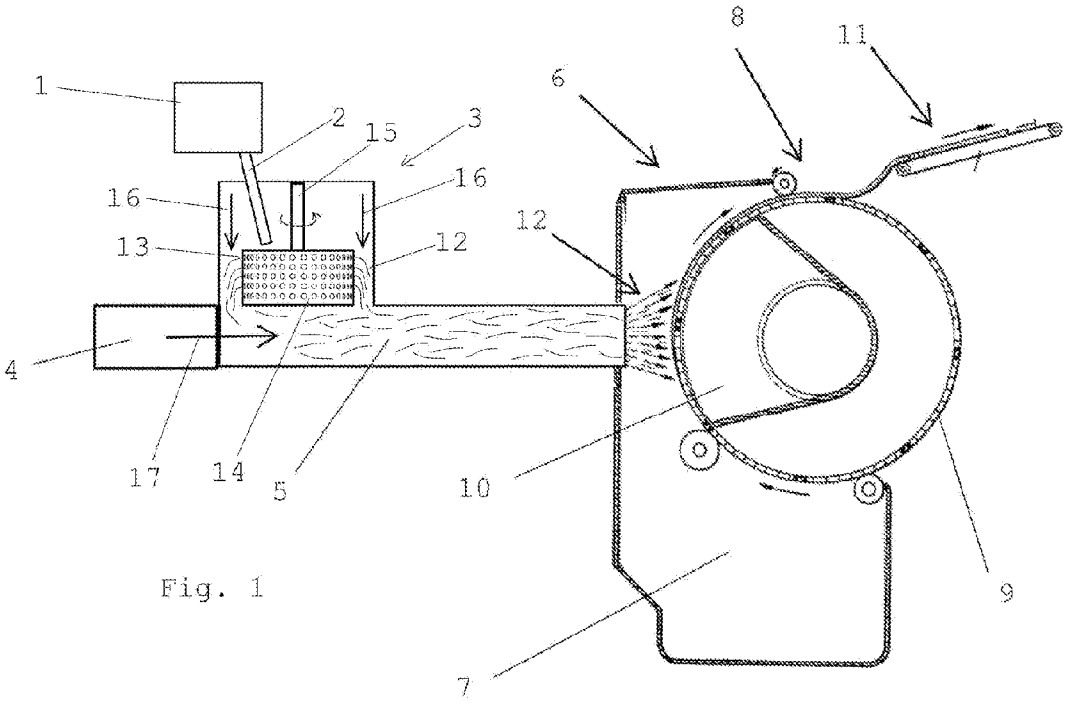

Fig. 1

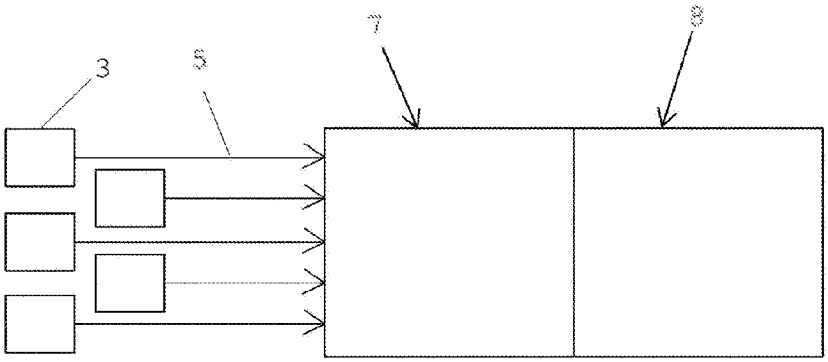

Fig. 2

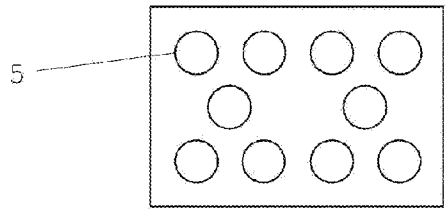

Fig. 3

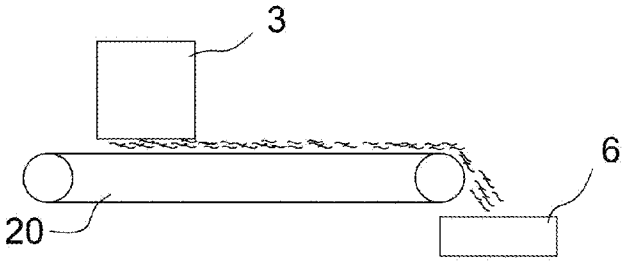

Fig. 4

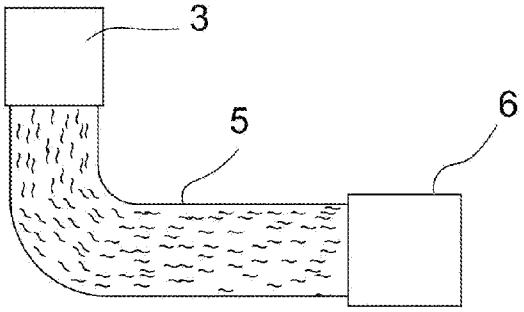

Fig. 5

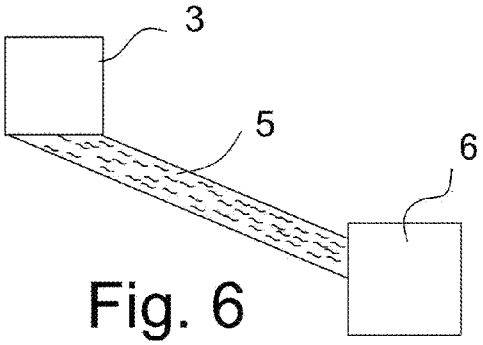

Fig. 6