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**(54) Title:** SOUND-ABSORBING GYPSUM FIBRE BOARD AND METHOD FOR MANUFACTURING SUCH A GYPSUM FIBRE BOARD

**(57) Abstract:** The invention relates to a sound-absorbing gypsum fibre board as well as to a method for manufacturing such a gypsum fibre board. Various measures are proposed, which permit the manufacture of gypsum fibre boards with good processability and which, at the same time, comprise a high density.

# Sound-absorbing gypsum fibre board and method for manufacturing such a gypsum fibre board

The invention relates to a gypsum fibre board with good sound-absorbing properties as well as a method for manufacturing such a gypsum fibre board.

There are various methods for manufacturing gypsum fibre boards. A known method is the so-called Siempelkamp method, also called a dry method. A dry mixture of fibrous stucco gypsum (β-:semi-hydrate) is evenly applied to a continuous filter belt and wetted with surplus water, i.e. with a larger amount of water than is needed for setting the gypsum. The surplus water is sucked into the fibrous stucco gypsum mixture by way of applying a vacuum. For manufacturing reasons the wetting process must be completed within a minimum of time.

The wetted fibre mixture is then pressed in a continuous press to form a continuous strip of boards and subsequently separated into appropriately sized panels. A large proportion of the water remaining in the string of boards reacts with the stucco gypsum thereby setting to form plaster. After setting the boards are dried and passed onto the finishing process (grinding, further separation, stacking etc.).

The board raw density is dependent on the mass/dumping height of the fibrous stucco mixture placed on the filter belt, and on the height of the pressing force applied. Furthermore the board raw density can be increased by using a lesser proportion of fibres. In this way the board raw density can be adjusted as required to values of approx. 1000 kg/m$^3$ to 1550 kg/m$^3$.

For an increase in the raw density of the boards the sound-absorbing properties, as a rule, also increase. But as the raw density increases, so does the hardness and brittleness of the boards, whilst its flexibility decreases.

Gypsum fibre boards with good sound-insulation properties are therefore difficult to process, due to their high degree of hardness and brittleness. They easily break, and the edges and corners tear when being fastened by screwing and the screw holes break out.

It is therefore the requirement of the invention to propose a gypsum fibre board of the kind mentioned, which comprises good sound-insulation properties, but nevertheless does not cause any problems during processing. In addition a method, in particular a dry method for manufacturing such boards is to be proposed.

This requirement is met by a gypsum fibre board with the characteristics according to claim 1 and a method for manufacturing a gypsum fibre board according to claim 10.

Accordingly a sound-absorbing gypsum fibre board comprises between 45 and 85 %-by-weight calcium sulphate dihydrate, between 5 and 15 %-by-weight fibres and between 10 and 40 %-by-weight of an inert material with an average grain size (d50) smaller than 1 mm. Preferably the average grain size is between 10 µm and 1 mm. The grain size of the inert material is determined by means of the linear intercept method.

A sound-absorbing gypsum fibre board in terms of this invention is understood to be a gypsum fibre board, which for a thickness of 12.5 mm comprises a weighted sound reduction index $R_w$ of at least 30 dB, preferably of at least 32 dB. An inert material is a material which during the manufacturing process when setting the gypsum, is essentially not integrated into the gypsum matrix or integrated reactively to a maximum of 50%, preferably max. 30% or especially preferably max. 10%. This results in a structure, which is less solidly interlocked and bonded, and therefore retains more flexibility in bending, but without the board losing in mass and thus losing any of its sound-absorbing properties.

By using an inert material, which comprises an average grain size of less than 1 mm, it is ensured that dehydration of the gypsum fibre „carpet" by means of vacuum

suction is not disturbed and that the settable material in the carpet is evenly wetted. Since the overall amount of settable material is reduced, it is critical for the mechanical properties of the board that all of the settable material present does indeed set. Therefore the small grain size of the inert material is an important criterion of the invention.

The inert material may, for example, be a calcium sulphate, which sets very slowly or not at all. Suitable materials are, for example, anhydrite, a-calcium sulphate semi-hydrate, dried REA-gypsum (calcium sulphate dihydrate, which is produced during desulphurisation of flue gases), another dihydrate (natural gypsum) or mixtures therefrom. Especially preferred is the use of a-calcium sulphate semi-hydrate. The inert material, in particular α-calcium sulphate semi-hydrate, replaces parts of the dihydrate, which is created from β-semi-hydrate by setting. a-semi-hydrate rehydrates comparatively slowly, so that during manufacture of the gypsum fibre board a maximum of 80 %-by weight, preferably max. 50 % of the a-semi-hydrate change to become dihydrate. As a result, the final strength of the gypsum fibre boards is reduced and processability is improved.

According to a further embodiment of the invention the inert material may be a rock flour. The rock flour may, for example, be a carbonate, in particular calcium carbonate or calcium magnesium carbonate. In principle, rock flours of any kind may be used. Preferably, however, they should have a relatively high density, in order to support the sound-absorbing properties of the gypsum fibre board. In particular the inert material should have a raw density which corresponds to at least 80% of the raw density of the gypsum matrix into which it is embedded. Particularly preferably the raw density of the inert material should be equal to or higher than the raw density of the gypsum matrix into which it is embedded.

According to a further embodiment of the invention a part of the fibres, mostly waste paper fibres, could be replaced by fibres from strong tissue paper (Kraft paper), a sturdy paper with high tensile strength. The higher strength of these fibres improves processability of the board material and in particular prevents the screw holes from

breaking out the edges. The proportion of strong tissue paper fibres may be up to 40 %-by-weight of the total amount of fibres.

For the same reason it is possible to replace a part of the fibres by cut glass fibres. Preferably up to 4 % by weight, particularly preferably up of 1.5 %-by-weight of the total amount of fibres consist of cut glass fibres.

All above-described embodiments can be combined with each other at random.

A method according to the invention for the manufacture of a gypsum fibre board is preferably a dry method. If a dry method is used, a dry mixture of β-semi-hydrate, fibres and an inert material is initially produced and applied as a dry carpet onto a conveyor system. The dry carpet wetted with water and optionally an additive, is pressed to form a continuous strip. Thereafter this continuous strip is separated into boards and the boards are dried. The inert material used comprises an average grain size of less than 1 mm, determined according to a linear intercept method.

All other features corresponding to the above-described measures refer to the components of the dry carpet. Reference should be made to what is described above.

## Patent Claims

1. A sound-absorbing gypsum fibre board comprising between 45 and 85 %-by-weight calcium sulphate dihydrate, between 5 and 15 %-by-weight fibres and between 10 and 40 %-by-weight of an inert material with an average grain size of less 1 mm, determined according to the linear intercept method.

2. The gypsum fibre board according to claim 1, characterised in that it comprises a weighted sound reduction index $R_w$ of at least 30 dB for a board thickness of 12.5 mm.

3. The gypsum fibre board according to one of the preceding claims, characterised in that the inert material is a calcium sulphate setting very slowly or not at all.

4. The gypsum fibre board according to claim 3, characterised in that the calcium sulphate, which is setting slowly or not at all, is an anhydrite, an a-calcium sulphate semi-hydrate, a REA gypsum, another dihydrate or mixtures therefrom.

5. The gypsum fibre board according to one of the preceding claims, characterised in that the inert material is a rock flour.

6. The gypsum fibre board according to claim 5, characterised in that the rock flour comprises calcium carbonate or a calcium magnesium carbonate.

7. The gypsum fibre board according to one of the preceding claims, characterised in that the fibres comprise waste paper fibres.

8. The gypsum fibre board according to one of the preceding claims, characterised in that up to 40 %-by-weight of the fibre quantity consist of strong tissue paper fibres.

9. The gypsum fibre board according to one of the preceding claims, characterised in that up to 4 %-by-weight, preferably up to 5 %-by-weight of the fibre quantity consists of cut glass fibres.

10. A method for manufacturing a gypsum fibre board, comprising a dry process, wherein a dry mixture is manufactured from β-semi-hydrate, fibres and an inert material and applied as a dry carpet onto a conveyor system, the dry carpet is wetted with water, pressed to form a continuous strip, separated into individual boards and the boards are then dried, wherein the inert material comprises an average grain size of less than 1 mm, determined according to a linear intercept method.

11. The method according to claim 10, characterised in that the inert material is a calcium sulphate, which sets very slowly or not at all.

12. The method according to claim 10, characterised in that the inert material is a rock flour.

13. The method according to one of claims 10 to 12, characterised in that the fibres are waste paper fibres.

14. The method according to one of claims 10 to 13, characterised in that up to 40 %-by-weight of the fibre quantity consist of strong tissue paper fibres.

15. The method according to one of claims 10 to 14, characterised in that up to 4 %-by-weight, preferably up to 1.5 %-by-weight of the fibre quantity consist of cut glass fibres.

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International application No
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B28B C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

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| Y | page 2, lines 52-55 ;60-62<br>page 6, lines 32-42 | 10, 11,<br>13-15 |
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| Y | W0 2014/207098 Al (KNAUF GI PS KG [DE] ) 31 December 2014 (2014-12-31)<br>claims | 10-15 |

-/- .

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

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