



- (51) International Patent Classification:
E04D 12/00 (2006.01)
- (21) International Application Number:
PCT/EP2017/051422
- (22) International Filing Date:
24 January 2017 (24.01.2017)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
10 2016 101 669.1
29 January 2016 (29.01.2016) DE
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- (81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN,
KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,
MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG,
NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS,
RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY,
TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN,
ZA, ZM, ZW.

- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SOFT WOOD FIBER INSULATION PLATE FOR THERMAL AND SOUND INSULATION

(57) Abstract: On a soft wood fiber plate for building insulation one of two main surfaces is provided with a coating which increases a friction value of the coated surface (2) by at least 10%.

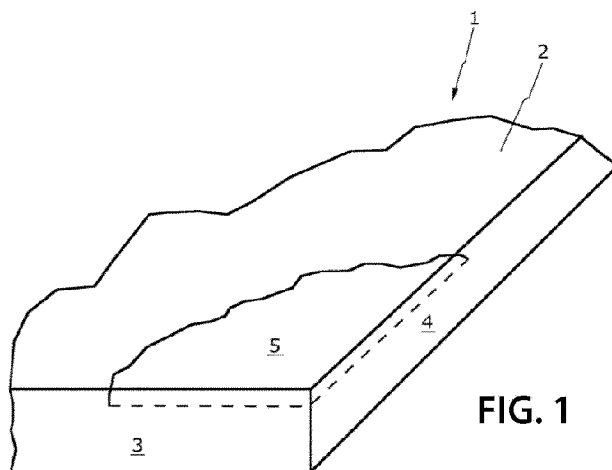


FIG. 1

SOFT WOOD FIBER INSULATION PLATE FOR THERMAL AND SOUND INSULATION

The invention relates to a soft wood fiber insulation plate for thermal and/or sound insulation of buildings, in particular roofs and outer walls according to the preamble of patent claim 1.

Wood fiber plates as they are typically used for thermal insulation of buildings typically have a raw density in a range of 30 – 250 kg/m³ and are designated as soft wood fiber plates. In addition to that there are medium hardness wood fiber plates typically in a raw density range of 350 – 800 kg/m³ and so called strong hard wood fiber plates with raw density values of 800 kg/m³.

Soft wood fiber insulation plates have been used for many years for thermal and sound insulation in the construction field but they have a small market share compared to mineral wood insulation elements and insulation elements from hard foam materials like e.g. polystyrol. Within the market segment of insulation materials made from renewable raw materials soft wood fiber insulation plates however have a market share of approximately 30%. The market share of soft wood fiber insulation plates is expected to increase in the next couple of years due to environmental considerations.

Soft wood fiber insulation plates are plate insulation materials made from wood fibers which are typically made from wood fibers by over 90% which are produced by wet or dry methods. Thus typically pine woods are preferred as a base material due to their superior fiber quality.

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According to the wet method the raw materials are ground up and subsequently stirred into an emulsion with up to 98% water and formed into a fiber cake on special forming machines. After a pressing and drying process at temperatures between 160° C and 220° C the wood fiber insulation plate is created. According to this wet method adding binder material is typically not necessary since a lignin portion of the wood is liquefied during the drying process due to the comparatively high temperatures so that the particles are bonded during cooling. In order to obtain higher strength or good hydrophobic properties materials including resin or bitumen can be added during the production process.

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According to the dry method the split up fibers are dried directly and are then mixed with added binder material using natural or synthetic binders, in particular synthetic resin glues. Typically polyurethane resin is added as a glue. Subsequently the fibers are sprinkled onto an endless band, compressed and subsequently cured by a mix of vapor and air so that the wood fiber insulation plate is formed thereafter.

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The wood fiber insulation plates that are typically used for thermal insulation in the construction field are being offered in different sizes. Thicknesses of wood fiber insulation plates of this type are typically in a range of 20 mm – 200 mm, wherein the raw density range, the plate size and its thickness are typically configured so that the plates do not exceed a certain size at the construction site so that they are still easy to handle.

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Furthermore the soft wood fiber insulation plates are typically open for diffusion so that they are suitable as thermal insulation plates. Soft wood fiber insulation plates are characterized in particular by a high heat capacity and provide in particular a high level of thermal protection during summer. Depending on the application and

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the use the soft wood fiber insulation plates are also surface coated, for example by synthetic resin coating and similar. For the application as an external insulation the soft wood fiber insulation plates are typically provided with a base coating so that stucco optionally with an intermediary stucco grid can be applied easily.

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Soft wood fiber insulation plates, thus also configured as soft wood fiber plates with one side coating and two sided coating are also being offered, thus with a humidity regulated coating using an adhesion agent, in particular for insulation measures in an inner portion of buildings. Coatings are also known with vapor blocking or vapor
10 retarding properties, wherein also an infusion is provided or a combination with bonded foils is proposed. In addition to decorative coatings there are also coatings for a use of the wood fiber insulation plates in an outer portion of buildings which improve an affinity to the stucco layer to be applied.

15 Furthermore it is known for example for improving a surface protection of soft wood fiber insulation plates (DE 20 2015 000 403 U1) which are provided with a coating made from a three component material namely two hardener components to obtain a wind suction resistant coating when using soft wood fiber insulation plates of this type in the construction field. Since this coating is configured so that it penetrates
20 sufficiently deep into the soft wood fiber structure an advantage of a firm connection is provided compared to subsequently applied commercially available flat roof sealing webs, in particular bitumen seals which also hold up against strong wind suction forces.

25 Soft wood fiber insulation plates are in particular used more and more for environmental reasons in the construction field thus also for roofs, in particular slanted roofs. However deploying and handling of these large size soft wood fiber insulation plates is more difficult due to the weight of the plates, than for other insulation plates made from hard foam or mineral wool so that particular care has to be taken
30 when deploying such plates in roofing applications. Typically deployment is more difficult in construction applications under wet conditions, thus when there is rain

and snow, which however can make deployment problematic also in observance of additional safety precautions.

Thus, it is an object of the invention to provide a soft wood fiber insulation plate for thermal insulation and/or sound insulation in particular in the construction field which is safety optimized so that a safe and correct deployment is also possible under adverse weather conditions.

Thus, it is another object of the invention that the safety measures shall not impair the properties of the soft wood fiber insulation plate that determine thermal insulation and/or sound insulation.

This object is achieved according to the invention by the measures according to patent claim 1. Advantageous embodiments can be derived from the measures of the dependent claims.

According to the invention the soft wood fiber insulation plates are configured by a coating so that they have a much higher slip resistance value compared to an uncoated soft wood fiber insulation plate so that the slip resistance is increased by at least 10%, advantageously at least 15%, particularly advantageously by 30% over a reference plate, thus experiments have shown that mostly two features are relevant for the safety aspect and are interrelated, this is namely on the one hand side friction as such based on technical- physical measures in that friction resistance is increased by coating the plates. However the experiments have also shown a surprising and amazing aspect, namely a subjective feeling of stand safety which is established completely unconsciously and automatically when the friction is increased, wherein this safety feeling as evident from walking experiments on roofs with an angle of 35° is achieved starting with a value that is increased by 10% for accordingly coated soft wood fiber insulation plates compared to uncoated surfaces of these plates. This subjective feeling that is developed in people's minds automatically in such situations then certainly also increases safety since a feeling of safety when walking on these surfaces typically creates a safer work environment than

compared to a timid condition. The tests and walking experiments performed in conjunction with this development show a surprising correlation between the values for subjectively perceived stand safety and the values determined by the testing methods.

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When determining the measures according to the invention the inventors have found that a slipping risk of soft wood fiber insulation plates, in particular soft wood fiber plates is caused by comparatively large friction at a surface of the plates which can lead to a very slippery surface in particular in humid weather conditions so that an anti-slip configuration of soft wood fiber insulation plates of this type is useful which is achieved in that a coating is applied to at least one of the main surfaces of the plate wherein the coating increases friction of the coated plate surface by at least 10%, advantageously by at least 15%, particularly at least advantageously by at least 30% over the same but uncoated soft wood fiber insulation plate.

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Thus, it is advantageous that the coating is configured so that a network structure is generated on the surface of the soft wood fiber insulation plate wherein the network structure on the one hand side contributes to a stabilization of the soft wood fiber insulation plate, develops a corresponding slip safety effect since the coating is attached to the a surface of the soft wood fiber insulation plate and furthermore forms a diffusion opening layer in an advantageous manner so that properties that determine thermal insulation properties of the soft wood fiber insulation plate are not impaired by the coating. Thus a stability increase is achieved in addition to the slip safety and the diffusion open character of the soft wood fiber insulation plate itself is maintained. Through these measures the advantageous properties of the soft wood fiber insulation plate which renders is suitable for thermal insulation in the first place are not impaired but rather maintained. These properties are the essentially porous and thus diffusion open structure of the soft wood fiber plates in a portion of the plate surface.

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In order to measure friction the accepted measuring method according to TAPPI T 549 is recommended which is an internationally accepted standard and which fur-

thermore yields measuring results that are comparable to the ISO method, however this measuring method is much less complex. The standard TAPPI T 549 is used in particular for determining friction coefficients for packaging materials in general.

- 5 The measurement of the friction value or the friction resistance is performed with a friction tester by the Zwick Company which is suitable for tests according to TAPPI T 549, ASTM D 1894 and 2534, ISO 8295 and DIN 53375. The measurement is thus performed according to the so called horizontal plane method wherein the static friction and dynamic friction are determined by a sled.

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With respect to friction a differentiation is made between dynamic friction and static friction wherein the friction surfaces move relative to each other when dynamic friction is measured which is not the case for static friction. Therefore according to the invention the surface is configured by the coating so that the dynamic friction is large, this means maximized so that the friction coefficient or the friction number is very high. Only when the static friction force is overcome there is a sliding movement, thus slippage, wherein the dynamic friction force is smaller than the static friction force for the slipping object.

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- 20 When measuring the friction forces care has to be taken that the reference fiber plates are identical or comparable besides the coating, in particular the surface structure and that conditions of the objects to be examined are identical, thus either dry or humid or wet surfaces, wherein a friction coefficient of the coated soft wood fiber plates compared to the uncoated soft wood fiber plates has to be high enough so that a slippage can be prevented also under adverse weather conditions thus for a humid or wet surface. Experiments have shown that this can be achieved reliably in that the slip resistance and thus the static friction coefficient is adjusted due to the coating to a value greater > 10%, in particular > 15%, advantageously > 30% compared to the reference plate with identical configuration but without the respective coating. Alternatively the coated surface can be compared with the uncoated surface in case of a soft wood fiber plate coated on one side. The term "identical"
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insulation plate relates to a plate with an identical type or a plate which is comparable structurally, namely in the surface structure.

Advantageously the coating is applied so that it substantially adheres to the wood fibers so that it is open for diffusion. This helps to achieve an open network structure in a simple manner which is useful for maintaining properties that are advantageous for insulation and which help an open diffusion character.

Through the measures according to the invention a soft wood fiber insulation plate is configured for a respective application at slanted roofs in that the soft wood fiber insulation plate is configured accordingly slippage inhibiting or slippage safe, whereas the advantageous properties of the soft wood fiber insulation plates are maintained, namely corresponding openness for diffusion. Simultaneously it is assured that an abrasion of particles of soft wood fiber plate is significantly reduced due to the coating so that the abraded material does not appear as particles with row characteristics on the plate surface which assures a respective slippage safety.

This is achieved in particular also by the increased friction according to the invention compared to the same uncoated soft wood fiber insulation plate wherein this increase is also configured for the coating accordingly because slippage risk when entering a roof surface does not only depend on from the properties of the plate surface but from the properties of the handy man namely his shoe soles and the prevailing weather conditions. Therefore the inventors have found that the coating has to be configured for a sufficient safety potential with respect to slippage inhibition or anti slippage properties compared to an uncoated plate surface.

It is also particularly important to maintain diffusion openness of the soft wood fiber insulation plate in spite of the applied coating in order to secure sufficient drying properties of the soft wood fiber insulation plate as required since mildew might be formed otherwise.

Thus, chemical coating materials are particularly advantageous that are based on polyvinyl acetate, polyacrylate, silica sol, which can be used undiluted and also with a thinner. Water is a particularly suitable thinner. It is an advantage of these materials that there are commercially available materials which use these materials as a chemical basis like for example Ponal Classic wood glue, Primaster Acryl-Clear Coat, Primaster Seidenlatex, Levasil 200/40, Rigips Haftgrund and Weber.prim 802 and similar which can be used undiluted or with a thinner.

Furthermore a portion of coating mass which is applied to the plate surface per square meter of plate surface is also essential for the invention in that the coating has to penetrate the plate surface on the one hand side and thus penetrate into an interior of the soft wood fiber insulation plate in order to fixate the coating accordingly on the other hand side also no excess amount of coating is provided on the plate surface in order to maintain the diffusion open character of the coated soft wood fiber insulation plate or in order not to degrade it to any large extent.

Thus, it is advantageous according to the invention that the coating is configured so that it accumulates at the wood fibers of the soft wood fiber insulation plate which is advantageous for maintaining the diffusion open character of the insulation plate.

In order to provide increased slippage protection it is advantageous when the amount of coating is in a range of 10 – 500 g/m² advantageously 10- 200 g/m², particularly advantageously 10 – 100 g/m² thus respectively with reference to solid material after drying at temperatures of 150°C and a time period of two hours. It is particularly advantageous for coating compound on the basis of polyvinyl acetate that the amount applied is in a range to 70 – 250 g/m² in particular 80 – 180 g/m². For a coating compound based on polyacrylate an application amount is advantageous which is in a range of 12 – 300 g/m², in particular 13 – 270 g/m², particularly advantageously of greater/ equal 14 g/m² in turn respectively with reference to solid material after drying (150° C, 2 hours). In case the coating compound is based on silica sol, a range of the application amount of 10, in particular 13 - 150 g/m², in particular

15 – 100 g/m² is advantageous, thus in turn with reference to solid material after drying (150° C, 2 hours).

5 It is advantageous for the invention for slip safety that a network layer is formed so that the diffusion open character of the plate is assured. Due to an accumulation of the coating at the wood fibers in the surface portion of the plate an increase of roughness of the plate surface is provided by its solidification which leads to an increase in slip safety. Furthermore a rather large porosity of the surfaces is obtained so that no change is provided in the micro structure of the plate itself, this means in
10 particular the diffusion openness of the soft wood fiber insulation plate is essentially not impaired.

In this context it is advantageous to apply the coating in a liquid form wherein the coating is advantageously applied by spraying it onto the plate which has proven
15 very effective for accumulating the coating at the wood fibers.

By the same token applying the coating material can also be performed in another conventional manner, thus for example by hand by applying with a spatula or similar, the compound can also be rolled on or similar and introduced into the surface
20 structure of the plate wherein introducing by rolling is advantageous.

The applied amount of the coating compound per square meter of plate surface can be in a range of 10 – 500 g/m², advantageously 10 – 200 g/m², particularly advantageously 10 – 100 g/m², respectively with reference to solid material after drying
25 (150° C, 2 hours). Depending on requirements also a greater minimum application amount of 15 g/m², 20 g/m² or 30 g/m². For economic reasons it is appreciated that the application amount is adjusted so that a predetermined minimum requirement with respect to the increased friction is provided.

30 It is advantageous to coat the entire surface of the insulation plate.

On the other hand side also coating the surface in sections can be advantageous, in particular a spot coating, wherein the surface portion of the individual coatings which are applied with a uniform distance from each other to the plate amounts to a surface which is approximately identical with a medium sole size, advantageously at least 150 cm². In this context it is advantageous to configure the distance of the spot applied coating in a half up to an entire average step increment, wherein a distance of at least 40 cm is advantageous. In another embodiment the coated portions can be stripped shaped and can be provided in parallel strips transversal to the longitudinal direction with an advantageous strip distance in step length, thus 50 – 80 cm.

It is furthermore advantageous to configure a soft wood fiber insulation plate accordingly, wherein its raw thickness is advantageously between 30 and 250 kg/m³. Advantageously plates are coated which have a blunt plate edge or whose edges are configured to show corresponding shoulders at the edges in order to facilitate deploying the soft wood fiber insulation plates with a corresponding engagement in the joint.

In order to coat the soft wood fiber insulation plate to increase slip safety the following materials are particularly suitable which are advantageously used in a liquid form for applying the coating to the soft wood fiber insulation plate for example advantageously:

- Agents based on poly acryl acid, advantageously with a molar mass between 2,000 and 150,000 Dalton, advantageously 40 – 100 kD (1,000 Dalton); these agents typically have a certain water resistance after curing; advantageous also pure acrylates or acryl polymers are possible and advantageous; agents based on poly vinyl acetate optionally partially converted into soap, water soluble advantageously with a mole mass of 20 kD;
- Agents based on polyvinyl alcohol, water soluble, advantageously with a mole mass of 20 kD to 500 kD;
- Furthermore inorganic material: in particular silica sol, watery colloidal suspension of almost spherical poly silica sol acid molecules with 30% up to at

the most 60% silicone dioxide; size of the poly silica sol acid colloids 200 – 500 nanometers which influences aging resistance advantageously.

Subsequently advantageous embodiments of the invention are described with reference to the drawing figure, wherein:

FIG. 1 illustrates a partial sectional; view of a soft wood fiber insulation plate; and FIG. 2 illustrates a diagram of a pull test.

The wood fiber insulation plate that is only partially illustrated in the perspective view in the figure is a so called soft wood fiber insulation plate 1 and has a raw density of 180 kg/m^3 in the instant embodiment which does not limit the scope of the embodiment. Typically raw densities of plates of this type are in a range between $100 - 250 \text{ kg/m}^3$ so that they are used for insulating roofs or outer walls.

It is well known that a plate of this type has two opposite main surfaces wherein only the main surface 2 is visible in the figure. Furthermore this illustrates the blunt edge surfaces 3 and 4 where the plates contact during joint to joint deployment. Typical engagement members like key/groove connections and step joints are not illustrated which are already known for plates of this type so that they are not illustrated in the drawing. Furthermore the plate 1 is provided on its main surface with an only partially illustrated coating 5 which completely covers the main surface 2 in this embodiment.

The plate surface 2 in these embodiments is respectively coated with a respectively different coating 5 which can respectively include suitable components like e.g. hardener components, retarders, accelerators, dilution agents or similar. As illustrated by the dashed line at the edge sides 3 and 4 of the plate, the coating 5 is applied so that it reaches an interior of the plate but so that a sufficient coating is still provided at the plate surface. This yields on the one hand side excellent anchoring of the coating at the plate itself as well as a respective surface treatment of the plate which remains open for diffusion. This is provided by a substantial accumula-

tion of the coating at the individual fibers of the soft wood fiber insulation plate in the drenched surface portion so that a corresponding breathing capability, this means openness for diffusion is maintained. Advantageously the coating is applied by spraying.

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The different coatings 5 are combined in the subsequent table 1, a listing of embodiments and reference samples with the application amounts in g/m² with reference to the coating material and the chemical basis.

Table 1: Embodiments and Reference Samples

Designation	Coating Material	Chemical Base	Applied Amount [g/m ²] Coating Material As Delivered	Applied Amount [g/m ²] Coating Material Solid After Drying
Embodiment 1A	Ponal Classic Wood Glue ⁴⁾	Polyvinylacetate	145 ²⁾	80
Embodiment 1B	Ponal Classic Wood Glue	Polyvinylacetate	300 ¹⁾	175
Embodiment 2A	Primaster Acryl-Clear Coat ⁵⁾	Polyacrylate	53 ²⁾	25
Embodiment 2B	Primaster Acryl-Clear Coat ⁵⁾	Polyacrylate	365 ¹⁾	175
Embodiment 3A	Primaster Seidenlax ⁵⁾	Polyacrylate	25 ²⁾	15
Embodiment 3B	Primaster Seidenlax ⁵⁾	Polyacrylate	440 ¹⁾	270
Embodiment 4A	Levasil 200/40 ⁶⁾	Silica sol	31 ²⁾	15
Embodiment 4B	Levasil 200/40 ⁶⁾	Silica sol	190 ¹⁾	95
Embodiment 5A	Rikombi Grund ⁷⁾	Polyacrylate	25 ²⁾	13
Embodiment 5B	Rikombi Grund ⁷⁾	Polyacrylate	37,5 ²⁾	19
Embodiment 6A	weber.prim 802 ⁸⁾	Polyacrylate	25 ²⁾	14
Embodiment 6B	weber.prim 802 ⁸⁾	Polyacrylate	37,5 ²⁾	22
Reference Sample 1	-	-	-	-
Reference Sample 2	-	-	-	-
Reference Sample 3	-	-	-	-
Reference Sample 4	Henkel Methylan Direct ⁴⁾ (Wall Paper Glue)	Methylcellulose	290 ¹⁾	12
Reference Sample 5	BESTWOOD SCHNEIDER Top 180 ⁹⁾	Latex	N/A	N/A
Reference Sample 6	BESTWOOD SCHNEIDER Top 180 ⁹⁾	uncoated	-	-

- 1) application undiluted in delivery condition;
- 2) application diluted with water in a mixing ratio 1: 3, this means e.g. 100 g/m² wet in case of embodiment 3A, 5A or 6A;
- 5 3) determined from delivery condition after drying for 2 hours at 150 °C;
- 4) commercial product by Henkel AG & Co. – KgaA
- 5) commercial product by Globus Baumaerkte
- 6) commercial product by Fa. AkzoNobel
- 7) commercial product by Saint-Gobain Rigips GmbH
- 10 8) commercial product by Saint-Gobain Weber GmbH
- 9) commercial product by best wood Schneider GmbH

The reference sample 1 is an uncoated plate with the same raw density, the reference samples 2 and 3 designate the uncoated surface on the back side of the embodiments 2 and 3. The reference sample 4 is the coated top side of a soft wood fiber insulation plate provided on side with a latex coating with a raw density of 180 kg/m³ which is advertised as slip inhibiting, the reference sample 5 is its uncoated back side for determining the friction value of the coated and uncoated surface.

20 Table 2 lists the individual measuring results and includes the respective means and standard deviations. At the lower end there are comparison values, wherein the illustrated means show the increased friction values for the embodiments based on polyvinyl acetate, poly acrylate and silica sol quite well. In particular the comparison with the commercially available wall paper glue based on methyl cellulose shows
25 the advantageous adhesion values which are obtainable with the recited materials.

Table 2 combines the determined maximum forces $F_{\max}$ [N] and the means F_{MW} [N] wherein a total of 12 pull tests are performed for each embodiment or reference sample wherein an arithmetic mean of the force F_{MW} in [N] 3000 mm². Additionally a
30 standard deviation of the individual values is stated. It is appreciated that the determined force values relate to a friction surface sized according to the vice set 313910 made by the Zwick Company of 50 x 60 mm, thus 3000 mm².

The three reference samples 1 – 3 only show a small deviation of the friction values or the characterizing pull forces which is also evident from the small deviations of percent increase of the pull force of an embodiment with reference to the three reference samples.

In order to obtain a correlation between the previously described test method and the subjective safety perception test persons walked on high pitch angle roofs with angles of 35°. The test persons described a subjective significantly improved stand safety comparing coated soft wood fiber insulation plates compared with uncoated plates with a friction increase of 10% according to the previously described test method.

The coating is provided in the instant case with the application amount that is stated in Table 1 and is configured so that the coating has the anti-slip feature due to an advantageous configuration of an open network structure and the coating is highly slip inhibiting due to the advantageous binding effect.

For determining the friction values there are diverse suitable friction devices wherein in the instant case a friction device made by the company Zwick GmbH & Co. KG from Ulm which is used in particular for measuring friction properties of plastic foils but for determining the friction properties of the soft wood fiber insulation plates a sled was used that was modified for receiving the soft wood fiber insulation plates, thus with a clamping vice (coarse) made by the Zwick Co. The sled was thus modified so that different weights could be applied for determining friction properties.

In particular a friction testing device made by the Zwick company with the type UZ 24467 was used with a friction device 316251 of the Zwick Company which is suitable for tests according to DIN 53375, ISO 8295, ASTM D 1894 and 2534 and in particular TAPPI T 549 with a table with easy conversion with a vice set of the type 313910 made by the Zwick Company. The measurement was thus performed ac-

according to the standard TAPPI T 549 wherein the friction values or friction coefficient was increased accordingly for the advantageous embodiments.

For determining the friction values or has a representation thereof the pull forces
5 the sample width was uniformly 150 mm, the test travel was 50 mm, the test surface was 3000 mm², the test velocity was 150 mm per minute and the pre load force was 0.5 N. The total mass of the sled including the clamping vice and the additional weight was 1450 g.

10 FIG. 2 illustrates the force/distance diagram of a pull test, thus based on a reference sample 1. Apparently the determined curve differs from typical tests for determining friction values or pull forces in that due to rough surfaces of product and clamping vice surface no sliding process starts, but a multiple sequence of adhesion, tearing loose and subsequent hook up which is represented by the curve with
15 many serrations. The pull test determines in addition to a maximum force $F_{\max}$ [N] a force value F_{MW} [N] that is averaged over the measuring curve. The force value is used as a reference and relates to the test surface of 3,000 mm².

Friction testers of this commercially available type which perform frictions test in
20 particular according to the international standards like ASTM 1894, ISO 8295 and TAPPI T 549 quickly determine a friction coefficient of a surface in a simple manner, wherein the determined friction coefficient of different surfaces can be compared.

Table 2: Results Friction Test

	Embodiment 1A		Embodiment 1B		Embodiment 2A		Embodiment 2B		Embodiment 3A		Embodiment 3B	
	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}
	[N] *											
	18,53	13,81	20,95	14,65	16,52	13,63	20,37	15,62	17,11	14,72	24,36	18,09
	19,29	13,89	19,12	14,53	16,81	13,76	21,15	16,48	17,57	14,27	22,22	18,06
	19,14	14,14	34,58	16,21	16,45	13,61	20,98	16,50	17,16	14,14	22,23	17,58
	19,09	14,10	22,48	14,88	16,74	14,54	19,98	16,61	17,74	14,83	22,29	17,74
	18,36	13,78	18,34	13,62	16,63	14,33	20,76	15,90	17,05	14,02	23,53	17,89
	18,65	14,63	20,89	14,69	17,12	14,26	21,32	16,69	16,47	13,72	21,15	17,85
	18,91	14,69	20,35	14,88	17,94	14,59	19,94	16,64	16,41	13,72	21,53	17,86
	18,89	14,15	23,02	14,79	16,38	13,68	19,76	16,50	16,89	13,85	21,45	17,57
	17,91	13,23	22,56	14,52	17,45	13,85	19,62	15,74	16,88	13,56	21,19	17,57
	17,64	13,25	26,98	14,70	17,84	14,57	20,51	16,26	17,15	14,43	23,30	17,78
	17,86	13,33	22,12	15,02	18,67	15,02	21,90	16,68	17,23	14,06	23,67	17,54
	17,74	12,64	20,34	15,03	18,11	14,77	20,97	16,74	17,27	13,72	21,43	17,23
Mean	18,50	13,80	22,64	14,79	17,22	14,22	20,61	16,36	17,08	14,09	22,36	17,73
Standard Deviation	0,59	0,60	4,36	0,58	0,76	0,49	0,70	0,39	0,41	1,10	0,24	
Percent Change Emb./Ref. Sample 1	13,5		21,7		16,9		34,6		15,8		45,8	
Percent Change Emb./Ref. Sample 2	11,7		19,7		15,1		32,4		14,0		43,5	
Percent Change Emb./Ref. Sample 3	14,4		22,6		17,8		35,6		16,7		46,9	
Mean of Percent Change	13,2		21,3		16,6		34,2		15,5		45,4	

*) Force [N] determined for a friction surface of 3000 mm²

Table 2: Results Friction Test (seqq)

	Embodiment 4A		Embodiment 4B		Embodiment 5A		Embodiment 5B		Embodiment 6A		Embodiment 6B	
	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}
	[N]*											
	23,71	20,21	30,87	23,91	16,73	13,76	15,94	13,27	16,05	13,40	17,65	14,33
	21,19	18,29	29,90	22,97	16,80	13,68	16,66	13,98	16,71	13,77	18,60	15,00
	21,89	19,53	29,82	23,06	16,52	13,27	16,41	13,77	15,98	13,67	16,79	13,85
	23,47	20,24	32,59	21,95	16,24	13,28	15,90	13,18	15,82	13,60	15,57	13,25
	23,59	20,75	28,84	23,09	16,95	13,49	16,28	13,19	16,42	14,09	17,50	14,46
	23,17	20,10	29,82	22,70	16,54	13,54	16,89	14,12	17,25	13,72	16,96	14,41
	23,67	20,81	28,69	22,04	16,37	13,32	16,92	14,47	15,74	13,01	16,91	14,31
	23,42	18,72	27,08	21,99	15,98	13,21	16,82	13,35	15,65	13,74	17,03	14,54
	21,64	19,18	26,34	22,49	16,70	13,26	16,44	13,44	16,88	14,38	17,48	14,46
	20,62	18,56	27,09	22,34	16,54	13,80	16,64	14,16	16,28	13,92	17,53	14,01
	21,80	18,77	25,91	21,87	16,29	13,42	16,46	13,98	16,74	13,73	16,74	13,36
	20,71	18,57	26,66	22,25	15,66	12,89	16,37	13,80	17,71	14,30	16,82	14,44
Mean	22,41	19,48	28,63	22,56	16,44	13,41	16,48	13,73	16,44	13,78	17,13	14,20
Standard Deviation	1,21	0,91	2,06	0,61	0,36	0,26	0,33	0,43	0,64	0,37	0,72	0,50

Percent Change Emb/Ref. Sample 1	60,2	85,5	10,3	12,9	13,3	16,8
Percent Change Emb/Ref. Sample 2	57,6	82,5	8,5	11,1	11,5	14,9
Percent Change Emb/Ref. Sample 3	61,4	86,9	11,1	13,7	14,2	17,7
Mean of Percent Change	59,7	85,0	10,0	12,6	13,0	16,5

*) Force [N] determined for a friction surface of 3000 mm²

Table 2: Results Friction Tests (seqq)

	Reference Sample 1		Reference Sample 2		Reference Sample 3		Reference Sample 4	
	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}	F _{max}	F _{MW}
	[N] *							
	14,66	12,39	15,95	12,61	15,40	11,91	21,61	13,61
	14,21	12,27	14,99	12,49	14,90	11,89	15,82	11,06
	14,75	12,22	14,85	12,11	14,96	12,19	16,06	11,12
	15,09	12,30	14,72	12,10	14,63	12,06	15,11	10,66
	14,93	12,64	15,10	12,56	15,50	11,96	15,90	11,13
	15,14	12,62	15,09	12,47	14,69	12,20	14,89	10,90
	14,51	12,26	15,14	12,60	14,46	11,99	13,88	10,70
	14,19	12,21	15,90	12,55	14,49	11,76	13,81	10,84
	14,38	11,69	15,74	12,47	16,08	12,07	15,01	11,13
	14,37	11,61	15,38	12,50	15,67	12,31	15,08	11,15
	14,26	11,87	14,85	11,92	14,26	12,16	15,00	11,03
	14,13	11,84	15,01	11,90	14,51	12,32	15,17	10,93
Means	14,55	12,16	15,23	12,36	14,96	12,07	15,61	11,19
Standard Deviation	0,36	0,34	0,42	0,27	0,57	0,17	2,01	0,78

Percent change Ref. sample 4/ Ref. sample 1	-8,0
Percent change Ref. sample 4/ Ref. sample 2	-9,5
Percent change Ref. sample 4/ Ref. sample 3	-7,3
Mean of Percent Change	-8,2

Percent change Ref. sample 5/ Ref. sample 6	-18,3
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Force [N] determined for a friction surface of 3000 mm²

PATENT CLAIMS

1. A soft wood fiber insulation plate for insulating buildings, in particular for
5 slanted roofs which is provided with a coating (4) on at least one of two main sur-
faces of the soft wood fiber insulation plate,
characterized in that
the soft wood fiber insulation plate is coated so that a friction resistance of a coated
surface (2) is increased by at least 10% compared to an identical uncoated soft
10 wood fiber insulation plate, advantageously increased by 15%, particularly advan-
tageously increased by at least 30%.
2. The insulation plate according to claim 1,
characterized in that
15 the coating (5) forms an open network structure which is open for diffusion.
3. The insulation plate according to claim 1 or 2,
characterized in that
the coating (5) is applied so that the coating (5) substantially adheres to the wood
20 fibers and is configured open for diffusion and/or is anchored at the soft wood fiber
plate, wherein the coating is advantageously applied in a liquid form and/or in par-
ticular in a form that is thinned with water.
4. The insulation plate one of the preceding claims,
25 characterized in that
the coating is provided based on polyvinyl acetate, poly acrylate or silica sol.
5. The insulation plate according to one of the preceding claims,
characterized in that
30 an applied amount of coating compound per square meter plate surface is in a
range of 10 – 500 g/m², advantageously 10 – 200 g/m², particularly advantageously

10 – 100 g/m², respectively with reference to the solid material after drying at 150° C for 2 hours.

6. The insulation plate according to one of the preceding claims,

5 characterized in that the applied amount of the coating material is in a range of 70 g/m²

to 250 g/m², advantageously 80 g/m² to 180 g/m² respectively with reference to solid material after drying at 150° C for 2 hours.

10 7. The insulation plate according to one of the claims 1 - 5, characterized in that

the applied amount of the coating material based on polyacrylate is in a range of 12 g/m² to 300 g/m², advantageously 13 g/m² to 170 g/m² particularly advantageously within a range of greater equal 14 g/m² respectively with reference to solid material
15 after drying at 150° C for 2 hours.

8. The insulation plate according to one of the claims 1 - 5, characterized in that

the applied amount of the coating material based on silica sol is in a range of 10 g/m², in particular 13 g/m² to 150 g/m², advantageously in a range of 15 g/m² to 100 g/m² respectively with reference to solid material after drying at 150° C for 2
20 hours.

9. The insulation plate according to one of the preceding claims,

25 characterized in that

applying the coating (5) is performed by a sprayer, by a spatula or by rolling on the coating material.

10. The insulation plate according to one of the preceding claims,

30 characterized in that

the entire plate surface (2) is coated.

11. The insulation plate according to one of the claims 1 - 9,
characterized in that

the surface of the soft wood fiber insulation plate is coated in sections, in particular
5 in uniform intervals, in particular with spot shaped portions with a surface area of at
least 150 cm² in particular at least 200 cm², wherein the portions are advantageous-
ly arranged within stride distance, in particular at a distance of at least 40 cm.

12. The insulation plate according to one of the preceding claims,
10 characterized in that

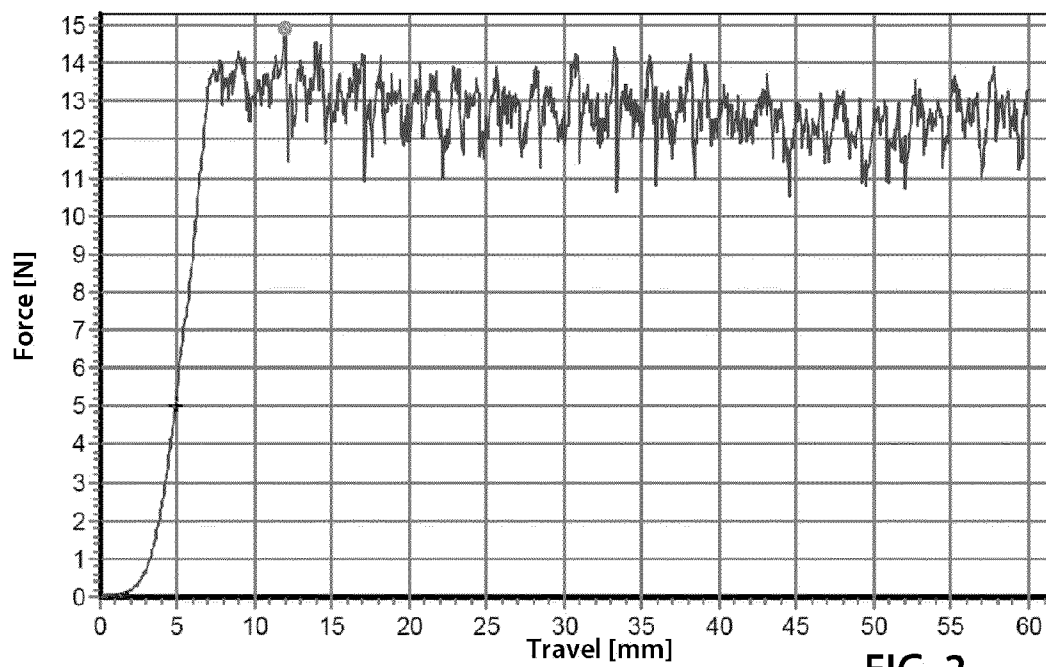
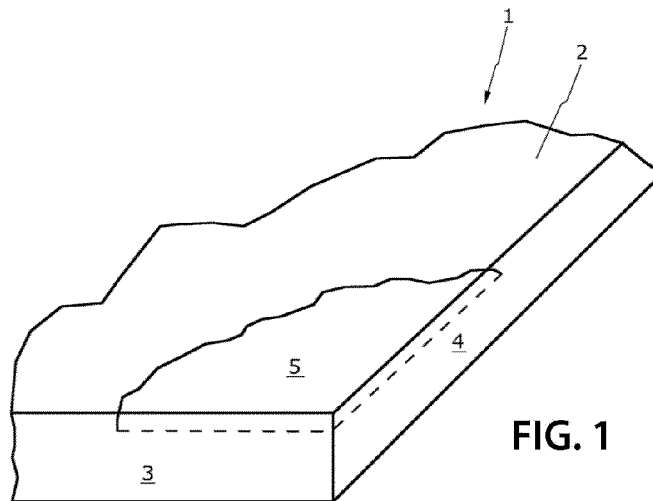
the wood fiber insulation plate (1) has a raw density in a range of 30 – 250 kg/m³.

13. The insulation plate according to one of the preceding claims,
characterized in that

15 a thickness of the insulation plate (1) is in a range of 20 – 200 mm.

14. The insulation plate according to one of the preceding claims,
characterized in that

the coating (5) is applied to one of the two main surfaces only.



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/051422

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04D12/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04D

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 899 021 A1 (PAVATEX SA [CH]) 29 July 2015 (2015-07-29) paragraph [0008] - paragraph [0028]; figures 1-4	1,9,10, 12,13
X	DE 20 2015 000403 U1 (PAULY NORBERT [DE]) 20 July 2015 (2015-07-20) cited in the application the whole document	1-3,5,6, 9,10, 12-14
X	US 2003/145550 A1 (BENNETT JOHN LANDUS [US] ET AL) 7 August 2003 (2003-08-07) paragraphs [0021], [0026], [0036]; figures 1, 3	1,5,6, 10,13,14
A	JP H06 228464 A (YAMAWAKI YUTAKA; MATSUDA NOBORU; KINOSHITA AKIRA) 16 August 1994 (1994-08-16) abstract	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 March 2017

Date of mailing of the international search report

04/04/2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/051422

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