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ARTICLES MOULDED FROM A BASE OF MINERAL WOOL AND METHOD FOR THEIR FABRICATION

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(57) Claim

1. An article moulded from a base of mineral fibres forming a wool, having specific properties due to the addition of solid particles and of which the mineral fibres are held together by a bonding agent, wherein said solid particles form an incrustation in the form of flocccules among the mineral fibres and said particles have a specific mean dimension less than or equal to 4 micrometres.

9. Method of fabrication of moulded article from a base of mineral wool, according to any one of Claims 1 to 8, in which the mineral wool is dispersed in a suspension, wherein use is made of a conducting medium of which the electrical conductivity is at least 700 µS/cm.

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Complete Specification for the invention entitled:
ARTICLES MOULDED FROM A BASE OF MINERAL WOOL AND METHOD FOR THEIR FABRICATION.

The following statement is a full description of this invention including the best method of performing it known to me:-

The present invention relates to an object moulded from a base of mineral wool, obtained in particular by a method of moulding under vacuum, having specific properties due to the addition of solid particles and of which the mineral fibres are held together by a bonding agent. The invention also relates to the method of fabrication of such a moulded article.

The articles moulded from a base of mineral wool, utilised in particular as packing plates or as shells for enclosing tubes are generally fabricated by dispersing the mineral wool in a suspension of a bonding agent, then draining it followed by drying the mineral wool prepared in this manner on a draining mat or in a mould by suction under vacuum. It is known that a sol of silica or starch can be used as the bonding agent. The mineral wool is, for example, rock wool, glass wool, alumino-silicate wool or a mixture of some or all of these products.

This method also allows for complete colouring of the mineral wool, by adding a colouring agent to the suspension of bonding agent. To colour the moulded article black, an appropriate blackening agent, for example activated carbon, carbon black or printer's black ink, is added.

To achieve adequate deposition of the solid particles on the fibres and to obtain a uniform bonding with the use of the bonding agent and/or to ensure uniform coloration of the final product, the silica gel, the starch, the colored pigment should be added to the water in sufficient amounts. In actual practice, an excess of the binding agent is always used, of which an appreciable amount is recovered in the water removed by suction. This excess of bonding agent in the suspension results in the formation of colloids and thus to a thickening of the dispersion, which is not favourable to good incrustation of, and uniform distribution over, the surface of the mineral wool. Independently of this primary problem, this residual content of the bonding agent entails the contamination of the suspension by micro-organisms during any prolonged stoppage of the operation, for example during the week-ends, to the extent that the suspension needs to be renewed each time. If more of the colouring agent is used, the water used should be filtered to remove all particles

of colouring agent before the water is discharged into the drains. This excess of bonding agent and colouring agent entails not only an elevation of the cost of the raw materials, but also the cost of handling and purification of the water used. Furthermore, it can be established in the final product, in particular if large amounts of colouring agent are used, that the mineral fibres are overloaded with solid particles of the agent, which leads to degradation of the desired properties.

The objective of the present invention is to provide a object, moulded from a base of mineral wool, having specific properties due to stable and uniform incrustation of solid particles on the fibres while, at the same time, a good distribution of the bonding agent should be obtained with sparing use of the various components. On the other hand, the invention also has the objective of providing a method for preparing the mineral wool for the purpose of moulding under vacuum, so that there is simple and rapid incrustation of the fibres with solid particles and bonding agent.

The article moulded in accordance with the present invention complies with that described in the preamble to Claim 1, namely an article based on mineral wool, possessing specific properties due to the addition of solid particles and inclusion of a bonding agent.

In accordance with the present invention, the solid particles are incrusted among the mineral fibres in the form of floccules and they are selected to have a specific mean dimension less than or equal to 4 micrometres. The moulded articles are preferably produced by moulding under vacuum.

According to a primary aspect of the present invention, it has for its object an article moulded from mineral wool, in which the solid particles are incrusted as floccules among the mineral fibres coated with bonding agent, starting out for preference with a suspension in water. to achieve this objective, the specific mean dimension of the solid particles is less than or equal to 4 micrometres. In a very surprising manner, it has been found that such an incrustation in the form of floccules allows, to a very large extent, for adjustment of the properties of the

article. For example, a moulded article may be colored black by particles of colouring material incrusted in the form of floccules on the mineral fibres, where this discrete incrustation is adequate in a very surprising manner to confer complete colouration on the mineral wool, without it being necessary to cover said mineral fibres with the colouring agent. The same applies to the adjustment of other properties, such as the absorption of radiation.

In a very simple manner, by incrustation through the entire thickness of the moulded article, it is thus possible to obtain different properties. By way of example, incrustation with clay allows moulded articles to be obtained which can withstand exposure to very high temperatures and are thus suitable to be utilised for the lagging of steam pipes. By incrustation with activated carbon, it is possible to produces filters for water or gas. Catalysts possessing properties adjustable in a very precise manner can be obtained by incrustation with acids, with bases, with metals or their oxides. Absorbents for micro-waves, especially radar waves, may be obtained by incrustation with carbon black or with graphite, where such articles are used, in particular, in zones close to airports, for the purpose of avoiding parasitic signals due to reflection of the waves by the buildings.

The manufacturing cost is decreased, especially by the use of a very small quantity of bonding agent and of solid particles. Furthermore, any overloading of the mineral fibres due to excessive quantities of bonding agent and solid particles for the incrustation is excluded, so that the risk of regions including irregular incrustations appearing in the mineral wool, which could arise due to such overloading, is eliminated. Actually, moulded articles having very uniform properties may be obtained. The solid particles with dimensions of less than 4 micrometres become incrusted in a remarkable manner as floccules among the mineral fibres. Preferably the solid particles have a mean dimension between 1 and 4 micrometres, or even better, between 1 and 3 micrometres, but still smaller particles will give satisfactory results and it is even possible to utilise colouring agents with

particles having dimensions on the molecular scale.

For the incrustation with the solid particles, it is suitable, by way of example as transport agents, to use mineral and organic substances which serve to form the suspension in which the bonding agent is dispersed. These transport agents can also serve as bonding agents so that it is not necessary to make a special addition of bonding agent. These mineral and organic substances are preferably cationic and/or anionic.

According to an example of embodiment of the invention, the organic substance consists of tylose and/or of starch and the mineral substance is silica gel. The mixture of tylose, of silica gel and/or of starch fulfils the role of bonding agent. The use of tylose allows for the reduction of the amount of starch by a factor of 10, thus permitting products to be obtained which conform to the class A1 of inflammable materials.

Incrustation with thermoplastic or thermosetting synthetic plastics materials make possible the improvement of the mechanical strength of the article. The use of silicones results in hydrophobic articles suitable for use in humid atmospheres. Particles of graphite improve the electrical conductivity of the articles. Aluminium hydroxide or other substances having a high content of water of crystallisation serve for the moulding of articles resistant to fire such as panels for use in fire-barrier doors. In all cases, a discrete incrustation serves to confer the desired properties on the moulded articles.

For the mineral wool, advantageous use is made, in particular, of rock wool. The application of solid particles in several layers allows for refinement of the load of solid particles in the moulded article. For example, clay particles may be used for incrustation in a first layer, followed by particles of a colouring agent in a second layer; more than two layers may be applied if necessary.

As mentioned previously, the suspension of solid particles is preferably effected with water of which the conductivity is at least 700 µS/cm (micro-siemens per centimetre) and, for preference, at least 800 µS/cm. This adjustment of the conductivity of the aqueous solution permits impeccable incrustation of

the bonding agent and the other solid particles on the mineral wool without the necessity of an excess of silica gel, of starch and/or of tylose and/or of other solid particles. On the contrary, if an elevated conductivity value is maintained, all the components in suspension are transported and incrusted among the mineral fibres, leaving practically no residue in the water. This results in a reduced cost for the raw materials and also a reduction in the cost of manufacture, in particular because it is not necessary to decontaminate the water.

In an especially advantageous form of embodiment, the conductivity of the aqueous solution is adjusted to be between 900 µS/cm and 1000 µS/cm. This adjustment is effected, for example, by the addition of conducting agents such as salts of metals, in particular magnesium sulphate.

Solid particles having a mean dimension less than or equal to 4 micrometres, are preferably added to the suspension. Especially suitable are solid particles of carbon, clays, colouring agents, thermoplastic and thermosetting synthetic plastics materials, acids, bases, metals, oxides of metals, silicones, materials with a high content of water of crystallisation and/or analogous products. The rate of incrustation is also favoured by agitation during the addition of the various components.

In a particularly advantageous manner, an incrustation in several layers of solid particles is possible if, in a first stage, the solid particles to form the incrustation are mixed directly into the suspension of the transport agent in the water, especially of tylose and/or of starch and of silica gel, and the mineral wool is added in such a manner that the bonding agent and the solid particles become fixed as floccules among the mineral fibres, without leaving any residue in the water. In a second stage, it is possible to add more silica gel and tylose and/or starch to the water, and to do the same with other solid particles to form the incrustation, so that this time the incrustation with the bonding agent and the other solid particles takes place among the already incrusted mineral fibres. If necessary, further supplementary stages may be executed.

The quantitative metering of the various constituents is effected in a very simple manner by adding just enough to the dispersion of tylose and/or of starch until all the solid particles are incrusted among the mineral fibres.

In a practical form of implementation, the mineral wool to be dispersed is added to the water in a vessel with a capacity of approximately 5500 litres. The other components of the suspension, namely silica gel, tylose and/or starch and the solid particles to form the incrustation are added with constant stirring. To colour the article black, activated carbon or carbon black is incorporated, preferably at the same time as the tylose. Thus the solid pigment particles will migrate at the same time as the bonding agent to the mineral fibres to form the coloured incrustation. It has been established that the incrustation is formed from floccules which, under the microscope, appear as discrete particles distributed uniformly among the mineral fibres.

If the stability to heat of the moulded article is to be increased, clay is added, in which case the solid clay particles migrate to the fibres at the same time as the bonding agent.

The flocculation of the fibres is also favourably influenced if the clay is added conjointly with the potato starch.

Methyl cellulose is advantageously utilised just like tylose. Starch may be utilised instead of tylose. It is also possible to add both tylose and starch. It is essential that the conductivity of the aqueous solution should be adjusted to a value of at least 700 µS/cm, preferably to at least 800 µS/cm. Salts of metals, such as magnesium sulphate, are especially suitable for use as additives for increasing the conductivity of the aqueous solution. When the conductivity has been suitably adjusted, the incrustation on the mineral fibres takes place after the addition of the silica gel and of the tylose or of the starch, without the necessity of using an excess of these components. Supplementary solid particles, which migrate to the mineral fibres at the same time as the bonding agent, may be utilised to confer specific properties, such as resistance to heat and so forth, on the moulded articles, so that, following the example of the bonding agent, these additional solid

particles need not be used in excess. After the incrustation of the mineral fibres, the residual water which drains off is free from contaminants and may be discharged directly into the waste-water drains after being subjected to filtration to recover any particles of mineral wool which may still be in suspension. However, the water may be re-used directly, especially for carrying out the incrustation in several layers by adding, before each stage of the operations, the definitive components for the bonding effect, namely silica gel and tylose and/or starch, in association with the solid particles which are required for the incrustation, for example clay or colouring agents.

Up to this point in the description, it has been stated that not only incrustations of clay particles and/or of colouring agents, but also that other appropriate solid particles can be used to form incrustations on the mineral wool or on the mineral fibres. However, for example, to improve the absorption of radiation or to increase the slippery character, it is possible to carry out an incrustation with graphite, for which purpose the fine particles of graphite are added to the suspension intended for the dispersion of the mineral wool.

Preferably, the solid particles added have a specific mean dimension less or equal to 4 micrometres, in particular, between 1 and 3 micrometres. During incrustation with the colouring agents, it is also possible to add solid particles of which the dimensions are in the molecular range.

For a moulded article possessing resistance to higher temperatures, it is typical to use the following composition :

99.9390	%	:	H_2O
0.0989	%	:	$MgSO_4$
0.0074	%	:	tylose
0.5194	%	:	mineral wool
0.0890	%	:	clay
0.3463	%	:	silica gel.

For a moulded article coloured black, it is typical to use the following composition :

99.0000	%	:	H_2O
0.0742	%	:	$MgSO_4$
0.0396	%	:	starch
0.5399	%	:	mineral wool
0.3467	%	:	silica gel
0.00248	%	:	Fakunkyl black.

For a moulded article capable of absorbing micro-waves, the composition of the suspension is, for example, the following :

98.76000	%	:	H_2O
0.09876	%	:	$MgSO_4$
0.37037	%	:	10 % suspension of carbon black
0.00493	%	:	tylose
0.02469	%	:	anionic silica gel (40 %)
0.34566	%	:	cationic silica gel (30 %)
0.54318	%	:	mineral wool.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An article moulded from a base of mineral fibres forming a wool, having specific properties due to the addition of solid particles and of which the mineral fibres are held together by a bonding agent, wherein said solid particles form an incrustation in the form of floccules among the mineral fibres and said particles have a specific mean dimension less than or equal to 4 micrometres.

2. The moulded article according to Claim 1, wherein organic and mineral substances are employed as transport agents for the solid particles forming the incrustation.

3. The moulded article according to Claim 2, wherein said organic and mineral substances are anionic and/or cationic in nature.

4. The moulded article according to claim 2 or 3, wherein said mineral substance consists of silica gel and said organic substance consists of tylose and/or of starch.

5. The moulded article according to any one of the preceding claims, wherein the solid particles consist of carbons, clays, colouring agents, thermoplastic or thermosetting synthetic plastics materials, acids, bases, metals, oxides of metals, silicones, and/or materials with a high content of water of crystallisation.

6. The moulded article according to any one of the preceding claims, wherein solid particles of carbon black or of graphite are utilised to produce a moulded article which can absorb radar waves.

7. The moulded article according to any one of the preceding claims, wherein the solid particles can be used to form an incrustation in several layers.

8. The moulded article according to any one of the preceding claims, wherein the wool of mineral fibres are obtained by a method of moulding under vacuum.

9. Method of fabrication of moulded article from a base of mineral wool, according to any one of Claims 1 to 8, in which the mineral wool is dispersed in a suspension, wherein use is made of a conducting medium of which the electrical conductivity is at least 700 µS/cm.

10. A method of fabrication according to Claim 9, in which the electrical conductivity of the conducting medium is at least 800 µS/cm.

11. A method of fabricating according to Claim 9 or 10, wherein the electrical conductivity of the conducting medium is between 800 µS/cm and 1000 µS/cm.

12. The method according to any one of Claims 9 to 11, wherein an aqueous solution is used as the conducting medium.

13. The method according to any one of Claims 9 to 12, wherein solid particles with a mean dimension equal to or less than 4 micrometres are added to the suspension.

14. The method according to Claim 13, wherein, for the production of an incrustation of solid particles in several layers in the mineral fibres, a transport agent and the solid particles are added to the suspension in several successive stages.

15. The method according to Claim 14, wherein the transport agent is added to the suspension until all the solid particles are incrusted among the mineral fibres.

16. The method according to any one of Claims 9 to 15, wherein salts of metals, are added to the aqueous solution to increase its electrical conductivity.

17. The method according to Claim 16 in which the metal salt is magnesium sulphate.

18. A method according to any one of Claims 9 to 17 in which the base of mineral wool is produced by moulding under vacuum.

19. An article moulded from a base of mineral fibres forming a wool substantially as hereinbefore described with reference to any one of the foregoing examples.

20. A method of fabrication of a moulded article from a base of mineral wool substantially as hereinbefore described with reference to any one of the foregoing examples.

DATED this 28th day of April 1993

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