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METHOD FOR THE PRODUCTION OF MINERAL FIBER BOARDS, CONTAINING MINERAL WOOL

Gunter Doring, Klaus Kahle, and Dietmar Schneider, Sondershausen, Germany, assignors to VEB Klombinat Kali, Sondershausen, Postfach, Germany

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ABSTRACT OF THE DISCLOSURE

Mineral fiber boards are produced by digesting a mixture of asbestos, a magnesia binding agent such as magnesia, mineral wool, and water wherein the weight ratio of asbestos to mineral wool is from 1:4 to 1:2.5 and the weight ratio of the binder calculated as MgO to the asbestos is no less than 1:4. The digestion is carried out for a period of time such that the bending strength of the mineral fiber board is at a maximum; the mixture is then made into a sheet by draining and suction.

This invention relates to mineral fiber boards and more specifically to a novel process for the production of mineral fiber boards containing in addition to conventional mineral wool and binding agents, other substances not incorporated so far into mineral fiber boards.

Many processes are known in the art for the production of mineral fiber boards. In general, the mix of ores, fluxes and water, is digested, then cast to boards by means of a Fourdrinier machine and finally hardened. The proportion of mineral fibers to binding agents is about 67% of the former to about 33% of the latter. In more general terms, in the conventional processes, the fibers have an acid modulus of between 1.8 to 2.2, expressed by the weight ratio formula

$$\frac{SiO_2+Al_2O_3}{CaO+MgO}=1.8\text{–}2.2$$

One drawback of the conventional processes is that they are limited with respect to the types of boards which may be produced, because they may be applied only with specific types of materials. For instance, the conventional processes may not be used with mineral wool which has an acid modulus different from the acid modulus set forth above.

One object of this invention is to provide a process which is suitable for the production of fiber boards containing mineral wool. Another object is to provide a process which is suitable for the production of mineral fiber boards containing a variety of substances as carriers. A further object is to provide a process for the production of fiber boards suitable for interior parts of buildings, insulating materials, industrial buildings, dwelling homes, agricultural constructions and ship buildings.

The present invention is based upon the observation that, in the production of mineral fiber boards, according to the wet process, the degree of digestion and the ratio of the carrier substance:mineral wool are critical in determining the properties of the final products, and that, on the other hand, the ratio of the binding agents:mineral wool is less important. The extent of digestion of the mineral wool fibers depends on several factors, namely, the solid content of the mineral wool suspension, the type of mineral wool, the length and the intensity of the digestion. The period of time the fleece is subjected to suction after the digestion period and the bending strength of the finished boards may be used as a measure of the effect of varying the digestion period when the intensity of the digestion is kept constant.

The bending strength of the finished products increases

with increase of the degree of digestion. Simultaneously, however, the filtration step required to drain the material after digestion is slowed up as a result of the increase in the degree of digestion. The increase in digestion causes an increase in the strength of the final boards because the mineral wool fibers become more closely packed and become arranged parallel to the surface of the boards and the efficiency of the binding agents increases.

The degree of digestion being reached at which the bending strength of the board is at a maximum, the bending strength remains constant during further digestion until a breaking of some fibers occurs which is followed by a breaking of all the fibers. The duration of the state of constant degree of digestion is an indicator in evaluation of the quality of the mineral wool for the production of mineral fiber boards by the wet process; the greater the duration of this state, the more valuable is the mineral wool.

Another important factor in the process in accordance with this invention, is the ratio of mineral wool:carrier. The carrier serves the purpose of fixing the binding agent into the fleece during the step when suction is applied. The ratio mineral wool:carrier is determined by several factors, namely, the suction period during the formation of the fleece, the permissible loss of binding agents (i.e., not greater than 5% by weight of the weight of binding agents initially charged) and the quality of the mineral wool, the latter as measured by the duration of the state of constant degree of digestion.

Particularly suitable carriers are asbestos with short fibers, cellulose, digested old waste paper and bentonite.

In the production of boards with greater strength, that is, $\tau_B > 65$ kg./cm.^{2}, the suction during the formation of the fleece must be at a low pressure corresponding to a 2.5 meter water column and for a period of time longer than three minutes.

In the production of insulating boards the ratio mineral wool:carrier substance is determined by the allowable losses of binding agents.

When using magnesia binding agents in the production of hard boards, the ratio of binding agent, calculated as MgO, to carrier substance must be $1:\leqq 4$.

Thus, in accordance with the present invention, mineral fiber boards may be prepared by the wet process, in a very satisfactory manner, and with optimum mixing ratios because the period of suction, the ratio mineral wool: carrier and the ratio of binding agent:carrier may be adjusted in accordance with the limitations set forth above. The same satisfactory results are achieved with a variety of raw materials, which have not been incorporated into mineral fiber boards heretofore..

The following examples are set forth below for the purpose of further illustration of the invention.

EXAMPLE 1

A mixture of 7.15 kg. St. Egidien basalt wool, 2.2 kg. fien asbestos, 3 kg. Spalt MgO, obtained by thermal dissociation of $MgCl_2$ or $MgSO_4$, 2 kg. $MgSO_4$ and 70 l. water, was digested under stirring in a turbosolubilizer. The ratio of the weight of the asbestos, that is the carrier, to the mineral wool, was 1:3.25. The digestion period was kept in different experiments at 2 minutes, 3 minutes, 7 minutes, 12 minutes and 20 minutes respectively. The values for the suction period and the bending strength obtained in each experiment are summarized in Table 1.

TABLE 1

	Digestion time, mins.				
	2	3	7	12	20
Suction period, mins	1	2	3	3	3
Bending strength, kg./cm.^{2}	30	40	60	60	60

Method for the production of mineral fiber boards,containing mineral wool (US Patent 3,684,650, 1972)
Published by AsbestosClaims.Law
ACL Doc 23039 · Page 1 of 2
asbestosclaims.law/library/23039/1

The data in Table 1 show that the suction period and the bending strength reach a constant value after a 7-minute digestion period. This digestion period is satisfactory to produce mineral fiber boards which do not change even with prolonged digestion. The mineral fiber boards so obtained have a size of 1 m.^{2} and a thickness of 20 mm.

EXAMPLE 2

A mixture of 7.15 kg. Unterwellenborn slag wool, 2.2 kg. fine asbestos, 3 kg. Spalt MgO, obtained by thermal dissociation of $MgCl_2$ or $MgSO_4$, 2 kg. $MgSO_4$ and 70 l. water, was digested under stirring for different periods of time, namely 2 minutes, 3 minutes, 7 minutes and 12 minutes respectively. The ratio of the weight of carrier to the mineral wool was 1:3.25, that is, the same as in Example 1. The suction period and the bending strength in the several experiments are summarized in Table 2, below.

TABLE 2

	Digestion period, mins.			
	2	3	7	12
Suction time, mins	2	4	12	35
Bending strength, kg./cm.^{2}	40	35	30	25

The data in Table 2 demonstrate that the Unterwellenborn wool may be subjected to digestion only for a period of 2 minutes. Further digestion causes destruction of the fibers, with decrease in bending strength, while the suction period increases.

EXAMPLE 3

A mixture of 7.15 kg. St. Egidien basalt wool, 2.2 kg. fine asbestos, 3 kg. Spalt-MgO, obtained by thermal dissociation of $MgCl_2$ or $MgSO_4$ and 70 l. water, was digested in the turbosolubilizer for 12 minutes. The ratio of the carrier to the mineral wool was 1:3.25. Experiments were conducted with ratios of asbestos to mineral wool as follows:

1:4; 1:3.5; 1:3.25; 1:3; 1:2.5

The digestion period was kept in each experiment at 12 minutes. The results are summarized in Table 3.

TABLE 3

	Ratio by weight of asbestos to mineral wool				
	1:4	1:3.5	1:3.25	1:3	1:2.5
Suction time, mins	0.2	2.0	3	4.5	15
Bending strength, kg./cm.^{2}	33	47	60	90	118

The data in Table 3 demonstrate that, with a constant period of digestion, the suction period and the bending strength increase as the ratio increases, that is, with a decrease in the amount of mineral wool.

What is claimed is:

1. A process for the production of mineral fiber boards comprising forming a mixture consisting essentially of asbestos, a magnesia binding agent, mineral wool and water, the weight ratio of the asbestos to the mineral wool being in the range of 1:4 to 1:2.5, the weight ratio of the binder, calculated as MgO, to the carrier being no less than 1:4, digesting the mixture for a period of time such that the bending strength of the mineral fiber board is at a maximum and converting the digested mixture into a fleece by draining and suction.

2. The process according to claim **1** wherein the suction is at a pressure corresponding to a 2.5 meter water column and is for a period longer than 3 minutes.

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S. LEON BASHORE, Primary Examiner

R. H. ANDERSON, Assistant Examiner

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