106-74 ARC CHUTE Examine

Patented Jan. 20, 1942 2,270,747

UNITED STATES PATENT OFFICE

2,270,747

CEMENT-ASBESTOS INSULATING MATERIAL AND PROCESS OF IMPROVING THE SAME

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No Drawing. Application July 31, 1940, Serial No. 349,010

5 Claims. (Cl. 18—48)

This invention relates to insulating materials comprising asbestos bonded with siliceous cement or the like and to a method of improving the insulating properties of such materials. It is particularly concerned with a method of treating arc shields or arc chute structures made from these materials to improve the dielectric strength and insulation resistance of such insulating structures.

It has long been known that cured or hardened cement-bonded asbestos products, such as asbestos board or the like, exhibit a marked decrease in dielectric strength or electrical resistance upon aging, particularly in a humid atmosphere. Although the electrical properties of these products are improved by baking at slightly elevated temperatures probably due to the removal of water taken during aging, the improvement resulting from this drying treatment ordinarily is only temporary, lasting at the most only a few days.

I have now found that a substantial and lasting improvement in the dielectric resistance of these cemented asbestos insulating materials and a more uniform product may be obtained by subjecting the cured material to a heat treatment at temperatures substantially above those necessary for the removal of any absorbed water therefrom in the presence of a reducing atmosphere. Preferably the formed insulating material is subjected to a baking temperature ranging between 350° and 600° C. in a hydrogen atmosphere for a period of time between twenty minutes and about four hours. Both the optimum time and temperature will vary with the types of material being treated and are apparently dependent upon both the composition and previous treatment of the cement-asbestos insulation. However, substantial and permanent improvements have been obtained in all cement-asbestos compositions so far encountered by subjecting such materials to any temperature falling within the prescribed range for any of the prescribed times.

It has further been found that the use of a reducing atmosphere during the heat treatment not only results in a more lasting improvement in the insulating characteristics of the hardened cement-asbestos article but also permits the use of a higher heat treating temperature than is possible with an atmosphere of air without materially impairing the mechanical properties such as the impact strength of the article.

The improvements obtained through the heat treatment of Portland cement-asbestos compositions in an atmosphere consisting preponderantly of hydrogen as compared with the untreated product and the product heat treated in air will be noted from the following table giving the milliampere leakage at different voltages of test bars cut from a certain asbestos board:

Table I

Treatment	Time test voltage applied, minutes	Milliamperes leakage at different voltage			
		5 kv.	10 kv.	15 kv.	20 kv.
IMMEDIATELY AFTER TREATMENT					
Untreated	0	1.2	7.0	x	x
	1	1.4	*	x	x
Heat treated	0	N	"	.4	.6
	1	N	"	.4	.6
Hydrogen treated	0	N	N	.2	.5
	1	N	N	.2	.5
APPROXIMATELY THREE DAYS AFTER TREATMENT					
Untreated	0	.8	4.0	x	x
	1	.8	*	x	x
Heat treated	0	.2	.5	1.0	1.6
	1	.3	.6	1.0	2.0
Hydrogen treated	0	N	N	N	.2
	1	N	N	N	.2
APPROXIMATELY TEN WEEKS AFTER TREATMENT					
Untreated	0	1.40	5.25	x	x
	1	1.70	*	x	x
Heat treated	0	.025	.080	1.50	x
	1	.025	.080	2.00	x
Hydrogen treated	0	.030	.055	.085	.120
	1	.030	.055	.085	.120

*—Off scale of milliammeter—no reading possible.
"—Slight.
N—Negligible.
x—No test.

The measurements were made using electrodes spaced three inches apart and clamped onto the bars having a cross-section of two inches by one-half inch and a length of five inches. The air heat treated samples were heated at a temperature of 400° C. for a period of twenty minutes while the hydrogen treated samples were heated at a temperature of 600° C. for the same length of time. These temperatures represent the approximate maximum temperatures at which heat treatment can be carried out in the respective atmospheres particularly with respect to the air bake without substantially impairing the mechanical strength of the treated product. It will be noted that although a substantial improve-

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ment in the resistance characteristics of the samples, as shown by their lower milliampere leakage, is obtained with both the air-treated and hydrogen-treated samples, the improvement is not as pronounced nor as enduring in the case of the air-treated samples, as can be seen from a comparison of the milliampere leakage of the various samples three days and ten weeks after treatment with the leakage immediately after treatment.

The variations in the results obtained with the same samples, in particular the untreated sample, immediately after heat treatment, about three days thereafter and approximately ten weeks thereafter can probably be explained by the difference in atmospheric conditions at the time the measurements were made. That this is true is shown by the following tabulated resistance values of bars cut from the same cement-asbestos board, and heat-treated respectively for three or four hours at 600° C. in hydrogen and in air:

Table II

Days after heat treatment	Humidity, in inches, Hg	Megohms resistance			
		Air fired 600° 4 hr.		Hydrogen fired	
		Sample 1	Sample 2	600° 3 hr.	600° 4 hr.
6	.74	9	9	14	18
7	.51	168	228	264	200
11	.64	12	8	16	28
22	.56	82	64	162	212
25	.55	34	26	60	93
26	.61	18	18	42	64

The bars used in obtaining the above values were of the same size as those used in obtaining the test tabulated in Table I. The electrodes were mounted three inches apart along the length of the bars with an applied voltage of 10 kv. It will be noted that the megohm resistance of the various samples varies with the particular atmospheric conditions, namely, the humidity conditions prevailing on the day of tests. In making the above comparison all of the samples were baked at a temperature of 600° C. It is to be understood, however, that when treated at such temperatures the air-treated product was wholly unsuitable for commercial application in so far as its mechanical properties are concerned.

It was previously stated that the particular times and temperatures employed would depend upon the material being treated. For example, it has been found that optimum improvement in certain molded cement-asbestos articles prepared by molding a moistened cement-asbestos composition into the form of its ultimate use was obtained with a hydrogen heat treatment at a temperature of 350° C. for a period of about one-half hour after being brought to this temperature by 50 degree intervals covering not less than 15 minutes from a starting temperature of about 200° C. On the other hand, certain cured cement-asbestos insulating materials of the type commonly known as asbestos board were best treated at temperatures of 600° C. for a period of 20 minutes although no substantial impairment of either electrical or mechanical properties was noted when the treatment was extended to as much as four hours. In certain instances the greatest improvement was noted with a three hour treatment.

Common asbestos boards treated in accordance with my process have been found superior in electrical properties to untreated higher priced materials supposedly made from higher grade starting materials. Furthermore, even when these higher grade products were so treated, they were no better than the similarly treated cheaper boards. The treated boards are darker colored, ordinarily being a light grey, and are apparently harder or more brittle in that, when tapped with a hammer or the like, they respond with a metallic ring as compared with the dull sound emitted by the untreated products.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The process which comprises subjecting bonded asbestos insulating materials to the action of a reducing atmosphere at a temperature between 350° and 600° C.

2. The process which comprises baking hardened cement-asbestos insulating materials at temperatures about 350° C. while surrounded by a hydrogen atmosphere.

3. The process of improving the insulating properties of cured cement-asbestos insulating materials which consists in subjecting said materials to an elevated temperature between 350° and 600° C. in an atmosphere consisting substantially of hydrogen.

4. The process of improving the insulating properties of cured cement-asbestos insulating materials which consists in heating said materials to a temperature of substantially 600° C. in a reducing atmosphere consisting mainly of hydrogen.

5. A cemented asbestos molded electrical insulation which has been heat treated in a hydrogen atmosphere, said article being characterized by an electrical resistance substantially higher than that of an untreated insulation of the same composition.

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