106. COMPOSITIONS, COATING OR PLASTIC

98

Cross Reference

Examiner

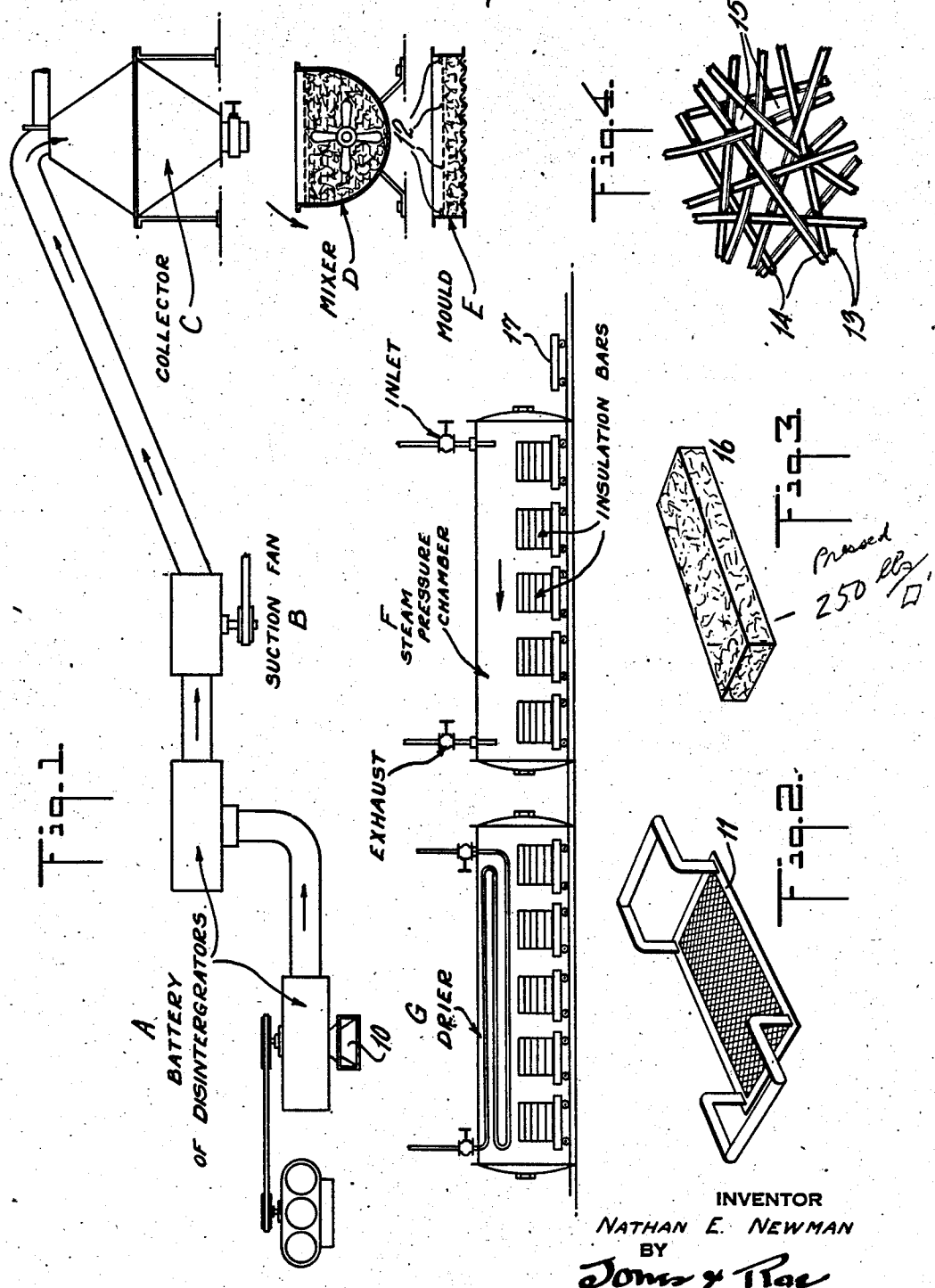
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Jan. 26, 1943. N. E. NEWMAN 2,309,206

PROCESS FOR THE MANUFACTURE OF INSULATION UNITS

Filed Jan. 27, 1942 2 Sheets-Sheet 1

92-54



INVENTOR
NATHAN E. NEWMAN
BY
Jones & Rae
ATTORNEYS

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Filed Jan. 27, 1942 2 Sheets-Sheet 2

Fig. 6.

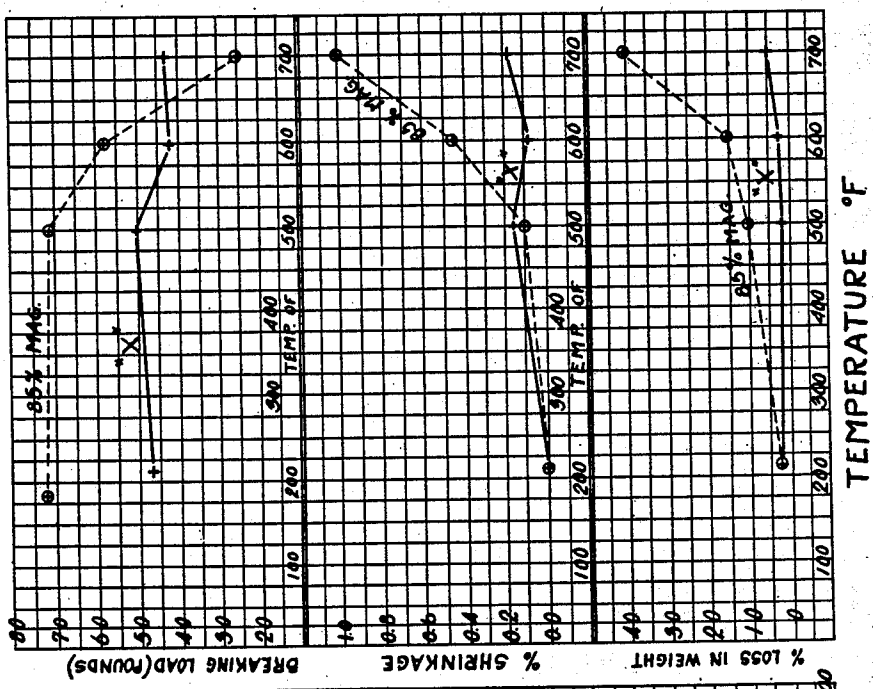
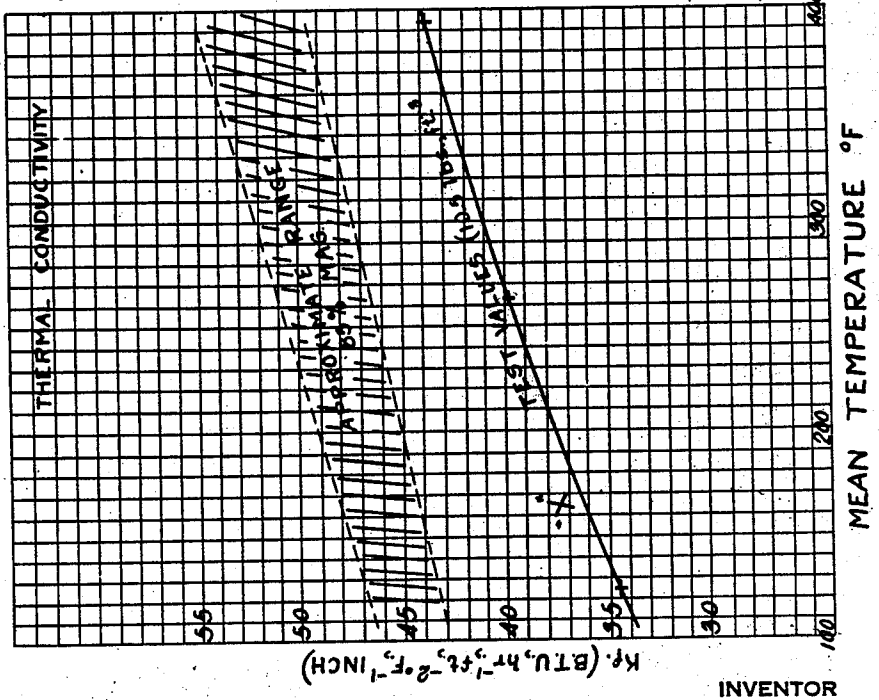


Fig. 5.



INVENTOR
NATHAN E. NEWMAN
BY
Toms & Roe
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,309,206

PROCESS FOR THE MANUFACTURE OF INSULATION UNITS

Nathan E. Newman, Bronxville, N. Y., assignor to Asbestos Limited Incorporated, New York, N. Y., a corporation of New York

Application January 27, 1942, Serial No. 428,385

5 Claims. (Cl. 92—54)

In the field of structural insulation, "85% magnesia" plays an important role. It is, however, deficient in many respects. At high temperature, its thermal conductivity is excessive; its breaking load is low; its shrinkage is unduly severe; and its loss in weight is notable. Then, too, it calcines at 600° F.

I have perfected a process for producing insulation of this general type which eliminates the foregoing disadvantages inherent in conventional "85% magnesia."

In carrying out the invention, asbestos, constituting one type of fiber which may be employed, is defiberized into its approximate ultimate filaments and then mixed with a preponderance of water and a binder. Subsequently, the slurry is placed in a mould where it is lightly compressed, and then permitted to settle and the surplus water to drain. There remains a mass of fibers held together by a binder, initially set, so to speak, and with countless interstices or voids between the set fibers. Then the unit is cured in any suitable manner. By way of example—and assuming that an acceleration of the setting of the spaced relationship of the fibers is desired, it may be introduced into a chamber under steam pressure for several hours. In any event, after curing, the unit is finally placed in a drier where excess moisture is evaporated. It is then ready for use.

One of the outstanding characteristics of my product is the countless voids or air pockets present in a given area of the block or bar—undoubtedly due, primarily, to the maximum degree to which the asbestos fibers are disintegrated at the outset, taken in conjunction with the means whereby they are intimately associated with each other and then permanently held in such relationship. A superior insulation is thus obtained.

Other objects and advantages will appear from the following explication taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of one form of apparatus employed in practicing the invention;

Fig. 2 is an illustration in perspective of a compressing device;

Fig. 3 is a perspective view of a unit;

Fig. 4 is a fragmentary section of the unit, greatly magnified;

Fig. 5 is a graph indicating the relative thermal conductivity of "85% magnesia" and the invention herein; and

Fig. 6 is a similar graph illustrating the relative effect of temperature on weight, shrinkage and strength.

A quantity of asbestos fiber in its raw state, say, 80 lbs., is fed into hopper 10 of a battery of disintegrators A. Through impact, and extreme pressure created by suction fan B, the fibers are broken down into innumerable very short, slender components, which are carried off to the collector C, from whence they are deposited in the mixer D. Some idea may be gained with respect to the transition of the asbestos from its original state to its ultimate form when it is said that 80 pounds of raw fiber will develop 40 to 50 times in bulk. As stated, the fibers are short in contradistinction to the long strands which are essential as a binder for the calcined dolomite rock employed in the production of "85% magnesia." Further, the fibers are so short as to be unfit for use in spinning or weaving operations.

Also in mixer D are added an excess quantity of water, for example, approximately 75 gallons or 625 pounds, 42 pounds of cement and 12 pounds of silica sand, preferably pulverized, or other suitable silicious material, as high temperature clay, bentonite, bauxite ore, or diatomaceous earth. The mixer is operated for a few minutes, whereupon it is inverted and the slurry-like contents poured into mould E (inside dimensions 36¾" x 12¾" x 3¾") until it is completely filled. Here the mass is very lightly compressed, say, about 250 pounds per square inch for an instant by means of any device suited for the purpose, as a reticulated frame 11, to free it of any unduly large entrapments of water or air and thereby insure an initial uniform density. To regulate the amount of compression to a nicety, the inside walls of the mould are provided with stops 12 a short distance below the top edges of the mould which are engaged by the lower portion of the frame 11 as the latter is constrained downwardly within said mould. Within an hour or so the water drains through the foraminous bottom of the mould and the mass settles rapidly therein. In this manner, owing to the over-abundant supply of water, the individual filaments 13 are suffused or bathed sufficiently with the binding agent to cause the deposition thereon of only a relatively

thin coating 14—just enough to bind the filaments together and leave therebetween the countless interstices or voids 15—see Fig. 4. Moreover, the initial setting of the filaments or fibers so acquired at this point is preserved throughout the subsequent stages of the process.

Next in order, the bar or other desirably-shaped units, as 16 in Fig. 3, is transferred to a truck 17 or equivalent support, and then introduced into pressure chamber F. where it is subjected to a minimum of 120–125 pounds saturated steam pressure—as opposed to dry or superheated steam, because the latter would arrest the chemical reaction—for approximately 10 hours to thoroughly cure the product. During this stage of the process, a further induration of crystallization of the binder ensues.

Using approximately the proportions hereinbefore given, i. e., asbestos 80 pounds; cement 42 pounds; silica 12 pounds; and water 75 gallons or 625 pounds; 8 blocks or units are produced, and each unit measures a scant 36¾ inches in length, 12¾ inches in width, and 3¾ inches in thickness. After the slurry is first placed in the mould and lightly compressed to rid it of large water or air pockets, its weight is 78 pounds. Subsequent to curing, its weight is 53 pounds. And finally, after drying, the weight of a single unit is reduced to a low of about 15 pounds—a reduction from its original heavy, soggy mass of 63 pounds, or over 80%. The space formerly occupied by water—one can appreciate that it is very considerable—becomes an exceedingly light, micro-cellular structure with a bulk density of 14.3 pounds per cubic foot.

As the final step, unit 16 is placed in dryer G and freed of moisture. Thereafter, the unit may be cut to desired size and shape.

In substantiation of claims of marked superiority of my invention over "85% magnesia," it is not deemed amiss to refer to the results of comparative tests conducted recently by Professor Gordon B. Wilkes, of Massachusetts Institute of Technology, Cambridge, Massachusetts.

Thermal conductivity.—The coefficient of thermal conductivity of the insulation constituting the subject matter of the present invention was determined by the guarded plate method—the samples having been dried previous to being placed in the tester—with the following results:

Thickness under test, 2.05 inches.			
Bulk density, dry, 10.5 lbs./cu. ft.			
Temp. warmer surface, °F.	174	443	694
Temp. cooler surface, °F.	71	80	98
Mean temperature, °F.	123	262	396
Kt—Coef. thermal conductivity	0.344	0.396	0.437

Kt is expressed in B. t. u., hr., —¹ ft., —² inch, °F. —¹

These results are shown graphically in Fig. 4, in which "X" designates the instant invention. And for comparison, the approximate range of "85% magnesia" is illustrated.

Effect of temperature on weight, shrinkage and strength.

For these tests, blocks (18" x 6" x 2") of "X" insulation were submitted and similar blocks of J—M 85% magnesia were purchased in Boston. Samples of both kinds of blocks were first dried and then heated for 5 hours at 500° F., 600° F., and 700° F. Three blocks of each kind were carefully weighed and the length determined accurately before and after each heat treatment. For these results the % less in weight and the % shrinkage were determined.

The breaking load was determined by supporting the blocks on 10 inch centers and gradually applying a load in the middle until rupture occurred. The results are the average of three determinations on each type of material.

Dry basis	"X"	85% magnesia
Percent loss in weight:	*Percent*	*Percent*
As received to dry	2.5	5.0
Dry to 500° F.	2.5	10.1
Dry to 600° F.	2.5	14.9
Dry to 700° F.	4.2	39.8
Percent shrinkage:		
As received to dry	0.06	0.06
Dry to 500° F.	0.15	0.11
Dry to 600° F.	0.08	0.44
Dry to 700° F.	0.17	1.02

	"X"	85% magnesia
Breaking load:	*Lbs.*	*Lbs.*
Dry	46	73
After 500° F.	50	72
After 600° F.	41	58
After 700° F.	42	24

The above results are shown graphically in Fig. 6 of the accompanying drawings—"X" indicating the instant invention.

Another test conducted by Armour Research Foundation, affiliated with Illinois Institute of Technology, proved that my heat-insulating structure did not calcine until the temperature in an electric furnace reached 1860° F., as against 600° F., for 85% magnesia.

It should be understood that in its broader aspects, my invention comprehends the employment not only of the various means described but of equivalent means for accomplishing the same or approximate result. For example, the term "asbestos fiber" is employed in a generic sense. Rock wool, mineral wool, or like mineral fibers, may be used instead. Then too, the product may be used to insulate low temperatures. Or the curing may be devised in some other manner. It is desired to reserve the right to effect such changes, modifications or variations as may come fairly within the scope of the appended claims.

The present application is a continuation in part of my co-pending application Serial No. 370,910, filed December 20, 1940.

I claim:

1. The herein described process of producing fibrous insulation, which is characterized by mixing fine mineral fibers in a suspension of water and a binder consisting of cement and silicious material in which only sufficient binder is held in suspension to coat thinly the fibers, depositing the resultant slurry in a mold, lightly compressing it to eliminate any unduly large entrapments of water or air, causing the same to drain, curing the mass in the presence of saturated steam, and then drying the product.

2. The herein described process of producing fibrous insulation, which comprises defiberizing asbestos into its approximate ultimate filaments, mixing with said filaments a mixture of water and a binder consisting of cement and silicious material and in which mixture only sufficient binder is held in suspension to coat thinly the filaments, depositing the resultant slurry in a mold, lightly compressing it to eliminate any unduly large entrapments of water or air, causing the same to drain, curing the mass in the presence of saturated steam, and then drying the product.

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3. The herein described process of producing fibrous insulation, which comprises expanding asbestos into its approximate ultimate filaments, mixing with said filaments a mixture of water and a binder consisting of cement and silicious material, depositing the resultant slurry in a mold, compressing it at about 250 pounds per square inch, causing the same to drain, curing the mass in a chamber supplied with saturated steam, and then drying the product.

4. The herein described process of producing fibrous insulation, which comprises defiberizing asbestos into its approximate ultimate filaments, mixing with said filaments a mixture of water and a binder consisting of cement and pulverized silicious material, depositing the resultant slurry in a mold, lightly compressing it to eliminate any unduly large entrapments of water or air, causing the same to drain, curing the mass in a chamber supplied with saturated steam, and then drying the product.

5. The process of producing a fibrous insulating unit, which comprises mixing the following ingredients in the approximate proportions recited, 80 parts of asbestos defiberized into its ultimate filaments, 42 parts of cement, 12 parts of silicious material and 625 parts of water, agitating the mixture, depositing the resultant slurry in a mold, lightly compressing it to eliminate any unduly large entrapments of water or air, causing the same to drain, curing the mass in the presence of saturated steam, and then drying the product.

NATHAN E. NEWMAN.

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