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METHOD OF PRODUCING CORK BOARD

Filed March 21, 1938

Fig. 1.

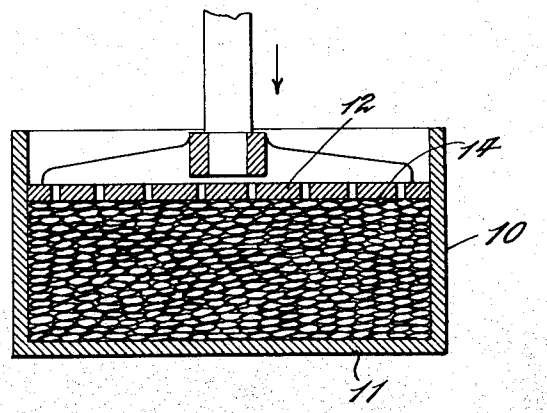


Fig. 2.

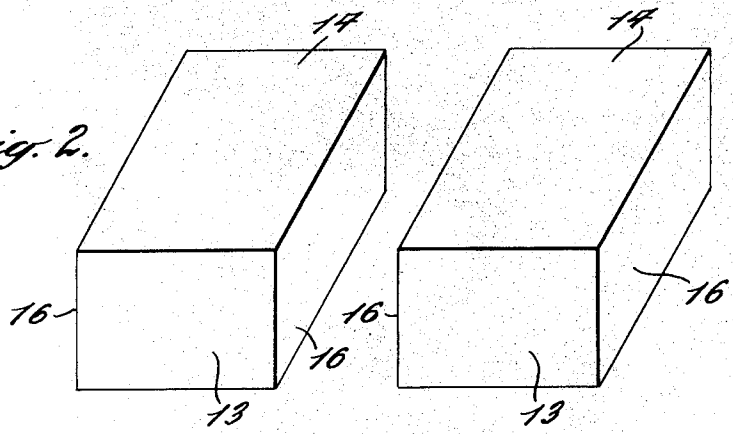
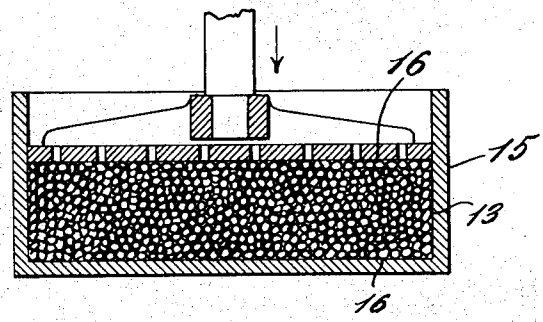


Fig. 3.



INVENTOR.
Quirin J. Schwarz
BY
Fackenthal & Hirschman
ATTORNEYS

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METHOD OF PRODUCING CORK BOARD

Quirin J. Schwarz, Rutherford, N. J., assignor to United Cork Companies, Kearny, N. J., a corporation of New York

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8 Claims. (Cl. 18—48)

The present invention relates to an improved method for producing compressed cork board suitable for use as isolating and/or insulating material, for flooring and other purposes, and to the product obtained thereby.

It is the general object of the invention to produce cork board of higher density and of higher resiliency and thus characterized by greater structural strength than has been commercially manufactured heretofore, and in particular to produce a board of, low compressibility and high vibration and sound absorbing qualities.

More particularly it is an object of the invention to provide an improved method for the manufacture of a cork board having a higher density than has heretofore been common commercially, coupled with a high degree of resiliency wherein relatively low capacity presses may be employed and wherein the cork may be efficiently de-resinified with steam or the like without the use of such medium at excessively high pressures.

It is also an object of the invention to provide an improved method for the production of higher density cork board wherein the board retains substantially the volume to which it is reduced by the ultimate compression, so that boards of a predetermined density may be manufactured on a commercial scale.

In accordance with the present invention, cork boards of more highly compressed character is produced from cork particles by carrying out the compression of the latter in two stages in such manner and under such condition is that in spite of the highly compressed nature of the cork, the board is nevertheless resilient to such a high degree that it is eminently suited for use as foundation material for machinery, and the like, to absorb vibration, for sound-proof floors and walls, etc.

In the preferred manner of carrying out the invention, a mass of cork particles is first compressed to an intermediate density in any suitable or known manner, but preferably under elevated temperature, as with the aid of steam, whereupon the partially compacted block is cut into sections and the latter then further compressed, advantageously in a direction at right angles to that in which the first pressure was applied.

By proceeding in the manner just outlined, a number of important advantages are obtained. In the first place, the initial treatment, involving heating of the cork particles with steam or other heating medium followed by or accompanied by pressure, expels substantially all the moisture and a certain amount of oils, resins and other volatile material contained in the cork. As the amount of expelled material is variable, depending not only upon source of the cork, but upon the conditions of treatment, it is practically impossible to predetermine the density of the final block of compressed cork by controlling the conditions of heating and compression in present commercial operation. By my improved process, however, the intermediately compressed block or sheet of cork, from which all or substantially all of the volatile material has been expelled, and thus the most important sources of variability removed, can be measured and weighed and the final volume of a given sample can be readily calculated in order to produce a product having a desired density. The second stage of compression, with or without the aid of steam, but preferably at elevated temperature, can then be readily carried out to the degree required to produce the desired density. Thus the second compression compresses the intermediate cork block (or a cut section thereof) to a volume which bears the same proportion to the volume of the block or section being again compressed that the measured, intermediate density bears to the desired or final density.

A further advantage of my improved process, as already indicated, arises from the fact that a cork board produced by two-stage compression in accordance with the invention is much more resilient than a board compacted to the same degree in a single compression stage. This is particularly true when the cork has been subjected, while in the heated condition, to pressures applied in sequence and at an angle to each other. Contrasted with a process in which the cork board is produced by the continuous application of pressure in one and the same direction, in which the cork particles undergo what may be termed only one degree of distortion, in the preferred form of my improved process the cork particles are first flattened by the pressure initially applied and are then further distorted by a pressure acting at an angle, for example at right angles, to the direction of the first-applied pressure. Considering a cork particle of more or less spherical shape, this particle will be compressed toward the disc-like condition by the pressure first applied. The second application of pressure, acting, for example, at right angles to the first applied pressure, then acts to distort the particle in another direction. In consequence, the cork particles are forced into the in-

terstitial spaces from various angles so that the volume of the voids is greatly reduced and the density of the mass thus increased. The product of the preferred mode of operation of the present invention thus differs from a board of equal density produced by a compression in only one direction, among other respects, in the feature that the voids have been reduced in two directions and the particles likewise distorted in two directions, so that the mass is relatively isotropic in nature, and, considering the density, the particles are still in a resilient condition. On the other hand, a board made by compressing cork particles in only one direction under a necessarily higher unit pressure is in fact denser in the direction of the applied pressure and less flexible and resilient in such direction; and since cork particles do not spread to any great extent on compression, there are considerably more voids in a direction at right angles to the compression than in the direction of compression. However, although compression in two directions is advantageous, the present invention relates to two-stage compression broadly, whether in the same or different directions.

As the relative rigidity of the cork is due, not to any congealed resin or other binder, but to the compactness of the body of cork itself, substantially free from resinous or other binder, the resiliency and isolating qualities of the original cork particles are retained by the process of the invention. There is thus obtained a board which, while itself in a highly compacted condition, is nevertheless free of solid binder or other similar material tending to reduce the resiliency, durability and isolating properties of cork.

A still further advantage of my improved process is due to the fact that much lower pressures are required to effect the final compression than would be necessary to secure the same degree of compression of a cork board in one stage. According to my improved process, the second stage of compression is carried out after the cork block or sheet has been brought to an elevated temperature of the order of about 200° to 400° F. although lower and higher temperatures may be employed. The board in this heated condition can be compressed with a fraction of the pressure required to produce the same degree of compression of a cork board compressed in one stage from the raw cork. The compression according to the invention is further facilitated by the fact that since the second compression is preferably accomplished in a direction at right angles to the first compression, air spaces and pockets are available to the compressed cork which either would not be reached or would require higher degrees of pressure for occupation by the cork if the compression were continued in the original direction. By compressing the cork in two directions which are at an angle to each other any air pocket or spaces created or incompletely filled by the first compression are to a large extent filled with cork during the second compression.

A satisfactory mode of carrying out the invention is as follows:

A mass of cork particles is placed into a suitable mold or chest and confined within a fixed volume. Hot air, superheated steam or other heated fluid is then passed through the cork until the desired degree of removal of water, oils, resins, and other volatile matter is attained. During this procedure the mold is preferably locked or otherwise held against expansion, so that the expanding particles are compelled to creep into the interstitial spaces and thereby become interlocked. The cork is then compressed while hot to an intermediate volume or density, the heating being continued, if desired, during the compression. The compressed block of cork is then removed and cut into smaller sections along planes parallel to the direction in which the pressure was applied. Either the sections or the whole block is weighed in order to determine the density of the material at this stage. While the sections are still hot they are placed in the first mold or in a different mold and subjected to pressure at right angles to the direction of the pressure previously applied. The sections may be first subjected to the action of steam which acts to soften and moisten the body of cork and facilitates its further compression. When the desired degree of compression, as predetermined by the density of the block sections and the final density desired, has been applied, the mass of cork is locked in its compressed condition and held against expansion until it has cooled to a considerable extent. The cooling may be conducted down to approximately room temperature before the locking devices are released, but it will ordinarily be found not to be necessary to keep the cork confined until this temperature is reached. The cooled block or sheet of cork so obtained will not expand appreciably when it is removed from the mold and may be cut into thinner sheets or into smaller blocks, as may be desired.

By the two-stage compression above described, I am able to produce easily a cork board having a density as high as 2½ lbs. and even more per board foot with the relatively low capacity presses in commercial use in the cork board industry.

The initial compression of the cork may be carried out in accordance with the manner described in my United States Patent No. 2,041,377. As described in such patent, the cork sheet or block obtained by the initial heating and compression does not depend for its cohesion on any resin or other binder, but upon the interlocking of the particles of cork. The sheets or blocks are thus substantially free of resin and are practically pure cork.

As described in my patent above referred to, I prefer to confine the mass of cork particles closely within a treating chamber or mold without exerting any substantial degree of pressure thereon during the passage of the hot (non-oxidizing) vapor or gas therethrough, the volume of the cork mass being kept substantially constant until practically all of the resinous and other volatile matter has been expelled, the cork being then subjected to pressure while still confined within the mold.

The compressed sheet or block obtained in accordance with the present invention has an even greater degree of cohesion than that obtained according to the process of the above-mentioned patent, by reason of the fact that the particles have been subjected to an interlocking force or pressure in more than one direction. Moreover, as above explained, by the two-step mode of compression, the final density of the product can be quite accurately controlled.

The accompanying drawing illustrates diagrammatically and by way of example the steps involved in carrying out my improved process according to one embodiment thereof. In said drawing,

Fig. 1 illustrates the mass of cork particles at the end of the first stage of compression; Fig. 2 shows the slab or block of Fig. 1 cut into sections, here illustrated as two halves; and Fig. 3 shows one of the halves illustrated in Fig. 2 at the end of the second compression at right angles to the direction of the first compression.

The mold 10 may be of any suitable type and may, for example, be provided with means for passing hot gases or super-heated steam through the mass of loose cork particles confined within a fixed volume, as described in my above-named patent, after which the hot particles are compressed to the condition shown in Fig. 1. The particles are confined within the walls of the mold and between the bottom 11 thereof and the movable top cover plate 12, pressure being applied in any suitable fashion as indicated by the arrow. When the block has attained a cohering condition, it is removed from the mold and cut into a suitable number of slabs 13, two halves being shown by way of example in Fig. 2. The top surface 14 of these slabs corresponds to the top surface 14 of the block shown in Fig. 1. These slabs are now placed in another mold 15 with the surface 14 parallel to the direction of pressure, i. e., the pressure is applied to the side 16 which is at right angles to the surface 14. When the desired density or degree of compression has been reached, the slab or section is allowed to cool, while still under pressure either in the mold, or outside the mold by being suitably clamped to prevent expansion during the cooling.

The temperatures and pressures applied in my process may be those customarily employed in this art. Variations from the specific conditions above described, may, therefore, be made within the scope of the appended claims without departing from the principles of the invention. Thus, the compression in directions at an angle to each other may be accomplished in one stage, although in commercial operation it will ordinarily be found to be more convenient to effect the compressions in succession.

It is obvious, of course, that my process is equally applicable to any cork mass which has already been subjected to a processing, partial or completed, to form a cork board, which board can be re-steamed or re-heated and re-compressed to a greater density in accordance with my process, the mass being held under pressure while it cools, as above described.

I claim:

1. The method of manufacturing cork blocks and boards suitable for use as isolating material and other purposes, comprising passing a hot, non-oxidizing gas through a mass of cork particles confined within a space of fixed volume without exerting any substantial degree of external pressure thereon, to expel volatile material therefrom, compressing the particles by applying external pressure thereon in one direction to reduce said volume and increase correspondingly the density of the cork mass, and then compressing the still hot, partially compressed cork mass in a direction at right angles to that of the first-applied pressure to reduce still further the volume and increase again the density of the mass.

2. The method of manufacturing cork blocks and boards suitable for use as isolating material and other purposes, comprising passing a hot, non-oxidizing gas through a mass of cork particles confined within a space of fixed volume without exerting any substantial degree of external pressure thereon, to expel volatile material therefrom, compressing the particles by applying external pressure thereon in one direction, cutting the mass of cork into smaller sections along planes parallel to the direction of the first-applied pressure, and then compressing the sections in a direction at right angles to that of the first-applied pressure, each compression being effected by applying substantially uniform pressure over the whole of a side of the cork mass until the volume of the mass has been reduced to a predetermined degree.

3. The method of producing a highly compressed but resilient mass of cork suitable for use for isolating and other purposes, which comprises placing a mass of cork particles into a mold, confining the cork particles within their original volume while passing a heated fluid therethrough at a temperature of about 200° to 400° F., compressing the cork to an intermediate volume, removing the compressed cork mass from the mold and cutting the same into smaller sections along planes approximately parallel to the direction of the applied pressure, placing a cut section into a mold and applying pressure thereto in a direction at right angles to that of the first-applied pressure, and cooling the compressed cork under pressure.

4. The method of manufacturing cork blocks and boards suitable for use as isolating material and other purposes, comprising compressing a mass of heated cork particles into a cohering block, then applying pressure to the block, while still hot, uniformly throughout the whole of a side of the block which is at right angles to the side to which the initial pressure was applied to reduce further the volume of said mass of cork particles, and allowing the block to cool while still under pressure.

5. The method of manufacturing cork blocks and boards of a predetermined density or weight per board foot and suitable for use as isolating material and other purposes, comprising passing a hot fluid through a mass of cork particles confined within a space of fixed volume corresponding approximately to the volume of the mass of cold, loose, cork particles until substantially all of the volatile material has been removed from the cork, compressing the cork particles into a cohering block, measuring the density of the so-compressed block, and then applying pressure to the block while hot throughout the whole of a side of the block which is at right angles to the side to which the initial pressure was applied until the volume has been reduced to that fraction of the intermediate volume that the measured density bears to the desired density.

6. The method of manufacturing cork blocks and boards of a predetermined density or weight per board foot and suitable for use as isolating material and other purposes, comprising passing a hot fluid through a mass of cork particles confined within a space of fixed volume corresponding approximately to the volume of the mass of cold, loose, cork particles until substantially all of the volatile material has been removed from the cork, compressing the hot cork particles into a cohering block, measuring the density of the so-compressed block, applying pressure to the still hot compressed cork throughout the whole of a side of the mass which is at right angles to that at which the pressure was first applied, until the volume has been reduced to that fraction of the intermediate volume that the measured density bears to the desired density, and cooling the

compressed mass of cork while confining it to the reduced volume attained by the last compression.

7. The method of forming cork blocks and boards suitable for use as isolating material and other purposes, comprising subjecting a mass of loose cork particles to pressure and heat until a cohering block is formed, said pressure being applied to one side of said mass and acting in one direction, cutting the block into sections, then applying pressure to a section, while still hot, uniformly upon and throughout the whole of a side of the section which is at right angles to the side to which the initial pressure was applied to reduce further the volume of the mass of cork particles in said section, and allowing the section to cool while still under pressure.

8. In a process for the manufacture of compressed cork board of high density for isolating and other purposes from a cork board composed of compressed cork particles, said particles having been heated and compressed by pressure applied to one side of a mass thereof and acting in one direction, and being of lower density than the desired final density, the steps which comprise subjecting said cork board, while still in heated condition, to pressure acting in a direction at right angles to the originally applied pressure and uniformly over the whole of a side of the board, until final density is reached, and allowing the compressed board to cool under pressure, whereby said compressed board remains at substantially the volume at the final compression.

QUIRIN J. SCHWARZ.