Aug. 18, 1936. C. N. WENRICH ET AL 2,051,628

ACOUSTIC PANEL AND METHOD OF MAKING SAME

Filed Jan. 16, 1932

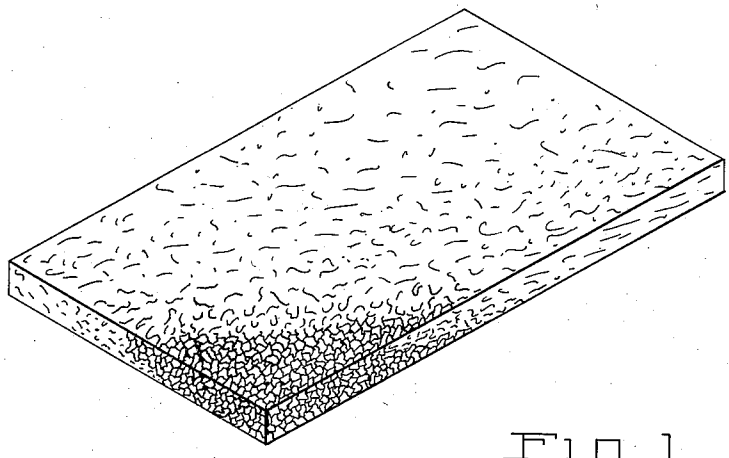


Fig. 1

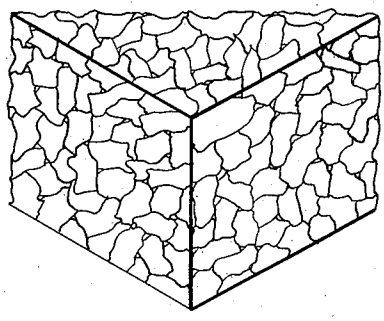


Fig. 2

Inventors
Calvin N. Wenrich
Herbert Paschke
Clarence C Voigt
by Walter F Kaufman
Attorney

Patented Aug. 18, 1936 2,051,628

UNITED STATES PATENT OFFICE

2,051,628

ACOUSTIC PANEL AND METHOD OF MAKING SAME

Calvin N. Wenrich, Herbert Paschke, and Clarence C. Vogt, Lancaster, Pa., assignors to Armstrong Cork Company, Lancaster, Pa., a corporation of Pennsylvania

Application January 16, 1932, Serial No. 587,130

8 Claims. (Cl. 18—48)

This invention relates to a corkboard for use in surfacing the interiors of auditoriums, halls or any rooms in which it is desired to enhance the acoustical properties by providing ceilings and walls of a sound absorbing and non-reverberating quality. The invention also relates to the process of making acoustic panels.

It has been found that one of the main sources of poor acoustical properties of auditoriums and other rooms used for similar purposes lies in the fact that the sounds are reflected and reverberated from the ceiling and wall surfaces of the room. Attempts have heretofore been made to utilize the sound absorption properties of cork to overcome these disadvantages which were extremely severe in the ordinary construction of hard smooth plaster surfaces. The cork used for acoustic purposes consisted of granulated or waste cork bonded together to form a panel. The cork panels were secured to ceilings or walls by any suitable tie members or cement. Constructions of this type showed a marked improvement in sound absorption qualities over the smooth dense surfaces that had been customarily built previous to that time. However, the prior art constructions of cork panels for acoustic purposes have signally failed to attain the maximum acoustic insulating value possible.

It is an object of our invention to provide a cork panel that will have a maximum acoustic insulating value. It is a further object of our invention to provide a strong and durable cork panel that is relatively inexpensive to manufacture and install. It is a further object of our invention to provide a cork panel which may be produced in the natural color of the cork so that it may readily be decorated in any desired color.

The advantages of our invention will become apparent upon reading the annexed specification taken in conjunction with the accompanying drawing in which:

Figure 1 is a perspective view of a cork panel constructed in accordance with our invention; and

Figure 2 is a magnified detail view through a portion of the panel of Figure 1 illustrating the peculiar construction of our cork panels.

By reference to Figure 2 it will be seen that the cork particles simulate fibrous material in appearance to some extent. We obtain this unusual structure by running the cork through a mill consisting of two cylindrical rolls which have corrugations on their surfaces. The rolls are run at a differential speed, one roll being rotated about three times as fast as the other. These rolls produce a kneading effect and cause the particles to be torn or shredded so that a large percentage of the particles have a long axis. Our grinding process, in addition to producing particles having long axes, softens the cork and imparts a ragged finish to the surfaces of the cork particles. The special shape, the unusual softness, and the ragged finish of the cork particles all contribute to the production of a cork panel having an exceptionally high acoustic value. The grinding process also removes substantially all of the hardback from the cork. The hardback is the hardened outer exposed surfaces of the cork. It is extremely brittle, and after the grinding operation substantially all of it is sieved out with fines. Our cork particles are graded to a substantially uniform size so that the fine grades of material which would otherwise fill the interstices between the cork granules in the finished article are eliminated. The grading of the cork to obtain particles of substantially uniform size is particularly advantageous in obtaining good uniform sound absorbing qualities.

We may form a cork panel from the elongated cork particles with or without the addition of a binder. In forming a panel without the binder, a mass of the cork particles is fed into a mold and is heated to approximately 550° F. for about twenty minutes. The heat is supplied by passing superheated steam through the cork contained in the mold. The mold is perforated so as to allow the escape, along with the exhaust steam, of a large proportion of the natural resins of the cork, which are volatilized by the heating process. The steam causes the cork particles to expand. The particles, however, are confined by the walls of the mold and are interlocked to form a block. The block is then sawed into individual panels of any desired size. Although it is generally more economical to mold the cork particles into blocks and then saw the blocks into panels, it is possible to mold the panels individually in any desired size and shape. The individual molding process is of particular advantage in cases where it is desired to form panels of a special shape.

We prefer to form a panel weighing approximately .70 pound per board foot because we have found that our panels have a maximum sound absorbing value at approximately that density. The amount of the increase in sound absorption with the increase in density of the corkboard appears to be dependent to some extent upon the size of the particles forming the board. We prefer to use particles within the size range of

from $\frac{3}{16}$'' to ½'' when the panel is to be formed without the addition of any binder.

We may form a block or panel by mixing our cork particles with any suitable binder and then molding the mass. We prefer to use a synthetic resin, usually of the phenolic condensation or urea-formaldehyde class, although any suitable resin may be used. As an example, we may use equal parts by weight of phenol and formaldehyde condensed with ammonium hydroxide to the initial stage of condensation. The amount of binder used may vary from ten to thirty per cent of the weight of the cork. We prefer to compress the cork particles to which a binder has been added from 2½ volumes to 1, although compressions ranging from 1½ to 1 to 3½ to 1 have been used. The size of particles to which a binder has been added may range from ¼'' to ½''.

When a binder is used with the cork particles the heat to which the mass is subjected to set the binder is generally less than 300° F. This low temperature is particularly advantageous because it does not affect the natural color of the cork particles. The color of the cork panel made in accordance with this method is of pleasing appearance. The panel has a further advantage in that it may be decorated in any pastel tint as well as in darker colors.

Ordinary cork board has a sound absorption value of .32 in a thickness of about one and one-half inches at a frequency of 512, while our new and improved cork board has a sound absorption value of .50 in the same thickness and at the same frequency. This unexpectedly high acoustic value appears to be dependent almost entirely upon the peculiar shape of the cork particles, the softness of the individual cork particles, and the ragged edges formed by the shredding operation, although the size of the particles does have some effect thereon. The particular arrangement of the cork particles in the finished board is immaterial. This simplifies the manufacture of the boards because it eliminates the necessity of arranging the cork particles in any specific relationship. The mass of cork particles may be dumped haphazardly into the mold and molded into the desired shape. Cork panels that have been baked without binders and panels that have binders incorporated therein have shown substantially the same acoustic properties.

Although the reason for these unusual acoustic properties is not entirely understood, it seems logical to assume that the viscous drag of the many fine projections on the elongated cork particles so impedes the progress of air-borne sound waves that the reflection and transmission of the sound waves is minimized. The softness of the cork particles imparted by the kneading action probably increases the damping factor.

While our material has been described as particularly valuable for use in auditoriums or the like, it is also desirable for use in interior finish for offices, stores or wherever sound deadening properties are desirable. While we have shown and described two particular embodiments of our invention it will be understood that variations to meet different conditions and purposes may be made, and we do not desire to be limited to the specific details described except as restricted by the appended claims.

We claim:

1. An article for use in acoustical treatment comprising substantially entirely shredded cork pieces having longitudinal dimensions materially greater than the cross-sectional dimensions, said pieces being mechanically softened and having ragged surfaces.

2. An article for use in acoustical treatment consisting substantially entirely of shredded cork pieces having ragged surfaces and longitudinal dimensions materially greater than the cross-sectional dimensions, and a binder present in an effective amount to hold the article together but insufficient to fill the voids between the cork pieces, the exposed surface of the article being characterized by the presence of relatively long sound-absorbing channels lying therein, extending inward therefrom and bounded by the ragged-surfaced particles.

3. In the method of producing an article for use in acoustical treatment, the steps consisting in producing pieces of cork having lengths materially greater than their cross-sectional dimensions by a kneading action which softens the cork and tears the pieces to form ragged surfaces, grading the pieces to remove those sufficiently small to fill voids between the larger pieces, and binding the remaining pieces together while maintaining voids therebetween to form a labyrinth having ragged cork walls for the absorption of sound waves.

4. In the method of making an article for use in acoustical treatment, the steps consisting in shredding cork to produce pieces having ragged surfaces and lengths materially greater than their cross-sectional dimensions and softened by mechanical working in the shredding operation, grading the particles to a substantially uniform size by eliminating the small particles which would tend to fill the voids in the finished article, and binding the said particles of a substantially uniform size together under heat and pressure with insufficient binder and insufficient pressure to fill the voids between the pieces.

5. An article for acoustical treatment comprising ragged-surfaced cork pieces having dimensions of width and thickness approaching each other and longitudinal dimensions materially greater than either of these dimensions and a binder present in an effective amount to hold the article together, said article being characterized by the presence of relatively long sound-absorbing channels lying in its exposed surface, extending inward therefrom and bounded by the ragged-surfaced cork pieces.

6. An article for use in acoustical treatment comprising a plurality of pieces of cork having generally elongated shape and the softened structure and ragged surfaces imparted by shredding, held together as a body having an apparent density of not more than approximately .7 pound per board foot and an absorption coefficient in excess of .32 in a thickness of about one and one-half inches at a frequency of 512, said article having relatively long sound-absorbing channels lying in its exposed surface, extending inward therefrom and bounded by the ragged-surfaced cork pieces.

7. An article for use in acoustical treatment comprising a plurality of pieces of cork having generally elongated shape and the softened structure and ragged surfaces imparted by shredding, held together as a body having an apparent density of not more than approximately .7 pound per board foot and an absorption coefficient of at least about .50 in a thickness of about one and one-half inches at a frequency of 512, said article having relatively long sound-absorbing channels

lying in its exposed surface, extending inward therefrom and bounded by the ragged-surfaced cork pieces.

8. In the method of making an article for acoustical treatment, the steps consisting in forming a plurality of generally elongated cork pieces having the softened structure and ragged surfaces imparted by shredding and binding the same together into a body having sufficient density to possess the strength and rigidity required for application to surfaces to be treated acoustically, but having sufficient elongated voids at the exposed surface to permit the transmission of sound into the body and maintaining a sufficiently open structure that the coefficient of sound absorption is not less than approximately .50 in a thickness of about one and one-half inches at a frequency of 512.

CALVIN N. WENRICH.
HERBERT PASCHKE.
CLARENCE C. VOGT.