May 22, 1945. J. S. IRVINE ET AL 2,376,698

FASTENING FOR FIBROUS BOARDS

Filed March 31, 1944

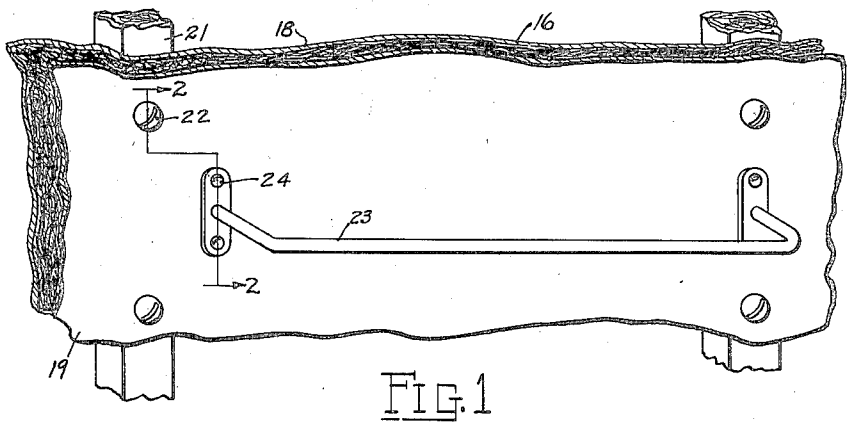


FIG. 1

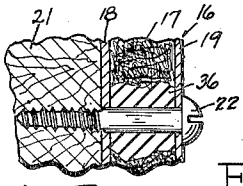
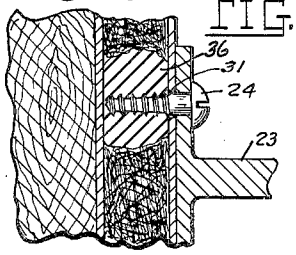


FIG. 2



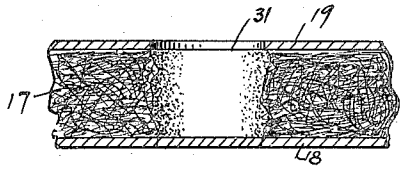


FIG. 3

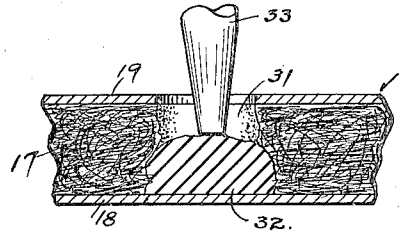


FIG. 4

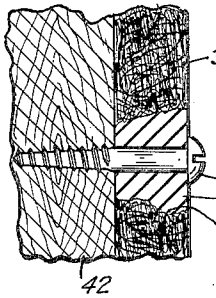


FIG. 7

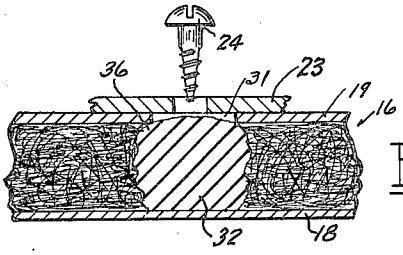


FIG. 5

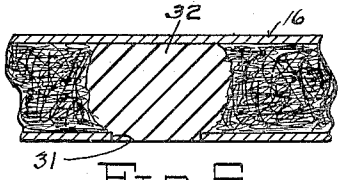


FIG. 6

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Patented May 22, 1945 2,376,698

UNITED STATES PATENT OFFICE

2,376,698

FASTENING FOR FIBROUS BOARDS

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Application March 31, 1944, Serial No. 529,002

3 Claims. (Cl. 72—105)

This invention relates to insulating boards especially of the kind used as wall panels or wall surfacing materials. It relates particularly to fastenings for securing fixtures and other objects to the boards and for securing such boards to walls and other supports.

The invention is applicable generally to low density sound and thermal insulating boards of fibrous material such as mineral wool, e. g., fibrous glass, or bagasse, wood fibers and the like, and boards of comminuted material, for instance, ground cork. These materials are usually combined with binders or adhesives and treated under compression and heat to form integral board-like bodies of relatively low density, say of from 2 to 16 pounds a cubic foot.

Many of these kinds of boards are provided on one or both major faces with surfacings such as resin coatings, cloth, resin-impregnated cloth, wood, wood veneer, plastic laminates of cloth or paper, metal, and other thin, strong, smooth facings. These facings are stronger and more dense than the fibrous or comminuted material and used mostly where the boards are employed to form walls of rooms, cabinets, and other enclosures. They provide a smooth decorative surface and one having high resistance to denting and puncturing.

Faced and unfaced boards of this character have presented serious problems in fastening the boards to supporting structures, and in fastening objects such as wall fixtures to the boards. These boards, due to the low density of the fibrous material, have little or no capacity to hold ordinary fastening elements such as nails or screws. In the case of faced boards, the facings are usually too thin to provide the purchase required to permit relatively heavy objects to be secured to the boards by means of ordinary fastening elements.

It is the object of this invention to provide a system for fastening faced and unfaced low density insulating boards to supports and for fastening other objects to the boards using ordinary nails, screws and similar fastening elements, and that increases the capacity of the boards for holding the fastening elements to such an extent that it is comparable to or better than the capacity of most woods.

It is a further object to provide such a method of fastening adapted to be performed at the time of installation of the boards and fixtures by simple operations without the need of special tools.

It is another object of the invention to provide fastening means that will resist the compressive force exerted on the boards by nails or screws employed to secure the boards to supports and in this way prevent boards especially of very low density fibrous material surfaced with thin facing materials from being deformed at the location of the nails or screws to an extent resulting in unsightly depressions in the outer surface of the boards.

The preferred embodiment of the invention is illustrated in the drawing in which:

Figure 1 is an elevational perspective view of a portion of a wall formed of faced insulating boards;

Figure 2 is a vertical cross-sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a cross-sectional view of a faced fibrous insulating board illustrating the first operation in the practice of the invention;

Figure 4 is a similar view illustrating an intermediate step in the practice of the invention;

Figure 5 is a similar view showing the last operation;

Figure 6 is a cross-sectional view of a faced fibrous insulating board depicting a different application of the invention; and,

Figure 7 is a cross-sectional view of an unfaced insulating board showing the application of the invention to this kind of board.

Although, as mentioned, the invention is applicable in many of its aspects to various kinds of insulating boards, it is most valuable in the case of low density fibrous boards. Fibrous glass boards ranging in densities of from 4 to 10 pounds a cubic foot, for example, are preferred for walls of enclosures. These boards are ordinarily formed by compacting a mass of long fine glass fibers to the desired density and, while the mass is held to the necessary thickness, curing or setting a binder previously distributed over the fibers of the mass. After curing, the compacted mass is in the form of a fairly rigid board replete throughout with voids. The length and fineness of the fibers in the board lends a high degree of resilience and strength to the board.

During or after the curing operation, the board may be covered on one or both major faces with resin, wood, cloth, paper or other suitable material to form a smooth continuous hard surface. One such facing is in the form of resin-impregnated glass cloth adhered to the board by a suitable adhesive, for instance, the same material used to bind the fibers of the board together. Another facing is in the form of a plastic laminate of a plurality of layers of cloth or paper

impregnated or coated with resin, the resin being set while the layers are under compression.

The present invention provides an effective method for securing fixtures and other objects to these and similar boards and for fastening the boards to wall supports. A high degree of flexibility is provided in that fastening elements may be located wherever desired as or after the boards are installed.

Referring to Figures 1 and 2 of the drawing, an insulating board 16 is shown comprising a core 17 of fibrous glass bonded together into an integral board. The core is covered on opposite sides with thin facings 18, 19 of suitable material. The board is secured to supports 21 by means of screws 22, and a fixture 23, shown as a towel bar, is fastened to the board by screws 24.

Following the present invention, the fixture 23 is secured to the board 16 by drilling holes 31 through the outer facing 19 of the board and into the fibrous core of the board at the points where the screws 24 are to be located. The depth to which the holes are drilled may vary depending upon the size of the screw necessary to secure the fixture in place but the holes preferably extend a substantial distance into the fibrous core and, for reasons later mentioned, preferably completely through the fibrous core as shown in Figure 3. The holes are made slightly larger than the overall diameter of the screws to permit the threads of the screws to clear the holes in the facing 19. This is to guard against tearing or splintering of the facing material surrounding the holes when the screws are inserted. Also, if the screws should be violently withdrawn from the board, as in the case where the fixture is ripped accidentally from the wall, the facing is not impaired. The slightly oversize hole in the facing also facilitates placement of the screw for reasons that will later become evident.

After the hole has been formed in the board, a pasty hardenable material 32 is introduced into the hole to substantially fill at least the portion of the hole within the fibrous core. The hole may be filled from a gun similar to a caulking gun or from a collapsible tube containing the material, or be forced into the hole with a spatula or knife. The hardenable material is shown in Figure 4 as being filled into the hole 31 from a caulking gun, the nozzle of which is shown at 33.

Before the material in the hole hardens, a screw is passed through the element to be secured to the board, in this case the base of the fixture 23, and is forced into the body of material. The opening in the facing being larger than the screw, insertion of the screw may be accomplished without tools. The displacement of the material as the screw enters causes the material to spread laterally into the interstices between the fibers surrounding the hole. This spread of the material within the fibrous core forms a body of material larger than the hole through the facing to provide a shoulder 36 beneath the facing. When the material within the hole hardens it holds the screw in place by engagement with the threads of the screw and anchors the screw within the board by the bond between the body of material and the fibrous core and by virtue of the shoulder on the body of hardened material engaging the inner side of the facing.

The plug of hardened material may serve also as a rigid spacer to hold the facings on the board spaced apart a fixed distance. When this result is desired, the hole in the board is formed substantially completely through the fibrous core of the board, as shown in the drawings, so that the plug of hardened material will contact the inner sides of both facings. Otherwise it is necessary that the hole extend into the fibrous material only a distance about equal to the length of the screw.

Certain features of the invention have also been found of value where fastening elements such as the screw 22 extend completely through the board to secure the board to a support. In this case a hole is drilled completely through the board 16 and the plastic material is forced into the hole. The board is then placed against the support or wall and a screw 22 passed through the hole and driven into the wall or support. The entry of the screw or nail into the filled hole causes the plastic material 32 to spread laterally and form a plug within the fibrous core of the board somewhat larger in diameter than the hole in the facing of the board, and when the plastic material hardens this plug provides a rigid spacer to hold the outer facing on the board positively spaced from the support.

A related application of the present invention is illustrated by Figure 6, wherein the sole purpose served is to fixedly space the facings of the board. A faced board 16 has a hole 31 drilled through one facing and substantially through the fibrous core and this hole is then filled with plastic material 32 under slight pressure, such as that applied by a caulking gun or by forcing the material into the hole by means of a spatula. The pressure causes the plastic material to spread laterally and form a plug some what larger than the hole in the facing. As a result the plug is effective to maintain the facings in spaced relation when the plastic material hardens.

Although the invention has been found most practical in connection with boards faced on one or both surfaces, it also displays advantages when employed with unfaced fibrous insulating boards. For instance, in the case of acoustic panels and tile formed of fibrous material it provides a means for fastening the tile in place on a ceiling or wall with a greater degree of security than is provided by previously known fastening means.

Such an application of the present invention is illustrated in Figure 7 in which a fibrous board or panel 36 is shown provided with a hole 38 extending completely therethrough. The hole is filled with a plug of hardened plastic material 39 through which a screw 41 passes, the screw being driven into the supporting element 42.

In this application of the invention the fibrous board may be provided with the holes and the holes filled with plastic material at the factory immediately after manufacture of the boards or the operation may be performed on the job just before the boards are applied. In either case the holes are formed in the board by a suitable instrument such as a punch or drill and plastic material is forced into the hole under slight pressure to cause a part of the material to permeate the fibrous material surrounding the hole. A hole for a screw or nail is then formed through the plastic material preferably before it has hardened although this hole may be formed later if desired. As shown in Figure 7, the hole 38 in the fibrous board may have outwardly tapering walls to increase the force with which the insulating board is held in place.

The plastic material employed in the present invention may be of any suitable kind. For reasons of economy it is preferably a thermoplastic

synthetic resin filled with a comminuted material such as wood flour, cotton fibers or cotton linters, glass fibers, asbestos, potter's flint, and the like. Filling materials such as wood flour and cotton linters are preferred because these materials permit fastening elements such as screws to be driven into the material with greater ease after it has hardened. Preferably only enough resin is used to hold the filling material in an integral mass.

The synthetic resin may be any of the well known kinds such as cellulose acetate, cellulose acetate butyrate, cellulose nitrate, ethyl cellulose, acrylic and methacrylic resins, and the vinyl resins such as polyvinyl chloride and polyvinyl acetate. These resins are combined with solvents in amounts sufficient to form a plastic pasty mass, about of the consistency of bread dough, when the resin has been filled with the selected filling material. The consistency may be adjusted by the use of more or less solvent to obtain greater or less penetration of the material into the fibrous core.

One suitable plastic material may be made by dissolving cellulose acetate in acetone and then mixing this with wood flour to obtain a readily deformable plastic mass of a consistency sufficiently thin to permit it to be readily filled into holes in the surfaced boards. The same procedure may be followed with ethyl cellulose by dissolving it in a suitable solvent such as an alcohol or an ester, ether, or the like. The same procedure is also followed with other resins of similar characteristics by employing the known solvents to form a solution of the selected resin and then admixing this solution with the desired filling material.

The present invention has been found to increase the screw holding capacity of faced boards of fibrous glass to an extent well in excess of that previously experienced and in fact to an extent where the screw holding capacity compares favorably with that of wood. As an illustration, tests performed on a number of samples of faced boards in which screws are embedded in accordance with the present invention have had the following results:

	Force necessary to pull screws from boards (average value of 3 tests)
	Pounds
Brass screw in wood	125
Brass screw in faced fibrous glass board	131
Steel wood screw in wood	275
Steel wood screw in faced fibrous glass board	120

These tests were made on an ordinary tester having a capacity of 0 to 400 lbs. and the screws were pulled at a rate of 12 inches per minute.

Various modifications of the invention may be made within the scope of the claims.

We claim:

1. The method of securing to supports boards formed of fibrous material of from 2 to 16 pounds per cubic foot density surfaced on opposite sides with layers of material more dense than said fibrous material, which comprises forming a hole completely through the board, substantially filling said hole with a hardenable plastic substance, and passing a fastening element through the plastic substance and into the support before the substance has hardened and spreading the plastic substance laterally into the fibrous material surrounding the hole to such an extent that it engages the inner faces of the surfacing layers and forms a body of the substance larger than the hole through the surfacing layers to thereby positively space apart the surfacing layers and secure the board to the support.

2. The method of increasing the rigidity of boards formed of fibrous material of from 2 to 16 pounds per cubic foot density and surfaced on opposite sides with layers of material more dense than said fibrous material, which comprises, forming a hole through the fibrous material and through at least one of the surfacing layers, and forcing into said hole a hardenable plastic substance with sufficient pressure to spread the substance laterally in the fibrous material to such an extent that it engages the inner faces of the surfacing layers and form a plug of the substance larger than the hole through the surfacing layer, whereby when the substance hardens the layers of surfacing material are held spaced by said plug.

3. The method of securing objects to boards formed of fibrous material of a density of from 2 to 16 pounds per cubic foot and surfaced on opposite sides with a layer of material more dense than said fibrous material, comprising forming a hole in said board extending through one of said layers and substantially completely through the fibrous material, and forcing a filled synthetic resinous material admixed with a volatile solvent into the hole to substantially completely fill the hole, introducing a fastening element such as a screw into the plastic substance and thereby forcing the substance to spread into the fibrous material surrounding the hole to such an extent that it engages the inner faces of the surfacing layers and forms a plug larger than the hole through said one of said layers, whereby when the substance hardens the fastening element is anchored within the board and the layers of surfacing material are held spaced by said plug.

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