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COLLAPSIBLE INSULATION

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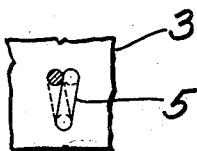
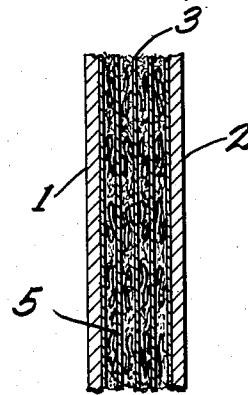
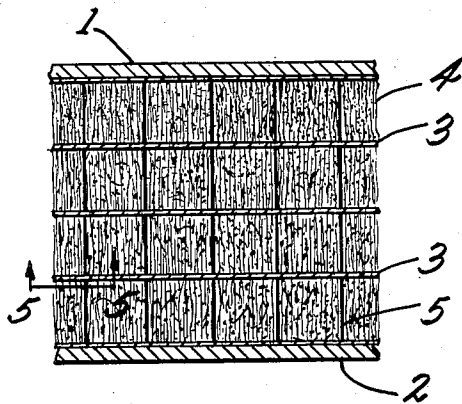
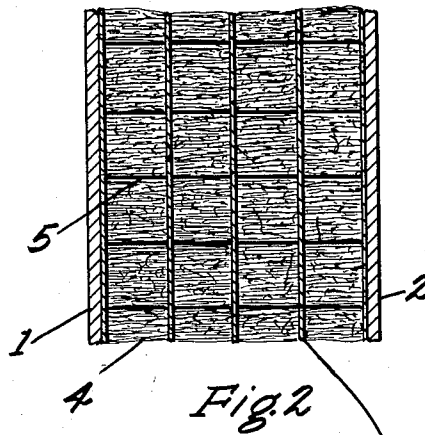
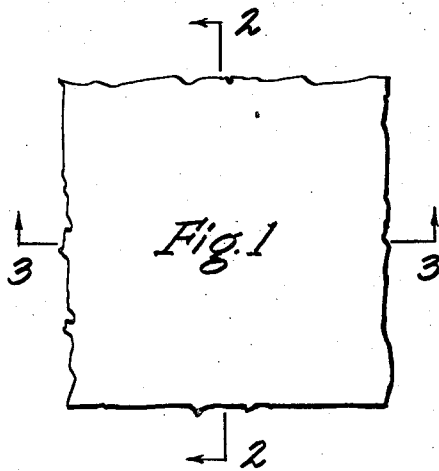


Fig. 5

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COLLAPSIBLE INSULATION

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8 Claims. (Cl. 20—4)

My invention relates to improvements in insulation and has for one object to provide a type of insulation which may be compacted for shipment and storage and may thereafter be conveniently expanded.

Another object of my invention is to provide an insulation which after it has been expanded will maintain under service conditions, a substantially uniform density.

It is well known that many insulations, rock wool, cotton or the like may be installed in the first instance at the proper density to give the maximum insulation effect but that gravity, vibration, temperature change gradually result in compacting of the insulation so that in some places the density is too low and in other places the density is too high to give the desired results.

Cotton is a very effective insulating medium because the cotton fibers themselves have a low heat conductivity and the cotton fibers if properly expanded and spread out furnish a sufficient bar to convection to limit heat flow but the cotton fibers or cotton batt lacks sufficient structural strength to support itself and if the cotton is shipped in a compacted bale or compacted batt, it is a most difficult task to pull it apart so as to expand it to the desired density and even when that is done, such density is by no means permanent.

I propose to build up an insulation by providing a multiplicity of parallel sheets, generally of fabric though they might be of paper, which sheets have adhered to opposite faces thereof by any suitable cement, cotton batts wherein the fibers are generally normal to the plane of the sheet, the spaces between the sheets being in the order of the length of the cotton fibers so that some of the fibers might even be cemented to opposite sheets. The sheets may be suspended from above and hang under the influence of gravity. Threads of cotton or the like attached to each sheet will when the sheets are pulled apart, be under tension and will hold the sheets in proper spaced relation and also support them even if they are not suspended from above. The inner and outer walls of the insulation may be of relatively stiff material so that the insulation may be compacted by applying pressure to hold the two outer walls close together with the cotton batt, the threads and the vertical sheets or curtains all compressed between the two relatively stiff and strong outer walls. This provides an insulation member which can be stored in a relatively small space.

When the insulation is to be installed, one of the outer sheets will be anchored in place and then the other outer sheet will be drawn away from it a distance sufficient to place all the holding threads in tension and hold all the intermediate supporting sheets in general parallelism and proper spacing.

The tension on the threads will be but just enough to hold them generally perpendicular to the sheets and they will be spaced both vertically and horizontally so that they, as well as the sheets themselves, furnish the rein-

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forcing or support to hold the cotton batt in proper position.

The cords or threads joining the sheets or curtains together might extend clear through the entire body being bent back upon themselves once where they pass through each sheet or they may be otherwise arranged. In any event when the sheets are collapsed, the cords collapse with the batt. When the sheets are spread apart, the cords maintain a generally constant space between each two adjacent sheets so that assuming that the cotton itself is attached to both of the sheets or there is cotton attached to both of the sheets, when any pair of sheets is pulled apart, the cotton will be stretched out to fill the space between the sheets and furnish adequate means for preventing convection within the volume of the insulation.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a plan view of an insulating body;

Figure 2 is a section along the line 2—2 of Figure 1 showing the insulating body in the expanded condition;

Figure 3 is a section along the line 3—3 of Figure 1;

Figure 4 is a similar section showing the insulated body compacted;

Figure 5 is a section along the line 5—5 of Figure 2 on an enlarged scale.

Like parts are indicated by like characters throughout the specification and drawings.

My collapsible insulation includes flat front and back panels 1 and 2. The panels may be of any suitable non-heat conductive material, heavy paper, wood or plastic, so long as they have, while perhaps flexible, a substantial stiffness and are generally self-supporting. Enclosed between these panels are a plurality of curtains 3 of paper cloth or fabric, it being essential that the curtains are also of non-heat conductive material and are generally flexible. They are not self-supporting in the sense that they will stand without being supported from above but they are of such material and such character that when supported from above, they hang freely. Adhering to the front and back faces of the curtains and also to the opposed faces of the front and rear panels are insulating fibrous batts 4 of cotton or other suitable material which also are non-heat conductive and non self-supporting. The fibers of these batts are preferably arranged as indicated so that they are generally perpendicular to the planes of the panels and curtains.

A multiplicity of flexible tension members 5—threads or cords or preferably cotton though of any suitable non-heat conductive material—extend perpendicularly to the front and back panels and join them extending through each individual curtain. These cords or tension members are equally spaced over the entire area of the insulation. For example, they may be so disposed that when the front and back panels are drawn apart, the distance between each surface and the one opposed to it whether of panels or curtains is approximately half an inch. Under these circumstances, at least some of the fibrous insulating material, if it is cotton with its normal fiber length in the order of half or five-eighths of an inch, may adhere to both opposed surfaces when the cotton batt is cemented to the curtains and panels but in any event even though certain fibers adhere to one surface and other fibers adhere to the other, the characteristic interlocking of the fibers will maintain the insulation fibers in the space between the curtains and so if the fibers are properly distributed in the first place, then when the front and back panels are drawn apart, the insulating material will be disposed throughout the area between the front and back panels according to the desired density best for insulation with the particular material

used. For example, if cotton is used, very good insulation results are had when the density is one-third of a pound per cubic foot.

Referring to Figure 5, it will be seen that each thread is passed through the panel and each of the curtains once, then turned back upon itself and passed through again, thus providing an interlock or loop which fixes the length of the thread between the panel and the adjacent curtain and between each curtain. Other thread distribution could well be used so long as the relationship is such that when the panels are drawn apart, the threads are tightened and the panels and the curtains are held in general parallelism and spaced apart the desired distance so that the insulating fibers are equally distributed and thus fill the space between the panels with a density sufficient to inhibit eddy currents.

This panel after assembly may be collapsed by applying pressure to cause the two panels to approach, thus compressing between them the loose fibrous insulation, the tension members and the curtains and such insulation may therefore be compacted as indicated in Figure 4 for storage and shipment. When it is installed all that is necessary is to separate the front and rear panels, the tension on the tension members will do the rest and distribute the curtains and the insulation throughout the desired area. The back panel might well be cemented to or otherwise attached to a supporting wall, the front panel would then be drawn out and attached to an inner supporting wall or structure or the panel itself might be relied upon to give the necessary wall strength. The tension members extend across between the panels provided the panels are held in place, will also support the curtains and the entire structure remains in place.

If desired, one or both of the front and back panels might be directly attached in installation to a supporting structure and they might or might not have fibrous material on their outer faces. In this case, it would be necessary to be sure that the tension members were associated with the supporting structure in such a way that sufficient tension would be applied to them to maintain the curtains in proper spaced parallel position.

Light muslin or cheesecloth or cotton fabric of that type could well be used for the curtains but other fabric, screening or even paper could be used to accomplish the desired result.

While it is convenient and will add to the strength and durability of the insulation to have the fibers of the batt perpendicular to the curtains, the batt will be held in place by the adhesion of the fibers and by the support of the tension members even if such perpendicularity of the fibers is not accomplished.

I claim:

1. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates of non-heat conductive material, a multiplicity of thin, flat, flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof adapted to limit separation thereof and maintain them in general parallelism.

2. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates of non-heat conductive material, a multiplicity of thin, flat flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, the fibers extending generally perpendicular to the planes of cover plates and curtains, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof to limit separation thereof and maintain them in general parallelism.

3. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates of non-heat conductive material, a multiplicity of thin, flat, flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, the fibers extending generally perpendicular to the planes of cover plates and curtains, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof to limit separation thereof to a distance substantially equal to the lengths of the fibers and maintain them in general parallelism.

4. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates of non-heat conductive material, a multiplicity of thin, flat, flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof adapted to limit separation thereof and maintain them in general parallelism, the tension members including flexible threads interlocking with the cover plates and curtains.

5. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates of non-heat conductive material, a multiplicity of thin, flat, flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof adapted to limit separation thereof and maintain them in general parallelism, the tension members including flexible threads extending between both cover plates and interlocking with the cover plates and curtains.

6. Collapsible insulation comprising a multiplicity of thin, flat, flexible curtains of non-heat conductive material, compressible fibrous insulation adhering to the opposite sides thereof, the fibers of the insulation extending generally perpendicular to the plane of the curtains, flexible tension members of non-heat conductive material generally distributed over the curtains, extending generally transversely thereof adapted to limit separation thereof and maintain them in general parallelism.

7. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates, a multiplicity of thin, flat, flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof adapted to limit separation thereof and maintain them in general parallelism.

8. Collapsible insulation comprising a pair of spaced relatively stiff generally self-supporting cover plates, a multiplicity of thin, flat flexible curtains of non-heat conductive material located between the cover plates, compressible fibrous insulation adhering to the opposed sides of curtains and cover plates, the fibers extending generally perpendicular to the planes of cover plates and curtains, flexible tension members of non-heat conductive material generally distributed over the plates and curtains, extending generally transversely thereof to limit separation thereof and maintain them in general parallelism.

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