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## INSULATING COMPOSITION

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This invention relates to compositions adapted for use as insulators against heat, (temperature change) sound or electricity.

An object of my invention is to provide a fibrous insulation material that does not tend to absorb moisture appreciably.

A further object of my invention is to use fibres made of organic derivatives of cellulose as an insulating medium in devices, chambers, buildings and the like, requiring insulation against heat, and/or sound and/or electricity. Other objects of my invention will appear from the following detailed description and claims.

The heat or sound insulation materials in the solid state that have been used heretofore were of the nature of cork, cotton, silk floss, or "dry-zero" (a product that grows on a certain bean tree in tropical South America). These substances, however, have the serious drawback of tending to absorb moisture from the atmosphere, whereby they lose their effectiveness as insulating materials appreciably, and also increase in weight—a phenomenon that is objectionable in devices or articles of manufacture that are intended to be moved about. In order to maintain the efficiency of these materials, it is necessary to remove them from the jackets or chambers in which they are contained, drive out the water, and then return them to the containers. Obviously this process is expensive and causes loss of use of the devices or articles of manufacture during the process of driving out the water from the insulating material.

I have found that fibres made of organic derivatives of cellulose, and particularly cellulose acetate, have remarkably high insulation properties with respect to heat, sound or electricity, but do not appreciably absorb moisture from the atmosphere. Thus if fibres made of cellulose acetate are exposed to a damp atmosphere, say of 90 to 100% humidity, the fibres do not absorb appreciably more than 5% of moisture after prolonged exposure to such atmosphere.

In accordance with my invention, I use fibres made of organic derivatives of cellulose as an insulating material against heat, (temperature change), and/or sound and/or electricity, in any device requiring the use of such insulating materials.

The organic derivatives of cellulose that are used for making the fibres to be employed in accordance with my invention, may be organic esters of cellulose or cellulose ethers. Examples of organic cellulose esters are cellulose acetate, cellulose formate, cellulose propionate or cellulose butyrate. Of cellulose ethers that may be used, ethyl cellulose, methyl cellulose or benzyl cellulose may be mentioned.

The fibres may be used as an insuating material against heat and cold in any suitable apparatus. It is particularly useful for jacketing or enclosing refrigerators, such as household refrigerators or refrigerator railway cars. It may be used as a heat insulator in the walls of rooms and in the walls of cabins of aeroplanes and lighter than air aircraft. A further use of the organic derivatives of cellulose fibres is in the jackets of portable jars intended to maintain the contents thereof hot or cold for picnics and the like. Another use of the fibres is as an insulating material in fireless cookers. The fibres may be used as an insulating material around pipes that are adapted to convey hot or cold fluids.

As an insulator against sound, the fibres may be used to fill walls of cabins of aeroplanes or airships or partitions in or walls of buildings.

The fibres of organic derivatives of cellulose are eminently suitable as insulators of electricity in any device where solid dielectrics are used. Since this material does not tend to absorb water, its electrical resistance does not tend to change even in damp atmospheres. As evidence of the value of the fibres containing organic derivatives of cellulose for electrical insulation work, the following table of relative resistance of various fibres to electricity, when measured in a damp atmosphere, is given:

| | |
|---|---|
| Reconstituted cellulose (rayon) | 0.9 |
| Silk | 45.8 |
| Cotton | 2.3 |
| Cellulose acetate fibres | 230. |

The use of the fibres containing cellulose acetate is particularly useful in moving or portable devices or articles of manufacture because of its light weight and because of the fact that it does not appreciably increase in weight due to absorption of moisture. The increase of weight due to the absorption of moisture by the substances formerly used as insulating material in aircraft is a serious drawback to their use, since this increase in weight is extremely dangerous.

In an example of carrying out my invention, I employ fibres made of cellulose acetate. This cellulose acetate may be an acetone soluble cellulose acetate having, for instance, an acetyl value of 54 to 55%. A solution of this cellulose acetate may be made by dissolving 1 part of cellulose acetate in 3 parts of acetone. The solution thus formed is extruded through orifices of a

spineret into a heated evaporative atmosphere or precipitated in a precipitating bath and the filaments thus formed are drawn and wound or not wound.

While this invention is not limited to the specific size of the fibres, I prefer to make the filaments very fine, say on the order of 1 to 4 denier. The filaments formed, either prior to winding or after winding, but preferably, but not necessarily without twisting, may be cut into comparatively short staples, say 1'' to 5'' in length, and the staples may be fluffed by agitation or blowing with air to obtain bulkiness by any known method. If desired further bulkiness or fluffiness may be obtained by causing the filaments, either prior to cutting or after cutting, to become crinkled or waved, by treating the same with a crinkling agent, such as boiling water. It it is desired to use the fibres of the cellulose acetate thus formed as a heat and sound insulating material in cabins of air-craft, such as aeroplanes or airships, this may be done by making the hollow walls of the cabin of say a total thickness of 4''. This wall is in the form of a jacket having the exterior walls of duraluminum 1/40 of an inch thick on wood of ⅛ of an inch thick. The hollow chamber is then filled with the fluffed filaments of cellulose acetate.

It is to be understood that the foregoing is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. Aircraft having at least part of their cabins jacketed with an insulating composition comprising fibres of organic derivatives of cellulose.

2. Aircraft having at least part of their cabins jacketed with an insulating composition comprising fibres of cellulose acetate.

3. Aircraft having at least part of their cabins jacketed with an insulating composition comprising fibres of organic derivatives of cellulose in fluffed condition.

4. Aircraft having at least part of their cabins jacketed with an insulating composition comprising fibres of cellulose acetate in fluffed condition.

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