

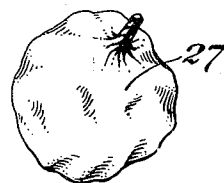
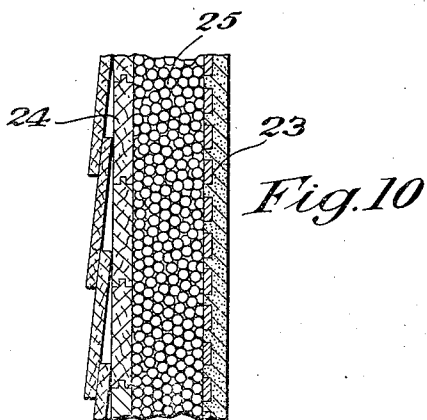
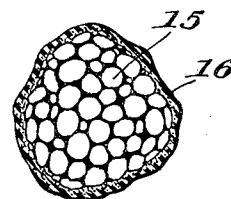
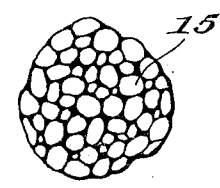
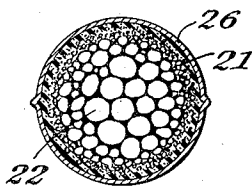
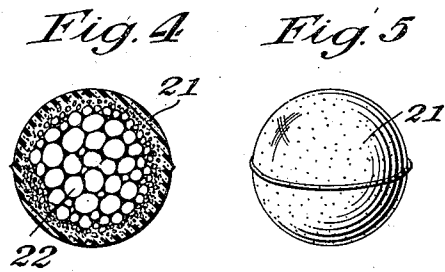
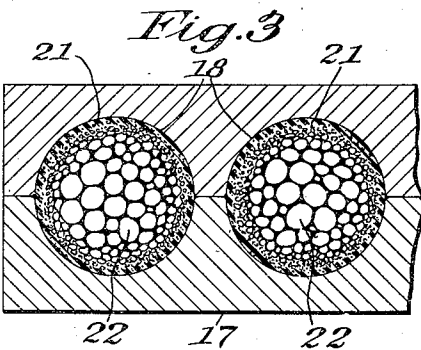
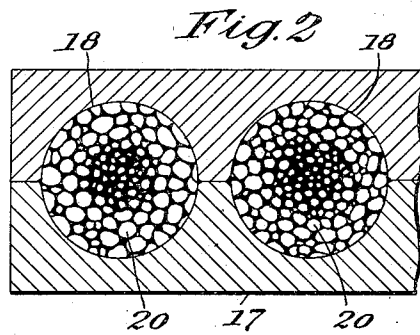
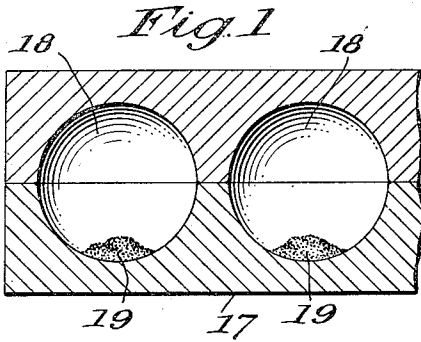
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C. L. NORTON

2,110,470

INSULATING MATERIAL

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UNITED STATES PATENT OFFICE

2,110,470

INSULATING MATERIAL

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3 Claims. (Cl. 106—19)

This invention relates to insulating material for use in walls, roofs and partitions of houses and other buildings for the purpose of preventing the transmission therethrough of heat and sound, and for insulating heated surfaces generally from loss of heat.

If a building or other structure is to be insulated during the process of construction, there are a wide variety of structural elements in the form of sheets, blocks, or the like which can be used for this purpose with more or less satisfactory results. These, however, cannot, as a rule, be conveniently employed in buildings already built, and in such cases a common method of house insulation is to introduce some insulating powder or fibre into the wall or the like to fill up the space between the interior plaster or other finish and the boarding or the like which forms the outside of the wall. This insulating material is usually introduced by blowing, in accordance with the system described in the Slayter Patent No. 1,728,837. Materials which have been used for this purpose include slag wool, rock wool, cork dust, sawdust, comminuted corn husks, air blown gypsum, and other mixtures of powder or fibres.

There are numerous objections to all of these materials as now commonly used. In the first place, when they are blown in they pack very lightly and tend to settle later, leaving uninsulated portions at the top. So far as I am aware, no remedies have been successful in preventing this. The vegetable fibres and similar organic materials are further objectionable because of their combustibility, because they offer favorable conditions for the breeding of vermin, and because many of them have a tendency to ferment or mould, resulting in diminished efficiency and malodorous and otherwise offensive conditions. When silicious powders and fibres are used, particularly when slag wool or rock wool is introduced in the usual manner by blowing, there is a tendency for finely divided portions of this material to filter through the cracks in the plaster or down around the box boards and out into the rooms, producing a dusty and unhealthy condition; the deleterious effects of breathing an atmosphere containing silicious dust being well known. Intumesced material, such as frothy masses or lumps of sodium silicate, has been used to some extent for this purpose, but this has not been entirely satisfactory since the material is not dust free, either in handling or in the presence of drafts and tremors such as occur in

most buildings; and even in the process of introducing the material into the wall there is a tendency, because of its very great friability, for the lumps to be broken up and reduced to dust, at least in part.

It is believed that an ideal insulating material for wall filling should have the following characteristics: (1) It should have high thermal insulating value. (2) It should be non-combustible or at least incapable of supporting its own combustion. (3) It should be absolutely free from possibility of decomposition or fermentation or the breeding and housing of vermin. (4) It should be of low density and light in weight. (5) It should be in the form of nodules or lumps which are sufficiently hard, at least upon their exterior, not to be dusty and the source of any powder or dust which may escape into the rooms. (6) The nodules or lumps should be sufficiently rigid not to pack down. (7) It should be of such a character as to prevent the transmission of heat by radiation as well as by conduction. (8) It should be capable of being introduced into proper position in the walls without blowing merely by a pouring, shoveling, or similar operation.

I have found that an insulating material meeting all of the above requirements may comprise a loose mass of nodules of a porous heat insulating material, preferably an intumesced soluble silicate, said nodules having smooth, hard surfaces or exterior crusts which are denser than their highly porous or cellular interiors; and the present invention consists in the provision of such a material.

The invention will best be understood from the following description of several illustrative forms of such a material and the methods of producing the same, all as illustrated in the accompanying drawing, these, however, having been chosen for purposes of exemplification merely, as it will be obvious to those skilled in the art that the invention, as defined by the claims hereunto appended, can be otherwise embodied and practiced without departure from the spirit and scope thereof.

In said drawing:

Figs. 1, 2 and 3 are sectional views illustrating three steps in the production of insulating material in accordance with the invention.

Fig. 4 is a sectional view of one of the resulting nodules.

Fig. 5 is a perspective view thereof.

Fig. 6 is a sectional view of a nodule such as that shown in Fig. 4 after having been subjected to further treatment.

Fig. 7 is a sectional view of a nodule produced in a different way.

Fig. 8 is a sectional view of the nodule shown in Fig. 7 after having been subjected to further treatment.

Fig. 9 is a perspective view of a further modification.

Fig. 10 is a fragmentary vertical sectional view of an insulated wall.

In Figs. 3, 4, 6 and 8 the proportions are somewhat distorted, the thickness of the crusts and coatings hereinafter referred to being exaggerated for clearness of illustration.

In accordance with the invention, small masses of a combustion resisting material intumescent by heat, such as alum or a soluble silicate, preferably sodium silicate, may be heated to cause the same to intumesce or froth up into the form of an expanded nodule. If this be done in the open or without restraint, the intumescence will be substantially uniform throughout, as indicated in the case of the nodule 15 shown in Fig. 7. Such a nodule is light and of high porosity and high insulating qualities but is so friable as to be of slight practical value, as above explained. In accordance with one mode of practicing the invention such a nodule is provided with a hardened surface or crust 16, Fig. 8, which enables it to resist breaking and also increases its insulating qualities. Such a crust can be applied in a variety of ways, as by coating with varnish or plaster, or with a solution of unintumesced sodium silicate or the like which is subsequently dried at such a rate as not to cause intumescence, or by fusing or flashing the surface by subjecting the nodule momentarily to the action of a flame.

While a satisfactory insulating material can be produced as above described, the preferred procedure is as illustrated in Figs. 1 to 3. If the intumescence of the sodium silicate or other material takes place in a confined space too small for its complete natural expansion, it results in the formation of a nodule which, although of the highest porosity inside, has upon the outside a naturally formed, hard, almost vitreous crust of a much higher density than the interior, and is strong enough to be capable of considerable handling without fracture or substantial abrasion. In Figs. 1 to 3 there is shown a mold 17 composed of two separable sections providing between them preferably spherical mold cavities 18 of suitable size. Said mold is heated to a temperature of from 650° F. to 800° F. and opened, a small quantity or mass 19 of sodium silicate introduced into each of the mold cavities 18, and the mold closed, as shown in Fig. 1. Said sodium silicate is preferably in the dry form, that is to say, containing not substantially more than 20% of water, although silicate containing a greater proportion of water can be used. The quantity introduced into each mold cavity, while sufficient, if completely intumesced, to produce a volume in excess of that of the mold cavity, is relatively small in proportion to the latter. If dry sodium silicate in solid form is used, the quantity introduced should be about 1/20 of the volume of the cavity. If dry sodium silicate in ground or powdered form is used, the volume should be from 1/5 to 1/10 the volume of the cavity, depending upon the fineness and lightness of the powder. If sodium silicate containing more than 20% of water is used, the volume introduced should be proportionately greater. After the closing of the mold, the heating at the above temperature is

continued for a period of from 30 seconds upward according to the size of the nodule. Under the action of the heat, the material begins to intumesce and eventually expands sufficiently to fill the mold cavities, as shown at 20 in Fig. 2. As the heating is continued, the resulting tendency to further expansion causes the exterior of the mass to be forced or crowded against the walls of the mold cavity so as to compact said material in this region and form an exterior crust 21 which has a relatively smooth, hardened surface and which is considerably denser than the frothy or cellular interior 22 of the mass, thereby resulting in the nodule shown in Figs. 4 and 5. When temperatures above approximately 650° F. are used, the nodules are found to be substantially insoluble in water at room temperatures. Some small pieces of sodium silicate intumesced at 800° F. have remained floating on water for more than two years.

Preferably before introducing the silicate into the mold cavities 18 the latter are washed or coated with a thin solution of lime which not only prevents the resulting nodules from sticking in the mold, but has more or less effect in promoting the formation of the hardened surface or exterior crust 21.

The intumesced nodules above described are extremely light and porous, having a density of only two to six pounds per cubic foot, depending upon the degree of intumescence, as compared to a density of from 10 to 16 pounds per cubic foot for ordinary slag wool and sawdust filling and even higher densities for other insulating materials as heretofore used. On the other hand, said nodules, due to their hardened surfaces or crusts, are strong and mobile enough to be poured or shoveled, as distinguished from being blown, into a wall without rupture or dusting due to abrasion, and are rigid enough not to pack down. Thus, as shown in Fig. 10 there may be introduced into the space between the inner and outer portions 23 and 24 of a wall a loose mass 25 of said nodules which substantially completely fills said space. The size of the individual nodules is susceptible of considerable variation. I have found convenient sizes to be from 1/4 to 3/4 of an inch in diameter. In some instances it may be desirable to use an assortment of sizes in order more effectively to fill the space.

The heat insulating efficiency of materials heretofore employed for filling spaces in walls and the like has depended chiefly upon the thermal conductivity of the substance or composition used. However, in the case of the nodules above described there are other features which delay the transmission of heat, namely, that besides being each a good insulator the contacts between them are points of resistance to heat flow. Moreover, the hard crusts upon the nodules are effective in stopping the transmission of heat by radiation, and I have found that the latter effect can be increased by providing said nodules with reflecting surfaces. The surfaces or crusts above described, by reason of their denseness, have certain natural reflecting qualities, particularly in the case of the nodule shown in Fig. 8 where the crust 16 is formed by flashing or glazing, but this effect can be enhanced by applying to them a reflective coating such as a varnish or the like. I prefer for this purpose to use aluminum paint, which may be conveniently applied by spraying, to form a metallic coating 26, as shown in Fig. 6, and which may even be applied to such a nodule as is shown in

Fig. 7 to form the desired hardened surface or crust. Thus the effectiveness as a wall filling of this material is greatly increased in that the heat flow is not only retarded by the customary insulating value of the froth of which all the nodules are composed, but it is also greatly retarded by the fact that attempts of the heat to enter or escape from each nodule are resisted by the surface of the nodule itself.

As shown in Fig. 9, instead of varnishing or painting the surfaces of the nodules, a reflecting surface may be provided by enclosing the nodule in a covering of aluminum foil.

In addition to those above discussed, the present mode of insulating has a great advantage in the possibility of preparing the insulating material at its point of use. In other words, instead of shipping very bulky insulating material to the point of installation, as is now necessary, it is possible to ship the sodium silicate powder of a density of about 125 to 130 pounds per cubic foot and, by means of a very simple apparatus, convert it at the point of installation into the light, porous, hard-crust nodules, suitably coated if desired, which can then be at once poured or shovelled into the walls, partitions, etc.

The advantages above referred to of the hard, dense crusts and reflecting surfaces on nodules used for insulating purposes are not confined to nodules of intumesced sodium silicate or the like,

but are also obtainable in the case of nodules of other porous heat insulating material such, for example, as magnesia, asbestos, diatomaceous earth, and the form of mica known as vermiculite.

While the insulating material above described is particularly well adapted for use in connection with the walls of existing building structures, it is by no means limited to such uses as it can to advantage be incorporated in the walls of such structures during the process of building and is also useful for other purposes where insulating jackets are required, as, for example, in oven walls, chimneys, etc.

I claim:

1. An insulating material for the hollow spaces of walls or the like comprising a loose mass of nodules of intumesced sodium silicate, each of said nodules having a hardened surface.

2. An insulating material for the hollow spaces of walls or the like comprising a loose mass of nodules of porous heat insulating material, each of said nodules having an exterior coating of aluminum paint.

3. An insulating material for the hollow spaces of walls and the like comprising a loose mass of nodules of an intumesced soluble silicate, each of said nodules having a hardened crust coated with aluminum paint.

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