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AIR PERMEABLE FIRE RETARDING AND FLAME PROOF PARTITIONS, DOORS AND THE LIKE

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Fig. 1.

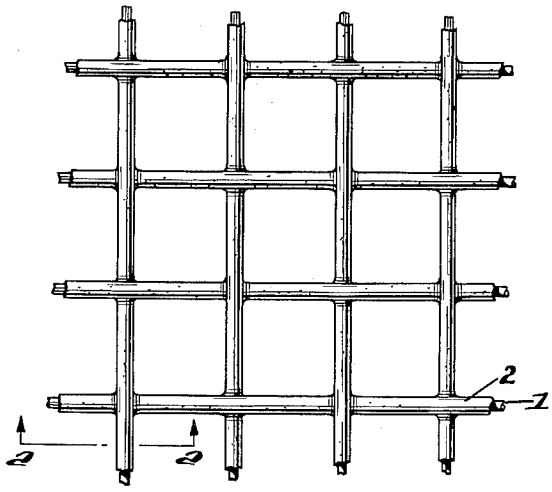
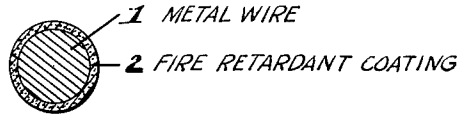


Fig. 2.



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AIR PERMEABLE FIRE RETARDING AND FLAME PROOF PARTITIONS, DOORS AND THE LIKE

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The present invention relates to improved fire retarding partitions, walls, doors and the like which while retarding progress of fire and flame beyond them are permeable to air or other gases under normal conditions.

Previously it has been customary to provide fire walls, fire doors and the like in buildings to limit the spread of fires. Also light intermediate partitions of combustible materials such as wood, cellulose wall board, cardboard or paper and the like in rooms and storage spaces in paper factories, wood storage houses, record storage houses and the like have customarily been impregnated with fire retarding chemicals or coated with foam forming fire retardant compositions to prevent the spread of fires. Such partitions, however, had the disadvantage that no air could be circulated between the spaces thus partitioned. Also, fire walls or fire doors provided with double steel surfaces are rather expensive and also do not permit the circulation of air.

Previously it has not been possible to prepare larger openings which especially serve for ventilation, such as, for example, cable shafts, mine shafts and the like, in such a way that penetration of fire therethrough could be completely prevented.

According to the invention it was unexpectedly found that fire retarding and flame proof partitions, doors, windows and the like while normally permitting a practically undisturbed passage of air therethrough could be produced from air permeable carriers, such as fine meshed nettings or grids of any desirable material, such as, for example, iron wire, or other metals or also of organic materials. According to the invention these carriers are coated with a fire protecting coating which is incombustible and expands or puffs up upon heating. Such coating is applied to the carrier so that the openings therein serving for passage of air therethrough are not sealed. When such carriers are subjected to the action of heat the fire retarding coating expands to close the openings and thusly prevents the penetration of flames therethrough. In view of its incombustibility and insulation, direct transfer of the heat of the fire is hindered.

Numerous fire retaring compositions suitable for the fire retarding coating according to the invention have already been developed. Those which essentially consist of a synthetic resin and a foam forming material, and if desired a carbon forming component such as glue or starch have proved particularly effective. Compositions of this nature are fully described in Jones et al. U.S. Patent Number 2,523,626 as well as in German Patent 962,824 and U.S. Patent Number 2,881,088 which corresponds to such German patent.

Preferably, the fire retarding compositions employed according to the invention contain about 50 to 80 parts by weight of foam forming material and about 3 to 50 parts by weight of synthetic resin and if desired 10 to 50 parts by weight of a carbon forming component.

The first retarding compositions employed according to the invention, in addition to the compositions indicated above, can also contain diluents or inert fillers such as asbestos powder, barium sulfate, kieselguhr and the like.

The following materials can advantageously be employed as the foam forming component of the fire retarding compositions employed according to the invention: phosphoric acid and its salts such as monoammonium or diammonium phosphate, ammonium sulfate, sulfamic acid, ammonium sulfamate, ammonium bromide, sodium tungstate, sodium borate and boric acid.

The resin component of the fire retarding compositions according to the invention preferably is a urea-formaldehyde resin and/or a urea-formaldehyde-acrolein resin. Mixtures of 40–60% of urea-formaldehyde resin with 60–40% of urea-formaldehyde-acrolein resin have been found particularly suitable. Urea-formaldehyde resins in which the proportions of formaldehyde component to urea component is 1 to 2.5 moles of formaldehyde component per mole of urea component are particularly suited. Urea-formaldehyde-acrolein resins in which the proportions of the components are about 2 to 2.5 moles of formaldehyde component and about 0.12 mole of acrolein component per mole of urea component are preferred.

Suitable carbon forming materials which can be used as the carbon forming component of the fire retarding compositions employed according to the invention, for example, are as follows: starch, dextrin, gum tragacanth, flour, mannitol glucosamine, glue, casein, gelatin and the like.

The fire retarding compositions employed according to the invention are generally applied to the surfaces of the air permeable carrier as a solution or suspension or emulsified in a liquid medium. Water is generally the cheapest suitable material. Drying oil or bituminous paint vehicles or other non-aqueous vehicles may also be employed. The method of application of fire retarding compositions to the air permeable carrier can be by dipping, spraying or painting.

Instead of employing nettings or grids as the air permeable carrier, other air permeable structures can be employed, such as, for example, perforated materials in which the small perforation will seal off under the influence of heat as described above. Also, free hanging curtains of single wires, asbestos fibres and the like can be provided with the fire retarding coating.

The present invention, for example, renders it possible to provide a means for preventing spread of fire through cable shafts, mine shafts or other openings which cannot be closed off by fire walls or doors because of required air circulation, in that the described discontinuous surfaces which have been provided with a foam forming fire retarding coating are firmly affixed transverse to the axis of the shafts or openings. In order to provide certain effects, it is also possible to provide a plurality of nettings or girds in series in which the individual nettings or grids may contain different sized openings which can be staggered with respect to each other and which also may be provided with fire retarding coatings of different thicknesses.

The novel coated air permeable materials according to the invention can also be employed as replacements for smaller fire walls. They are very light and air permeable and are not employed as solid walls. It is possible to install and dismantle partitions of such materials without trouble and without entailing too great an expense.

In addition, surfaces, which, for certain reasons, cannot be painted with fire retardant paints, such as lime walls, can be provided with fire retarding grids or nettings according to the invention. The grids or nettings can also be applied over easily combustible or readily fusible building elements, such as, for example, foamed styrene plastic, to provide them with protection against fires.

In the accompanying drawing:

FIG. 1 shows a fire retarding netting according to the invention; and

FIG. 2 shows a cross-section of one of the coated wires of such netting.

In such drawing, 1 represents the carrier netting which,

for example, can be metal wire or other suitable strand material, such as asbestos fibre strands and 2 represents the fire retarding coating over such netting.

The following example will serve to illustrate an air permeable fire retarding structure according to the invention.

Example

A netting having square meshes with a mesh opening of 5.5 mm. and formed of iron wire 1 mm. in diameter was coated with an aqueous suspension containing 200 parts by weight of urea-formaldehyde resin, 170 parts by weight of urea-formaldehyde-acrolein resin, 484 parts by weight monoammonium phosphate, 20 parts by weight of calcium phosphate, 76 parts by weight of soluble starch, 50 parts by weight of asbestos powder, all having a particle size passing through a screen of 1,600 meshes per cm.^{2}. The application of the coating was such that upon drying a coating weighing 900 g. per square meter of netting was obtained.

Such netting, when employed in partitions, doors and the like, normally permitted good circulation of air therethrough but upon access of fire prevented spread of fire therethrough, as the heat of the fire caused the coating to foam and swell up to seal off the mesh openings with an incombustible, stable, heat insulating foam.

The urea-formaldehyde resin employed was produced as follows: 35 kg. of disodium phosphate were dissolved in 812 kg. of 30% formaldehyde (243 kg. formaldehyde) with adjustment of the pH to 8.2 and 243 kg. of urea were added to such solution. The resulting mixture was stirred for about 4–5 hours while maintaining a temperature up to about 40° C. and then allowed to stand over night. The resulting thick mass was then heated to about 55° C. and the water content thereof reduced to 5–10% under a vacuum of 80–100 mm. Hg. As the water evaporates, the temperature is gradually raised to about 120° C. The resulting semi-dried product was then put into aluminium pans which were placed in a drying oven maintained at 103° C. under a vacuum of 100 mm. Hg. for 24 hours. The originally tough mass rose similarly to a cake dough and a coarsely porous frangible product resulted which was easy to remove from the pans and grind.

The urea-formaldehyde-acrolein employed was produced as follows: 17.76 kg. of urea, 4.43 liters of distilled water and 0.30 kg. of glacial acetic acid were mixed and heated to 50° C. Upon reaching this temperature, 2 kg. of acrolein were added over a period of 5–6 minutes at a rate that the temperature of the mixture did not exceed 58° C. After the acrolein had been added, the mixture was heated to 70° C. for 30 minutes and then cooled to 45° C. The product obtained was a yellowish thinly viscous precondensate.

At the same time, 55.43 kg. of 30% formaldehyde, 4.35 kg. of hexamethylene tetramine and 15.55 liters of distilled water were mixed in another vessel and the resulting solution mixed with the precondensate after it had been cooled to 45° C. The resulting mixture was heated in 10 minutes to 90° C. and maintained at this temperature for 30 minutes and then cooled to 20° C. and the pH adjusted with NaOH to 7.2.

Similar results were also obtained when other foam forming fire retarding coating compositions, such as described in Schulenburg U.S. Patent Number 2,881,088, were employed. Of course, in each instance care must be taken that the quantity of fire retarding coating applied is sufficient so that upon swelling upon access to fire the openings in the normally air permeable carrier will be closed.

I claim:

1. An air permeable fire retardant and flame proof fire shielding element comprising an air permeable wire netting having spaced openings coated with an incombustible fire retardant composition which swells upon heating normally leaving air permeable openings in such shielding element but swelling to seal such openings upon access of heat from a fire to such element.

2. An air permeable fire retardant and fiame proof fire shielding element comprising an air permeable carrier provided with spaced openings coated with an incombustible fire retardant composition containing a foam forming component and a synthetic resin component which swells upon heating normally leaving air permeable openings in such shielding element but swelling to seal such openings upon access of heat from a fire to such element.

3. A fire shielding element according to claim 2 in which said synthetic resin component comprises a urea-formaldahyde resin.

4. A fire shielding element according to claim 2 in which said synthetic resin component comprises a urea-formaldehyde resin and a urea-formaldehyde-acrolein resin.

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