

PATENT SPECIFICATION

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(54) FIRE-RESISTANT STRUCTURES

(71) We, NATIONAL RESEARCH DEVELOPMENT CORPORATION, a British Corporation established by Statute, of Kingsgate House, 66—74 Victoria Street, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to fire-resistant structures with intumescent surfaces, that is to say surfaces that swell when heated. Such structures find obvious use as building members, etc. In particular the invention relates to structures that have been painted with intumescent paint. It is known to coat structures with such paint to protect them against heat and flame in the event of fire; when subjected to heat from such a fire, the paint layer swells to form a layer, perhaps one-quarter of an inch thick, of expanded solid over the structure. This expanded solid not only prevents direct impingement of flame on the structure, it also acts as an insulator and protects the structure from heat by radiation, convection or conduction.

We have now discovered that intumescent substances, in particular paint, can on swelling give rise to an expanded solid which can fill perforations in the structure which supports them, thus making the structure opaque instead of perforated. The invention is defined by the claims, and embodiments of it will now be described by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of one form of structure according to the invention, before intumescence;

Figure 2 is part of a similar view, after intumescence;

Figures 3 and 4 are sections on the lines III—III and IV—IV in Figures 1 and 2 respectively, and

Figure 5 is a perspective view, part cut

away, of a structure as shown in the previous figures when installed in the service duct of a building.

The structure of Figures 1—4 comprises an egg-crate grid-type former 1 made up of slotted sheet metal strips 2. The spacing between adjacent parallel strips is about half an inch and the depth 3 of each strip is about 1½ inches. Both faces of each strip are painted with a layer 4 of intumescent paint. The paint is of the kind known to the trade as a "phosphate resin paint," comprising a resin base and incorporating a suitable phosphate compound as a blowing agent. Typical suitable examples are sold under the names ALBI R and ALBI-SAF. Other suitable paints, e.g. as sold under the name SNUFF, contain similar active agents but are water-based. The paint will be applied as a layer about ten thousandths of an inch thick, and when subjected to a temperature of 200—250°C it swells or intumesces into a layer up to one inch thick. Typically, one gallon of paint will cover 20 sq. yds. of surface. The paint layer, when heated, froths up as a very viscous foam which sets into a solid non-porous foam as heating continues.

Figures 2 and 4 show the structure once intumescence has taken place. Since the intumesced layer 5 could swell to one inch thick and the spacing between adjacent grid strips 2 does not exceed half an inch, the layers 5 supported by opposed strips have touched one another down the middle of each cell 6 formed by the grid, and substantially block the cell. The grid 1, which previously offered little resistance to the flow of gas through it, thus becomes a substantially solid obstruction. Figure 5 shows such a grid 1 mounted in a channel 7 formed around the periphery of a metal-walled duct 8. The floor 9 of one run of channel 7 is removable to allow insertion or removal of the grid. The duct 8 may be a vertical services duct within a modern multi-storey building. If a fire starts low down in

such a building, hot gases from the fire may well reach such a duct and travel by it to higher regions. It is well known to mount spring loaded flaps within such ducts, such flaps being held open by fusible links which part when the temperature within the duct rises dangerously high, allowing the spring to close the flap and block the dust. Unfortunately it is often difficult for maintenance staff to reach such flaps, which may have gone without attention for many years before they are first called upon to close. When that time comes they may have rusted, or debris falling down the duct may have jammed them, and they fail to move. A structure according to the present invention has the advantage that it lacks moving parts and reacts to a rise in temperature just as surely as a fusible link. Tests have indicated that the hot gases rising up a typical services duct as the result of a fire would generate a pressure difference of a few inches of water gauge, or even a fraction of an inch, across an obstruction which completely blocks the duct. A paint layer as described is well able to withstand such a difference without being dislodged, both during formation and when set.

Other types of grid are of course possible, for instance a matrix of hexagons.

In all embodiments of the invention already described a rise in temperature, due probably to the onset of fire, causes a hitherto perforate structure to become effectively solid, and thus to offer resistance to the flow of gas. This will almost certainly cause a rise in the static pressure of gas upstream of the newly created obstruction, and a fall downstream. Such changes in pressure may operate pressure-sensitive elements. Such elements are shown at 14, 15 in Figure 5. Either or both of such devices may be used. They may be linked, as indicated diagrammatically, to a fire alarm 16, a sprinkler system 17 and other fire fighting devices as desired.

Because of the insulation that a swollen paint layer offers to the material carrying it, the strips 2 of Figures 1—4 could be of flammable or plastics material instead of metal.

It is of course possible that the intumescent substance could respond to a rise in temperature of liquids and other fluids passing over it, not just gases as previously described.

WHAT WE CLAIM IS:—

1. A fire-resistant structure comprising a grid-like member defining a plurality of open-ended cells, in which the side-to-side dimension of the cells is smaller than their end-to-end dimension, in which the side walls of each cell carry an intumescent substance, and in which this substance on intumescence fills the cells and constitutes a substantially solid obstruction to the flow of gas through the structure.

2. A fire-resistant structure according to Claim 1 in which the end-to-end dimension of the cells is about three times greater than the side-to-side dimension.

3. A fire-resistant structure according to Claim 2 in which the end-to-end dimension is about 1.5 inches and the side-to-side dimension is about 0.5 inches.

4. A services duct for a building in which a fire-resistant structure according to Claim 1 spans the duct, whereby allowing air flow down the duct before the substance has intumesced but blocking it afterwards.

5. A fire-resistant structure according to any of Claims 1 to 3, substantially as described with reference to Figures 1 to 4 of the accompanying drawings.

6. A ventilation or similar services duct for a building, according to Claim 4 and substantially as described with reference to Figure 5 of the accompanying drawings.

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