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GB 2345125 A
GB 2297609 A
GB 2325728 A
US 4054711 A

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Other: EPODOC; WPI

(54) Abstract Title: **Fireproofing cover and intumescent material for heat sink**

(57) A fireproofing cover for a light fitting includes a cover top 1, a bevel edge 2, a cover enclosure 6 and a cover skirt 9. On the bevel edge there are heat sinks made up of two layers: an intumescent underlayer 8 and a ceramic fiber paper upper layer 4. The cover top, bevel edge, cover enclosure and cover skin are made of glass fiber cloth, one side of which is surfaced with fireproofing coat. Inside the cover enclosure there is an inner cover support bracket 14. The intumescent layer for the said heat sink uses ceramic fiber, 32-mesh expandable graphite and polyvinyl alcohol as the main raw materials, and can completely and instantly seal the air holes on the heat sinks to achieve the goal of extinguishing fire automatically.

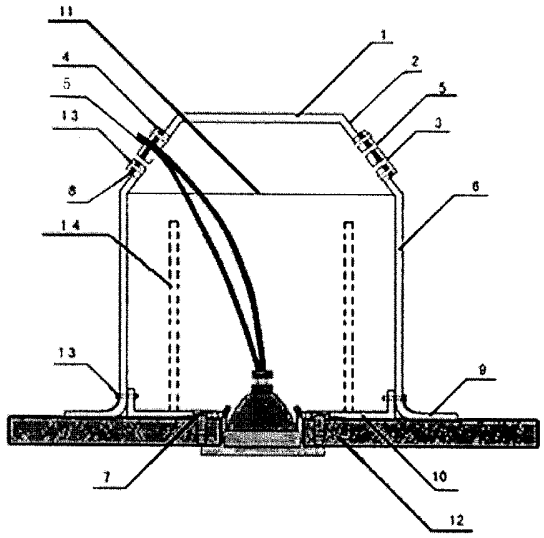

Fig. 2

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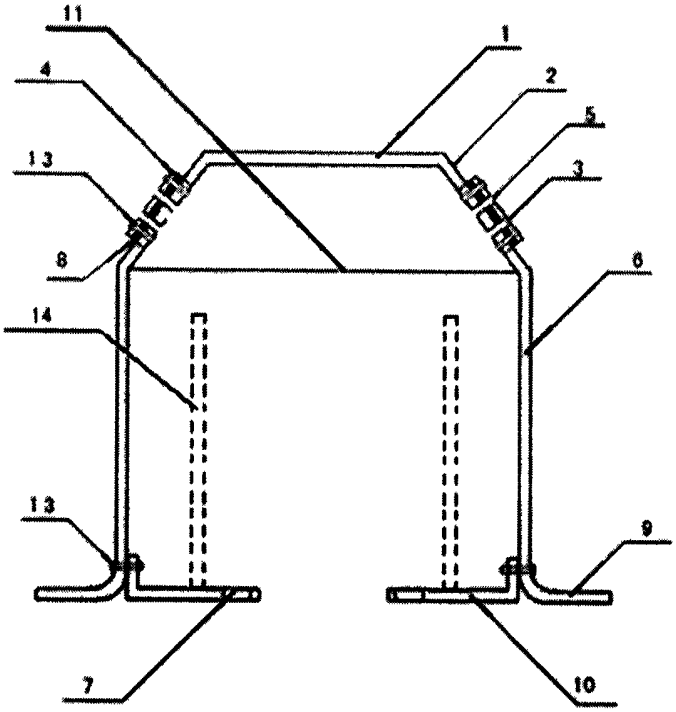

Fig. 1

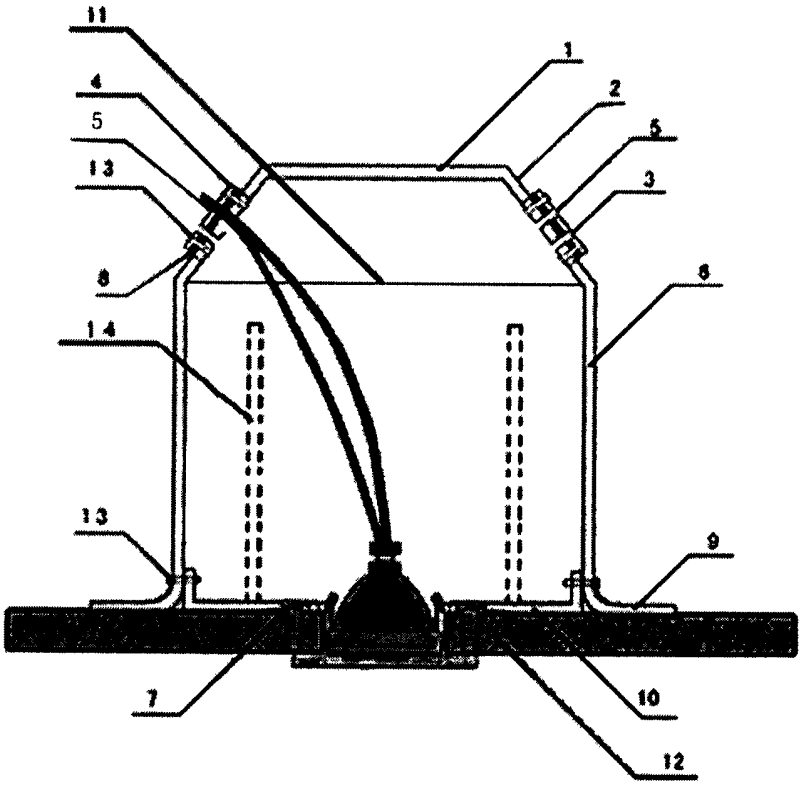

Fig. 2

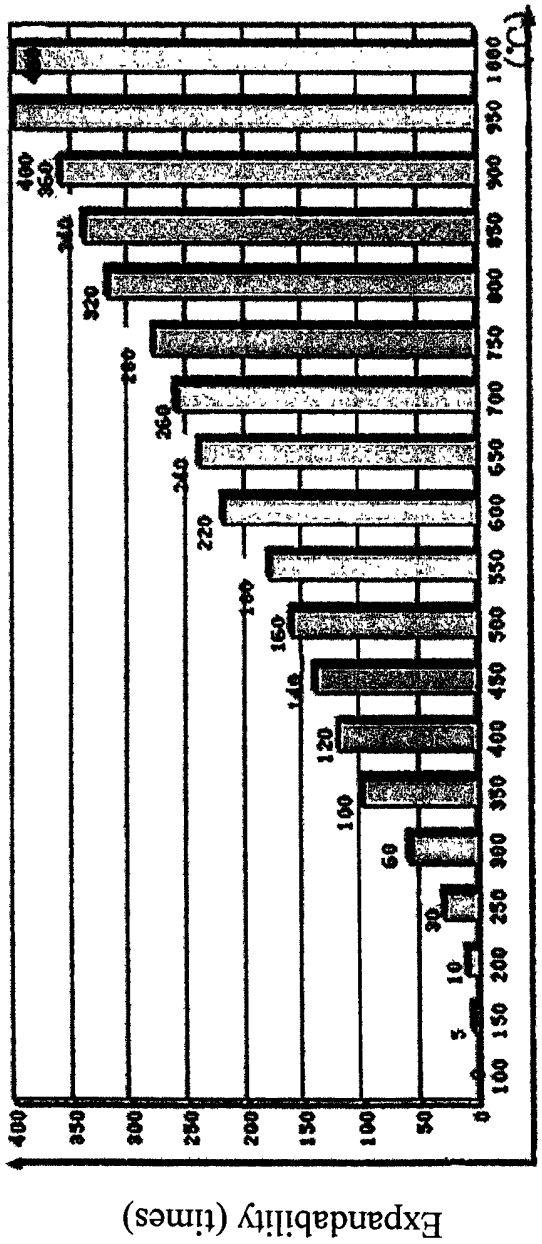
Expandability (times)
Temperature
(°C)
400
350
300
250
200
150
100
50
0
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000
5
10
30
60
100
120
140
150
180
220
240
260
320
340
360
400

Fig. 3

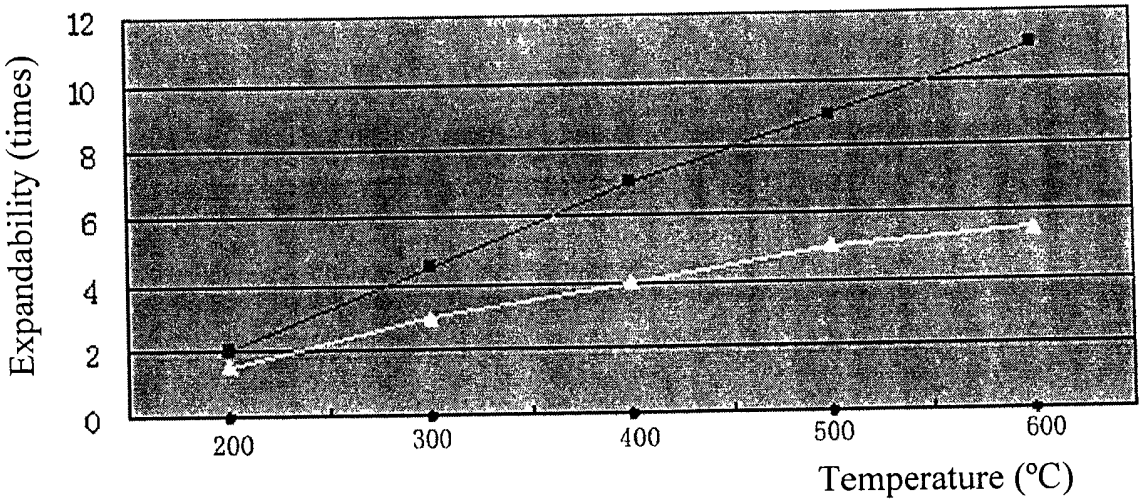
Expandability (times)
12
10
8
6
4
2
0
200
300
400
500
600
Temperature (°C)
Present Invention
Abroad

Fig. 4

Fireproofing Cover and Intumescent Material for Heat Sink

Technical Field

The present utility model relates generally to a protection device for electric lighting appliances and the special material for its heat sinks and, more particularly, to a fireproofing cover for electric parts of lighting fittings and the special material for its heat sinks. The fireproofing cover is designed to control the inflammation resulting from the inflammables which are emblazed due to the electric sparks produced by the short circuited electric wires or appliances or poor contact, and it can stop fast spreading of fire, thus causing flame to lack the combustion conditions and go out by itself.

Background Art

In the existing interior decoration of housings, the tail parts of the lighting fittings and the electrical parts (including the wire connection and electrical fittings, e.g. rectifier, transformer, trigger, and capacitor, etc.) are normally hidden and left naked behind the panels (for example, the suspended ceiling panel, wall protection panel, etc.). So, once the wires or parts/components of the appliances are short circuited or in poor contact to produce electric sparks, it is very liable to light up the inflammables around the electric appliances as to lead to combustion, thereby resulting in fire accident. Particularly, in some public places such as large singing halls, dancing halls, markets, conference halls and cinemas as well as wood-framing residences, fire accidents occur now and then due to the lighting facilities, leading to an extreme serious impairment and damage.

Though the broad public has had a common understanding on such disasters as resulted thereof and taken necessary measures, no product so far can hold back the spread of fire completely and efficiently as to achieve the goal of extinguishing flame.

Description of the Invention

The object of the present invention is to solve the following problems: (1) provide a fireproofing cover, which can effectively control the combustion area as resulted by the lighting fittings and delay the occurrence of fire accident, even isolate flame from environment air, thus making flame go out by itself; (2) provide a kind of special intumescent material for the heat sinks used on the said fireproofing cover.

The technical solutions of the present invention are as follows:

A fireproofing cover. It comprises a cover body, on which is fitted the heat sinks with air holes. The heat sinks are made up of two layers: the intumescent piece underlayer and the ceramic fiber paper upper layer. Namely, the intumescent material piece is covered with high temperature resistant (temperature resistance of >1000℃) ceramic fiber paper to ensure the intumescent material to go expanded laterally.

The said cover body includes the cover top, bevel edge, cover enclosure and cover skirt. On the bevel edge there is fitted the heat sinks available with a number of air holes.

The said cover top, bevel edge, cover enclosure and cover skirt are made of the glass fiber cloth material, on one side of which is painted the fireproofing coat capable of resisting the temperature as high as >750℃, forming a sealed cylinder body. Inside the cover enclosure, the inner cover support bracket is provided.

The cover enclosure of the said fireproofing cover is linked with the mounting support that is provided with the mounting holes.

The fireproofing cover can be made into square, rectangular, arch or any other shapes depending on the different shapes and sizes of the lighting fittings and their electrical parts. The fireproofing cover can be easily mounted at the different locations through the mounting holes on the mounting support.

The operating principle of the present invention is described below. The most of the possible causes of fires due to the electrical appliances are resulted from the short circuit or poor contact of the naked electric wires and other electrical parts and components, which produces the electric sparks and lights up the inflammables around the electrical appliances. In light of the aforesaid cases, there needs a kind of product which is able to make the burning electrical appliances not to get contact with the surrounding articles and air as far as possible, in an attempt to control the burning area within a given range, hold back the burning speed and restrict the burning conditions until the flame goes out by itself. In this way, it is possible to avoid greater damages and leave the sufficient time for the people to escape or to carry out firefighting and rescue operation in time. The present invention is a fireproofing cover based on aforesaid demands. Within the panel in the building, the tail ends of the lighting fittings and the naked wire connections of electrical appliances are all laid inside the cover. On the bevel edge of the cover, the heat sinks are provided with the air holes made on the fins. The air holes are through with the outside for air inflow so that the heat energy diffused by the electrical appliances in the operation can be discharged and the electrical appliances of the lighting fittings can operate normally. When the combustion occurs inside the cover as to produce heat energy, the increasingly rising heat energy can only be discharged through the said air holes. As the heat sinks around the air holes are made of the expansion materials, which would go expanded once heated, the air holes on the heat sinks will be closed automatically in an instant to prevent the external air from entering the fireproofing cover through the air holes. Thereby, the combustion area is controlled and the flame goes out by itself as there is no more inflowing air.

It can be seen from the operating principle of the fireproofing cover that the expansion performance of the intumescent material as used by the heat sinks is most important. The intumescent material of good performance can completely seal the air holes instantaneously and achieve the goal of extinguishing fire automatically. The intumescent material of poor performance can't completely seal air holes as to affect the fireproof and extinguishing effect of the fireproofing cover. The known intumescent material used as the fireproofing sealing units is normally made of a kind

of intumescent matter, fiber framework and adhesive agent, and the intumescent matter is basically the flake graphite.

The present invention has tried another kind of intumescent matter as the raw material, i.e. expandable graphite. The expandable graphite is known to have the following natures.

1. Generally, the grain size of graphite determines the expansion performance. It can be seen from Table 1 that the less the number of graphite mesh, the higher the expansibility.
2. For the same type of graphite, the different expansion temperatures will bring about different expansibility. As shown in Fig.3, the higher the expansion temperature of graphite, the higher the expansibility.

Table 1 Technical Specifications of Expandable graphite (Ordinary Type)

Type	Carbon content %	Volatility %	Water content %	PH value	Grain %	Expansibility (times)
32-mesh	80-99.9	≤13	≤2.5 (fine quality≤1)	3-6	Plus mesh ≥80	200-400
50-mesh						150-300
80-mesh						100-200
100-mesh						100-130

Note: Methods to test expansion performance of graphite:

Measure 50ml of unexpanded graphite with a measuring cylinder and put it into the 1000ml crucible. Increase temperature according to the designed temperature rising procedures (at the temperature rising rate of OPH), and cool it down to the room temperature. Then measure the volume (ml) of the expanded graphite with the measuring cylinder.

The formula for calculating the expansibility of graphite:

$$\text{Expansibility} = \frac{Volume(ml)after\ expansion - Volume(ml)before\ expansion}{Volume(ml)before\ expansion}$$

The present invention chooses the expandable graphite, ceramic fiber and polyvinyl

alcohol as the main raw materials to make the intumescent pieces. Through study and research, it has been found that:

1. The intumescent pieces made of the less mesh expandable graphite have better expansion performance than those made of the more mesh expandable graphite. It can be seen from Table 2 that the intumescent pieces using the 32-mesh expandable graphite have much higher expansibility than those using the 80-mesh expandable graphite.
2. The higher the expansion temperature, the higher the expansibility of the intumescent pieces made of the expandable graphite (See Table 3).

Table 2 Expansion Performance of Intumescent pieces Using the Expandable graphite of Different Grains

Mesh	32-mesh	80-mesh
Volume before expansion (ml)	50	50
Volume after expansion (ml)	1500	800
Expansibility	30 times	16 times

(Test conditions: The temperature rising rate OPH is set at 80% and the temperature is maintained at 1000℃ for 2 minutes.)

Table 3 Expansion Performance of Intumescent Materials under Different Temperatures (taking 32-mesh expandable graphite as the raw material)

Expansion temperature (℃)	600	800	1000
Volume before expansion (ml)	50	50	50
Volume after expansion (ml)	800	1200	1500
Expansibility	16 times	24 times	30 times

Therefore, according to the actual need of the fireproofing cover, the present invention chooses 32-mesh expandable graphite as the raw material of special intumescent material used on the fireproofing cover. Namely,

The said intumescent material takes the ceramic fiber, 32-mesh expandable

graphite and polyvinyl alcohol as its main raw materials.

In the said intumescent material, the 32-mesh expandable graphite has a content of 20-50%. The optimal preparation proportion of the said intumescent material is 60% of ceramic fiber, 25% of 32-mesh expandable graphite and 15% of polyvinyl alcohol.

The intumescent pieces on the heat sinks of the said fireproofing cover can use the ceramic fiber, 32-mesh expandable graphite and polyvinyl alcohol as the raw materials through the processing of stirring, lamination and drying.

The advantageous effects of the present invention are as follows:

1. The fireproofing cover of the present invention can check the quick spreading of fire, causing the flame to go out by itself as the combustion conditions are not available.
2. The special intumescent material for the heat sinks used on the fireproofing cover of the present invention has an excellent expansion performance, and it can completely and instantly seal the air holes on the heat sinks of the fireproofing cover as to achieve the goal of extinguishing fire automatically.

Description of the Drawings

Fig. 1 is the structural schematic view showing the fireproofing cover of the present invention.

Fig. 2 is the schematic view of the fireproofing cover in the present invention, showing that it is mounted on the lighting fitting.

Fig. 3 is the curve diagram showing that the expansibility of the graphite used in the present invention varies with the temperatures.

Fig. 4 is the comparative curve showing that the intumescent piece in the present invention compares with that of the same kind abroad in respect of expansibility.

Description of the Particular Embodiments

Below is a detailed description of the present invention in conjunction with the embodiments.

Embodiment

A fireproofing cover is as shown in Fig. 1 and Fig. 2. It includes the cover top 1, bevel edge 2, cover enclosure 6 and cover skirt 9. On the bevel edge2, there are the heat sinks comprising two layers: the expansion material plate underlayer 8 and the ceramic fiber paper upper layer 4. The heat sinks are installed on the bevel edge2 with rivets 13. On the heat sinks there are a number of air holes 3, one of them is a wire-passing hole 5. Inside the cover enclosure 6, there is the inner cover support 14. The cover top1, bevel edge 2, cover enclosure 6 and cover skirt 9 are made of the glass fiber cloth sewed together, the cloth is surfaced on one side with fireproofing painting coat able to resist the temperature as high as >750℃ (it can be seen from the figures that there is a sewing line 11 between the bevel edge 2 and cover enclosure 6), thus forming a closed cylinder. The two metal mounting supports 10 are fixed on both ends of the cover enclosure 6 through the rivets 13. The mounting supports10 have mounting holes 7 and through which the fireproofing cover can be mounted onto the ceiling panel 12 and hidden behind the ceiling panel12. The electrical components at the back of the lighting fitting can thus be covered. The wires at the tail end of the lighting fittings go through the wire-passing hole 5. The said intumescent piece 8 uses the ceramic fiber, 32-mesh expandable graphite and polyvinyl alcohol as the main raw materials.

Preparation Example and Test Example

Prepare the intumescent piece as per the following methods:

Put 60kg of ceramic fiber and 25kg of 32-mesh expandable graphite into 15kg of polyvinyl alcohol, and prepare it into 2# expansion material piece through the technological process of stirring, lamination and drying.

Prepare the 1#, 3#, 4# and 5# intumescent material piece as per the similar methods as above.

Test the expansibility of 1#, 2#, 3#, 4# and 5# intumescent material pieces respectively under the different temperatures of 200-600℃. The results are shown in Table 4.

Table 4 Expansibility of Different-Composition Intumescent Material Pieces under Different Temperatures (Times)

No. of intumescent piece	Temperature / Expansibility / Composition	200 ℃	300 ℃	400 ℃	500 ℃	600 ℃
1#	Ceramic fiber 65% 32-mesh expandable graphite 20% Polyvinyl alcohol 15%	1.5	3.5	5.5	7.5	9.5
2#	Ceramic fiber 65% 32-mesh expandable graphite 25% Polyvinyl alcohol 15%	2	4.5	7	9	11
3#	Ceramic fiber 55% 32-mesh expandable graphite 30% Polyvinyl alcohol 15%	2.5	5	7.5	10	12
4#	Ceramic fiber 45% 32-mesh expandable graphite 40% Polyvinyl alcohol 15%	3	6	9	12	14
5#	Ceramic fiber 35% 32-mesh expandable graphite 50% Polyvinyl alcohol 15%	3.5	7	11.5	14.5	17

1#, 2#, 3#, 4#, 5# intumescent material pieces have been respectively applied on the heat sinks of the fireproofing cover and the comparison test in respect to the sealing performances has been conducted, with the results obtained as shown in Table 5.

Table 5 Sealing Performance Comparison of Intumescent Material Pieces of Different Compositions

1#	2#	3#	4#	5#
Capable of sealing the air holes partially, but failure to seal the air holes completely	Capable of sealing the air holes completely	Capable of sealing the air holes completely	Capable of sealing the air holes completely	Capable of sealing the air holes completely

Brittleness comparison has been tested on the aforesaid 1#, 2#, 3#, 4#, 5# intumescent material pieces, with the results obtained as shown in Table 6:

Table 6 Comparison of Brittleness Performance of Intumescent Material Pieces of Different Compositions

1#	2#	3#	4#	5#
The finished product is soft and flexible, with a good flexibility.	Crease is left when the finished product is folded, with a normal flexibility.	Visible cracks are found when the finished product is folded, with a poor flexibility.	The finished product is broken when folded together, with a poor flexibility.	The finished product fails to be folded by 90°, with a poor flexibility.

It can be seen from Table 4 that the higher the content of 32-mesh expandable graphite in the intumescent piece, the better the expansion performance. And it can also be seen from Table 5 and Table 6 that although the 2#, 3#, 4# and 5# intumescent material pieces have a good expansion performance and can be used on the fireproofing cover to satisfy the actual demands for quick expansion under high temperature and complete sealing of air holes on the heat sinks instantly, the higher content of 32-mesh expandable graphite will cause the finished intumescent material piece to be easily hardened and get brittle crack, with the poorer flexibility. Therefore, 2# intumescent material piece, which has a content of 25% of the 32-mesh expandable graphite, is ultimately chosen as the optimal special intumescent material piece for the heat sinks used on the fireproofing cover of the present invention.

When the 2# intumescent material piece of the present invention is compared with the

products of the same kind abroad, the results obtained are as shown in Table 7 below:

Table 7 Comparison of the Intumescent Material Piece of the Present Invention with the Products of the Same Kind Abroad

	Expansibility (times)				
Temperature	200℃	300℃	400℃	500℃	600℃
Present invention	2	4.5	7	9	11
Abroad product	1.5	3	4	5	5.5

The aforesaid test results can also be reflected from Fig. 4. It can be seen from Table 6 and Fig. 4 that the special intumescent material piece for heat sinks used on the fireproofing cover is much better than the expansion performance of the same kind of products abroad. And the higher the temperature, the much better the expansion performance.

Claims

1. A fireproofing cover, wherein the feature is that it comprises a cover body on which there are heat sinks with air holes; The heat sinks are made up of two layers: the intumescent piece underlayer and the ceramic fiber paper upper layer.
2. The fireproofing cover as set forth in claim 1, wherein the feature is that the said cover body includes the cover top, bevel edge, cover enclosure and cover skirt; on the bevel edge there is fitted the heat sinks with air holes.
3. The fireproofing cover as set forth in claim 2, wherein the feature is that inside the said cover enclosure is fitted the inner cover support bracket.
4. The fireproofing cover as set forth in claim 1, 2 or 3, wherein the feature is that the said cover body is made of the glass fiber cloth, one side of which is surfaced with a fireproofing paint coat having a heat resistance ability of >750℃.
5. The fireproofing cover as set forth in claim 4, wherein the feature is that the said cover enclosure is linked with the mounting support, on which is provided the mounting holes.
6. The fireproofing cover as set forth in claim 5, wherein the feature is that the said intumescent piece uses the 32-mesh expandable graphite, ceramic fiber and polyvinyl alcohol as the main raw materials.
7. The fireproofing cover as set forth in claim 6, wherein the feature is that the said intumescent piece is made of the 60% ceramic fiber, 25% 32-mesh expandable graphite and 15% polyvinyl alcohol through the processing of stirring, lamination and drying.
8. A special intumescent material for heat sink used on the fireproofing cover as set forth in claim 1 to 7, wherein the feature is the said intumescent material is made mainly of the 32-mesh expandable graphite, ceramic fiber and polyvinyl alcohol, and the content of 32-mesh expandable graphite is 20%~50%.
9. The special intumescent material for heat sinks used on the fireproofing cover as set forth in claim 8, wherein the feature is that it is a kind of the intumescent material piece made of the ceramic fiber, 32-mesh expandable graphite and polyvinyl alcohol through the processing of stirring, lamination and drying.
10. The special intumescent material for heat sinks used on the fireproofing cover as set forth in claim 8 or 9, wherein the feature is that in the said intumescent

material the ceramic fiber has a content of 60%, the 32-mesh expandable graphite 25% and polyvinyl alcohol 15%.

11. A fireproof cover substantially as hereinbefore described by reference to, and as illustrated in, Figures 1 and 2 of the accompanying drawings.

Amendments to the claims have been filed as follows

Claims

1. A fireproofing cover, which comprises a cover body on which there are heat sinks with air holes, wherein the heat sinks are made up of two layers: an intumescent piece underlayer and a ceramic fiber paper upper layer.
2. The fireproofing cover as set forth in claim 1, wherein the said cover body includes a cover top, a bevel edge, a cover enclosure and a cover skirt; and wherein the heat sinks with air holes are fitted on the bevel edge.
3. The fireproofing cover as set forth in claim 2, wherein an inner cover support bracket is fitted inside the said cover enclosure.
4. The fireproofing cover as set forth in claim 1, 2 or 3, wherein the said cover body is made of the glass fiber cloth, one side of which is surfaced with a fireproofing paint coat having a heat resistance ability of >750℃.
5. The fireproofing cover as set forth in claim 4, wherein the said cover enclosure is linked with the mounting support, on which is provided the mounting holes.
6. The fireproofing cover as set forth in claim 5, wherein the said intumescent piece is made from 32-mesh expandable graphite, ceramic fiber and polyvinyl alcohol, which are the main raw materials.
7. The fireproofing cover as set forth in claim 6, wherein the said intumescent piece is made of 60% ceramic fiber, 25% 32-mesh expandable graphite and 15% polyvinyl alcohol.
8. The fireproofing cover as set forth in any of claims 1 to 7, wherein the said intumescent material is made mainly of 32-mesh expandable graphite, ceramic fiber and polyvinyl alcohol, and the content of 32-mesh expandable graphite is 20%-50%.
9. The fireproofing cover as set forth in claim 8, wherein the intumescent material piece is made of ceramic fiber, 32-mesh expandable graphite and polyvinyl alcohol through the processing of stirring, lamination and drying.
10. A fireproof cover substantially as hereinbefore described by reference to, and as illustrated in, Figures 1 and 2 of the accompanying drawings.

Application No: GB0513296.4 **Examiner:** Brian Caswell

Claims searched: 1-7, 11 **Date of search:** 28 September 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A		GB 2345125 A (TENMAT)
A		GB 2325728 A (EURO PASSIVE)
A		GB 2297609 A (ENVIRONMENTAL SEALS)
A		US 4054711 A (JOHNS-MANVILLE)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

A5A

Worldwide search of patent documents classified in the following areas of the IPC^{07}

A62C

The following online and other databases have been used in the preparation of this search report

EPODOC; WPI