

## DESCRIPTION

### MOLDED TRANSFORMER PROVIDED WITH FIRE EXTINGUISHING DEVICE

#### 5   **Technical Field**

The present invention relates to a molded transformer. More particularly, it relates to a molded transformer provided with a fire extinguishing device that can quickly extinguish a fire when a fire occurs in the molded transformer.

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#### **Background Art**

A molded transformer is formed by covering a primary coil and a secondary coil of a transformer with epoxy resin for insulation from peripheral components. In general, a coil is wound and put into a mold and then epoxy resin is injected into the mold so that the coil is covered with the epoxy resin. Although the primary coil and the secondary coil are covered with epoxy resin in a molded transformer, there is a danger of fire due to a spark that is generated while the transformer is operated.

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That is, since a current at a high voltage flows in a transformer, when a fire occurs while the transformer is operated, it is very difficult to suppress the fire. In particular, persons who suppress a fire may be exposed to a

danger due to high voltage, so it is not easy to suppress a transformer fire.

In order to solve this problem, as disclosed in a prior art document, gas for extinguishing a fire is injected from the  
5 outside into the space where a transformer is disposed. However, according to the Patent Document, the gas cannot be injected directly around coils where the fire occurs, and thus the coils are still burned and peripheral parts are also lost by fire.

10 Further, once transformers are installed, they are generally used for ten or more years and, in the prior art document, the configuration for extinguishing a fire is disposed not in the space where the transformer is installed, but outside. Accordingly the configuration is easily aged by an  
15 external environmental influence, so it may not be operated when it is actually needed.

## **Disclosure**

### **Technical Problem**

20 In order to solve the problems in the art, an object of the present invention is to be able to spray fluid directly to the points where a fire frequently occurs in a molded transformer to extinguish the fire.

Another object of the present invention is to be able to suppress a fire by mounting a configuration for extinguishing a fire on a molded transformer itself.

Another object of the present invention is to protect a  
5 configuration for extinguishing a fire from external environmental influence.

### **Technical Solution**

According to an aspect of the present invention for  
10 achieving the objects, there is provided a molded transformer provided with a fire extinguishing device, the molded transformer including: a base; a bottom frame disposed on the base; top frame disposed to be supported over the bottom frame; a core of which a lower portion is coupled to the bottom frame  
15 and an upper portion is coupled to the top frame; secondary coils covered with an insulating material and receiving a portion of the core therein; primary coils covered with an insulating material and receiving the secondary coils therein; a case disposed adjacent to one of the primary coils; canisters  
20 disposed in the case and filled with fluid for extinguishing a fire; and nozzles coupled to sections extending along the top frame of pipes connected to the canisters to spray the fluid for extinguishing a fire to the primary coils and the secondary coils.

The nozzles may spray the fluid to spaces between the primary coils and the secondary coils and between the outer sides of adjacent primary coils.

Nozzle holes may be formed in a predetermined area around  
5 a free end of the nozzles and the nozzles may be inclined toward the spaces between the primary coils and the secondary coils and between the outer sides of adjacent primary coils.

The case may be disposed at a longitudinal end of the bottom frame and the canisters may be disposed opposite to one  
10 of the primary coils with the case therebetween.

The case may be formed in the shape of a hexahedron with a top and an opposite side to the primary coil open.

Specific pipes may be further disposed along the bottom frame and nozzles for spraying the fluid from the canisters may  
15 be coupled to the pipes.

The canisters may be positioned with inlets facing up.

The pipes may be arranged along both sides, respectively, of the top frame or the bottom frame and the nozzles may be coupled to the pipes.

20 Nozzles for spraying the fluid to the space between the outer sides of the primary coils and nozzles for spraying the fluid to the spaces between the primary coils and the secondary coils may be both coupled to each of the pipes.

## 25 **Advantageous Effects**

It is possible to obtain the following effects from the molded transformer provided with a fire extinguishing device of the present invention.

According to the present invention, since the nozzles are  
5 disposed to spray fluid for extinguishing a fire are disposed between the primary coils and the secondary coils, that is, adjacent coils, over and under the primary coils and the secondary coils in the molded transformer, it is possible to quickly extinguish a fire occurring in the molded transformer.

10 Further, since the components for extinguishing a fire are mounted on the frames of the molded transformer, it is possible to protect the molded transformer against a fire without increasing the size of the molded transformer.

Further, since all of the components for extinguishing a  
15 fire are disposed in the container where the molded transformer is disposed, particularly, on the bottom frame and the top frame of the molded transformer, the device for extinguishing a fire is not influenced by the external environment, so the durability is improved. Further, since the pipes are short, it  
20 is possible to more quickly extinguish a fire.

### **Description of Drawings**

FIG. 1 is a perspective view showing the configuration of a molded transformer provided with a fire extinguishing device  
25 according to the present invention.

FIG. 2 is a perspective view showing the configuration shown in FIG. 1 in another direction.

FIG. 3 is a front view showing the configuration of an embodiment of the present invention.

5 FIG. 4 is a side view showing the configuration of an embodiment of the present invention.

FIG. 5 is a rear view showing the configuration of an embodiment of the present invention.

FIG. 6 is an enlarged perspective view showing a nozzle  
10 unit of the configuration according to an embodiment of the present invention.

### **Mode for Invention**

Hereinafter, embodiments of the present invention will be  
15 described with reference to exemplary diagrams. In the specification, in adding reference numerals to components throughout the drawings, it should be noted that like reference numerals designate like components even though components are shown in different drawings. In describing the present  
20 invention, well-known functions or constructions will not be described in detail since they may unnecessarily obscure the understanding of the present invention.

Further, terms such as 'first', 'second', 'A', 'B', '(a)', and '(b)' may be used for describing components in embodiments  
25 of the present invention. These terms are used only for

discriminating the components from other components, so the essence or order of the components indicated by those terms are not limited. It is to be understood that when one element is referred to as being "connected to", "combined with" or  
5 "coupled to" another element, it may be connected directly to or coupled directly to another element, or another element may be "connected", "combined", or "coupled" between them.

As shown in the drawings, a molded transformer provided with a fire extinguishing device according to the present  
10 invention has a base 10. The base 10 supports the entire molded transformer. In this embodiment, the base 10 is composed of two rods arranged in parallel with each other, but the present invention is not limited thereto. The configuration of the base 10 may be changed in various ways.  
15 The base 10 has wheels 12. The wheels 12 are used for moving the molded transformer. The wheels 12 may be disposed at least at both ends of the rods of the base 10. For example, a total of four wheels 12 are used.

A bottom frame 14 is disposed on the base 10. The bottom  
20 frame 14 is formed by combining two first support members 16 made of channels, coupled by first couplers 18. A plurality of first couplers 18 is used and is composed of bolts and nuts in this embodiment. The first couplers 18 are installed through a steel core 30 to be described below, thereby fixing the steel  
25 core 30 to the bottom frame 14.

A top frame 20 is disposed at a predetermined distance over the bottom frame 14. The top frame 20 has a configuration similar to the bottom frame 14. That is, two support members 22 are coupled by second couplers 24. A plurality of first  
5 couplers 24 is used and is also composed of bolts and nuts in this embodiment. The second couplers 24 are installed through a steel core 30 to be described below, thereby fixing the steel core 30 to the top frame 20. Lifting lugs 26 are formed on the second support members 22. The lifting lugs 26 are used to  
10 lift up the entire molded transformer using a crane or a lifter.

Tie rods 28 are provided to couple the bottom frame 14 and the top frame 20. The lower ends and upper ends of the tie rods 28 are fastened to the bottom frame 14 and the top frame  
15 20, respectively. A plurality of tie rods 28 is used and a pair of tie rods 28 may be provided in a secondary internal space 40 of each of secondary coils 38 to be described below. This is for coupling both sides of the portion of the steel core 30 inside the secondary internal space 40. The tie rods  
20 28 are long plates having a small thickness relative to the width and the pair of tie rods is fastened to each other by fasteners (not shown), whereby it can fix the steel core 30.

The steel core 30 is formed by stacking a plurality of steel plates, and they are not vertically stacked, but  
25 vertically erected in contact with each other in this

embodiment. The steel core is formed such that connecting portions disposed inside the internal space 40 of the secondary coil 38 to be described below are connected to the portion extending in parallel with the bottom frame 14 and the portion  
5 extending in parallel with the top frame 20. The steel core 30 is coupled to the bottom frame 14, the top frame 20, and the tie rods 28, but is insulated from them.

A plurality of insulating spacers 32 are coupled to the bottom frame 14 and the top frame 20. The insulating spacers  
10 32 are made of an insulating material and support the primary coils 34 and the secondary coils 38, insulated from the bottom frame 14 and the top frame 20. That is, the primary coils 34 and the secondary coils 38 are placed on the insulating spacers 32 on the bottom frame 14 so that the primary coils 34 and the  
15 secondary coils 38 are insulated from the bottom frame 14 and supported over the bottom frame 14.

The insulating spacers 32 on the top frame 20 are placed on the primary coils 34 and the secondary coils 38 to fix the tops of the coils 34 and 38 to the top frame 20 in an  
20 insulation state. The insulating spacers 32 are disposed on the primary coils 34 and the secondary coils 38 that are formed in a cylindrical shape, and are circumferentially arranged on each pair of the primary coils 34 and the secondary coil 38.

Pairs of the primary coil 34 and the secondary coil 38  
25 extend between the bottom frame 14 and the top frame 20. The

primary coil 34 is formed in a cylindrical shape with a primary internal space 36 and the secondary coil 38 is disposed in the primary internal space 36. The secondary coil 38 is also formed in a cylindrical shape and has a secondary internal space 40. The core 30 is disposed through the secondary internal space 40. A predetermined gap is defined between the inner side of the primary internal space of the primary coil 34 and the outer side of the secondary coil 38.

The primary coil 34 and the secondary coil 38 are formed in a cylindrical shape by putting a wound coil into a mold and the injecting epoxy resin into the mold. This is for insulating the primary coil 34 and the secondary coil 38 from peripheral parts. The primary coil 34 and the secondary coil 38 have a primary electrode 42 and a secondary electrode 44, respectively. The primary electrode 42 and the secondary electrode 44 are provided to electrically connect the coils 34 and 38 respectively to the outside.

Insulators 46 are coupled to the top frame 20 through brackets 48 to support some of the secondary electrodes 44. The insulators 46 insulate the secondary electrodes 44 from the top frame 20 and support the secondary electrodes 44 to prevent them from easily deforming.

A case 50 is disposed at a side of the bottom frame 14. The case 50 is disposed at one of the longitudinal ends of the bottom frame 14. This is for using the spaces at the

longitudinal ends of the bottom frame 14. The case 50 is not completely separated from the outside and has only to be positioned with a predetermined gap from the outer sides of the coils 34 and 38, particularly, an adjacent primary coil 34 such  
5 that components disposed inside the case 50, that is, canisters 52 to be described below are not influenced by heat from the primary coil 34. In this embodiment, the case 50 has a U-shaped transverse cross-section such that the inside is not influenced by heat from the primary coils 34. The case 50 is  
10 formed, in this embodiment, in a hexahedron that vertically extends, with the top and the opposite side to the side facing the primary coil 34 open.

The canisters 52 are disposed in the case 50. The canisters 52 are filled with fluid for extinguishing a fire.  
15 The fluid may be gas that can extinguish a fire. Three canisters 52 are provided in this embodiment, but the number is not limited. The canisters 52 are formed in the shape of a bottle and arranged with the inlets facing up in the case 50.

Pipes 54 are connected to the canisters 52. The pipes 54  
20 are passages for fluid from the canisters 52 to flow. The pipes 54 are connected to the inlets of the canisters 52 and extend toward the top frame 20. The portions extending upward of the pipes 54 bend toward the top frame 20 and then extend along the top frame 20. The portions extending along the top  
25 frame 20 of the pipes 54 are fixed to the top frame 20.

Nozzles 56 are coupled with a predetermined interval to the portions extending along the top frame 20 of the pipes 54. The nozzles 56 are parts for spraying fluid supplied through the pipes 54. The nozzles 56 are, as shown in FIG. 4, inclined  
5 downward at both sides when seen from a longitudinal end of the top frame 20. A plurality of nozzle holes 58 are formed in each of the nozzles 56, as shown in FIG. 6. The nozzle holes 58 are formed in a predetermined area around the free end of the nozzle 56. Fluid is sprayed through the nozzle holes 58.  
10 The nozzle holes 58 are open toward the primary coils 34 and the secondary coils 38.

The nozzles 56 coupled to the pipes 54 are positioned between the coils 34 and 38. That is, the nozzles 56 are positioned between the primary coil 34 and the secondary coil  
15 38 and between the primary coils 34.

In the embodiment shown in the figures, it can be seen that the nozzles 56 are positioned between the primary coils 34 from FIG. 3 and that the nozzles 56 are positioned between the primary coil 34 and the secondary coil 38 from FIG. 5. This  
20 arrangement is a basic arrangement of the nozzles and a smaller number of nozzles 56 may be used.

For example, as in the embodiment shown in the figures, when three pairs of primary coil 34 and secondary coil 38 are provided, five nozzles 56 may be coupled to each of the pipes

54 arranged along the two support members 22 of the top frame 20.

Further, the nozzles 56 are most preferably arranged along the top frame 20. This is because the sprayed fluid can  
5 extinguish a fire downward by gravity.

However, the nozzles 56 may be disposed along the bottom frame 14. It is more preferable, however, to arrange nozzles 56 along the top frame 20 and additionally arrange nozzle on the bottom frame 14. Obviously, depending on design  
10 conditions, that is, if it is possible to sufficiently spray fluid up to the tops of the coils 34 and 38 using only the nozzles 56 on the bottom frame 14, nozzles 56 can be arranged along only the bottom frame 14.

Further, when the primary coils 34 and the secondary coils  
15 38 are same height, nozzles 56 may be arranged along both of the top frame 20 and the bottom frame 14. In this case, the pipes 54 extend along the bottom frame 14 and are fixed to the bottom frame 14.

According to the present invention, the nozzles 56 are  
20 positioned in consideration of spraying fluid for extinguishing a fire directly to positions where a fire may occur in the molded transformer. That is, the nozzles 56 are positioned to be able to spray fluid directly to a fire and the directions of the nozzle holes 58 are also determined to be able to spray  
25 fluid to directly to a fire.

A fire has to be sensed so that fluid can be discharged from the canister. To this end, there are provided a specific sensor (not shown) and a controller (not shown) that controls the fluid to be discharged from the canisters 52 in response to  
5 sensing information from the sensor. Various sensors such as a smoke sensor may be used for this sensor. The sensor may be disposed on the top frame 20.

For reference, the molded transformer of the present invention is disposed inside a hexahedral container. The  
10 container is a part such as a cabinet and of which the inside can be opened by opening doors to both sides. The molded transformer is disposed in the internal space of the container and the sensor may be disposed on the ceiling of the internal space. A display or an operation panel for the controller is  
15 disposed on the outer side of the doors of the container.

Using of the molded transformer provided with a fire extinguishing device having the configuration described above in accordance with the present invention is described in detail hereafter.

20 The molded transformer of the present invention is disposed to be used in a container. To this end, doors of the container are opened and then the molded transformer is put into the internal space. Since the case 50 and the canisters 52 are disposed at a side of the bottom frame 14, there is no  
25 need for a specific space for them in the internal space of the

container. That is, the case 50 is disposed in a space remaining at a side of the bottom frame 14 in an existing molded transformer.

The case 50, which prevents influence by heat from the adjacent primary coil 34 and secures an insulation distance, protects the fluid in the canisters 52 from influence by heat and an electromagnetic field.

A fire may occur in the molded transformer disposed to be used in the internal space of the container. For example, the epoxy resin covering the primary coils 34 or the secondary coils 38 may be burned by a spark. Obviously, the epoxy resin is a fire retardant material, so it is difficult to burn, but it may be burned by continuous sparks or a flame generated in cables connected to the primary electrodes 42 or the secondary electrodes 44.

When a fire occurs, a sensor senses it and transmits the sensing information to the controller. When the controller finally determines that it is a fire, the fluid in the canisters 52 is discharged into the pipes 54. The fluid discharged into pipes 54 is sent to the nozzles 56 and sprayed through the nozzle holes 58. The fluid sprayed through the nozzle holes 58 mainly drops to the spaces between primary coils 34 and the secondary coils 38 and between adjacent primary coils 34. Obviously, it is also possible to spray the fluid to positions where a fire may occur other than the

positions described above, by appropriately changing the open areas of the nozzle holes 58.

The fluid sprayed from the nozzles 56 drops particularly to the spaces between the primary coils 34 and the secondary coils 38 where there is a danger of fire. In other words, the fluid sprayed from the nozzles 56 directly reaches the position of a fire, so it is possible to quickly extinguish the fire.

Meanwhile, the nozzles 56, as described above, may be arranged along the bottom frame 14. That is, it is possible to arrange nozzles 56 along the bottom frame 14 with or without nozzles 56 arranged along the top frame 20 to extinguish a fire by spraying fluid to the position of a fire.

Further, in the present invention, all of the case 50, canisters 52, pipes 54, nozzles 56, and sensor are disposed in the container. This configuration allows for preventing the parts from being damaged or aging due to the external environment, so it is possible to increase the lifespan of the device and keep the highest performance for a long period of time.

The above description is an example that explains the spirit of the present invention and may be changed and modified in various ways without departing from the basic features of the present invention by those skilled in the art. Accordingly, the embodiment described herein are provided not to limit, but to explain the spirit of the present invention

and the spirit and the scope of the present invention are not limited by the embodiments. The protective range of the present disclosure should be construed on the basis of claims and all the technical spirits in the equivalent range should be  
5 construed as being included in the scope of the right of the present disclosure.

For example, although the case 50 and the canisters 52 are on the bottom frame 14 in the embodiment shown in the figures, they may be mounted on the top frame 20.

**CLAIMS**

1. A molded transformer provided with a fire extinguishing device, the molded transformer comprising:

5 a base;

a bottom frame disposed on the base;

top frame disposed to be supported over the bottom frame;

a steel core of which a lower portion is coupled to the bottom frame and an upper portion is coupled to the top frame;

10 secondary coils covered with an insulating material and receiving a portion of the steel core therein;

primary coils covered with an insulating material and receiving the secondary coils therein;

15 a case disposed adjacent to an outer side of one of the primary coils;

canisters disposed in the case and filled with fluid for extinguishing a fire; and

20 nozzles coupled to sections extending along the top frame of pipes connected to the canisters to spray the fluid for extinguishing a fire to the primary coils and the secondary coils.

2. The molded transformer of claim 1, wherein the nozzles spray the fluid to spaces between the primary coils and the

secondary coils and between the outer sides of adjacent primary coils.

3. The molded transformer of claim 2, wherein nozzle holes  
5 are formed in a predetermined area around a free end of the  
nozzles and the nozzles are inclined toward the spaces between  
the primary coils and the secondary coils and between the outer  
sides of adjacent primary coils.

10 4. The molded transformer of claim 1, wherein the case is  
disposed at a longitudinal end of the bottom frame and the  
canisters are disposed opposite to one of the primary coils  
with the case therebetween.

15 5. The molded transformer of claim 4, wherein the case is  
formed in the shape of a hexahedron with a top and an opposite  
side to the primary coil open.

6. The molded transformer of any one of claims 1 to 5,  
20 wherein specific pipes are further disposed along the bottom  
frame and nozzles for spraying the fluid from the canisters are  
coupled to the pipes.

7. The molded transformer of claim 6, wherein the  
25 canisters are positioned with inlets facing up.

8. The molded transformer of claim 6, wherein the pipes are arranged along both sides, respectively, of the top frame or the bottom frame and the nozzles are coupled to the pipes.

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9. The molded transformer of claim 8, wherein nozzles for spraying the fluid to the space between the outer sides of the primary coils and nozzles for spraying the fluid to the spaces between the primary coils and the secondary coils are both  
10 coupled to each of the pipes.