

STATIONARY INDUCTION APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a stationary induction apparatus, and in particular to the one which has a configuration of an liquid-filled electric
5 equipment composed of an iron core, a plurality of windings and a cooling insulator.

In the case of installation of an liquid-filled electric equipment such as a stationary induction apparatus in a building, installation of a
10 fire extinguishing system is mandatory, as disclosed in JP-A-02-154406 (Fig. 1), that is, a fire detection device, a gas fire-extinguishing system associated with the fire-detection device and a water supply device are installed around a stationary induction apparatus.

15 However, in the above-mentioned conventional technology, when a stationary induction apparatus is installed in a building, since the fire detection device and a fire-extinguishing system have to be installed in addition to the stationary induction
20 apparatus, a pipe line for feeding a fire-extinguishing agent is also required together with the fire-extinguishing system, thus, in addition to a work of installation of a stationary induction apparatus, an application of a fire extinguishing system and a pipe
25 line work are required so that the work of installation

thereof is complicated.

BRIEF SUMMARY OF THE INVENTION

The present invention is devised in or to solve the above-mentioned problems of the prior art, and accordingly an object of the present invention is to provide a stationary induction apparatus which can eliminate the necessity of application of a fire extinguishing system and a pipe line work when the stationary induction apparatus is installed in a building.

To the end, according to the present invention, there is provided a stationary induction apparatus which is integrally incorporated with a fire extinguishing system which has been previously connected thereto with a pipe line for a fire extinguishing agent injected toward the stationary induction apparatus from the fire extinguishing system.

With the configuration of the present invention as stated above, in the case of installation of a stationary induction apparatus in a building, the necessity of a work of a pipe line which has been conventionally indispensable can be eliminated, thereby it is possible to simplify the installation of the stationary induction apparatus.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWING:

Fig. 1A is a front view illustrating a

stationary induction apparatus in a first embodiment of the present invention;

Fig. 1B is a side view illustrating the stationary induction apparatus shown in Fig. 1A;

5 Fig. 2 is a top view illustrating essential parts of a cooler and a fire extinguishing system;

Fig. 3 is a side view illustrating the fire extinguishing apparatus and the cooler;

Fig. 4 is a flow-chart for explaining the
10 operation of the fire extinguishing apparatus shown in Fig. 1A;

Fig. 5A is a front view illustrating a stationary induction apparatus in a second embodiment of the present invention;

15 Fig. 5B is a side view illustrating the stationary induction apparatus shown in Fig. 5A;

Fig. 6A is a front view illustrating a stationary induction apparatus in a third embodiment of the present invention; and

20 Fig. 6B is a side view illustrating the stationary induction apparatus shown in Fig. 6A.

Description of Preferred Embodiment of the Invention

Explanation will be hereinbelow made of several embodiments of the present invention with
25 reference to the accompanying drawings. Referring to Fig. 1A which is a front view illustrating a stationary induction apparatus in a first embodiment of the present invention, and Fig. 1B which is a side view

illustrating the stationary induction apparatus, the stationary induction apparatus which is of a fully equipped portable type, comprises a stationary inductor (transformer) 10 and a fire-extinguisher 12 which are
5 integrally incorporated with each other. The stationary inductor 10 comprises a tank 14 accommodating therein an iron core (which is not shown), and a plurality of wirings (which is not shown) such as a primary winding and a secondary winding,
10 which are wound around the iron core, together with a flammable cooling and insulating medium such as silicone liquid, in order to transform a voltage from the primary winding and to deliver the thus transformed voltage from the secondary winding, and coolers
15 (radiator) 16 introducing therein the silicone liquid as the cooling and insulating medium from the tank 14 so as to cool the silicon liquid and then returning the same into the tank 14. The tank 14 is secured at its bottom side to a base 18 in a building. There are
20 provided bushings 20 at one side surface of the tank 14, and the fire extinguisher 12 and a control box 24 at the front surface thereof on opposite sides of the coolers 16 which is therefore interposed between the fire extinguisher 12 and the control box 24.

25 The tank 14 incorporates therein sensors for detecting various unserious failures of the stationary inductor 10, including a thermometer for detecting a liquid temperature exceeding a set value, and a sensor

for detecting serious failures of the stationary inductor 10, such as a pressure sensor 26a for detecting a pressure in the tank 14, exceeding a set value so as to cause a relief valve 26 to discharge the pressure in the tank 14. The pressure sensor 26a is adapted to detect a surface pressure at all surfaces of the tank 14. The sensors for detecting unserious failures, and serious failures deliver detection signals to a controller (which is not shown) in the control box 24.

Further, the tank 14 is secured thereto with a frame 28 as shown in Figs. 2 and 3, and the coolers 16 which are secured to the tank 14 are supported by the frame 28. Further, the fire-extinguisher 12 is also secured to the frame 28 on the cooler 16 side while it is supported therearound by reinforcements 30, 32. A blower fan 34 for blowing cooling air onto the coolers 16 is also secured to the frame 28 on the cooler 16 side.

The fire extinguisher 12 secured to the frame 28, for the stationary inductor 10 as an object to be fire-extinguished, is filled therein with a fire-extinguishing agent such as nitrogen gas, and is connected thereto with a pipe line 36 for jetting the fire-extinguishing agent from the fire-extinguisher 12, downward onto the stationary inductor 10. A shut-off valve 38 is connected in the pipe line 36. This shut-off valve 38 is normally-closed, and is adapted to be

opened in response to a fire-extinguishing instruction delivered thereto from the controller in the control box 24 through a wiring cable (which is not shown).

When the shut-off valve 38 is opened, a spraying pump
5 (which is not shown) is energized, and accordingly, the fire-extinguishing agent is fed through the pipe line 36 from the fire-extinguisher 12, and is then jetted onto the stationary inductor 10 from a spraying port 40.

10 A smoke sensor 42 for sensing smoke produced from the stationary inductor 10, and a flame/heat sensor 44 for sensing flame or heat generated from the stationary inductor 10 are provided around the spraying port 40 of the pipe line 36, and sensing signals from
15 these sensors are delivered to the controller in the control box 24 through wiring cables (which are not shown). Further, the controller receives a signal from a manual start switch (which is not shown) located at a position remote from the stationary inductor 10.

20 Next, explanation will be hereinbelow made of the operation of this embodiment with reference to a flow-chart shown in Fig. 4. At first the controller determines whether the manual start switch is turned on or not (step S1), and if the operator has not yet
25 operated the manual start switch which is therefore not turned on, and then determines whether sensing signals are delivered respectively from the smoke sensor 42 and the flame/heat sensor 44 or not (step S2). If AND of

the sensing signal from the smoke sensor 42 and the sensing signal from the flame/heat sensor 44 is not satisfied, step S1 is again carried out, but if AND of the sensing signal from the smoke sensor 42 and the
5 sensing signal from the flame/heat sensor 44 is satisfied, the controller delivers a fire-extinguishing instruction (control signal) to the shut-off valve 38 which is therefore opened (Step S5). These process steps are carried out upon occurrence of an unserious
10 or serious failure of the stationary inductor 10 when the manual start switch 10 is turned on. That is, when the manual start switch is turned on, the controller also delivers the fire extinguishing instruction to the shut-off valve 38 which is therefore opened (steps S1
15 and S5). Further, when a detection output is delivered from the unserious failure sensor for detecting an unserious failure of the stationary inductor 10, or when a detection output is delivered from the serious failure sensor for detecting a serious failure of the
20 stationary inductor 10, the controller similarly delivers the fire-extinguishing signal to the shut-off valve 38 which is therefore opened (steps S3, S4 and S5).

When the shut-off valve 38 is opened, the
25 spraying pump is energized (step S6) so that the fire-extinguishing agent is fed from the fire-extinguisher 12 and through the pipe line 36 and is then jetted from the spraying port 40 to a position above the stationary

inductor 10 (step S7). Thus, the fire-extinguishing agent is jetted to the stationary inductor 10 so as to extinguish fire at the stationary inductor 10.

Thus, in this embodiment, as the fully
5 equipped portable type stationary induction apparatus, the stationary inductor 10 and the fire-extinguisher 12 are integrally incorporated with each other, and accordingly, it is possible to eliminate the necessity of application of a pipe line work for installation of
10 the fire extinguisher 12, in the case of installation of the stationary induction apparatus on the base 18 in the building. Thereby it is possible to facilitate the installation of the stationary induction apparatus so as to contribute to enhancement of the workability.

15 Next, explanation will be hereinbelow made of a second embodiment of the present invention with reference to Figs. 5A and 5B. The configuration of this embodiment is the same as that of the first embodiment shown in Fig. 1, except that the pipe line
20 36 is connected thereto with a branch pipe line 36a which therefore branches from the pipe line 36 connected to the fire-extinguisher 12, for filling the fire-extinguishing agent into the tank 14 of the stationary inductor 10.

25 With this embodiment, upon occurrence of fire, the fire-extinguishing agent from the fire-extinguisher 12 is jetted to a position above the stationary inductor 10, and is also filled in the tank

14, the fire can surely be extinguished in comparison with the first embodiment. Thereby it is possible to contribute to enhancement of the safety.

Next, explanation will be hereinbelow made of
5 a third embodiment of the present invention with reference to Figs. 6A and 6B. The configuration of this embodiment is the same as that of the first embodiment shown in Fig. 1, except that the pipe line connected to the fire-extinguisher 12 is connected
10 therein with a cooling water introduction pipe line 36b which branches from the pipe line 36 so as to introduce cooling water into the pipe line 36 and which is connected to a cooling water tank 46 in the building.

In this embodiment, the shut-off valve 38 is
15 opened upon occurrence of fire so as to extinguish fire at the stationary inductor 10. During normal operation without no fire, the shut-off valve 38 is closed so as to cooling water is introduced through the cooling water introduction pipe line 36b from the cooling water
20 tank 46, and is then sprayed onto the stationary inductor 10 from the spraying port 40 through the pipe line 36. Thus, even though the stationary inductor 10 is overloaded, the stationary inductor 10 can be fully cooled, thereby it is possible to execute a
25 countermeasure against overload of the stationary inductor 10 during the summer season, and further, to contribute to snow removal during the winter season.

CLAIMS:

1. A stationary induction apparatus comprising a stationary inductor accommodating therein an iron core, a plurality of windings wound around the iron core together with a flammable cooling and insulating medium, and a fire-extinguisher for the stationary inductor as an object to be fire-extinguished, secured to the stationary conductor, and a pipe line connected to the fire-extinguisher, for jetting a fire-extinguishing agent onto the stationary inductor from the fire-extinguisher.
2. A stationary induction apparatus comprising a stationary inductor accommodating therein an iron core, a plurality of windings wound around the iron core together with a flammable cooling and insulating medium, a fire-extinguisher for the stationary inductor as an object to be fire-extinguished, secured to the stationary inductor, a pipe line connected to the fire-extinguisher, for jetting a fire-extinguishing agent from the fire-extinguisher downward onto the stationary inductor, and a branch pipe line branching from the pipe line, for feeding the fire-extinguishing agent into the stationary inductor.
3. A stationary induction apparatus comprising a stationary inductor accommodating therein an iron core, a plurality of windings wound around the iron core together with a flammable cooling and insulating medium, a fire-extinguisher for the stationary inductor

as an object to be fire-extinguished, secured to the stationary inductor, a pipe line connected to the fire-extinguisher, for jetting a fire-extinguishing agent from the fire-extinguisher downward onto the stationary inductor, and a cooling water introduction pipe line branching from the pipe line, for introducing cooling water into the pipe line.

4. A stationary induction apparatus as set forth in any one of claims 1 to 3, wherein the stationary inductor comprises a tank accommodating therein the iron core and the plurality of windings wound around the iron core together with the flammable insulating medium, and the fire-extinguisher is secured to the tank which is either provided thereto with a cooler or is not.

5. A stationary induction apparatus as set forth in any one of claims 1 to 3, wherein there is provided a frame for securing the tank which is either provided thereto with a cooler or not, and the fire-extinguisher is secured to the frame.

6. A stationary induction apparatus as set forth in any one of claims 1 to 3, wherein there is provided a blower fan for blowing air onto the cooler and the tank, and the fire-extinguisher is secured to the frame.

7. A stationary induction apparatus as set forth in any one of claims 1, 2 and 3, wherein a shut-off valve is connected in the pipe line connected to the

stationary inductor, and is adapted to open the pipe line in response to a fire-extinguishing instruction which is delivered in association with a turn-on of a manual start switch.

8. A stationary induction apparatus as set forth in any one of claims 1, 2 and 3, wherein there are provided a smoke sensor for sensing smoke produced from the stationary inductor, and a flame/heat sensor for sensing flame or heat generated from the stationary inductor, and a shut-off valve connected in the pipe line connected to the stationary inductor, the shut-off valve being adapted to open the pipe line in response to a fire-extinguishing instruction which is delivered when the following conditions are satisfied: the smoke sensor senses smoke and the flame/heat sensor senses flame or heat.

9. A stationary induction apparatus as set forth in any one of claims 1, 2 and 3, wherein there are provided an unserious failure sensor for sensing an unserious failure of the stationary inductor, and a shut-off valve connected in the pipe line connected to the stationary inductor, the shut-off valve being adapted to open the pipe line in response to a fire-extinguishing instruction which is delivered when the following condition is satisfied: the unserious failure sensor detects an unserious failure.

10. A stationary induction apparatus as set forth in any one of claims 1, 2 and 3, wherein there are

provided a serious failure sensor for detecting a serious failure of the stationary inductor, and a shut-off valve connected in the pipe line connected to the stationary inductor, the shut-off valve being adapted to open the pipe line in response to a fire-extinguishing instruction which is delivered when the following condition is satisfied: the serious failure sensor detects a serious failure.