

[54] AUTOMATIC FIRE EXTINGUISHER IN
ELECTROPHOTOGRAPHIC COPYING
MACHINE OR THE LIKE

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169/11; 340/228.2; 352/143

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[57]

ABSTRACT

An automatic fire extinguishing device for use in an electrophotographic copying machine or the like having a heat treating section including inlet and outlet portions through which flammable material is passed and heat treated, the fire extinguishing device including means for detecting a fire in the heat treating section, a source of fire extinguishing gas, means responsive to the fire detecting means for releasing fire extinguishing gas upon detection of a fire, nozzle means connected to the source of fire extinguishing gas for spraying upon outbreak of a fire, the fire extinguishing gas in the form of a curtain so as to form an air curtain of the extinguishing gas at at least one of the inlet and outlet portions of the heat treating section to prevent the inflow of air therethrough, and an exhaust system responsive to the fire detecting means for sucking up the fire extinguishing gas after it has performed its function as an air curtain, so as to let it cover the source of the fire, and for discharging hot air in the heat treating section to the outside of the machine.

3 Claims, 3 Drawing Figures

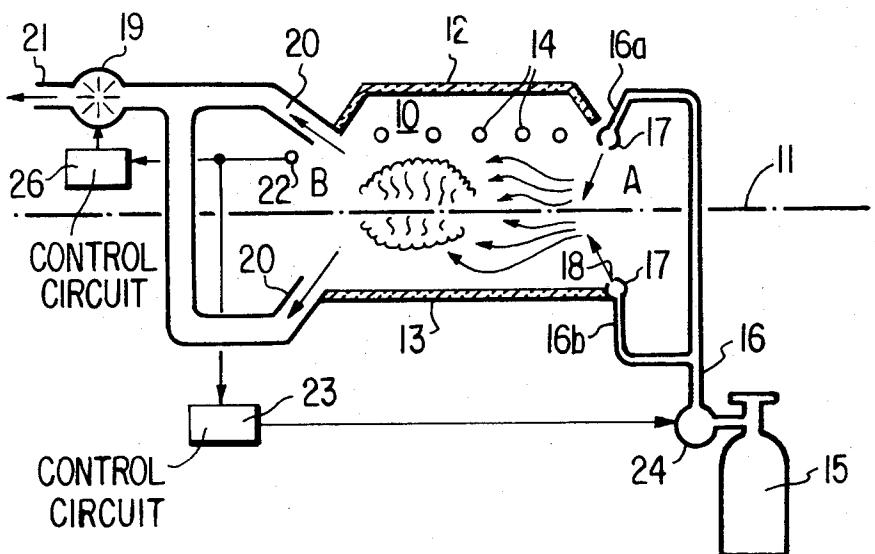


FIG. 1

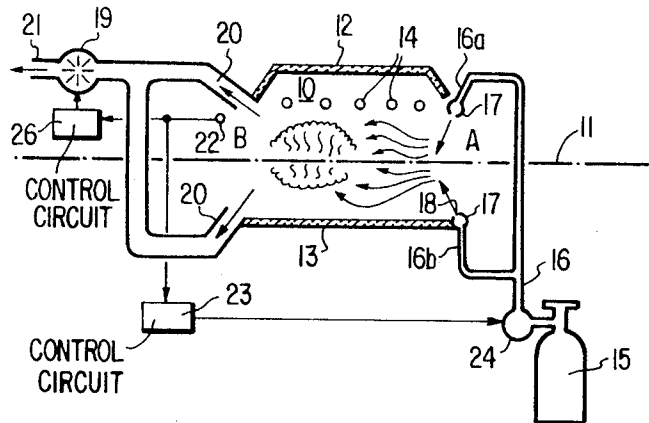


FIG. 2

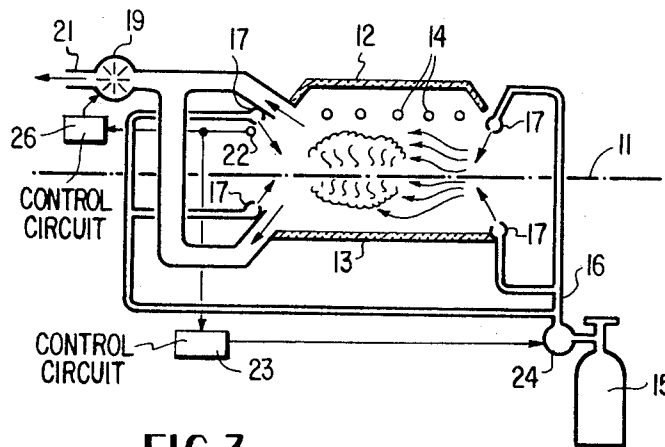
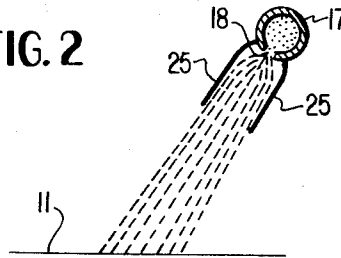


FIG. 3

AUTOMATIC FIRE EXTINGUISHER IN ELECTROPHOTOGRAPHIC COPYING MACHINE OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to fire extinguishers and in particular to such extinguishers as may be used in the heat fixing section of an electrophotographic copying machine or the like.

In copying machines, printing machines and the like employing the principle of electrophotography, in general, it is widely practiced to electrostatically form an image on a photoconductive layer by utilizing heat-fusible, fine colored particles called toner, then transfer the formed image on a copying paper sheet and fix it by means of a heat fixing device to obtain a final image. However, should the paper be unexpectedly stopped due to some mechanical trouble or be contacted with a thermal element or elements in the heat fixing device, the sheet may be overheated thereby causing a fire. As a precaution against this happening, an automatic fire extinguisher is manually integrally installed in the heat fixing device.

However, the conventional fire extinguishers of this type are only capable of detecting the outbreak of a fire and injecting the fire extinguishing gas into the heat fixing device. They are incapable of intercepting inflow of fresh air into the fixing device at the time of outbreak of the fire, so that the fire extinguishing efficiency is extremely low. Further, they are ineffective against waste heat of the thermal elements whose power circuit is typically cut off at the time of fire outbreak so that there is a substantial danger of causing re-ignition because of the waste heat.

SUMMARY OF THE INVENTION

A primary object of this invention is to provide an improved fire extinguishing device for use in a heat treating section such as the heat fixing section of an electrophotographic copying machine or the like wherein the fire extinguishing efficiency is increased by intercepting inflow of air into the heat treating section.

A further object of this invention is to provide a fire extinguisher of the above type wherein waste heat generated by de-energized thermal elements is positively excluded from the heat treating section to substantially minimize the probability of fire re-ignition.

A further object of this invention is to provide a fire extinguisher of the above type wherein turbulence of the sprayed fire extinguishing gas is substantially minimized.

Other objects and advantages of this invention will become apparent upon reading the appended claims in conjunction with the following detailed description and the attached drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a longitudinal sectional front view of a first embodiment of the invention.

FIG. 2 is a diagrammatic sketch illustrating the nozzle action of the invention.

FIG. 3 is a longitudinal sectional front view of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the figures of the drawing, like reference

numerals refer to like parts. Referring, in particular, to FIG. 1 there is shown a heat fixing section generally indicated at 10 where a paper sheet carrier strip is indicated at phantom line 11. The paper sheets carried thereon have a toner image which is transferred thereto at an image transfer section (not shown). The paper sheets are then passed through the heat fixing section 10. Disposed above and below carrier strip 11 in opposed relation are an upper heat insulating plate 12 and a lower heat insulating plate 13.

Thermal elements 14 such as infrared lamps are disposed above the carrier strip 11. Both end portions of the heat fixing section 10 perpendicular to the advancing sheet direction are enclosed by end plates not shown, the end plates, of course, including openings to permit sheet entry into and exit from the heat fixing section as is well known to those of ordinary skill in this art. The inlet and outlet portions to the heat fixing section are generally indicated at A and B respectively.

A source 15 of fire extinguishing gas such as a bomb filled with CO₂ gas, for example, is disposed at a suitable position in the copying machine. A pipe 16 is connected to the bomb through a solenoid valve 24, the pipe 16 being bifurcated as shown, with the respective end portions 16a and 16b being adjacent the inlet portion A of the heat fixing section at the upper and lower edges thereof respectively. Each end portion 16a and 16b is connected to a nozzle 17. Each nozzle 17 is disposed horizontally and perpendicularly to the paper sheet advancing direction as will be described in more detail hereinafter with respect to FIG. 2 where each nozzle has both ends closed and a slit 18 formed longitudinally therein.

On both upper and lower sides of the outlet portion B of the heat fixing section are provided suction ports 20 for an exhaust system including a blower 19 and an outlet 21. A solenoid valve 24 is controlled by a control circuit 23 which receives a signal from a detecting means 22, such as for example an ultraviolet ray detecting tube, which detects any fire present in the heat fixing section 10. Thus, in case a fire should break out in heat fixing section 10, it is immediately detected by detecting means 22, whereby control circuit 23 is actuated to open the solenoid valve 24.

With the opening of solenoid valve 24, the fire extinguishing gas is forced out from bomb 15, passed through pipe 16, and jetted out from the nozzles 17. At the same time, the power circuit of the thermal elements 14 is cut off by suitable means (not shown) upon fire detection by the detecting means 22. Also blower 19 is actuated via control circuit 26 which is also energized by detecting means 22 upon detection of a fire.

The fire extinguishing gas is sprayed from the nozzles 17 in the form of a curtain substantially vertical to the plane in which the paper sheet advances or at an angle with respect to the vertical which should generally not be more than 45° as approximately indicated in FIG. 2. Thus, an air curtain of the fire extinguishing gas is formed at the inlet portion A. This air curtain substantially prevents the inflow of air through inlet portion A. After striking the carrier strip 11 or the paper sheets thereon and performing its function as an air curtain, the fire extinguishing is sucked up by blower 19 and moved into the heat fixing section 10 to cover the source of the fire. Further, hot air in the heat fixing section is removed from the machine through the suction ports 20 with rotation of the blower 19, thus effecting

rapid decline of the temperature in the section 10, so that the danger of causing re-ignition by waste heat of the heating elements 14 is substantially eliminated and also the fire extinguishing efficiency is markedly improved.

FIG. 2 illustrates a spray pattern of the fire extinguishing gas from a nozzle 17 which is provided with a pair of spray flow controlling flat plates 25 disposed parallel to the sprayed direction of the gas. These plates serve to prevent turbulence of the jetted flow of fire extinguishing gas, thereby allowing the formation of a more effective air curtain.

FIG. 3 illustrates another embodiment of the invention in which the nozzles 17 are provided not only in the inlet portion A of the heat fixing section but also in the outlet portion B as shown, so as to shut off the fixing section from the outside air at both inlet and outlet portions in the event of outbreak of a fire, the nozzles 17 at outlet portion B also being connected to pipe 16 as indicated in the figure.

Numerous modifications of the invention will become apparent to one of ordinary skill in the art upon reading the foregoing disclosure. During such a reading it will be evident that this invention provides unique fire extinguishing apparatus for accomplishing the objects and advantages herein stated.

What is claimed is:

1. An automatic fire extinguishing device for use in an electrophotographic copying machine or the like having a heat treating section including inlet and outlet portions through which flammable material is passed and heat treated, said fire extinguishing device comprising:

means for detecting a fire in said heat treating section;

a source of fire extinguishing gas;

means responsive to said fire detecting means for releasing said fire extinguishing gas upon detection of a fire;

nozzle means connected to said source of fire extinguishing gas for spraying upon outbreak of a fire, the fire extinguishing gas in the form of a curtain so as to form an air curtain of said extinguishing gas at at least one of said inlet and outlet portions of the heat treating section to prevent the inflow of air therethrough, at least two said nozzle means being located at each of said inlet and outlet portions respectively; and

exhaust means responsive to said fire detecting means for sucking up the fire extinguishing gas after it has performed its function as an air curtain so as to let it cover the source of the fire, and for discharging hot air in the heat treating section to the outside of the machine.

2. An automatic fire extinguishing device for use in an electrophotographic copying machine or the like having a heat treating section including inlet and outlet

portions through which flammable material is passed and heat treated, said fire extinguishing device comprising:

means for detecting a fire in said heat treating section;

a source of fire extinguishing gas;

means responsive to said fire detecting means for releasing said fire extinguishing gas upon detection of a fire;

nozzle means connected to said source of fire extinguishing gas for spraying upon outbreak of a fire, the fire extinguishing gas in the form of a curtain so as to form an air curtain of said extinguishing gas at at least one of said inlet and outlet portions of the heat treating section to prevent the inflow of air therethrough, a pair of said nozzle means being located on opposite sides of said flammable material to form said air curtain; and

exhaust means responsive to said fire detecting means for sucking up the fire extinguishing gas after it has performed its function as an air curtain so as to let it cover the source of the fire, and for discharging hot air in the heat treating section to the outside of the machine.

3. An automatic fire extinguishing device for use in an electrophotographic copying machine or the like having a heat treating section including inlet and outlet portions through which flammable material is passed and heat treated, said fire extinguishing device comprising

means for detecting a fire in said heat treating section;

a source of fire extinguishing gas;

means responsive to said fire detecting means for releasing said fire extinguishing gas upon detection of a fire;

nozzle means connected to said source of fire extinguishing gas for spraying upon outbreak of a fire, the fire extinguishing gas in the form of a curtain so as to form an air curtain of said extinguishing gas at at least one of said inlet and outlet portions of the heat treating section to prevent the inflow of air therethrough, said nozzle means comprising an elongated tube having a slit disposed longitudinally therein, said tubes being oriented across the width of said flammable material to form said air curtain and a pair of plates disposed at the opposite sides of said slit to prevent turbulence of the sprayed fire extinguishing gas; and

exhaust means responsive to said fire detecting means for sucking up the fire extinguishing gas after it has performed its function as an air curtain so as to let it cover the source of the fire, and for discharging hot air in the heat treating section to the outside of the machine.

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