PATENT SPECIFICATION (11) 1 588 776

1 588 776

(21) Application No. 24868/77 (22) Filed 14 June 1977 (19)

(31) Convention Application No. 700 408 (32) Filed 28 June 1976 in

(33) United States of America (US)

(44) Complete Specification published 29 April 1981

(51) INT. CL.³ B01D 5/00 G03D 7/00

(52) Index at acceptance

B1B 403 603 717 L

G2X J3

(72) Inventors STEPHEN ERNOHAZY
LARRY ALLEN SONGER and
THOMAS VERNON DE RYKE

(54) METHOD AND APPARATUS FOR DEALING WITH DEVELOPER WASTE

(71) We, AM INTERNATIONAL INC. (formerly ADDRESSOGRAPH-MULTIGRAPH CORPORATION), a corporation organized and existing under the laws of the State of Delaware, United States of America, of 1900 Avenue of the Stars, Los Angeles, California 90067 (formerly of 20600 Chagrin Blvd., Cleveland, Ohio 44122), United States of America, 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 method and apparatus for dealing with gaseous developer waste, more especially for diazo machines.

In the ammonia developing process an excess of ammonium hydroxide is introduced into the developer system to provide a hot, moist alkaline environment. In a conventional ammonia type diazo machine the waste of aqueous ammonia solution is drained from the developer system to a waste collection container and the container is periodically emptied. To eliminate this inconvenient and undesirable procedure, and to avoid escape of ammonia gas or fumes to the atmosphere, the present invention provides convenient and safe method and apparatus for dealing with the waste without the need for emptying a waste container and without requiring intervention by the machine operator.

The invention in one aspect provides a device for dealing with gaseous developer waste from a developer system of an ammonia type diazo copying machine, in which the gaseous waste includes a first portion of ammonia gas and a second portion of steam, comprising:

inlet duct means for receiving gaseous waste from the developer system of the copying machine;

condenser means associated with the inlet duct means for separating the first and second portions of gaseous waste by converting the second portion to liquid;

evaporator means for receiving the liquid;

the evaporator means including heater means for heating the liquid therein to vapourize it; and

tube means extending from a position below the level of the liquid in the evaporator means to the inlet duct means to prevent flow of the vapourized liquid from the evaporator means to the developer system.

In its preferred form this device can be installed on existing copying machines without requiring major modification thereof.

In another aspect the invention provides a method of dealing with gaseous developer waste comprising a first portion of ammonia gas and a second portion of steam from a developer system of an ammonia type diazo copying machine, which comprises the steps of:

separating the first and second portions of gaseous waste by converting the second portion to liquid;

recirculating the first portion to the developer system;

vapourizing the liquid by heating the liquid to an elevated temperature while preventing recirculation of the vapourized liquid to the developer system; and

expelling the vapourized liquid.

A preferred embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a front elevation, partially in section, of a device in accordance with the present invention for dealing with gaseous waste, in association with a developer system and an exhaust system of an ammonia type diazo machine;

Figure 2 is a plan view of the device; and

Figure 3 is an end elevation of the device partially in section, as viewed from the left in Figure 1.

The device shown in Figure 1 comprises an evaporator tank indicated generally by the reference numeral 10. An inlet duct 12 ex-

tends from an ammonia developer system 14 of a diazo copying machine to a waste separating station indicated at 15 and from there to an inlet duct connector 16 on the tank 10. The waste leaving system 14 includes a first portion of ammonia gas and a second portion of water vapour or steam. The water vapour or steam in the gaseous waste is largely condensed by a condenser 70. At the separating station, 15, the ammonia gas is recirculated to the developer system 14 and the water is conveyed by the inlet duct 12 to the tank 10 where it settles as shown at 13 at the bottom of the tank, as will be further described hereinafter.

A heater unit 18 is provided at the bottom of the tank 10 which, under control of a first thermostat 20, heats the evaporator tank 10 to an elevated temperature to vaporize the water in the tank. As the second portion of the waste which is substantially pure water, enters the tank from the inlet duct 12, the heater unit 18 is effective to vapourize the water and the hot steam resulting from vapourization of the water is expelled from the tank 10 through an outlet duct 22 extending from an outlet duct 21 on the tank to an exhaust system of the copying machine.

A second or safety thermostat 24 is provided and, in the event of a heater failure, the thermostat 24 detects the lower temperature and initiates a machine cool-down cycle which arrests ammonia flow to the developer system 14 and gaseous waste flow from the developer system to prevent overflow of the water in the evaporator tank.

With reference to Fig. 2, the evaporator tank 10 may be constructed in any suitable manner to provide side walls 30 and 32, end walls 34 and 36 terminating in a leg 26 and 28 respectively, a top and 38 a bottom 40. Preferably, the tank 10 is of welded construction to provide a sealed enclosure to prevent leakage of the water 13. Also, the evaporator 10 and the connectors 16 and 21 are of stainless steel or other suitable material which is impervious to attack by chemically reactive liquid such as ammonia.

The heater unit 18 is a 300 watt electrically heated plate mounted in contact with the outer surface of the bottom 40 of the evaporator tank 10. The heater unit is mounted to the tank with a pair of straps 42 and 44 positioned on the top 38 of the tank, and a pair of bolts 46 and a pair of bolts 48 extending from the straps 42 and 44 respectively, and threaded into nut-bars 50 and 52 respectively, positioned at the bottom of the heater unit 18.

The thermostat 20 is mounted on the side wall 32 with fastening means 54 and controls and maintains the temperature at a proper working range for vaporizing the water in the evaporator tank 10. The thermostat 20 is connected between a terminal 56 on the heater unit 18 and one side of a main of an electrical circuit. The thermostat 20 is operable to maintain the vaporizing temperature in the evaporator tank 10 within a working range of about 200°F.—250°F. Without a control for the heater unit 18, the heater unit could produce a temperature output as high as 500°F—600°F. Therefore, the thermostat 20 is designed to operate such that it opens at 250°F. to thereby prevent excessive heat build-up of the heater unit and possible damage to the device. Also, the thermostat is operable to close at 200°F. to maintain the temperature in the evaporator tank 10 within a working range and to prevent the temperature from dropping to a low level which would be insufficinet to vaporize the water in the evaporator tank.

The safety thermostat 24 is mounted on the top 38 of the evaporator tank 10 with fastening means 58, and as explained above, is effective to initiate arrestment of residue waste flow from the developer system 14 in the event of a heater failure. The thermostat 24 is connected to a terminal 60 (Fig. 3) on the heater unit 18 and from there to the other side of the main of the electrical circuit. The thermostat 24 is operable within a range of about 140°F.—170°F. In the event of a heater failure and the thermostat 24 detecting a temperature below the working range, at 140°F. the thermostat 24 is operable to a closed condition which initiates a machine cool-down cycle, discontinues ammonia flow to the developer system 14 and arrests residue waste flow from the developer system. This arrangement prevents the possibility of the water overflowing the evaporator tank 10.

With reference to Figs. 1 and 3, the device further includes a tube 62 extending from an end 64 positioned below the level of the water 13 at the bottom of the evaporator tank 10, upwardly through the connector 16 and into the inlet duct 12 whereat it is retained by a ferrule 63. The tube 62 is also made of stainless steel or other suitable material impervious to attack by chemically reactive liquids such as ammonia. To insure that the end 64 of the tube 62 is maintained below the level of the water in the evaporator tank, to prevent flow of the vaporized water from the evaporator tank through the tube 62 to the developer system 14, the end wall 36 is preferably made somewhat longer than the end wall 34 so that the evaporator tank 10, when mounted in an operative position on the legs 26 and 28, is positioned at a slight angle as shown in Fig. 1 to cause the water 13 to flow towards the tube 62.

From the tube 62, the inlet duct 12 extends upwardly to the separator station 15 comprising a "Y" connection 65 and then branches into a branch 66 connected to a waste exit 67 of the developer system 14, and a branch 68 connected to an ammonia inlet 69. The branch 68 is provided with a

connector 71 in the form of a finned tube acting as the condenser 70 previously mentioned for trapping and condensing steam in the branch 68 to allow the ammonia gas free passage back to the developer system 14 as will be further described hereinbelow.

The outlet duct 22 extends from the connector 21 on the evaporator tank 10 and terminates in an end 72 in a duct air-flow 74 of the exhaust system of the machine as shown schematically and in phanton in Fig. 1. The end 72 of the outlet duct 22 is bias cut and exposes a large area of the inside diameter of the duct 22 to a high velocity air flow, in a direction parallel to the bias cut of the end 72 as shown by the arrows A. The high velocity air flow in provided by a blower 76. This arrangement results in a ejector action on flow.

A description of the operation of the device will now be given. The waste issuing from the exit 67 of the developer system 14 into the branch 66 is a combination of a first portion of ammonia gas and a second portion of steam having a temperature of about 220°F. —230°F. The residue waste comprising the ammonia gas and the steam traverses the branch 66 and moves down to the junction of the "Y" connection 65, whereat it has two possible paths it can take. However, because both the ammonia gas and the steam are light and are seeking a low pressure area, from the "Y" junction they are caused to traverse up the opposite branch 68.

The ammonia gas which traverses up the branch 68 is allowed free passage by the condenser 70 and passes to the inlet 69. The steam which traverses up the branch 68, however, is cooled and condensed by the condenser 70 and flows down the inlet duct 12 to the bottom of the evaporator tank 10.

Hence, the waste entering the evaporator tank 10 is almost pure heated water containing little or no ammonia. The water is vaporized in the evaporator tank to form steam which creates a higher pressure in the evaporator tank. Because the end 64 of the tube 62 is positioned below the level of the water 13 in the tank 10, this higher pressure within the tank is not carried upwardly into the duct 12 and into the developer system 14. The higher pressure within the evaporator tank 10 in combination with the ejector effect produced by the duct air-flow 74, as described above, are effective to expel the waste in the form of steam from the tank to the exhaust system. Accordingly, there is no discharge or leakage of ammonia gas, fumes or the like to the exhaust system or to the atmosphere because the waste vaporized in the evaporator tank 10 and expelled to the exhaust system is almost entirely steam from the condensed water in the branch 68. The ammonia in the branches 66 and 68 is recirculated into the developer system 14 and does not reach the exhaust system.

From the foregoing, it will be appreciated that the preferred embodiment of the present invention provides a device for dealing with waste in an ammonia type diazo copying machine in a safe and convenient manner. The device is effective to separate ammonia from steam, condense the steam to form water, vaporize the water to form steam, expel the steam to an exhaust system and to recirculate ammonia into the developer system. There is no requirement for machine operator intervention in the way of periodically emptying a waste container as associated with conventional residue waste collectors of ammonia type diazo copying machines.

WHAT WE CLAIM IS:—

1. A device for dealing with gaseous developer waste from a developer system of an ammonia type diazo copying machine. in which the gaseous waste includes a first portion of ammonia gas and a second portion of steam, comprising:

inlet duct means for receiving gaseous waste from the developer system of the copying machine;

condenser means associated with the inlet duct means for separating the first and second portions of gaseous waste by converting the second portion to liquid;

evaporator means for receiving the liquid;

the evaporator means including heater means for heating the liquid therein to vapourize it: and tube means extending from a position below the level of the liquid in the evaporator means to the inlet duct means to prevent flow of the vapourized liquid from the evaporator means to the developer system.

2. A device as set forth in Claim 1, having a branch conduit for communication with an inlet of the developer system for recirculating the first portion from the condenser means to the developer system.

3. A device for dealing with gaseous developer waste from a developer system of an ammonia type diazo copying machine, in which the gaseous waste includes a first portion of ammonia gas and a second portion of steam, comprising;

a first branch conduit for communication with a gaseous waste exit of the developer system;

a second branch conduit in communication with the first branch conduit and for communication with the developer system;

condenser means associated with the second branch conduit for separating the first and second portions of gaseous waste by converting the second portion to liquid;

inlet duct means in communication with the first and second branch conduits for conveying the liquid to an evaporator means;

the evaporator means including heater

means for heating the liquid therein to vapourize it; and

tube means extending from a position below the level of the liquid in the evaporator means to the inlet duct means to prevent flow of the vapourized liquid from the evaporator means to the developer system.

4. A device as set forth in Claim 1 or Claim 2 further comprising a thermostat for controlling the heater means for maintaining the vapourizing temperature within a working range.

5. A device as set forth in Claim 4 in which the working range is about 200°F.—250°F.

6. A device as set forth in any of the preceding claims further comprising outlet means for expelling the second portion vapourized by the evaporator means.

7. A device as set forth in Claim 6 in which the outlet means comprises:

an outlet duct extending from the evaporator means and terminating in a bias cut end in an air duct; and

blower means producing a high velocity airflow in the air duct in a direction parallel to the bias cut end of the outlet duct to assist in the removal of said second portion from the outlet duct.

8. A device as claimed in claim 4 or in any of the claims appendent thereto further including a second thermostat for arresting flow of gaseous waste from the developer system in response to detecting a temperature below the working range.

9. A method of dealing with gaseous developer waste comprising a first portion of ammonia gas and a second portion of steam from a developer system of an ammonia type diazo copying machine, which comprises the steps of:

separating the first and second portions of gaseous waste by converting the second portion to liquid;

recirculating the first portion to the developer system;

vapourizing the liquid by heating the liquid to an elevated temperature while preventing recirculation of the vapourized liquid to the developer system; and expelling the vapourized liquid.

10. A method as set forth in Claim 9, comprising the further stop of controlling the heating to maintain the vapourizing temperature within a working range.

11. A method as set forth in Claim 10, further comprising the stop of arresting flow of gaseous waste from the developer system in response to detecting a temperature below the working range.

12. A device for dealing with gaseous developer waste, substantially as herein described with reference to the accompanying drawings.

13. A method of dealing with gaseous developer waste, substantially as herein described with reference to the accompanying drawings.

LLOYD WISE, TREGEAR & CO.,
Norman House 105—100 Strand,
London, WC2R 0AE.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1588776 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

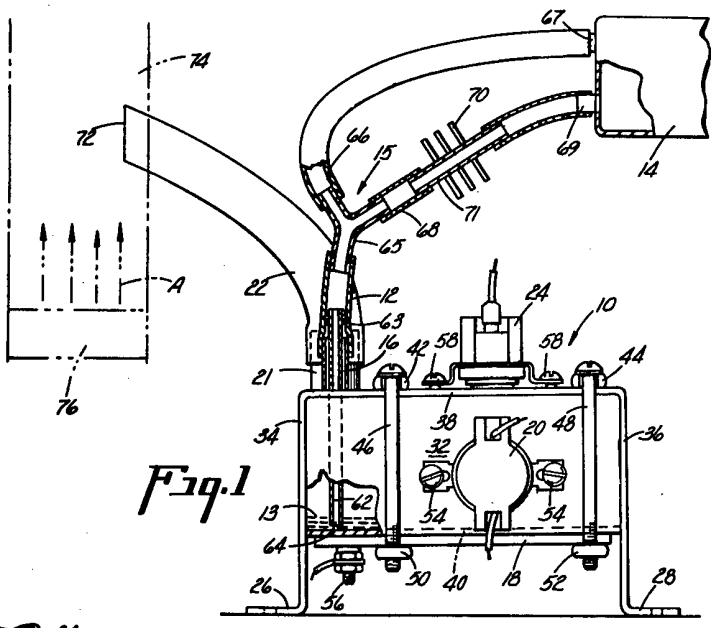

Fig.1

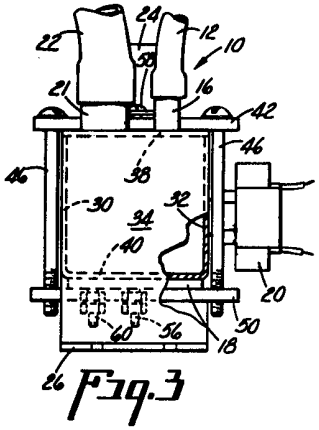

Fig.3

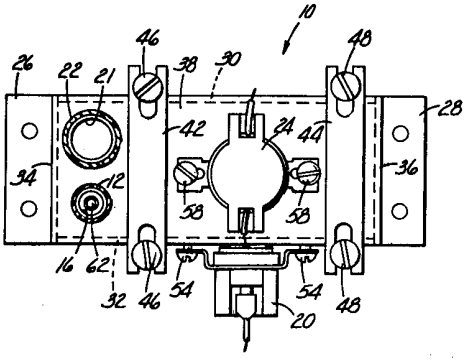

Fig.2