

[54] **DEVICE FOR HEATING AND DRYING COPY MEDIUMS**

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 [58] Field of Search..... 432/42-44, 432/59, 60, 62, 77-80, 227-232; 219/216, 388, 469; 100/93 RP; 34/72-74, 76-80, 89.1, 131, 155; 165/89, 105; 250/65 ZE, 65 T

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[57] **ABSTRACT**

In a liquid development type copying machine, a device for heating and drying copy mediums comprises a heating-drying chamber in which copy mediums wet with developing liquid may be heated and dried. Pump means is provided for sucking air containing the developing liquid vapor produced in the heating-drying chamber. Cooling-liquifying means is provided to cool and liquify the sucked air containing the developing liquid vapor. The developing liquid liquified by the cooling-liquifying means is collected in a collector. The cooled air provided by the cooling-liquifying means is blown through blow-out means toward the heating-drying chamber. The air is circulated by an air pump.

20 Claims, 8 Drawing Figures

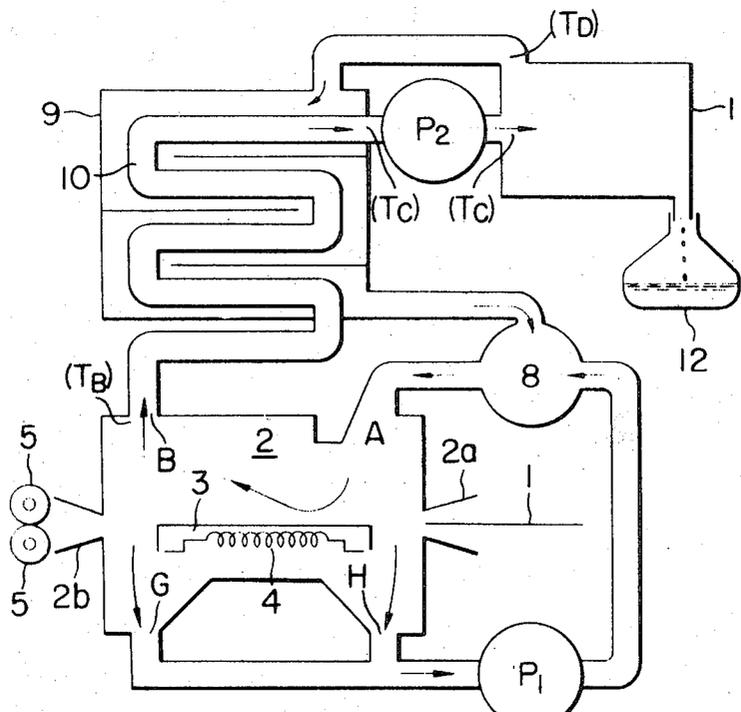


FIG. 1

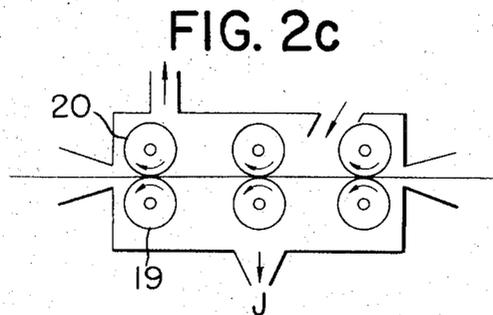
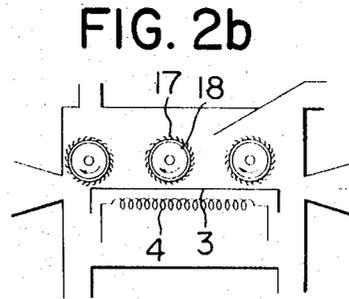
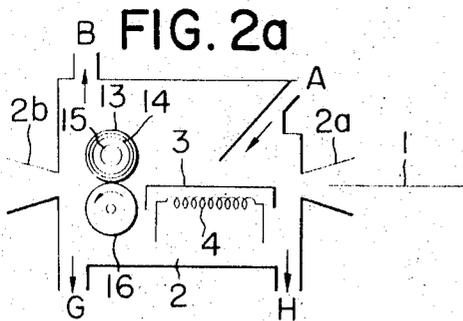
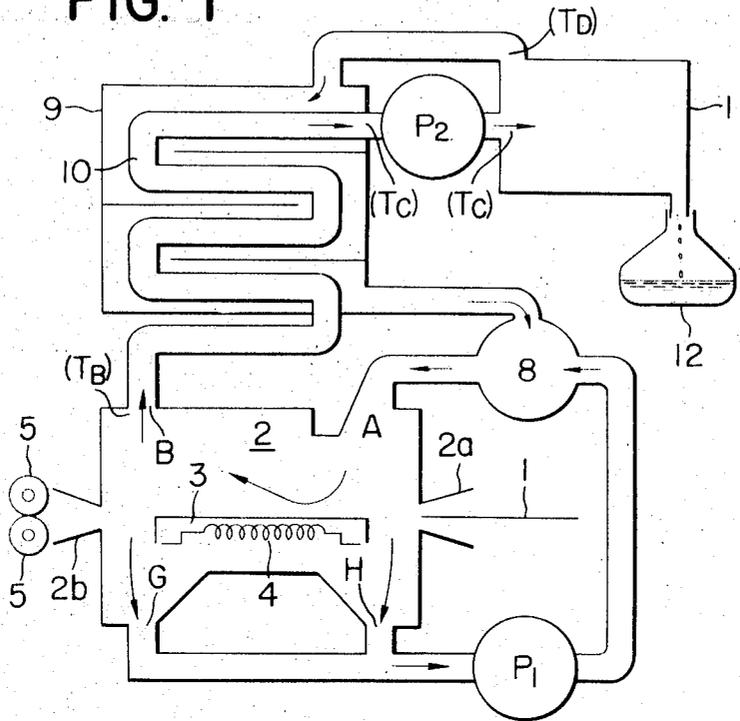


FIG. 3

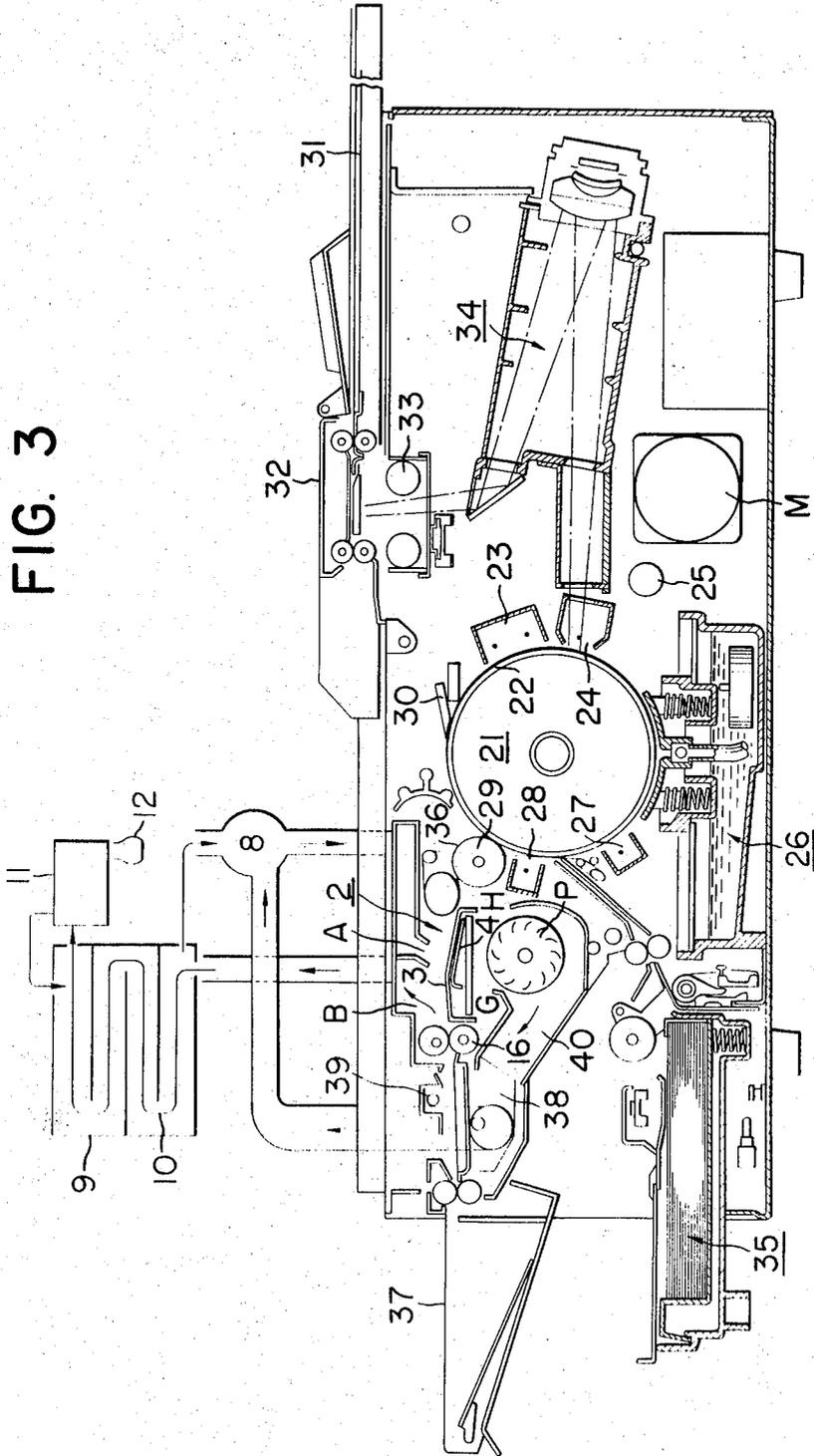


FIG. 4

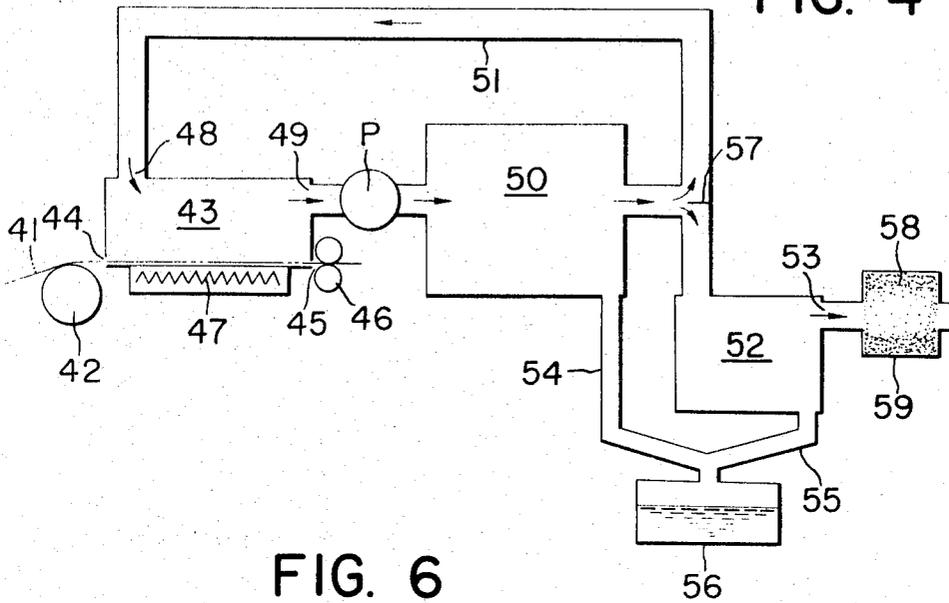


FIG. 6

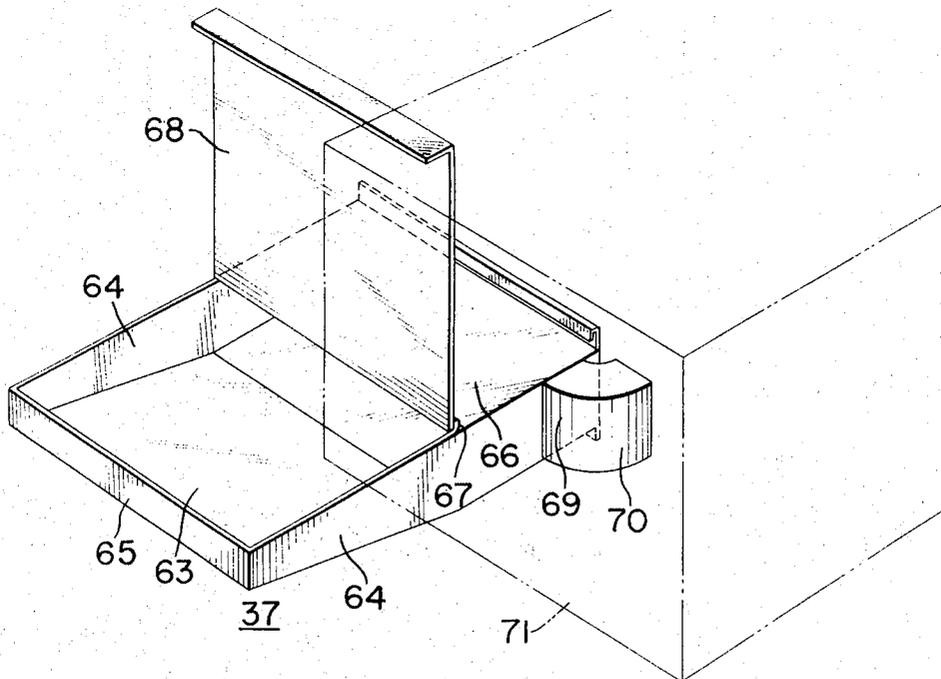
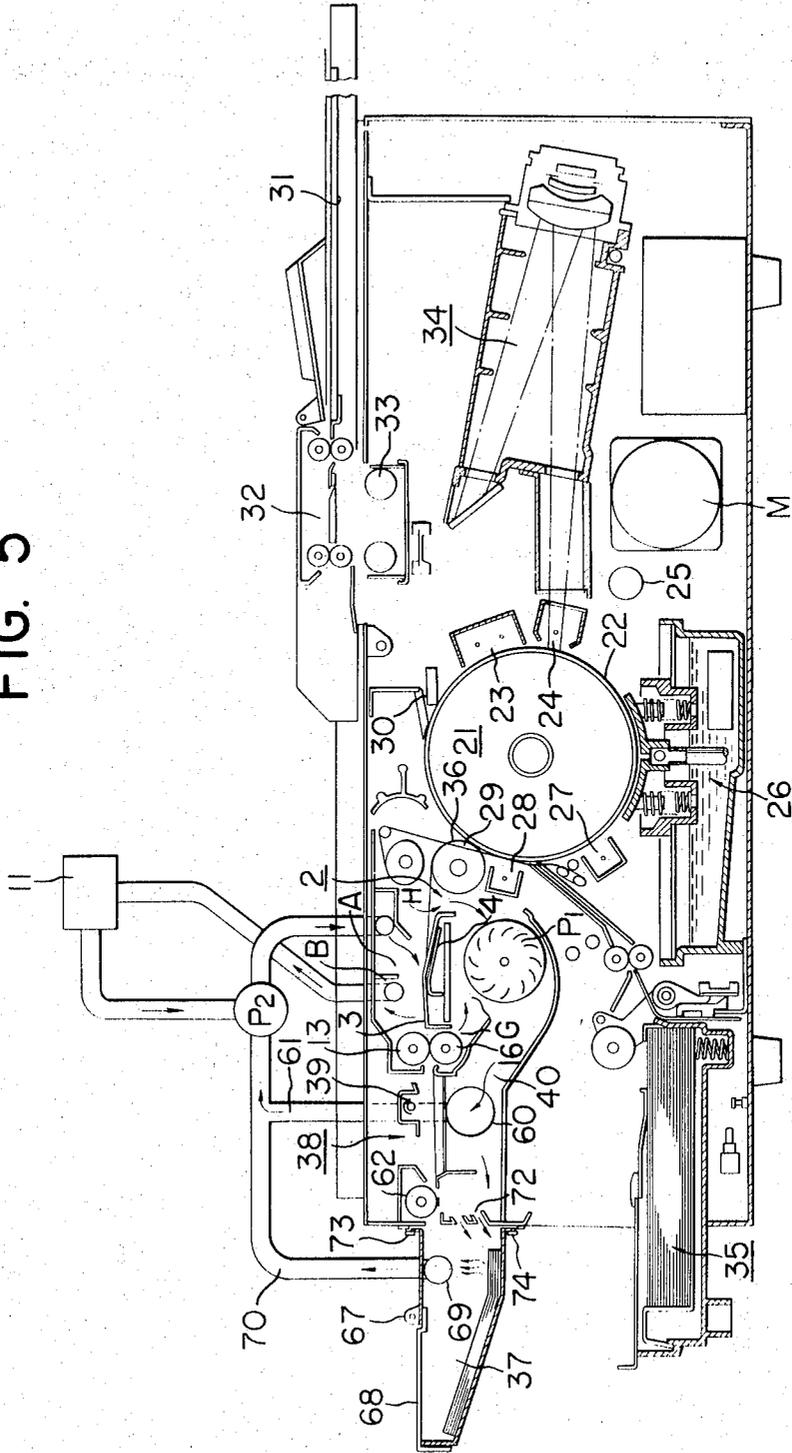


FIG. 5



DEVICE FOR HEATING AND DRYING COPY MEDIUMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a device for heating and drying copy mediums wet with developing liquid in a liquid development type copying machine. More particularly, it relates to such a device which can efficiently purify the exhaust gasses polluted by developing liquid vapor produced by heating and drying and also can prevent such vapor from being discharged outwardly of the apparatus; and, which can provide a drying system having excellent thermal efficiency and fixing-drying characteristics.

2. Description of the Prior Art

Heretofore, in the liquid development type electrophotographic copying machines, it has generally been the practice that a photosensitive sheet or medium having an electrostatic latent image formed thereon through charging and exposure is brought into developing liquid consisting of toner dispersed in a carrier liquid such as Isopar or like petroleum series to thereby develop the latent image, whereafter the photosensitive sheet may be passed between a pair of squeeze rollers to squeeze out most of the residual developing liquid, and then passed through a fixing-drying device to vaporize any residual carrier liquid and fix the toner. In case of the transfer type copiers, the toner image on the photosensitive medium is transferred to a transfer medium through the carrier liquid, whereafter the transfer medium is likewise passed through a fixing-drying device to vaporize the residual carrier liquid thereon and fix the toner image.

In these cases, the carrier vapor so produced is generally exhausted directly from the apparatus and diffused in the environment, whereas the carrier liquid such as petroleum solvent is hygienically harmful and even slight amounts of it in the environment may be harmful. Especially, where the copying machine is used in a closed office room or like environment, the workers in the room would be exposed to the danger imparted to their health by the exhausted carrier vapor which tends to increase in amount per unit time in the modern high-speed copiers.

For this reason, it is necessary that the carrier vapor be not discharged out of the apparatus but be collected or treated within the apparatus. Various methods of collection and treatment have already been proposed for such purpose. For example, there have been proposed the use of active carbon for absorption and collection of carrier vapor, or means for the condensation and collection of carrier vapor, but these have proved to be nearly incapable of sufficiently collecting the carrier vapor.

SUMMARY OF THE INVENTION

In view of the foregoing, the present invention provides means for circulating the carrier vapor for reuse without discharging it out of a copying apparatus and for condensing the carrier vapor in the circulating system to separate and collect it from air, thereby overcoming the hygiene problem.

The present invention prevents carrier-containing air from discharging out of the apparatus by making a fixing-drying chamber which is hermetically sealed as far

as possible except at the inlet and outlet thereof for copy paper, causing the air in the chamber to be circulated by a pump for repeated use in fixing-drying, and maintaining the pressure in the chamber at a level below the atmospheric pressure. Also, a carrier vapor collector is provided in the circulating system so that an amount of air corresponding to the amount of air admitted through the inlet and outlet for copy paper may be discharged while being made hygienically harmless. Thus, substantially all of the carrier vapor may be removed and collected from the air in the copying apparatus, whereas it is still impossible to sufficiently prevent the discharge of carrier vapor out of the apparatus. This is attributable to the reasons that it is very difficult to vaporize 100 percent of the carrier liquid present on and/or in a copy sheet in the fixing-drying means; that air containing carrier vapor tends to leak out along the copy sheet as it moves out of the fixing-drying means; and that carrier liquid has a time lag in vaporization and in spite of heat applied to the copy sheet wet with developing liquid, such carrier liquid often continues to vaporize even after the copy sheet has left the fixing means.

The present invention may also overcome these drawbacks by providing an air-tight tray for receiving successive copy sheets discharged from the apparatus after fixing, and more particularly an improved copy tray for use with copiers which enables the collection not only of the carrier vapor once used for fixing and drying but also of the carrier vapor which continues to be produced from copy sheets after fixing.

It is therefore a primary object of the present invention to provide a device for heating and drying copy mediums which is designed to circulate carrier vapor without discharging it outside, and to condense the carrier vapor in the circulating system to thereby separate and collect it from air.

It is another object of the present invention to provide a device for heating and drying copy mediums which is designed to condense only the portion of the carrier vapor which is at a higher carrier vapor pressure.

It is still another object of the present invention to provide a device for heating and drying copy mediums which is designed to cool and condense the air containing the carrier vapor, and to utilize the cooled air free of carrier liquid for such cooling and condensing purposes.

It is yet another object of the present invention to provide a device for heating and drying copy mediums in which the cooled air produced by cooling and liquification and the air containing the portion of the carrier vapor from copy medium which is at a lower carrier vapor pressure are both reintroduced into the heating-drying device.

It is another object of the present invention to provide a device for heating and drying copy mediums which is provided with an air-tight copy tray so as to prevent outward discharge of the carrier vapor produced from copy mediums.

Other objects and features of the present invention will become fully apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic illustration of the device according to an embodiment of the present invention.

FIGS. 2(a), (b) and (c) are vertical sections of various forms of fixing-drying chambers applicable to the present invention.

FIG. 3 is a longitudinal vertical section showing an example of the liquid development type electrophotographic copying machine to which the present invention has been applied.

FIG. 4 diagrammatically shows the construction of the fixing-drying device according to the present invention.

FIG. 5 is a front view, in longitudinal section, of another example of the electrophotographic copying machine to which the present invention has been applied.

FIG. 6 is a perspective view of the tray according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, the basic construction of the present invention is diagrammatically shown. A copy sheet 1 developed in a developing device (not shown) and wet with the developing liquid may be directed to a fixing-drying chamber 2. The chamber 2 has guides 2a and 2b directed toward the inlet and outlet for the copy sheet 1, and is generally hermetically sealed except at the openings in these inlet and outlet portions, and preferably may be constructed to operate adiabatically. Within the fixing-drying chamber 2 there is provided a hot plate 3 heated by a sufficient suitable heat source 4 for fixing the toner image on the copy sheet and for vaporizing the carrier liquid present on the surface and/or in the interior of the copy sheet. The wet copy sheet may be moved along the hot plate in intimate contact therewith, whereby the heat transfer from the hot plate to the copy sheet may fix the toner image on the surface of the copy sheet and rapidly vaporize the carrier liquid present on and/or in the copy sheet. Thereafter, the copy sheet may be discharged out of the chamber 2 by a pair of discharge rollers 5.

In the fixing-drying chamber 2 of such construction, there are provided four air openings A, B, G and H. The opening A is located above the copy sheet inlet, the opening B is located above the copy sheet outlet which undergoes a higher pressure of carrier vapor, and the openings G and H are located below the outlet and the inlet, respectively. However, the openings G and H may also be unitary and located centrally of the chamber bottom as indicated at J in FIG. 2(c). The openings, B, G and H each provide an intake port which is at a pressure level below the atmospheric pressure and the opening A provides a blow-out port which is at a pressure level above the atmospheric pressure.

The openings G and H are connected to the intake side of a pump P1 to suck the air from the fixing-drying chamber 2 and pass it through a mixer 8 so as to blow it through the blow-out port A toward the level above the copy sheet within the chamber 2, and the air circulated in this way may guide the copy sheet into intimate contact with the hot plate 3. Also, by setting the interior pressure of the chamber 2 to a level below the atmospheric pressure, the air and carrier vapor within the

chamber may be prevented from escaping out of the chamber.

The portion of the interior air adjacent the copy sheet outlet with the highly dense and hot carrier may be sucked by a pump P2 through the opening B and passed through a duct 10 in a heat exchanger and primary cooling device 9. The duct 10 may desirably have its outer peripheral surface formed with a number of pleats or fins so as to provide an increased surface area and accordingly an increased heat exchange efficiency. The air temperature TC at the outlet of the heat exchanger 9 is made lower than the air temperature TB at the opening B due to the radiation effect. Therefore, the relative temperature of the carrier vapor contained in the air may be correspondingly lowered and such carrier vapor under concentrated condition may be directed into a cooling and collection chamber 11.

The cooling and collection chamber 11 is similar in construction to the conventional refrigerator, dehumidifier or the like, and in accordance with the temperature difference between the inflow air temperature TC and the outflow air temperature TD, i.e., $\Delta T = TC - TD$, this chamber may collect an amount of the carrier vapor corresponding to the difference between the saturated vapor pressures of the carrier vapor at various temperatures. Therefore, the greater the value of ΔT , the better the collection efficiency. In other words, the air containing the carrier vapor may be rapidly cooled in the cooling and collection chamber 11 and when the carrier vapor exceeds its saturated vapor pressure, the oversaturated carrier vapor will be condensed and liquified and most of it (e.g. about 90 percent for $\Delta T = 50^\circ \text{C}$) will be collected in accordance with the aforesaid temperature difference ΔT and discharged into a collector 12.

As a result, the air temperature TD and the amount of the carrier vapor at the outlet of the cooling and collection chamber 11 are lower than their initial levels, but discharging such mixture of air and carrier vapor out of the apparatus would be uneconomical and undesirable in terms of thermal efficiency since the mixture still contains carrier vapor of the order of 10 percent. Therefore, such cooled air may be introduced into the heat exchanger 9 for reuse as a coolant, which may effect heat-exchange with the air from the fixing-drying chamber 2 to reduce the temperature of the latter air within the duct 10 and thereby increase the relative density of the carrier vapor contained in such latter air. On the other hand, the cooling air itself may be heated to reduce the relative density of the carrier vapor contained therein and directed into the mixing chamber 8, where it merges and mixes with the hot air sucked through the openings G and H of the fixing-drying chamber 2 and may be heated or pre-heated by such hot air, and then blown into the chamber 2 through the opening A to force the copy sheet against the hot plate 3 and expedite the vaporization of the carrier liquid on the copy sheet while flowing toward the opening B.

To dry a wet copy sheet efficiently, application of heat alone would be insufficient and a great amount of air blown against the copy sheet would be most effective. According to the present invention, therefore, the air in the portion of the fixing-drying chamber 2 where the carrier vapor pressure is lower may be made to act cyclically and in addition, the air in the portion of the chamber 2 where the carrier vapor pressure is higher may be passed through the heat exchanger and the

cooling and collection device so that as much carrier vapor as possible may be condensed and separated from the air and such air may be reused as a coolant in the heat exchanger, whereafter this latter air may be mixed with the former air and preheated thereby, and then the air-air mixture may be recirculated. Thus, all the air in the chamber 2 may be treated within the confines of the apparatus housing with substantially none of the air being discharged out of the apparatus, thus preventing pollution of the atmosphere as well as greatly improving the fixing-drying efficiency and contributing to the high-speed operation of the liquid development type electrophotographic copying machines.

FIG. 2 shows various forms of the fixing-drying device suitable to carry out the present invention. The device shown in FIG. 2(a) employs a combination of a hot plate 3 and a blotting roller. The blotting roller 13 and a driving rubber roller 16 therefor are provided between the hot plate 3 and the copy sheet outlet 2b. The blotting follower roller 13 comprises a liquid-absorbing material 13 such as blotting paper or felt attached to the outer surface of a pipe 14 which in turn incorporates therein a heater to heat the copy sheet so as to vaporize the carrier liquid present on and/or in the copy sheet on the one hand and cause the carrier to be absorbed by the blotting material on the other hand, thus ensuring a complete fixing-drying effect.

FIG. 2(b) shows a construction in which a plurality of rollers 18 having their surfaces covered with ciliary fiber 17 of heat-resistant resin are used to urge the copy sheet into intimate contact with the hot plate 3.

The example shown in FIG. 2(c) employs pairs of heating rollers 19 and driven rollers 20 to transport the copy sheet 1 for fixing-drying. Each of these rollers may contain a suitable heat source, and the driven rollers 20 may be constructed as shown in FIG. 2(a) or 2(b). In FIG. 2(c), the suction port for the chamber air is shown as a single port J.

FIG. 3 shows an example of the electrophotographic copying machine to which the present invention has been applied. The machine includes a rotatable drum 21 covered with a photosensitive medium 22, a primary charger 23, a secondary charger or AC charger and exposure means 24, a lamp 25 for overall exposure, a liquid developing device 26, a charger 27 for squeezing out any excessive developer on the surface of the photosensitive medium, a transfer charger 28, a transfer paper separator belt 29, a blade 30 for cleaning the photosensitive medium, a reciprocally movable carriage 31 for thicker originals, a sheet original transport means 32, a lamp 33 for illuminating the original, an optical system 34 for through-the-slit exposure, a paper supply station 35, a transfer paper separator roller 36, a drive motor M, a tray 37 and a discharger 39. The photosensitive medium 22 comprises a photosensitive layer and an insulative layer formed thereon.

The apparatus of FIG. 3 employs an embodiment of the invention as shown in FIG. 2(a), that is, blow-out ports B, A and intake ports G, H are respectively disposed above and below the passageway of the copy paper so that the air sucked by the pump P1 is passed through passageways 40 and 38 and into the mixing chamber 8.

In such construction, it is difficult to make the fixing-drying chamber 2 hermetically sealed, yet it is possible to cause the air to be sucked in through the openings

B, H, G and 40 and blown out through the opening A, thereby circulating the air between the chambers 2 and 38 to minimize the amount of the air exhausted from the apparatus.

Referring to an embodiment shown in FIG. 4, a sheet of photosensitive paper carrying thereon a visible image developed from an electrostatic latent image by means of liquid developer or a sheet of transfer paper 41 carrying thereon a visible image transferred from the photosensitive medium may be guided by a roller 42 to pass into a fixing-drying chamber 43 through an inlet 44 and leave the chamber through an outlet 45 for discharge through a set of rollers 46 onto a tray (not shown). The fixing-drying chamber 43 is hermetically sealed as far as possible, except at the inlet and outlet 44 and 45. The carrier liquid present on and/or in the copy sheet may be vaporized for toner fixation both by the heat from a heater 47 underlying the bottom of the chamber 43 and by the air blown from a blow-out port 48. Alternatively, however, the fixing-drying chamber 43 may be constructed such that the copy sheet moves along the center line of the chamber with a suitable hot plate and heat source disposed just below the center line.

The fixing-drying chamber 43 is provided with an air intake port 49 through which the air in the chamber 43 may be sucked by a pump P, which is connected through an air cooling condenser 50 and further through a duct 51 to the blow-out port 48, thus forming an air circulation path. The duct 51 is branched to pass part of the air to a cooling chamber 52 such as refrigerator or dehumidifier which is provided with an exhaust port 53. In the air cooling condenser 50 and in the cooling chamber 52, the air may be reduced in temperature to oversaturate the carrier vapor contained therein and the carrier liquid thus condensed may be collected through pipes 54 and 55 into a vessel 56. The ratio of the air circulated from the air cooling condenser 50 to the chamber 43 to the air passed to the cooling chamber 52 may be suitably adjusted to 1:1 to 100:1 by a control plate 57 disposed at the branching point of the duct 51. Empirically, the ratio of 5:1 to 20:1 has been found most suitable. An absorbing chamber 59 filled with a charge of absorbent material 58 such as active carbon may be connected to the exhaust port 53, if required.

In the construction described just above, the air and carrier liquid in the fixing-drying chamber 43 may be circulated by the pump P and since the interior of this chamber is at a pressure level below the atmospheric pressure, the air cannot go out of the chamber 43. Rather, the chamber 43 may admit thereinto a small amount of external air through the copy sheet inlet and outlet 44 and 45 and such air will force out a corresponding amount of the internal air. The air thus forced out is almost clean and hygienically harmless, because the air is passed through the air cooling condenser 50 for condensation and separation of carrier vapor from the air and part of such air is further passed to the cooling chamber 52 for further collection of carrier vapor until it is finally exhausted into the atmosphere, preferably through the filter 58 such as active carbon which absorbs any residual carrier vapor in the air. Also, the absence of air leakage from the fixing-drying chamber 43 enables the amount of air to be increased sufficiently to accomplish the drying and accordingly, enhances the efficiency of fixing and drying operation. On

the other hand, the smaller amount of air passed to the cooling chamber 52 leads to an increased cooling capacity of this chamber, which in turn improves the collection efficiency of the carrier liquid. Thus, the present invention is highly effective to improve the liquid development type electrophotographic copying machines.

FIG. 5 illustrates an example of the transfer type electrophotographic copying apparatus to which the present invention has been applied. The apparatus includes a rotatable drum 21 covered with a photosensitive medium 22, a primary charger 23, a secondary charger or AC charger and exposure means 24, a lamp 25 for overall exposure, a liquid developing device 26, a charger 27 for squeezing out any excessive developer on the surface of the photosensitive medium, a transfer charger 28, a transfer paper separator belt 29, a blade 30 for cleaning the photosensitive medium, a reciprocally movable carriage 31 for thicker originals, a sheet original transport means 32, a lamp 33 for illuminating the original, an optical system 34 for through-the-slit exposure, a paper supply station 35, a transfer paper separator roller 36 and a drive motor M.

In the above-described copying machine, a copy sheet 1 carrying an image transferred thereto from the toner image on the photosensitive drum 21 may be directed to fixing means 2. The fixing means 2 includes a hot plate 3 heated by a heater 4 therebelow, a driven roller 16, and a heating roller 13 biased into engagement with the roller 16 by spring or like means. The heating roller 13 comprises a steel pipe covered with a blotter for absorbing liquid such as blotting paper or the like and having a heater therein. The fixing means further has a blow-out duct A and an intake duct B in the upper portion, and a suction blower P1 in the lower portion.

After being separated from the drum 21, the copy sheet 1 may be forced into intimate contact with the hot plate 3 by the air from the blower P1 and from the blow-out duct A so that the carrier liquid present on and in the copy sheet may be vaporized by the heat transfer from the hot plate 3 and by the pair of heating rollers 13 and 16. The air containing the carrier vapor may be sucked through the intake duct B into the cooling-collecting means 11, where most of the carrier vapor may be separated and collected from the air and the air thus cleaned may be recirculated by pump P2 to the fixing means 2 through the blow-out duct A. On the other hand, the blower P1 may suck the air from the interior of the fixing means 2 in the vicinity of the inlet and outlet H and G to thereby reduce the pressure in the fixing means so as to prevent the carrier-containing liquid from escaping outwardly.

Since the air from the blower P1 contains a small amount of carrier vapor and is hot, such air may be passed to the drying chamber 38 contiguous with the fixing means 2, to thereby expedite the drying in cooperation with the residual toner removing discharger 39. Some of such air may be recirculated by the pump P1 through duct 61 to the fixing means 2.

In such construction, the copy sheet may be passed through the fixing means 2 and drying chamber 38 and discharged onto the tray 37 by the pair of discharge rollers 62. The copy sheet 1 now on the tray is still continuing to vaporize the carrier liquid thereon due to the above-described time lag in vaporization.

A feature of the present invention is that such carrier vapor is collected to prevent it from escaping out of the apparatus.

To that end, the tray 37 is in the form of a box comprising a bottom plate 63, opposite side plates 64, an end plate 65 and a top plate 66, as shown in FIG. 6. A cover 68 is pivotally connected to the top plate 66 by means of a hinge 67, and normally closed in the manner as shown in FIG. 5 to hermetically seal the box so as to prevent escape of the air from within the tray.

An opening 69 of suitable dimensions is formed in the side plate 64 of the tray and a duct 70 is joined to this opening. The duct 70 is connected to the pump P2 so that the air in the hermetically sealed tray is directed to the carrier vapor collector 11 after being used cyclically for fixing and drying. The duct 70 may alternatively be connected directly to the collector 11.

The tray 37 is sealingly secured to the cover 71 of the copying apparatus body. A flow of hot air is introduced from the apparatus body into the tray through an opening 72 in the cover by the blower P1, and the hot air is circulated through the interior of the tray to completely dry the still wet copy sheet, whereafter the air with the carrier vapor passes through the duct 70 to the collector 11.

The air admitted through the opening 72 may also act to float a subsequent copy sheet which has been discharged into the tray so as to keep it separate from the underlying copy sheet to thereby expedite the drying thereof.

The tray cover 68 may desirably be formed of transparent plastics to readily permit the operator to observe the arrival of successive copy sheets in order to prevent the jam which would result from overstocking copy sheets in the tray.

In the above-described embodiment, the tray is of a cassette type and detachably mounted to the apparatus body by means of rails 73 and 74, whereas it may also be formed integrally with the apparatus body so that the cover 68 when opened is available to provide an access opening for copy sheets.

In the liquid development type electrophotographic copying machine, as already described, it has been extremely difficult to prevent leakage of the carrier vapor from the machine since the air containing carrier vapor leaks outwardly along the copy sheet, i.e., the carrier liquid on and/or in the copy sheet continues to vaporize. The present invention, therefore, provides a hermetically sealed construction of the tray in which the carrier vapor resulting from said cause may be collected. This, combined with other collector means in use, is highly effective to overcome the described problem which has heretofore been a serious drawback of the liquid developing system.

As has been described, the copy sheet heating and drying device according to the present invention can almost completely remove and collect the developing liquid vapor and accordingly can maintain the ambient atmosphere in highly hygienic conditions.

Also, since the interior of the heating-drying chamber is always maintained at a pressure level below the atmospheric pressure, any vapor produced by the heating of the developing liquid cannot leak out of the chamber and thus, complete removal and collection of such vapor is ensured.

Further, circulation of the air between the heating-drying chamber and the cooling-condensing chamber eliminates leakage of the developing liquid vapor.

Furthermore, the hermetically sealed construction of the copy sheet receiving tray is also useful to collect almost all of the low-pressure developing liquid vapor produced from the copy sheets in the tray.

We claim:

1. A device for heating and drying copy mediums in a liquid development type copying machine, comprising:

a heating-drying chamber having an inlet and an outlet for receiving and discharging copy mediums, and including means for heating and drying copy mediums wet with developing liquid;

suction means for sucking air containing developing liquid vapor produced in said heating-drying chamber and for reducing the pressure in said chamber below the ambient air pressure surrounding said machine wherein said suction means comprises a first suction portion for sucking the part of the developing liquid vapor containing air which is at a higher vapor pressure and a second suction portion for sucking the part of said air which is at a lower vapor pressure;

cooling-liquifying means for cooling and liquifying the sucked air containing said developing liquid vapor;

means for collecting the developing liquid liquified by said cooling-liquifying means;

a passageway for circulating air between said heating-drying chamber and said cooling-liquifying means; and

means for blowing the cooled air provided by said cooling-liquifying means through said passageway and into said heating-drying chamber.

2. A device according to claim 1, wherein said first suction portion is located in the upper portion of said heating-drying station, and said second suction portion is located in the lower portion of said station.

3. A device according to claim 1, wherein the cool air cooled by said cooling-liquifying means is used as coolant for said cooling-liquifying means.

4. A device according to claim 1, further comprising means for combining the cool air provided by said cooling-liquifying means and the developing liquid vapor containing air which is at a lower vapor pressure, and for blowing said combined air toward said heating-drying chamber.

5. A device according to claim 1, wherein said heating means includes a hot plate.

6. A device according to claim 1, wherein said cool air blown toward said heating-drying chamber is blown against a copy medium.

7. A device according to claim 5, wherein said heating-drying chamber further includes a roller provided to transport a copy medium in intimate contact with said hot plate.

8. A device according to claim 1, wherein said heating-drying chamber includes at least one pair of hot rollers for holding and transporting a copy medium therebetween.

9. A device according to claim 1, wherein said heating-drying chamber further includes developing liquid blotting rollers for holding and transporting a copy medium therebetween.

10. A device according to claim 9, wherein each of said blotting rollers has a heat source therein.

11. A device for heating and drying copy mediums in a liquid development type copying machine, comprising:

a heating-drying chamber having an inlet and an outlet for receiving and discharging copy mediums, and including means for heating and drying copy mediums wet with developing liquid;

suction means or sucking air containing developing liquid vapor produced in said heating-drying chamber;

first and second cooling-liquifying means for cooling and liquifying the sucked air containing said developing liquid vapor;

distribution means for distributing part of the cool air provided by said first cooling-liquifying means to said heating-drying chamber and for distributing the remainder of said cool air to said second cooling-liquifying means;

means for exhausting the air cooled by said second cooling liquifying means; and

means for collecting the developing liquid liquified by said first and second cooling-liquifying means.

12. A device according to claim 11, wherein said distribution means includes a first air passageway for air discharged from said first cooling-liquifying means, second and third passageways connected to said first passageway at a branching portion for carrying air from said first passageway to said heating-cooling chamber and to said cooling-liquifying means, and an air flow-rate and distribution control plate disposed at said branching portion.

13. A device according to claim 11, wherein said second cooling-liquifying means has air exhaust means provided with an absorbing material for absorbing any residual developing liquid vapor.

14. A device according to claim 11, wherein said distribution means includes adjustment means for distributing said cool air to said heating-drying chamber and said second cooling-liquifying means at a ratio of 5:1 to 20:1.

15. A device according to claim 13, wherein said absorbing material is active carbon.

16. A device according to claim 11, wherein said heating-drying chamber is hermetically sealed except at the inlet and outlet thereof for copy medium.

17. A device for heating and drying copy mediums in a liquid development type copying machine, comprising:

a heat-drying chamber including means for heating and drying copy mediums wet with developing liquid;

hermetically sealed receptacle means for receiving copy mediums heated and dried by said heating-drying chamber;

first suction means for sucking air containing developing vapor produced in said heating-drying chamber;

means for blowing preheated air into said receptacle means;

second suction means for sucking developing liquid vapor produced from copy medium in said receptacle means;

cooling-liquifying means coupled to said first and second suction means for cooling and liquifying the

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developing liquid vapor containing air sucked by
 said first and second suction means;
 means for collecting the developing liquid liquified
 by said cooling-liquifying means;
 means for blowing the cooled air from said cooling- 5
 liquifying means into said heating-drying chamber;
 and
 an air pump for circulating said air between said
 chamber and said cooling-liquifying means.
 18. A device according to claim 17, wherein said 10

copy medium receptacle means is detachably mounted
 on said copying machine.
 19. A device according to claim 17, wherein at least
 a portion of said copy medium receptacle means is
 transparent.
 20. A device according to claim 17, wherein said her-
 metically sealed copy medium receptacle means is
 mounted on said copying machine and is connected to
 said second suction means in an airtight manner.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,854,224 Dated December 17, 1974

Inventor(s) KEIZO YAMAJI, ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

at column 3, line 34, delete the word "sufficient"

Signed and sealed this 22nd day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

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