

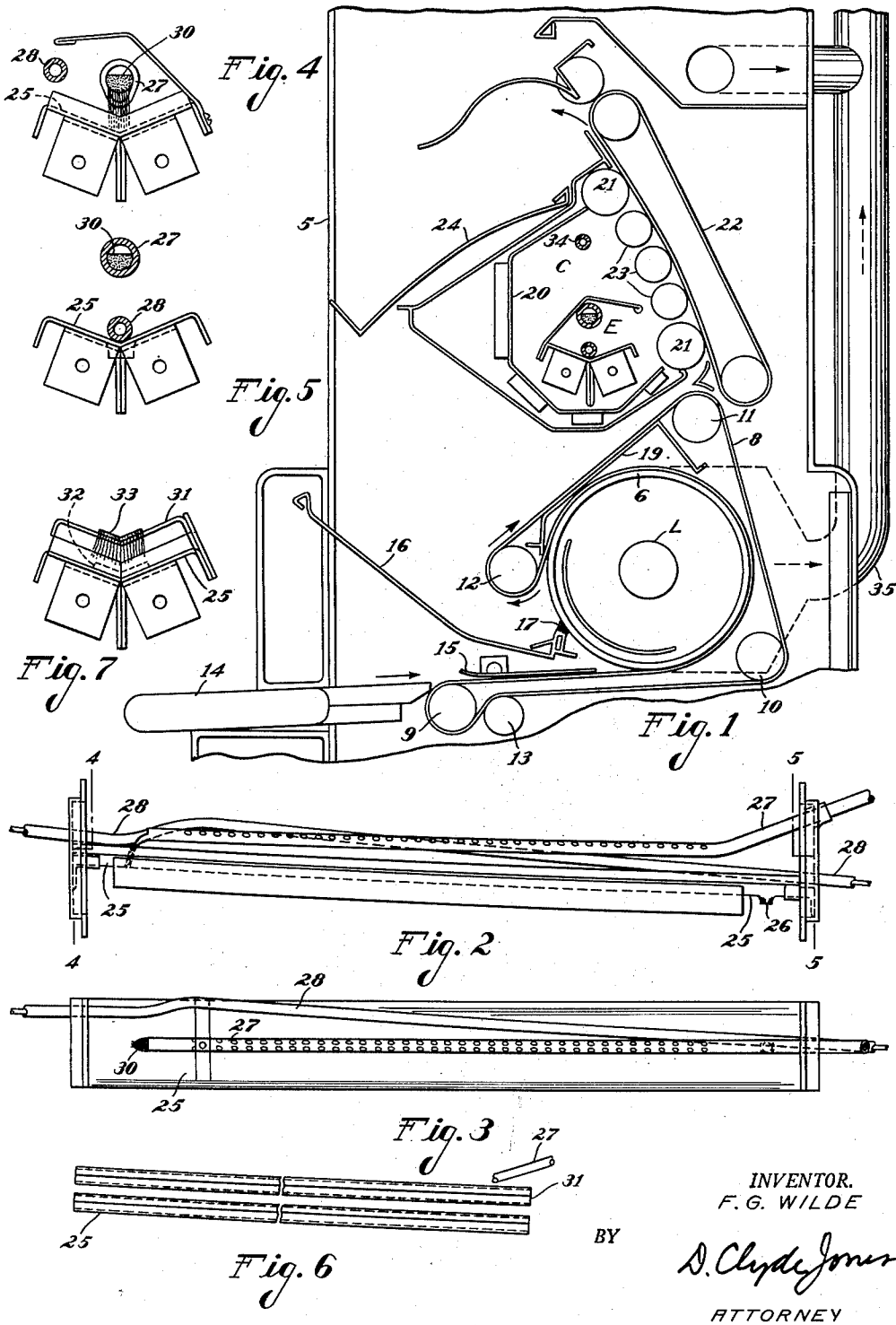
March 10, 1953

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2,630,744

EVAPORATOR FOR GAS DEVELOPING MACHINES

Filed Jan. 16, 1950



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## UNITED STATES PATENT OFFICE

2,630,744

EVAPORATOR FOR GAS DEVELOPING  
MACHINES

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Application January 16, 1950, Serial No. 138,864

7 Claims. (Cl. 95—89)

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This invention relates to a combined photographic printing and developing machine of the so-called dry developer type which utilizes ammonia gas or the like and is a continuation-in-part of my copending application Serial Number 109,298, filed August 9, 1949.

Where a printer and a developer of this type are incorporated in a single cabinet much difficulty has been encountered in obtaining satisfactory prints throughout the wide range of required speeds at which the photosensitive paper to be printed, is passed through the machine. For example, if the speed of the machine is slowed down, as is frequently required in the printing of certain types of tracings, there is danger of too much moisture accumulating in the printed photosensitive paper, with the result that the surface of the finished print will be wavy or wrinkled and the appearance of the print will be otherwise marred by water stains. It has been discovered that the stains and the lack of uniformity in the surface smoothness of the prints, produced at various speeds, has been due to the fact that the moisture and heat distribution through the combined printer and developer cannot properly be regulated with the present devices and that the evaporation of the aqua ammonia cannot be controlled with the required nicety.

In accordance with the present invention, an aqua ammonia evaporator located in a temperature controlled atmosphere, is so constructed that proper moisture conditions can be maintained within the developing chamber at all times; and yet the rate of evaporation of the aqua ammonia as well as the rate of evaporation of the water therein can be independently and accurately controlled to correspond with the predetermined speed of travel of the printed photosensitive sheet to be developed thereby.

The various features and advantages of the invention will appear from the detailed description and claims when taken with the drawings in which:

Fig. 1 is an end view of the upper portion of a combined printing and developing machine in accordance with the present invention;

Fig. 2 is a detailed side view of the evaporator unit to be used in the machine of Fig. 1;

Fig. 3 is a plan view of the evaporator unit illustrated in Fig. 2;

Figs. 4 and 5 are transverse sections of the evaporator unit taken substantially on the line 4—4 and 5—5, respectively of Fig. 2;

Fig. 6 is a side elevational view with exag-

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gerated spacing of the trays of a modified form of the evaporating unit; and

Fig. 7 is an end view of this modified unit. Referring to Fig. 1 there is diagrammatically illustrated, a combined printing and developing machine of the present invention. This machine comprises a closed cabinet 5 of which only the upper portion is shown, and of which one end thereof, is removed. The printing unit of the machine comprises a glass cylinder 6 mounted within the lower part of the cabinet for rotation around a horizontal axis, on suitable means (not shown). A light source generally designated L, extends substantially along the main axis of the glass cylinder. This cylinder is rotated by a wide, driven belt 8 or it can be driven by a series of parallel narrow belts engaging a substantial portion of the cylinder, the belt having a path of travel defined by the rollers 9, 10, 11, 12 and 13, one of which rollers is driven from a suitable source (not shown). The front of the cabinet as illustrated at the left of Fig. 1, is provided with a shelf 14 over which a strip of photosensitive paper or cut sheets can be inserted to pass through the machine along a path indicated by the arrows. Tracings to be printed are laid on the portion of the sheet passing over the shelf. The advancing sheet and the superimposed tracing pass under the guide plate 15 to be drawn by the cylinder 6 and the engaging belt 8 in exposure position around the light source L. It will be understood that the length of the exposure is determined, in part, by the speed of travel of the tracing and photosensitive strip through the machine, this speed being adjusted by well-known mechanism (not shown).

After exposure the tracing drops into the receiving tray 16. In order to prevent the tracing from continuing to cling to the cylinder, a separator brush 17 mounted on the rear edge of the tray 16 disengages the tracing from the cylinder and directs the tracing into the tray. The exposed portion of the photosensitive paper continues to be moved along by the belt 8 riding on the guide 19, into the developer unit. As more fully disclosed in the Patent 2,475,809 granted to Sullivan et al. on July 12, 1949, this unit comprises a gas chamber C closed at its ends and front by the end walls of the cabinet and by the chamber wall 20 respectively, the wall 20 terminating in spaced tubular guide members 21 coextensive with the length of the chamber. The rear of the chamber between the guide members 21, has a rectangular opening which is sealed by a traveling rubber belt 22 which rides on the

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spaced guide members 21 and guide rolls 23. The belt and the rolls 23, guide the printed portion of the photosensitive sheet over the opening in the rear of the chamber C where this portion of the sheet is developed by the ammonia gas passing between the rolls 23 as more fully disclosed in the mentioned patent. After being developed, the mentioned portion of the paper is guided to the receiving tray 24. The developing ammonia gas in the chamber C is supplied by an evaporator E to be described, to which aqua ammonia is pumped from a suitable source.

In the use of machines of the so-called dry developer type, much difficulty has been encountered in the production of satisfactory prints when the speed of the machine has to be slowed down to effect desired exposure of certain tracings or originals. It has been discovered that the cause of this difficulty arises from the fact that changes in speed of the machine, frequently require changing to a different optimum relation between the following factors: (1) the temperature within the chamber, (2) the temperature of the paper being developed, (3) the amount of water vapor within the chamber and (4) the concentration of ammonia gas therein. It will be understood that if the temperature within the chamber changes, the dew-point therein will also change so that moisture demands in the machine will change accordingly. The moisture in the chamber is supplied by evaporation of the water in the aqua ammonia at the same time that the ammonia gas is given off. However, the optimum relation between moisture and gas, changes with the speed of travel of the paper but this fact has not been recognized in prior machines of this type, or if recognized, no provision has been made to effect the necessary change.

In accordance with the present invention a novel evaporator for aqua ammonia is provided which in combination with heat removal to be described, overcomes the difficulties of former machines. This evaporator comprises a V-shaped trough 25 which gently slopes downward from left to right (Fig. 2) where its lower end has a discharge opening 26 located above a waste pipe or the like (not shown). The aqua ammonia is intermittently supplied by a pump or the like (not shown) to an evaporator pipe 27 which is perforated on its upper side. This pipe which extends in superimposed parallel relation with the deepest part of the trough, first slopes downward toward the right end of the trough (Fig. 2) and then gradually slopes upward toward the left end thereof. At that point, the pipe discharges into the left end of the trough. With this shape of the evaporator pipe 27, a pool of aqua ammonia, is continually maintained therein so that substantially all of the ammonia gas is evaporated from the aqua ammonia in the evaporator pipe and only water with a trace of ammonia gas therein is forced out of the left end of the pipe to discharge into the high end of the trough 25. This water, as it flows downward in the trough, is evaporated in amounts necessary to satisfy the moisture requirements in the chamber while the excess water is discharged through the opening 26. The controlled evaporation in the trough, of the water with some ammonia gas therein, is effected by an electrical heating element 28 extending generally along and above the trough. The heating current to this element is suitably controlled by a rheostat (not shown). As best illustrated in Fig. 2, the element 28 is positioned below the right-hand portion of

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the evaporator pipe 27 but the intermediate portion of the element is bent upward and away from the evaporator pipe until the left-handed portion of the element, extends generally parallel to one edge of the trough 25 (Fig. 3). By this arrangement of the heating element, the aqua ammonia is heated sufficiently to drive off the greater part of the ammonia gas therein while the residue can be separately heated to any desired degree to drive off water vapor in amounts necessary to satisfy the moisture requirements in the developing chamber.

In accordance with a modified form of the invention, the pipe 27 is provided with wick 30 (Fig. 4) of asbestos or the like, preferably co-extensive in length with that portion of the pipe 27 which extends upward toward the left in Fig. 2. By the use of the wick 30, the aqua ammonia is fed along the pipe by capillary action. The extensive area of the wick affords a large surface for effecting evaporation of the aqua ammonia while the residue thereof is discharged into the tray 25 as described above.

A further modified form of the invention is illustrated in Figs. 6 and 7. In this form, evaporation of the aqua ammonia and water vapor are effected in an evaporator in which the perforated portion of the pipe 27 is replaced by a tray 31 which is upwardly inclined toward the left (Fig. 6) to discharge at its left end in a tray 25 of the construction previously described. The heater element which has been omitted from Fig. 6, is arranged in the manner shown in Fig. 1. The trays 25 and 31 are each provided with a strip of asbestos such as 32 and 33 extending preferably along the inner bottom surface of its related tray for the entire length thereof. The wick 33 may extend over the left end of tray 31 as shown in Fig. 7. The aqua ammonia is delivered to the tray 31 by the stub pipe 27. The evaporation of the aqua ammonia in the tray 31 and the evaporation of water vapor in tray 25 will be obvious from the foregoing description.

The temperature in the development chamber, in part, is maintained by a top heater in the form of an electric heating element 34 which extends across the developing chamber above and in parallel relation with the evaporator tray. Since the developing chamber is located directly above the printer unit, heat from the light source L of this last named unit, modifies the temperature within the development chamber. If the temperature around the developing chamber is not carefully controlled, this temperature may drop below the dew-point with the result that moisture will accumulate on the outside of the chamber and drip down on the printed sheet.

In order to maintain the proper temperature conditions within the cabinet and especially within the glass cylinder 6 of the printing unit, excess heat is withdrawn therefrom by an air exhaust system. This system comprises an exhaust fan (not shown) and an air duct 35, having branches communicating with the upper part of the cabinet as well as with the interior of the glass cylinder at the right end thereof.

It will thus be seen that the present invention provides a combined printing and developing machine in which the heat from the printing unit does not adversely affect the developing unit so that staining and crinkling of the finished photoprints is avoided at all speeds at which the machine is operated.

What I claim is:

1. In an evaporator for generating ammonia

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gas and water vapor for use in a developing unit for a printed photosensitive sheet, a pipe perforated along its top, means for introducing aqua ammonia to one end of said pipe, the intermediate portion of said pipe being lower than the ends thereof whereby a pool of aqua ammonia is contained therein, a wick extending at least from said intermediate portion of the pipe to the other end thereof whereby an increased evaporating area is provided, a downwardly sloping tray into the high end of which said pipe discharges, and a heating element arranged to supply controlled heat in the region of said tray.

2. In a device of the class described, a developer chamber having an exposure area by which a printed photosensitive sheet can be developed, an aqua ammonia evaporator in said chamber by which ammonia is generated and supplied to the interior of the said chamber, said evaporator comprising an elongated closed container having a perforated wall extending generally in a horizontal direction from its supply end to its discharge end, a wick in said container extending to the discharge end thereof whereby an increased evaporating area is provided, means for supplying aqua ammonia to the supply end of said container, a generally horizontal trough under said container to receive the discharge therefrom, and a heating element in spaced relation to said trough and said container whereby the evaporation of ammonia and water vapor both contained in aqua ammonia can be independently controlled.

3. In an evaporator for generating ammonia gas and water vapor for use in a developing unit for a printed photosensitive sheet, an elongated closed container having a perforated wall extending generally in a horizontal direction from its supply end to its discharge end, a wick in said container extending to the discharge end thereof whereby an increased evaporating area is provided, a tray below said container into which the residue of said aqua ammonia passes from the discharge end of said container, and a source of controlled heat adjacent said tray and said container.

4. In an evaporator for generating ammonia gas and water vapor for use in a developing unit for a printed photosensitive sheet, a pipe perforated along its length, means for introducing aqua ammonia to one end of said pipe, a wick extending at least from an intermediate portion of the pipe to the discharge end thereof whereby an increased evaporating area is provided, a downwardly sloping tray into which the discharge end of said wick discharges, and a heating element arranged to supply controlled heat in the region of said tray.

5. In a device of the class described, a developer

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chamber having an exposure area by which a printed photosensitive sheet can be developed, an aqua ammonia evaporator in said chamber by which ammonia is supplied to the interior of said chamber, said evaporator comprising an inclined trough, an evaporating pipe perforated at its upper side and extending along the trough to discharge into the upper end thereof, the intermediate portion of said pipe being lower than the ends thereof to maintain a pool of aqua ammonia therein, means for supplying aqua ammonia to said pipe, a heating element extending in spaced relation to said trough and said pipe, said spacing varying from one end of said trough to the other end thereof whereby the evaporation of ammonia and water vapor both contained in aqua ammonia can be independently controlled.

6. In an evaporator for supplying ammonia gas and water vapor to a developing unit for a printed photosensitive sheet, a pipe located in a heated region and perforated along its top, means for introducing aqua ammonia near one end of said pipe, the intermediate portion of said pipe being lower than the ends thereof whereby a pool of aqua ammonia is contained therein, a downwardly sloping tray, the other end of said pipe being arranged to overflow into the high end of such tray, and a heating element arranged to supply controlled heat in the region of said tray.

7. In an evaporator for supplying ammonia gas and water vapor to a developing unit for a printed photosensitive sheet, a downwardly sloping trough, a pipe perforated along its top and extending above and in parallel relation to said trough, means for supplying aqua ammonia to one end of said pipe, said pipe having a dip therein to hold a pool of aqua ammonia, the other end of said pipe discharging into the high end of said trough, a pipe perforated along its top and extending from a point between the lower end of said trough and said pipe to an intermediate point on said trough and then along one edge of said trough to the region of the discharge end thereof.

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