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ABSTRACT

Users of ammonia-developing print machines have been confronted with two major problems peculiar to that type of machine: ventilation, and ammonia feed.

A print room in which no trace of ammonia is detectable has resulted from installation of additional vents in the print machine housing. The original aqueous ammonia system has been replaced by a gaseous system, which operates only when prints are being fed into the machine.

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INTRODUCTION

Users of ammonia-developing print machines will agree generally that such machines present two major problems unique to that type. First and foremost has been the ever-present unmistakable odor of ammonia which, even in very low concentration, is very disagreeable as is apparent from the expression on the face of the operator shown in Fig. 1. The other related problem is the means of transferring the aqueous ammonia to the print machine (Fig. 2). After suffering with these problems for several years, we at UCRL were forced, through a combination of circumstances, to find a quick solution to both problems.

GETTING RID OF THE FUMES

With two 42-inch machines in an area of 600 ft^2, our print room has had its full share of ammonia fumes; during the first five years of operation in the present location these fumes were a constant source of irritation. Fumes from the print room dissipated into the adjacent drafting room, which covered an area of 8,000 ft^2. When the drafting room was moved, the open area adjacent to the print room was reduced from 8,000 to 150 ft^2. The concentration of fumes then became intolerable and was raised to the point where only one machine could be operated, and that for only a part of the day. Obviously, something had to be done immediately.

Two solutions to the problem were proposed: (1) installation of a forced-draft ventilation system in the print room, and (2) increasing the rate of exhaust from the print-machine housing. The latter course was chosen as a first try because of the relative simplicity of the work involved and the fact that the job literally had to be done over-night.

A 4-inch hole was cut in the top of the housing at both ends of each machine. These were connected by ducts to the existing print-machine exhaust system as shown in Fig. 3. The connections were generously proportioned to avoid the possible necessity of increasing the size at a later date. Each was provided with a partial damper which, has since been operated in the closed position, indicating that a somewhat smaller duct could have been used. The normal exhaust systems of the machines were not materially affected by the additional vents.

The effect of this alteration was gratifying indeed. After 10 months of operation of the improved exhaust system, even those with the most sensitive olfactory organs have been unable to detect fumes in the print room.

TRANSFER SYSTEMS

The second problem, that of getting the aqueous ammonia into the print machine, had been a continual annoyance. The original system did not last long. The glass carboys originally provided with each machine were discarded soon after installation because of their hazard--holes were blown in carboys when pressurized with the hand pump provided for that purpose. Needless to say, the subsequent occasional mopping-up of aqueous ammonia while wearing a gas mask was extremely unpleasant. The loss of printing time because of the fumes, the damage to print paper, and the general nuisance , did not endear the original system to anyone.

A SECOND-RATE AQUEOUS-AMMONIA SYSTEM

The second system was a distinct improvement, although it too had its sore points. After giving up the original transfer system we set up a rack for two 55-gal drums of aqueous ammonia just ouside the building, a distance of about 100 feet from the print room. A small electric motor-driven pump operating under a positive suction head was installed below the drums and piped to the two machines. A dead-man switch and solenoid valve was installed on each print machine, thus making the supply to the two machines independent of each other. When the switch was operated, the solenoid valve opened and the pump started. This worked fine--when we didn't have a vapor-lock, which happened too often. The location of the drums and pump in a sunny sheltered spot at the south end of the building had been determined by aesthetics rather than by utility (Plant Engineers, please take note!). This unfortunate location permitted the temperature of the pump, even though it was shielded, to rise to 100° on a hot day, too hot for trouble-free handling of aqueous ammonia. To offset this, the pump casing was vented to the top of the ammonia drum so that the suction head would keep the pump primed. Those working in the adjacent area naturally took a dim view toward venting the fumes in their direction--we suspect that the more forward ones regularly and surreptitously closed the vents, thereby aggravating the situation (we don't blame them, however!). Fate again intervened: expansion of facilities required moving the ammonia-pumping setup.

"COOKING WITH GAS"

When considering a new location, we felt that an easier means of handling the 55-gal drums was a "must". The heavy, awkward drums were a real hazard to the man on the night shift who handled them alone. We had felt for some time that a less troublesome pumping system and elimination of the drum-handling problem would be highly desirable.

Suggestions for an improved system ranged from an underground aqueous-ammonia supply tank to the use of bottled ammonia gas. The latter sounded feasible, but with no information available on the subject, we felt this would require some experimentation. Accordingly, a test setup was made by inserting a perforated tube in the developing chamber in place of one of the heater rods. The prints made with ammonia gas were not different from those developed in the regular process. Intermediate prints, however, required a moist atmosphere. It was suggested to us by a print-paper chemist that such an atmosphere also was required for ordinary prints. To test this, we compared prints developed with ammonia gas to those developed in aqueous ammonia vapor six months after their printing. The prints had been posted in a west window continuously during that time and actually were subjected to direct exposure (through the glass) to the sun. Naturally, the prints were well faded, but they were readable, and the print processed without moisture was slightly more legible than the other. The tests conducted with the two types of developer, moist and dry, were much more extensive than the 6-months comparison test of course and finally lead to the adoption of the gas system.

As may be seen in Figs. 4 and 5, the system is very simple. The solenoid valve formerly used on the aqueous ammonia now is used to feed city water to the regular feed tank to provide moisture. Although not absolutely required for regular prints, the heat and moisture are run continuously because of the frequency of orders for intermediate prints. An innovation is the feeding of ammonia to the machine only when an operator is in working position in front of the machine. When the operator is about to run a print, she steps on a floor-mat switch as she reaches for print paper. This actuates a solenoid feed valve which releases the gas into the machine. When the operator is not at work in front of the machine, the ammonia is shut off automatically. To avoid delays in starting printing again, the operator at her convenience presses the 3-minute switch on the front of the machine. This actuates the solenoid feed valve through an adjustable interval timer which is set for three minutes. Thus, when the operator is ready to resume printing, a charge of ammonia is in the developing chamber and printing can proceed without delay.

As a matter of interest, an electric hour meter was installed on each machine to record actual printing time, thus giving the duty factor for each machine. Curiously enough, it was found that on our busiest machine, even though it was in continuous use all day (printing cut sheets most of the time), the duty factor averaged only 33%.

After more than a year of trouble-free operation, we have found that the maintenance time is considerably less with the gas system. The daily cost of ammonia gas has averaged $2.45. The cost of continuous-feed aqueous ammonia would have been $3.95 per day for the same period. This represents an annual savings of about $375.00.

We have completely eliminated fumes from the print room and adjacent areas. Better yet, we no longer have the health hazard and damage to print paper from the occasional high concentration of fumes. Best of all, we have improved the morale of our personnel who, rather than our physical plant, are our most valuable asset.

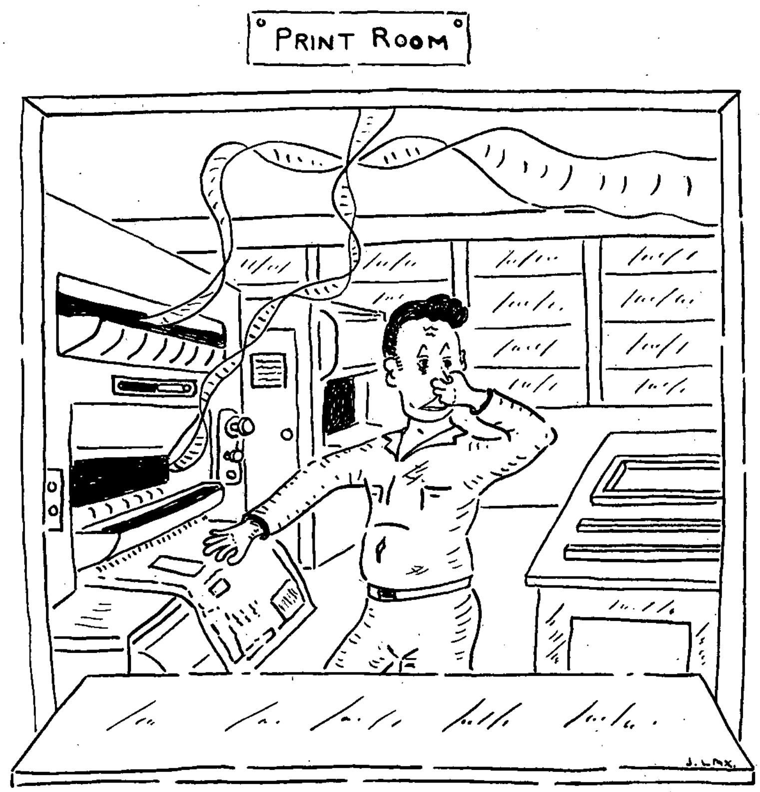

Fig. 1. "…. ever-present unmistakable odor…."

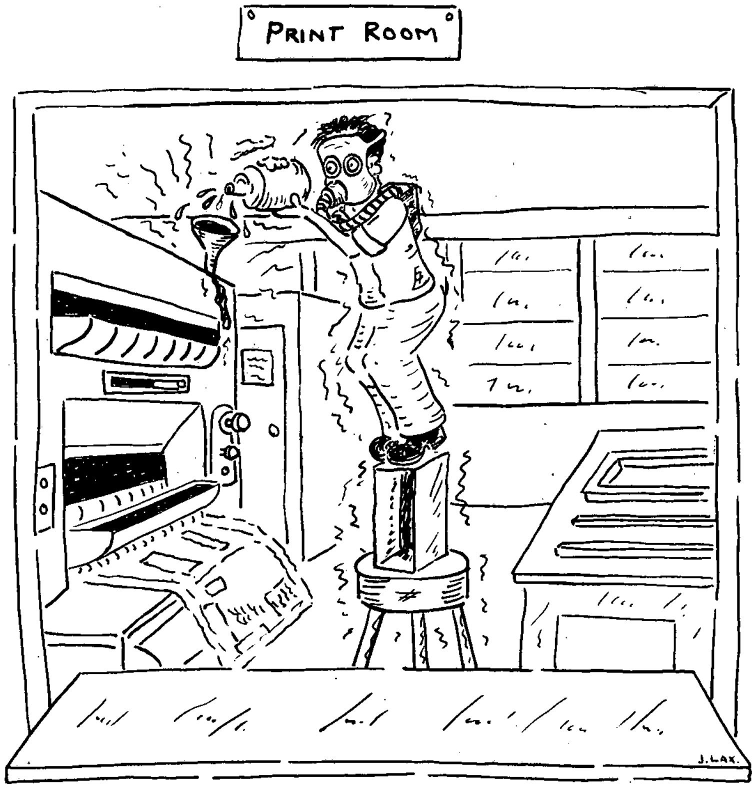

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Fig. 2. ".... means of transferring aqueous ammonia...."

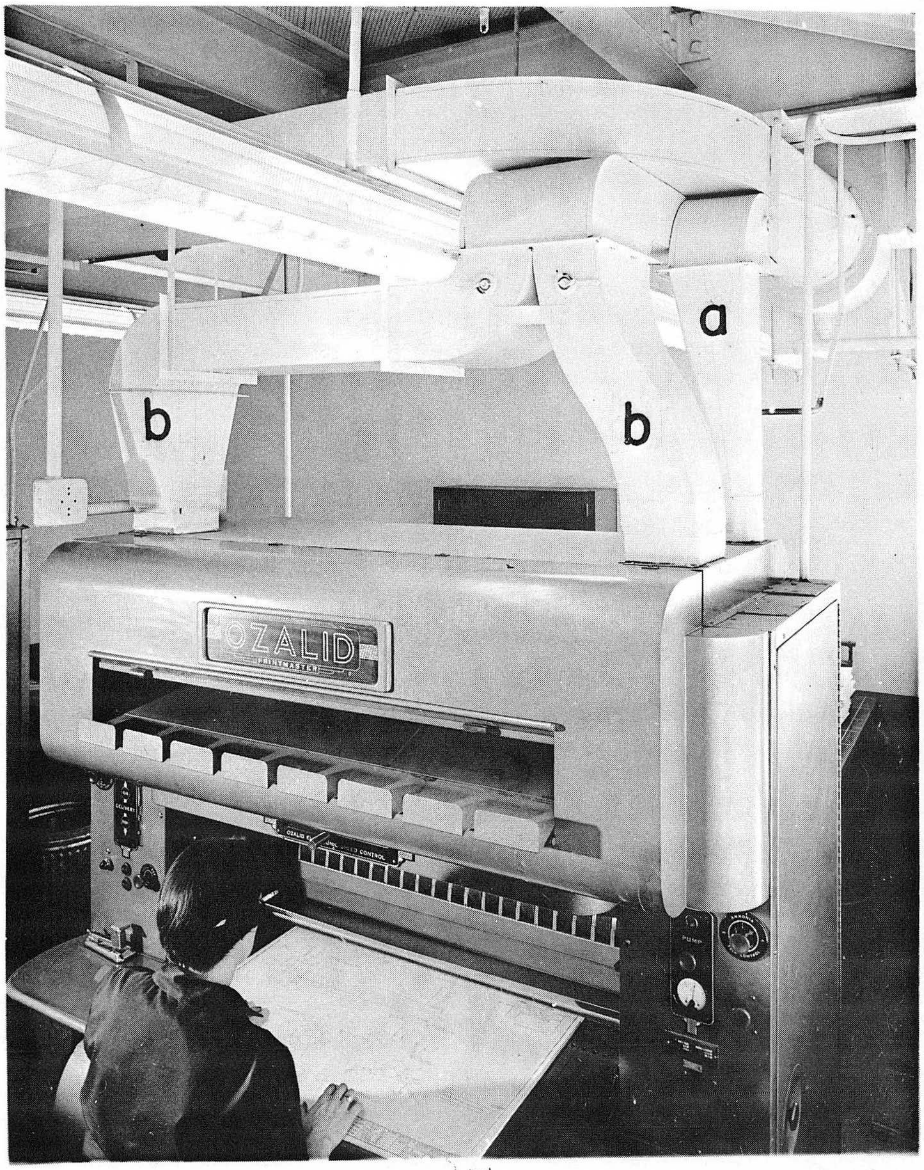

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Fig. 3. Print-machine housing vents.
The existing exhaust vent is shown at (a).
The added housing vents are those indicated by (b).

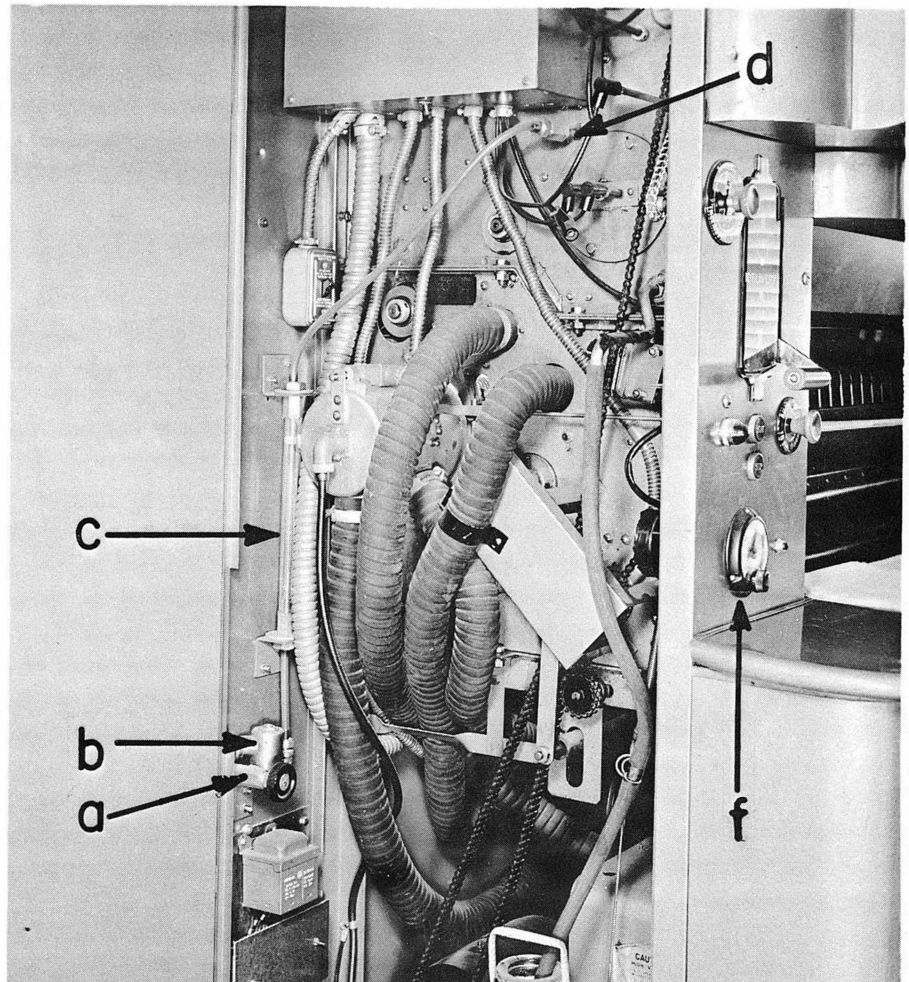

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Fig. 4. Ammonia feed line inside machine.
The feed line enters the housing at the left rear of each machine. Fittings shown are (a), needle valve, (b), solenoid valve, (c), flowrate meter, (d), perforated tube extending the full width of the printing chamber, (e), hour meter, and (f), interval timer and switch.

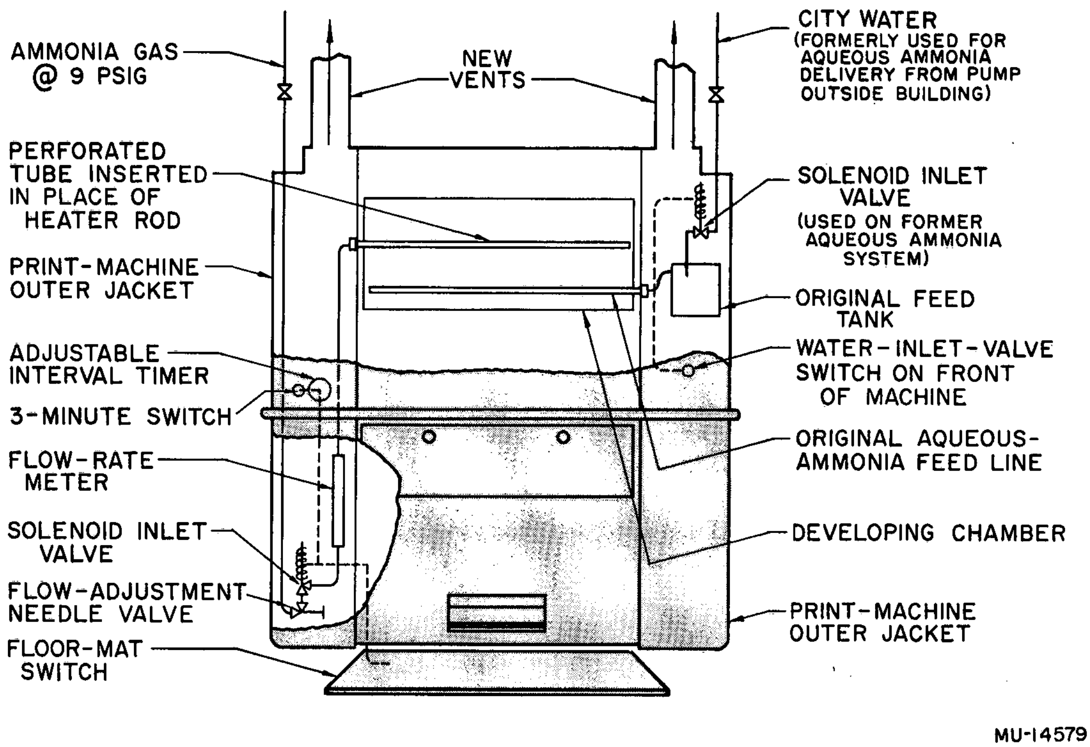

Fig. 5. Diagrammatic arrangement of feed lines and vents.