

Sept. 8, 1964

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3,147,687

METHOD OF AND APPARATUS FOR THE DEVELOPMENT OF LIGHT
SENSITIVE DIAZOTYPE MATERIALS

Filed Oct. 5, 1961

3 Sheets-Sheet 1

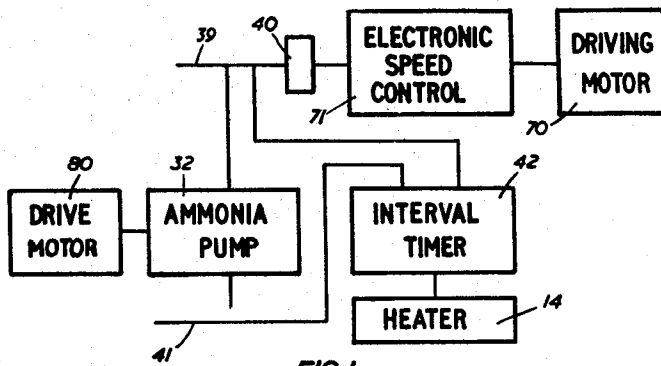


FIG. 1.

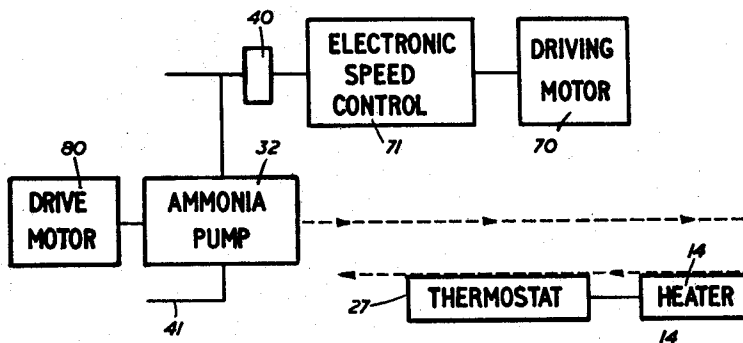


FIG. 2.

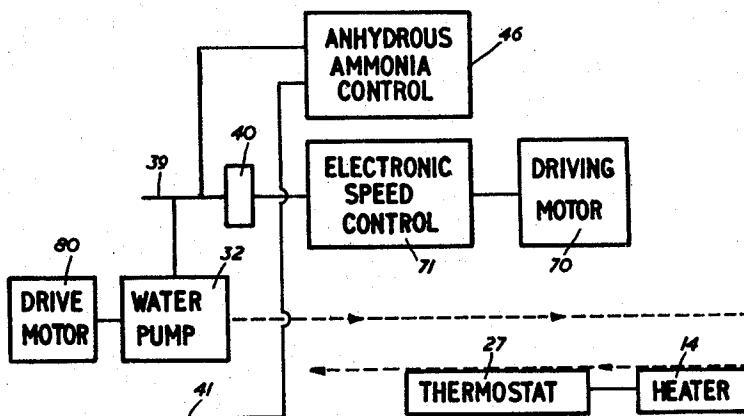


FIG. 3.

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3 Sheets-Sheet 2

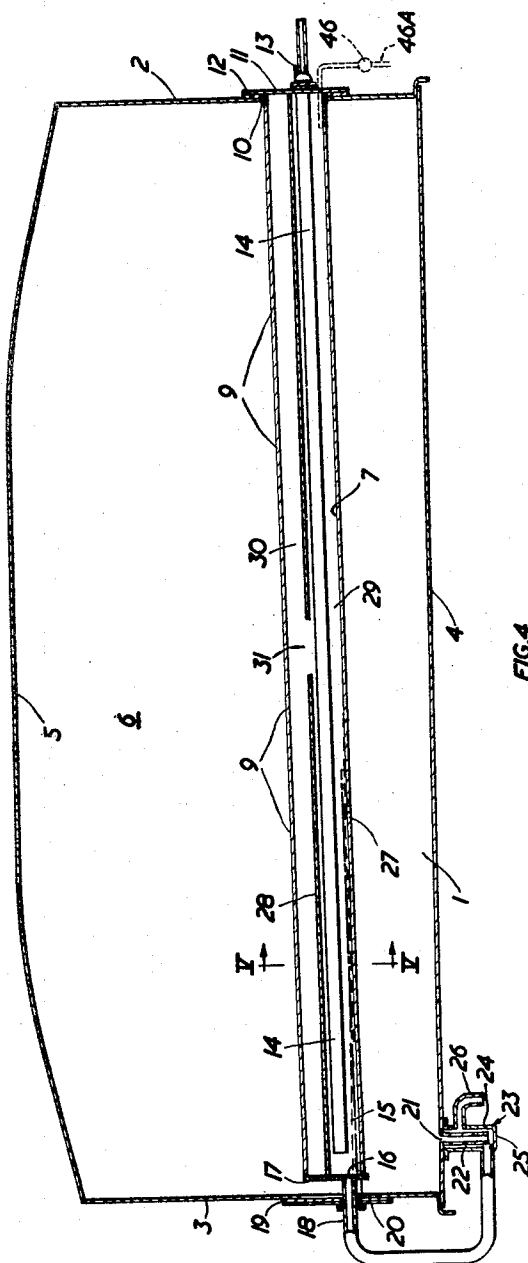


FIG. 4.

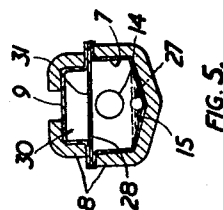


FIG. 5.

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Sept. 8, 1964 J. G. B. HALDEN 3,147,687
METHOD OF AND APPARATUS FOR THE DEVELOPMENT OF LIGHT
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Filed Oct. 5, 1961 3 Sheets-Sheet 3

964 J. G. B. HALDEN 3,14
METHOD OF AND APPARATUS FOR THE DEVELOPMENT OF LIGHT
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3,147,687

Filed Oct. 5, 1961

3 Sheets-Sheet 3

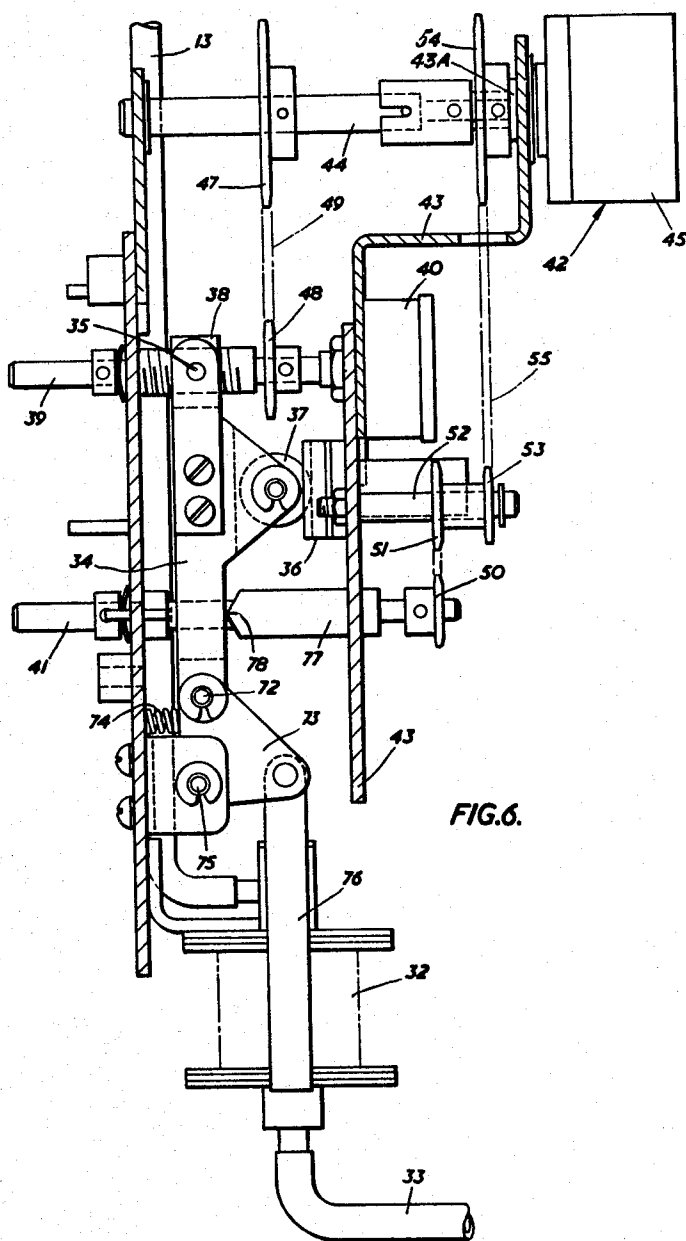


FIG.6.

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1

3,147,687

METHOD OF AND APPARATUS FOR THE DEVELOPMENT OF LIGHT SENSITIVE DIAZOTYPE MATERIALS

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Filed Oct. 5, 1961, Ser. No. 143,248
10 Claims. (Cl. 95-94)

In the development of light sensitive diazotype materials by means of ammonia gas it is known that for optimum developing conditions a certain proportion of water vapour must be present with the ammonia gas in the development atmosphere. The development atmosphere is normally produced by heating an aqueous solution of ammonia in a vaporizing device disposed either within the developing chamber or externally thereof, the spent solution being drained away to waste after it has been heated to liberate ammonia gas and water vapour.

Unless the development atmosphere contains a certain minimum proportion of water vapour satisfactory development cannot be achieved while if the water vapour content of the development atmosphere is excessive, there is a tendency for water vapour to condense on and soil the diazotype material undergoing development and also to retard the process of development by excessive dilution of the ammonia gas.

In existing developing machines no provision is made for varying the energy input to the heater. Even if there is no provision for varying the speed of throughput of the exposed diazotype material it is necessary from time to time to vary the rate of supply of ammonia solution to the vaporizing device with the result that there is a corresponding and undesirable variation in the relative proportions of water vapour and ammonia gas in the development atmosphere. Most modern forms of developing machine provide, however, for variation in operating rate, i.e. in speed of operation of the motor which feeds the diazotype material through the machine, and it is known to arrange for the rate of supply of ammonia solution to the vaporizing device to be varied automatically to suit changes in setting of the speed control of the machine. In such machines the heater is set to operate at conditions appropriate for maximum setting of the speed control. In practice, however, development machines are operated more often than not at speeds below the maximum. As the result they operate inefficiently because the development atmosphere contains an excessive proportion of water vapour and this reduces the efficiency of development and may, as already noted, result in soiling of the diazotype material.

The present invention provides a method of developing light sensitive diazotype material which comprises supplying at a controlled rate to a vaporizing zone fluid which, when heated, will produce a developing vapour consisting of a mixture of ammonia gas and water vapour and supplying heat to said fluid in the vaporizing zone at a rate corresponding to the rate of supply thereto of the fluid so as to maintain in the vaporizing zone a predetermined control temperature and thereby maintain substantially constant at a predetermined value the relative proportions of ammonia gas and water vapour in the developing atmosphere.

The fluid supplied to the vaporizing zone may be an aqueous solution of ammonia, in which case it is preferred to use the commercially available solution of specific gravity 0.910. As an alternative, however, anhydrous ammonia and water may be separately supplied to the vaporizing zone. Where the developing apparatus includes provision for varying the rate of feed of exposed diazotype material through a developing zone, we may

2

arrange for the feed of ammonia solution, or of anhydrous ammonia and water, to the vaporizing zone (which may be located in the developing chamber or externally thereof) to be controlled automatically in accordance with changes in the rate of feed of diazotype material.

The control of heat input to the vaporizing zone may be effected by a thermostat sensitive to the temperature of the liquid in the vaporizing zone or by an interval timer which is controlled by the mechanism for varying the speed of operation of the machine. By appropriate adjustment of the thermostat or interval timer it is possible to vary as desired the control temperature and therefore the relative proportions of ammonia gas and water vapour in the development atmosphere.

In existing developing machines, the spent liquid from the vaporizing zone is drained to the bottom of the developing chamber where its temperature drops, with the result that the spent liquid absorbs ammonia gas from the development atmosphere. According to a feature of the invention this tendency is reduced to a minimum by separating spent liquid leaving the vaporizing zone from the vapour phase at a temperature approximating to the control temperature. The spent liquid then has a minimum content of ammonia gas.

In existing developing machines, the relative proportions by weight of ammonia gas and water vapour are of the order of 30% to 70%. By operating a developing machine in accordance with the above-described method it is possible to work with a developing atmosphere containing a preponderating amount of ammonia gas, e.g. an atmosphere containing 60-75% by weight of ammonia gas and 40-25% by weight of water vapour.

It has been found in practice that optimum developing conditions are provided if water vapour is evolved to the extent of between 15% minimum and 30% maximum of the water present in an aqueous ammonia solution of specific gravity .910. An aqueous ammonia solution of specific gravity .910 consists of 25.25% ammonia and 74.75% water by weight therefore the evolution of, for example, 20% of the total available water vapour and 90% of the total ammonia results in a concentrated developing mixture, consisting of 64% ammonia gas and 36% water vapour. This mixture provides very much more efficient development than is possible by means of the proportions of ammonia gas and water vapour vaporized under conventional methods and utilizing conventional apparatus.

The following experimental results, in which the control temperature in the vaporizing zone was determined by a sensitive thermostat, illustrate the variations obtained in the proportions of ammonia gas and water vapour in the developing atmosphere under different temperature conditions and also illustrate the desirability of utilizing controllable temperature conditions.

Experimental Results With External Vaporizer

° F. control temp.	SG of effluent	Percent- age of water vapor- ized	Percent- age of ammonia extracted	Percentage concen- tration in develop- ing atmosphere	
				NH ₃	H ₂ O
(a) 145.....	.965	4	77	84	16
(b) 164.....	.978	16	88	70	30
(c) 170.....	.984	18	90	68	32
(d) 175.....	.986	20	93	64	36
(e) 185.....	.989	29	95	56	44

The products of the vaporizer were fed to the developing zone. Poor results were obtained from serial (a). Results improved with (b) and best results were obtained from (c) and (d). From these results it was concluded that the optimum mixture of NH₃/H₂O in the developing

atmosphere was in the region of 65% to 35%. Less water resulted in conditions too dry to permit complete coupling, more water reduced the concentration of NH_3 and slowed down coupling and also induced undesirable changes in the hue of some black line coatings.

By varying the control temperature the proportions of water vapour to ammonia gas in the developing atmosphere can be varied at will over a very wide range from about 25% ammonia gas to 75% water vapour to about 85% ammonia gas to 15% water vapour from a .910 specific gravity aqueous ammonia solution.

Thus sufficient heat may be provided fully to vaporize the aqueous ammonia solution or the heat input may be reduced to a level at which very little water vapour is evolved.

It has been found experimentally however that, with a specific design of machine, if less than 13% of the water content of a .910 specific gravity aqueous ammonia solution is vaporized performance is badly affected and in practice therefore the level of water vaporization should not be allowed to fall below 15%. Optimum results with most materials are obtained at a vaporization level of about 20% which provides a developing atmosphere of 64% ammonia gas to 36% water vapour.

The following experimental results show in tabulated form the effect of utilizing an interval timer to control the vaporization of aqueous ammonia solution in a specific developer unit. The higher proportion of water vapour to NH_3 at a given level of effluent SG in this case is because the vaporizer was fitted internally. In the case of the experimental results quoted previously for the external vaporizer, condensation occurred in the connecting tube between the vaporizer and the developing chamber and in the distribution tube, resulting in a lower proportion of water vapour in the developing atmosphere.

Experimental Results With Internal Vaporizer With Asbestos Lagged Tube. Heater Controlled by Interval Timer

Interval timer setting, percent	Nominal energy, watts	Watts per ml.	Feed rate, ml./min.	SG effluent	Percentage of water vaporized	Percentage of ammonia extracted	Percentage concentration of developing atmosphere	
							NH_3	H_2O
(a) 53.7-----	450	22.5	20	987	28	93.5	52	48
(b) 72.4-----	608	23.5	25.9	987	30	94.4	52	48
(c) 38.4-----	323	26	12.5	991	33	95.8	49.5	50.5
(d) 78.4-----	658	27	24.5	991	35	96.2	48	52
(e) 42.4-----	356	28	12.8	992	42	96.6	44	56
(f) 62.7-----	526	28	19	992	40	96.5	44.5	55.5

These experiments were conducted to establish the effect of higher water vaporization rates on various diazo coatings. The results confirmed the earlier findings that nothing is gained by vaporizing more than 20% to 25% of the water content of a .910 liquor.

It will be noted that the control of the system is good and that vaporizer performance remains nearly constant in relation to the SG of the effluent at widely differing feed rates and heat inputs even with the relatively unrefined control by an interval timer.

With a correctly designed vaporizer system controlled by a sensitive thermostat, however, an extremely accurate control can be imposed and the performance of the developing machine can be stabilised at any desired level within the range of the system.

Means may be provided to permit the machine operator to select at will approximately correct operating proportions to suit the specific requirements of different types of diazo materials and in this connection it will be appreciated that in the case of some lacquer coated materials it may be necessary to soften the lacquer surface to permit adequate penetration of ammonia gas thereto and consequently a high water vaporization rate may be desirable.

However, it will be appreciated that there will be a time lag between the selection of the desired proportions of ammonia gas to water vapour and the stabilisation of the developing atmosphere at these selected proportions. This has been established experimentally at approximately 10 to 15 minutes when the machine is in operation.

Particularly when thermostatically controlled means are employed, legible developed copies may be obtained extremely quickly, within 3 to 4 minutes of switch on even though the developing chamber is still cold. This is due to the fact that because the amount of water vaporized is limited and the proportion of ammonia gas in the mixture much greater, recombination of ammonia with the water when discharged into the cold developing chamber is not sufficient to prevent partial development of materials taking place under these conditions. Thus by the time the printing lamp of the machine has warmed up legible developed copies can be produced.

However, whether an interval timer or whether a thermostat is employed the optimum control temperature or interval timer setting may be easily obtained by reference to the specific gravity of the spent liquid from which can be calculated, in conjunction with the measured volume of the effluent, the proportions of ammonia gas and water vaporization obtained for given settings.

It has been found experimentally that the embodiment of the invention employing thermostatic control is capable of maintaining the developing conditions in a machine constant within very close limits in respect of proportions of ammonia gas and water vapour and it has also been found that provided these proportions are maintained at the optimum level the operating temperature of the developing tank can be substantially reduced without significantly affecting the developing performance

of the unit. This is particularly advantageous when developing solvent coated materials particularly those with thermoplastic bases.

The invention includes apparatus for developing light sensitive diazotype materials comprising a developing chamber, means for feeding exposed diazotype material through a developing zone in the chamber, a vaporizer, means for supplying to the vaporizer at a variable rate fluid adapted when heated to produce a developing atmosphere constituted by a mixture of ammonia gas and water vapour for conveyance to the developing zone, and means for supplying heat to the vaporizer at a rate controlled automatically by the rate of supply thereto of said fluid so as to maintain a predetermined control temperature in the vaporizer and therefore substantially constant relative proportions of ammonia gas and water vapour in the developing atmosphere.

The rate of feed of aqueous ammonia solution can be automatically varied in direct proportion to the rate of feed of diazotype material through the machine in various ways. Thus in pump fed machines, in which the motor driving the diazotype material feeding means has an electronic speed control unit fitted with a poten-

tiometer for adjusting it, the control shaft of the potentiometer may be mechanically coupled to the ammonia solution pump so as to vary the stroke of the pump. Alternatively, the ammonia pump may be operated direct by a suitable cam arrangement from one of the rollers of the machine which varies the number of strokes in a given time period according to the speed of the machine. In gravity fed machines where a drip controlled gravity fed system is used variation in the ammonia feed may be achieved automatically by mechanical or electrical operation of the drip control in accordance with the machine speed.

In order to utilize the products of vaporization to the best advantage it is necessary to ensure complete mixing of ammonia gas and water vapour and even distribution throughout the developing chamber and for this purpose recourse may be had to the apparatus described below.

It has been found in practice that the apparatus of the present invention will permit the speed of processing to be at least doubled for a given exposing surface and will provide completely even conditions across the full width of the machine, will improve the developed colour, particularly of blackline diazo materials, will eliminate condensation marking of prints, and will eliminate or at least very substantially reduce paper curl in processing due to moisture absorption. Further, since the working temperature of the developing chamber can be substantially reduced the tendency for lacquered materials to stick while traversing the developing zone is very substantially reduced if not completely eliminated.

These alternative forms of developing apparatus according to the invention will now be described in more detail, by way of example, with reference to the accompanying drawings in which

FIGS. 1-3 are block diagrams illustrative of the three forms of developing apparatus,

FIG. 4 is a section through the developing chamber utilized in accordance with FIG. 1, but showing in chain-dotted lines certain modifications required for compliance with FIGS. 2 and 3 respectively,

FIG. 5 is a section on the line V-V in FIG. 4, and

FIG. 6 is a sectional view of control apparatus complying with FIG. 1.

Like reference numerals indicate like parts throughout the figures.

The system shown in block diagram form in FIG. 1 will first be described. The developing chamber 1 shown in FIGS. 4 and 5 has end walls 2, 3, a bottom wall 4, an upper perforated wall 5, and side walls, one of which is shown at 6.

The upper perforated wall 5 of the developing chamber is sealed by an endless moving belt or blanket (not shown) which traverses the material to be developed over the perforated wall 5 and prevents the developing vapours emanating through the perforations escaping into the surrounding atmosphere. The diazotype material is traversed through the machine in known manner by a variable speed electric motor 70 (FIG. 1) having an electronic speed control 71 provided with a speed control shaft 39.

The developing chamber 1 contains a vaporizer including a trough 7, extending across the width of the developing chamber. The trough 7 is insulated by means of asbestos or like lagging 8 (FIG. 5).

The trough 7 extends into the chamber 1 through an aperture 10 provided for the purpose in the end wall 2 and an end plate 11 and sealing washer 12 are provided to prevent escape of vapour from the chamber at this point.

The trough 7 slopes downwardly from the wall 2 towards the wall 3 to permit the aqueous ammonia solution fed to the interior of the trough 7 to flow down it from one end to the other. Aqueous ammonia solution is fed to the interior of the trough 7 as later described through a feed pipe 13.

Inside the trough 7 is an electric heating element 14 for heating the aqueous ammonia solution as it flows down the trough 7.

As the aqueous ammonia solution is heated it vaporizes to evolve ammonia gas and water vapour, the spent solution draining to form a pool 15 at the lower end of the trough 7. As this spent liquid is maintained at the temperature at which the vapours were evolved no recombination of ammonia gas with it will take place.

To remove this spent solution from contact with the evolved vapour at the prevailing control temperature a port 16 is provided in the end wall 17 of the trough 7, and the spent solution is conveyed to the exterior of the developing chamber 1 by a pipe 18 which extends through sealing washers 19 and an end plate 20 provided externally of the wall 3 of the developer chamber.

Any water vapour which may condense on the inner walls of the developing chamber 1 is drained through a port 21, a pipe 22 and a vapour trap 23.

The trap 23 consists of a container 24 secured to the bottom wall 4 of the developing chamber and into which the pipe 21 extends downwardly thereinto to within a short distance of its bottom wall 25. Near the upper end of the container 24 is an overflow pipe 26 leading to a waste container (not shown). The pipe 18 which removes the spent solution from the trough 7 is connected to the trap 23 near its lower wall 25.

The trap 23 operates as a constant level device and effectively prevents any recombination of ammonia gas with the water contained in the waste so that optimum conditions prevail within the developing chamber 1.

Assuming that ammonia solution of SG .910 is supplied to the vaporizer through the feed pipe 13, the hot effluent discharged from the vaporizer maintains the liquid in the trap 23 at a temperature approximating to the control temperature and a SG of .989 to .990. The small amount of condensate which drains into the trap 23 through the tube 22 is raised in the trap to a temperature such that nearly all the ammonia which has been reabsorbed in the condensate is again driven off into the developing chamber. Virtually all loss of ammonia into the effluent is thus prevented and about 93% of the available ammonia is extracted under normal operating conditions. Known developing machines require a large number of heaters to prevent condensation in the developing chamber. The apparatus of the present invention can be operated effectively with only one such heater, which is not shown in the drawings, to maintain the ambient temperature of the developing chamber at a level sufficient to promote rapid development.

The vaporizing tray is divided by a wall 28 into two compartments 29, 30 communicating via a central aperture 31 in the wall 28. The developing atmosphere escapes from the compartment 30 of the vaporizer to the developing zone through holes 9. There is thus provided a system of baffles which causes the evolved ammonia gas and water vapour to be brought to a single point 31 for mixing and then distributes the mixture through the holes 9 across the width of the developing chamber.

Referring now to FIG. 6 of the drawings aqueous ammonia solution from a pipe line 33 leading from a source of supply (not shown) is pumped by means of a bellows pump 32 of known construction to the pipe line 13 which leads to the vaporizer trough 7.

The pump 32 is operated by means of a cam 36, driven from a constant speed drive motor 80 (FIG. 1), through a follower 37 carried by a lever 34, pivoted at 35 to a sleeve 38 and pivoted at 72 to an arm 73. The arm 73 is loaded by a spring 74, mounted to rock on a fixed pivot 75 and connected to the pump 32 by a stirrup 76.

The main speed control shaft 39 serves, when rotated, to adjust the potentiometer 40 of the electronic speed control 71 (FIG. 1). Rotation of the shaft 39 to adjust the rate at which diazotype material is fed through the machine effects longitudinal adjustment on the shaft

of the sleeve 38, which is threaded to the shaft, and so shifts the position of the pivot 35 and effects a corresponding adjustment of the stroke of the pump 32 and therefore of the rate of supply of ammonia solution to the vaporizer.

An independent manual adjustment of the rate of supply of ammonia solution is afforded by a shaft 41, which carries a threaded sleeve 77 formed with a knife edge 78. Adjustment of this knife edge serves to vary the stroke which is imparted to the pump 32 by the cam 36.

The heat input to the heater 14 (FIG. 4) is controlled by an interval timer 42 rotatably mounted on a bracket 43 and provided with an operating spindle 44. This interval timer is of known type, thus it may be of the type sold by Sunvic Controls Ltd. under the trademark Simmerstat. It comprises a pair of contacts which control the supply of current from the mains to the heater 14, and includes a bimetal strip which is adjustable by a cam and an associated heater element. The contacts are normally closed so that when connected to an electrical supply current will flow through the heater element around the bimetal strip. According to the setting of the cam a greater or lesser amount of heat will be required to cause the bimetal strip to bend sufficiently to cause the contacts to open and break the flow of current to the heater 14 of the vaporizer. The cam is rotated by the operating spindle 44 and thus any relative movement of the spindle 44 and the body 45 of the interval timer will alter the time intervals during which the electrical load (in this case the heater 14) is switched on or off. The rate of supply of heat to the vaporizer can thus be adjusted both by rotation of the spindle 44 and by rotation of the body 45 of the interval timer 42.

The spindle 44 carries a sprocket 47 connected by a chain 49 to a sprocket 48 secured to the speed control spindle 39. Accordingly as the spindle 39 is rotated to increase or decrease the speed of operation of the machine, the spindle 44 will be rotated to effect corresponding adjustment through the interval timer 42 of the output of the heater 14.

The shaft 41 for manual regulation of the rate of feed of aqueous ammonia solution carries a sprocket 50 meshing with a second sprocket 51 which is mounted on a stub axle 52. The stub axle 52 carries a second sprocket 53 connected by a chain 55 to a sprocket 54 rotatably mounted on the spindle 44 and fixed to the mounting sleeve 43A of the interval timer which is free to rotate in relation to the bracket 43.

Accordingly as the ammonia feed rate control shaft 41 is rotated the body 45 of the interval timer is rotated to adjust the energy input to the heater 14.

As an alternative to the use of an interval timer for varying the heat input to the vaporizer, a thermostat 27 may be provided in the vaporizer as shown in chain dotted lines in FIG. 4. The ammonia solution pump 32 is adjusted to deliver ammonia at a rate proportionate to the speed of the motor 70 and also has an independent manual adjustment as shown in FIG. 6. This system is shown in block diagram form in FIG. 2. The thermostat 27, which is adjustable to maintain a desired predetermined control temperature in the vaporizer cuts out the heater 14 whenever the preset control temperature is reached and cuts the heater in again as soon as the temperature in the vaporizer tends to fall below the preset value. The thermostat responds to any change in the rate of supply of ammonia solution to the vaporizer or to any fluctuation of the electrical supply voltage or to any change in the specific gravity of the ammonia solution used, to adjust the energy input to the heater in such fashion as to maintain the control temperature at the preset value. The control imposed by the thermostat is therefore very much more precise than that provided by an interval timer and compensates fully for any change in operating conditions which can occur except a change of the specific gravity of the ammonia solution. In this case

since there will be a change in the proportions of ammonia and water in the solution supplied to the vaporizer and the amount of ammonia vaporized will increase or decrease according to whether the solution supplied is stronger or weaker. The quantity of water vaporized, however, will remain constant as will the specific gravity of the effluent since these are dictated by the control temperature.

It is in the automatic compensation for uncontrollable variations of one or more of the factors that thermostatic control is much superior to interval timer control, since the latter is unable to compensate for variation of these factors, which will thus cause deviations from the desired performance.

A thermostat of high sensitivity is required and one responsive to a temperature change of less than 1° Fahrenheit has been found very suitable for the purpose. A commercial type thermostat of low sensitivity will not provide satisfactory results.

In the arrangement shown schematically in FIG. 3, the pump 32 serves to pump water only to the vaporizer, anhydrous ammonia being supplied to the vaporizer from a cylinder through a pipe 46A, shown in chain dotted lines in FIG. 4. The control temperature is maintained by a thermostat 27 as in FIG. 2, and the stroke of the pump 32 is adjusted as described with reference to FIG. 6. Adjustment of the speed control shaft 39 effects a corresponding adjustment of a valve 46 (FIG. 4) for controlling the admission of anhydrous ammonia to the vaporizer and of the pump 32 for controlling the supply of water.

Adjustment of the manual control shaft 41 serves only to adjust the valve 46 to alter the supply of anhydrous ammonia.

What I claim as my invention and desire to secure by Letters Patent is:

1. Apparatus for developing light-sensitive diazotype material comprising a developing chamber, variable speed means for feeding exposed diazotype material through a developing zone in the chamber, a vaporizer, a speed controlling member for adjusting said variable speed means, a variable delivery pump adjustable by said speed control means for feeding aqueous ammonia to the vaporizer at a rate corresponding to the rate of feed of said material, an electrical heater in the vaporizer for vaporizing said aqueous ammonia to produce a developing atmosphere of ammonia gas and water vapour for conveyance to said developing zone, and means responsive to variations in the delivery of said pump for varying the input of current to said heater to maintain a predetermined control temperature in the vaporizer and thereby controlling the evaporation both of ammonia gas and of water vapour from said vaporizer to maintain substantially constant relative proportions of ammonia gas and water vapour in the developing atmosphere.

2. Apparatus as claimed in claim 1, comprising a pivoted lever connected to said pump, a cam operative on said lever to cause it to oscillate about its pivot to actuate the pump and means operable by the speed control member for adjusting the position of the pivot of said lever and thereby varying the delivery of the pump.

3. Apparatus as claimed in claim 2, which includes a stop for determining the amplitude of oscillation of said lever and manual control means for adjusting the position of the stop.

4. Apparatus for developing light-sensitive diazotype material comprising a developing chamber, variable speed means for feeding exposed diazotype material through a developing zone in the chamber, a vaporizer, a speed controlling member for adjusting said variable speed means, a variable delivery pump adjustable by said speed control means for feeding aqueous ammonia to the vaporizer at a rate corresponding to the rate of feed of said material, an electrical heater in the vaporizer for vaporizing said aqueous ammonia to produce a developing atmos-

phere of ammonia gas and water vapour for conveyance to said developing zone, and an interval timer for intermittently supplying current to said heater which is adjustable by said speed controlling member to maintain a predetermined control temperature in said vaporizer.

5. Apparatus as claimed in claim 4, which includes a manual control for effecting simultaneous adjustment of the delivery of said pump and of said interval timer.

6. A method of developing light sensitive diazotype material which comprises feeding exposed diazotype material through a developing zone, supplying to a vaporizing zone, from which a developing atmosphere of ammonia gas and water vapor is supplied to the developing zone, an aqueous solution of ammonia at a rate controlled automatically by the rate of feed of the diazotype material, varying the supply of heat to the vaporizing zone in accordance with variations in the rate of the supply of the ammonia solution to said zone so as to maintain in the vaporizing zone a predetermined control temperature and thereby maintain substantially constant at a predetermined value the relative proportions of ammonia gas and water in the developing atmosphere, and separating spent liquid leaving the vaporizing zone from the vapor phase at a temperature approximating to the control temperature.

7. Apparatus for developing light-sensitive diazotype material comprising a developing chamber, variable speed means for feeding exposed diazotype material through a developing zone in the chamber, a vaporizer, means for supplying to the vaporizer, at a rate dependent upon the rate of feed of said material, fluid adapted when heated to produce a developing atmosphere constituted by a mixture of ammonia gas and water vapor for conveyance to said developing zone, an electrical heater in the vaporizer and means responsive to variations in the rate of supply of fluid to the vaporizer for maintaining substantially constant relative proportions of ammonia gas and water vapor in the developing atmosphere by varying the input of heat to said heater to maintain a predetermined control temperature in the vaporizer and thereby control the evaporation both of ammonia gas and of water vapor from said vaporizer, said responsive means being a thermostat for controlling the input of current to said heater to maintain a predetermined control temperature in the vaporizer irrespective of variation in the rate of supply of fluid to the vaporizer.

8. Apparatus as claimed in claim 7, wherein said vaporizer includes a downwardly sloping tray wherein said heater is positioned, said apparatus including a pipe for discharging aqueous ammonia from said fluid supplying means into the upper end of said tray.

9. Apparatus as claimed in claim 7, wherein said vaporizer includes a downwardly sloping tray wherein said heater is positioned, said apparatus including pipes for discharging anhydrous ammonia and water from said fluid supplying means into the upper end of said tray.

10. Apparatus for developing light-sensitive diazotype material comprising a developing chamber, variable speed means for feeding exposed diazotype material through a developing zone in the chamber, a vaporizer, a speed controlling member for adjusting said variable speed means, a variable delivery pump adjustable by said speed control means for feeding aqueous ammonia to the vaporizer at a rate corresponding to the rate of feed of said material, an electrical heater in the vaporizer for vaporizing said aqueous ammonia to produce a developing atmosphere of ammonia gas and water vapor for conveyance to said developing zone, and means responsive to variations in the rate of supply of fluid to the vaporizer for maintaining substantially constant relative proportions of ammonia gas and water vapor in the developing atmosphere by varying the input of heat to said heater to maintain a predetermined control temperature in the vaporizer and thereby control the evaporation both of ammonia gas and of water vapor from said vaporizer, said responsive means being a thermostat for controlling the input of current to said heater to maintain a predetermined control temperature in the vaporizer irrespective of variation in the rate of supply of fluid to the vaporizer.

References Cited in the file of this patent

UNITED STATES PATENTS

2,096,015	Von Meister et al. -----	Oct. 19, 1937
2,475,809	Sullivan et al. -----	July 12, 1949
2,630,744	Wilde -----	Mar. 10, 1953
2,696,771	Frantz -----	Dec. 14, 1954
2,926,592	Wilde -----	Mar. 1, 1960

FOREIGN PATENTS

664,373	Germany -----	Aug. 25, 1938
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