

Oct. 13, 1942.

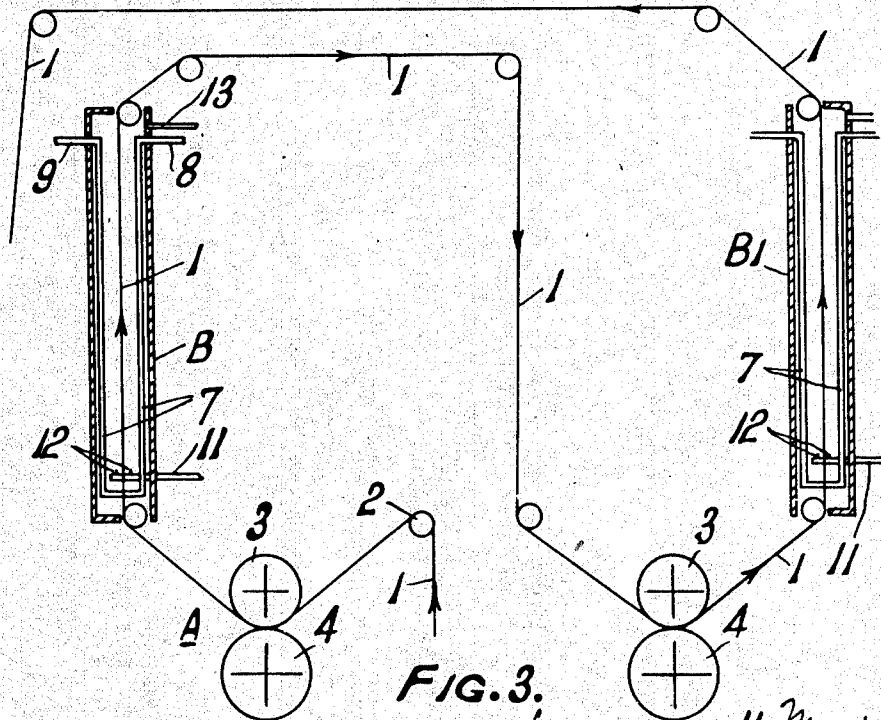
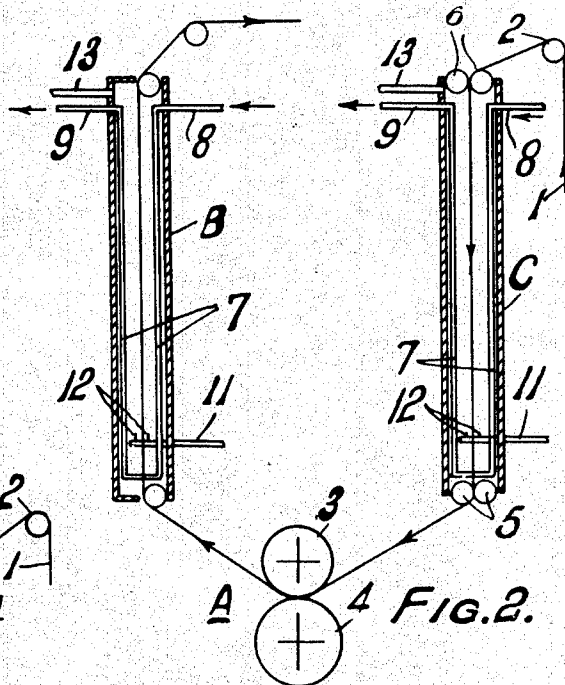
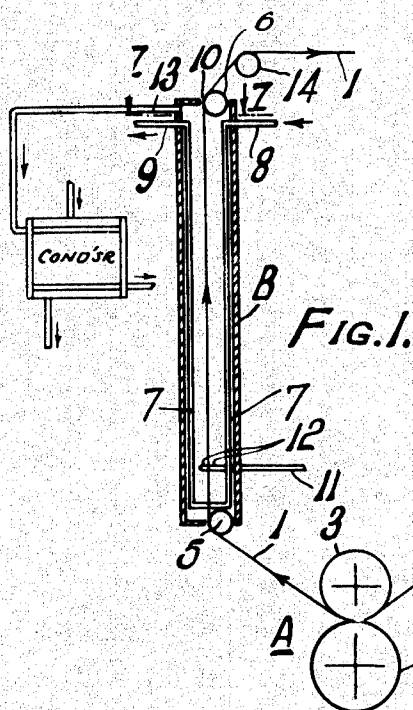
H. N. MORRIS

2,298,803

DRYING OF PRINTED MATTER

Filed Feb. 8, 1938

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

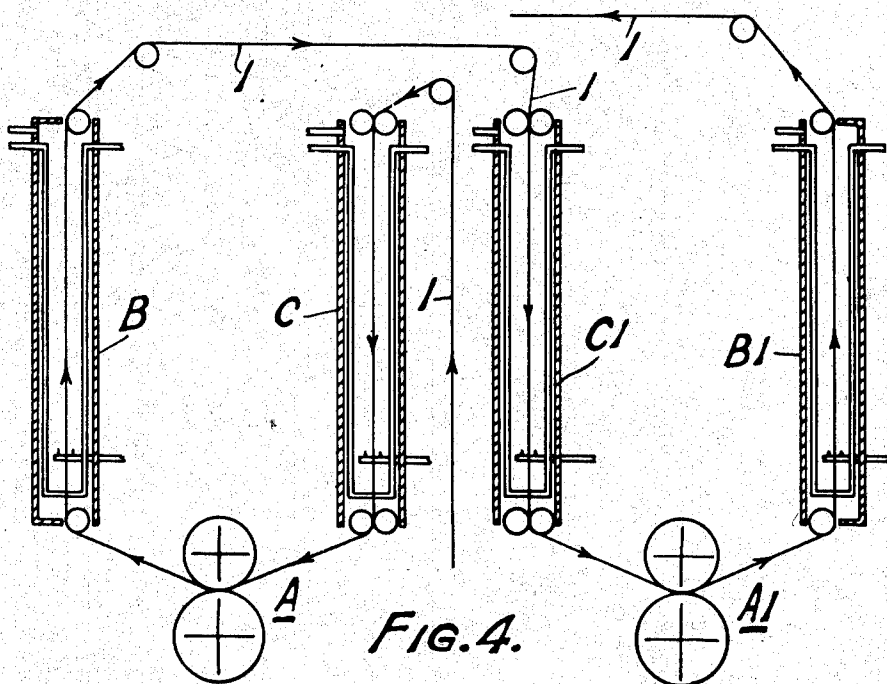


FIG. 4.

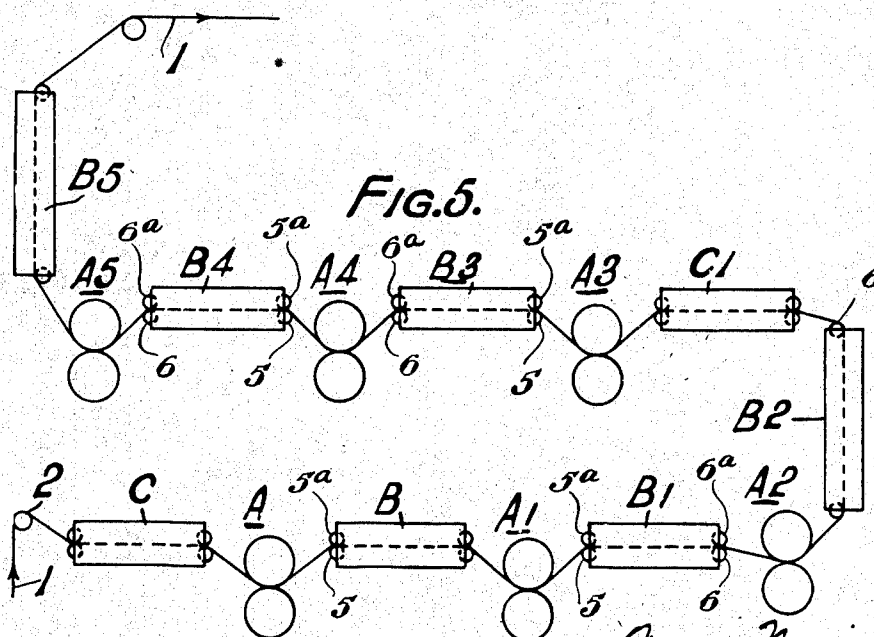


FIG. 5.

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3 Sheets-Sheet 3

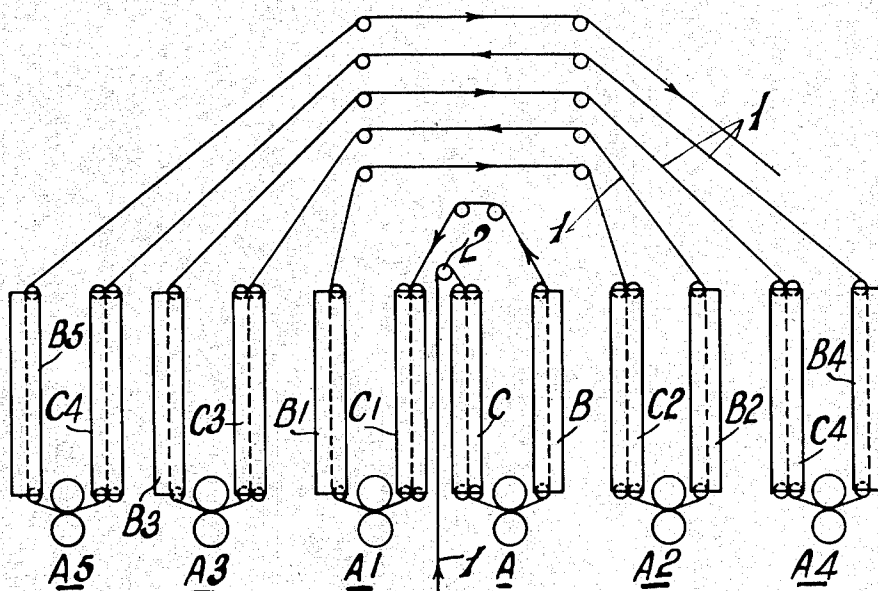


FIG. 6.

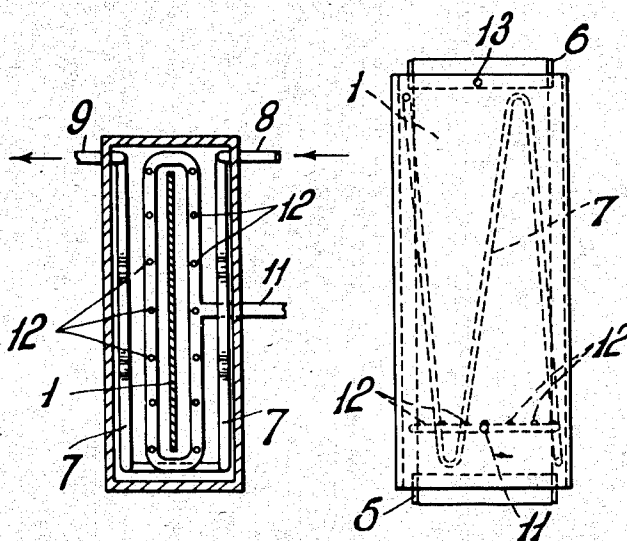


FIG. 7.

FIG. 8.

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UNITED STATES PATENT OFFICE

2,298,803

DRYING OF PRINTED MATTER

Herbert Newall Morris, London, England

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In Great Britain March 3, 1937

11 Claims. (Cl. 101-416)

This invention relates to printing and is concerned with the rapid drying of the print and the invention is specially advantageous where the printing medium employed is a liquid or other ink containing volatile solvents.

Hitherto many proposals have been made for rapidly drying the printed sheets such, for example, as by the use of heated cylinders or plates over which the printed matter is passed, by subjecting the printed sheets to blasts of hot or cold air or by the suction of air over or under the printed matter, by electrical discharge and by the ignition of the vapours.

The object of the present invention is to provide improved means whereby the drying of printed matter is under control and can be effected as rapidly as desired so as to eliminate the occurrence of "offsetting."

My invention consists in a method for effecting rapid drying of printed matter according to which the surface of the paper upon which the print has been applied is subjected to the action of superheated steam at a temperature so regulated with relation to the speed of movement of the paper that the temperature to which the surface of the paper is raised by the superheated steam is above that of the boiling point of the volatile constituents of the printing ink when subjected to the superheated steam but below that at which the paper can be damaged in the period during which it is subjected to the influence of the superheated steam so that the volatile constituents of the printing ink are evaporated in a very short time. By the expression "a very short time" is meant a time so short that the print is dry before it is subsequently touched. In multiple printing, for example, the print from one impression cylinder will be completely dry before the next impression cylinder is reached.

Manifest advantages over the methods hitherto proposed follow from the adoption of my invention. For example, the vapours of the volatile constituents of the ink are not mixed with air to make them either explosive or difficult of recovery. It is unnecessary even for the highest speed of printing to use any dangerously inflammable and toxic inks and thus printing which has hitherto been only possible by using dangerously inflammable, explosive and toxic inks may be done with inks of a character and in a manner which is safe and non-injurious to workpeople. Further printing at varying speeds may be carried out with the same ink and it is unnecessary to use several inks varying in volatility with the

speed of work, for tuning up at the beginning of a run. The necessity for a totally enclosed ink fountain is eliminated since it is unnecessary to use the highly volatile and toxic solvents which are subject to special and onerous regulations on account of their low flash point, and their risk of fire and explosion when mixed with air, and their being injurious to the health of operators.

In order that the invention may be readily understood and carried into practice reference is hereby made to the accompanying diagrammatic drawings wherein Figure 1 is a diagrammatic side elevational view illustrating the simplest form of my invention where the paper passes through a single chamber; Figure 2 is a similar view illustrating the use of a pretreatment chamber in addition to the drying chamber; Fig. 3 is a similar view illustrating one suitable arrangement where printing is effected on both sides of the paper; Figure 4 is a similar view illustrating another application of the invention to printing on both sides of the web; Figure 5 is a similar view illustrating the application of the invention to the case where successive printings on the same side of the web have to be effected; Figure 6 is a similar view illustrating an application of the invention to permit six successive printings on one web, three printings on each side, whereby three colors can be applied to each side of the web alternately in one continuous run, and Figures 7 and 8 are more detailed diagrams of the essential part of printing plant according to my invention, Figure 7 being a sectional plan of Figure 8 to an enlarged scale.

Referring to these drawings and particularly to Figure 1, the numeral 1 designates the web of paper or other material to be printed, which after leaving the reel passes over a roller 2 into the printing machine A in the usual way through or between the impression cylinder 3 and the forme cylinder 4. The web 1 then passes into and through the rectangular vertical drying chamber B which is partly closed at each end by the rollers 5 and 6. The chamber is constructed of non-conducting material or of material such as steel or iron lagged inside and/or outside with non-conducting material. Inside the chamber and located at one or both sides is a metal heating coil 7 through which superheated steam or steam of high pressure is passed, this steam entering at 8 and passing out at 9. The chamber is as nearly as possible totally enclosed at both ends, allowing only slots 10 at each end through which the paper web can pass.

In order to prevent condensation of any steam on the web the chambers are heated before printing is commenced to a suitable temperature usually not less than 100° C. This is effected in the apparatus illustrated by passing steam through the coils 7 but it should be here mentioned that any system of heating such for instance as by electrical heaters can be employed in place of these steam coils.

As soon as printing begins low pressure steam is introduced by means of a pipe 11 fitted with nozzles 12 into the chamber B at a pressure which may suitably be about 2 lbs. per sq. inch, the jets discharging in the direction in which the web is passing. This direct steam may be supplied from a superheater, or the necessary superheat may be derived from the internal heating device which in this instance is the steam coil 7 by using high pressure or superheated steam for heating the coil.

The outlet 13 for the steam and vapours extracted from the printed material is provided as near the top of the chamber as possible and may be connected with any suitable condenser or recovery plant in which the gases can be condensed and the solvent recovered. The suction caused by the cooling and condensing of the vapours may be sufficient to overcome any slight pressure in the chamber, but a suitably disposed fan or steam ejector may be provided to give full control of the working pressure of the chamber.

The printed web passes out of the chamber B through the narrow slot 10 and over the roller 14 and the volatile solvents contained in the inks and thinners used are recovered in the usual way as before indicated.

Referring to Figure 2 the web 1 passes over a roller 2 and through the pretreatment chamber C which may be of similar construction and design to the drying chamber B illustrated in Figure 1 and therefore for brevity and convenience the same figures of reference are used to indicate corresponding parts throughout.

Inside the pretreatment chamber C and close to the sides is a steam heating coil 7 through which superheated or high pressure steam may be passed so as to keep the inside of the chamber above 100° C. and thus prevent internal condensation. The inlet of steam to the coil is at 8 and the outlet at 9.

Direct steam is provided as in the case of the drying chamber B and is introduced at 11 through nozzles 12. The direct steam may be superheated and of low pressure, or if the temperature of the chamber be raised to a much higher temperature than 100° C. by means of the coil 7 saturated steam of low pressure may be used this being superheated as it passes through the chamber.

An outlet for the direct steam is provided at 13 as near the top of the chamber as possible. This may be connected with a condenser or steam boiler or with the superheater which may be required for the drying and/or pretreatment chambers.

The entrance to the pretreatment chamber is totally enclosed by two rollers 6—6 through or between which the web passes. The outlet is also closed by two rollers 5—5 in the same way and the web passes through these and, directly into a printing machine A and between the impression and forme cylinders 3 and 4 to be printed and dried in the chamber B.

In fact this pretreatment chamber C only dif-

fers from the drying chamber B in the arrangement of the double rollers 5—5 and 6—6 which close the chambers.

Referring to Figure 3, it will be seen that the paper 1 passes from the reel over a roller 2 through the printing machine A, through a drying chamber B, constructed and arranged to operate as before described, and thence over suitably disposed guiding rollers through the second printing machine A1, a second drying chamber B1 to the cutting, folding or re-reeling machine. The path taken by the web can be readily traced by following the direction of the arrows applied to the web.

Referring to Figure 4, the web 1 passes over a roller 2 into and through the pretreatment chamber C, through the first printing machine A through a drying chamber B, over rollers into and through a second pretreatment chamber C1, through the second printing machine A1 and thence through the second drying chamber B1 for its further normal treatment.

Referring to Figure 5, paper web 1 passes from the reel over a roller 2 into and through a pretreatment chamber C, through a printing machine A, then through a drying chamber B, through a second printing machine A1, a second drying chamber B1, a third printing machine A2, a third drying chamber B2, a second pretreatment chamber C1, a fourth printing machine A3, a fourth drying chamber B3, a fifth printing machine A4, a fifth drying chamber B4, a sixth printing machine A5 and thence through a final drying chamber B5 onward as previously described. It will be observed that the drying chambers B and B1, B3 and B4 are provided with both top rollers closing the chambers and there is also indicated at 5a and 6a small rollers which are only engaged adjacent the edges of the web. It will be understood that the pretreatment and drying chambers can be arranged horizontally vertically or at any desired angle and the relative disposition of the printing machines will be such as to ensure the proper tension being maintained on the web.

For example, in the case of the pretreatment chambers the rollers under and over the web completely enclose the chambers. In the case of the drying chambers the upper rollers extend the whole width of the chamber, but the rollers under the web act as clips or runners so that only the edges of the web come into contact with them. The under rollers may be parallel with the upper rollers, or they may be set at a slight angle so as to give a pull or stretch to the web as will be readily understood by printing engineers.

By means of the foregoing arrangement printing in three colours can be effected on both sides of the web.

In the arrangement shown in Figure 6 the web 1 from the reel passes over a roller 2 through a pretreatment chamber C and is printed on one side by the printing machine A. The web then passes through the drying chamber B over rollers to the pretreatment chamber C1, through the printing machine A1 in which it is printed on the reverse side. From the printing machine A1 it passes through the drying chamber B1 over rollers to and through the pretreatment chamber C2, printing machine A2, drying chamber B2, pretreatment chamber C3, printing machine A3, drying chamber B3, pretreatment chamber C4, printing machine A4, drying chamber B4, pretreatment chamber C4, printing machine A5

and drying chamber B5 and thence onward as before.

In some cases the direct steam may be omitted from the pretreatment chambers and these chambers used as driers, conditioners or coolers to keep the web in uniform condition as to moisture content and temperature. In fact in some cases both the direct and indirect steam may be omitted from these pretreatment chambers when it is desired to keep the temperature low before printing. It should also be mentioned that instead of direct steam or in addition to it there may be introduced into one or more of the pretreatment or drying chambers a spray of varnish or wax solution to improve the gloss or finish of the printed material and the same may be transparent or coloured to produce a variety of effects.

In Figures 7 and 8 there is illustrated one of the drying chambers B on a larger scale to indicate one possible construction and arrangement of the various parts, Figure 7 being a section on the line 7-7 and Figure 8 a section on the line 8-8 of Figure 1.

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

1. A method for effecting rapid drying of printed matter consisting in subjecting the surface of a single reach of paper immediately following the making of an impression thereon with a low volatile, non-toxic ink to the action of an atmosphere substantially free from air and containing superheated steam at a temperature above the boiling point of volatile constituents in the ink of the impression and below that which will damage the paper, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper, the steam and the volatile constituents removed from the ink by the action of the steam.

2. A method for effecting rapid drying of printed matter consisting in continuously passing a single reach of paper immediately following the making of an impression thereon with a low volatile, non-toxic ink, through a substantially closed chamber, displacing air within said chamber by a continuous supply of superheated steam at a temperature above the boiling point of volatile constituents of the ink of the impression and below that at which the paper will be damaged, and maintaining a continuous current of the steam about the paper by continuously withdrawing the steam and the volatile constituents of the ink of the impression from said chamber.

3. A method for effecting rapid drying of printed matter consisting in subjecting the surface of paper immediately before the making of an ink impression thereon to the action of an atmosphere substantially free from air and containing superheated steam at a temperature below that which will damage the paper, making an ink impression on the paper, and thereafter subjecting the surface of paper having an ink impression thereon to the action of an atmosphere substantially free from air and containing superheated steam at a temperature above the boiling point of volatile constituents in the ink of the impression and below that which will damage the paper, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

4. A method for effecting rapid drying of printed matter consisting in passing paper in a single reach immediately following the making of

an impression thereon with a low volatile, non-toxic ink through a substantially closed chamber delivering saturated steam of low pressure into said chamber in sufficient volume to create therein an atmosphere substantially free of air, superheating the steam within the chamber by a suitable heating element, regulating the temperature of said superheated steam with relation to the speed of movement of the paper, whereby the temperature of the surface of the paper is raised above the boiling point of the volatile constituents of the ink but is maintained below that at which the paper will be damaged while passing through the chamber, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

5. A method for effecting rapid drying of printed matter consisting in subjecting the surface of the paper to the action of superheated steam immediately before the printing operation and thereafter passing paper upon which an ink impression has been applied through a substantially closed chamber, delivering saturated steam of low pressure into said chamber in sufficient volume to create therein an atmosphere substantially free of air, superheating the steam within the chamber by a suitable heating element, regulating the temperature of said superheated steam with relation to the speed of movement of the paper, whereby the temperature of the surface of the paper is raised above the boiling point of the volatile constituents of the ink but is maintained below that at which the paper will be damaged while passing through the chamber, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

6. A method for effecting rapid drying of printed matter containing a sequence of impressions made with a low-volatile, non-toxic ink upon either or both sides of the paper consisting in subjecting the surface of a single reach of the paper following the making of each impression to the action of an atmosphere substantially free from air and containing superheated steam, regulating the temperature of said steam with relation to the speed of movement of the paper so that the temperature to which the surface of the paper is raised by the superheated steam is above that of the boiling point of the volatile constituents of the ink but below that at which the paper can be damaged in the period during which it is subjected to the action of the superheated steam, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

7. A method for effecting rapid drying of printed matter containing a sequence of ink impressions upon either or both sides of the paper consisting in subjecting the surface of the paper immediately before the making of each impression, to the action of an atmosphere substantially free from air and containing superheated steam at a temperature below that which will damage the paper, regulating the temperature of said steam with relation to the speed of movement of the paper, immediately thereafter making an ink impression on said paper, subjecting the surface of the paper following the making of each impression to the action of an atmosphere substan-

tially free from air and containing superheated steam, regulating the temperature of said steam with relation to the speed of movement of the paper so that the temperature to which the surface of the paper is raised by the superheated steam is above that of the boiling point of the volatile constituents of the ink but below that at which the paper can be damaged in the period during which it is subjected to the action of the superheated steam, and maintaining a current of superheated steam about the paper by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

8. A method for effecting rapid drying of printed matter consisting in subjecting the surface of a single reach of paper immediately following the making of an impression thereon with a low volatile, non-toxic ink to the action of an atmosphere substantially free from air and containing superheated steam at a temperature above the boiling point of volatile constituents in the ink of the impression and below that which will damage the paper, and maintaining a uni-directional current of superheated steam about the paper, the flow of which is in the same direction as the movement of the paper, by continuously withdrawing from adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

9. A method for effecting rapid drying of printed matter consisting in subjecting the surface of paper immediately before the making of an ink impression thereon to the action of an atmosphere substantially free from air and containing superheated steam at a temperature below that which will damage the paper, making an ink impression on the paper, and thereafter subjecting the surface of paper having an ink impression thereon to the action of an atmosphere substantially free from air and containing superheated steam at a temperature above the boiling point of volatile constituents in the ink of the impression and below that which will damage the paper, and maintaining a uni-directional current of superheated steam about the paper, the flow of which is in the same direction as the movement of the paper, by continuously withdrawing from

adjacent the paper the steam and the volatile constituents removed from the ink by the action of the steam.

10. Apparatus for practicing the herein described method embodying therein the combination with a printing couple of a plurality of substantially closed chambers, one of said chambers being positioned upon the feed side, and the other of said chambers being positioned upon the delivery side, of said printing couple, each chamber having an entrance opening adjacent one end thereof and an outlet opening adjacent the other end thereof permitting a single reach of paper to be passed through the chamber immediately prior to and immediately following the making of an ink impression thereon by said printing couple, guide rollers adjacent and substantially closing each opening, the guide rollers of the chamber positioned upon the delivery side of said printing couple being positioned so as to be engaged by the unprinted side of the paper, a steam inlet adjacent one of said openings of each chamber, and a steam outlet adjacent the other said opening, whereby a continuous circulation of steam is maintained through, and volatile constituents of ink continuously withdrawn from, each chamber.

11. Apparatus for practicing the herein described method embodying therein a plurality of substantially closed chambers each having an entrance opening adjacent one end thereof and an outlet opening adjacent the other end thereof permitting a single reach of paper to be passed through the chamber, guide rollers adjacent and substantially closing each opening, a steam inlet adjacent one of said openings of each chamber, a steam outlet adjacent the other said opening, whereby a continuous circulation of steam is maintained through, and volatile constituents of ink continuously withdrawn from, each chamber, one of said chambers being located adjacent the feeding side of a printing mechanism and another chamber being located adjacent the delivery side of the printing mechanism, and suction creating means connected with said steam outlet whereby the rate of flow of superheated steam and volatile constituents of ink from the chamber may be accelerated and controlled.

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