

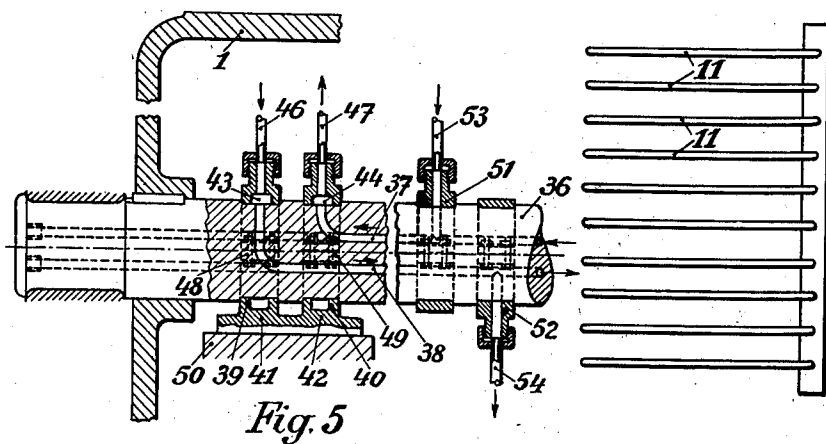
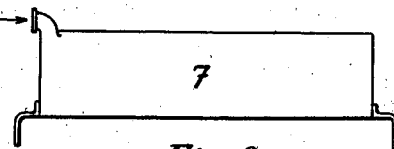
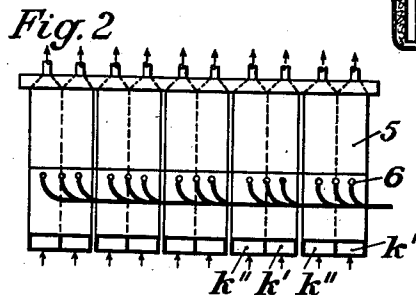
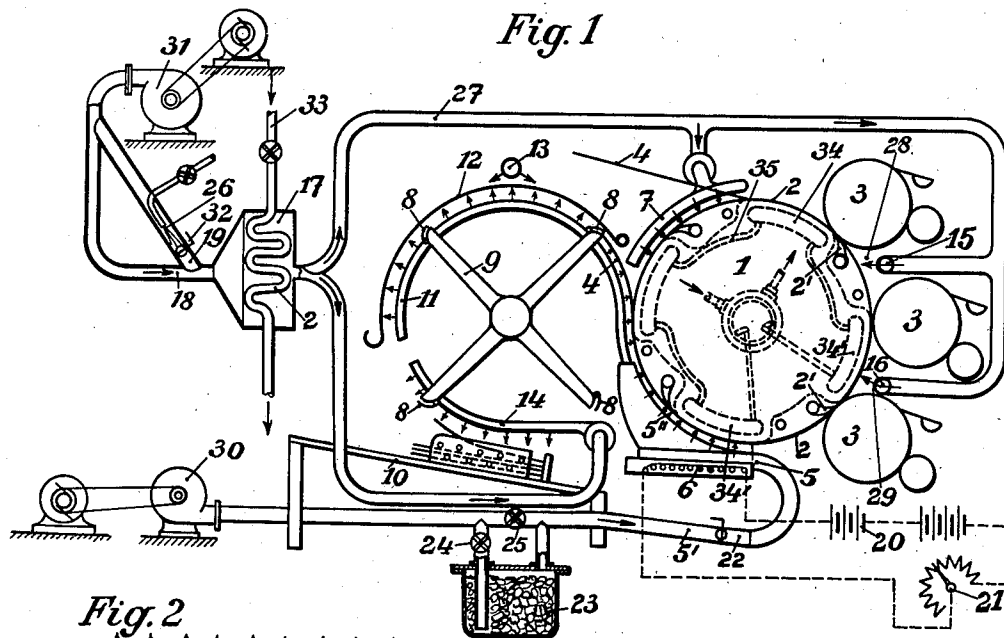
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METHOD OF AND APPARATUS FOR DRYING SHEETS IN MULTICOLOR INTAGLIO PRINTING

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# UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR DRYING SHEETS IN MULTICOLOR INTAGLIO PRINTING

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My invention relates to multi-color intaglio printing and has for its object to provide an improved method of and apparatus for drying the printed sheets between the several applications of color and after the printing is completed.

The capacity of a machine for multi color sheet intaglio printing depends on the rapidity of the method of drying employed. A drying method effected by heat alone would cause inconveniences on account of the dried paper contracting and preventing the prints from fitting upon each other after the repeated taking in of color; besides the dried sheet would seldom be in a suitable condition for a further application of color.

The present invention provides a novel method and apparatus for the quick drying of the imprinted color wherein the paper is not disadvantageously influenced.

In accordance with said invention warm air is blown upon the printed sheet after each color printing operation, the warm air being dried in certain cases. Cold air is then blown upon this sheet, the air being moistened when required. The application of the last color is preferably followed by a warm air treatment for some considerable time followed again by a cold air treatment on the receiving table.

This heated air is blown against the freshly printed sheets in accordance with the invention, especially when the back of said sheets is placed against a surface which is a good conductor of heat; said surface being cooled when required.

The drawing shows diagrammatically an arrangement for carrying out my improved method, wherein

Fig. 1 represents the general arrangement and Figs. 2-4 the top plan views of details represented in side elevation in Fig. 1,

Fig. 2 showing a top view of a warm air blasting device,

Fig. 3 being a plan view of the cold air blasting device and

Fig. 4 a top view of the warm air supply for the completely printed sheets.

Fig. 5 shows a section through the shaft of the impression cylinder and the feed and

drain pipes of the cooling means leading to and coming from the cooling chambers of the impression cylinder.

The sheets 4 to be printed are conveyed to the crown of the impression cylinder, where they are caught by the claws 2' associated with the impression fields 2. With each revolution of the impression cylinder 1 one color is impressed upon a sheet through a printing cylinder 3, after which the freshly printed sheet must be dried before the sheet is printed by a second printing cylinder.

The drying during the rotation of the impression cylinder is effected as the latter revolves by causing the sheet to pass an air blower box 5 which is supplied with compressed air by a compressed air pipe 5' and equipped with a great number of air nozzles directed towards the impression cylinder and marked by little arrows in the drawing indicating the discharge of air.

The box 5 is divided into a number of separate chambers k', k'', arranged in the direction of the impression cylinder shaft as will be seen from Fig. 2.

Electric heating elements 6 arranged in the chambers k', k'' are supplied by the current generator 20 and are regulated separately at 21.

The warm air is blown thus through the openings 5'' upon the printed sheet when the latter is passing the heating arrangement 5 and the chambers k', k'' thereof and this blowing action of short duration will be sufficient to dry the applied color.

Provision is also made for the dividing up of the space in the heating apparatus 5 into chambers and the regulating of the heating in the several chambers so that more intensified heating and drying on such places of the sheet to which the colors are applied more thickly is accomplished. The air supply of the several chambers of the drying arrangement 5, 6 may also be regulated by way of throttling devices 22. The air can be dried by conveying the same through the drier 23, or it can be conveyed to the heating elements 5 without being dried by closing the valve 24 and opening of the valve 25.

In consequence of the fact that the back

side of the printed sheet, which is treated by blowing heated air or, when desired dried heated air against it, is placed upon the impression cylinder, whose metallic shell being a good conductor of heat, prevents local heating, the temperature of the sheet is not changed except at the surface exposed immediately to the hot air flow. There are, however, printing colors which take an exceedingly long time to dry, necessitating the employment of a strongly heated air current in order to attain a sufficient drying of the printing color during the short time intervals the printed sheet is passing through the hot air current. To keep the temperature of the sheet constant also in such a case the cooling effect of the impression cylinder is increased. According to the present invention, this is accomplished through the arrangement of cooling chambers 34 in the impression cylinder, wherein the cooling chambers 34 are connected to each other by way of pipe lines 35, the last cooling chambers being directly connected with the supply and discharge line of the cooling means. For this purpose, as is shown in Fig. 5, the shaft 36 of the impression cylinder 1 is provided with bores 37 and 38. Rings 41 and 42 slide in grooves 39 and 40 in the shaft 36, said rings having hollow spaces 43 and 44, which on one side are continuously connected with the bore holes 38 and 37 of the shaft, on the other side with a supply pipe 46 and with a discharge pipe 47, respectively, for the cooling means. The slip rings are divided at 48 and 49 to allow the mounting of same on the shaft grooves. They are rigidly supported in the engine frame at 50. Rings 51 and 52 are shrunk at a suitable place upon the shaft 36, said rings revolving with the shaft in contradistinction to the stationary rings 41 and 42, and are connected with the last cooling chambers 34' by way of the lines 53 and 54. Cooling water is supplied to the stationary pipe line 46, this cooling water flowing constantly through the ring shaped hollow space 43 into the hole 38 whence it flows by way of pipe line 54 into one of the last cooling chambers 34'. The cooling means, after flowing through all the chambers 34 and 34' by way of the pipe connections 35, is drained from the other chamber 34' by way of pipe line 53 into the stationary cooling means discharge line 47 through the hole 37 and the hollow space 44.

The sheet, after passing the device 5 and before passing the printing cylinder to get a new color impression, passes a blower device 7 which directs a strong blast of cold air and, when desired, of moistened air against said sheet. The vapors produced by the heated air are in this manner blown away. The cold air current rests the sheet into the state it was in before the first print. The sheet may also be slightly moistened by such cold blast

which is very desirable as an excess of dryness of the sheet would cause a deficient absorption of color.

This second air treatment, together with the cooling effect of the impression cylinder, insures that the sheet arrives in a suitable condition at each impression operation with the printing cylinders 3.

The sheets which have received their last imprint, must be dried a little more, than after the previous impressions because the third color—the blue color—requires the most time to dry. The sheet is therefore caught after passing the hot air openings 5" three times, by the claws 8 of the revolving crossed arms 9 for leading it to the delivery table 10. On its way to the table 10 the printing side of the sheet passes the pipes 11 coming from the upper ends of the device 5, or of the chambers  $k'$ ,  $k''$  and is thus swept by heated compressed air. This warm air forces the back of the sheet against a sheet metal cover 12 in such a way that the back side is kept relatively cool. To insure this cooling effect of the cover 12, a pipe 13 may be employed to discharge a cooling means, for instance water upon said cover. In this way the same result is accomplished as with the metallic shell of the impression cylinder 1, namely that the drying effect is limited to the surface of the treated sheet. By these means the gaseous oils of the printed color are removed; as the heat transmission from the printed side of the sheet to the cold face supporting it is much larger than the heat supplied by way of the warm air, an undesirable drying of the paper need not be feared.

The sheet, completely printed and dried on its surface, is then blown through pipes 14, conveying cooling air, against the delivery table until another sheet arrives. By these means the sheet returns to its initial state of dryness.

In the embodiment of the invention illustrated the cooling arrangements 7 and 14 receive their cold air by way of a cooling apparatus 17 from a pipe 18, moistened air being added through a feed line 19 by means of the spray 26. In the same way, by means of pipes 15 and 16, connected with the cold air line 27 and provided with suitable delivery nozzles 28 and 29, the sheet between the printing cylinders is blown against the impression cylinder 1. The warm air pipe 5' receives its air from the blower 30, and the cold air pipe 27 its cold air from the blower 31, a throttling device 32 in the pipe 19 for moist air permitting the regulation of the addition of moist air to the cold air. The cooling apparatus 17 receives its cooling liquid, such as cooling water, by way of pipe 33.

I claim:

1. In a multi-color sheet intaglio printing machine, in combination, an impression cylinder, printing cylinders, movable towards the

impression cylinder and away from it, means adapted to convey different printing colors to the printing cylinders, boxes arranged around the impression cylinder and subdivided in the direction of the shaft of the impression cylinder, means for supplying the several boxes with compressed air, means for regulating the compressed air supply of the several boxes, said boxes constructed with discharge nozzles on the sides facing the impression cylinder, heating arrangements for heating the air discharge by the individual boxes, and means for changing the degree of heating of such air.

2. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool.

3. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated dried air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool.

4. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool, and directing a stream of cold air upon the printed surface of said sheet before applying the next color thereon.

5. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool, and directing a stream of cold moist air upon the printed surface of said sheet before applying the next color thereon.

6. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool, directing a stream of cold air upon the printed surface of said sheet before applying the next color thereon, and blowing heated air against the printed surface of the sheet after the application of the last color, while simultaneously holding the rear face of the sheet against a cool surface.

7. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of

heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool, directing a stream of cold air upon the printed surface of said sheet before applying the next color thereon, blowing heated air against the printed surface of the sheet after the application of the last color, while simultaneously holding the rear face of the sheet against a cool surface, depositing the completely printed sheet and directing a stream of cold air thereupon.

8. The improvement in the art of drying printed sheets in multi-color intaglio printing, which comprises directing a stream of heated air upon the printed surface of a sheet while simultaneously holding the rear face of such sheet against a cooled surface to keep the body of such sheet cool, directing a stream of cold air upon the printed surface of said sheet before applying the next color thereon, blowing heated air against the printed surface of the sheet after the application of the last color, while simultaneously holding the rear face of the sheet against a cool surface, depositing the completely printed sheet and directing a stream of cold moist air thereupon.

9. In a multi-color intaglio printing machine, in combination, an impression cylinder, a plurality of printing cylinders movable toward and away from the impression cylinder, means for cooling the surface upon which a sheet to be printed rests, and means for directing a stream of heated air upon the printed surface of such sheet.

10. The combination as set forth in claim 9, including means for drying said heated air.

11. In a multi-color intaglio printing machine, in combination, an impression cylinder, a plurality of printing cylinders movable toward and away from the impression cylinder, means for cooling the surface upon which a sheet to be printed rests, means for directing a stream of heated air upon the printed surface of such sheet, and means for directing a stream of cold air upon a printed sheet prior to the application of the next color.

12. The combination as set forth in claim 11, including means for moistening the stream of cold air.

13. In a multi-color intaglio printing machine, in combination, an impression cylinder, a plurality of printing cylinders movable toward and away from the impression cylinder, means for cooling the surface upon which a sheet to be printed rests, means for directing a stream of heated air upon the printed surface of such sheet, gripping mechanism arranged to strip the printed sheet from the impression cylinder and including a plurality of gripping arms, a cover concentric with the path of movement of said

gripping arms, conduits arranged between said arms, means for feeding heated air to said conduits, nozzles at the outlet ends of said conduits for discharging the heated air against the printed surface of the sheet, and means for cooling said cover.

14. In a multi-color intaglio printing machine, in combination, an impression cylinder, a plurality of printing cylinders movable toward and away from the impression cylinder, means for cooling the surface upon which a sheet to be printed rests, means for directing a stream of heated air upon the printed surface of such sheet, gripping mechanism arranged to strip the printed sheet from the impression cylinder and including a plurality of gripping arms, a cover concentric with the path of movement of said gripping arms, conduits arranged between said arms, means for feeding heated air to said conduits, nozzles at the outlet ends of said conduits for discharging the heated air against the printed surface of the sheet, means for cooling said cover, a delivery table, conduits arranged above said table, means for conducting cold air to said conduits, and nozzles at the outlet ends of said conduits for directing such cold air against a freshly deposited sheet.

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