Feb. 10, 1953 J. R. GILLIS 2,627,667

METHOD AND APPARATUS FOR DRYING INKS

Filed Oct. 7, 1946 2 SHEETS—SHEET 1

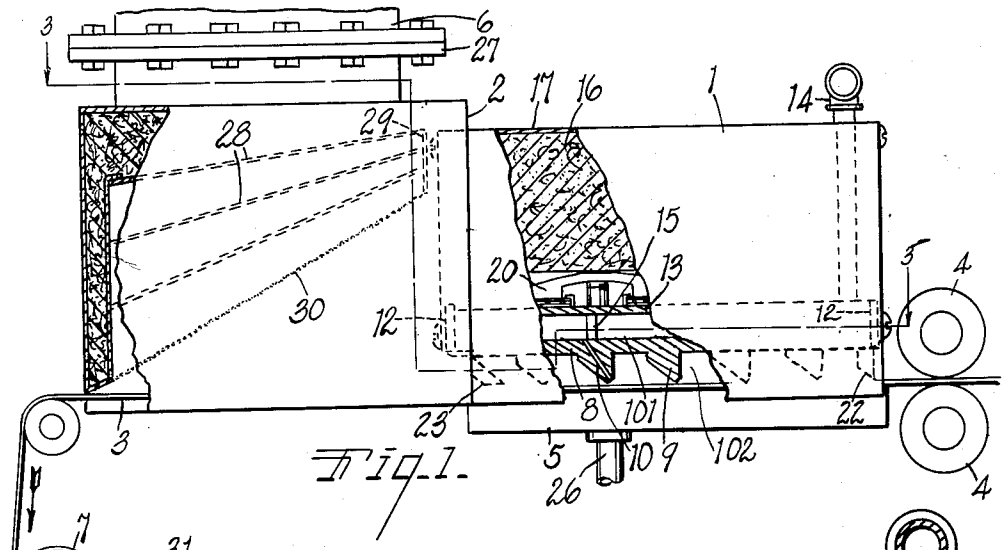


Fig. 1.

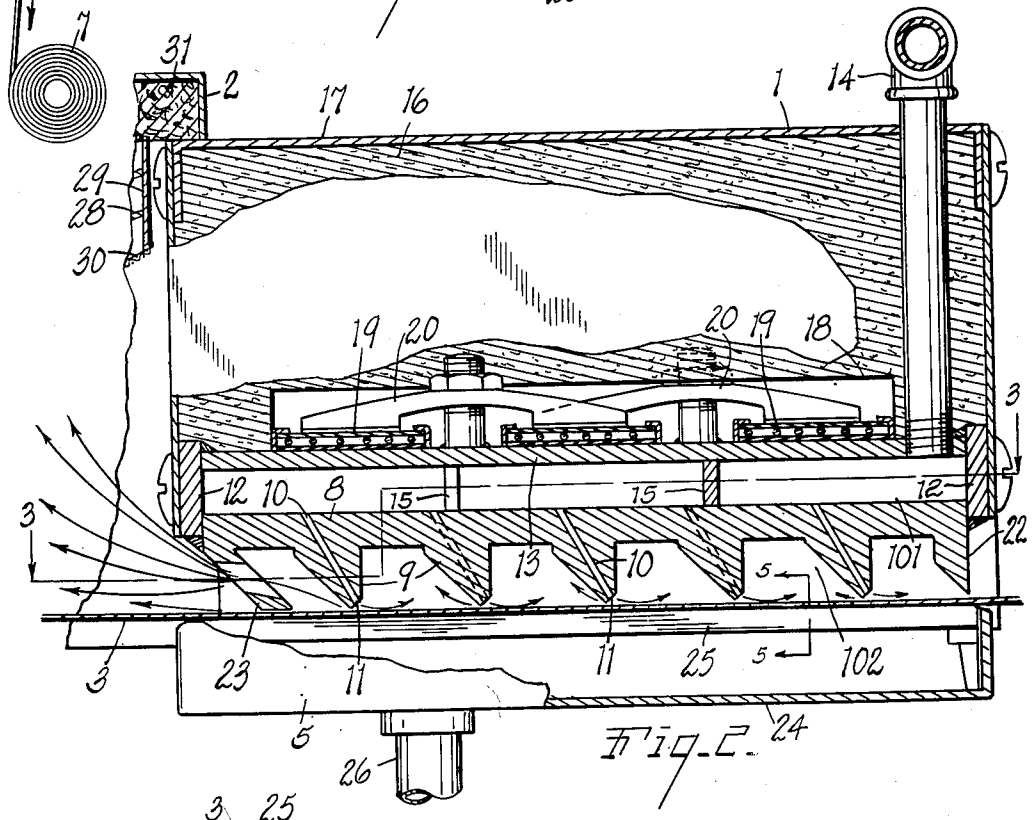


Fig. 2.

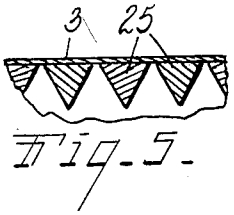


Fig. 5.

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METHOD AND APPARATUS FOR DRYING INKS

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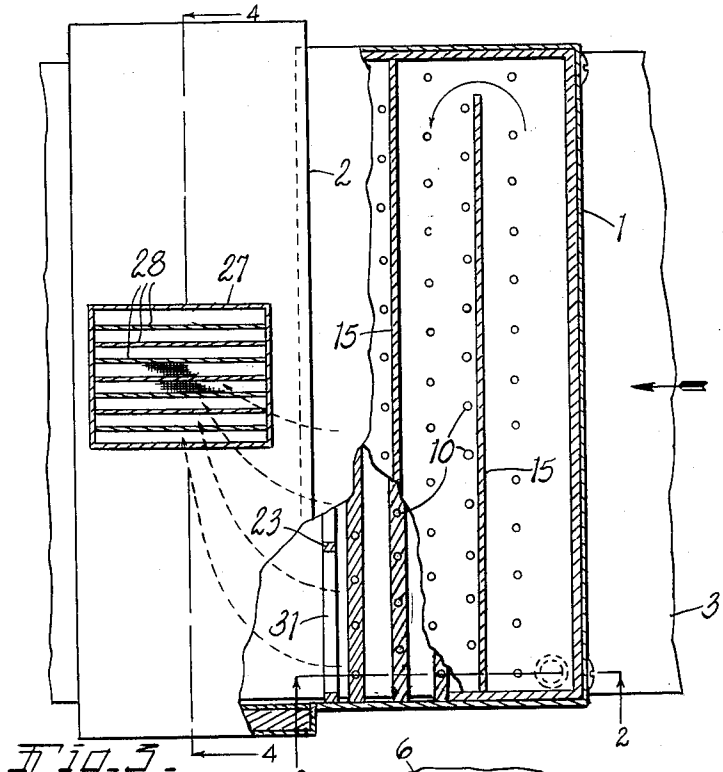


Fig. 3.

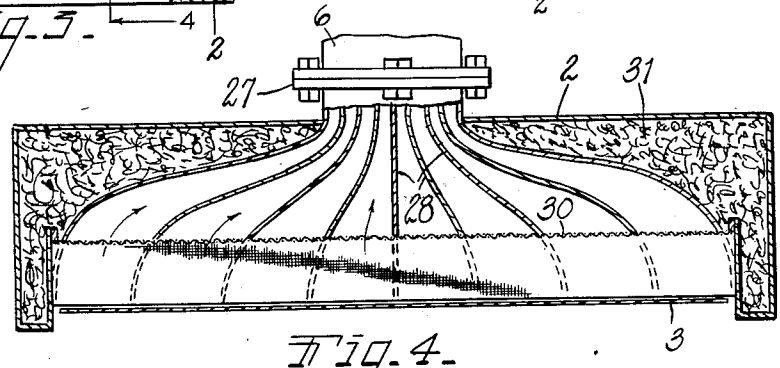


Fig. 4.

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METHOD AND APPARATUS FOR DRYING INKS

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18 Claims. (Cl. 34—23)

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This invention relates to improvements in methods and apparatus for drying inks.

The principal objects of this invention are:

First, to provide a method for effectively and quickly drying the ink as it comes from the printing machine or press.

Second, to provide novel mechanism for effectively drying the ink on printed matter as it comes from a printing press without smearing the ink or damaging the web.

Tihrd, to provide apparatus for drying the ink on printed matter which eliminates the fire hazard present in the use of inks with volatile solvents.

Fourth, to provide a method for drying the ink of printed matter which permits the use of high speed printing on a continuous web of paper.

Other objects and advantages of this invention will be apparent from the description to follow. The invention is further pointed out in the claims.

The drawings, of which there are two sheets, illustrate a preferred form of my invention.

Fig. 1 is a side elevational view partially broken away of my drying apparatus in operative position relative to the web of a printing press, parts of the press being shown in schematic outline only.

Fig. 2 is a fragmentary vertical cross-sectional view along the plane 2—2 in Fig. 3.

Fig. 3 is a plan view partially broken away along the plane 3—3 in Figs. 1 and 2.

Fig. 4 is a transverse vertical cross-sectional view along the plane 4—4 in Fig. 3.

Fig. 5 is a fragmentary cross-sectional view along the plane 5—5 in Fig. 2.

There have been numerous systems devised for the purpose of quick drying inks after the printing operation. In quick drying by evaporation of an ink solvent it has been the practice to use the heat of either burning gas jets or heated air blown on the traveling web of papers. These methods have many drawbacks, such as the danger of fire, removal of moisture from the paper which destroys its mechanical strength and the inability to furnish enough heated air to allow the paper to run at high speeds.

My process consists of discharging superheated steam directly against the web from jets located close to the web and to exhaust or draw off this steam and the solvent vapors driven off by or combined therewith before the steam has a chance to condense and wet or spot the paper. The subjecting of the paper to steam under pressure and the application of exhaust suction

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thereto makes it highly desirable to provide means for holding the paper so that it will not flutter while being treated and contact the steam jets or other parts on the printed side of the paper and so that the evacuation of the steam will be complete.

The embodiment of my invention illustrated consists generally of a steam chamber 1 and a suction or exhaust header 2 positioned above and closely adjacent to the web of paper or other material treated, the apparatus being shown in association with a printing press conventionally indicated at 4. The suction chamber 5 is disposed below the steam chamber and is provided with a foraminate platen or face across which the web is translated while it is subject to the steam. The web is illustrated as being wound into a roll 7 after treatment but it may be directed to any desired type of folding and cutting mechanism.

The steam chamber 1 has a relatively narrow steam space 101, this steam space comprising a bottom or nozzle plate 8 having a plurality of transversely disposed rib-like nozzles 9 defining a series of forwardly directed jet passages 10 opening to the inclined tips 11 of the nozzles. The bottom or nozzle plate has the side plates 12 welded thereto and to the top plate or wall 13 to provide the steam chamber or header for the nozzles. The steam supply pipe 14 is connected to deliver to the forward end of the chamber. Baffle plates 15 are positioned between the top and bottom plates to provide a series of zigzag connected nozzle headers within the chamber.

The top plate is provided with an insulating material 16 retained by the suitable covering panel 17, the insulating material defining a recess 18 on its lower side within which are positioned a series of electrical heating units 19 clamped upon the top plate 13 by a means of the clamps 20 so that the heating units are in an effective heat-transfer relation to the tops of nozzle headers of the steam chamber. The side plates 12 extend downwardly and enclose the ends of the nozzles and desirably terminate somewhat below the web 3. This provides a nozzle chamber, the web extending against, or constituting a closure, one side of the chamber. It also provides a series of steam pockets 102 between the nozzles, the only communication by these pockets being the spaces between the ends of the nozzles and the web.

The front bar 22 depends from the front end of the bottom member 8 and constitutes a wall for the front end of the nozzle chamber. The rear bar or wall member 23 depends from the

rear end of the wall member 8 and is provided with exhaust openings 31. It will be noted that the nozzles and the wall members 22 and 23 terminate close to the surface of the web with only such clearance as is practical without actually having the surface of the web contact with these parts. This clearance is desirably between .0012 and .008 inch.

The suction chamber 5 is in the form of a box-like header 24 having a series of V sectioned bars 25 (see Fig. 5) disposed longitudinally thereof to provide a grid-like supporting surface across which the web is translated while subject to such suction as to prevent vibration or fluttering of the web which would cause it to contact the nozzles or the walls of the nozzle chamber. These bars 25 diverging downwardly prevent clogging of the slots by lint or fiber drawn from the web as it travels over the platen. The suction or vacuum pipe is shown at 26.

The suction header 2 is positioned at the rear of the steam chamber and nozzle chamber to exhaust the steam and any solvent that may be picked up by the steam and carry it away preventing any condensation thereof such as might dampen or spot the web. The suction or exhaust header extends completely across the web. The upper or top wall of the exhaust header defines a flange outlet 27 for the attachment of the exhaust or suction pipe 6. A series of baffle or nozzle plates 28 are arranged within the suction header extending longitudinally across the same and converging upwardly to communicate with the conduit 6 which distributes the exhaust or exhaust effect of the suction header across the web. The lower edges of the plates 28 slope upwardly from a point at the rear of the suction box and closely adjacent to the web 3 to a vertical panel 29 near the front of the suction box or header. A fine mesh screen 30 slopes upwardly and forwardly against the lower edges of these plates to further equalize or distribute the draft or suction effect within the suction header.

In operation of my apparatus, superheated steam is supplied through the pipe 14 to the steam chamber. The heating units 19 are provided and arranged to maintain the steam in its superheated condition as it is distributed through the several nozzle headers to the nozzles. I have found that a pressure of between 40 and 50 pounds is desirable for the entering steam. The web is translated below the nozzle across the supporting platen by the suction in the suction box thereby preventing fluttering or vibration of the web. The superheated steam is directed and discharged directly upon the printed surface of the web, desirably in a forwardly directed path opposite to the direction of travel of the web.

The parts constituting the walls of the steam pockets between these nozzles are heated by the steam so that condensation of the steam is prevented in these pockets and the steam in the pockets constitute additional drying means for the web; that is, means in addition to the direct impact of the jets.

The tendency of the steam to move forwardly below the wall 22 is effectively counteracted by movement of the web and the exhaust suction of the exhaust header so that the steam together with the volatile components of the ink which may be driven off by the heat are drawn rearwardly between the lower edges of the nozzles and the web and exhausted by the exhaust header. The exhaust header is as stated designed to insure a substantially uniform exhaust vacuum transversely across the web. This not only results in effective exhausting of the steam but it prevents excessive pull on the web by drawing one portion of it away from the platen which might result in its being brought into contact with some stationary part other than the platen. The exhaust header is desirably provided with insulating covering 31 and if operating conditions are such as to be likely to result in condensation in the exhaust header, I contemplate employing heating elements within the header as it is important that there shall be no condensation as will moisten the web or result in spots thereon.

At the same time the ink is dried without any substantial change in the moisture content of the web. The web may be translated at high speed with complete and effective drying of the print material.

I have illustrated and described my invention in a highly practical embodiment thereof. Certain of the parts are shown more or less conventionally and no regard has been made to the proportions of the parts. However, it is believed that this disclosure will enable those skilled in the art to embody or adapt my invention as may be desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an apparatus of the class described, the combination of walls forming a vacuum chamber provided with a grid face constituting a platen across which a printed web of paper may be translated, means for maintaining a vacuum in said vacuum chamber, other walls forming a chamber for superheated steam disposed above the platen and provided with a plurality of downwardly projecting rib-like nozzle members disposed transversely of and spaced longitudinally of the platen and terminating closely adjacent thereto but in clearing relation to a web of paper translated thereon, said nozzle members each having a plurality of jet passages delivering closely adjacent the web, the nozzle members defining a plurality of elongated steam pockets therebetween extending transversely of the web and open to the surface thereof, the only communication between the pockets being the spaces between the web and the ends of the nozzles, means for supplying steam to one end of said steam chamber, a series of baffles arranged in said steam chamber to provide zig-zag connected nozzle headers for said nozzle passages, heating elements operatively associated with said nozzle headers, and an exhaust header disposed above the web at the rear of the nozzles with respect to the path of travel of the web and opening closely adjacent to the surface of the web, said exhaust header having a series of baffles extending transversely of the path of the web and providing a series of passages communicating with a common exhaust.

2. In an apparatus of the class described, the combination of walls forming a vacuum chamber provided with a grid face constituting a platen across which a printed web of paper may be translated, means for maintaining a vacuum in said vacuum chamber, other walls forming a chamber for superheated steam disposed in facing relationship to the platen and provided with a plurality of projecting rib-like nozzle members disposed transversely of and spaced longitudinally of the platen and terminating closely adjacent thereto but in clearing relation to a web of paper trans-

lated thereon, said nozzle members each having a plurality of jet passages delivering closely adjacent the web, the nozzle members defining a plurality of elongated steam pockets therebetween extending transversely of the web and open to the surface thereof, the only communication between the pockets being the spaces between the web and the ends of the nozzles, means for supplying steam to said steam chamber, and an exhaust header disposed at the same side of the web as said nozzles and at the rear of the nozzles with respect to the path of travel of the web and opening closely adjacent to the surface of the web.

3. In an apparatus of the class described, the combination of walls forming a vacuum chamber provided with a foraminate face constituting a platen across which a printed web of paper may be translated and comprising a plurality of bars of V-section disposed longitudinally of the path of travel of the web and spaced to provide a longitudinally slotted grid surface subject to the vacuum of the vacuum chamber, means for maintaining a vacuum in said vacuum chamber, other walls forming a chamber for superheated steam disposed above the platen and provided with a plurality of downwardly projecting rib-like nozzle members disposed transversely of and spaced longitudinally of the platen and terminating closely adjacent thereto but in clearing relation to a web of paper translated thereon, said nozzle members each having a plurality of forwardly directed jet passages delivering closely adjacent the web, the nozzle members defining a plurality of elongated steam pockets therebetween extending transversely of the web and open to the surface thereof, an exhaust header disposed above the web at the rear of the nozzles with respect to the path of travel of the web and opening closely adjacent to the surface of the web.

4. In an apparatus of the class described, the combination of walls forming a vacuum chamber provided with a foraminate face constituting a platen across which a printed web of paper may be translated, means for maintaining a vacuum in said vacuum chamber, other walls forming a chamber for superheated steam disposed in facing relationship to the platen and provided with a plurality of projecting rib-like nozzle members disposed transversely of and spaced longitudinally of the platen and terminating closely adjacent thereto but in clearing relation to a web of paper translated thereon, the nozzle members defining a plurality of elongated steam pockets therebetween extending transversely of the web and open to the surface thereof, an exhaust header disposed at the same side of the web as said nozzles and at the rear of the nozzles with respect to the path of travel of the web and opening closely adjacent to the surface of the web.

5. In an apparatus of the class described, the combination of walls forming a vacuum chamber provided with a foraminate face constituting a platen across which a printed web of paper may be translated, means for maintaining a vacuum in said vacuum chamber, other walls forming a chamber for superheated steam disposed above the platen and provided with a plurality of downwardly projecting rib-like nozzle members disposed transversely of and spaced longitudinally of the platen and terminating closely adjacent thereto but in clearing relation to a web of paper translated thereon, the nozzle members defining a plurality of elongated steam pockets therebetween extending transversely of the web and open to the surface thereof, an exhaust header disposed above the web at the rear of the nozzles and opening closely adjacent to the surface of the web, said exhaust header having a series of baffles extending transversely of the path of the web and defining a series of passages communicating with a common exhaust conduit.

6. In an apparatus of the class described, the combination of a steam chamber provided with parallel walls and baffles arranged therein in zig-zag relation to provide a series of zig-zag connected nozzle headers, one of said walls having a plurality of transverse rib-like nozzle members on its outer side, the nozzles having a plurality of bore-like jet passages opening to the nozzle headers, a connection for supplying superheated steam to one of said nozzle headers, electric heating units associated with the other walls of said headers in heat transfer relation thereto, means for translating a web of paper closely adjacent to but out of contact with said nozzles, the web of paper coacting with said nozzles to define steam pockets between the nozzles communicating only through the spaces between the ends of the nozzles and the web of paper, and a suction exhaust header disposed at the rear of the nozzles with respect to the path of travel of the web.

7. In an apparatus of the class described, the combination of a steam chamber provided with parallel walls and baffles arranged therein in zig-zag relation to provide a series of zig-zag connected nozzle headers, the bottom wall having a plurality of transverse rib-like nozzle members on its outer side, the nozzles having a plurality of bore-like jet passages opening to the nozzle headers, a connection for supplying superheated steam to one of said nozzle headers, electric heating units associated with the other walls of said headers in heat transfer relation thereto, means for translating a web of paper closely adjacent to but out of contact with said nozzles, the web of paper coacting with said nozzles to provide steam pockets between the nozzles communicating only through the spaces between the ends of the nozzles and the web of paper.

8. In an apparatus of the class described, the combination of means for supporting and translating a web of freshly printed paper, a chamber for superheated steam, a wall of which is provided with a plurality of nozzle passages terminating closely adjacent to the translated web but in clearing relation thereto, means for supplying steam to said steam chamber, a series of baffles arranged in said steam chamber to provide zig-zag connected nozzle headers for said nozzle passages, and heating elements operatively associated with said nozzle headers to maintain the steam in superheated condition as it is delivered to said nozzles.

9. In an apparatus of the class described, the combination of a steam chamber provided with parallel top and bottom walls and baffles arranged therein in zig-zag relation to provide a series of zig-zag connected nozzle headers, the bottom wall having a plurality of nozzle members opening to said nozzle headers, connections for supplying superheated steam to one of said nozzle headers, heating units associated with said headers, means for translating a web of paper as closely adjacent to said nozzles as possible without contacting said nozzles, and an exhaust header disposed at the rear of the nozzles with respect to the path of travel of the web.

10. In an apparatus of the class described, the

combination of a superheated steam chamber provided with a plurality of delivery nozzles, means for translating a web of paper closely adjacent to but out of contact with said nozzles, a housing for said nozzles providing a chamber having a discharge at the rear thereof with respect to the path of travel of the web, the web of paper constituting a closure for one side of said chamber, a foraminated supporting platen across which the web of paper is translated, the platen being subject to vacuum whereby fluttering of the web passing through the nozzle chamber is minimized, and a suction exhaust header disposed at the rear of the nozzle chamber and opening closely adjacent to the web and having a series of inlets extending transversely of the path of the web and communicating with a common exhaust passage whereby a substantially uniform exhaust draft is maintained in the several exhaust header passages.

11. Drying apparatus for setting the ink of printed material on a moving web comprising a steam chamber adapted to discharge superheated steam downwardly and forwardly against said web, means depending around the bottom of said steam chamber forming a heating chamber open to said web, a platen arranged to support said web in closely spaced relationship below said heating chamber, means for applying a vacuum through said platen to the underside of said web to hold said web in a plane surface, and means forming a suction chamber on top of said web and behind said steam chamber with respect to the path of travel of said web, said suction chamber being arranged to evacuate substantially all of the steam issuing from said steam chamber along the surface of said web and against the forwardly directed movement of said steam before said steam has reached a saturated condition.

12. The method of drying printed matter on a moving web of paper which comprises the steps of supporting said web against substantially plane foraminate surfaces by means of a vacuum applied through said surfaces, directing a plurality of superheated steam jets downwardly and forwardly against the incoming printed surface of the supported portion of said web from nozzles positioned closely adjacent thereto and evacuating said steam and the volatile portions of the ink solvent through the space between said jets and in the same direction as the path of travel of the web before said steam has cooled below a superheated state.

13. The method of drying printed matter on a moving web of paper which comprises holding said web in a substantially plane position by means of a vacuum, directing a plurality of longitudinally and transversely spaced superheated steam jets closely adjacent and downwardly and forwardly against the incoming printed surface of said web and evacuating said steam and the volatile portions of the ink solvent from along the surface of said web in the same direction as the path of travel of the web before said steam has cooled below a superheated state.

14. The method of drying printed matter on a moving web of paper which comprises holding said web in a substantially fixed position normally with respect to its path of movement by means of a vacuum, directing superheated steam forwardly against the incoming printed surface of said web and evacuating said steam and the volatile portions of the ink solvent rearwardly from along the surface of said web before said steam has cooled below a superheated state.

15. In an apparatus of the class described, the combination of means for translating a web of freshly printed material and directly supporting a substantial length thereof, said means for supporting said web including a vacuum chamber with a foraminate wall across which the web is translated and adapted when subjected to vacuum to hold said web thereagainst, a chamber adapted to be supplied with superheated steam, a wall of which is provided with a plurality of rib-like nozzle members disposed transversely of and spaced longitudinally along the path of travel of the web and terminating between .0012 and .008 inches from the web where it is supported by said foraminate wall, said nozzle members each having a plurality of forwardly directed jet passages delivering through its edge adjacent the web, the nozzle members forming a plurality of elongated steam pockets extending transversely of the web and open to the surface thereof, the only communication between the pockets being the spaces between the web and the edges of the nozzles, and walls forming an exhaust chamber at the rear of said steam chamber with respect to the movement of said web and communicating with the rearmost of said pockets.

16. In an apparatus of the class described, the combination of means for translating a web of freshly printed material and directly supporting a substantial length thereof, said means for supporting said web including a vacuum chamber with a foraminate wall across which the web is translated and adapted when subjected to vacuum to hold said web thereagainst, a chamber adapted to be supplied with superheated steam and having a plurality of transverse rib-like nozzle members disposed transversely across and spaced longitudinally of the supported portion of the web, the nozzle members having a plurality of jet passages delivering from the steam chamber to the face of the web, the web of paper coacting with said nozzle members to form steam pockets between the nozzle members communicating only through the spaces between the edges of the nozzles and the web, the spaces between said nozzles and the web being between .0012 and .008 inch wide, and a suction header disposed at the rear of said steam chamber with respect to the movement of said web and communicating with the rearmost of said pockets.

17. In an apparatus of the class described, the combination of walls forming a steam chamber and provided with a plurality of nozzles distributed over one of its walls, other walls forming a housing around said one wall and nozzles and forming a drying chamber, means for translating a web of paper closely adjacent to but out of contact with said other walls and said nozzles, the web of paper constituting a substantial closure for one side of said drying chamber, a foraminate supporting platen across which the web of paper is translated and forming a backing for that portion of the web facing said drying chamber, walls forming a vacuum chamber across the back of said platen, means for creating a vacuum in said vacuum chamber whereby fluttering of the web passing across said platen and heating chamber is minimized, and other walls forming a suction header disposed where the web issues at the rear of said drying chamber and opening closely adjacent to the web.

18. Drying apparatus for setting the ink of printed material on a moving web comprising, a steam chamber having nozzles adapted to discharge superheated steam against said web, means projecting around the periphery of said steam chamber and forming a drying chamber surrounding said nozzles and open to said web, a foraminate platen arranged to support said web in closely spaced but non-touching relationship with said projecting means and nozzles along the open side of said drying chamber, means for applying a vacuum through said platen to the back surface of said web to hold said web against fluttering, and means forming a suction chamber opening to the printed side of said web behind said steam chamber with respect to the path of travel of said web.

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