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DRYING METHOD AND APPARATUS

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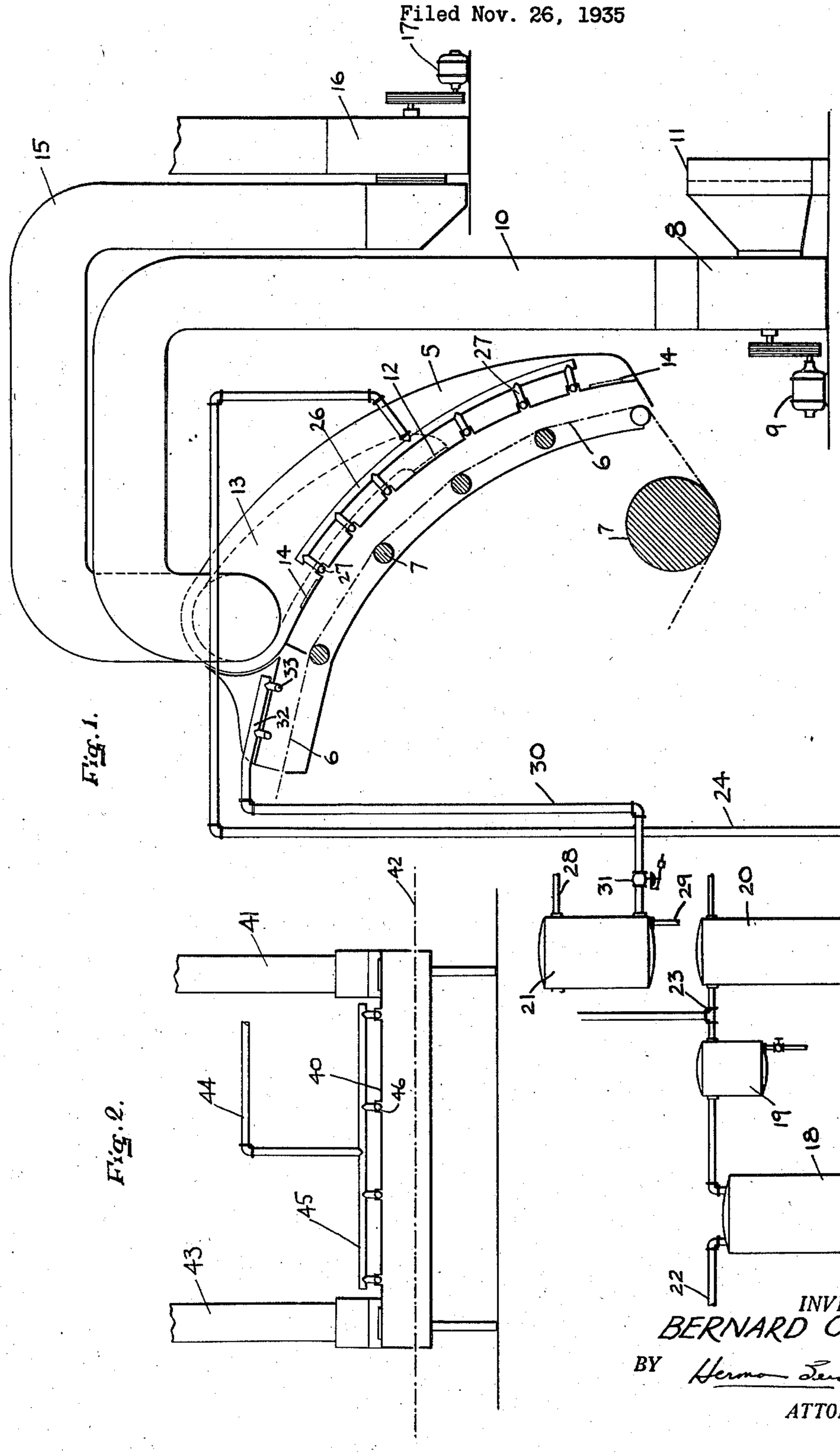

Fig. 1.

Fig. 2.

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DRYING METHOD AND APPARATUS

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3 Claims. (Cl. 34—24)

This invention relates to drying.

This application is a continuation in part of my co-pending application, Serial No. 6,453 filed February 14, 1935.

The general object of the invention is to provide an improved method of and apparatus for drying materials of various description, particularly freshly inked paper, textiles, chemicals, and the like.

It has been general practice in the drying art to dry materials by passing the materials under a hood or through a tunnel-like enclosure. To this tunnel-like enclosure is supplied air at predetermined temperatures to accomplish the required drying. The temperature of the air is varied, in accordance with the nature of the material to be dried, the speed at which the material is to be dried, and the characteristics of the material with relation to heat.

When freshly inked surfaces are passed through a tunnel-like enclosure or hood for drying, the air supplied thereto at predetermined temperatures absorbs the solvents and water vapors given off by the inked surfaces. In addition, the air acts as a medium to heat the surface to bring about a vaporization of the solvents and the water of the ink. The higher the temperature of the air supplied, the more readily will the inked surface give up its solvents.

In the drying of inked surfaces, certain ingredients of the ink are materially softened by high temperatures. This becomes objectionable beyond a certain point. For this reason, the temperature of drying air is maintained at a relatively low point, but large air volumes are used to sweep away from the surface the vapor laden air so that the vapors can readily vaporize into air not laden with solvents or water vapors.

The surface of a freshly inked web is rough and irregular, due to the little crevices and spaces in between the various inked particles on the surface. This inked paper travels at a high rate of speed, as for example, between 500 and 1500 feet a minute. At such a speed, and with the irregular printed surface, the paper in traveling along, carries a film of air along with it. This film, which blankets the paper, becomes saturated quickly with solvents or water vapors, and retards the liberation of vapors from the surface. In present-day practice, large air volumes are required to effect penetration of this film, so that the freshly-introduced and relatively vapor-free air may pick up solvents and vapor from the surface, and in order to maintain an overall low vapor content in the air. Moreover, because of the insulating effect of this film, the air supplied must be at a relatively high temperature, in order that the heat may penetrate through the film to the inked surface and cause the solvents to vaporize.

According to the present invention, applicant breaks up and disperses this film by impinging thereagainst streams of air at high pressure and at high velocity. These streams of air also disperse the small volumes of air contained between the irregularities of the surface. The dispersion of the film permits the drying air to heat the surface directly and to convey vapors from the surface, inasmuch as the drying air and the surface are thus brought into direct and intimate contact.

By breaking up this film and dispersing the air between the particles, applicant continually brings to the printed surface air that has a small content of solvents and water vapors, as well as a desired temperature to assist in liberating the solvents. In this way applicant effects more rapid liberation of the solvents, and through the dispersement of the volumes close to the inked surface, accomplishes the liberation and removal of the solvents with a smaller air volume and also with a lower air temperature. This lower temperature is important since it does not soften some of the ingredients of the ink.

Further, the turbulent action caused by the high pressure air brings the drying air more frequently in contact with the printed surface with the result that there is greater vapor absorption by the air. This brings about more rapid and more efficient drying, permits drying at lower temperatures in view of the better contact with the surface, and permits the use of smaller, more economical apparatus.

A feature of the invention resides in supplying air to material to be dried, removing the air after it has contacted the material, and impinging other air in the form of high pressure, high velocity streams against the material.

Another feature of the invention resides in supplying air to material to be dried at a first point, removing said air at a second point, moving the material to be dried relative to said points, and impinging jets of other air against the material.

Another feature of the invention resides in drying a material by impinging thereagainst air in the form of high pressure, high velocity streams.

Another feature of the invention resides in supplying a first volume of air to a surface to be dried, impinging a second volume of air against the surface in the form of high velocity high pressure streams, removing said volumes of air

after they have contacted the surface, and then impinging a third volume of air against the surface in the form of high velocity high pressure streams, the temperature of said third air volume being lower than that of the first and second air volumes. Neither, either or both of the first and second air volumes may be heated to hasten the drying of the material. When warm air is used it has a tendency in some cases to soften the ingredients of the material. By subjecting the material to the action of a cooled third volume of air, applicant chills the material, or at least the surface of the material, hardening the same, and thus preparing the material for subsequent treatment. As will be understood, the expansion of the compressed air of the third volume brings about a chilling effect which supplements that caused by the initially low temperature of the third air volume.

Other objects, features and advantages of the invention will be more apparent from the following description of the invention to be read in connection with the accompanying drawing in which:

Fig. 1 diagrammatically represents one form of applicant's invention, utilizing a drying hood; and

Fig. 2 is a diagrammatic view illustrating the application of the invention to a tunnel drying system.

Turning now to the drawing, 5 represents generally a drying hood similar to that disclosed in my co-pending application, Serial No. 6,453, filed February 14, 1935. Under the hood is passed a web of paper 6, or the like, to be dried, carried on rollers 7. Air is drawn into the system by fan 8, driven by motor 9, and is supplied to hood 5 through duct 10. If desired, the intaken air may be heated by heater 11. Inside the hood 5 air is supplied to discharge port 12 through passage 13. The air discharged from port 12 contacts the web 6, and is drawn off through exhaust ports 14, and discharge duct 15, under the influence of discharge fan 16, driven by motor 17.

18 represents a dehydrator, 19 an air cleaner, 20 an air heater, and 21 an air pre-cooler. Compressed air is supplied to dehydrator 18 through pipe 22, from any suitable source. The compressed air, dehydrated and cleaned, is divided at 23, part of the compressed air being routed through heater 20, and part of the compressed air being routed through pre-cooler 21. Compressed air from heater 20 is passed through pipe 24, equipped with a pressure regulating valve 25, to manifold 26 disposed within the hood 5. Air from manifold 26 is discharged at high velocity and at high pressure through a plurality of jets 27, directed against web 6. The high pressure, high velocity air streams break up the film of solvent laden air which forms a blanket along the surface of web 6 and thus facilitates drying of the web. Further, the high pressure air disperses the minute air volumes immediately surrounding the small particles of ink applied to the surface, and thus permits contact of the fresh air with the large exposed area offered by the small ink particles. This direct and effective contact and continual change of the air immediately in contact with the small inked particles, make for rapid and efficient drying.

The air introduced through jets 27 is passed from the hood through discharge duct 15.

Air in the cooler 21 is cooled by a cooling medium introduced through pipe 28 and removed through pipe 29. The cooled air is fed through pipe 30, preferably equipped with a suitable pressure regulating valve 31, to the manifold 32, whence it is discharged against the web 6, after the web has been subjected to the drying action of air from passage 13 and jets 27. Air is discharged from manifold 32 through jets 33 in a plurality of high pressure high velocity streams which chill the web, or rather the inked surface of the web, and thus prepare it for further treatment.

Fig. 2 illustrates the application of the invention to a drier of the tunnel type. Heated air is introduced to the tunnel 40 through supply duct 41, and after contact with material 42, to be dried, is removed through duct 43. Compressed air is supplied through pipe 44, corresponding to pipe 24 of Fig. 1, to manifold 45, whence it is discharged in the form of a plurality of high velocity high pressure streams through jets 46.

In the drying of chemicals on trays or conveyors of any form, to which applicant's invention is suited, it is customary to provide a heating means in the tunnel. In the drying of textiles it is usually necessary to provide a hot plate over which the material passes. Applicant's invention supplements these and similar arrangements, and does not conflict with them in any respect.

If desired, drying may be affected solely by the high pressure high velocity air streams and heating.

Since many modifications may be made in the invention without departing from the scope thereof, it is intended that the foregoing description and accompanying drawing be regarded as illustrative only, applicant limiting himself only as indicated in the appended claims.

I claim:

1. A method of drying a printed surface of a web consisting in passing the web through a confining hood, discharging a main volume of air within the hood in a condition capable of effecting drying of a freshly printed surface, discharging a secondary smaller volume of air within the hood at a velocity much greater than that of the velocity of discharge of the main volume, the secondary volume being directed at the web to break up film forming at the printed surface.

2. A method of drying a printed web consisting in passing the web through a confining hood, discharging a main volume of air within the hood for drying the web, simultaneously discharging a second volume of air within the hood at a velocity considerably higher than the discharge velocity of said main volume of air in the form of small streams of air impinging forcefully against the web, and relieving air from the hood.

3. The method of drying a web which consists in passing the web through a confined space, admitting within said space air in a condition capable of effecting drying of the web and passing such air adjacent said web, withdrawing said air from the vicinity of the web and from said space after it has passed adjacent said web and exerted a drying action thereon, and discharging a secondary smaller volume of air within said space at a velocity much greater than that at which said first mentioned air is passed adjacent the web, the secondary air volume being directed at and impinged against the web to prevent the formation of film at the web surface or to break up such film if formed.

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