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METHOD AND APPARATUS FOR REMOVING LIQUIDS FROM GLASS PLATES

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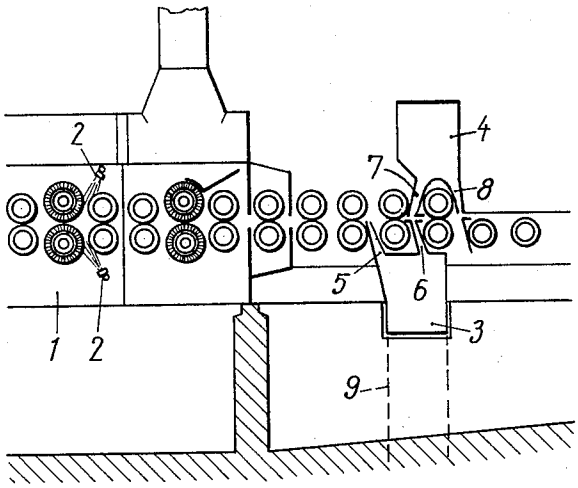
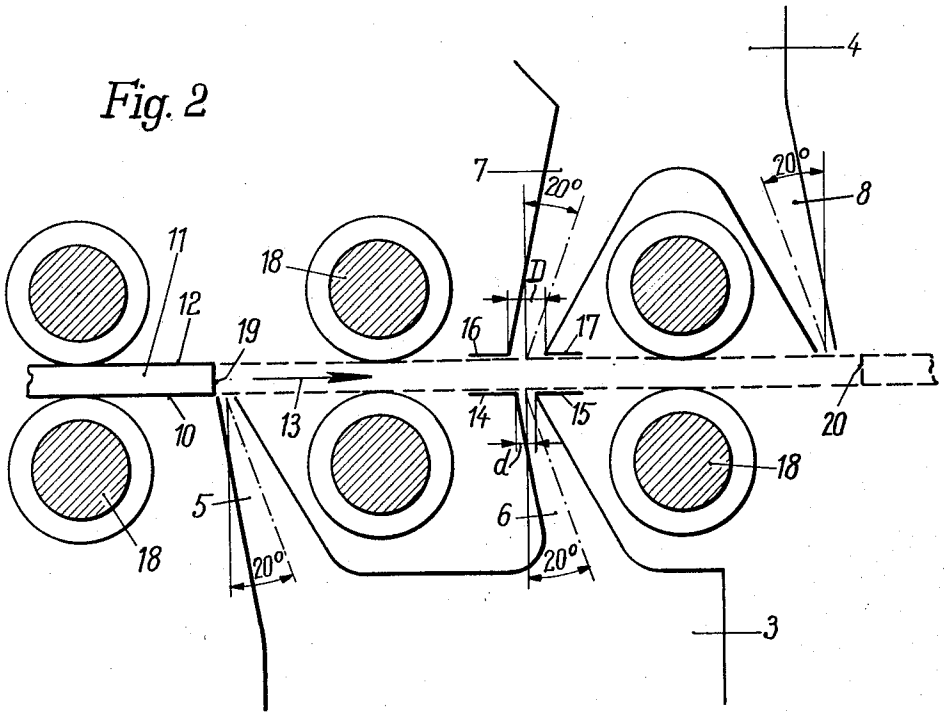


Fig. 1

Fig. 2



INVENTOR

EBERHARD BREYER

BY Dicke and Craig

ATTORNEYS.

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METHOD AND APPARATUS FOR REMOVING LIQUIDS FROM GLASS PLATES

Eberhard Breyer, Gartringen, Germany, assignor, by mesne assignments, to Firma Beka Lufttechnik G.m. b.H., Bielefeld, Germany, a company of Germany

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The present invention relates to a new method and apparatus for removing liquids, and particularly water, from non-hygroscopic products and sheet material, particularly glass plates, which have a substantially level surface and limited length.

It is an object of the present invention to provide a simple and inexpensive method and apparatus for drying such products after they have been washed or treated with a liquid, and for carrying out such drying process very quickly and effectively.

Essentially, this new method consists in blowing off the liquid adhering to the surface of the products to be dried by means of one or more air currents which may be of room or increased temperature and have a force stronger than the adhesive power of the liquid at the surface of the products. Thus, the air current or currents used for blowing off the liquid should have a high velocity of at least 15 m./sec. and preferably one of about 70 to 120 m./sec.

The apparatus for carrying out the method according to the invention may consist, for example, of at least two feed rollers for feeding the glass plates, each of which is mounted in or surrounded by the nozzle mouth of a blast-pressure tank from which at least one nozzle is directed toward the plane of travel of the glass plates or other sheet material for thus blowing a gas or air current directly against the plates. If only one nozzle is provided at one side of the plane of travel of the plates, such nozzle is preferably mounted in a direction vertical to the plane of travel. If, however, several nozzles are provided on one blast-pressure tank, they are preferably mounted so that at least one of them blows the gas or air current at an oblique angle against the sheet material to be dried, preferably at an angle of about 10 to 30° relative to a plane vertical to the plane of travel of the material.

In one preferred embodiment of the invention, two pairs of feed rollers are mounted at opposite sides of the plane of travel of the plates to be dried, and at a small distance from each other. The feed rollers are mounted symmetrically relative to the sheet material and each pair is surrounded by a blast-pressure tank from which a nozzle is directed upon the material either in front of or behind the feed rollers. Both the upper and lower blast-pressure tanks together are connected to a single high-pressure fan or blower through a channel in which a baffle is preferably provided for regulating the distribution of air to the upper and lower blast-pressure tanks and the nozzles thereof.

A further modification of the apparatus according to the invention, particularly for the purpose of blowing the liquid off the front and rear edges of the sheet material consists in providing the pairs of nozzles at the upper and lower sides of the material at an offset relation to each other so that, as seen in the direction of travel, the first nozzle for blowing the liquid off the upper side of the material is disposed above the second nozzle for blowing the liquid off the lower side.

Particularly for washing apparatus which are provided with a drying apparatus according to the invention, the latter proposes that the first nozzle be mounted at the lower side of the plane of travel for blowing the washing fluid from the front edge of the material, and the second nozzle at the upper side for blowing the washing fluid off the rear edge of the material, and in such a manner that the air currents from either nozzle will not be affected by any opposed air currents.

According to another embodiment of the invention, the nozzles for blowing the washing fluid off the lower side of the material are preferably disposed at an angle of about 20° from the vertical in a direction opposite to the direction of travel. The first nozzle for blowing the washing fluid off the upper side of the material may likewise be inclined at an angle of about 20° to the vertical opposite to the direction of travel of the material.

The second nozzle for blowing the washing fluid off the upper side of the material may preferably also be inclined at an angle of about 20° to the vertical, but in the direction of travel so as to be most effective upon the washing fluid at the rear edge of the material.

Still another feature of the invention consists in providing the first nozzle for blowing the washing fluid off the upper side of the material with a nozzle opening of a width twice as large as that of the other nozzles so that this nozzle alone will blow the same quantity of air as is blown through both nozzles at the lower side.

Furthermore, the nozzles at each side of the plane of travel of the sheet material to be dried are preferably spaced from each other at a distance corresponding to approximately twice the diameter of the feed rollers.

As will appear from the drawings referred to hereinafter, the termination or discharge apertures of the nozzles are positioned in close spaced relationship to the surface of the plates passing through the liquid-removing apparatus.

Further objects, features, and advantages of the present invention will be apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings of one preferred embodiment of the invention, in which—

Fig. 1 diagrammatically shows the new drying apparatus in connection with a washing apparatus, while

Fig. 2 shows an enlarged detail view of the nozzle arrangement of the new apparatus.

Referring to the drawings, Fig. 1 shows a washing apparatus 1 in which glass plates are sprayed with water or other washing fluid by nozzles 2. At the end of washing apparatus 1, the new drying apparatus is mounted for removing all the water or fluid from the glass plates which still adheres thereto from the washing operation. This apparatus essentially consists of a pair of opposite air-blast tanks 3 and 4 which terminate in nozzles 5, 6 and 7, 8, respectively, and are supplied with compressed air through a channel 9 from a suitable blower, not shown.

As shown particularly in Fig. 2, air-blast tank 3 with nozzles 5 and 6 is mounted at the lower side 10 of the plane of travel of glass plate 11 for blowing the water or washing fluid therefrom, while air-blast tank 4 with nozzles 7 and 8 is mounted at the upper side 12 of glass plate 11 for blowing the water or washing fluid off that side. The second nozzle 6 of air-blast tank 3 is disposed directly opposite to the first nozzle 7 of air-blast tank 4, and both nozzles 5 and 6 at the lower side are inclined at an angle of approximately 20° to the vertical in a direction opposite to the direction of travel 13 of glass plate 11. Nozzle 7 at the other side is similarly inclined, while nozzle 8 is inclined at an angle of approximately 20° in the opposite direction, that is, in the direction of travel. While nozzles 5, 6 and 8 have substantially the same width d, nozzle 7 is preferably made twice as wide, as

shown at D. The ends of nozzles 6 and 7 are preferably provided with guide plates 14, 15, and 16, 17, respectively, extending horizontally in the opposite directions to each other, that is, parallel to glass plate 11.

If the glass plates to be dried are of sufficient weight, the feed rollers need only be provided at the lower side thereof, as shown in Fig. 1, so that the feeding is then carried out by the gravity of the plates and the friction of the rotating feed rollers on the lower surface of the plates. However, as shown in Fig. 2, the feed rollers are preferably disposed in pairs vertically above each other so as to exert the proper feeding pressure from opposite sides upon glass plate 11. According to the invention, the air-blast tanks 3 and 4 are of bifurcated shape, the two arms thereof forming the nozzles 5, 6 and 7, 8, respectively, while the space intermediate the nozzles on each side thereof is utilized for mounting the rollers 18. These rollers are preferably mounted on air-blast tanks 3 and 4 or vice-versa, so as to serve as guides for insuring that nozzles 5, 6 and 7, 8, respectively, will always be disposed at the proper distance from glass plates 11.

In the operation of the apparatus, when glass plate 11 is fed between feed rollers 18 toward the right, as seen by arrow 13, the air current discharged from nozzle 5 blows the washing fluid off the front edge 19 of glass plate 11. As the glass plate 11 further proceeds, the same nozzle 5, and subsequently nozzle 6 as well, blows the air against the lower side 10 of glass plate 11, while the double amount of air is blown by nozzle 7 upon the upper side 12 of glass plate 11 to blow the washing fluid therefrom. After passing nozzles 5, 6, and 7, any water adhering to the rear edge 20 of glass plate 11 will finally be blown off by nozzle 8.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An apparatus for removing a liquid from non-hygroscopic plates comprising a plurality of feed rollers arranged in pairs vertically opposite to each other and adapted to engage the upper and lower sides of a plate to be dried for moving the same in one direction of travel, at least two nozzles at both lateral sides of at least one upper and lower feed roller, one of said upper and lower nozzles being disposed substantially vertically to each other and directed at an oblique angle opposite to said direction of travel, the other lower nozzle being directed similar to said first two nozzles but spaced from and disposed in front of the first lower nozzle, while the other upper nozzle is directed at an oblique angle to and in the direction of travel and disposed behind the first upper nozzle, and means for blowing air currents through said nozzles upon said plate.

2. An apparatus as defined in claim 1, in which said lower nozzles are directed at an angle of about 20° to the vertical in the direction opposite to the direction of travel.

3. An apparatus as defined in claim 1, in which the first upper nozzle is disposed at an angle of about 20° to the vertical in the direction opposite to the direction of travel.

4. An apparatus as defined in claim 1, in which the second upper nozzle is disposed at an angle of about 20° to the vertical in the direction of travel.

5. An apparatus as defined in claim 1, in which the discharge opening of the first upper nozzle has a width substantially twice as large as that of the discharge openings of the other nozzles so as to allow the passage of substantially twice the amount of compressed air as said other nozzles.

6. An apparatus for removing a liquid from non-hygroscopic plates comprising conveying means for moving said plates in one direction of travel in a substantiially horizontal plane, at least one pair of nozzles at opposite sides of the plane of travel of each plate and directed at an oblique angle of approximately 70° therewith and opposite to said direction of travel for progressively blowing air currents through said nozzles upon the front edge, the upper and lower surfaces, and the rear edge of said plate, and one further nozzle beyond said first-mentioned nozzles in said direction of travel arranged above the plane of travel and directed at an oblique angle with respect thereto and in said direction of travel for blowing liquid from the trailing edge of said plate, said nozzles terminating with their discharge apertures in close spaced relationship to the surface of the plates from which liquid is to be removed, and means communicating with said nozzles for forcing air therethrough at a high velocity for blowing the liquid from the surfaces of said plates.

7. An apparatus for removing a liquid from plate-shaped non-hygroscopic material comprising a pair of nozzles facing each other, one of said nozzles being above and the other below a path of travel of said material, said nozzles being inclined and opposite to the direction of travel for directing air upon said material to blow liquid from the surface thereof, a third nozzle arranged in front of said pair of nozzles below the path of material travel and oriented to blow air obliquely upwardly and in the direction counter to material travel, and a fourth nozzle above the path of material and beyond said pair of nozzles in the direction of material travel, said last-mentioned nozzle being oriented to blow obliquely downwardly and in the direction of material travel to remove liquid adhering to the rear edge of the material, said nozzles terminating with their discharge apertures in close spaced relationship to the surface of the plate-shaped material from which liquid is to be removed, and means communicating with said nozzles for forcing air therethrough at a high velocity for blowing the liquid from the surfaces of said plate-shaped material.

8. An apparatus according to claim 7 wherein the nozzle of said pair of nozzles which is located above the path of the material and is inclined in the direction opposite to that of material travel has a discharge area twice as large as the discharge area of the nozzles arranged below the path of the material.

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