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3,073,038

DRYING DRUM

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FIG. 1

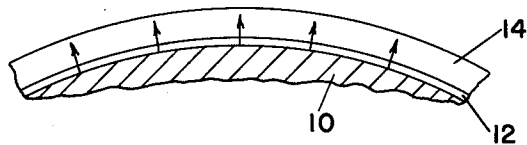


FIG. 2

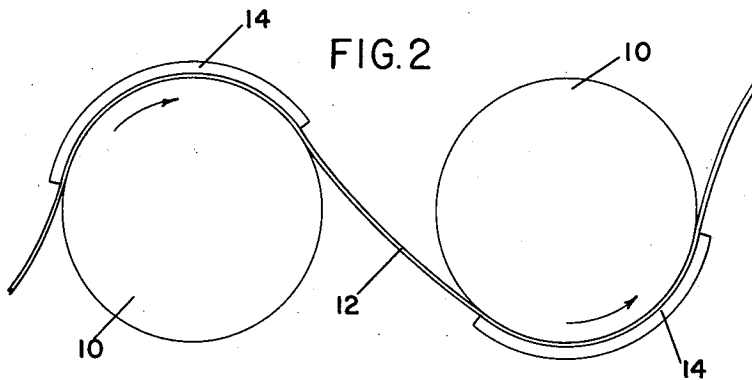


FIG. 3

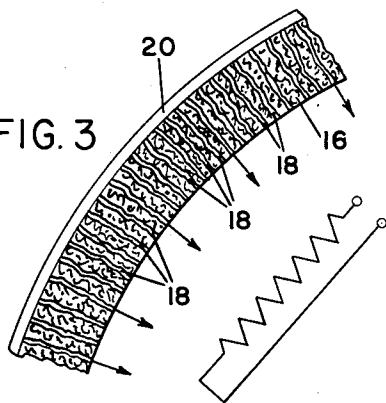
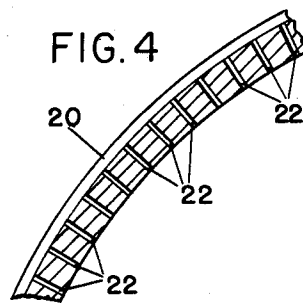


FIG. 4



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3,073,038

DRYING DRUM

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This invention relates to a new and improved method and apparatus for drying materials in general and particularly materials in the form of webs which may be dried to some extent in a preliminary manner but which are finally more or less completely dried by the application of heat thereto. The invention also contemplates drying of chemicals or other materials which may be powdered, granulated or comminuted.

One of the principal objects of the invention resides in the provision of a novel apparatus and method for drying which decreases greatly the interval of time necessary for the drying steps and which also reduces the amount of apparatus utilized for such purposes; and one illustration in this regard relates to the paper-making industry wherein a web of paper pulp is fed to a thermal section for drying and includes heated cylinders over which the web passes, usually with a felt on the paper holding the same to the surface of the cylinder over which the paper is passing at the particular moment.

The present invention also resides in the provision of a foraminous or porous member having a surface over which the web is adapted to be traveled, this member being provided at the side opposite the web with a source of dry heat obtained in any way, so that the heat is imparted to the web through the member whereby vapor pressure is produced by the impingement of the heat on the web and between the surface of the heated member and the web. The vapor is forced to move inwardly away from the web through the foraminous or porous member, toward the source of heat where the humidity is kept as low as possible so that a large amount of moist air or vapor is accepted, thus drying the web very quickly, particularly as compared with the prior art thermal drying apparatus. In the prior art, the apparatus provides for heating one side of the web by means of an opaque or solid cylinder and driving the vapor directly but only partially through the web and then passing the web over on another roll and heating the opposite side of the web. Thus the vapor in the prior art is driven away from the surface of the roll toward the center of the web, alternately from different sides thereof, increasing the length of time required for thermal drying, as opposed to the much faster operation of the present invention which provides for the moisture, i.e., vapor, to be extracted from the web at the heated side rather than being pushed through the web from the heated to the cooler side.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

FIG. 1 and FIG. 2 are diagrammatic views illustrating the prior art;

FIG. 3 is a diagrammatic view illustrating the present invention; and

FIG. 4 is a sectional view illustrating a modification of the present invention.

In the prior art as shown in FIG. 1, an opaque or solid cylinder or roll 10 is heated with steam and over the surface thereof there is passed the web 12 which may be for instance of paper. Over the paper there is usually provided a felt belt or the like 14 which is adapted to press the web into intimate contact with the heated surface of the roll.

The arrows show the direction of the vapor which of

course cannot pass through the solid surface of the steam-heated roll but instead tends to be forced outwardly in the direction of the arrows into the felt. The surface of the web next to the cylinder tends to dry but the moisture is forced into the remainder of the thickness of the web.

It is to be understood that this action is repeated time after time through a stack of cylinders but in passing from one cylinder to another, the heat is applied to the opposite sides of the web. Therefore looking at FIG. 1 it will be seen that the vapor is driven from the surface of the roll through the paper toward the felt, but one pass of the web over the roll is not sufficient to drive much of the moisture into the felt, or into the atmosphere if the felt is not present, and when the next roll is applied to the opposite surface of the paper, the action is to drive the vapor in the opposite direction back into the web. Obviously this results in a lengthy period of time required to extract the moisture from the paper web.

On the other hand, in the present invention there is provided a cylindrical or other shaped member which is foraminous or porous. The openings passing through the member may be relatively small but there should be provided a great number of small passages completely through the member from the exterior surface to the interior surface thereof. This is illustrated in FIG. 3 where the member is indicated at 16 and is shown as a roll, and it is made of any kind of material which will provide passages therethrough as indicated at 18, see also the arrows in this figure. The web is shown at 20.

The interior of the roll 16 is provided with a dry heat which may be derived from electricity, gas, oil, or other source. The humidity of the interior of this roll is kept at a minimum humidity whereas of course in the prior art the steam heat for the rolls 10 adds to the atmospheric moisture rather than subtracting from it.

In any event it will be seen that as the web 20 passes over the surface of roll 16, it comes in contact with the heated surface which is provided with a great number of small through holes. A vapor pressure is set up at the surface of roll 16, i.e., just at the line of the surface of the roll where the paper hits it. The vapor under pressure finds a ready outlet and is forced to move inwardly in the direction of the arrows through the holes in the foraminous roll. This vapor does not condense at the interior of the roll because of the low humidity provided therein, but as vapor it proceeds out the ends of the rolls or may be collected in any way desired by being cooled at suitable points.

Instead of the porous roll 16, a relatively large cylinder of stainless steel or the like may be punched to provide holes 22 for the same purpose. The operation of the drying apparatus will be the same as above described and the vapor will be forced in through holes 22 in the same manner as described above with relation to the porous roll in FIG. 3.

No felt such as that at 14 is needed in the invention in this case because due to the presence of the holes, the paper web is held thereto. If a felt is utilized, however, the same may be provided without departing from the scope of the invention, and of course such felt will not take up or tend to bar the vapor escape.

It will be seen that this invention provides a greatly improved method and apparatus for drying materials particularly in the form of webs. These webs may be paper, textiles, plastics, etc. On the other hand, the apparatus and method may also be used for drying granulated material particularly where the granules are larger than the holes in the surface of the roll so that the granules continue to pass over the roll surface without being drawn inwardly with the vapor pressure. The moisture is continually drawn from the interior of the web

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outwardly to the heated surface thereof regardless of the transposition of the web in the new method as described in the old method in FIG. 2. In the old method, the moisture is attempted to be pushed inwardly from one surface through the web toward the other surface, so that instead of in effect drying a half of the thickness of the web at the heated side, as in the new method, in the old method the moisture has to be pushed through what amounts to the entire depth of the paper. Instead of being continually drawn outwardly, as for instance from the center to the surfaces of the web, it is pushed inwardly from the surfaces toward the center in the prior art. Therefore it will be clear that the method of operation in the present invention is a great improvement over the prior art particularly with respect to the time element involved and also to the fact that the number of rolls or cylinders used in drying the web can be reduced to about one-fifth the number ordinarily used in the prior art.

The material of the member 16 may be cindered metal, porous ceramic, plastic or metal, felted or matted and fused, etc. The member 16 should be relatively heavy to hold and conduct the heat through the material thereof, and it is observed that condensation in the holes 18 or 22 is prevented by the conducted heat.

Higher heats may be utilized in this invention because no cockles or ripples will be produced as in the prior art when the heat rises over a certain reading and when processing coated or impregnated papers, the invention avoids migrating. This is due to the fact that the vehicle used in coating or impregnating is released easier and faster in the new method.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. Drying apparatus of the class described comprising

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a heated surface over which moist material to be dried passes in intimate contact therewith, said surface being foraminous, a source of substantially dry heat at one side of said surface, said material being at the opposite side thereof, said heat passing through said foraminous surface and being applied to one side of the mass of the material and forming a source of continuous vapor pressure between the foraminous surface and the mass of material, the vapor escaping through the foraminous surface toward the source of heat, and means providing for dispersal of the vapor, said voraminous surface being in the form of a spongy hard porous material.

2. Drying apparatus of the class described comprising a heated roll over which moist material to be dried passes in intimate contact therewith, said roll having a foraminous porous surface, a source of dry heat within said roll, said heat providing a continuous source of vapor between the surface of the roll and the adjacent surface of the material, said vapor pressure escaping from the point where it is formed inwardly of the roll through the roll surface toward the source of heat, at least one end of the roll being open to provide for dispersal of the vapor, said roll being in the form of a hard spongy mass including continuous passages from one surface thereof to the other surface.

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