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MATERIAL CONDITIONING

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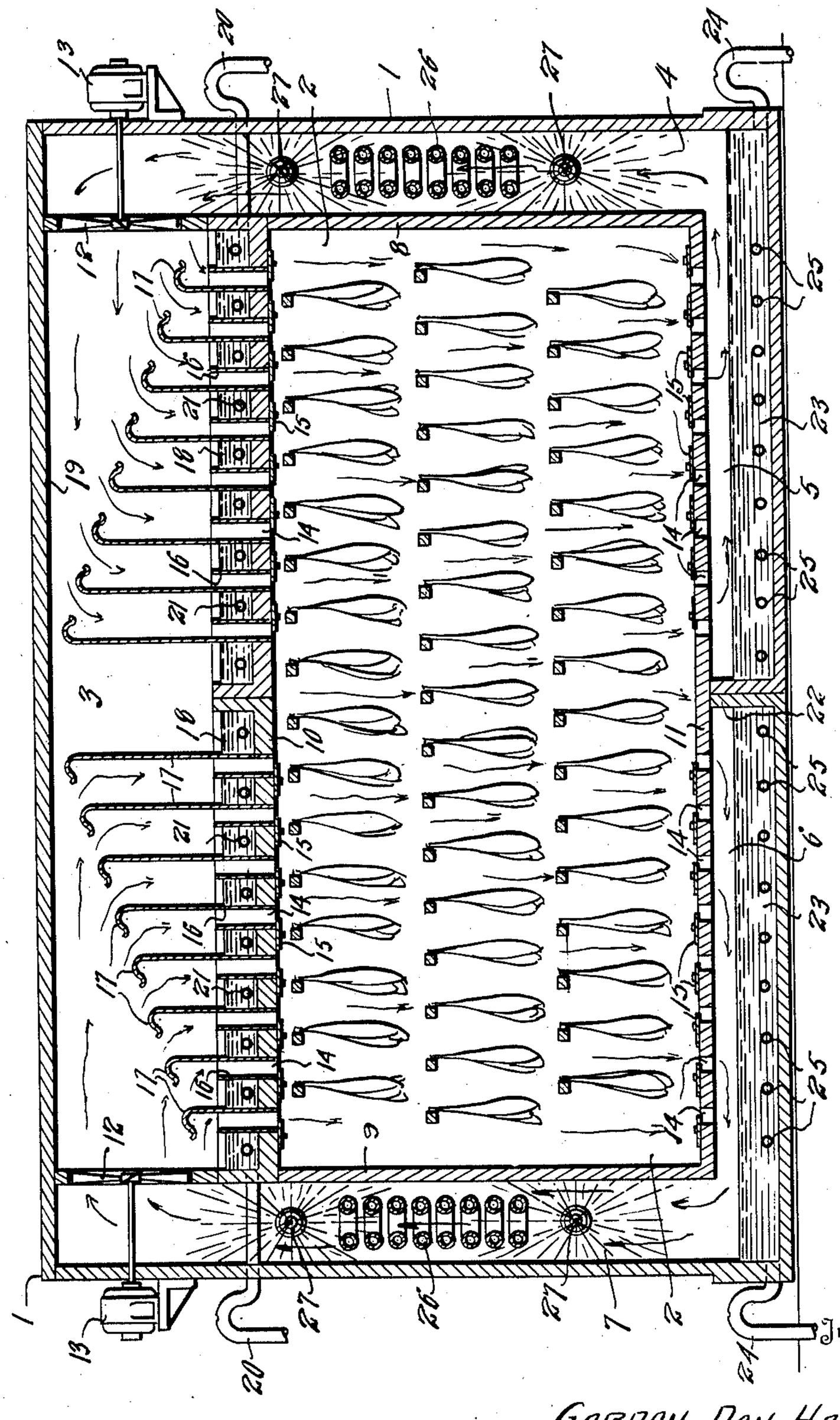

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MATERIAL CONDITIONING

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This invention relates in general to the conditioning of materials and more particularly has reference to a process and apparatus for conditioning air or other gases, which are circulated over tobacco or other materials to be treated.

Tobacco, when dry, is crisp and brittle and, consequently, cannot be worked without danger of breaking the leaf. Tobacco leaves for use as wrappers for cigars must be unbroken and yet must be manipulated many times prior to being assembled on a cigar. It is essential, therefore, that the tobacco be treated so that the leaves will assimiliate moisture sufficient to render the same pliable to an extent that they may be handled and conditioned for use as wrappers without danger of fracture.

The most successful processes for changing the physical characteristics of tobacco from a dry condition, wherein the leaves may be easily broken, to a pliable and flexible condition, in which it is susceptible of handling without risk of fracture, are those in which the hands of dry tobacco are subjected to conditioned air. The condition of the air is modified during the treatment to insure the permeation of moisture throughout all parts of the leaves, including the stem, the blade or lamina, and the petiole connecting the blade with the stem. Tobacco treated in accordance with this process is of high commercial value. The present invention contemplates improvements in the processes in which conditioned air is passed over tobacco or similar materials.

A major object of this invention is to devise an improved method and apparatus for treating tobacco and other materials with conditioned air.

Another object of this invention is to devise a method and apparatus for treating tobacco and materials requiring similar treatment with conditioned air in which air is humidified and supplied with entrained moisture by spraying water into the same. The spraying may also function as a cooling means.

Yet another object of this invention is to devise a method and apparatus for treating tobacco and materials requiring similar treatment with conditioned air in which air is conditioned by diffusing vapors arising from heated bodies of water therein and by spraying water into the air.

Still another object of this invention is to devise a method and apparatus for conditioning tobacco and materials requiring similar treatment with conditioned air in which air is conditioned by spraying water into the same and cooling the air.

A still further object of this invention is to provide an apparatus for treating tobacco and other materials in which treated air is subjected to a body of heated water, water sprays and cooling means before being passed over the material to be treated.

With these and other objects in view, which may be incident to my improvements, the invention consists in the several process steps and parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary features of my invention may be varied as desired without departing from the spirit and scope of the appended claims.

In accordance with the present invention, material such as tobacco is conditioned by circulating air over a body of heated water, dispersing water into the air, cooling the air and then passing the air over the material to be treated. An apparatus susceptible of carrying out the process of treating materials may be constructed in the form of a structure which is divided into a products chamber surrounded by air conditioning chambers. The partition forming the upper and lower walls of the products chamber are provided with a plurality of slots or other apertures through which air is circulated from the conditioning chamber into the products chamber. Tank structures are provided in the conditioning chamber directly above the upper portion of the products chamber and beneath the products chamber. These tank structures are provided with means for heating water contained therein to a temperature sufficient to generate vapors. Suitable fans or blowers are provided for circulating air or other suitable gas over the tanks into the conditioning chamber and through slotted partitions into the products chamber.

In order to regulate the temperature of the air, cooling coils or other suitable heat exchange devices are provided in the conditioning chamber between the tank structures. As air passes from the products chamber, it is subjected to the vapors rising from one of the tank structures and is then cooled to a predetermined temperature before being subjected to the vapors rising from the other tank. Water may be dispersed into the air just before and/or after the cooling treatment. In some instances, it may be desirable that the air have water sprayed

therein before the air is re-introduced into the products chamber. The temperature of the water in the tank, the temperature of the cooling coils and the temperature of the water sprayed into the air may be regulated so that the air in the products chamber will be maintained at a predetermined temperature and in all events, substantially saturated with moisture. Of course, the sprays may function to regulate the temperature of the gas.

In order to make my invention more clearly understood, I have shown in the accompanying drawing means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the drawing:

The single figure is a somewhat diagrammatic representation of a material conditioning apparatus constructed in accordance with the present invention and which is susceptible of effecting the process herein described.

In the drawing, there is shown an apparatus 1 for conditioning tobacco or other materials requiring similar treatment. This apparatus is divided by walls or partitions into a treating or products chamber 2 and air-conditioning chambers 3, 4, 5, 6 and 7. The vertical partitions or walls 8 and 9 separate chamber 2 from the side conditioning chambers or ducts 4 and 7, respectively, and horizontal partitions 10 and 11 separate chamber 2 from the upper and lower conditioning chambers. Chamber 5 is in open communication with the side chamber or duct 4, and the lower chamber 6 is in open communication with the side chamber 7. Side chambers 4 and 7 communicate with the upper conditioning chamber 3 through openings, in which are positioned fans 12, driven by electric motors 13 or other suitable sources of power. The upper conditioning chamber communicates with the products chamber 2 through slots in the partition 10, and chambers 5 and 6 beneath partition 11 communicate with chamber 2 through similar slots in partition 11.

In order to secure an even distribution of air through the products chamber 2, slots 14 in the walls or partitions 10 and 11 are provided with adjustable closure members 15, which may be actuated to vary the size of the slot openings. It has been found that the size of the slot openings can be so regulated that air will flow through the products chamber in well-defined streams with practically no intermixing of the streams. This is very desirable since, when the air flows in well-defined streams without any cross circuiting, an even distribution is obtained and proper treatment of all of the materials will be effected.

Slots 14 in the upper partition 10 are fitted with tube-like members 16, with which are associated drip guard deflectors 17. The tube-like members 16 extend a predetermined distance above the partition 10 and cooperate with the partition 10 and walls 8 and 9 to form tank structures in which are contained bodies of water 18. The drip guard deflectors 17 extend above the tubes 16 varying distances, as is clearly shown in the drawing. These deflectors prevent any moisture which condenses on the upper wall 19 of the treating apparatus from dripping through the slots 14 onto the material contained in the products chamber 2.

The tank structures afforded by the several partitions 8, 9 and 10 and the tube structures 16 are provided with suitable overflow conduits 20, which serve to prevent water contained in the tanks from exceeding a predetermined level. Submerged in the bodies of water 18 are suitable heating elements 21, which may be in the form of coils through which hot fluids are circulated, or electrical heating elements. Water is supplied to the tanks above the slotted partition 10 by means of suitable supply conduits, (not shown), which preferably are fitted with valves controlled by automatic regulating devices, such as floats, positioned in the tank structures hereinbefore described. With the construction just described, it will be appreciated that the water within the tank structure will be maintained at a substantially constant level, regardless of the quantity of water evaporated therefrom by the heating elements.

Chambers or ducts 5 and 6 beneath partition 11 are seperated by the partition or separating wall 22. Each of these chambers is provided with a tank adapted to contain a body of water 23, which is prevented from exceeding a predetermined level by means of the overflow conduits 24. The bodies of water 23 are heated by means of heating elements 25, which are in the form of coils, through which are circulated hot fluids, or elements through which electric current is passed. Water is supplied to the lower tank structures by suitable supply conduits provided with automatically controlled valves for maintaining a predetermined level of water within the tanks.

It will be appreciated that after the vapors arising from the bodies of water diffuse into the air, the temperature of the air will be increased; also, the surrounding or outside temperature may be greater than is desired in the products chamber. In order to cool the air so that it will be at the proper temperature for treating the material in the products chamber, there are provided suitable cooling coils 26 in the side conditioning chambers 4 and 7. Water or other cooling media may be supplied to these coils through suitable conduits, (not shown), which are equipped with regulating valves. If desired, thermostatic control means may be provided in the products chamber 2, by means of which the valves positioned in the cool fluid supply conduits may be actuated. With such construction, the temperature of the air within the products chamber 2 can be automatically maintained at a predetermined value.

Certain material may be advantageously treated by circulating saturated air thereover, which contains entrained moisture. It has been found necessary to saturate the air into which the water is sprayed in order to properly moisten the material. If water is sprayed into dry air, or air having a low moisture content, and then with the entrained moisture in drop form passed over tobacco, the humidification of the tobacco is not properly effected. Therefore, it is essential that the air which carries the moisture be substantially saturated with water vapor, regardless of the amount of entrained water droplets.

Apparatus for introducing entrained water in the air is shown in the drawing. In each of the compartments 4 and 7, there are positioned a plurality of spraying means 27 of any construction and size found suitable for the purpose. As shown, the sprays are positioned above

and below the cooling coils, but I wish it to be clearly understood that the sprays may be located at any point found desirable, and that any number of them may be employed.

It is within the concept of the present invention to regulate the temperature of the water supplied to the spraying devices so that the temperature of the air may be properly maintained.

The structure herein described is particularly useful for surface wetting the material to be treated. When so used, the moisture is evenly deposited on the material.

In operation, material to be treated is placed in the products chamber 2, and the fans 12 are set in operation so that air will flow over the material in the desired direction. Air from chamber 1, in one direction of flow, will be drawn down through slots 14 in partition 11 over the bodies of water 23. These bodies of water may be heated at a constant rate or at a varying rate, dependent upon the manner in which the structure is to be operated. Vapors generated by heating the bodies of water 23 arise and diffuse into the air which flows through ducts 5 and 6.

Mixtures of air and vapors flow up through ducts 4 and 7 over the cooling coils 26. The temperature of the cooling coils is maintained by a thermostat within the products chamber, or elsewhere, so that the air flowing over the coils will be at such a temperature that, after further treatment, it will be at the temperature desired for the products chamber. Before and/or after the cooling treatment, water from the spraying devices is dispersed into the air. This water is entrained in the air and is carried with the air over the material to be treated. The tempered air from the ducts 7 and 8, which is substantially saturated with moisture, is then drawn upwardly by the fans 12 and is forced into chamber 3, where it meets with vapors arising from the bodies of water 18. Vapors arising from the bodies of water 18 will diffuse into the air in the chamber 3 to further moisten the same. After this treatment, the air will be at substantially 100% saturation. The treated air will then flow down through the slots 14 over the tobacco or other material to be treated.

The temperature of the conditioning air may, of course, be regulated by controlling the temperature of the cooling coils and the temperature of the water entrained in the air, and by regulation of the heating elements in the conditioning chambers.

As hereinbefore pointed out, the size of the slots 14 may be regulated by adjusting closures 15 so that the air will flow through the products chamber 2 in well-defined streams, so that material in all portions of the chamber will receive the proper treatment.

While I have described one form of operation of my invention, in which air is passed downwardly through the products chamber, I wish it to be clearly understood that the direction of air flow may be reversed so that the air will flow upwardly through the products chamber.

It will be appreciated that the construction herein set forth by way of example is very simple, in that relatively few parts are required and that the structure is susceptible of operation to produce very effective results. By placing humidifying tanks in the upper compartment 3 and so associating them with the partition 10 that the partition 10 is of practically the same temperature as the heated bodies of water, and above that of the heated air, there will be no condensation of moisture on the partition 10 which could drip onto the material being treated to spot or otherwise damage the same. The construction herein described is susceptible of being used both in continuous process type of conditioning apparatus or in the intermittent, or compartment type, in which the condition of the air is varied. By this method, the material is not only subjected to desired moistening by humidified air, but is simultaneously subjected to surface wetting by entrained droplets.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention or exceeding the scope of the appended claims.

I claim:

1. A method of conditioning material comprising conditioning a gas by saturating it with moisture, cooling the moisture-saturated gas, and simultaneously spraying water into it and flowing the treated gas over material to be conditioned.

2. A method of treating tobacco and similar materials comprising circulating a gas over a body of heated water, cooling the gas in the presence of dispersed water, passing the gas over a second body of heated water and then flowing it over tobacco to be treated.

3. A method of treating tobacco and similar materials comprising circulating a gas over a body of heated water, dispersing water into the gas, cooling the gas, again dispersing water into the gas, passing the gas over a second body of heated water and then flowing it over material to be treated.

4. A method of treating tobacco and similar materials comprising circulating a gas over a body of water, heating the water to diffuse vapors into the gas, cooling the gas and dispersing water into the same, passing the gas over a second body of water, heating the second body of water to diffuse water vapor into the gas and flowing the conditioned gas over material to be treated, and regulating the cooling of the gas to obtain desired gas temperatures.

5. A method of treating tobacco and similar materials comprising circulating a gas over a body of water, heating the water to diffuse vapors into the gas, cooling the gas and dispersing water into the same, passing the gas over a second body of water, heating the second body of water to diffuse water vapor into the gas and flowing the conditioned gas over material to be treated, and regulating the heating of the water bodies and the cooling of the gas to obtain desired gas temperatures.

6. An apparatus for conditioning tobacco and similar materials comprising a products chamber and conditioning chambers, the products chamber being positioned centrally of the conditioning chamber and in communication therewith by means of slotted partitions, a plurality of tanks containing water bodies in said conditioning chamber, means interposed between said bodies of water for cooling the gas, a plurality of spraying elements adjacent the cooling means,

and means for circulating the gas through said chambers.

7. An apparatus for conditioning tobacco and similar materials comprising a products chamber and conditioning chambers, the products chamber being positioned centrally of the conditioning chamber and in communication therewith by means of slotted partitions, a plurality of tanks containing water bodies in said conditioning chamber, means interposed between said bodies of water for cooling the gas, water spraying elements positioned above and below said cooling means, and means for circulating the gas through said chambers, means for heating said bodies of water to saturate the gas with water vapor and means for circulating the gas through said chambers.

8. An apparatus for conditioning tobacco and similar materials comprising a products chamber, the lower and upper walls of said products chamber being provided with a plurality of slots, conditioning chambers positioned about the products chamber and communicating therewith through said slots, a plurality of tanks containing water bodies positioned in said conditioning chambers, means between said water bodies for cooling the gas, means positioned above and below the cooling means for spraying water into the same, means for circulating the gas through said chambers and means for controlling the size of said slots.

9. An apparatus for conditioning tobacco and similar materials comprising a products chamber, the upper and lower walls of said products chamber being provided with a plurality of slots, conditioning chambers positioned about the products chamber and communicating therewith through said slots, a tank structure associated with said upper slotted walls adapted to contain a body of water, a tank containing a body of water in the conditioning chamber beneath said lower slotted wall, cooling means in said conditioning chambers between said bodies of water, a plurality of spraying elements positioned adjacent said cooling means, and means for circulating the gas through said products chambers and through said conditioning chambers over the bodies of water and the cooling means.

10. An apparatus for conditioning tobacco and similar materials comprising a products chamber, the upper and lower walls of said products chamber being provided with a plurality of slots through which the gas is circulated, conditioning chambers positioned about the products chamber and communicating therewith through said slots, a plurality of tanks containing water bodies in said conditioning chamber, means between said water bodies for cooling the gas, means for entraining moisture in the gas, a plurality of drip guard deflectors associated with the slots in said upper wall adapted to prevent condensed moisture passing through said slots and means for circulating the gas through said chambers.

11. An apparatus for conditioning tobacco and similar materials comprising a products chamber, the upper and lower walls of said products chamber being provided with a plurality of slots through which the gas is circulated, conditioning chambers positioned about the products chamber and communicating therewith through said slots, a plurality of tanks containing water bodies in said conditioning chamber, means between said water bodies for cooling the gas, a plurality of water spraying elements positioned in said conditioning chamber, means associated with said slots for varying the size thereof and means for circulating the gas through said chambers.

12. An apparatus for conditioning tobacco and similar materials comprising a products chamber, the upper and lower walls of said products chamber being provided with a plurality of slots through which the gas is circulated, conditioning chambers positioned about the products chamber and communicating therewith through said slots, a plurality of tanks containing water bodies in said conditioning chamber, a plurality of spraying elements positioned in said conditioning chamber for entraining moisture in the gas, a plurality of drip guard deflectors associated with the slots in the upper partition to prevent moisture condensed from the gas from dripping through said slots, means associated with said slots for varying the cross-sectional area thereof and means for circulating the gas through said chambers.

13. A method of conditioning material comprising moistening a gas, cooling the gas to a desired temperature while dispersing water into the gas, again moistening the gas, passing the gas in one direction of flow through a zone containing material to be treated, and subsequently reversing the direction of flow of the gas, and moistening, cooling and again moistening the gas before it enters the zone.

14. A method of conditioning tobacco and other materials in which the material to be treated is positioned in a zone through which a conditioning gas is passed in one direction of flow or the reverse direction, comprising moistening the gas immediately upon being discharged from the zone in either direction of flow, and moistening the gas immediately before being introduced into the zone in either direction of flow, and cooling the gas while spraying water into it as it flows intermediate of the moistening steps.

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