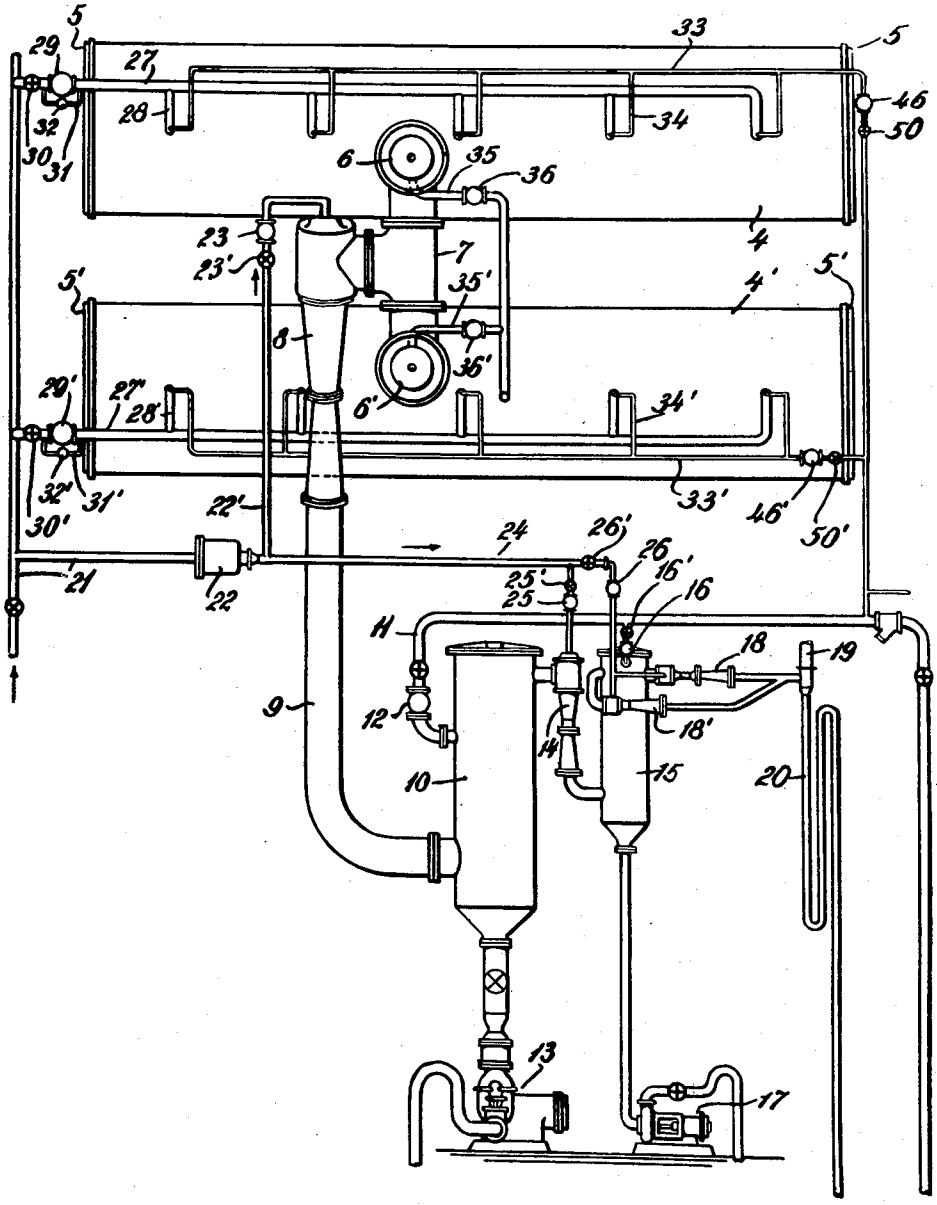
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METHOD FOR MOISTENING TOBACCO

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METHOD FOR MOISTENING TOBACCO

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This invention relates to a method for moistening tobacco under vacuum, and more particularly to improvements in the use of multiple chambers.

Devices for the moistening of tobacco under vacuum are now in wide use in which tobacco in hogsheads, bales or other packages, is placed in an airtight chamber, and subjected to a high vacuum and then is supplied with steam to reduce the vacuum. In many of these processes the vacuum is again increased after the steaming operations and these steps may be repeated one or more times. One of the difficulties encountered in speedy handling of tobacco is the time necessary for removing hogsheads from the treating chamber and the introduction of the new batch of tobacco therein. Not only is time lost in this interchange but if an attempt is made to hurry the processes, the workmen are required to enter chambers which are exceedingly hot and moist, which in some cases is objectionable.

In accordance with the present invention, a plurality of chambers is employed by means of which the time lost in loading and unloading the chambers is eliminated, it being even possible to air the chambers for some time before emptying them. Furthermore, a large saving in steam consumption and in pumping costs may be accomplished by interconnection of the chambers so that instead of breaking the vacuum to atmosphere as the final step, an evacuated chamber is connected to an unevacuated chamber and thereby accomplishes the first stages of air removal from the latter. The invention has the additional advantage that by use of multiple chambers one of the chambers and the product within it may be utilized as a condenser by means of which a warmer chamber and the tobacco in it may be cooled. This also means that the steam necessary to heat and moisten the cooled tobacco is supplied by the warmer tobacco, whereas, otherwise the exhausted steam is wasted.

The invention is illustrated diagrammatically in the drawing in which a pair of tobacco chambers 4 and 4' of substantially identical construction are included. While two chambers are shown in the present arrangement, any convenient multiple number of chambers may be used, if desired, the number being dependent upon the time required for loading and other desirable features as will become evident from the following description. The chambers shown may be of any desired shape whether cylindrical or rectangular, those illustrated being cylindrical. They are provided with removable doors or closures 5 and 5' at each end thereof to permit the introduction and removal of the tobacco to be treated. The treatment chambers are airtight and the doors are provided with suitable gaskets or other sealing means which prevent the admission of air during the evacuation cycles. Each chamber is preferably large enough to accommmodate several hogsheads of tobacco, or an equivalent volume of tobacco or other product. Suitable means are provided for selectively evacuating the chambers 4 and 4' it being generally preferable to employ multi-stage steam jet evacuators for this purpose, or at least for the latter stages of the evacuation. The illustrated apparatus includes a three-stage steam jet evacuating system.

As shown, the chambers 4 and 4' are respectively connected to the suction line valve 6 and 6' with a common T fitting 7, opening into the inlet of a first stage steam jet ejector or booster 8. The first steam jet booster 8 discharges through a pipe 9 into an intercondenser 10. The intercondenser 10 may take any suitable form, and, as shown, comprises a direct contact condenser of known construction. It is supplied with water through a pipe 11 under control of the valve 12. Water and condensate are withdrawn from the intercondenser 10 through a pump 13 constructed to prevent ingress of air to the condenser. The fluid outlet of the intercondenser 10 is connected to the inlet of a second-stage steam jet ejector 14 which discharges into a second intercondenser 15. The intercondenser 15 may be similar in construction to the first-stage intercondenser 10, but is preferably of smaller capacity. Water is supplied to the intercondenser 15 from the pipe 11 under control of a valve 16, and condensate and water are withdrawn by a sealing pump 17. Two third-stage steam jet ejectors 18 and 18' are connected in parallel to withdraw fluid from the second intercondenser 15. The ejectors 18 and 18' may discharge steam and evacuated fluid to the atmosphere directly through an exhaust pipe 19, or a final condenser may be employed to condense the exhaust steam, if desired. A trapped drain 20 is preferably provided to carry off the liquid which condenses in the exhaust pipe 19, and the liquid from this drain may be either wasted or recirculated through a cooling system with the discharge from the condenser pumps 13 and 17.

The steam jet ejectors 8, 14, 18 and 18' are of known construction, each employing a jet of steam to propel and compress gaseous fluid by entrainment in a restricted throat. High pressure steam for operating the ejectors is supplied from any suitable source through a pipe 21 in which a separator 22 of known construction may be connected.

The first-stage steam booster 8 receives steam through a branch pipe 22' under the control of an automatic valve 23 and a hand valve 23'. The second and third-stage ejectors receive steam from the pipe 24. The automatic valve 25 and manual valve 25' govern the admission of steam to the second-stage ejector 14 and the automatic valve 26 and manual valve 26' control the admission of steam to the third-stage ejector 18 and 18' in parallel.

Suitable means are provided for admitting steam to the treatment chambers 4 and 4'. In the disclosed embodiment, steam is introduced at a plurality of points spaced longitudinally by means of the manifold pipes 27 and 27' and the branch pipes 28 and 28' which terminate in openings in the chamber walls. The manifold pipes 27 and 27' are connected to the steam supply pipe 21 through automatic control valves 29 and 29', and manual valves 30 and 30' may also be used at this point, as shown. Restricted by-pass pipes 31 and 31' are preferably connected respectively around the automatic steam control valves 29 and 29' to admit steam at a restricted rate to the chambers 4 and 4' at certain times, as hereinafter explained. Water may be introduced with the restricted steam supply, if desired. Automatic control valves 32 and 32' are provided in the by-pass pipes 31 and 31' respectively.

In accordance with one embodiment of our invention, water is introduced to the treatment chambers with steam, and for this purpose, water manifold pipes 33 and 33', each having branch pipes 34 and 34', are provided for the respective chambers 4 and 4'. The branch pipes 34 and 34' are connected to spaced openings in the walls of the chambers 4 and 4' respectively, and preferably enter these chambers at the same points as the branch steam pipes 28 and 28'. The admission of water is controlled by the automatic valves 46 and 46' in the manifold pipes 33 and 33' respectively and manually operable valves 50 and 50' may also be provided for this purpose.

Suitable means are provided for venting the chambers 4 and 4' to the atmosphere. As shown, the pipes 35 and 35', controlled respectively by the valves 36 and 36', are used for this purpose. The pipes 35 and 35' are shown as connected to the chambers 4 and 4' through the fittings which connect the suction line valves 6 and 6' to the chambers. The vent pipes could obviously be connected to the chambers at any other convenient point.

The supply of steam and water to the steam jet ejectors and the introduction of these fluids to the treatment chambers, as well as the venting and evacuation of the chambers, may be controlled manually by separate valves, manually from a central point or by suitable automatic control apparatus. The particular form of control valve actuation employed forms no part of the present invention but in many instances both manually operable and automatic valves have been disclosed to indicate the different types of actuation which may be resorted to. The suction line controlled valves 6 and 6' are preferably of large capacity and are usually operated by diaphragm or electric means of known construction. The remaining automatic valves may be similarly operated.

In accordance with one feature of our invention, water is introduced to the treatment chambers with the steam during the steaming steps or stages including the soaking stage, if desired, and is converted into a fine mist or suspension and entrained with the steam as the two fluids enter the chamber.

In operating the apparatus, tobacco or other material is placed within one of the chambers, for example, within the chamber 4. The doors of the chamber are closed and the tobacco is subjected to a series of operations in which the pressure is first reduced to cause boiling of moisture from the tobacco and the resultant removal of all air from the chamber, after which the tobacco is steamed with a mixture of steam and water hereinbefore described, after which it may again be subjected to an increased vacuum followed by further steaming. These cycles can be repeated as often as is necessary to insure proper treatment of the tobacco. In these treatments the degree of initial vacuum employed will, of course, depend upon the temperature of the tobacco. Usually the evacuation is continued until the pressure has dropped below .5 inch of mercury absolute and sometimes is reduced as low as .05 to .15 inch of mercury absolute.

The steam jet evacuating equipment described may be operated in various ways to produce the desired initially high vacuum and the following sequence of operations has been found effective and economical. The suction line valve 6 is opened and the valve 6' controlling the chamber 4' is closed, the valves 36, 23, 12, 25, 16, 29, 32 and 46 being closed. The steam supply valve 26 for the third-stage ejectors 18 and 18' is opened and these ejectors, acting in parallel, reduce the absolute pressure by withdrawing fluid from the treatment chamber 4. When the pressure is dropped to about 10 inches absolute, it is preferred to start the second-stage ejector 14 which is done by opening the valve 25. At the same time, cooling water is admitted to the second intercondenser 15 by opening the water valve 16, and in this manner, the steam issuing from the ejector 14 is condensed before it reaches the third-stage ejectors 18 and 18'. When the absolute pressure of the chamber has been further reduced to a value such as about 2 inches, the first-stage booster 8 and first intercondenser 10 are operated by opening the steam valve 23 and the water valve 12. With all of the ejectors in operation, the absolute pressure on the tobacco is rapidly reduced to the desired final value. The entire evacuating operation can be completed in a relatively short interval, for example, less than twelve minutes. At the conclusion of the initial evacuating step, the suction line valve is closed and the ejectors and intercondensers are shut down by closing the valves 23, 12, 25, 16 and 26.

After the desired high vacuum has been attained, steam is supplied to the tobacco whereby the vacuum thereon is reduced. In accordance with one feature of our invention, water is supplied to the tobacco simultaneously with the steam, the amount of water so supplied being greater than that required to de-superheat the steam at the vacuum obtaining in the chamber. The simultaneous addition of water and steam is effected by opening the steam valve 29 and the water valve 46, and the pressure within the chamber increases to an intermediate but preferably sub-atmospheric value. We believe that the excess water introduced is carried into intimate contact with the tobacco by the steam which flows rapidly into the previously evacuated tobacco structure. In this manner, the moisture content of the tobacco is increased, both by the

condensation of steam and by the water introduced with the steam.

During the steaming step, the absolute pressure should be increased to such a value that the steam, and entrained water where water is introduced therewith, will quickly penetrate the tobacco mass and moisten it substantially uniformly throughout. The steam introduced heats the tobacco and raises its temperature, and the amount of steam introduced, as determined by the absolute pressure attained at the conclusion of the steaming step, should not be so high as to cause discoloration or other heat deterioration of the tobacco within the time interval during which the elevated temperature is maintained. In accordance with our process, the absolute pressure attained in the steaming step produces a tobacco temperature high enough to cause discoloration of the tobacco after a time interval, but prior to the expiration of such interval, the absolute pressure is reduced sufficiently to appreciably lower the tobacco temperature, whereby discoloration or other heat deterioration is avoided. This reduction of absolute pressure takes place in the re-evacuating step or steps as hereinafter described. With various varieties of tobacco and times of treatment, the final steaming pressure may vary between about 8 and 18 inches of mercury absolute. The steaming stem is terminated by closing the steam and water valves 29 and 46.

The amount of water introduced during the steaming step is preferably in excess of that required to de-superheat the steam supplied to the tobacco whereby an excess of water, in the form of a fine mist or suspension, is carried into the tobacco structure by the steam. The amount of water so introduced is not critical, and amounts from twice to four or five times the amount necessary to de-superheat the steam may be used. In a typical example of our process, assuming that 25 lbs. per minute of dry saturated steam at an initial pressure of about 115 lbs. per square inch gauge is introduced through each branch pipe 28, about .7 gal. of water per minute may be introduced with the steam through each branch pipe 34. In the example given, assuming an initial vacuum of about 29.5 inches of mercury in the chamber, approximately .35 gal. per minute of water would be sufficient to saturate (de-superheat) the steam introduced at each branch.

The water is preferably introduced to the tobacco chamber at the same point as the steam whereby the steam is de-superheated as the superheat develops and the water is broken up and entrained by the steam as it enters the chamber. The atomizing or breaking up of the water may be promoted by the use of known types of atomizing or spray nozzles. One or more combined water and steam inlets may be provided, and good results are obtained by using one such inlet for each hogshead, bale or other mass of tobacco in the treatment chamber 4. When our improved steam and water injecting nozzle is used, one such device may be provided at each inlet point and located adjacent each tobacco hogshead.

A so-called "soaking" step preferably follows the introduction of steam and water. During this portion of the process, the absolute pressure on the tobacco is maintained constant or nearly constant for a limited time interval. The previously introduced steam continues to condense after the introduction of steam has been discontinued, and accordingly, the pressure in the chamber 4 would normally fall during the "soaking" period. Accordingly, we prefer to introduce steam at a low rate substantially sufficient to continuously replace the steam being condensed, whereby the absolute pressure on the tobacco is maintained substantially constant. This may be accomplished by opening the steam valve 32 in the restricted by-pass pipe 31, it being understood that the rate of steam flow through this pipe is reduced by the pipe size, a restricted orifice or otherwise to produce the desired continuous replacement of the steam being condensed in the chamber. The introduction of steam at a restricted rate during the "soaking" stage may, if necessary or desirable, be accompanied by the introduction of water in the form and amount explained above. The "soaking" step is terminated by closing the valve 32.

At the conclusion of the "soaking" step, the tobacco is subjected to an increased vacuum, the pressure thereon being reduced. The degree of evacuation to which the tobacco is subjected in this step is preferably high enough to vaporize or evaporate some moisture from the tobacco whereby its temperature is reduced, heat being absorbed in the form of latent heat of vaporization. This re-evacuating step may comprise the final step of the process, and the evacuation preferably continues to an absolute pressure at which sufficient moisture has been evaporated or vaporized to reduce the tobacco temperature to a safe value. The heat discoloration and other heat deterioration of tobacco is a function of the temperature, the time for which the temperature is maintained and the type of tobacco under treatment. If certain types of bright tobacco are maintained at temperatures above about 125° F. for an extended time interval, the discoloration and often other forms of heat deterioration take place, and the value of the tobacco is thereby substantially reduced. However, these tobaccos may be maintained at temperatures in the neighborhood of about 180° F. for intervals of about 10 or 15 minutes without discoloration or other detrimental change. In general, bright tobacco is more sensitive to heat than other varieties—burley tobacco, for example, will withstand high temperatures for appreciably longer periods than will bright tobacco.

The re-evacuating step of the process is continued to a value of vacuum at which the temperature of the tobacco has been reduced by the evaporation or vaporization of moisture to a value at which heat deterioration will not take place. This temperature, and accordingly, the final value of vacuum, varies as indicated above, depending upon the type of tobacco under treatment. The treatment to which the tobacco is subjected after the conclusion of our process is also a factor in fixing the final tobacco temperature. In most cases, the tobacco is unpacked from the hogsheads or bales and the leaves are separated immediately after the "ordering" treatment. With this procedure, the tobacco is cooled by the atmosphere promptly after the treatment process is concluded and accordingly the temperature to which the tobacco is reduced in the re-evacuating step may be somewhat above the minimum temperature at which heat deterioration can take place after an extended interval. If the tobacco is not to be unpacked at the conclusion of the process, the re-evacuation is continued until the tobacco temperature is below the lowest temperature at which it can be adversely affected by heat in any time interval.

In the disclosed example, assuming bright tobacco is under treatment and is to be unpacked at the conclusion of the process, the re-evacuating step is continued to a vacuum of about 27.25 inches of mercury (2.25 inches of mercury absolute pressure). This final vacuum may vary from about 25 to about 29.8 inches of mercury (5 to .2 inches of mercury absolute pressure) and in the case of very dark heat resistant tobaccos, which are to be unpacked immediately after treatment, the final vacuum may be as low as 20 inches of mercury (10 inches of mercury absolute pressure).

The re-evacuating step may be performed by operating the third-stage ejectors 18, 18' and the first-stage intercondenser 10 until the absolute pressure has been reduced to some intermediate point. The second-stage ejector 14 and second intercondenser 15 may then be operated by opening the valves 25 and 16 and the absolute pressure is further reduced to the desired point by the second and third-stage ejectors acting in series. If desirable or necessary, the first-stage booster 8 may also be operated in drawing the desired vacuum. The re-evacuation step is concluded by closing the suction line valve 6 and cutting off the supply of steam and water to the ejectors and intercondensers.

At the conclusion of the re-evacuating step, the treatment chamber 4 is vented by opening the valve 36, and the pressure on the tobacco rises to atmospheric pressure. The tobacco is now removed from the treatment chamber 4 and the process is complete.

It is obvious that the above described steaming and re-evacuating steps may be repeated one or more times if desired. Since a second steaming, "soaking" and re-evacuating cycle consumes only a short time interval, the temperature to which the tobacco is cooled in the first re-evacuating step may be somewhat higher than the temperature required at the conclusion of the treatment. In general, a practical working range of absolute pressures at the conclusion of an initial re-evacuating step may be from about 3 to about 5 inches of mercury absolute.

The first re-evacuating step in the case of recycling may be accomplished by manipulating the apparatus as described above. It is usually necessary to operate the third-stage ejectors 18 and 18' and the first inter-condenser 10 only, although operation of the second-stage ejector 14 and second intercondenser 15 may be resorted to during a part of the re-evacuating step, if necessary or desirable.

The re-evacuating step just described is followed successively by a repetition of the steaming, "soaking" and re-evacuating steps. At the end of the final re-evacuating step the treatment chamber is vented to the atmosphere, and the tobacco is removed from the chamber. The "soaking" step is believed to aid in the uniform distribution of moisture in the tobacco. By introducing water with the steam, the amount of moisture added to the tobacco is increased without undesirably increasing the maximum temperature to which the tobacco is heated.

Our improved process exterminates tobacco pests, such as the cigaret beetle, in all forms of its life cycle. This can be done simultaneously with the addition of moisture as described above, or without net change in the moisture content. In the latter case, the re-evacuating step is continued until all of the added moisture has been evaporated or vaporized and removed.

The foregoing description illustrates the general operations carried out in any one chamber. In operating a pair of chambers together, it will be seen that there are many occasions on which the tobacco in one chamber may be at a higher pressure than the tobacco in the other and it is desired to reduce the tobacco at the higher pressure to some lower pressure. These occasions occur, for example, when one chamber has just been filled with tobacco and is under full atmospheric pressure and the other chamber has passed through its entire cycle of operation and is under a relatively low pressure under an atmosphere of steam. In such case, both valves 6 and 6' may be opened, the steam jet ejector being in such case shut off from the atmosphere by any suitable means. The result of such opening of valves 6 and 6' is to equalize the pressure in the two containers thereby producing a vacuum of 10 to 14 inches in each tank far more rapidly than would be the case with any mechanical evacuation system and without cost.

In other stages of the evacuation system the two tanks may be in even more favorable relationship from the standpoint of the advantages of interconnecting the two. For example, if tank 4 is at maximum evacuation of .4 inch and tank 4' is at a pressure of 10 inches of steam, interconnection of the two chambers produces a totally new effect. Under these conditions each chamber has an atmosphere of steam but the pressure and temperature in the two chambers differ. In such a case the tobacco in chamber 4 being cold will act as a condenser and will draw from chamber 4' the steam contained therein, thus lowering the pressure. At the same time, the reduction in pressure will cause evaporation of moisture from the tobacco in chamber 4' and this evolved moisture will be further condensed by the tobacco in chamber 4 until the temperature of the tobacco in both chambers is substantially equal. In this way not only is the work of evacuating chamber 4' over this range eliminated, but the steam which would have had to be supplied to the tobacco in chamber 4 is saved.

Moreover, each evacuation of steam from tobacco eliminates by a process of steam distillation certain ingredients from the tobacco, and by this process these ingredients are saved to the extent that such steam is re-condensed in the other tobacco.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom.

We claim:

1. The method of treating tobacco and the like which comprises subjecting two lots of tobacco in separate zones to vacuum and producing an atmosphere substantially completely of steam about the tobacco in each lot, the pressure in one lot being relatively high as compared with the other, and the tobacco therein being relatively moist as compared with the other, and then interconnecting the two zones, whereby the lot of tobacco under lower pressure acts as a condenser and its temperature and moisture content are increased while the other lot of tobacco is cooled and its moisture content is decreased.

2. The method of treating an organic product in which the product is submitted to a plurality of cycles in an atmosphere substantially completely of a condensible gas during which the temperature and pressure upon the organic

product are alternately increased and diminished, the steps of carrying out the alternation of cycles upon two lots of the product in cooperation in adjacent chambers and utilizing the lot of the product under a relatively high vacuum portion of the cycle as a condenser for the lot of the product under a low vacuum portion of the cycle.

3. The method of treating an organic product which comprises subjecting two lots of the product in separate zones to a cyclic treatment, the product in each zone being first subjected to a high vacuum during which the air is substantially completely removed therefrom and is replaced substantially completely with an atmosphere of steam, the additional steam being introduced to the product to raise its temperature and pressure, and the pressure then reduced in the product to decrease its temperature and moisture content, characterized by utilizing one lot of the product under high vacuum in an atmosphere of steam as a condenser for another lot of the product under relatively high pressure and temperature in an atmosphere of steam.

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