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DRYING PROCESS

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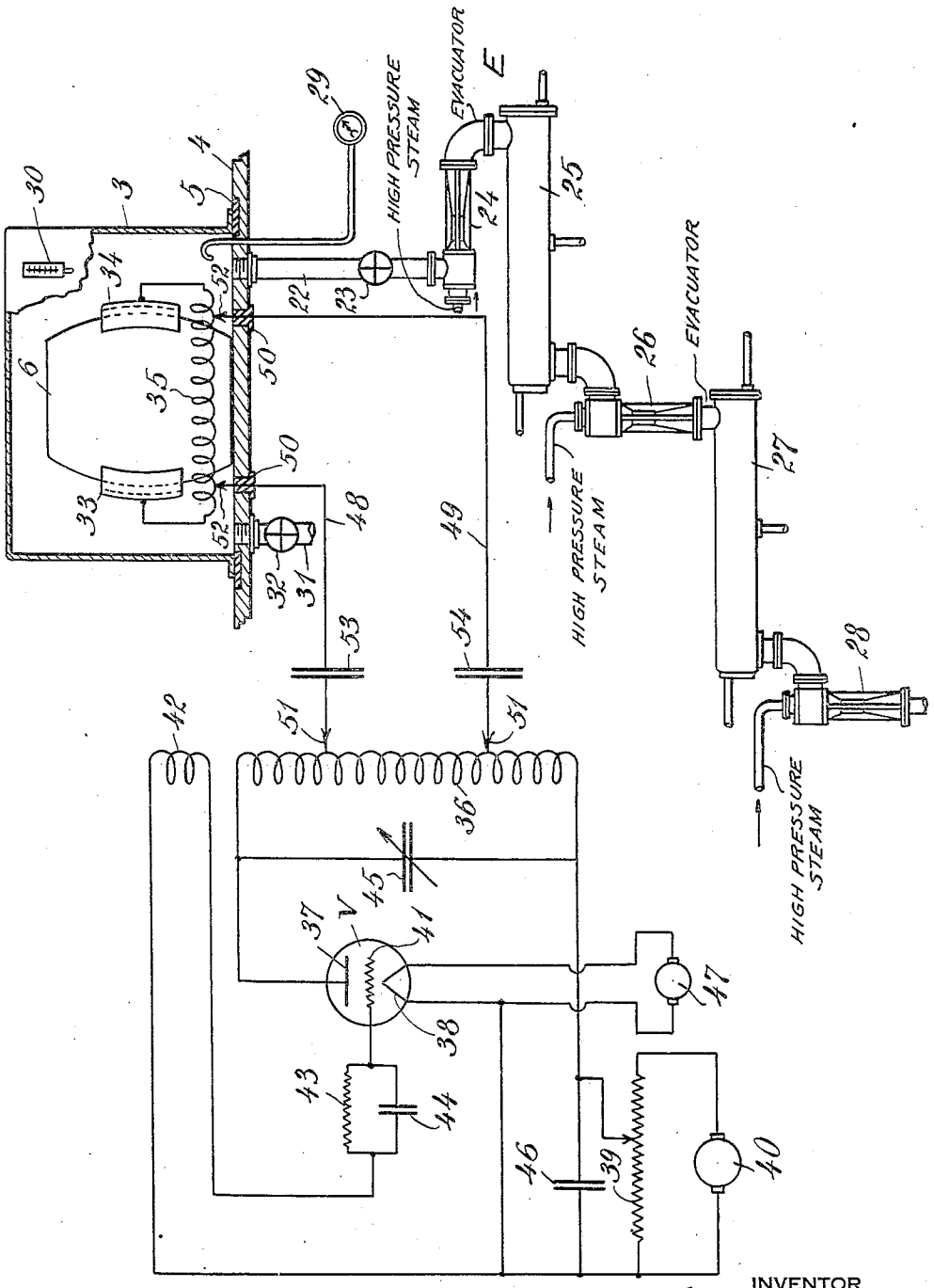

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DRYING PROCESS

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This invention relates to an improved process for reducing the moisture content of tobacco.

In the aging of tobacco, the so-called green tobacco, which has been sun or flue cured by the grower, has a relatively high moisture content, so high in fact that fermentation or other deterioration or spoiling takes place if the tobacco is allowed to stand in closely packed condition for any considerable length of time. Since tobacco is usually aged for a period of two or more years and is tightly packed in hogsheads for convenience in handling and shipment, it is essential that the moisture content be reduced before aging.

Tobacco has in the past been dried prior to aging by exposing the tobacco leaves to the action of heated air and for this treatment, it is necessary to unpack the tobacco from the hogsheads before and re-pack it after the drying operation. Since the packed tobacco is very tightly compressed within the hogsheads, it is frequently necessary to break the hogsheads open in order to get the tobacco out without undue tearing of the leaves. Further, the dried tobacco is quite fragile, and considerable shattering of the leaves during handling and re-packing is unavoidable. Because of the losses due to broken hogsheads and shattered tobacco as well as the labor costs incident to handling and air drying the loose tobacco, known drying operations are very expensive.

It is proposed in accordance with the present invention to provide an improved process for drying tobacco and more particularly, a process capable of reducing the moisture of tobacco without physically disturbing this material, whereby the moisture content of tightly packed tobacco can be reduced without loosening the material or removing it from the hogshead or other packing container in which it is enclosed. Another object of the invention is to provide a drying process which can be rapidly and economically performed.

In general, the above and other objects of the invention are carried out by subjecting the tobacco to a relatively high vacuum to cause evaporation of moisture therefrom, and setting up an electro-static field in the tobacco to supply heat thereto which replaces at least a part of the heat lost as latent heat of vaporization during the vacuum evaporation. The amount of heat supplied to the tobacco in carrying out the process may be considerably varied depending upon the kind of tobacco under treatment, the initial temperature thereof, the amount of moisture to be extracted therefrom and other factors. In general, the amount of heat added should be sufficient to maintain the material within a temperature range high enough so that the desired amount of moisture can be readily removed by vacuum evaporation, but not so high as to cause heat deterioration of the tobacco under treatment.

In describing the invention in detail, reference will be made to the accompanying drawing in which the single figure is a diagrammatic and simplified representation of apparatus for carrying out a typical embodiment of the improved process.

Referring to the drawing, the apparatus there represented comprises generally a vacuum chamber or bell **3** removably mounted on a platform or base **4** together with means for evacuating the chamber. In the vacuum chamber shown, the vacuum bell **3** is disposed with its lower edges resting on a gasket **5** carried by the base **4**. With this arrangement, the bell **3** may be readily lifted to permit the insertion and removal of the material under treatment. A packed tobacco hogshead **6** has been represented within the bell **3**.

Suitable means are provided for controllably evacuating the chamber formed by the bell **3**. Although various forms of pumps or other suction devices might be used with good results, it has been found that steam jet evacuators are very well suited for this purpose. Accordingly, there has been illustrated in the drawing a three-stage evacuator E having its intake connected to the vacuum or suction pipe **22** leading to the interior of the bell **3** through the base **4**. A control valve **23** is preferably provided in the suction pipe **22**. The evacuator illustrated includes a first stage steam jet booster **24**, an inter-condenser **25**, a second stage steam jet booster **26**, a second inter-condenser **27** and a third stage steam jet booster **28**. The number of stages of evacuating boosters may be increased or decreased, and the invention is in no way limited to the use of the three-stage apparatus illustrated. Since multi-stage steam jet evacuators of the type illustrated are well known in the art, a detailed description of the construction thereof will not be given.

The vacuum or absolute pressure within the bell **3** may be indicated by a suitable gauge **29** and the temperature by a thermometer **30**. Suitable means are provided for admitting air to break the vacuum within the bell **3** and as shown, a pipe **31** passing through the base **4** and controlled

by the valve 32 may be employed for this purpose.

Suitable means are provided for setting up an alternating electro-static field in the mass of tobacco under treatment whereby the tobacco is heated. Various forms of apparatus may be employed for this purpose, and in general, the field is set up by impressing a high frequency alternating potential difference between spaced plates or other conductive elements disposed adjacent and preferably on opposite sides of the mass of tobacco under treatment.

In the embodiment disclosed in the drawing, two conductive radiating plates 33 and 34 are disposed at spaced points within the bell 3 on opposite sides of and closely adjacent the tobacco hogshead 6. The plates 33 and 34 are respectively connected to opposite ends of a terminal feed coil 35 which is supplied with radio-frequency alternating current energy from a suitable source as hereinafter explained. It is to be understood that the plates 33 and 34 and the coil 35 have been illustrated in a diagrammatic manner. Thus these elements may be supported by the conductors connected thereto or by suitable insulating supports of high dielectric strength as may be necessary or expedient. Further, the coil 35 may be of any suitable shape, size and number of turns, and may be disposed in various positions within the bell 3.

Suitable means are provided for supplying high frequency alternating current to the terminal feed coil 35 whereby a high frequency potential difference is set up between the radiating plates 33 and 34. The frequency of the alternating current energy so supplied is preferably in the radio-frequency range, that is, above about 25,000 cycles per second. Various devices may be used to supply such current, and a radio-frequency oscillator has been diagrammatically illustrated as typical of such devices.

The radio-frequency oscillator shown comprises a thermionic vacuum tube V having an output coil 36 connected between its plate 37 and filament 38 through a circuit including a variable uni-directional plate voltage source comprising a potentiometer 39 bridging the terminals of a direct current generator 40. The circuit between the grid 41 and filament 38 of the tube V includes a feed-back coil 42, and a grid leak 43 and condenser 44 are connected in this grid circuit in accordance with conventional practice. A variable tuning condenser 45 is connected across the output coil 36 and serves to variably control the frequency of the current produced. A by-pass condenser 46 is connected across the potentiometer 39. The filament 38 is supplied with heating current from a suitable source illustrated as a separate generator 47.

The radio-frequency oscillator operates in a known manner to generate radio-frequency currents in the output coil 36. The output of the oscillator, that is, the magnitude of the currents produced, can be variably controlled by altering the plate circuit voltage through adjustment of the potentiometer 39, and the frequency of such currents can be changed both by the potentiometer and by adjustment of the variable condenser 45.

The high frequency currents generated by the radio-frequency oscillator are impressed upon the terminal feed coil 35 through a suitable feed line illustrated by the wires 48 and 49. These wires pass through insulating bushings 50 in the base 4 of the bell 3. The input terminals 51 of the feed line wires 48 and 49 are adjustably connected to spaced points on the oscillator output coil 36 and the output terminals 52 of these wires are similarly adjustably connected to spaced points on the terminal feed coil 35. The feed line circuit is preferably balanced, and this is accomplished by properly adjusting the connections of the terminals 51 and 52 to the coils 36 and 35 respectively whereby the effective inductances of those portions of the oscillator output coil 36 and the terminal feed coil 35 included in the feed line circuit may be balanced. The final adjustment should, of course, be made with the hogshead 6 and the bell 3 in their operating positions relative to the coil 35 and the plates 33 and 34 so that the influence of these bodies on the effective inductance of the coil 35 may be taken into account. This final adjustment with the bell 3 in position may be effected by shifting the line terminals 51 with respect to the oscillator output coil 36. Blocking condensers 53 and 54 may be inserted in series with the feed line wires 48 and 49 to protect the circuit against overloads due to grounding or short circuits. The feed line wires 48 and 49 are preferably rather widely spaced by suitable insulating supports to avoid an effective capacitative coupling between these wires.

In carrying out the process of the invention, a mass of tobacco to be dried, which may be tightly packed within the hogshead 6, is placed between the radiating plates 33 and 34. The bell 3 is placed over the hogshead 6 and seated on the gasket 5 of the base 4. The heads may be removed from the hogshead 6 before treatment if desired, but this is not essential since tobacco hogsheads are not fluid-tight. With the hogshead 6 and bell 3 in position, the inductances in the feed line may be balanced as described above, but this balancing need not necessarily be repeated for each hogshead treated. With the valve 32 closed and the valve 23 open, the evacuator E is operated whereby a vacuum is created within the bell 3. This vacuum causes evaporation of moisture from the tobacco, and the moisture is drawn off by the evacuator E. As the moisture evaporates, heat is absorbed from the tobacco to supply the latent heat of vaporization, and unless heat is supplied or generated to replace this loss, the tobacco temperature would quickly fall to a point where little if any further evaporation could be obtained. According to the invention, heat is supplied to the tobacco by creating an alternating electro-static field therein with a resultant generation of heat. In this manner, the tobacco temperature is kept high enough to permit rapid evaporation of the desired amount of moisture from the tobacco. The alternating electro-static field is set up or created within the tobacco by impressing a high frequency potential difference between the radiating plates 33 and 34, and this potential difference is produced by the currents generated in the radio-frequency oscillator and supplied to the terminal feed coil 35.

The tobacco may be successively subjected to the vacuum evaporation and the action of the alternating electro-static field for heating, but it is generally preferred that these treatments be simultaneously applied.

The above described process is continued until the moisture content of the tobacco has been reduced to the desired point, whereupon the valve 23 is closed, operation of the evacuator E and the radio-frequency oscillator is discontinued and the vacuum within the bell 3 is broken by

opening the valve 32 or otherwise to permit removal of the bell 3 from the hogshead 6.

Although the invention is in no way limited to any particular theory of operation, it is believed that the alternating electro-static field created in the tobacco sets up or induces electronic or ionic movements or oscillations in the tobacco, and that the heat results from these movements or oscillations.

The amount of heat supplied to the tobacco during the process, while sufficient to at least partially replace the heat lost as latent heat of vaporization should be so limited that the tobacco temperature does not rise to values at which heat deterioration thereof takes place. The amount of moisture removed from the tobacco under treatment may be regulated to the desired value in various ways. The moisture removed is a function of the degree of vacuum employed, the time of vacuum treatment and the tobacco temperature during evacuation. The time of vacuum treatment and degree of vacuum employed may be varied by controlling the operation of the evacuator E and the temperature of the tobacco may be regulated by varying the amount of heat supplied thereto through changes in the output of the radio-frequency oscillator. By properly adjusting these several factors, the moisture content of the tobacco can be reduced to practically any desired value and the tobacco temperature can be maintained well below injurious values throughout the process.

In the foregoing specification and appended claims, the reference to the material under treatment as tobacco does not preclude the application of the process of this invention to other substances or materials to which it may be found applicable.

I claim:

1. A process for drying tobacco comprising subjecting a mass of tobacco to a vacuum whereby moisture is evaporated therefrom, and simultaneously creating an alternating electro-static field in the tobacco mass whereby at least a part of the heat absorbed from the tobacco as latent heat of vaporization during the vacuum evaporation is replaced.

2. A process for drying tobacco comprising subjecting a mass of tobacco to a vacuum whereby moisture is evaporated therefrom, and during such vacuum evaporation, creating an alternating electro-static field in the tobacco mass to supply heat thereto whereby at least a part of the heat absorbed from the tobacco as latent heat of vaporization by the vacuum evaporation is replaced.

3. A process for drying tobacco comprising subjecting a mass of tobacco to a vacuum whereby moisture is evaporated therefrom, and simultaneously creating a radio-frequency alternating electro-static field in the tobacco mass to supply at least a part of the heat absorbed from the tobacco as latent heat of vaporation during the vacuum evaporation.

4. A process for drying tobacco comprising subjecting a mass of tobacco to a vacuum whereby moisture is evaporated therefrom, and simultaneously impressing a radio-frequency alternating potential difference between spaced conductive elements adjacent the tobacco mass to supply at least a part of the heat absorbed therefrom as latent heat of vaporization during the vacuum evaporation.

5. A process for drying tobacco comprising subjecting a mass of tobacco to a vacuum whereby moisture is evaporated therefrom, and while the moisture is being evaporated impressing a radio-frequency alternating potential difference between spaced conductive elements disposed adjacent and on opposite sides of the tobacco to supply at least a part of the heat absorbed from the tobacco as latent heat of vaporization during the vacuum evaporation.

6. A process for drying packed tobacco comprising subjecting a packed hogshead of tobacco to a vacuum whereby moisture is evaporated from the tobacco and drawn from the mass thereof, and while the moisture is being evaporated creating an alternating electro-static field of radio-frequency in the mass of packed tobacco to supply at least a part of the heat absorbed from the tobacco as latent heat of vaporization during such vacuum evaporation.

7. A process for drying packed tobacco comprising subjecting a mass of such tobacco to a vacuum whereby moisture is evaporated therefrom and simultaneously creating in the tobacco mass an alternating electrostatic field of such magnitude that the tobacco is supplied with an amount of heat sufficient to at least partially replace the heat absorbed as latent heat of vaporization but insufficient to raise the tobacco temperature to a value at which heat deterioration takes place.

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