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APPARATUS FOR MOISTENING TOBACCO AND OTHER PRODUCTS IN BULK

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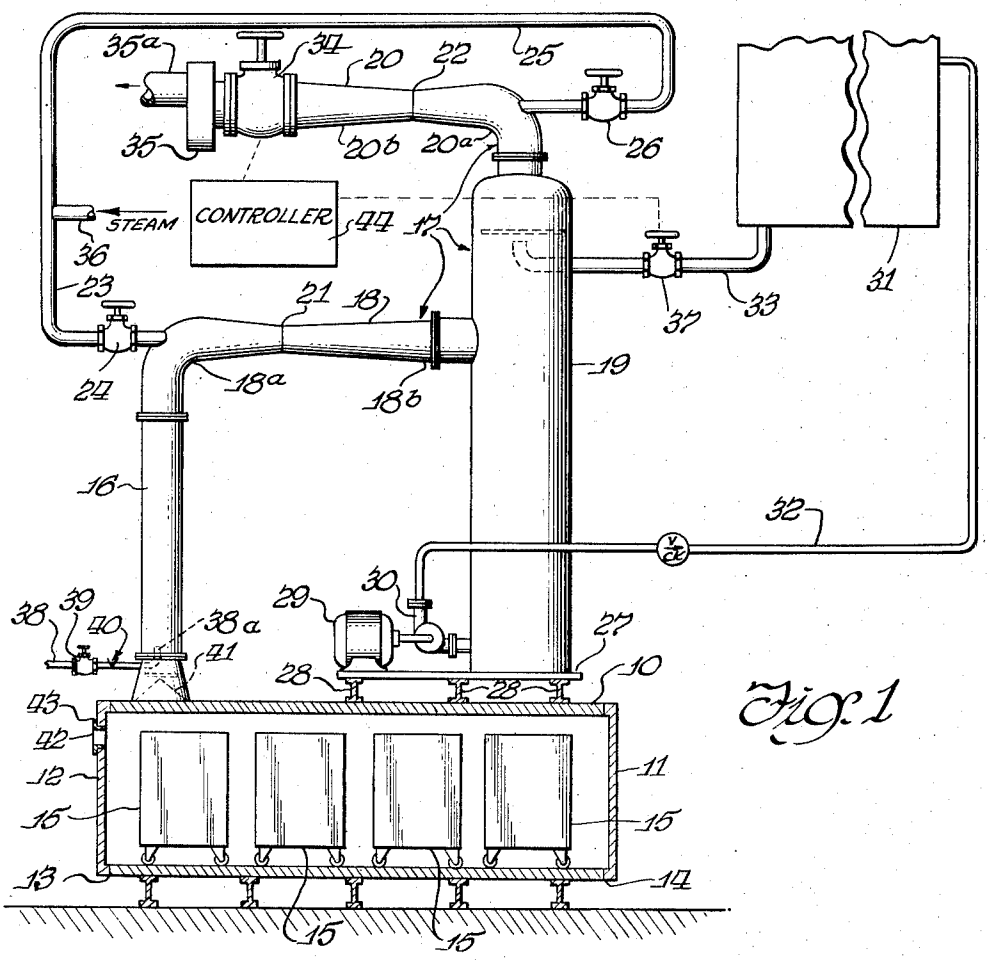


Fig. 1

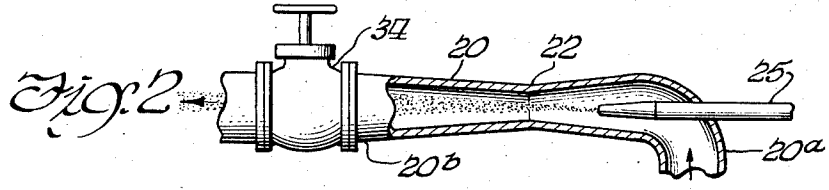


Fig. 2

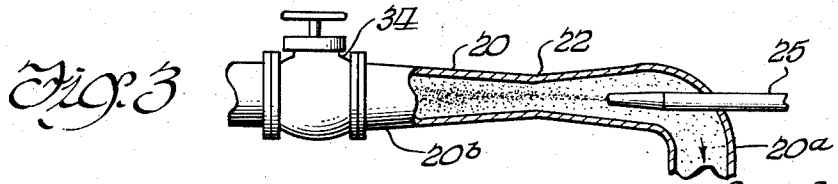


Fig. 3

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APPARATUS FOR MOISTENING TOBACCO AND OTHER PRODUCTS IN BULK

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7 Claims. (Cl. 131—133)

My invention relates to a mechanism for moistening organic products in bulk and, more particularly, for moistening tobacco in hogsheads.

During the relatively long period between the time tobacco is picked and its ultimate use it is desirable, at various times, to add moisture to the product. For example, when tobacco is aged it becomes dry and brittle and cannot be handled without damage to the leaves. It is therefore necessary to apply moisture to the tobacco to render it fit for handling in further operations.

It has been found that for the most satisfactory introduction of moisture to products in bulk it is necessary to first remove the air which permeates the product before applying the moisture to the product. This prevents incondensible air pockets in the product from blocking penetration of the moisture to the center of the cells of the products. The present method for introducing moisture to tobacco or other organic products is to provide a relatively air-tight chamber which receives the product. Means for controllably evacuating this chamber, usually a steam evacuator, is provided to subject the product to a high vacuum. After the desired vacuum has been reached steam is added to the chamber through a separate and independent system. This system includes means to add water to the steam before introduction to the chamber to provide a steam of proper quality to achieve the desired moistening effect. After the steam has been introduced, the chamber is again evacuated until a sufficiently low pressure is reached to cause a boiling of the moisture in the product. This boiling washes out the residual noncondensibles. The introduction of steam and evacuation is repeated until there is a uniform distribution of moisture throughout the product.

In addition to the moistening process, there are other processes where it is desirable to apply steam to tobacco or other organic products. For example, it is sometimes necessary to fumigate the product. The fumigant may be introduced to and removed from the product in superheated steam, using the same apparatus used for the moistening process.

Apparatus presently used in adding moisture to tobacco requires two separate systems, one for the introduction of the steam to the chamber and the other for the evacuation process. In the present invention the steaming and evacuations are accomplished with a single simple system, resulting in a corresponding reduction in piping, valves, and associated equipment. In addition, the apparatus of the present invention greatly facilitates operation of the steaming cycle. This is a distinct advantage to the smaller processors who cannot afford a fully automatic installation and must rely on manually controlled apparatus. Another feature of the present invention is a simple, reliable means for introducing water to the steam before it enters the chamber.

In brief, a hermetically sealed chamber is provided to receive the tobacco or other products in bulk. The chamber is connected to a gas exhaust passage or steam evacuator system which receives a relatively high pressure steam at the upstream side. A valve on the downstream side opens to the atmosphere. During the steaming operation water is introduced into the passage connecting the chamber to the steam evacuator. A pipe, with a valve, connected to a source of water extends into the passage with the axis at the discharge end of the pipe parallel to the axis of the passage. A needle valve in the pipe and a screen across the passage at the point of entry into the chamber causes a proper mixing of the steam and water.

During the evacuating process the valve on the downstream side of the steam evacuator is opened to the atmosphere and the valve in the pipe connecting the source of water is closed. The steam passes through the evacuator system at high velocity and low pressure, drawing the air or steam out of the chamber. When the desired vacuum is reached, the valve on the downstream side of the steam evacuator is closed, preventing the exit of steam into the atmosphere. The steam received by the evacuator system is thus forced into the chamber containing the product. The water valve is opened to supply water for mixture with the steam to provide a steam of proper quality for moistening the product. To re-evacuate the chamber, the water valve is closed and the steam evacuator valve is again opened to the atmosphere. This process is repeated until a desired uniform moisture permeates the product. Thus the steaming and evacuation process are accomplished by a single system by reversing the flow of steam through the system and adding moisture to the steam only during the steaming process.

It is therefore a general object of the present invention to provide a simple apparatus for introducing moisture to organic products, such as tobacco, in bulk.

It is another object of the present invention to provide apparatus combining in a single system means for evacuating air or steam from, and introducing steam to, a chamber receiving tobacco or other organic products.

It is yet another object of the present invention to provide a gas exhaust passage connected to a chamber containing tobacco in bulk which can be closed to apply steam to the tobacco.

It is still another object of the present invention to provide apparatus for mixing water with steam to produce steam of the proper quality for applying moisture to organic products.

A further object of the present invention is to provide an improved system for treating organic products which selectively uses a steam evacuator for purposes of evacuation or for the purpose of introducing steam, as desired.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together

with further objects and advantages thereof, will best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a side elevational view of the present invention;

Figure 2 is an enlarged view of the final stage of the steam evacuator system showing steam passing out into the atmosphere through the open valve; and

Figure 3 is the same as Figure 2 except that the valve is closed and the steam is shown being forced back through the gas discharge passage.

Construction

Referring now to Figure 1, a hermetically sealed or air-tight chamber **10** is provided with doors **11** and **12** at either end. The doors have sealing gaskets **13** and **14** around their edges to form air-tight seals when closed. A window **42**, having an air-tight seal **43**, is mounted in door **12**. Containers **15**, holding tobacco or other organic products to be moistened, are received within the chamber **10**.

A gas exhaust passage consisting of discharge pipe **16** and the evacuator system **17** is connected to the chamber **10**. Discharge pipe **16** defines a passages between the chamber **10** and the steam evacuator system shown generally at **17**. The steam evacuator system in the particular apparatus herein described comprises a first stage evacuator, shown generally at **18**, an intermediate condenser **19**, and a final stage evacuator, shown generally at **20**.

The first stage evacuator **18** consists of a pipe having a restricted passage **21**. A steam discharge pipe **23** receives steam from pipe **36** which is connected to a source of relatively high pressure steam (not shown). Pipe **23** is connected to the first stage evacuator **18** at its upstream end **18***a*. The admission of steam to evacuator **18** is regulated by valve **24** connected to pipe **23**. Discharge pipe **16**, leading to chamber **10**, is connected to the first stage evacuator near its upstream end **18***a*. At its downstream end **18***b* the first stage evacuator connects to condenser **19**.

The final stage evacuator **20** is connected at its upstream end **20***a* to condenser **19**. The construction of the final stage evacuator **20** is similar to the construction of evacuator **18**, having a restricted passage **22** and a steam discharge pipe **25** receiving steam from the source of steam through pipe **36**. Pipe **25** is connected to the upstream end **20***a* of evacuator **20**. Valve **26**, connected to pipe **25**, regulates the admission of steam to the final stage evacuator **20**.

A shut off valve **34** is connected to the downstream end **20***b* of the final stage evacuator **20**. The outlet side of valve **34** connects to a heater **35** which utilizes the heat of the steam discharged from the evacuator system to heat water fed to the boiler. The heater outlet **35***a* discharges to the atmosphere.

The condenser chamber **19** is installed on a platform **27** affixed to the top of three I beams **28** attached across the top of chamber **10**. An electric motor **29**, also mounted on platform **27**, drives hydraulic pump **30** connected to the bottom of condenser **19**. Hydraulic pump **30** is connected to the water cooling tower **31** by pipe **32**. The water cooling tower **31** is installed above the condenser **19** and is connected to it by pipe **33**. Valve **37** regulates the entry of water to the condenser from the water cooling tower **31**.

A source of water (not shown) is connected by water pipe **38** to discharge pipe **16**, which latter pipe also serves to carry the steam into chamber **10**. Water pipe **38** has a valve **39** to regulate the quantity of water admitted to discharge pipe **16**. A needle valve **40** is installed in water pipe **38** between valve **39** and the point where water pipe **38** enters discharge pipe **16**. Inside the discharge pipe **16** water pipe **38** is bent at a 90° angle so that its discharge

end **38***a* is parallel to the axis of pipe **16**. The discharge end **38***a* of water pipe **38** may either be turned up, as shown in Figure 1, or turned down. A conical shaped screen **41**, which may be of 16 gauge wire on ⅛ inch centers, is installed in discharge pipe **16** in inverted position across the opening of pipe **16** into chamber **10**.

Operation

At the beginning of the initial evacuation of chamber **10**, steam discharge valve **26** and shut off valve **34** are opened permitting steam to flow from its source through the final stage evacuator **20** into the atmosphere, as shown in Figure 2. Valve **24** is then opened sending steam through the first stage evacuator **18** into the condenser. Cooling water is circulated through the condenser **19** by opening valve **37** in the line from the water cooler **31** and pumping water from the bottom of the condenser **19** to the water cooler **31** by means of hydraulic pump **30**. During this process a high vacuum is created in condenser **19** by the action of the final stage evacuator **20** and by the contraction of steam entering the condenser **19** from the first stage evacuator **18**. With a high vacuum at the downstream end of the first stage evacuator and with the steam under an initial pressure of at least 75 pounds per square inch, the steam reaches a high velocity passing through the first stage evacuator **18**. This causes a low pressure in the evacuator **18** and air is drawn out of chamber **10** through discharge pipe **16**. During the evacuation process valve **39** in the water line is closed.

After the chamber **10** is exhausted, shut off valve **34** is closed. This stops the exit of steam from the gas exhaust passage into the atmosphere. With the exit into the atmosphere blocked and a vacuum existing in chamber **10** the steam reverses its flow through the gas exhaust passage. Steam from discharge pipe **25** is forced back into the condenser **19** as shown in Figure 3. Similarly, steam from pipe **23** (Figure 1) is drawn into discharge pipe **16**. At approximately the same time that shut off valve **34** is closed, valve **37** is closed to stop entry of water into the condenser **19** from the water cooler **31**. If desired, valves **34** and **37** may be operated simultaneously by electrical means (not shown) and controlled by a single controller **44** as shown diagrammatically in Figure 1.

The steam as used in the evacuation process is in a superheated state. However, the steam used to add moisture to the products in the treating chamber should be in the saturated state. Since in the present invention a single system is used having a single source of steam to both evacuate and add steam to the chamber **10**, it is necessary to have controllable means in the system to add moisture to the steam when the system is operating as source of moisture for the products. This is achieved by water pipe **38** leading from a source of water (not shown), valve **39**, needle valve **40**, the elbow bend **38***a* in pipe **38**, and the screen **41**. Shortly after the flow of steam is reversed in the system valve **39** is opened to permit water to flow into discharge pipe **16**. Needle valve **40** acts to break up the stream of water into small droplets, creating a mist. This mist is directed through pipe bend **38***a* into the flow of steam in discharge pipe **16** in a direction parallel to that flow. The screen **41** is located across the passage defined by discharge pipe **16** at a point between the entry of the mist to that passage and the air-tight chamber. Thus the mist will contact the screen **41** with full impact to aid in mixing with the steam which carries it throughout the treating chamber. It has been found by experiment that for most satisfactory moistening of the product in bulk the proper quantity of water to admit through valve **39** is the minimum amount which will produce a fog in chamber **10**. This condition can be observed through window **42**, and valve **39** regulated accordingly.

With the introduction of steam to the chamber, the temperature in the chamber rises. As the temperature of the vapor in the chamber approaches within 10 to 20

degrees Fahrenheit of the desired ultimate chamber temperature, which for example, would be approximately 160 degrees Fahrenheit for Burley tobacco, it is desirable to reduce the steam flow to the chamber to permit a slower approach to the desired temperature. To reduce the flow of steam, valve 24 may be closed.

When the ultimate desired temperature in the chamber is reached, the re-evacuation of the chamber is begun. Initially valve 39 is closed to stop the entry of moisture into discharge pipe 16 and valve 34 is opened to permit exit of the steam into the atmosphere. Valve 37 is opened to begin circulation of water through the condenser 19. When the pressure in the chamber is reduced to about 3 inches of mercury absolute valve 24 is opened to reactivate the first stage evacuator 18. At about 2 inches of mercury absolute valves 34 and 37 are closed and valve 39 opened to begin the resteaming process. Normally, to achieve a satisfactory uniform distribution of moisture throughout the bulk product three steamings and three evacuations are desirable.

The apparatus herein described is not limited in its use to the introduction of moisture to the product in bulk. It is sometimes desirable to introduce other matter to the product, such as fumigating chemicals. It may be desirable to carry this matter to the chamber 10 in a superheated steam. The apparatus and process described herein can be used by introducing the desired chemical to the system into discharge pipe 16 in lieu of water as described in the moistening process.

While I have shown and described specific embodiments of the present invention it will, of course, be evident that various modifications and alternative constructions may be made without departing from the true spirit and scope thereof. Particularly, the present invention is not limited to the use of a two stage evacuator system as shown, but may be incorporated in a single or multi-stage system. I therefore intend by the appended claims to cover all such modifications and alternative constructions as come within their true spirit and scope.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means defining a gas exhaust passage from the chamber, said means including a plurality of restricted passages defining evacuators; means defining a steam condenser chamber in said passage between two of said restricted passages; means to cool said condenser chamber to condense steam therein; steam discharge pipes connected to said source and in discharge relation to the restricted passages, respectively, each pipe being oriented in the exhaust direction to effect cumulative gas evacuation from the chamber in conjunction with the action of the condenser when normal steam flow and condenser cooling action takes place; and a shut off valve located in the exhaust passage downstream of the plurality of evacuators, whereby when the valve is closed and the condenser not cooled the direction of steam flow throughout the exhaust passage is reversed to introduce steam into the chamber.

2. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means defining a gas exhaust passage from the chamber, said means including a plurality of restricted passages defining evacuators; steam discharge pipes connected to said source and in discharge relation to the restricted passages, respectively, each pipe being oriented in the exhaust direction to effect cumulative gas ejection from the chamber when normal steam flow takes place; and a shut off valve located in the exhaust passage downstream

of the plurality of evacuators, whereby when the valve is closed the direction of steam flow throughout the exhaust passage is reversed to introduce steam into the chamber.

3. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means defining a gas exhaust passage from the chamber, said means including at least one restricted passage defining an evacuator; a steam discharge pipe connected to said source and in discharging relation to the restricted passage, the pipe being oriented in the exhaust direction to eject gas from the chamber when normal steam flow takes place; a shut off valve located in said gas exhaust passage downstream the steam discharge pipe, whereby upon valve closure the steam flow is reversed to travel through said passage and into the chamber.

4. In a machine for treating organic products having a source of steam and a relatively air-tight chamber to receive the organic products, the improvement comprising: an evacuating system having a plurality of restricted passages in a gas exhaust passage from the chamber; means defining a condenser chamber between two of the restricted passages; controllable means to cool the condenser chamber to condense the steam therein; a plurality of steam pipes from the source of steam connected to the restricted passages of the evacuating system and oriented in the discharge direction to produce an evacuation of the relatively air-tight chamber in cooperation with the condensation of the steam flowing through the condenser as cooling takes place; a shut off valve in the evacuating system downstream of the restricted passages as steam flows during evacuation to check the flow of steam and reverse its course through the restricted passages forcing it into the air-tight chamber; and electrically operable means to close the shut off valve and stop the cooling of the condenser in one operation.

5. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means dening a gas exhaust passage from the chamber, said means including at least one restricted passage defining an evacuator; a steam discharge pipe connected to said source and in discharging relation to the restricted passage, the pipe being oriented in the exhaust direction to eject gas from the chamber when normal steam flow takes place; a shut-off valve in the gas exhaust passage downstream of the restirdted passage as normal steam flow takes place to check the flow of steam and reverse its course forcing it back through the gas exhaust passage into the air-tight chamber; and means located in the path of travel of the reversed steam flow to introduce water in mist form to desuperheat the steam prior to entry into said chamber.

6. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means defining a gas exhaust passage from the chamber, said means including at least one restricted passage defining an evacuator; a steam discharge pipe connected to said source and in discharging relation to the restricted passage, the pipe being oriented in the exhaust direction to eject gas from the chamber when normal steam flow takes place; and means located in said gas exhaust passage downstream of the steam discharge pipe as normal steam flow takes place to shut off the passage and direct the steam flow into the chamber.

7. In a machine for treating organic products with steam including a source of steam at relatively high pressure and a hermetically sealed chamber to receive the organic products, the improvement comprising: means

defining a gas exhaust passage from the chamber, said means including at least one restricted passage defining an evacuator; a steam discharge pipe connected to said source and in discharging relation to the restricted passage, the pipe being oriented in the exhaust direction to eject gas from the chamber when normal steam flow takes place; and means located in said gas exhaust passage downstream of the steam discharge pipe as normal steam flow takes place to shut off the passage and direct the steam flow back through the gas exhaust passage into the chamber.

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