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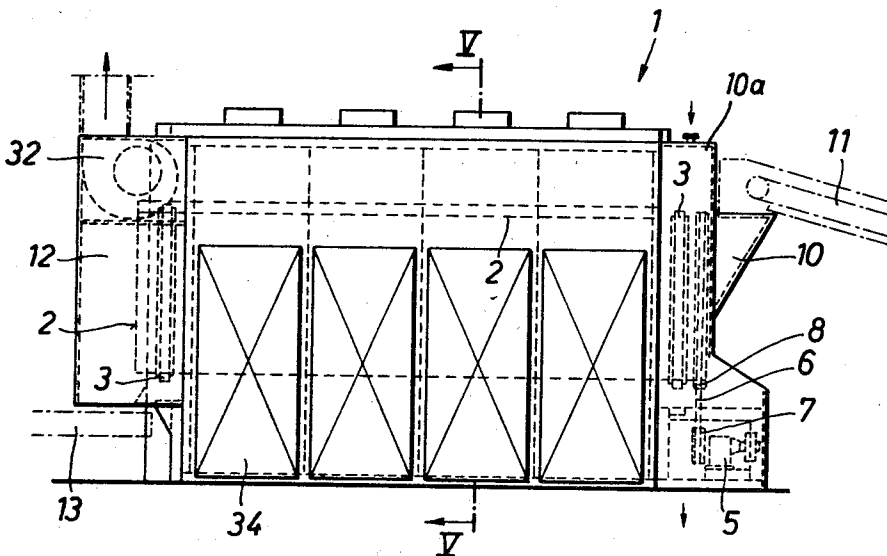
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[54] **APPARATUS FOR TREATING FIBROUS MATERIAL**
12 Claims, 6 Drawing Figs.

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 [51] Int. Cl. F26b 11/04
 [50] Field of Search 34/13, 131,
 129, 33, 139, 142, 212, 213, 217

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ABSTRACT: This disclosure provides an apparatus for drying fibrous materials such as tobacco. The fibrous material being treated is moved in an axial direction through a drum wherein treating medium is passed through the material in a substantially transverse or radial direction with respect to the drum. The treatment medium may be air used in a drying operation or other types of treating fluids used in operations such as remoisturizing or impregnating. Various auxiliary devices may be used to control the atmospheric conditions within the drum and the treatment medium which is passed transversely through the charge of fibrous material moving through the drum in an axial direction.



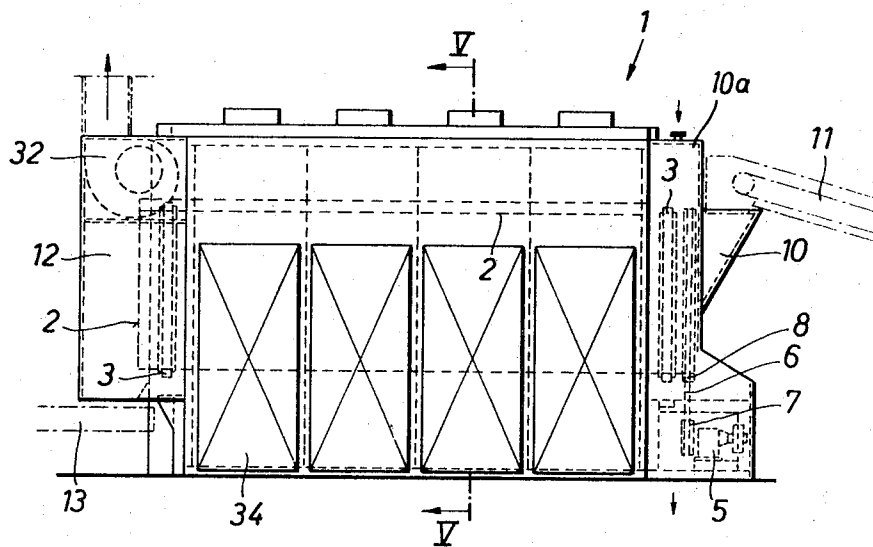


FIG. 1

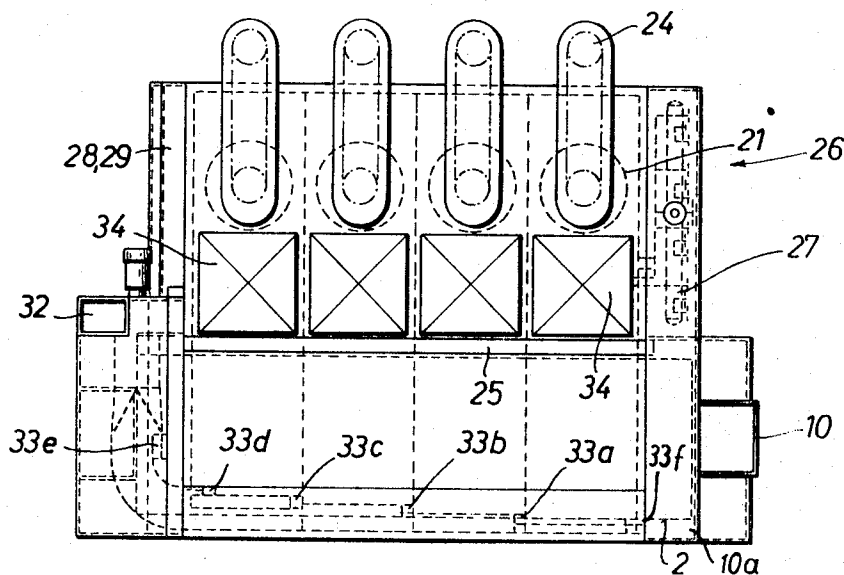
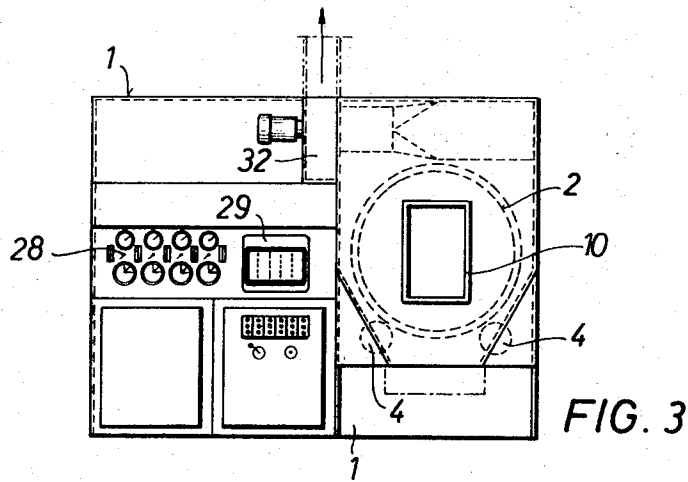
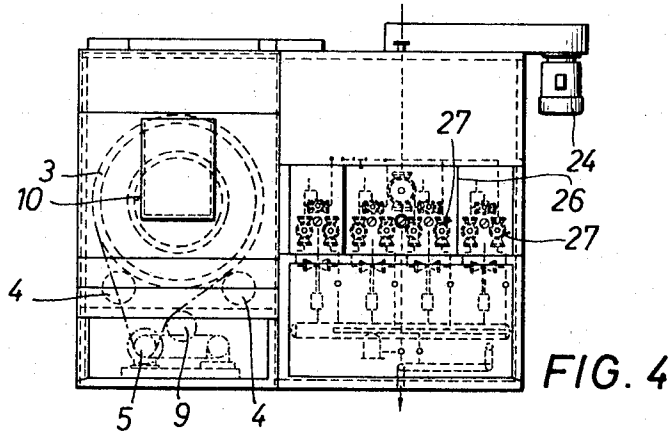
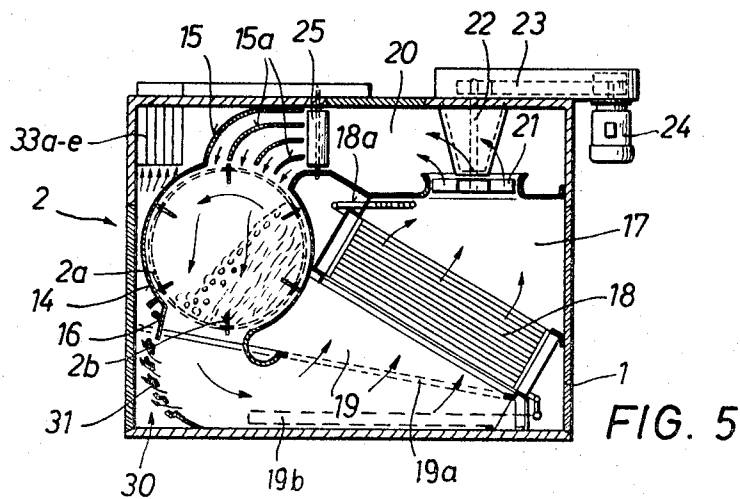


FIG. 2

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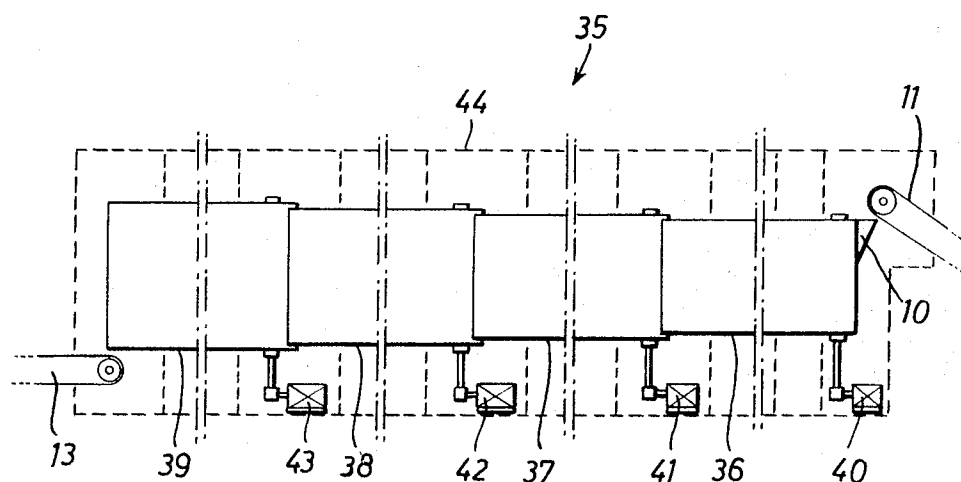


FIG. 6

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APPARATUS FOR TREATING FIBROUS MATERIAL

BACKGROUND OF THE INVENTION

The processing of fibrous materials such as tobacco includes such operations as drying, remoisturizing and impregnating treatments. A typical prior art process of drying a moist tobacco is generally performed in the tobacco processing industry with a drum dryer. The moist tobacco is conveyed axially in a rotary drum that is equipped with means for conveying the material in an axial direction as the drum revolves. A heated current of air is passed through the drum to remove the moisture content of the tobacco. These prior art processing treatments require the dry air to be axially guided through the drum in either a direction corresponding to or flowing against the direction of tobacco movement through the drum dryer. The efficiency of such drum dryers is limited. Process parameters include the strength of the air current through the drum as well as the temperature of the air being used. These parameters are limited in their control and therefore the tobacco is not hurried through the drum to accomplish the desired drying effect. There is an occasional over intensive drying occurring at the beginning of the operation under conditions which presently prevail in the prior art. Generally, the drying process cannot be sensitively controlled to the degree desired.

The known drum dryers are often used in combination with direct or indirect heating of the drum wall itself. Furthermore, it is uneconomical to perform the drying operation in different zones within the drum dryer. The prior art presently uses extensive regulating devices to achieve the desired drying results. These particular extensive regulating devices are complex, expensive and prone to breakdown. Other disadvantages attendant the prior art processing operations used in the treating of fibrous materials are well known.

The processing of fibrous material such as tobacco requires various types of treatment before obtaining the final product. For example, tobacco must be treated in several different ways before it is in a cut condition for subsequent processing in a cigarette machine. Prior art fabrication processes involve the removal of tobacco from one processing device to another through the use of various types of conveying devices. These conveying devices include belt devices such as conveyor belts and double belt conveyors. Processing stages included in the preparation of tobacco are impregnation, flavoring, toasting at elevated temperatures, drying, roasting and the like. Various devices and assemblies are used for each of these different treatment processes. The various devices are located at different points within the processing plant and therefore specific transportation problems must be met. The tobacco is exposed to the atmosphere during the transporting from one operation to another. This affects the tobacco in a deleterious manner so that it is in an improper condition when entering the subsequent processing operation. Obviously, the fluctuations of various parameters in atmospheric conditions will affect the ultimate quality of the end product. The transporting of tobacco from one operation to another within air conditioned rooms would prove to be extremely expensive and uneconomical.

PURPOSE OF THE INVENTION

The primary object of this invention is to provide an apparatus for treating fibrous material such as tobacco in a simple and direct way to eliminate the attendant disadvantages prevailing in the use of prior art apparatus and processing operations.

Another object of this invention is to treat a continuous moving supply of fibrous material with a current of fluid material that is flowing in a direction substantially normal to the direction of movement of the supply of fibrous material.

A further object of this invention is to provide a drying operation wherein a heated current of air is passed substantially transversely to the path of movement of a continuous supply of fibrous material passing through a treating zone.

Another object of this invention is to treat fibrous material with a transverse flow of fluid material for the purpose of obtaining highly efficient contact between the said fibrous material and fluid material.

A still further object of this invention is to provide a quick-drying apparatus using a heated current of air which contacts the moist fibrous material in a manner which is less destructive than previous treating operations and eliminates any necessary additional heating of the drum wall.

A still further object of this invention is to provide an apparatus having a much greater capacity and a much higher efficiency in the treatment of fibrous material with a fluid medium than any known apparatus in the prior art.

A further object of this invention is to provide an apparatus which includes a rotary drum having means for supplying a flow of fluid-treating medium in a radial direction of said rotary drum.

SUMMARY OF THE INVENTION

This invention involves the directing of a fluid medium through a fibrous material which is moving through a process treatment zone. The flow of the fluid medium is substantially normal to the movement of the fibrous material through the treatment zone. The apparatus of this invention includes a revolvable drum through which the fibrous material passes in an axial direction. The drum includes structural means to direct the fluid medium in a radial direction of the drum. This necessarily causes the fluid medium to pass substantially normal or transversely to the flow of the fibrous material as it moves axially through the revolving drum.

The radially directed fluid medium may be advantageously divided up into partial currents along the length of the fibrous material as it moves through the apparatus. These partial currents can be effectively regulated with respect to temperature, volume of air, velocity and other like parameters. The parameters are controlled as a function of the condition of the fibrous material exposed to the partial air currents along the length of the material being treated. The particular processing operation is therefore easily supervised, controlled and regulated during the material's entire stay within the treating zone. The division of the total volume of air into partial air currents affords the construction of apparatus having capacity which is much greater than any heretofore known. Large amounts of fibrous material can now be quickly and efficiently treated. The apparatus of this invention therefore provides a considerable saving in space as, in addition to initial capital outlay and subsequent operating cost, the drying process used in the treatment of moistened tobacco may now be carried out in one single device whereas previously a number of smaller installations were needed. The particular method of operation provides for a sensitivity of control of various phases of the drying process that is considerably improved. That is, the particular drying process may be adapted in a distinctive manner to the particular nature of the fibrous material being treated. The current of air can be variously timed and the degree of drying can be varyingly adjusted as desired while the fibrous material is passing through the revolving drum.

It is within the contemplation of this invention that the fluid medium may include a certain amount of moisture. At the same time, this moisture may be heated or cooled as desired. The use of such moisture within the air current is highly desirable where the fibrous material is tobacco. It is known that the tobacco quality and other characteristics are affected by various process conditions that exist during the overall tobacco-drying operation. That is, it is desired that the material should occasionally be in another condition than in a continuously progressive drying state. The apparatus of this invention is directed to the carrying out of such a conditioning process.

An embodiment of the apparatus of this invention includes a rotary drum having a circumferential wall provided with gridded surfaces. The drum is surrounded by a jacket construction which includes both inlet and outlet openings located on

either side of the rotatable drum. The inlet and outlet openings together with the grilled surfaces enable the passage of air through the rotatable drum as the fibrous material moves axially therethrough. A heating appliance is included with the apparatus for controlling the temperature of the air passing through the drum. A diversion channel is associated with each pair of inlet and outlet openings. A fan and heater means are provided in each of the channels and may be independently adjusted with respect to each individual diversion channel. Any suitable device is included in the diversion channel to provide passage for an airflow. The heaters are controlled by thermostats to correlate the temperature of the air through the channel with the temperature of the surrounding atmosphere.

Another embodiment of the invention includes the use of at least two drums which are connected in series with each other. This assembly of drums is provided with a transverse flow of fluid medium for the purpose of treating the fibrous material as it passes axially through the drum assembly. The specific embodiment entails the use of drums having differing diameters being connected to provide successive zones for accomplishing successive steps in an overall treatment process. This type of an assembly not only functions as a treatment device but also as a unit for transporting fibrous material from one treatment zone to another. When the drums of the assembly are set closely together longitudinally, the fibrous material is automatically conveyed from one treatment device to the next. The fibrous material is ejected directly into the next drum by the step arrangement of the drums having different size diameters thereby conveying the fibrous material axially into the second drum.

The fluid treatment medium is passed transversely through the drum assembly so that there are not only different conditions existing from drum to drum but there may also be treatment sections which spatially succeed one another within a single drum of the assembly. The fluid treatment medium is so introduced into the drum assemblies that the condition of one section does not disturb another in carrying out the separate operations therein. This separation of treatment sections is accomplished without the necessary use of a point separating intermediate wall. Therefore, the fibrous material is not in any way hindered on its passage through the drum assembly. The use of separate treatment sections within each drum and from drum to drum enables control to be accomplished within each section to function independently and separately. It is obvious therefore that various process steps may be conducted along the entire length of the fibrous material supply as it passes through the drum assembly.

A specific embodiment of the drum assembly provides for conditioning in the first drum which also includes a remoisturizing zone. The following drum is used for impregnation. The third drum is used for flavoring the fibrous tobacco and a fourth drum is used for toasting and/or roasting the tobacco. The use of the drum assembly having the successive process operations also automatically moves the tobacco from the first drum to the last. The continuous revolving of the drums within the assembly insures the continual loosening effect to be applied to the tobacco during treatment. This clearly exposes the tobacco to the full force of the fluid medium flowing transversely through the drum assembly. The obvious advantages over the use of separate treatment stations involving the necessity for particular transportation devices is clearly seen by the use of the drum assembly of this invention. The use of additional devices to heat the walls of the drums is unnecessary to perform the processing operation.

The speed at which the drums revolve within the apparatus controls the rate at which the fibrous material falls through the transversely flowing fluid medium. The control of the drum peripheral speed clearly provides an opportunity for a simple and quick regulating of the time factor in the contacting of the fluid medium and the fibrous material. Where at least two drums are arranged in an assembly, the respective drums might be revolved in opposite directions. This type of opera-

tion provides both total mixing and turbulence of the fibrous material within the drum assembly. At the same time, the material can be fed in diametrically opposite directions. The advantages of such an operation with regard to the treatment process are obvious.

BRIEF DESCRIPTION OF DRAWINGS

Other objects of this invention will appear in the following description and appended claims, reference being made to the accompanying drawings forming a part of the specification wherein like reference characters designate corresponding parts in the several views.

FIG. 1 shows a side elevational view of an apparatus made in accordance with this invention,

FIG. 2 shows a top plan view of the apparatus of FIG. 1,

FIG. 3 is a rear elevational view of the apparatus of FIG. 1,

FIG. 4 is a front elevational view of the apparatus as shown in FIG. 1,

FIG. 5 is a cross-sectional view along line V-V of FIG. 1, and

FIG. 6 is a side elevational view of another embodiment of an apparatus made in accordance with this invention.

DESCRIPTION OF SPECIFIC EMBODIMENT

More specifically, a drum 2 is rotatably mounted in a casing 1. Runner rings 3 are mounted on the circumference of the drum 2 and are set on rollers 4. A drive motor 5 includes a pulley wheel 7 mounted on the shaft of the motor 5. The belt 6 runs over the pulley wheel 7 and through a ring 8 on the drum 2 to thereby effect the driving of the said drum 2. A tightener 9 is interposed between the motor 5 and drum 2 to control the tension on the belt 6. A conveyor device 11 transports fibrous material into a loading hopper 10 which leads through the input hood 10a to the interior of the drum 2. The conveyor device 11 may be a conveyor belt, a shaker loader or the like. A discharge hood 12 is mounted at the other end of the drum 2. The fibrous material drops out of the drum 2, falls through the discharge hood 12 and onto a conveyor device 13 which carries the material away. A perforated portion 2a of the drum 2 is located around the circumference of the drum to allow air to penetrate into or emerge from the interior of the drum 2. This perforated portion 2a may comprise sieves, grilles or the like. The perforated portion 2a may be interchangeable so that the particular size of the openings may be varied depending upon the particular use of the apparatus. With the interchangeable characteristic, the perforated portion 2a might be easily removed for quick cleaning or for simple replacement if it becomes damaged in any way. Guide means 2b which may be composed of plates and/or rows of rods mounted around the inside of the drum 2. The guide means 2b have an oblique position with respect to the drum 2 thereby causing the fibrous material to move towards the exit as the drum 2 rotates.

Air supply channels 15 are provided along the circumference of the drum 2 in a substantially transverse or radial direction to the longitudinal axis. Air is supplied through these channels 15 to treat the fibrous material as it passes through the drum 2. The supply channels or nozzles 15 lead into a jacket member 14 which surrounds the drum 2. The air used for treatment enters the drum through the nozzles 15 and is exhausted through nozzles 16 which are provided as outlet openings. The air recirculates from the exhaust nozzles 16 back to the supply nozzles 15 outside of the drum 2 by way of the chamber 17. A heat exchange member 18 located within the chamber 17 comprises a steam-heated body having a cluster of tubes. The heat exchange member 18 may be mounted in an oblique position within the chamber 17. A channel 19 is provided adjacent the nozzles 16 to direct the exhausted air from the drum 2 to the heat exchange member 18. A fan 21 is mounted in a channel 20 which leads from the chamber 17 to the supply nozzles 15. The fan 21 may be a high-performance fan having vanes which allow conveyance

of the air in one direction. In this specific embodiment, it may be desired to have the air move from above to below. The reversal of the direction of the rotation of the fan 21 would cause the air to move in the opposite direction from above to below. The vane shaft 22 of the fan 21 is driven by a belt 23 from a motor 24. The revolutions per minute of the motor 24 can be changed in any conventional manner known in the prior art. The speed of the belt 23 driving the vane shaft 22 may be advantageously changed by altering the gearing or exchanging the size of the drive pulley located on the motor 24. Regulator valves 25 are mounted in the apparatus between the channel 20 and the supply nozzles 15. The valves 25 enable the operator to distribute the air as evenly as possible over the surface of the drum 2 in the most efficient manner. The heat exchange member 18 may be supplied with either a heating medium or cooling medium depending upon the desired temperature of the air passing from the nozzles 16 and recirculating through the system to the supply nozzles 15.

At least two air circulation assemblies comprising inlet and outlet nozzles 15 and 16, air channel 19, heat exchange member 18, chambers 17 and 20, and fan 21 are distributed over the entire length of the drum 2. The location of such air circulation assemblies affords the opportunity for generating different temperatures in the various locations of the drum 2. This control of temperature is effected by altering the steam pressure in the heat exchange member 18 and/or the speed of the fans 21. The direction of airflow through a first air circulation assembly may be alternated with the flow direction of air through an adjacent air circulation assembly. That is, a first air circulation assembly may have the air flowing from nozzles 15 through the drum 2 and exhaust through nozzles 16 while an adjacent air circulation assembly may have air flowing from the nozzles 16 through the drum 2 and exhaust through the nozzles 15 on the other side of the said drum 2. The distribution of air circulation assemblies along the length of the drum 2 enables the formation of cooled zones along the drum 2 through which the fibrous material would necessarily pass as it moves longitudinally through the said drum 2.

A distributor point 26 is mounted on the front side of the casing 1 to supply steam to the heat exchange members 18. Each heat exchange member 18 can thereby be controlled automatically and independently of heat exchange members located in air circulation assemblies adjacent thereto. The valves 27 are mounted in the apparatus to effectively control the flow of steam to the heat exchange members 18. Thermostats and hydrometers 28 are located at the other side of the casing 1 from the valves 27. The atmospheric conditions within the apparatus are measured by the thermostats and hydrometers 28 and thereby automatically control the valves 27 which supply the heat exchange members 18. In addition, a recorder 29 may be mounted within the apparatus of this invention for the purpose of recording the values of the atmospheric conditions on a continuous basis.

Part of the air exhausted from nozzles 16 is diverted and led off through a chamber or branch channel 30 through the use of guide plates 31 located in the nozzles 16. As the air passes through the drum 2 from the inlet nozzle 15 to the exhaust nozzles 16, it carries water into the air circulation assembly. An exhaust fan 32 draws moisture-laden air from the exhaust nozzles 16 through the branch channel 30. Adjustable valves 33a, 33b, 33c, 33d and 33f are interposed between the exhaust fan 32 and the exhaust nozzles 16 so that air may be removed separately and independently from each of the air circulation assemblies located along the length of the drum 2. A slight upward draught may be provided within the discharge hood 12 by locating a diversion channel 33e within the input hopper 10 the said hood 12. This structural relationship prevents moist air from passing out of the lower parts of the hoods 10a and 12. The exhaust air coming from nozzles 16 has an increased moisture content as mentioned hereinabove and may be led to the outer air through the exhaust fan 32. In the event that fine dust is entrained in the exhaust air, filter devices (not shown), may be mounted within the system to remove the said

dust material from the exhaust air before being led to the outside air by the exhaust fan 32. A filter device 19a is also mounted within the air circulation assembly to capture any particles of material before the exhausted air is led or is directed through the heat exchange member 18. As is apparent from the drawings, the heat exchange member 18 is disposed in an oblique position with respect to the horizontal. This relationship enables the more efficient use of room resulting in an extremely compact apparatus. Any of the material captured by the filter device 19a may be collected in the box 19b so that the dust material might be used again. Casing 1 includes doors 34 located at numerous locations to provide easy access to the interior of the said casing 1 and therefore to the various parts of the apparatus.

Operation of the apparatus of this invention may be conducted in various ways so that different treatment effects may be obtained. A pure drying operation, drying with subsequent cooling, and the combination of drying, cooling and remoisturizing may be effected with the apparatus of this invention. It is specifically noted that the remoisturizing of a very warm tobacco of from about 90° to 100° C. is extremely difficult and requires a long period of time. Therefore, to attain a much more efficient remoisturizing operation, the temperature of the tobacco being treated must be reduced very quickly to as low a temperature as possible. That is, a much better remoisturizing of the tobacco takes place at lower temperatures. Overly warm tobacco is not desirable at the end of the process. The use of outside air or room air within the operation may present a particular problem if the ambient temperature fluctuates. When such an ambient temperature fluctuation occurs, continuous regulation is required because the cooled tobacco necessarily varies considerably from one days operation to the next. Therefore, prior art remoisturizing zones had to be continuously controlled either by hand or by means of expensive registering machines.

By using the apparatus of this invention, tobacco conditioning plants can be constantly set for remoisturization. This factor provides a uniformly moist tobacco ready for further processing as an end product from the conditioning plant. The apparatus of this invention effects this ability for constantly setting remoisturization by maintaining the cooling air at a uniform temperature over the working period of the conditioning plant which extends over a period of days. The more moist the tobacco end product is from the conditioning plant, the better the tobacco may be operated on at subsequent work stations by other machines. This condition of the tobacco enables the machines to operate with less regulation.

It is desirable that neutral areas be located between the drying, cooling and remoisturizing zones so that the effects of the cooling zone will not affect the drying and remoisturizing operations within the drum 2. To accomplish this, a section of the drum 2 is constructed without sieves. This section may be about one meter in length and placed between the sieves of the drying zone and the cooling zone. It is important that the smallest possible movement of air takes place within this particular neutral zone. This minimizes the influence of the cooling zone on the drying zone and vice versa.

In another embodiment of this invention, the device of FIG. 6, generally designated 35, has four drums 36, 37, 38 and 39. These drums 36, 37, 38 and 39 have a progressively larger diameter in the direction of movement through the said apparatus. These drums 36, 37, 38 and 39 are interconnected so that the material being treated is automatically conveyed from one drum to the next. Sieves are provided on the circumference of each drum to allow the fluid-treating medium to enter or leave the interior of each of the drums. Guide plates or vanes (not shown) are mounted in each of the drums so that the material being treated is conveyed while each drum is revolving. These guide plates or vanes have an oblique position relative to the drum exit to effect the movement of material and pass it on to the adjacent drum. An optional number of sections may be provided in each of the drums where separate radially arranged nozzles are located for either

feeding in or withdrawing the treating material. The drums 36, 37, 38 and 39 are each driven by an adjustable independent drive motor 40, 41, 42 and 43 respectively. Any suitable drive connection such as belts or the like may be used to revolve the respective drum in one direction or the other as provided by the respective drive motor. The direction of rotation of the drums can be easily adjusted and controlled. A conveyor device 11 supplies fibrous material to the drum assembly by way of the input hopper 10. The treated fibrous material which drops out of the drum 39 is carried away on a conveyor device 13. The whole assembly of drums 36, 37, 38 and 39 along with the drive motors 40, 41, 42 and 43 are housed in a casing 44.

In this specific embodiment, the drum 36 is provided with at least four treating zones. In each of these zones a fluid-treating medium can flow transversely through the fibrous material being conditioned. The entire conditioning step of the fibrous-material-processing operation will be accomplished in the drum 36. The last section of the drum 36 will be capable of remoisturizing the tobacco. The succeeding drum 37 is used for impregnating the material. The first section of the drum 37 connected directly to the last section of drum 36 is used to prepare the conditioned fibrous material for impregnating directly after passing through the remoisturizing zone. Each of the individual sections in drum 37 is intended for preparing the fibrous material for the impregnation treatment. The succeeding drum 38 performs the task of flavoring the fibrous material. This drum 38 may also be divided into a pretreatment and post-treatment configuration to work on the fibrous material accepted from drum 37 and preliminarily treat fibrous material going into drum 39. It is noted that the direction of the flow of the treating medium may change diametrically from drum to drum or from section to section within each of the drums. Sections may also be provided wherein the material is not exposed to any special treatment. In this way, the material is left alone to allow the previous treatment in the preceding section to take its full effect on the fibrous material being treated. The drum 39 may be used for a drying or toasting operation. The overall plant is clearly not restricted to four successive drums as shown in this particular embodiment. That is, as many drums as desired may be used to directly succeed one another to accomplish the various functional treatments required in the overall processing of the tobacco material.

As required, each section of a drum in the assembly can be equipped with an independent diversion channel in which a heat exchange device or other device may be placed to accomplish the desired results. Where low temperature is desired, a cooler may be incorporated instead of a heating means. The fluid medium used to treat the tobacco material may be fed from a fresh supply to each section or in a recirculated manner. Separate regulating and control units may be associated with each section located along within the drum assembly of this invention.

While the process and apparatus for treating fibrous material have been shown and described in detail, it is obvious that this invention is not to be considered as being limited to the exact form disclosed, and that changes in detail and construction may be made therein within the scope of the invention, without departing from the spirit thereof.

Having thus set forth and disclosed the nature of this invention, what I claim is:

1. An apparatus for treating fibrous material such as tobacco with a fluid treatment medium comprising:

- a. a drum means rotatably mounted within a casing and having perforations along the outer circumference thereof,
- b. means for driving the drum means,
- c. means located on the inside surface of the drum means to cause the fibrous material to move in an axial direction through the rotating drum means,
- d. at least two fluid medium circulation assemblies located adjacent each other along the length of the drum means,

- e. each circulation assembly having an inlet and outlet means for fluid treatment medium flow, fan means for effecting flow, heat exchange means to regulate the temperature of the fluid treatment medium and means to independently control the fan means and a heat exchange means within each said assembly, and
 - f. structural means located along said drum means to provide a neutral area between circulation assemblies in which substantially different treatment atmospheres exist,
 - g. said fluid treatment medium flow through the drum means from the inlet to outlet means being in a radial direction with respect to the axis of the drum means.
2. An apparatus as defined in claim 1 wherein said neutral area structural means comprises a nonperforated section along said drum means between said circulation assemblies having said different treatment atmospheres.
3. An apparatus as defined in claim 1 wherein said drum means comprises an assembly of at least two drums located end to end with respect to each other to cause the fibrous material to move through successive drums.
4. An apparatus as defined in claim 3 wherein said successive drums have respectively larger diameters from one end of the drum assembly to the other.
5. An apparatus as defined in claim 4 wherein said apparatus assembly includes means to drive each drum at an independent speed.
6. An apparatus as defined in claim 4 wherein said driving means includes means to drive two successive drums in two different directions.
7. An apparatus as defined in claim 4 wherein said apparatus assembly includes means for producing a suction effect within said drum assembly.
8. An apparatus for treating fibrous material such as tobacco with a fluid treatment medium comprising:
- a. a drum means rotatably mounted within a casing and having perforations along the outer circumference thereof,
 - b. said casing includes a jacket structure surrounding the drum means, an input hood mounted at one end of the drum means and an output hood mounted at the other end of the drum means,
 - c. said input hood includes adjustable valves to control the atmosphere within each said circulation assembly,
 - d. means for driving the drum means,
 - e. means located on the inside surface of the drum means to cause the fibrous material to move in an axial direction through the rotating drum means, and
 - f. at least two fluid medium circulation assemblies located adjacent each other along the length of the drum means,
 - g. each circulation assembly having an inlet and outlet means for fluid treatment medium flow, fan means for effecting flow, heat exchange means to regulate the temperature of the fluid treatment medium and means to independently control the fan means and a heat exchange means within each said assembly,
 - h. said inlet and outlet means comprises a pair of nozzles located in said jacket structure,
 - i. said fluid treatment medium flow through the drum means from the inlet to outlet means being in a radial direction with respect to the axis of the drum means.
9. An apparatus as defined in claim 8 wherein said fan means is located outside the drum between the inlet and outlet means and said heat exchange means is mounted within the casing between the inlet and outlet means.
10. An apparatus as defined in claim 8 wherein said control means includes means to reverse the direction of fluid medium flow within each said assembly.
11. An apparatus as defined in claim 8 wherein said casing includes an exhaust channel branch to direct exhaust fluid medium to the surrounding atmosphere,

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said channel branch includes a second fan means to draw the exhaust fluid medium out of the circulation assembly and valve means to adjust the cross-sectional area within the exhaust branch channel.

12. An apparatus as defined in claim 8 wherein said circulation assembly includes a filter means located between the outlet nozzle and the heat exchange means

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to capture solid particles of fibrous material entrained in said fluid treatment medium after the medium has passed through said rotating drum means,
said heat exchange means comprises a member disposed at an oblique position with respect to the horizontal.

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