Oct. 1, 1963 F. J. HASSLER 3,105,713

APPARATUS FOR BULK CURING TOBACCO

Filed June 13, 1960 2 Sheets-Sheet 1

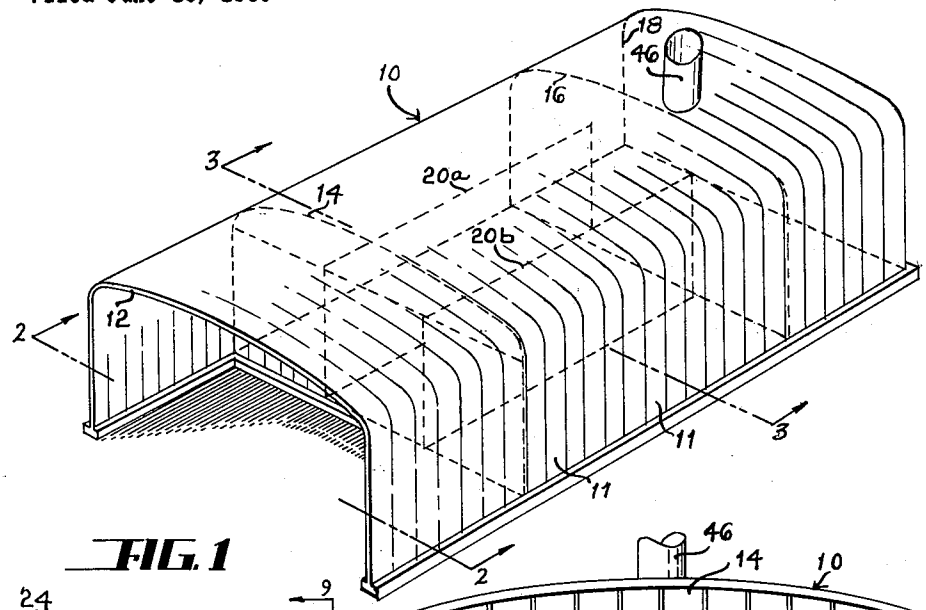


FIG. 1

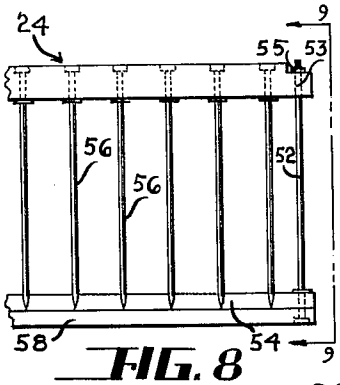


FIG. 8

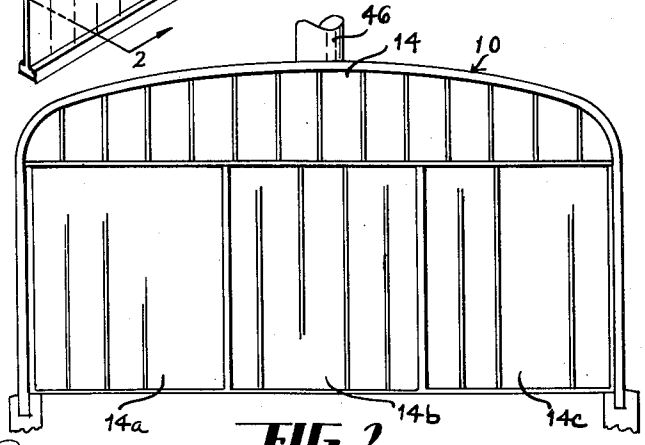


FIG. 2

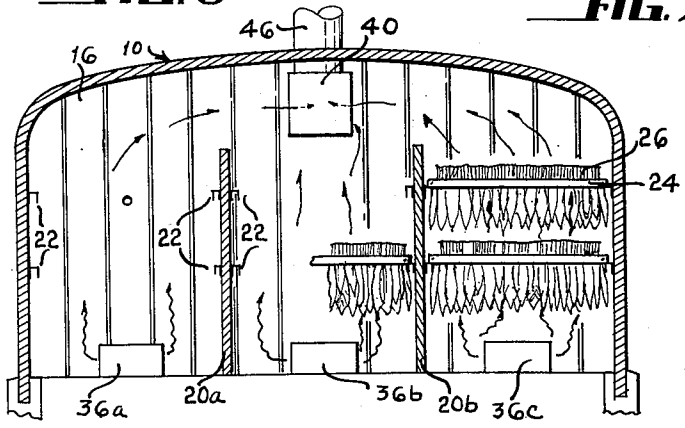


FIG. 3

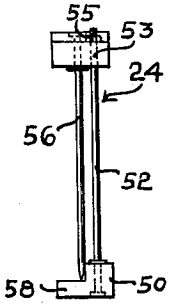


FIG. 9

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APPARATUS FOR BULK CURING TOBACCO

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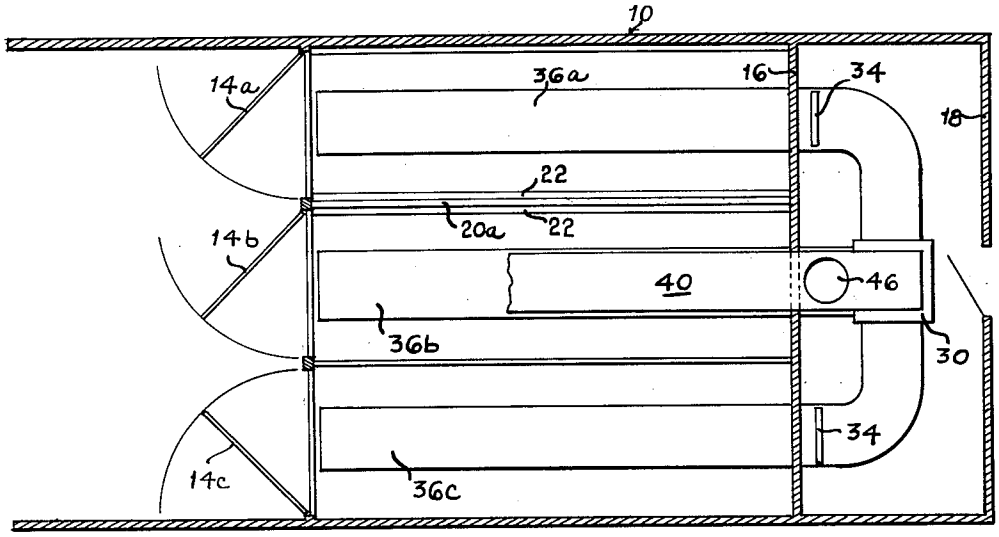


FIG. 4

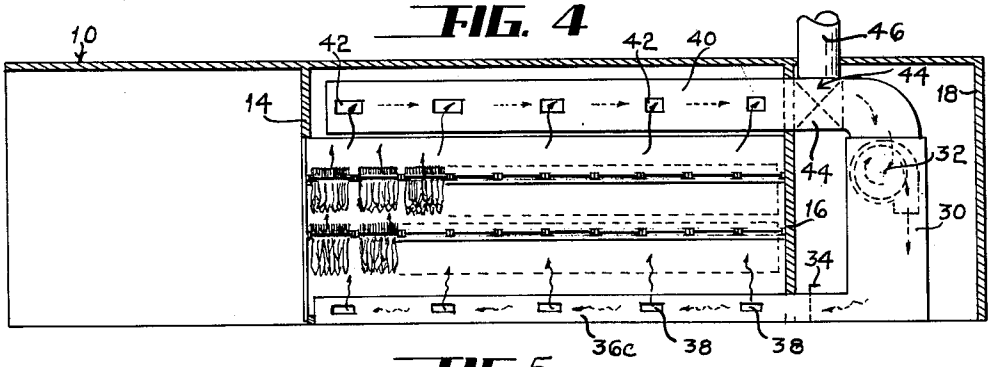


FIG. 5

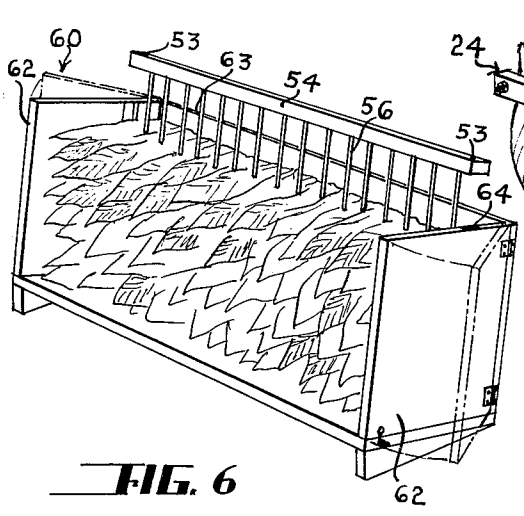


FIG. 6

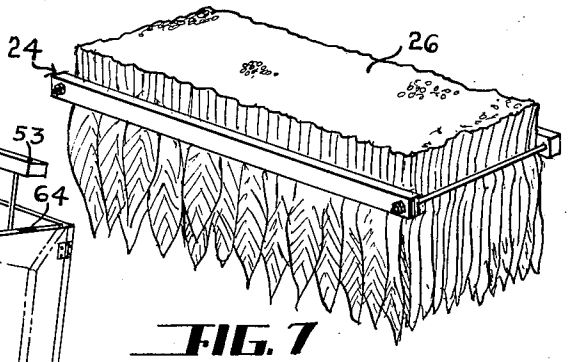


FIG. 7

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APPARATUS FOR BULK CURING TOBACCO

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1 Claim. (Cl. 294—5.5)

The present invention relates to an improved method and apparatus for curing tobacco and, more particularly, to a method for curing tobacco in bulk and the apparatus for carrying out such method, however, the invention is not necessarily so limited.

A fundamental problem in tobacco production is the great amount of hand labor required in the conventional method of production. Approximately three-fourths of the total labor required in the production of tobacco is devoted to harvesting and processing operations. In recent years much has been done in the way of mechanizing harvesting operations, and the labor saving through mechanization has been substantial. However, there has been little advance in the techniques for processing the harvested tobacco. Thus, the techniques for processing tobacco today are, with the exception of a few minor improvements, the same as employed more than a century ago.

In curing tobacco it has long been the practice to string the tobacco leaves on elongated sticks which are supported in a curing barn. The stringing operation is a cumbersome and time consuming operation which must be done by hand. When the tobacco has been strung and placed in the barn, it is carried through a curing operation which can be roughly divided into four stages.

These stages will be described in detail in the following remarks. Accordingly, it suffices for the present to state that the first stage is a leaf yellowing stage wherein physiological transformations evidenced by yellowing of the tobacco leaf occur. In the second stage the leaf is dehydrated to halt the physiological transformations occurring in the leaf. In the third stage the dehydration is accelerated so that the stem of the tobacco leaf is dried out. At this point, the tobacco leaf is substantially bone dry and the leaf itself is very fragile. In the final stage moisture is added to the leaf so that it softens and can be handled. Thereafter, the tobacco is ready for removal from the curing barn for subsequent processing.

It is obvious that the curing of tobacco could be greatly simplified if it were possible to cure the tobacco in bulk. This would eliminate the cumbersome stringing operation since it would then be possible to cure the tobacco in large bundles. Unfortunately, however, the leaf yellowing stage described above involves exothermic reactions in the tobacco leaf. Thus, when tobacco is cured in bundles, large amounts of heat must be dissipated. For this reason, it has been considered impossible to satisfactorily control a bulk curing operation.

It is an object of the present invention to provide a method for curing tobacco which enables bulk curing and which affords sufficient control over the curing process that the heat released exothermically does not impair the operation.

Another object to the present invention is to provide apparatus for bulk curing tobacco, which apparatus enables close control over heat released during the curing operation.

Still another object of this invention is to provide an improved method for bulking tobacco in racks.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture and the mode of operation, as will become more apparent from the following description.

FIGURE 1 is a perspective view of the tobacco curing barn.

FIGURE 2 is an end elevational view of the barn taken from the direction indicated by the arrows 2—2 of FIGURE 1.

FIGURE 3 is a sectional view of the barn taken substantially along the lines 3—3 of FIGURE 1.

FIGURE 4 is a plan view of the interior of the barn.

FIGURE 5 is a longitudinal sectional view of the barn illustrating heating apparatus employed therein.

FIGURE 6 is a perspective view illustrating the method of placing tobacco leaves in a rack.

FIGURE 7 is a perspective view illustrating a completed rack of tobacco.

FIGURE 8 is a fragmentary plan view of an assembled rack with the tobacco removed.

FIGURE 9 is an end view taken in the direction of the arrow 9—9 of FIGURE 8.

Referring to the drawings in greater detail, FIGURE 1 illustrates a tobacco barn **10** which is designed specifically for use in the present method. The exterior covering for the barn is formed with a plurality of arched sheet metal panels **11**. At the forward end of the barn, as viewed in FIGURE 1, an overhang **12** is provided. This overhang provides a shelter where tobacco leaves may be placed in racks, as will be described hereinafter, prior to movement into the curing barn.

Behind the overhang **12** is a partition **14** which closes the forward end of the barn. As best illustrated in FIGURE 2, this partition includes three doors **14***a*, **14***b* and **14***c* which may be opened to gain access to three separate compartments within the barn.

Rearward of the partition **14** is another partition **16** which cooperates with a rear end wall **18** to establish a furnace room. The partition **16** isolates the furnace room from the central part of the barn.

As best seen in FIGURE 3, the central part of the barn is divided into three sections by a pair of dividers **20***a* and **20***b* extending between the partitions **14** and **16**. The doors **14***a* and **14***b* and **14***c* open separately into these sections.

The dividers **20***a* and **20***b*, as well as the side walls of the barn, support horizontal rails **22** which form supporting shelves for tobacco racks placed thereon. FIGURE 3 schematically illustrates tobacco racks or supporting frames **24** supporting tobacco leaves **26** mounted on the rails **22**. In the tobacco barn illustrated, two tiers of tobacco racks are placed in each of the three sections of the barn.

FIGURES 4 and 5 illustrate a heating system which is installed in the barn. This system includes a furnace **30** located in the furnace room between the partition **16** and the end wall **18**. Leading from the furnace at floor level are three outlet ducts **36***a*, **36***b* and **36***c*, each of which is regulated by a hand damper **34**. These three ducts pass centrally through the three sections of the central portion of the barn and are each provided with a plurality of spaced openings or ports **38** in the sides thereof through which air may escape. A blower unit **32** located within the furnace forces air into the duct **36**. The air leaving the ports **38** moves upwardly between the bulked tobacco leaves and ultimately flows into a return duct **40** located centrally in the barn at an elevation above the dividers **20***a* and **20***b*. This duct **40** is provided with spaced ports **42** into which the air moves.

A damper **44** is located in the duct **40** between the several ports **42** and the blower **32**. Above the damper is an outlet duct **46**, best seen in FIGURE 4, communicating with the outside atmosphere. By adjustment of the damper **44**, varying amounts of fresh air may be admitted to the heating system, or if desired, the duct **46**

may be closed such that the air within the system is recirculated without addition of fresh air.

The blower **32** operates to establish a pressure differential between the top and bottom of the curing barn in the central curing section such that the air is forced to move upwardly through the tobacco. The design of the racks is such as to force the circulated air to flow between the bulked tobacco leaves.

An individual rack **24** is illustrated in FIGURES 8 and 9. This rack includes an elongate side member **50** with outwardly extending rods **52** fixedly secured to each end thereof. A second side member **54** of equal length has apertures **53** therein complementary to the rods **52**, the arrangement being such that the rods **52** may be projected into the apertures **53** to assemble the rack. Suitable nuts **55** are threaded onto the rods **52** to fix the assembly. The side member **54** carries a plurality of parallel fixedly attached spikes **56** which, in the assembled rack, abut a shoulder **58** provided on the side member **50**.

In bulking tobacco, the rack is used in association with a bin **60** illustrated in FIGURE 6. This bin has an open top and one open side. The end walls **62** of the bin are hingedly joined to the rear panel **63** and are normally locked in the position illustrated in solid line detail. In inserting the tobacco into the rack, the side member **50** is seated on the bottom of the bin and is located by slots **64** provided in the end walls **62**. The rods **52** carried by the side member **50** project upwardly in the slots **64**. The bin **60** is then filled with tobacco leaves each of which has its base butted against the rear panel **63**. The side member **54** is then pressed downwardly into the bin **60** to force the spikes **56** through the tobacco leaves. Any suitably designed press mechanism may be employed to force the side member **54** into the bin **60** in accurate registry with the side member **50**.

After the side member **54** has been forced into the bin **60** and secured by means of nuts **55** engaging the rods **52**, the end walls **62** are swung outwardly so that the rack may be removed from the bin. A completed rack of tobacco is illustrated in FIGURE 7. In the completed rack, the shoulder **58** provided on the side member **50** supports the ends of the spikes **56** so that the weight of the tobacco does not deform the spikes.

In loading the racks in the curing barn the racks are slid along the rails **22** and pushed one after the other into the barn. The dimensions of the racks are modular with respect to the interior of the barn so that when a full complement of racks are butted one against the other, they exactly fit between the partitions **14** and **16** leaving substantially no room for escape of air around the sides of the racks. In this regard it will be noted in FIGURE 3 that the leaves of the tobacco flare outwardly from the racks and cooperate with the rails **22** to minimize the escape of air around the ends of the racks. The air which is forced upwardly through the central portion of the barn must therefore move in and around the tobacco leaves.

As mentioned hereinbefore, the initial portion of the tobacco curing cycle involves exothermic reactions and it is important that the temperature of the tobacco leaves be carefully controlled during this portion of the cycle. This is done by forcing air of the correct temperature and humidity through the tobacco.

At the beginning of the curing process, the tobacco leaf contains complex starch and protein molecules, chlorophyll, nicotine, water and many other components. The leaf moisture content is normally 80 to 90 percent of the total green weight of the leaf. In the initial curing stage, designated the leaf yellowing stage, the major chemical conversions are the simplification of complex starch and protein molecules and the disappearance of chlorophyll by oxidation. Rapid dessication at this stage would arrest all chemical conversions and accordingly the moisture content of the leaves must be maintained above 70 percent. During this stage, starch molecules

are hydrolyzed to simpler sugars. The disappearance of chlorophyll proceeds at a rate parallel to the conversion of starch. Thus, the leaf color is a good indication of the state of the leaf. When all chlorophyll has disappeared the major portion of the starch has been hydrolized. This is evidenced by a yellowing of the leaf as the disappearing chlorophyll unmasks yellow leaf pigments.

The rate at which the aforementioned reactions occur increases with an increase in temperature. Hence, the cure time is shortened with increasing temperature. However when the temperature exceeds 110° F., an undesirable browning resulting from oxidation of polyphenols occurs, along with other reactions which result in an accumulation of undesirable components. Under the circumstances it is found preferable to control the leaf temperature to around 100° F. This is accomplished by circulating air which has a temperature in the range 90 to 100° F. through the tobacco. During this stage of the cure a relative humidity of 85 to 95% is employed. The dampers are therefore set to allow a high humidity.

The yellowing stage is normally accomplished within 30 to 60 hours depending upon the state of the leaves when the cure is begun. During this period, the moisture content of the leaf reduces to about 70 or 75%.

After yellowing is accomplished, that is, after the leaf is at the desired chemical state, further chemical reaction is arrested by dehydrating the leaf. This stage of the cure process is known as the leaf drying stage. To accomplish dehydration, the air temperature is elevated at a rate of 2 to 3° F. per hour and is ultimately held in the range of 130 to 135° F. To insure maximum dessication, the dampers are adjusted to exhaust the humid air with no recirculation. The normal time required for the leaf drying stage is from 20 to 30 hours during which the leaf moisture content is reduced to a level of 30 to 50%. With average atmospheric conditions the air circulated through the curing barn during this stage has a relative humidity of around 40%.

After dehydration of the leaf, the cure is carried into a stem drying stage wherein moisture is extracted from the midribs. In this stage the temperature is increased at the rate of 2 to 5° F. per hour to 160 to 170° F. During this stage the dampers are set to achieve 90 to 100% recirculation of air, thus conserving on fuel. After 15 to 30 hours of drying under these conditions the stems become brittle while the moisture content of the leaf lamina approaches zero. The leaf becomes crisp and fragile in this stage and it is necessary to recondition or reorder the leaf before removal from the curing barn.

In the final stage of the tobacco cure, moisture is added to the leaf. This may be accomplished in two ways. Under favorable environmental conditions of 50 to 70° F. and 85 to 100% relative humidity, air can be drawn in from outside the barn and forced through the tobacco without additional heat, then exhausted from the barn. However, when the ambient atmosphere is not sufficiently humid it is found preferable to employ a humidifier, not shown, located within the duct work. The controls are set to provide a temperature of from 80 to 100° F. and a relative humidity of around 85% with full recirculation of air. Normally the leaf is conditioned to a moisture content of 15 to 20% by weight. The time required for this reconditioning is 6 to 10 hours. The tobacco is then ready for removal from the curing barn.

It is found that bulk curing on the cycle indicated produces a marketable tobacco leaf comparable to the best obtained with conventional curing techniques. At the same time, it is found that the cure obtained is more uniform than that obtained conventionally such that a higher average market price is realized. Another important advantage resulting from the method and apparatus disclosed herein is a substantial reduction in the amount of labor required to effect the cure.

Although the preferred embodiment of this method

and apparatus has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof, the method of manufacture and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claim.

Having thus described my invention I claim:

A rack for supporting a batch of tobacco leaves in compressed bulk form within a curing barn for passage of a flow of forced air vertically therethrough comprising a pair of separable rack sections disposed in spaced relation with respect to each other in a loading position with a batch of tobacco leaves in loose bulk form having the flat surfaces thereof disposed generally in the same direction positioned therebetween, a plurality of thin elongated spikes fixedly secured at one of their ends to one of said rack sections in generally parallel relation and extending in a direction toward the other of said rack sections when the latter are disposed in said loading position, said rack sections being movable with respect to each other from said loading position rectilinearly toward each other in the direction of extent of said spikes into an operatively engaged position to pierce the free ends of said spikes into the leaves in a direction perpendicular to at least a substantial portion of the flat surfaces thereof and to compress the batch of leaves in loose bulk form into a relatively compact batch on said spikes, and means carried by said rack sections adjacent each of the end portions thereof engageable to fixedly secure said rack sections against movement out of said operatively engaged position after the rectilinear movement of said rack sections into said operatively engaged position and disengageable to permit movement of said rack sections out of said operatively engaged position, said rack with said rack sections in operatively engaged position providing a rectangular structure defining a continuous inwardly facing peripheral surface means for exteriorly peripherally supporting the batch of compressed leaves, spaced supporting surfaces on one pair of opposite sides thereof facing in a direction perpendicular to the direction of extent of said spikes for engagement with cooperating oppositely facing supporting surfaces in the curing barn to

mount the rack in an operatively engaged curing position within the curing barn for passage of the flow of forced air vertically through the batch of leaves supported therein with their flat surfaces extending generally in the direction of the forced air flow, and exterior outwardly facing surfaces extending along the other pair of opposite sides thereof each being of a configuration to engage a corresponding opposite exterior surface of a similar rack in operatively abutting relation along the entire length of the respective exterior outwardly facing surfaces so as to effectively prevent the passage of air therebetween when such racks are disposed in operatively engaged curing position in side-by-side abutting relation, said spikes when said rack sections are disposed in said operatively engaged curing position extending generally horizontally substantially throughout the space within which the batch of leaves is peripherally confined by said continuous peripheral surface means and being spaced apart relative to each other a distance substantially greater than their thickness and substantially less than their length so as to provide adequate interior support for the batch of leaves without materially restricting the flow of forced air vertically through the batch of leaves.

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