July 20, 1937. W. E. MOLINS 2,087,697

METHOD OF AND MEANS FOR DRYING OR CONDITIONING ARTICLES

Filed Dec. 10, 1934 3 Sheets-Sheet 1

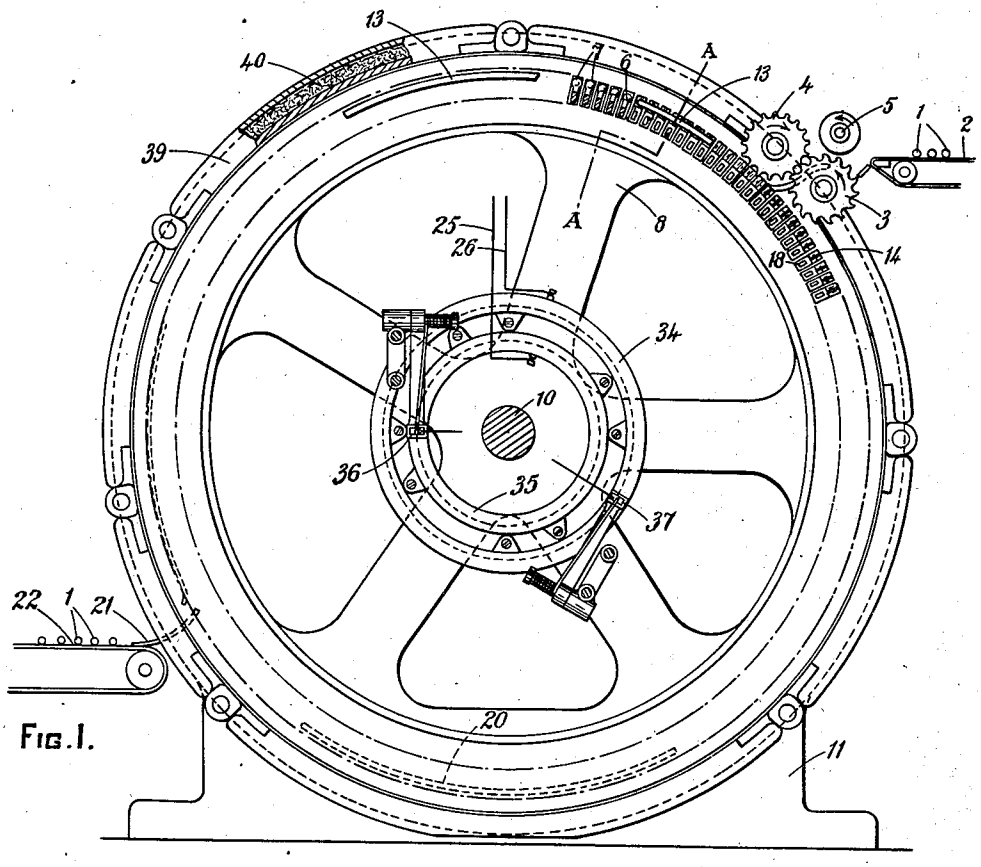


FIG. 1.

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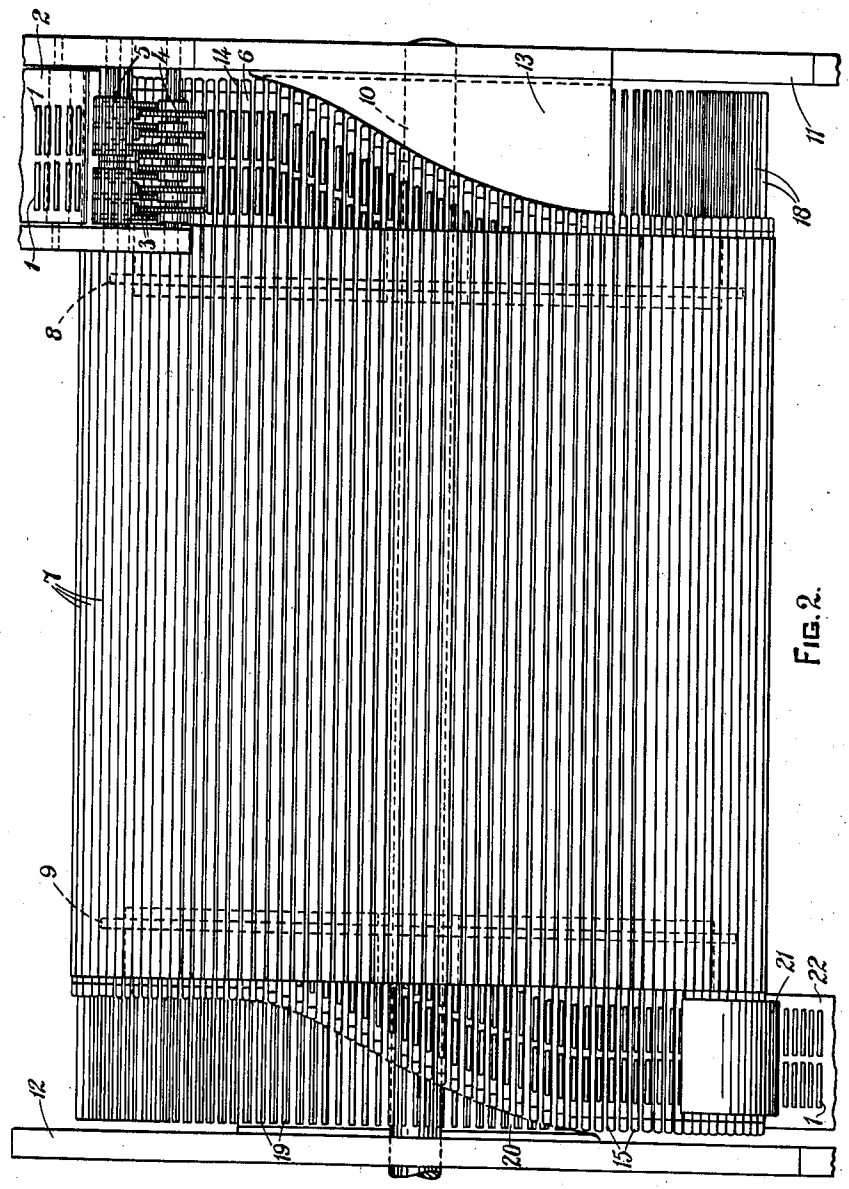


FIG. 2.

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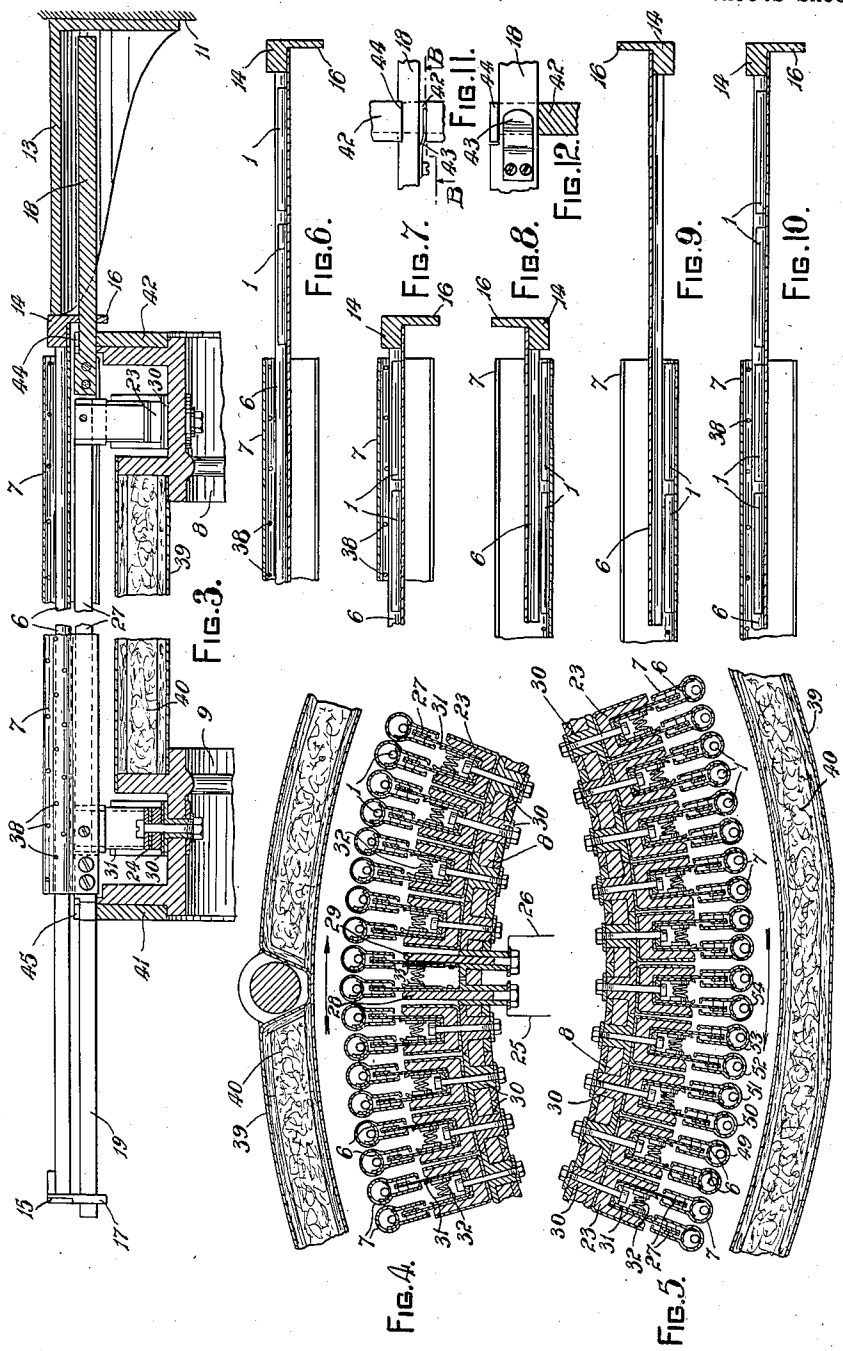


FIG. 3.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

FIG. 11.

FIG. 12.

FIG. 4.

FIG. 5.

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Patented July 20, 1937 2,087,697

UNITED STATES PATENT OFFICE

2,087,697

METHOD OF AND MEANS FOR DRYING OR CONDITIONING ARTICLES

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Application December 10, 1934, Serial No. 756,873
In Great Britain December 9, 1933

17 Claims. (Cl. 34—4)

(Granted under the provisions of sec. 14, act of March 2, 1927; 357 O. G. 5)

This invention is for a new or improved method of, and means for, drying or conditioning articles such as cigarettes, and is particularly, though not exclusively, applicable to the cigarettes as they emerge from a cigarette making machine.

It is well known that tobacco must be worked through the cigarette making machine with a sufficiently high moisture content to prevent undue breakage of tobacco in the process of distributing and showering the same to form the cigarette rod.

The moisture content necessary for feeding tobacco is generally considered too high for the satisfactory packing of the cigarettes into the usual packages, and it is desirable to reduce the moisture content of the finished cigarettes both for the purpose of preventing the cigarettes from going mouldy, and for improving their smoking quality.

It has hitherto been customary to take the cigarettes produced by the cigarette making machine and place them in trays in which they are stood in drying rooms until they are in a suitable condition for packing.

When this process of drying the cigarettes is used, the ends of the cigarettes, which are exposed to the atmosphere, become dried first and the bodies of the cigarettes which are in contact with each other are dried last. By the time the bodies are properly dried, therefore, the ends become excessively dry and tend to fall out.

An object of the present invention is to obviate these defects, and according to one form of the present invention there is provided a method of drying or conditioning articles by applying heat by conduction evenly along a part at least of the longitudinal surfaces of the articles (e. g. equally or substantially equally over the longitudinal surfaces of the articles). The heat may be applied equally or substantially equally over the longitudinal surfaces of the articles by causing the latter to make contact at a part only of their longitudinal surfaces at any given time with a heated surface, and changing the parts of the surfaces of the articles which are in contact with the heated member or members.

According to another form of the present invention, there is provided a method of drying or conditioning articles (e. g. cigarettes) by receiving the articles from a source of supply, inserting the articles into drying or conditioning chambers (e. g. heated chambers), in which the articles make contact on their longitudinal surfaces with heated surfaces, moving the articles lengthwise through the chamber during a predetermined time interval, and ejecting the articles from the chamber at the expiration of the predetermined time interval. The points of contact between the surfaces of the articles and the chamber may be changed so that each article is evenly treated over its surface.

Further, according to the invention there is provided apparatus for drying or conditioning articles, comprising a drying or conditioning chamber having a heated surface or surfaces therein, means to feed articles into the chamber in which the longitudinal surfaces of the articles make contact with the heated surface or surfaces and in which the articles are heated along a part at least of their longitudinal surfaces (e. g. equally or substantially equally over their longitudinal surfaces) by conduction from the heated surface or surfaces, and means to remove the articles from the chamber after a predetermined time interval. Means may be provided to move the articles lengthwise through the chamber during a predetermined time interval. Means may also be provided to change the points of surface contact between the articles and the sides of the chamber during the passage of the articles through the chamber and a plurality of drying or conditioning chambers may be disposed around the periphery of a rotatable carrier, each of said chambers being arranged substantially parallel to the axis of the carrier. A movable element (e. g. a slidably mounted trough) may be arranged to pass through the drying or conditioning chamber, and is operative to receive articles in succession and move them lengthwise through the chamber. The movable element may be used to receive at least one article from a source of supply, and may be then moved into the drying or conditioning chamber (e. g. by a cam engaging with an end of the element), the element being then inverted and moved in an opposite direction (for example by a cam engaging with the opposite end of the element), the article during the second movement of the element being supported by the walls of the chamber. At the end of its second movement the element may be again reversed and the articles in the chamber may again be deposited thereon, being displaced lengthwise upon the element with respect to its previous position thereon. The drying or conditioning chamber or chambers may be pro-

vided with vent-holes through which steam or other gases may escape, and the chamber or chambers may be heated (e. g. by insulated resistances through which an electric current is passed).

The invention will be more particularly described with reference to the accompanying drawings in which:—

Figure 1 is an end elevation, partly in section, of apparatus constructed in accordance with the invention.

Figure 2 is a plan of Figure 1.

Figure 3 is a longitudinal section on an enlarged scale taken on the line A—A, Figure 1, and illustrates one of the drying chambers together with its associated parts.

Figure 4 is a sectional end elevation showing a portion of the upper part of the apparatus in the position illustrated in Figure 1.

Figure 5 is a view similar to Figure 4, but shows the lower portion of the apparatus in the position illustrated in Figure 1.

Figures 6 to 10 are detail views illustrating means by which articles are moved lengthwise through the drying chamber.

Figure 11 is a view, to an enlarged scale, showing the means by which the drying chambers are connected to the carriers.

Figure 12 is a sectional elevation taken on the line B—B of Figure 11.

Like references refer to like parts throughout the specification and drawings.

Referring to the drawings, the apparatus illustrated therein is designed more particularly for drying or conditioning cigarettes, and for the purpose of describing the invention, articles which are to be treated will be referred to as cigarettes. The cigarettes to be treated may be delivered to the apparatus from any suitable source, such for example, as a hopper, or they may, as in the construction illustrated in the drawings, be delivered to the apparatus directly from the delivery end of a cigarette making machine. As shown in the drawings, the cigarettes **1** are delivered from a cigarette making machine (not shown) by a belt **2**, which delivers them to fluted feeding rollers **3**, arranged to receive the cigarettes and deliver them to the drying or conditioning apparatus. Wheels **4** and rollers **5** are provided to ensure that the cigarettes are delivered to the apparatus in the proper order. It will be seen from Figure 2 that for the purpose of illustration, the cigarettes are shown as being delivered in two rows, since this is the manner in which they are normally delivered from a cigarette making machine. It will be obvious, however, that the cigarettes may be delivered in any desired number of rows, or that if desired, other means may be provided to feed the cigarettes to the drying or conditioning apparatus.

One form of such other means may comprise a chain conveyor in place of the belt **2**, and means may co-operate with the conveyor to transfer the cigarettes from the conveyor to the conditioning tubes. Further, means may also be provided to synchronize the feed of the conveyor with deflectors which remove the cigarettes from the continuous cigarette rod line of the cigarette making machine.

The cigarettes delivered by the feeding rollers **3** are deposited upon trough-like members **6** which are slidably mounted and pass through drying or conditioning chambers **7** which are mounted upon a rotatable carrier comprising discs **8** and **9** carried upon a spindle **10** mounted for rotation in frames **11** and **12**. The carrier is driven by any suitable means, and when as in the present instance it is linked with a cigarette making machine, it may be driven synchronously therewith from the main drive of the cigarette making machine. But preferably the drive of the carrier is independent of the cigarette machine. The arrangement of the drying or conditioning chambers **7** can be clearly seen from Figures 1 to 5, and Figure 3 clearly illustrates the construction of one of the chambers, together with the associated parts which ensure that the cigarettes being treated are moved lengthwise through the chambers. Referring more particularly to Figure 3, it will be seen that the trough **6** has been moved to its fullest extent into the drying chamber **7**, this movement being effected by means of a stationary cam **13** fixed to the frame **11** of the apparatus, the trough **6** being provided with end pieces **14** and **15** which engage respectively with the face of the cam **13** and with a further cam for the purpose hereinafter described. The end pieces **14** and **15** are provided with tails **16** and **17**, which are provided with suitable slots, and are carried upon guide rails **18** and **19** rigidly attached to the drying chamber **7**. The purpose of the guide rails **18** and **19** is to guide the troughs **6** during their movements into and out of the drying or conditioning chambers **7**, and also to provide a means by which the drying chambers can be fixed to the discs **8** and **9** in a manner such that any one of the chambers can be readily detached from the apparatus and replaced by another should such a procedure be desirable.

The manner in which the drying chambers are attached to the discs **8** and **9** is clearly shown in Figures 3, 11, and 12. The discs **8** and **9** are provided with rings **41** and **42** which are fixed to the discs and the peripheries of the rings are slotted in order to accommodate the rails **18** and **19**. Each of the rails **18** and **19** is provided with a flat spring **43** which, when the rails are inserted into the slots, engage with one wall of the slot and press the rail against the other wall thereof.

In order to positively locate the rails within the slots, the rails are grooved in the manner shown in Figure 11, and the sides of grooves engage with the sides of rings **41** and **42**. To further assist in the location of the rails, the rings are slotted in a manner such that a portion of the periphery of a ring projects slightly over the slot as shown at **44** and **45**, and the rails are arranged to be held in position between these projecting portions, and the bottoms of the slots as shown in Figure 12.

When it is desired to remove a drying chamber from the apparatus, it is only necessary to press on the rails to overcome the influence exerted by the springs **43** and to then withdraw the rails from the slots.

The rotatable carrier upon which the chambers **7** are mounted may be continuously rotated, and when a trough **6** arrives at the position at which it is to receive cigarettes from the feeding roller **3**, it is in the position illustrated in Figure 6. As the carrier rotates, the end piece **14** engages with the face of the cam **13**, and the trough **6** is thereby moved into the drying chamber **7** until it reaches the position shown in Figures 3 and 7, at which position it has reached the fullest extent of its movement into the chamber. The carrier continues its rotary movement with the

troughs in this position until they arrive at the lowermost position illustrated in Figure 5, when the cigarettes which were carried by the troughs have rolled into a position such that they rest on the walls of the chamber 7, as shown in Figure 5. The end pieces 15 connected to the troughs then engage with a further fixed cam 20 which moves the troughs 6 back to their original position as illustrated in Figures 6 and 10.

As the carrier continues its movement to bring the troughs 6 back to the position at which they receive further cigarettes, the cigarettes which are contained in the chambers 7 roll back until they are again supported by the troughs 6. When the cigarettes again rest upon the troughs, it will be seen from Figures 9 and 10 that they have been displaced lengthwise with respect to the original position which they held upon a trough. It will be appreciated that each further operation of a trough 6 into and out of the chamber 7 causes the cigarettes in the chamber to be moved lengthwise towards the outlet end of the chamber, and when they arrive at the position illustrated at the left hand side of Figure 2, they fall by gravity on to a plate 21, and deposited into any suitable receptacle, or, as shown in Figures 1 and 2, the cigarettes are delivered on to a belt 22 which carries them to a point at which they may be collected.

In order to dry or condition the cigarettes the chambers 7 are heated by means of an electrical current passed through insulated resistances. The electrical current is passed through wires 25 and 26 and is communicated to the heating elements 27 through the members 28 and 29. The heating elements 27 are fixed to the discs 8 and 9 by fixing blocks 23 and 24, and the drying chambers are arranged to be slipped over the elements 27. The members 28 and 29 are insulated from the discs 8 and 9 by insulators 30 and pairs of adjacent elements 27 are connected with each other by means of U shaped elements 31. The blocks 23 and 24 are held in position by springs 32, the springs separating the members 28 and 29, being insulated from the member 31 by means of an insulating element 33. Since the carrier is rotating when the apparatus is in operation, the source of supply of the current to the heating element is provided by means of a pair of rings 34 and 35 which are fixed to the disc 8 and which rub against contact bushes 36 and 37 which are suitably connected with mains, the wires 25, 26 being connected to the rings. The heating elements 27 are thus connected in series.

It is found that during the drying process steam rises from the cigarettes, and in order to allow this to escape from the drying chambers, suitable apertures 38 are provided along the lengths of the chambers 7. Further, in order to prevent too great a loss of heat by radiation, the major portion of the apparatus is enclosed within shrouds 39, and suitable heat resisting material 40 may be provided in order to retain the heat within the shroud. As an example how the electrical current passes from one heating element to another, six of the chambers in Figure 5 are marked 49, 50, 51, 52, 53, and 54 respectively. As shown in Figure 5, the heating element belonging to chambers 50, 51 and those of the chambers 52 and 53 are electrically connected on one side of the drum by the elements 31. On the other side of the drum, however, the elements 31 connect the heating elements of the chambers 49 and 50, those of 51 and 52, and those of 53 and 54.

Since the cigarettes are to be dried or conditioned by applying heat by conduction equally or substantially equally over the longitudinal surfaces of the cigarettes, it is necessary in the construction shown, to change constantly the points at which the surfaces of the cigarettes make contact with the heated surfaces of the drying chamber 7 so that the heat is applied equally over the longitudinal surfaces of the cigarettes. By the arrangement illustrated in the drawings, when the drying or conditioning apparatus is in operation, the discs 8 and 9 are rotated, and it will be seen that as the chambers are carried round by the discs, the points of contact between the surfaces of the cigarettes and the heated surfaces of the chambers will be constantly changing owing to the fact that the internal diameter of the tubes is greater than the diameter of the cigarettes. As a result of this action, the drying or conditioning of the cigarettes is effected in a more efficient manner, since the point to which the greatest heat is applied, that is, the points of contact between the surfaces of the cigarettes with the heated surfaces of the chamber, is constantly being changed. The greatest heat, therefore, is continually travelling towards the centres of the cigarettes along different radii so that by the time the discs have completed one revolution, each point on the surface of a cigarette will have been subjected to the action just described. It will be seen that by this method the cigarettes are uniformly dried or conditioned, since the heat applied around the longitudinal surfaces while drying the cigarettes, expands the air in the cigarettes, which air takes the outlet of least resistance, (namely, through the ends of the cigarettes) so that moisture from the centres of the cigarettes leaves through the ends, and the ends are therefore the last portions of the cigarettes to dry. The ends are thus somewhat more moist than the centres during the drying, so that the objection of over-dried ends (which break and fall out) or sunken ends is avoided. It will also be appreciated that by reason of the flow of vapor outwardly through the cigarette ends, these ends thus acquire a lower temperature as well as a more humid condition than the intermediate portion of the cigarette.

It will be appreciated that many other ways of carrying the invention into effect may be provided, thus instead of providing troughs 6 to move the cigarettes through the drying chamber, the troughs may be dispensed with and cigarettes may be delivered to the drying chamber from the source of supply by means of a fluted wheel. The cigarettes may be removed from the fluted wheel and inserted into the chambers 7 by means of a plunger, and by this means, as each cigarette is pushed into the drying chamber 7, the preceding cigarettes will be moved lengthwise through the chambers until they are ejected from the ends of the chambers opposite those ends at which they enter the chambers. With a construction of this type, however, it may be necessary, should the source of supply of the cigarettes cease, to provide means whereby the drying chamber does not cease to operate, so that the cigarettes which are already in the chamber are only contained therein for the definite predetermined time interval. In order to overcome this difficulty, should the source of supply of cigarettes fail, means may be provided to supply substitute articles, such for example as dummy cigarettes, to the drying or conditioning cham-

ber during the interruption of the normal source of supply. In such a case, also, means may be provided to extract the substitute articles from the product issuing from the drying or conditioning chamber, and to return them ready for re-insertion into the chamber when necessary.

Again, if desired, the internal dimensions of the drying or conditioning chambers may be substantially equal to the diameter of the cigarettes so that all points on the longitudinal surfaces of the cigarettes are in contact with the heated surfaces of the chambers and the cigarettes are, therefore, dried or conditioned by applying heat by conduction equally or substantially equally over the longitudinal surfaces of the cigarettes.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In apparatus for reducing the moisture content of cigarettes, the combination with a chamber adapted to receive cigarettes therein, said chamber being provided with an interior, generally cylindrical surface, of means for heating said surface to a substantially higher temperature than that established within the chamber, means for introducing cigarettes in said chamber with the lateral surfaces thereof in contact with the heated surface of said chamber and with the cigarette ends out of contact with such heated surface, means for rolling said cigarettes on said heated surface, and means to move the cigarettes in succession in a predetermined path through said chamber.

2. In apparatus for reducing the moisture content of cigarettes, the combination with a chamber adapted to receive cigarettes therein, said chamber being provided with an interior, generally cylindrical surface, of means for heating said surface to a substantially higher temperature than that established within the chamber, means for introducing cigarettes in said chamber with the lateral surfaces thereof in contact with the heated surface of said chamber and with the cigarette ends out of contact with such heated surface, and means for rolling said cigarettes on said heated surface and for moving said cigarettes axially thereon.

3. A method of reducing the moisture content of cigarettes which comprises moving the cigarettes axially through a chamber having a heated inner surface and rolling said cigarettes in contact with said surface while rotating said chamber, whereby substantially every part of the longitudinal surface of each cigarette comes into contact with said heated surface during a portion of the travel of said cigarette through said chamber.

4. A method of reducing the moisture content of cigarettes which comprises moving the cigarettes axially through a chamber having a heated inner surface and rolling said cigarettes in contact with said surface while rotating said chamber, whereby substantially every part of the longitudinal surface of each cigarette comes into contact with said heated surface during a portion of the travel of said cigarette through said chamber, the end faces of said cigarettes being maintained free while passing through said chamber.

5. In apparatus for reducing the moisture content of cigarettes, a rotatable carrier, a plurality of substantially cylindrical chambers mounted thereon, said chambers having an internal diameter greater than that of a cigarette, means for passing cigarettes through said chambers, means for heating said chambers, and means for rotating said carrier.

6. In apparatus for reducing the moisture content of cigarettes, a rotatable carrier, a plurality of heated chambers mounted thereon, article supporting members reciprocally mounted in said chambers, means for moving said members longitudinally within said chambers during a portion of a revolution of said carrier, and means for returning said members during another portion of a revolution of said carrier.

7. In apparatus for reducing the moisture content of cigarettes, a rotatable carrier, a plurality of heated chambers mounted thereon, said chambers having an internal diameter greater than that of a cigarette, troughlike members reciprocally mounted in said chambers, and means for reciprocating said members within said chambers.

8. In apparatus of the character described, a rotatable carrier having a horizontal axis, a plurality of chambers mounted on said carrier, article supporting members reciprocally mounted in said chambers, and means for reciprocating said members within said chambers, said means comprising means for moving said members in one direction while said members are in the upper portion of their orbit, and means for returning said members while said members are in the lower portion of their orbit.

9. In apparatus of the character described, a rotatable carrier, a plurality of chambers mounted on said carrier, trough-like members reciprocally mounted in said chambers, and means for reciprocating said members, said means comprising means for moving said members in one direction while said members are concave upwardly, and means for returning said members while said members are concave downwardly.

10. In apparatus of the character described, a rotatable carrier, a plurality of chambers mounted on said carrier, article supporting members reciprocally mounted in said chambers and having a length exceeding that of said chambers, a fixed member arranged adjacent said carrier and adapted to engage said article supporting members to move them longitudinally of said chambers, and a second fixed member arranged adjacent said carrier and adapted to engage said article supporting members to return them to their initial position.

11. In apparatus for reducing the moisture content of cigarettes, a rotatable carrier, a plurality of heated chambers mounted on said carrier, article supporting members reciprocally mounted in said chambers, means for feeding cigarettes into said article supporting members, means for reciprocating said members in timed relation to the rotation of said carrier, and means for removing cigarettes from said members after passage of said cigarettes through said chambers.

12. In apparatus for reducing the moisture content of cigarettes, a carrier, a plurality of heated chambers mounted thereon, article supporting members mounted within said chambers, means for feeding cigarettes into said article supporting members, means for inverting said members to permit said cigarettes to rest upon the walls of said chambers, and means for ejecting said cigarettes from said chambers.

13. A method of reducing the moisture content of cigarettes which comprises moving the cigarettes in succession in a predetermined path through a drying zone, heating the cigarettes in such manner that the major portion of the heat

is supplied to the lateral surfaces of the cigarettes while maintaining the end faces of the cigarettes free, whereby vapor driven from the cigarettes by the heat escapes through the open ends of the cigarettes to establish, at least momentarily, a more humid condition near the ends than the mid-portion of the cigarettes.

14. A method of reducing the moisture content of cigarettes which comprises moving the cigarettes in spaced relation in a predetermined path through a drying zone, heating the cigarettes principally by conduction through the lateral surfaces of the cigarettes while maintaining the end faces of the cigarettes free, whereby vapor driven from the cigarettes by the heat escapes through the open ends of the cigarettes to establish, at least momentarily, a more humid condition near the ends than the mid-portion of the cigarettes.

15. A method of reducing the moisture content of cigarettes which comprises moving the cigarettes in spaced relation in a predetermined path through a drying zone, heating the cigarettes by applying greater radiation to the lateral surfaces of the cigarettes than to the open ends thereof while maintaining the end faces of the cigarettes free, whereby vapor driven from the cigarettes by the heat escapes through the open ends of the cigarettes to establish, at least momentarily, a more humid condition near the ends than the mid-portion of the cigarettes.

16. In apparatus for reducing the moisture content of cigarettes, the combination with means conforming generally with the lateral contour of a cigarette to receive and engage the body of a cigarette, the ends of the cigarette being exposed, of means to apply heat to a part at least of said first named means.

17. In apparatus for reducing the moisture content of cigarettes, the combination with a chamber for receiving cigarettes, of means associated with said chamber for heating the surface thereof, said heated surface contacting with at least a portion of the lateral surface only of the cigarettes, the ends of the cigarettes being freely exposed, whereby said lateral surfaces may be subjected to much greater radiation per unit area than the cigarette ends and whereby vapor may be freely discharged through the cigarette ends, and means to move the cigarettes in spaced relation in a predetermined path through said chamber.

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