Oct. 30, 1934. W. WILKIE 1,978,829

METHOD AND APPARATUS FOR DRYING CAPSULES

Filed July 21, 1930 2 Sheets-Sheet 1

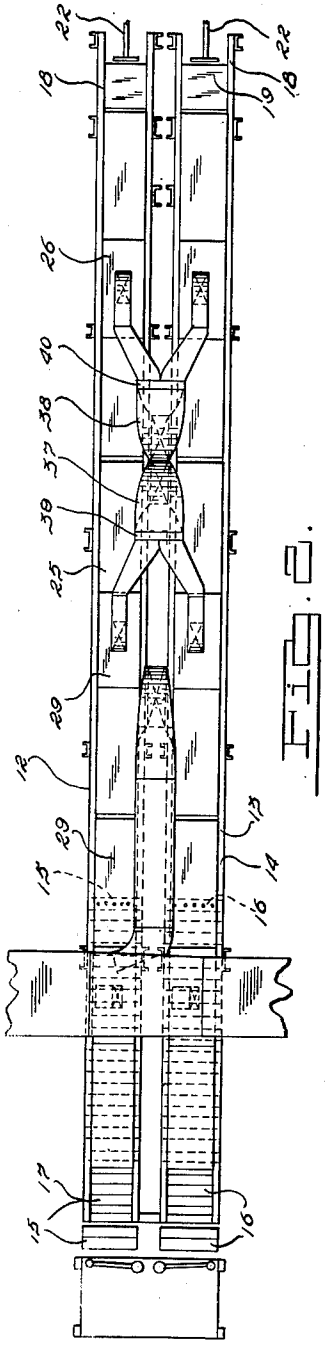


Fig. 2.

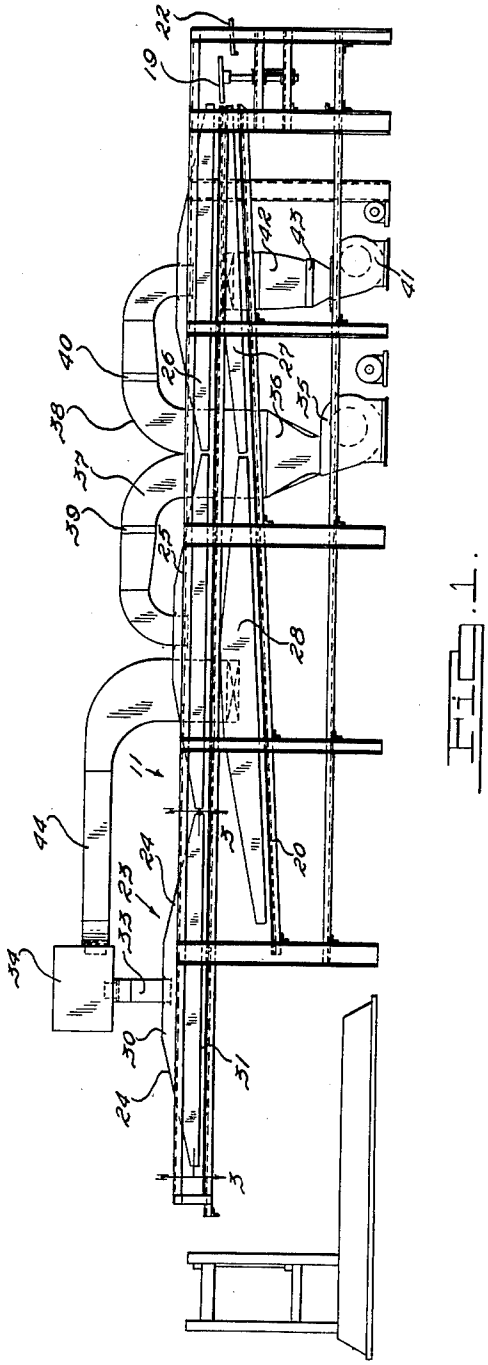


Fig. 1.

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METHOD AND APPARATUS FOR DRYING CAPSULES

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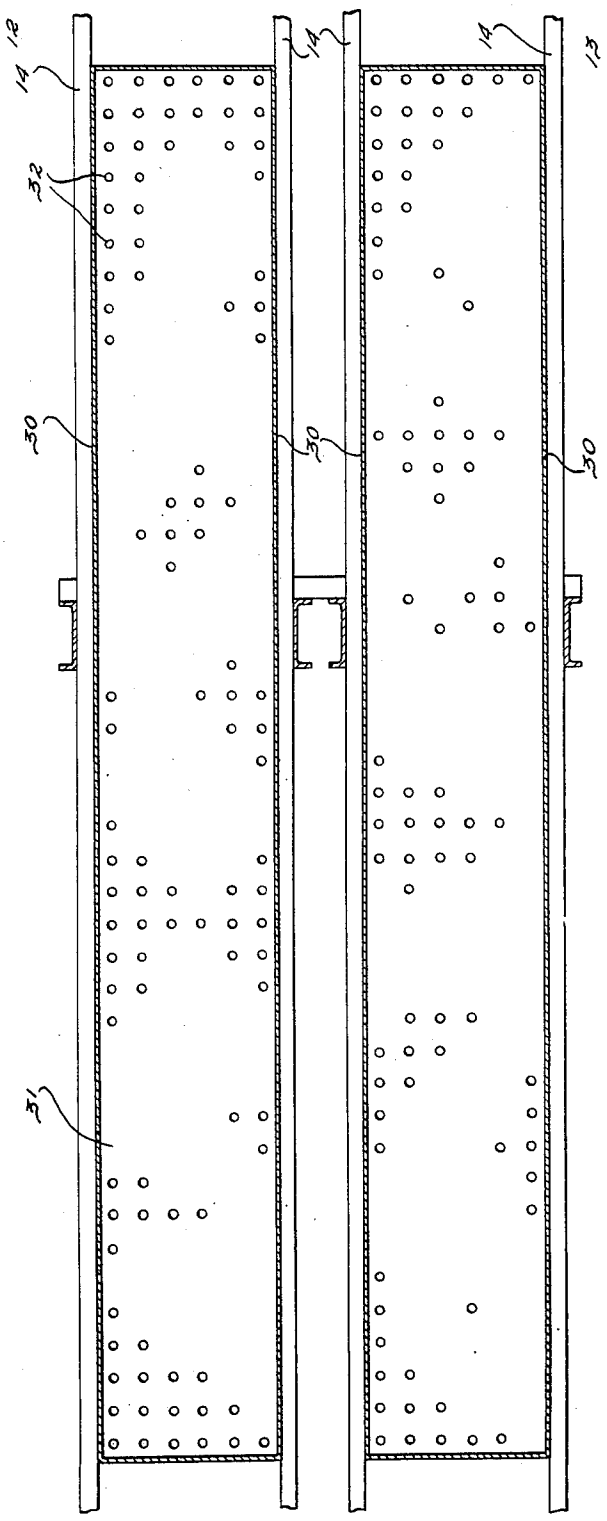
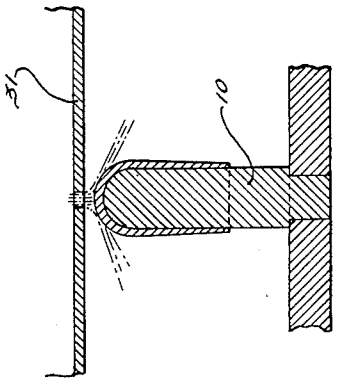


Fig. 3.

Fig. 4.



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Patented Oct. 30, 1934

1,978,829

UNITED STATES PATENT OFFICE

1,978,829

METHOD AND APPARATUS FOR DRYING CAPSULES

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Application July 21, 1930, Serial No. 469,461

11 Claims. (Cl. 34—12)

This invention relates generally to drying systems and has particular reference to improvements in the method and apparatus for drying capsules.

The present invention contemplates a capsule drying system capable for use in connection with machines wherein the process of making the capsules from the dipping to the joining operations is a continuous and thoroughly automatic one, and to this end (the invention) consists in providing a system of the type specified above capable of drying the capsules more uniformly to the proper degree of hardness and capable of accomplishing this result more expediently, rendering it possible to operate the capsule making apparatus at substantially full capacity with the result that production is materially increased.

This invention provides for drying the capsules more uniformly and more expediently by insuring a circulation of air around each individual capsule part and by directing a stream of air against each part at the point containing the most moisture which, as will be more fully hereinafter set forth, is usually the sealed end portions of the parts.

Another advantageous feature of this invention which contributes materially to the reduction in time required to dry the capsules resides in the method of heating the latter as they are advanced from the dipping to the joining mechanisms. The particular method of heating employed, as well as the apparatus utilized for accomplishing the same will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a side elevational view of a capsule drying system constructed in accordance with this invention.

Figure 2 is a top plan view of the construction shown in Figure 1.

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 1. And

Figure 4 is a detail view of one of the capsule forming pins showing a capsule part in assembled relation therewith.

While the system of drying capsules to be presently described may be used as a separate unit independent of the capsule making apparatus, nevertheless, for the purpose of illustration I have shown my improved drying system as used in connection with apparatus similar in basic design and in operation to the apparatus illustrated in the Colton co-pending application Serial No. 153,806, filed December 10, 1926 now Patent No. 1,787,777 wherein the process of making the capsules from dipping the forming pins or dies, corresponding respectively to the body and cap portions of the capsule, to the trimming and joining operations is a continuous and thoroughly automatic one. Thus, it will be observed that the capacity of apparatus of the foregoing type depends largely upon the system of drying employed since it is essential that the cooperating capsule parts be dried to the proper degree of hardness prior to being introduced to the trimming and joining mechanisms.

One method of drying which is disclosed in the above identified co-pending application is to circulate warm air through an elongated chamber and advance the capsule parts through the chamber prior to introducing the same to the trimming mechanism. While the foregoing method of drying is simple in operation, it is objectionable not only from the standpoint of the time interval required between the dipping and trimming operations to dry the capsules, but also due to the fact that the warm air is directed against only one side of the capsules with the result that the latter are not uniformly dried. In this connection it is to be noted that in order to obtain satisfactory results and eliminate waste, the capsules must not only be uniformly dried, but also dried to the proper degree of hardness since if the capsules are not dried sufficiently, the same will be too soft and have a tendency to collapse upon being stripped from the forming pins while on the other hand if the capsules are dried too thoroughly, the same will be brittle and have a tendency to crack or break during subsequent handling thereof. Thus, it will be observed that the efficiency of the process of manufacturing capsules depends to a large extent upon the manner in which the cooperating capsule parts are dried since if the capsule parts are not properly dried, the operation of the remaining steps in the process is materially affected.

In way of illustrating the problems involved in properly drying capsules, reference is made to Figure 4 of the drawings wherein there is illustrated in cross-section a die 10 having a capsule part thereon. It will be observed from the aforesaid figure that the cross-sectional area of the capsule parts vary having the greater amount of gelatin solution at the tops of the forming pins or dies and gradually tapering down the sides of the latter. Thus, it will be

apparent that unless extreme care is taken in drying the capsule parts the lower portions thereof containing the least moisture will have a tendency to dry too thoroughly and become brittle, while the upper portions containing a relatively great amount of moisture will have a tendency to remain soft with the result that the same are liable to collapse when stripped from the pins. Another thing that must be taken into consideration in drying the capsule parts is the temperature of the forming pins or dies since if the latter are subjected to too great a temperature during the drying process and have not cooled sufficiently prior to again being dipped into the gelatin solution, the required amount of the latter will not adhere to the forming pins with the result that the capsule part formed thereby will be too thin necessitating scrapping the same.

The present invention contemplates eliminating the objections and solving the problems specified above by subjecting the capsule parts to progressively increasing temperatures until the same approach the trimming and joining mechanisms at which time the temperature is appreciably lowered so as to cool the pins to the proper temperature prior to dipping the same in the gelatin solution. Moreover, with the present system of drying, the heated air is directed upon the top or sealed end of each capsule with the result that the latter will be uniformly dried irrespective of variations in the cross-sectional area thereof as stated above.

In detail, I have shown in Figure 1 a drying system 11 comprising laterally spaced upper track assemblies 12 and 13 formed of track sections 14 spaced laterally apart a sufficient distance to support the forming pin bars 15 and 16 as shown in Figure 2 of the drawings. The forward ends 17 of the track assemblies 12 and 13 are preferably positioned in operative relation to the dipping mechanism (not shown) of the capsule forming apparatus for receiving the pin bars after the pins carried thereby have been dipped in the gelatin solution. The construction is such that the pins corresponding to the body portions of the capsule are deposited upon the track assembly 12, while the pins corresponding to the cap portions of the capsules are deposited upon the track 13. The pin supporting bars 15 and 16 preferably extend transversely of the track assemblies 12 and 13 and are advanced along the latter by the preceding pin bars by a step-by-step movement. In other words, when a group of pin bars are deposited upon the track assemblies 12 and 13, all of the pin bars resting upon the said track sections are advanced a distance depending upon the number of pin bars deposited upon the track sections. When the pin bars reach the rear ends 18 of the track assemblies 12 and 13, they are deposited upon a suitable transfer platform 19 and moved downwardly into alignment with a second set of track assemblies 20 and 21 disposed below the track assemblies 12 and 13 and extending forwardly from the rear ends 18 of the latter to a point adjacent the trimming and joining mechanisms forming no part of the present invention and accordingly are not shown herein. For moving the pin bars from the transfer platform upon the lower track assemblies 20 and 21, I provide suitable pusher bars 22 operable in timed relation to the operation of the platform to engage the pin bars and transfer the same from the platform to the lower track assemblies 20 and 21. Thus, it will be observed that after the pins carried by the bars have been dipped in the gelatin solution, they are caused to move along the track assemblies hereinbefore set forth prior to being introduced to the trimming and joining mechanisms.

In order to insure proper drying of the capsule parts carried by the pins prior to being introduced to the trimming mechanism, a plurality of independent hood members or chambers 23 are disposed above the upper and lower track assemblies in juxtaposition to each other. While the particular number of hoods or chambers employed has no direct bearing upon the present invention, nevertheless, for the purpose of illustration, I have shown five pairs of separate hood members 24, 25, 26, 27 and 28. As shown in Figure 1, the hood members 24, 25 and 26 are supported above the upper track assemblies 12 and 13, while the lower hood members 27 and 28 are supported above the lower track assemblies 21 and 22. Each of the hood members 23 are of a box-like construction having top, bottom and side walls 29, 30 and 31, respectively, preferably formed of sheet metal or other suitable material. The hood members are supported above the track assemblies in such a manner that the bottom walls 31 thereof are spaced a slight distance above the tops of the pins carried by the pin bars and are provided with a series of openings 32 spaced from each other a distance corresponding to the distance between the pins carried by the pin bars with the result that the capsule parts carried by the pins assume positions during the interval of rest in direct vertical alignment with the openings 32.

As shown particularly in Figure 1, each of the hood members 23 are adapted to communicate with a suitable source of preheated air under pressure with the result that the air upon entering the hoods is directed through the openings 32 in the bottom walls thereof upon the capsule parts. In this connection it is to be noted that since the number of openings 32 correspond to the number of forming pins carrying the capsule parts and since the openings 32 are arranged directly above each of the pins, a separate stream of air will be directed against the top of each individual capsule part. As previously stated, this arrangement is of primary importance since the top or sealed end portions of the capsule parts are usually considerably greater in cross-sectional area than the lower end portions and as a consequence it is desirable to concentrate the greater amount of heat upon the sealed end portions of the capsule parts. Moreover, with the above system of drying all portions of the annular side walls of the capsule parts receive substantially the same amount of air since the latter in striking the sealed end portions of the parts is deflected outwardly against the side walls of adjacent capsule parts. Thus, it will be observed that with the foregoing system of drying, the capsules are not only expediently dried, but are dried uniformly.

In utilizing preheated air for drying the capsule parts, extreme care must be taken in controlling the temperature of the air since if the capsule parts are subjected to too great a temperature immediately after leaving the dipping mechanism, the gelatin solution is liable to melt and flow off of the pins. As a consequence, the hoods 24 adjacent the forward ends of the track assemblies 12 and 13 are pref-

erably supplied with air heated to substantially room temperature. For accomplishing this result air from the room may be blown directly into the hoods 24 by a suitable blower (not shown) or, as shown in Figure 1, the hoods 24 may be connected by means of a suitable pipe 33 having one end communicating with the hood members 24 and the opposite end communicating with the room conditioning system illustrated generally by the reference character 34. The next adjacent hood members 25 and 26 are supplied with air by a suitable blower system 35 adapted to withdraw the air from the room and discharge the same into the main supply pipe 36. The main supply pipe 36 is provided with suitable branch pipes 37 and 38 adapted to move with the hood members 25 and 26, respectively, as shown in Figure 2 of the drawings. Each of the branch pipes 37 and 38 are equipped with thermostatically controlled heaters 39 and 40, respectively, for heating the air prior to discharging the same into the hood members 25 and 26. The thermostat controlling the heater 39 is preferably set to heat the air discharged into the hood members 25 to a temperature slightly above the temperature of the air discharged into the hood members 24. The thermostat controlling the heater 40, on the other hand, is set to heat the air discharged into the hood members 26 to a greater degree than the air discharged into the hood members 25. The hood members 27 upon the rear end portions of the track assemblies 20 and 21 are preferably supplied with air by a separate blower unit 41 similar in construction to the blower unit 35 with the exception that the main supply pipe 42 is provided with a thermostatically controlled heater 43 set to heat the air discharged into the hood members 27 to a greater degree than the air discharged into either of the hood members aforesaid. Thus, from the foregoing it will be observed that as the capsule parts are advanced beneath the hood members 24, 25, 26 and 27 along the upper and lower track assemblies, the same are subjected to progressively increasing temperatures.

As will be observed from Figure 1 of the drawings, the hood members 28 adjacent the trimming mechanism (not shown) are supplied with air by means of the supply pipe 44 having one end communicating with the hood members 28 and the opposite end communicating with the room conditioning system 34. Thus, it will be observed that the hood members 28 are supplied with air from the same source as the hood members 24 with the result that the temperature within the hood members 28 will substantially correspond to room temperature. The arrangement is such as to cool the forming pins prior to the same reaching the dipping mechanism so that the required amount of the gelatin solution will adhere to the pins.

What I claim as my invention is:

1. In apparatus for drying capsule parts and the like, the combination of means for supporting the capsule parts in spaced relation to each other with their closed end portions uppermost, and means for discharging a fine stream of drying fluid upon the closed end portions of each individual capsule part whereby the closed end portions are dried to a greater extent than the open end portions.

2. In apparatus, for drying capsule parts the combination with means for supporting a plurality of capsule parts to be dried in spaced relation to each other, of a plate disposed to one side of the capsule parts having openings therein of an area not substantially larger than said capsule parts and spaced from each other a distance corresponding to the spacing of said capsule parts on the support whereby each opening is arranged in direct alignment with the closed end of one of the capsule parts, and means for discharging a drying fluid through the openings whereby a stream of fluid is discharged directly upon the closed end of each individual capsule part to be dried.

3. In apparatus for drying capsule parts and the like, the combination of means for supporting the capsule parts in spaced relation to each other, a plate disposed to one side of the said parts and having spaced openings therethrough in alignment with the closed end of said capsule parts and smaller in size than said capsule parts, means for advancing the said parts along said supporting means by a step-by-step movement substantially equal to the distance between the openings, and means for discharging a drying fluid through said openings whereby the closed end of each capsule part is subjected to the direct action of an individual stream of drying fluid.

4. In apparatus, for drying capsule parts the combination of means for advancing a plurality of capsule parts to be dried along a predetermined path by a step-by-step movement, and means for discharging individual streams of drying fluid upon each capsule part during the course of travel of the same, and means for heating the streams of air to different predetermined temperatures, whereby each capsule part is subjected to varying temperatures during the course of travel thereof.

5. An apparatus for drying capsules comprising capsule carrying means and means for causing a current of drying fluid of smaller cross-sectional size than said capsule to strike the closed end of said capsule and flow around the same toward the open end thereof whereby a differential drying effect is obtained.

6. An apparatus for drying capsules comprising a conveyer for supporting a plurality of capsules, means for intermittently advancing said conveyer, a series of hoods extending over portions of said conveyer, means for supplying drying fluid to said hoods, perforated baffles in said hoods closely spaced to said capsules and having perforations corresponding to each of the capsules and aligned with respect thereto and means for increasing the temperature of the drying fluid supplied to successive hoods in the direction of advancement of said conveyer.

7. The step in the method of drying capsule parts comprising directing upon the closed end of each capsule part an individual stream of drying fluid of cross-sectional area less than said capsule part.

8. That step in the method of drying capsule parts which consists in discharging upon the sealed end portion of each capsule part an individual stream of preheated fluid of cross-sectional area less than said capsule part.

9. In the method of manufacturing capsules by dipping a mold into soluble gelatin, the step of differentially drying the capsule on the mold comprising the directing onto the closed end of the capsule a stream of drying fluid of smaller area than said capsule and permitting the same to flow around said closed end and longitudinally toward the open end whereby a greater drying

effect is obtained at the closed end of the capsule than at the open end thereof.

10. The method of drying a capsule comprising directing a stream of drying fluid of smaller area than said capsule on the closed end of the same in an axial direction and causing the stream to flow around the sides of said capsule, thereby imparting a differential drying effect.

11. The method of drying a plurality of capsules comprising directing a plurality of individual streams of drying fluid, each of area less than a capsule against the closed ends of said capsules and causing the individual streams to flow around the sides of said capsules toward the open ends thereof and intermittently advancing said plurality of capsules with respect to said streams to align said capsules with a different set of streams and increasing the temperature of the streams of drying fluid in the direction of advancement of said capsules.

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