Dec. 27, 1966 R. J. OSBORNE ET AL 3,294,554

DEHYDRATION METHOD AND APPARATUS

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FIG. 1

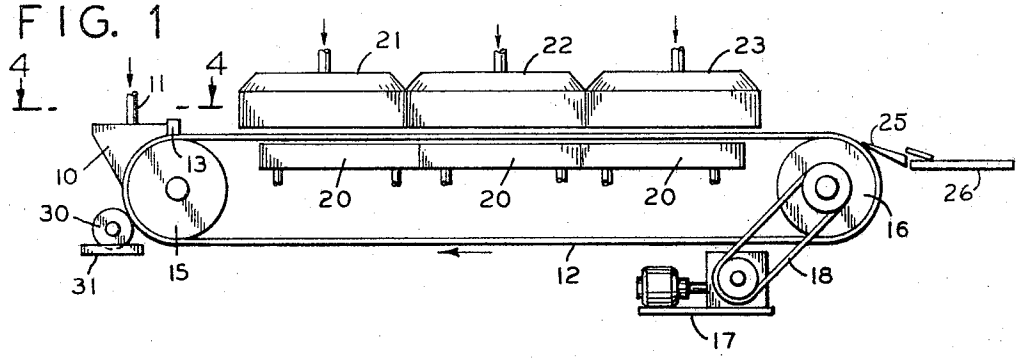


FIG. 2

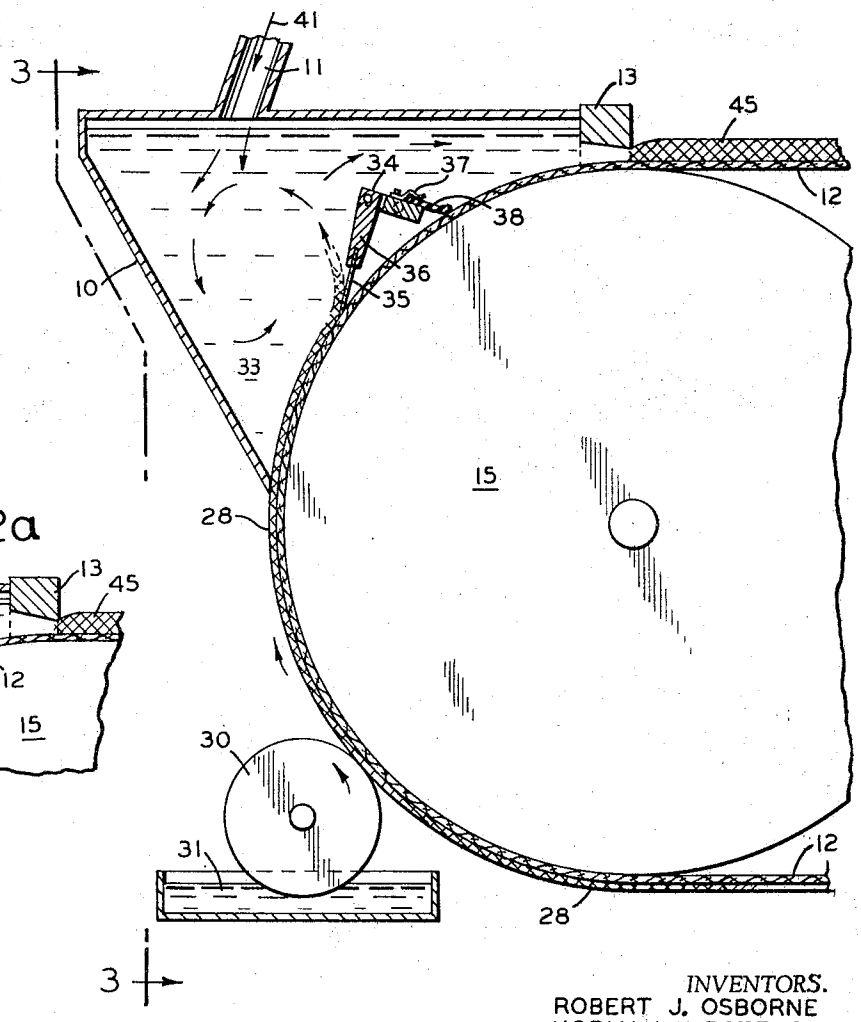
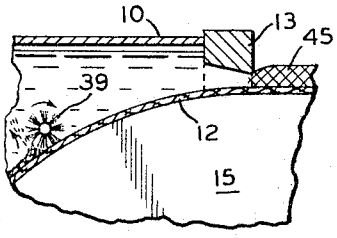


FIG. 2a



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FIG. 3

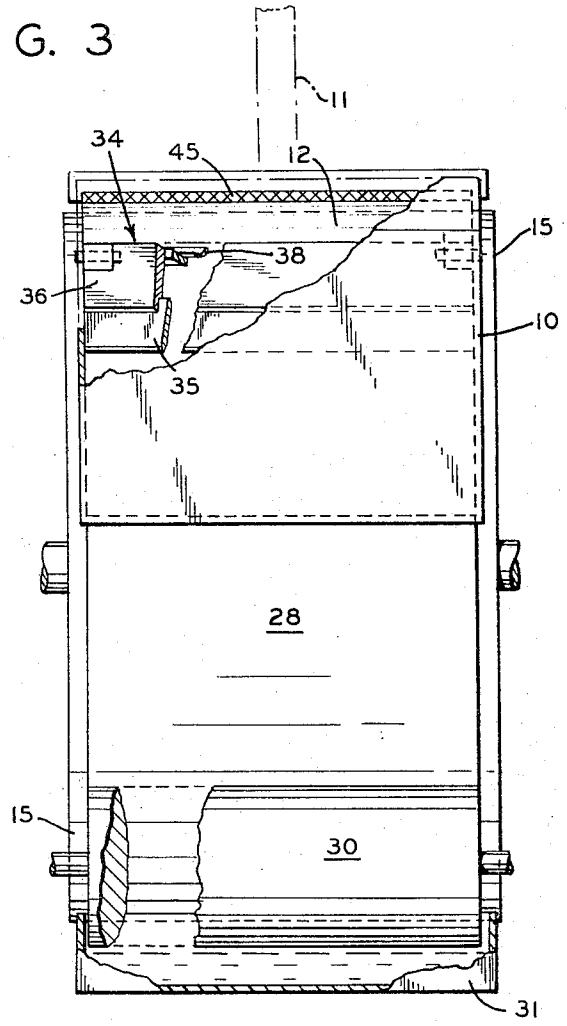
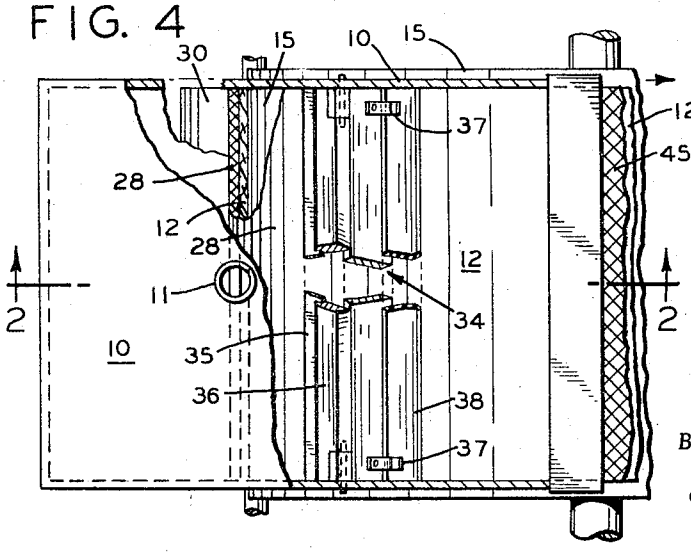


FIG. 4



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DEHYDRATION METHOD AND APPARATUS

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4 Claims. (Cl. 99—199)

This invention relates to an improved method of drying material on a continuous belt and to the related apparatus. More particularly, the invention relates to means for facilitating the cleansing and recovery of residual material remaining on the belt after the dried product has been removed and to the related apparatus useful for this purpose.

The invention will be described in conjunction with its use in drying food slurries and in particular in connection with the drying of foam layers of food stuffs but it will be understood that the inventive teaching is not limited to this specific application.

In the drying of food purees as foam layers, many foods are encountered which are difficult to remove from the drying surface in the dried state. Among these are tomato paste, orange juice and grape juice. Complete removal of these materials is desirable in order to improve yield. It is even more important to prevent the repeated travel of the product through the dryers since degradation will eventually occur under even the mild conditions in drying foam layers. This degradation will result in poorer product quality than desired.

Attempts have been made to eliminate the problem as by using a fluorocarbon resinous composition such as Teflon, as a belt material, but experience with this approach indicates that this type of belt must be washed to remove undoctored material. Experience with conventional stainless steel belts has shown that even a greater problem exists with belts of this type.

In accordance with the invention, we have found that an entirely satisfactory procedure may be applied by the recovery and recycle of the undoctored material. Since foods which are dried in the foam state reconstitute readily, the undoctored residue on the belt, after the bulk of the product has been removed, is rewetted by some means such as a felt roll applicator. The moist residue, still on the belt, passes to the casting box zone. Inside the casting box, a removal means for the residue, which is now rewetted and softened, such as a doctor knife doctors the material which is then distributed into the fresh material by the turbulent action of the foam in the box.

Although this process involves the recycling of some material, the amount is relatively insignificant. If as much as 5% of the product remains on the belt after doctoring, only 0.012% of the final product will receive as many as three passes through the dryer. This does not have any noticeable deleterious effect on the product in view of the fact that any residue is "new" with each cycle.

It is an object of the present invention to provide means for cleansing adhering residual material from a continuous drying surface after the bulk of material dried has been removed from the surface. It is another object of the invention to provide an apparatus for the removal and recovery of residual material from a continuous drying belt. It is still another object of the invention to provide a simple and expeditious means for removal of encrusted material adhering to a continuous drying surface to prevent adverse flavor effects therefrom to the material dried on said surface.

The means for accomplishing the foregoing and other objects as well as for securing various advantages will become apparent as the invention is further described in

connection with the construction and arrangement illustrated by the drawing in which:

FIG. 1 is a diagrammatic illustration of an endless drying conveyor with the residue removal arrangement of the invention.

FIG. 2 is a more detailed side elevational representation, taken substantially along line 2—2 of FIG. 4, of a means for carrying out the invention illustrating a foam layer deposit reservoir and belt residue removing arrangement situated in the foam material reservoir.

FIG. 2*a* illustrates an alternate embodiment of a belt residue removal element.

FIG. 3 is an end elevational view partially in section taken substantially along line 3—3 of FIG. 2.

FIG. 4 is a top view partially in section taken substantially along line 4—4 of FIG. 1.

Referring to FIG. 1, a foamed food-stuff prepared in a manner known in the art and described, for example, in the copending application of R. J. Osborne et al., entitled "Drying Process and Apparatus," filed on even date herewith, Serial No. 258,807, now Patent No. 3,266,559, issued on August 16, 1966, is introduced into reservoir **10** through line **11**. The foam in the reservoir **10** is continuously applied as by a conventional casting bar or knife **13** onto an endless conveyor or belt **12** in layers of suitable depths. The belt **12** is suitably supported at **15** and **16** and driven by conventional variable drive and motor arrangement **17** through connecting chain or belt **18**. The belt **12** is provided with a zone controlled heating arrangement such as a series of steam boxes **20** into which steam, or steam admixed with air, is fed for zone control of temperature. Heat for the belt **12** is preferably supplied at the underside of the belt by steam jets which impinge on the belt. Drying may be supplemented by utilization of air or gas in contact with the surface of the material within one or more zones contiguous to the belt. Three such zones **21**, **22** and **23** are illustrated. In these zones, for example, increasingly hotter gases with variable humidity, velocities, etc. may be introduced to the drying surface in zones **21** and **22**, respectively, and in zone **23** a final contact with an inert gas may be used just prior to or coincidental with the removal of the dehydrated product from the conveyor belt **12**. A conventional means such as doctor blade **25** may be used to remove the dried material collected at **25** from the belt **12**. Additional detail in connection with the underside heating of belt **12** and controlled contact of drying material by steam boxes **20** and in zones **21**, **22** and **23** is presented in the above noted copending Osborne et al. application.

The advantageous features of the invention are described in greater detail by reference to FIGS. 2, 3 and 4. As shown, undoctored residue designated **28**, which remains on the belt **12** after the bulk of dehydrated material has been removed at **25** (FIG. 1), is preferably remoistened by suitable means such as felt roller **30** in contact with the belt surface and a reservoir **31** or other source of solvent for the residue. Various other means such as a spray (not shown) may be used for remoistening the belt surface in lieu of the remoistening roll **30**. The belt **12** containing residue **28** thereon passes through the feed reservoir or chamber **10** where it is contacted by feed material **33**. The reservoir comprises a suitably enclosed chamber into which foam may be introduced at atmospheric pressure or under a slightly elevated pressure. Contained in a suitable location to enhance intimate admixture of the residue **28**, after removal from the belt, is a belt cleaning element **34** suitably secured to the sides of reservoir **10**. The element illustrated comprises essentially means to remove and recirculate the residue within the chamber **10** and may include a conventional doctor blade **35** appropriately supported in a blade holder

36 adapted for ready replacement of blades. It will be understood that other arrangements such as a rubber roll or brush 39 revolving against the belt may be used in lieu of the doctor blade, as shown in FIG. 2*a*.

To eliminate a stagnant zone of feed behind the doctor blade 35, a dam or barrier 38 removably secured as at 37 to element 34 may be used. The barrier 38 comprises a rigid element which may comprise metal or plastic. Barrier 38 is secured at one end to the doctor blade holder element 34 and positioned so as to contact the conveyor belt 12 at the other end. The arrangement of the doctor blade 35 is preferably such that the residue 28 removed from the belt is suitably admixed with the feed in the reservoir by circulation as shown by arrows within the chamber 10. Circulation may be aided by the direction in which the fresh feed is introduced at 11 as shown by arrow 41. The arrangement 13 is of conventional design which permits casting of feed layers 45 of variable thicknesses.

In order to further illustrate the advantages of the invention the following illustrative examples are provided.

Foamed tomato paste having a foam density of 0.52 gm./cc. prepared by whipping a commercial 30% solids tomato paste with 0.85% mixed monoglycerides (Myverol 18–00, Distillation Products Industries, Division of Eastman Kodak Company) based on tomato solids, as foam stabilizer, is deposited to form a layer of 25 mils on the apparatus illustrated in the drawing.

Three runs were made, each on separate days.

Run No. 1

In the first run, the roll moistener 30 and the doctor knife 35 were not functioning, i.e. residue was allowed to accumulate. The product doctored from the belt toward the end of this run had a noticeable deleterious taste attributable to the "burning" of residue continuously recirculated on the belt through many drying cycles. Toward the end of the run a portion of this residue which was clearly inferior in taste was compared with the residue of Run No. 3.

Run No. 2

In the second run, again in which the invention was not applied, a second doctor blade was positioned approximately at the place where the moistener roll is illustrated in FIG. 1 in an attempt to remove residue undoctored at 25 (FIG. 1) at the time of removal of the bulk of the product. A residue amounting on the average to between 3–5% of the product was removed from the belt 12 at this point. This residue was different in appearance from the product doctored at 25 and consequently could not be comingled in the interests of providing a highly uniform quality product. Even after this second doctoring, significant amounts of residue still remained on the belt.

Run No. 3

In the third run, wherein the apparatus and procedure of the invention was applied, no deleterious effect or adverse taste was apparent at any time. Residue doctored from the belt toward the end of the run contiguous to but prior to moistener roll 30 had excellent flavor as compared with residue from Run No. 1.

From the foregoing it is seen that an exceptionally efficient, economical and advantageous apparatus and method are provided for cleansing belts in continuous dehydration processes wherein the material dried is applied directly upon and adheres to the belt surface.

It will be apparent that variations of the details presented herein are possible without departing from the scope of the inventive concept. Accordingly, it is understood the invention is not to be limited precisely to the construction shown and specifically to each of the steps recited except as necessitated by the limitation expressly set forth in the claims.

We claim:

1. In a method for continuous drying of material on an arrangement comprising an endless belt including the steps of depositing material, from a feed material reservoir, on said belt, drying said material and separating the dried material, the steps which include remoistening residue on said belt after separating the dried material and before the belt passes to the feed reservoir, scraping residue from said belt by means situated within said reservoir, and interspersing said residue with said feed material in said reservoir.

2. In a method for continuous dehydration of foodstuff foam on an arrangement comprising an endless belt including the steps of depositing said foam from a foam reservoir on said belt, drying said foam and separating the dried foam, the steps which include remoistening dried residue on said belt and doctoring said residue by means situated within said reservoir and interspersing said doctored residue with foam within said reservoir.

3. In combination with an endless belt for drying material; means including a reservoir from which material to be dried is applied to said belt and separation means to remove dried material from said belt, a belt cleaning element comprising a belt scraping arrangement contained in said reservoir, belt remoistening means interposed between said separation means for the dried material and said belt cleaning arrangement, said belt scraping arrangement including means to remove from said belt residue remaining on said belt after being subjected to said separation means and means to intersperse said residue with material in said reservoir.

4. The combination of claim 3 in which the means to remove residue from said belt comprises a doctor blade immersed below the feed material level in said reservoir.

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