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[54] **DOUGH FEEDING APPARATUS**
9 Claims, 6 Drawing Figs.

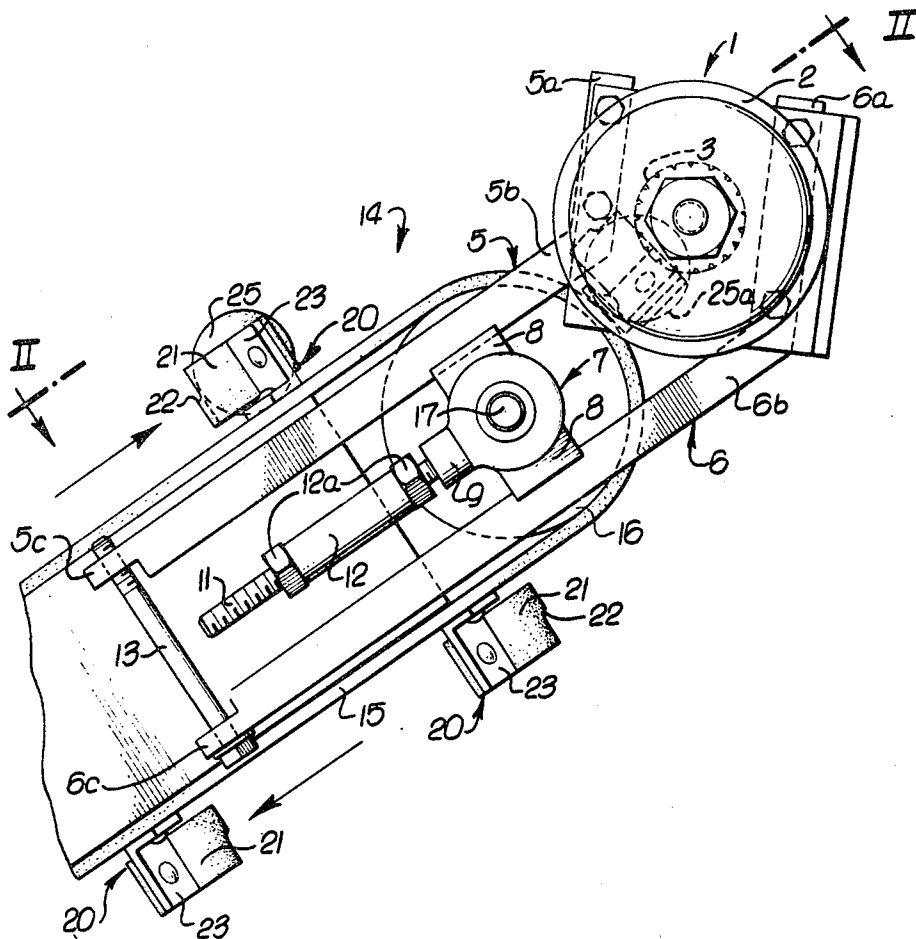
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107/57, 198/128, 198/153, 198/185
[51] Int. Cl. B65g 37/00
[50] Field of Search 198/103,
131, 25, 128, 153, 185; 107/57.1

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ABSTRACT: An apparatus for transporting a plurality of divided elements of a tacky dough substance to a predetermined location where the elements are shaped into toroids. An impelling mechanism consisting essentially of driven impeller wheels is associated with the apparatus. The wheels engage and impel the elements from their predetermined location of a conveying portion of the apparatus at a uniformly predetermined rate, to a toroid-forming machine. The use of the impelling mechanism avoids pileup of one element upon another in the toroid-forming machine by overcoming the normally adhering characteristics of the elements to the material of the conveying portion of the apparatus, brought about by the normally tacky nature of the elements. The impelling mechanism, therefore provides only one element at a time through a feeder to a toroid-forming portion of the toroid-forming machine, thereby resulting in a toroid of uniform size and shape. The use of the impelling mechanism further prevents clogging of the toroid-forming machine by enabling only a single element at a time to be fed to this machine, thereby improving product reliability and reducing the rejection rate of the manufactured toroids.



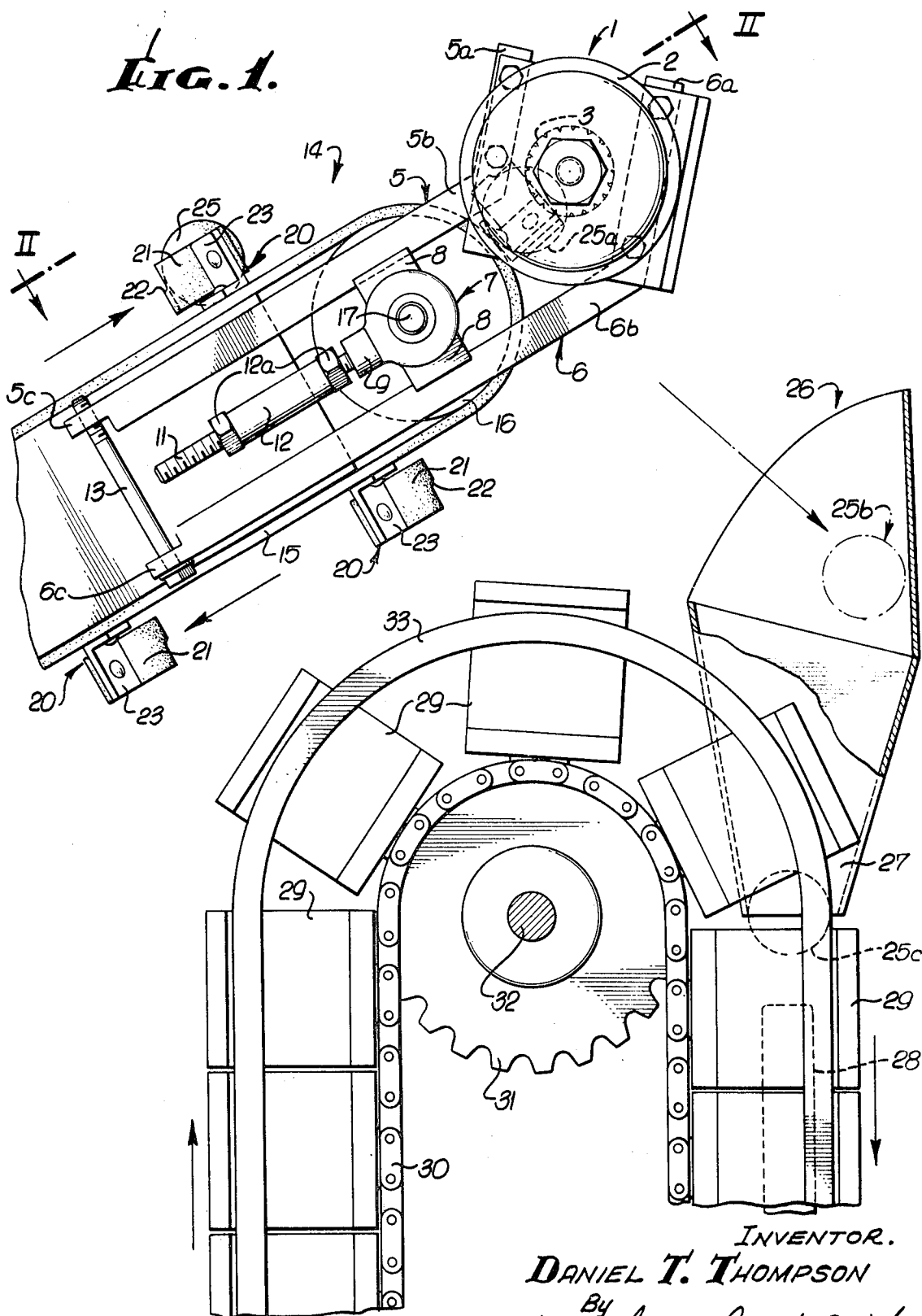


FIG. 2.

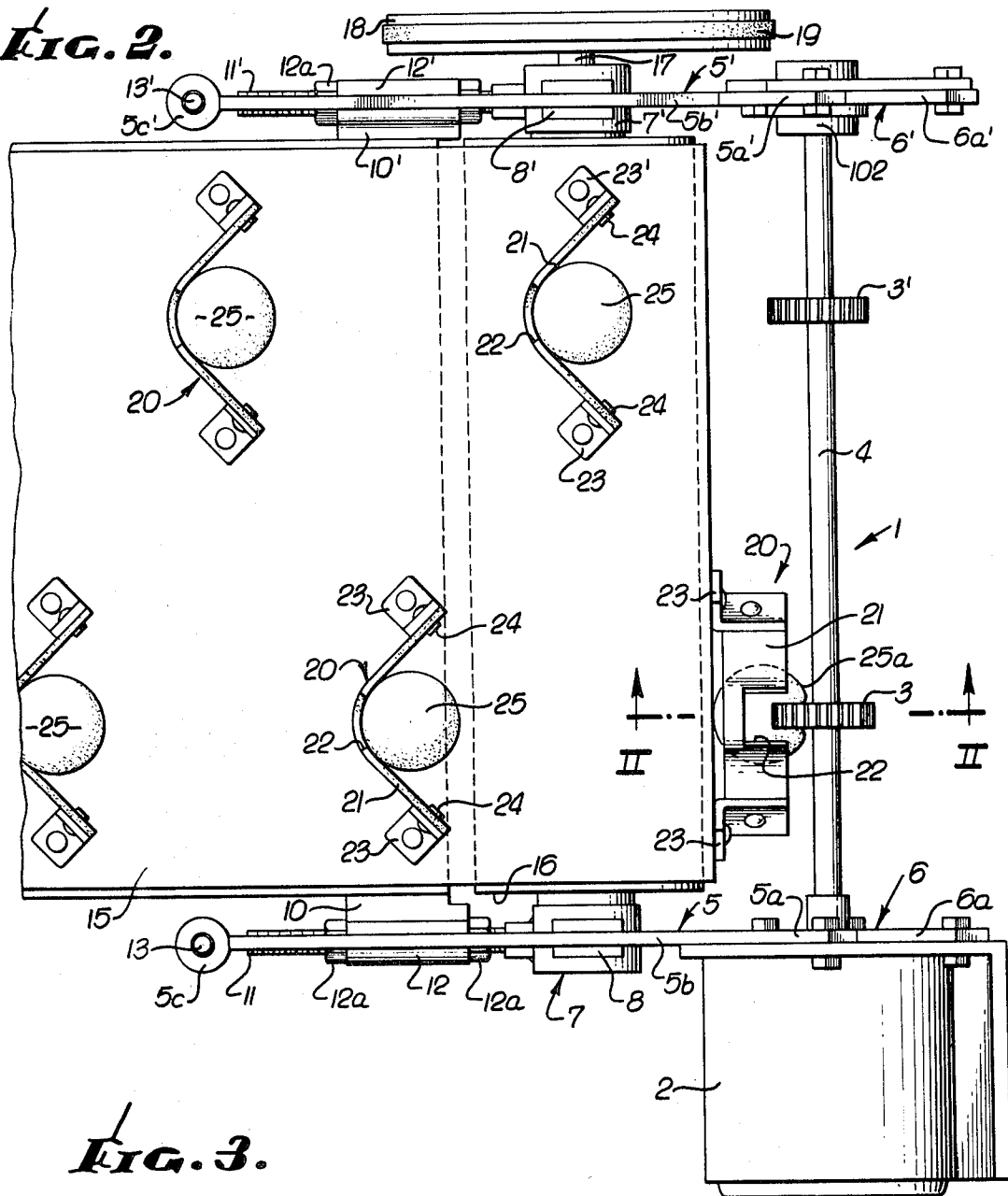
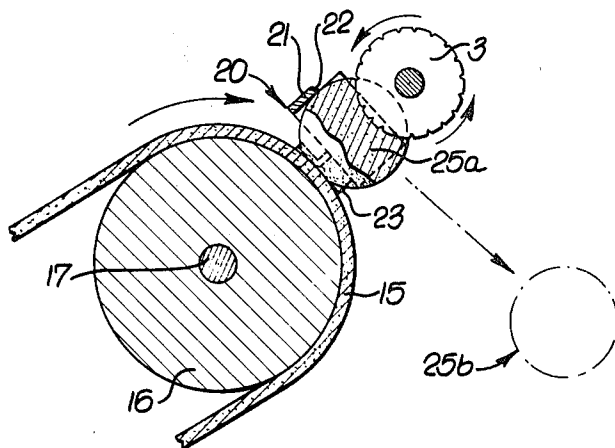


FIG. 3.



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Fig. 4.

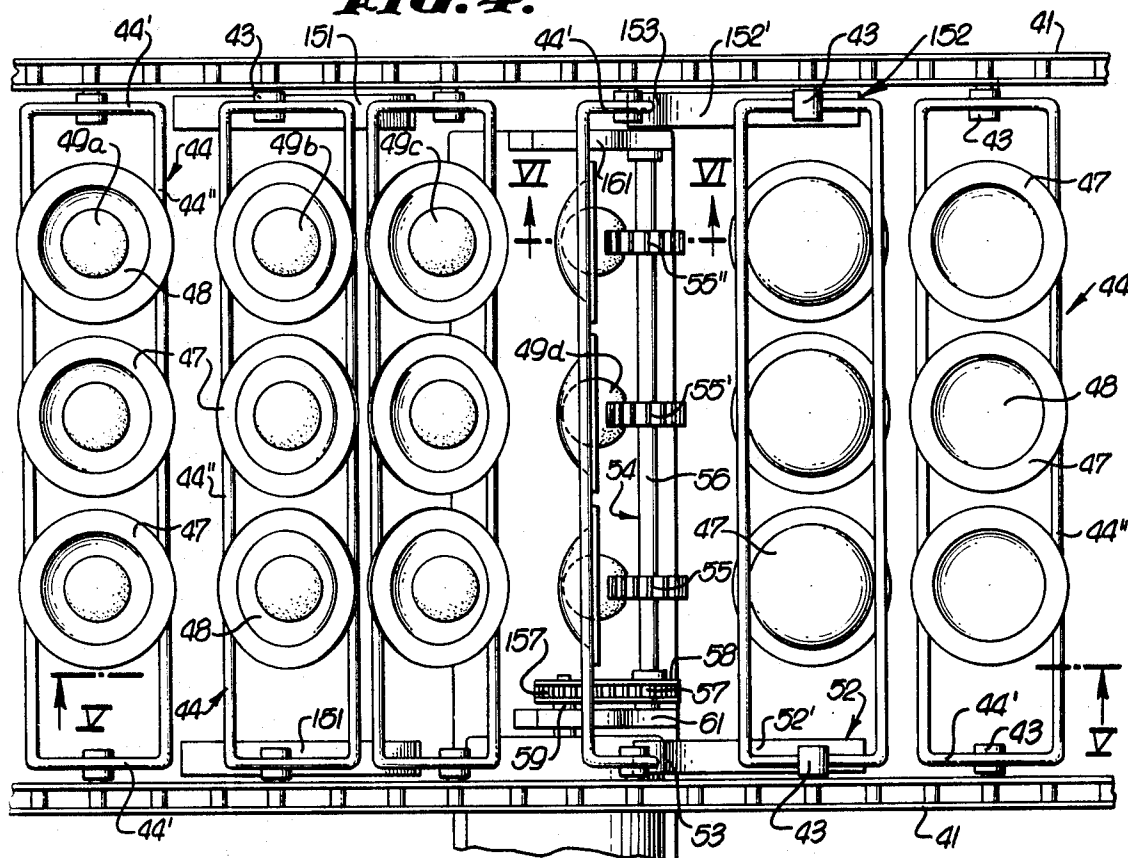


Fig. 5.

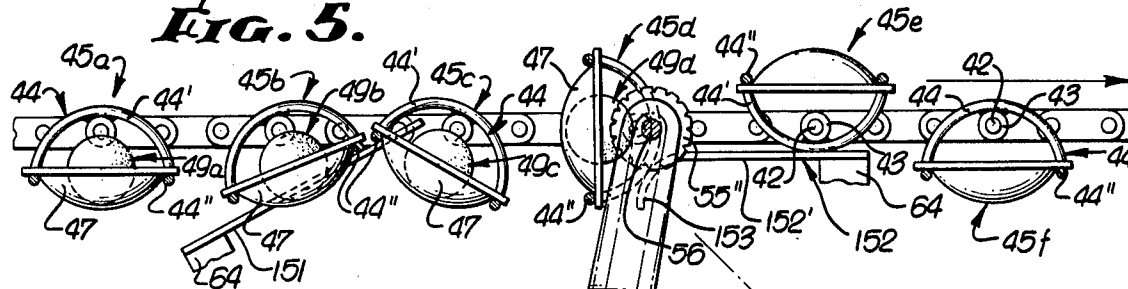
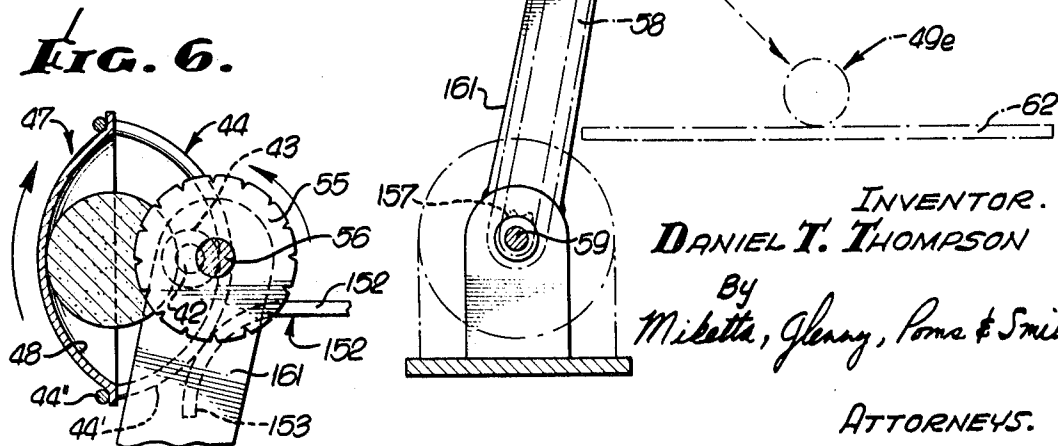


Fig. 6.



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DOUGH FEEDING APPARATUS

BACKGROUND OF THE INVENTION

The invention embodiments disclosed herein may be used in conjunction with toroid-forming and dough conveying machines which are disclosed in prior U.S. Pats., No. 3,031,979, issued May 1, 1962 and No. 3,371,624, issued Mar. 5, 1968.

This invention relates in general to an apparatus for rapidly transporting a plurality of divided elements of a pliant, deformable, tacky dough substance or other plastic material used for making toroids. More particularly, this invention relates to a conveyor apparatus particularly suited for transporting relatively tough, elastic dough, required for making bagels of an annulus or toroid configuration preparatory to baking the dough and to a finished bagel.

In the art of forming and baking bagels in the past, it has been the practice to transport by means of a conveyor means, a plurality of divided elements of dough which had been subjected to proofing, to a toroid or other bagel-forming machines. Proofing is the time during which the dough is allowed to rise, prior to baking to compensate therefor. Inasmuch as the dough elements being fed by the conveyor means are tacky, the tendency is for the dough elements to adhere to the material of the conveyor means. The dough elements are retained by holding means attached to the conveyor means at specifically predetermined and regularly spaced locations on the conveyor means. These holding means, may be a plural number of cleats attached to a conveyor belt or may be a plural number of dough pans or trays attached to a plural number of pivotable hangers which in turn are attached to the conveyor drive chains.

A major disadvantage of the conveyor belt and cleat configuration or of the dough pan and hanger arrangement, is brought about by aperiodic feeding of the dough elements to a hopper of the toroid-forming machine. This aperiodic or erratic feeding is caused by the tacky character of the dough elements, where one dough element will adhere to the holding cleat surface, conveyor belt surface or dough pan surface with different degrees of adhesion. The varied adhesive character of the dough elements with respect to the different surfaces causes these elements to be fed to the toroid-forming machine, often with such irregularity that while a particular toroid is in the process of being formed another dough element is fed to the same forming portion of the toroid-forming machine. Also, due to the lack of positive and impulsive feeding, two or more dough elements may often be fed with insufficient time spacing therebetween so that the toroid-forming portion is presented with two or more dough elements to form the single toroid. This results in toroids of varied size and operates to clog the toroidal-forming apparatus, thereby resulting in an unreliable toroid production cycle, and contributing to down time for unclogging the toroidal-forming machine, frequent machine adjustment and repair, and in inferior product in view of size irregularity.

Still further disadvantages relate to the incapability of complete circular rotation of the hangers which hold the dough pans, thereby restricting the freedom of rotation of these hangers and consequently limiting feed positioning capability of the dough pans for achieving the correct feed angle with respect to a hopper of the toroid-forming machine. Lack of complete circular rotation of the hangers also involve complex mechanism for returning the hangers and dough pans thereon to their initial feeding positions.

INVENTION OBJECTIVES AND SUMMARY

It is therefore, an objective of the present invention to disclose and provide an apparatus operatively associated with the conveyor means for overcoming the aperiodic feeding of the dough elements to the hopper of the toroid-forming machine.

It is another object of the present invention to provide dough element cleat-type holding means of the same material as the conveyor belt surface for maintaining the same degree of adhesion of the dough element to the two surfaces.

It is a further object of the present invention to provide impelling means associated with the conveyor for impelling each of the dough elements from the conveyor at a predetermined location thereof, and at a uniform rate to the specific toroid-type dough forming machines as disclosed in prior U.S. Pat. Nos. 3,031,979 and 3,371,624 as well as to other dough handling or forming apparatus.

It is still a further object of the present invention to provide more positive and regular feeding of the dough elements to the dough feeding machine by providing roughened edges or grooves at the periphery of driven wheels of the impelling means for improving the engagement characteristics of the impelling means with the dough elements.

It is still another object of the present invention to provide adjustable mounting means on the conveyor for mounting the impelling means thereon, thereby enabling the setting of the depth of entry of the driven impeller wheel into the dough elements and thereby providing optimum setting of this adjustment for obtaining regularity of impulsive feeding of the dough elements.

It is another object of the present invention to provide relieved portions in the cleat-type holding means for enabling the edge of the impeller wheel to enter the dough element at the required depth.

It is still a further object of the present invention to provide locking-type fastening means for fastening the impelling means to the conveyor and for enabling adjustment of the impeller means into a selected position of adjustment.

It is still a further object of the present invention to provide a plurality of hangers with dough pans thereon and which are pivotably suspended from conveyor drive chains, and where capability of full circular rotation about their pivotal suspension is provided.

It is still another object of the present invention to include guide members attached to the conveyor for providing camming action of the hangers for pivoting the hangers and the dough pans to a predetermined position, thereby obtaining the best delivery position of the dough elements for engagement with the impeller wheel.

It is a still further object of the present invention to improve the reliability of the process of making toroids, to decrease the down time and maintenance time of the dough forming machines resulting from aperiodic feeding of the dough elements, and to improve the quality of the product being produced by providing only one dough element at a time to a dough forming portion of the toroidal-forming machine.

Further objects and various advantages of the present invention will become apparent to those skilled in the art from a consideration of the following detailed explanations of a first exemplary embodiment and an alternative exemplary embodiment of the apparatus of the present invention. Reference will be made to the appended sheets of drawings in which:

FIG. 1 is an elevation view of an exemplary apparatus for conveying dough elements to an impelling means, showing the relationship of the impelling means with respect to the conveyor, and the relationship of the conveying and impelling means with respect to a toroid-forming machine;

FIG. 2 is a plan view of the conveying and impelling means taken along plane II-II of FIG. 1;

FIG. 3 is a detail section view of a portion of the conveying and impelling means taken along plane III-III of FIG. 2;

FIG. 4 is a schematic plan view of an alternate embodiment of the invention showing another conveying and impelling means arrangement;

FIG. 5 is a section view of the conveying and impelling means taken along plane V-V of FIG. 4 and showing the driving mechanism for the impelling means; and

FIG. 6 is a detail section view taken along plane VI-VI of FIG. 4 and showing the relationship of the dough pan, the dough element, the impeller wheel, and the camming relationship of the dough pan hangers with guide members of the conveyor.

DETAILED EXEMPLARY EMBODIMENTS

A detailed explanation of an exemplary embodiment of the apparatus for transporting a plurality of uniformly spaced divided elements of a tacky dough substance to a predetermined location, and having a conveying means and impelling means may be seen by referring to FIGS. 1, 2 and 3.

Impelling means indicated generally at 1, are associated with a conveyor means indicated generally at 14 for impelling each of the elements from the conveyor means at a predetermined location where the conveyor means carries the elements into engagement with the impelling means.

Impelling means 1 in the exemplary embodiment comprises impeller wheels 3 and 3' mounted on drive shaft 4 which is driven by drive motor 2. Drive shaft 4 is attached to a coupling of motor 2 at one end and is supported at the other end in a journal bearing 102. Impeller assembly 1 having wheels 3 and 3', motor 2 and drive shaft 4 are attached to two pair of oppositely disposed spaced parallel arms. Portions 5a and 6a of the left pair of arms 5 and 6 are used for mounting motor 2 thereon by means of bolts. Portions 5a' and 6a' of the right pair of arms 5' and 6' are used for securing bearing 102 thereto. The rearward portions 5b, 5b' and 6b, 6b' (not shown) of both pair of arms 5, 6 and 5', 6' are held within slots of extensions 8 and 8' which are integral portions of journal bearings 7 and 7' respectively. Ends 5c and 5c' and 6c, 6c' of arms 5, 5' and 6, 6' have apertures therein for inserting fastening means such as bolts 13. The apertures in ends 5c and 5c' are threaded for enabling fastening means or bolts 13, which are partially threaded, to be tightened so as to pull arms 5, 5' and 6, 6' respectively together, thereby wedging portions 5b, 5b' and 6b, 6b' of each pair of arms within the slots of the associated extensions 8 and 8'. Tightening bolts 13 locks adjustable mounting means consisting of arms 5, 6 and 5', 6' in a selected position of adjustment of the impelling means with relation to the dough element holding means 20 and the dough element 25.

The conveyor assembly consists of conveyor belt 15 which is translated by a pair of rollers 16, one of which is shown. Rollers 16 have shafts as at 17 supported in journal bearings 7. The right end of shaft 17 extends from journal bearing 7 and is used for mounting pulley 18 thereon. Pulley 18 is driven by belt 19 which in turn is driven by a conveyor drive means (not shown).

Tightening or loosening conveyor belt 15 is accomplished by conveyor adjusting means consisting of bolts 11 and 11', a pair of sleeves 12 (one is shown) and attached to brackets 10 and 10', and nuts 12a. This adjustment capability is achieved by having one end of each of bolts 11 held respectively in each of extensions 9 (one is shown) of journal bearings 7 and 7'. Bolts 11 and 11' extend through sleeves 12 which are attached to the main structure of the conveyor assembly by means of brackets 10 and 10' respectively. Sleeves 12 have nuts 12a at both ends thereof so that these nuts may be tightened against the ends of sleeves 12 when roller 16 has been properly positioned with respect to conveyor belt 15.

A plural number of cleats 20 are provided for holding divided dough elements 25. These cleats are equally spaced on the surface of conveyor belt 15. Each of cleats 20 comprises holding portion 21, relieved portion 22, a pair of mounting brackets 23 and 23' attached to the surface of conveyor belt 15 for pivotably holding the ends of holding portion 21 by means of pivot means 24 and 24' respectively. Holding portions 21 of cleats 25 have concave surfaces which actually cooperate with dough elements 25. The holding portions are of a generally arc-shaped configuration. The pivotal arrangement of holding portions 21 enables this holding portion to adjust itself with respect to dough element 25 and the surface of conveyor belt 15 as the dough element is being moved into position with respect to impeller wheel 3 preparatory to providing impeller action upon dough element 25.

Relieved portions 22 which are provided in holding members 21 enable a portion of the impeller wheel to be admitted therein and for enabling adjustment of the impeller means so as to provide the desired depth of entry of the impeller wheel into the dough elements.

The impeller wheels 3 and 3' are provided with roughened or grooved peripheral edges for improving engagement with the dough elements, for impelling the elements from the conveyor belt and holding means surfaces as these dough elements are carried into contact with each impeller wheel 3 or 3' such as at 25a. Dough element 25 is shown at 25a deformed from its initial shape by impeller wheel action thereupon.

It is noted that the speed at the circumference of the impeller wheel should be substantially higher than the conveyor surface translation speed. Good impulsive action upon the dough elements was obtained in one arrangement of impeller wheel and conveyor belt, when impeller wheels of approximately 2.5-inch diameter were driven at 800 r.p.m. in combination with a conveyor roller diameter of 4 inches which was driven at 40 r.p.m., and provided proper impelling movement of the dough elements of the conveyor. This combination provides a linear translation ratio of impeller wheel circumference to conveyor belt of 12.5. Inasmuch as the range of impeller wheel circumference to conveyor belt translation ratios may have a wide range, these ratios may be higher or lower than 12.5 with different diameters of impeller wheel and conveyor roller and correspondingly different driving speeds thereof.

Dough element 25 is again shown at 25b after being impelled into hopper 26 of a toroid or annulus making apparatus. A chute at 27 shows the dough element at 25c being injected into sleeves 29 of the toroid-forming machine. Toroid-forming mandrel 28 within sleeve 29 forms the toroid in accordance with a process described in the patents hereinabove referenced.

Briefly the toroid-forming machine is comprised of hopper 26, chute 27, mandrel 28, sleeves 29 which are attached to links of a continuous link chain 30, a pair of sprocket wheels 31 (one of which is shown) driven by drive shaft 32 of a drive means (not shown) of the toroid-forming machine in the direction indicated by the arrows. Continuous guide member 33 which is part of the main structure of the toroid-forming machine guides sleeves 29 by means of flanged portions on sleeves 29 in cooperation with the outer surface of guide 33.

It is pointed out that the material used to fabricate holding member 21 is the same material as used for conveyor belt 15. This is of specific advantage in that the adhesive qualities between the dough elements and the conveyor belt are the same as between the dough elements and the holding members. The advantage of maintaining virtually equal adhesive contact characteristics of the dough elements with respect to the surfaces of the conveyor and holding means, results in a uniform pull-away of the dough elements from these surfaces. Further, the virtually equal pull-away characteristics operates to assist the driven impeller wheel in providing a supply of dough elements to the toroid-forming machine at a uniform predetermined rate, positively impelling each of the dough elements from the conveyor to the toroid-forming machine. Additionally, the roughened edges at the periphery of the impeller wheels further operate to provide better engagement with the dough elements and hence provide more positive and regular feeding of the dough elements to the toroid-forming machine.

Additionally, the provision of relieved portions relative to the outer ends of the dough element holding means and impeller assembly adjustment and locking means provide for the setting of the depth of entry of the driven impeller wheel into the dough elements and hence enable optimum setting of the impeller apparatus for providing dependable regularity of impelling action upon the dough elements.

An alternative exemplary embodiment of a conveyor-impeller combination is shown in FIGS. 4, 5 and 6, and is generally indicated at 40.

Link chains 41, driven by a motor or other drive means (not shown) are used for driving the conveyor. The link chains are provided with pins 42 equally spaced thereabout and sleeve bearings 43 circumjacent said pins. A plurality of hangers 44 are provided with vertical portions which are attached to the outer surfaces of sleeve bearings 43. Dough pans 47 are provided for each of the plural number of hangers 44. These dough pans are attached to hangers 44 by means of flanges which are integral portions of the pans 47. Dough pans 47 have concave surfaces 48 in each of which a divided element of a tacky dough substance is retained and carried thereby. Such dough elements are shown at 49a, 49b, 49c, 49d, and 49e in different locations during the conveying process.

Oppositely disposed guide members 51 and 151 are attached to the main structure 64 of the conveyor assembly. These guide members are inclined at an acute angle with respect to the plane of the conveyor assembly so as to provide pivotal action upon hangers 44 as these hangers are transported by the conveyor assembly in the direction indicated by arrow in FIG. 5.

Initially hanger 44 is shown in its normally hanging position at 45a. As the conveyor is translated along the direction of the arrow in FIG. 5, horizontal portion 44' of hanger 44 cooperates with the surfaces of inclined planes of guide members 51 and 151, which are attached to the main structure 64 of the conveyor impeller assembly. This cooperative action during conveyor translation causes hanger 44 to be inclined at an acute angle with respect to its initial position as at 45b. Further translation of the conveyor results in cooperation of the surface of the inclined planes at the ends of guide members 51 and 151 with the horizontal portion of hanger 44 as at 45c.

Oppositely disposed guide members 52 and 152, also attached to main structure 64 have curved surfaces 53 and 153 respectively for providing camming action with hangers 44. As indicated at 45d, curved surfaces 53 and 153 of guide members 52 and 152 cooperable with vertical portions 44' of hanger 44, providing camming action upon vertical portions 44' and orienting hanger 44 essentially 90° with respect to its initial orientation at 45a.

Hanger 44 is positioned as at 45d during impelling action, however, after the dough element is impelled as at 45e to conveying means 62, which can be a component of a toroid-forming machine, further positioning of hanger 44 is accomplished by camming action of vertical portions 44' of hanger 44 with respect to planar portions 52' and 152' of guide members 52 and 152 respectively. When the conveyor portion of assembly 40 transports hanger 44 to the position at 45f, cooperation of the hanger with the surfaces of guide members 52 and 152 ceases and hanger 44 is again positioned in its upright initial position as at 45a preparatory for loading the dough pans with more dough elements. The operative rotational action of the hangers 44 may be briefly stated. The normal hanger position is as at 45a; when first cooperating with inclined planes 51 and 151, the position is as at 45b and subsequently as at 45c. When the hanger cooperates with curved portions 53 and 153 of guide members 52 and 152 respectively, the hanger is positioned as at 45d. When the hanger cooperates with the flat portions of guides 53 and 153, the hanger is positioned as at 45e. Subsequent positioning of the hanger when the conveyor chains carry the hanger off of cooperation with the surfaces of guides 52 and 152, result in hanger position as at 45f which is identical to the initial starting position at 45a.

Means for impelling divided dough elements are shown at 54. The impelling means comprises impeller wheels 55, 55' and 55'', shaft 56, sprocket wheels 57 and 157. Sprocket wheel 157 is mounted on shaft 56 and sprocket wheel 157 is mounted on shaft 59. Link chain 58 cooperating with the sprockets of sprocket wheels 57 and 157 drives impeller mechanism. Support structures 61 and 161 are provided for supporting the impelling means assembly. The ends of shaft 56 are rotatably retained in bearing means associated with support structures 61 and 161. These structures are adjustable so

as to position the impelling means with respect to the dough elements thereby engaging the impeller wheels which have roughened peripheral edges with the dough elements, and thereby impelling the dough elements as shown at 49e onto another conveying means 62 from the position at 49d.

Hence, it is seen that guide members are provided in this exemplary alternative conveying apparatus for producing camming action with hanger members so as to pivot the hanger members and the holding means for the divided elements to a predetermined element delivery position, wherein the elements are engaged by the impeller wheel and impelled off of these holding means. The engagement of the driven impeller wheel with the dough elements results in tangential forces which are applied to these elements thereby impelling them from their delivery positions to either another conveyor or to a toroid-forming machine.

It is also seen that a plurality of dough pans may be attached to the hanger members of the conveyor for retaining the dough elements while being moved by the conveyor and while being positioned with respect to the impelling means during the pivotal action of the hanger members.

An important aspect of this invention includes a plurality of hanger members which are not only pivotally suspended on the conveying apparatus used for carrying the dough elements, but in addition, these hanger members have freedom of movement throughout a full circle of their individual pivotal suspensions. This circular freedom of movement enables proper pivotal action throughout the entire conveying and impelling cycle and permits proper positioning of dough pans containing the dough elements with respect to the impeller apparatus so that the impeller wheels may engage with the dough elements and positively impel these elements to a predetermined location of a dough-forming machine from a predetermined position of the conveyor-impeller apparatus.

Proper positioning of the hangers carrying the dough pans and the associated dough elements is therefore accomplished by camming action of the hangers with inclined plane members and with curved members of these inclined plane members associated with the conveyor assembly.

The conveyor assembly not only provides proper positioning for impelling action with the impeller wheels but also provides a transportation means for the dough elements between the proofing and forming steps of the process of making toroids.

I claim:

1. In an apparatus for transporting a plurality of uniformly spaced, divided elements of tacky, deformable, dough substance to a predetermined location, said apparatus including conveyor means for carrying the uniformly spaced elements to the predetermined location, and holding means associated with the conveyor means for retaining the elements on said conveyor means as they approach the predetermined location; the improvement comprising the provision of:

a rotating impeller wheel and adjustable mounting means for mounting the impeller wheel at the predetermined location for engagement with each element to deform the element to a desired depth of wheel entry into the element to hold the element to the impeller wheel while the rotation thereof pulls the element away from the conveyor means and the conveyor associated holding means despite the tackiness of the element and impel the element from the predetermined location, said wheel having circumferential speed substantially higher than the speed of the conveyor means.

2. The apparatus as stated in claim 1 wherein said holding means comprises:

at least one cleat with a relieved portion between its outer ends for admitting a portion of said impeller wheel through said relieved portion and for providing the desired depth of entry of said impeller wheel into said elements.

3. The apparatus as stated in claim 1 wherein the conveyor means includes a conveyor belt, and the holding means com-

prises a plurality of cleats spaced along the conveyor belt in two rows, the cleats in one row being staggered from the cleats in the second row, and wherein an impeller wheel and associated mounting means are provided for each row to impel the elements seriatim and alternately from each row.

4. The apparatus as stated in claim 1 wherein said holding means is of the same material as the material of the conveyor means for maintaining virtually equal adhesive contact characteristics of said elements with respect to the surfaces of said conveyor and holding means and for providing uniform pull-away of said elements from said surfaces.

5. The apparatus as stated in claim 1 including:

journal bearings mounted at each side of said conveyor means, said journal bearings having extensions integral therewith and said extensions having slots therein;

said adjustable mounting means includes bracket means associated with each said journal bearing, each said bracket means including a pair of spaced paralleled arms; and fastening means associated with each pair of said arms for holding said arms wedged within said slots and thereby locking said adjustable mounting means in a selected position of adjustment.

6. The apparatus as stated in claim 1 wherein:

said impeller wheel has a roughened peripheral edge for improving engagement with said elements.

7. The apparatus as stated in claim 1 wherein said conveyor means comprises:

a plurality of hanger members pivotably suspended on said apparatus and carrying said holding means, said members having freedom of movement throughout a full circle of their individual pivotal suspension; and

guide members attached to said apparatus for providing camming action with said hanger members to pivot said hanger members and said holding means into a predetermined element delivering position wherein said elements

are engaged by said impeller wheel and impelled off of said holding means.

8. The apparatus as stated in claim 7, said holding means being:

a plurality of dough pans attached to said hanger members for retaining said elements while being moved by said conveyor means and while being positioned with respect to said impelling wheel during pivotal action of said hanger members.

9. In an apparatus for transporting a plurality of uniformly spaced divided elements of a tacky, deformable dough substance to a predetermined location adjacent a dough-forming machine having a dough element receiving hopper, said apparatus including conveyor means for carrying the uniformly spaced elements to the predetermined location, and spaced holding means associated with the conveyor means for retaining each element on the conveyor in spaced relationship as each element approaches the predetermined location, the improvement comprising the provision of:

rotating impeller means for deforming the element to hold the element to the impeller means temporarily, said impeller means having a circumferential speed substantially higher than speed of the conveyor means; and

adjustable mounting means for mounting the impeller means at the predetermined location for engagement with each element individually as the element is moved to the predetermined location to deform the element to a desired depth of impeller means entry into the element for holding the element to the impeller means while the rotation thereof pulls the element away from the conveyor means and the conveyor means associated holding means, and impelling the element into the hopper at a uniform and predetermined rate.

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