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METHOD OF AND APPARATUS FOR MAKING BALL DOUGHNUTS

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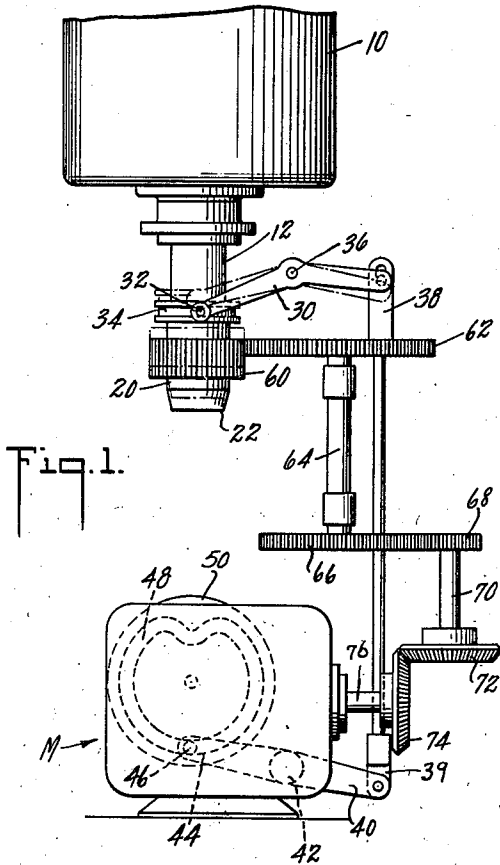


Fig. 2.

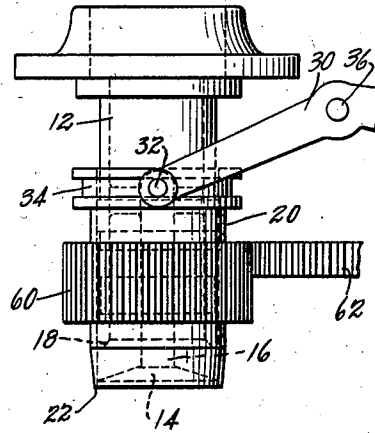


Fig. 3.

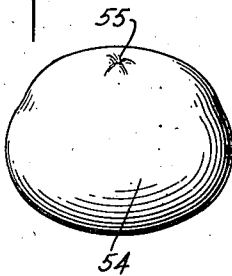
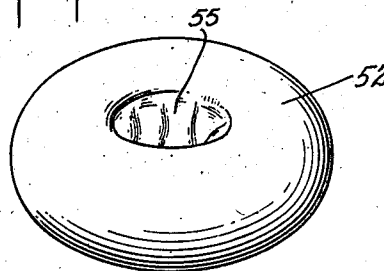


Fig. 4.



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METHOD OF AND APPARATUS FOR MAKING
BALL DOUGHNUTSLewis E. Russell, Catonsville, Md., assignor to
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Application October 4, 1941, Serial No. 413,575

5 Claims. (Cl. 107-54)

My invention relates generally to a food product and in particular to the pastry or cake product commonly referred to as a "doughnut," or similar article. The usual type of doughnut comprises an annular ring having an appreciably-sized circular opening in the center thereof, but it has been attempted in the past to make doughnuts of other shapes, as for instance the polygonally-shaped product described in the Bleier Patent No. 1,621,454, dated March 15, 1927; the crescent-shaped product described in Bergner Patent No. 1,839,180, dated December 29, 1931; and the elongated "stick" product of the Hunter Patent No. 1,814,830, dated July 14, 1931. The present invention is directed towards the formation of a doughnut or pastry product having a form which is different from all of these, and the main objects of this invention are the provision of such different product and the method and machinery for making the same.

A further object of my invention is the provision of a doughnut having a substantially spherical shape, and the method of forming same.

Another object of my invention is the provision of a spherical or ball doughnut which is of substantially uniform texture throughout.

Still another object of my invention is the provision of a method of forming a spherical or ball doughnut from the same material as is used in the manufacture of the conventional ring doughnut.

Still another object of my invention is the provision of a method for making a spherical or ball doughnut on substantially the same type machinery as is conventionally used in the formation of ordinary annular doughnuts.

Still another object of my invention is the provision of apparatus for forming spherical or ball doughnuts.

Still another object of my invention is the provision of an apparatus to form ring doughnuts in such fashion as to cause the rings to assume spherical or ball shape during the frying or heat treating step in the process.

Still another object of my invention is the provision of a method of forming a spherical or ball doughnut which comprises the formation of an annular ring doughnut and subsequently changing the ring to ball shape.

In addition to the above, further objects of my invention will be obvious, and still others will be pointed out specifically in connection with the following description of an illustrative embodiment.

Attempts have been made in the past to produce spherically-shaped or "ball" doughnuts. These attempts have consisted mainly of changes in the formula of the mix, variations in the frying temperatures, and provision of machines to form a ball product and deposit same in the frying vat. It has even been attempted to make ball doughnuts by hand, but commercially these attempts have all been uniformly unsuccessful because a consistently satisfactory product could not be obtained.

Conventional doughnut making machines usually comprise a hopper or receptacle into which the doughnut "mix," i. e., the mixed ingredients, is deposited. The mix is fed, either by gravity or air pressure into an elongated, narrow cylindrical chamber, having a circular forming disc disposed below and spaced from the open end of the cylinder passing therearound and over in a ring-like mass. An encircling cutter sleeve axially reciprocates in a straight line across the opening between the cylinder and the forming disc, resulting in a shearing off of the material extruded from the opening. The annular dough ring formation (see Fig. 4 of the annexed drawing) is then dropped into hot cooking liquor and fried for a sufficient length of time, on both sides thereof, until completed. This type of construction and method of operation are well known in the art (see the U. S. Patent to Hunter No. 2,067,849), and needs no further discussion or illustration. In my method, while I employ the same basic type of apparatus; the same type of mixture of ingredients; and subject the product to the same frying or heating treatment, I am enabled to achieve a ball or "holeless" doughnut, a substantially spherical or ball product of uniform texture throughout, because of my new method and apparatus.

In the drawing annexed hereto, forming a part hereof:

Figure 1 is an elevational schematic view of one form of apparatus constructed according to and embodying my invention;

Fig. 2 is a slightly enlarged elevational view of a portion of the apparatus shown in Fig. 1;

Fig. 3 is a perspective view of my new ball doughnut product as formed by the apparatus and in accordance with the method of my invention; and

Fig. 4 is a perspective view of the conventional ring doughnut.

In the drawing, reference numeral 10 indicates the dough hopper into which the mixed ingredients are deposited. At the bottom of hopper 10,

there is secured an elongated cylindrical discharge neck 12 in communication with hopper 10. A cutter disc 14 is mounted on a rod or axial stem 16 centrally secured inside neck 12, so that disc 14 is spaced from and below the lower edge 18 of the discharge neck 12. A cylindrical cutter sleeve 20 is mounted over and in concentric relationship to the discharge neck 12, in close sliding relationship thereto. In conventional constructions, means are provided to vertically reciprocate cutter sleeve 20 along discharge neck 12 with respect to the opening between disc 14 and edge 18, so as to shear off portions of the dough extruded from the discharge neck between the edge of the forming disc 14 and the sharpened lower edge 22 of the cutter sleeve 20. As an example of this type of construction, see U. S. Patent No. 2,067,849 to H. T. Hunter, and specifically Figs. I, VI and VII thereof.

When sleeve 20 is raised into the dotted line position of Fig. 1 by means of the cutter lever 30, which has a pin 32 extending outwardly therefrom engaging an annular groove or track 34 formed around sleeve 20, the annular opening between the lower edge of neck 12 and the edge of the fixed cutter disc 14 is uncovered, and it is through this annular opening at the bottom of discharge neck 12 that the dough flows or is forced, as by suction or pressure. As cutter sleeve 20 is moved axially downwardly into the full line positions of Figs. 1 and 2, the annular dough formation extruded through the opening is severed, and permitted to drop into the conventional frying vat which is normally disposed below and in vertical alignment with the discharge neck 12.

Lever 30, centrally mounted for pivotal movement as at 36, is connected at one end to cutter sleeve 20, and at its opposite end to a vertical drop link 38. The other end 39 of said vertical drop link 38 is connected to a cam lever 40. Cam lever 40 is also centrally fulcrumed, as at 42, and at its free end 44, lever 40 is provided with a suitable roller 46 engaged with a face track or groove 48 formed on a rotary cam 50. Thus, as cam 50 is motor rotated via M, it will, because of the course of the groove 48, and through cam lever 40, drop link 38 and cutter lever 30, cause the cutter sleeve 20 to reciprocate vertically along discharge neck 12, forming ring shaped products 52 as above outlined.

As will be seen in Fig. 1, groove 48 follows a circular path for about 270°, and dips inwardly for about one-half of the remaining 90° portion and rides upwardly for the remainder until it returns to the circular path again. Thus, as cam 50 is rotated by a suitable motor through a speed reducing apparatus, as M, roller 46 held captive within trackway groove 48, will move upwardly and pivoting about point 42, will cause a downward shifting of link 38 and a raising of sleeve 20.

As the ring shaped products so formed are successively dropped into the frying vat, they are fried first on one side, and after a predetermined time interval, they are automatically turned over and fried on the other side until they are completed. During these frying operations, the object does not lose its character as a ring. Its size may change somewhat, that is, the ring may puff or swell to some extent, but its character as a ring with a definite hole therein will not change appreciably.

I have found it possible, with substantially the same machine, the same mix and the same sequence of steps, to cause the ring to change its

shape and become a substantially spherical, "holeless" object, as illustrated in Fig. 3.

The fixed linear distance between the cutter disc 14 and the end of the discharge neck 12 may be, for example, about five-eighths ($\frac{5}{8}$ "') of an inch. Cutter sleeve 20 must be reciprocated across this distance to permit the dough to pass through the uncovered opening on the up or opening stroke, and to shear the same on the down or shearing stroke. I have found that by rotating the cutter sleeve during the down or shearing stroke, I can thereby make ball or spherical doughnuts. Preferably, in my method, the cutter sleeve should be rotated through 360 degrees on the down or cutting stroke only. In normal operation, the cutter cam 50 may be motor-rotated about eight times a minute; that is, there are eight complete reciprocations of the cutter sleeve each minute, and there are eight doughnut rings cut each minute. The time consumed, therefore, in the formation of each individual doughnut will be approximately seven and five-eighths ($7\frac{5}{8}$) seconds. Groove 48 is so proportioned that cam lever 40 will be shifted for about 90 degrees of (or a quarter of) each cycle and dwell for the remaining 270 degrees thereof. The actual movement of cutter cam lever 40 is one-fourth of $7\frac{5}{8}$ seconds or about $1\frac{1}{8}$ seconds, and it is during this time interval that the cutter sleeve is opened and closed and the doughnut ring cut. It is also during this $1\frac{1}{8}$ seconds that the cutter sleeve 20 is rotated.

For purposes of illustration, but not limitation, I provide a relatively wide pinion gear 60 around sleeve 20, and in mesh therewith, I mount a spur gear 62 which is narrower than pinion gear 60. Spur gear 62 is supported in engagement with gear 60 by one end of vertical shaft 64, and at the other end of shaft 64, I mount a gear 66 and in mesh therewith a driving or spur gear 68. Spur gear 68 is connected, via a shaft 70, bevelled or mitre gears 72, 74 and shaft 76 with speed reducer M, which may function, motor driven, through connection to appropriate clutching means, in addition to rotating cam 50, and cutter cam lever 40, etc., to rotate shaft 76 during the 90 degree portion of the cam cycle in order to impart rotational movement to cutter sleeve 20 during the shearing stroke. This shaft and gear assembly (as shown in Figs. 1 and 2), is but one way by which I can impart rotational movement to cutter sleeve 20 during the down movement of the cutter sleeve.

If desired, independent means may be employed to vertically reciprocate the cutter sleeve and rotate same. However, if a single mechanism is employed, via M, herein described, intermittent action to rotate cutter sleeve 12 preferably during the shearing stroke may be secured through the train of gears or through the speed reducer which becomes effective only during the down stroke to rotate the sleeve.

Pinion gear 60 is made sufficiently wide so as to remain in mesh with spur gear 62 while cutter sleeve 20 is reciprocated. As shown in Figs. 1 and 2, spur gear 62 engages gear 60 near the top thereof, while cutter sleeve 20 is in the "down" position, and will engage gear 60 near the bottom thereof in the "up" position.

With cutter sleeve 20 rotated during the shearing stroke with respect to the discharge neck 12, the same annular ring formations are formed, as 52, and dropped into the frying vat. However, due in some manner to this rotational movement of the cutter sleeve during the "down" portion of

the shearing stroke, the ring, during frying, flows together inwardly, the central opening 55 closes over and practically disappears, and the ring puffs up and becomes sphere-like, as illustrated at 54, Fig. 3. Apparently, the circular shearing movement tears the surface of the ring and disrupting the "grain" or structure of the doughnut mix, causes it to flow together inwardly. The ring formations are sheared off against cutter disc 14 at the inner margins of the rings, and that is apparently why the rings flow inwardly and ball up at that point, rather than flow outwardly.

It will thus be seen that the only addition needed to a conventional doughnut machine in order to adapt same to the manufacture of ball doughnuts is the provision of means for causing rotation of the cutter sleeve with respect to the discharge neck during the shearing stroke. The degree of rotation is important. If the cutter sleeve is rotated substantially less than 360 degrees, there is not obtained sufficient "balling" up to close the central aperture 55 during the frying step. With a full 360 degree range of relative rotation, the hole 55 practically disappears (see Fig. 3) and the ring becomes almost completely spherical.

As the ring formation is dropped into the hot frying liquor, it starts to "ball" up almost immediately on the top thereof, which extends up out of the hot liquor, and the "balling" continues until the central opening is substantially completely closed. The time interval so consumed will represent about one-half of the time needed to completely fry the doughnut. The doughnut is then turned over and fried on the other side thereof for an equivalent of the time. The "balling" will continue to some extent on this other side, at least so as to substantially close the hole. The fact that the "balling" up is not an instantaneous process affords sufficient time so that the completed article will be thoroughly fried throughout.

Having now described my invention, what I claim and desire to secure by Letters Patent is:

1. Apparatus for forming ball doughnuts comprising a dough hopper, an outlet therefrom, means to feed dough from the hopper through

the outlet, said outlet having an annular opening at the bottom thereof, means to shear annular dough formations off at the bottom of the outlet, and means to rotate the shearing means through at least substantially 360 degrees during the shearing operation.

2. Apparatus for forming ball doughnuts comprising a dough hopper, an outlet therefrom, means to feed dough from the hopper through the outlet, said outlet having an annular opening at the bottom thereof, means to shear off annular dough formations at the bottom of the outlet, said means comprising a sleeve encircling the outlet, and means to rotate the sleeve through at least substantially 360 degrees during the shearing operation.

3. Apparatus for forming ball doughnuts comprising a dough hopper, an elongated outlet therefrom, means to feed dough from the hopper through the outlet, a cutter disc spaced from and below the bottom of the outlet defining an annular opening, a cutter sleeve encircling said outlet, means to vertically reciprocate the cutter sleeve across the annular opening, and means to rotate the cutter sleeve through at least substantially 360 degrees during the downward stroke of the cutter sleeve.

4. Apparatus as in claim 3, in which cutter sleeve is provided with an encircling pinion gear, and a spur gear is provided in mesh with the pinion gear, the vertically reciprocating means maintaining the spur and pinion gears in mesh during up and down movement of the cutter sleeve, and the spur gear rotating the cutter sleeve through at least substantially 360 degrees at least during the down stroke of the cutter sleeve.

5. The method of forming ball doughnuts which comprises extruding a ring-like mass of dough, axially shearing annular ring formations from said mass, disrupting the surface of the ring formations during the shearing operation by a 360 degree rotation of the shearing means during the shearing operation, and thereafter heat treating the disrupted ring formations to form the ball doughnuts.

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