

Dec. 8, 1959

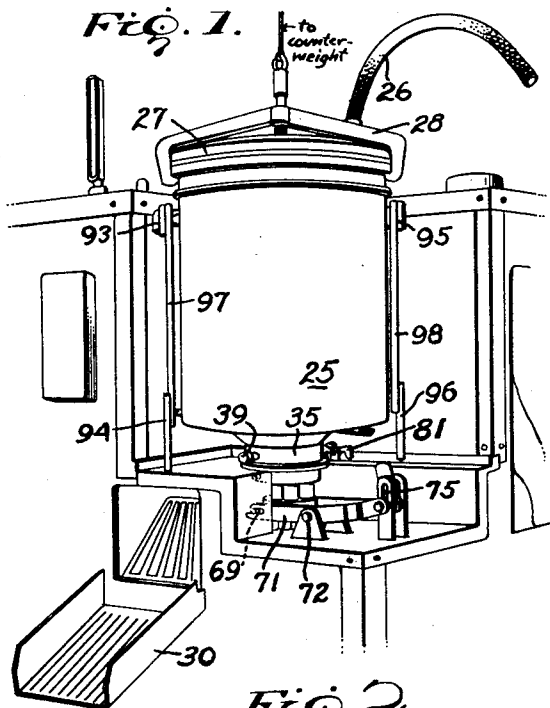
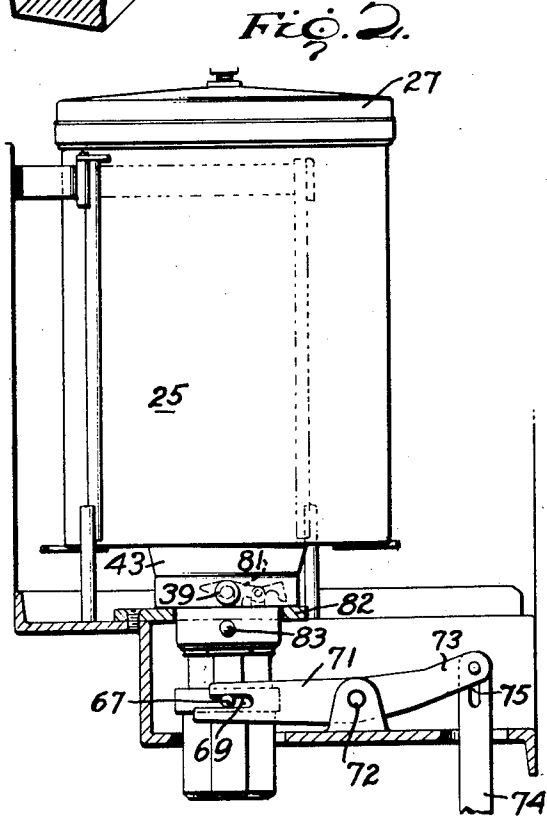
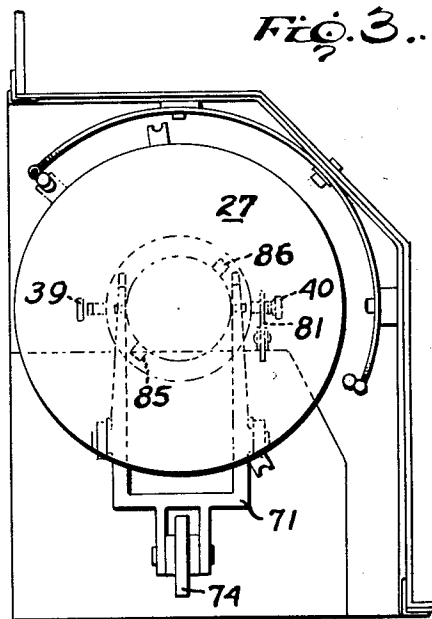
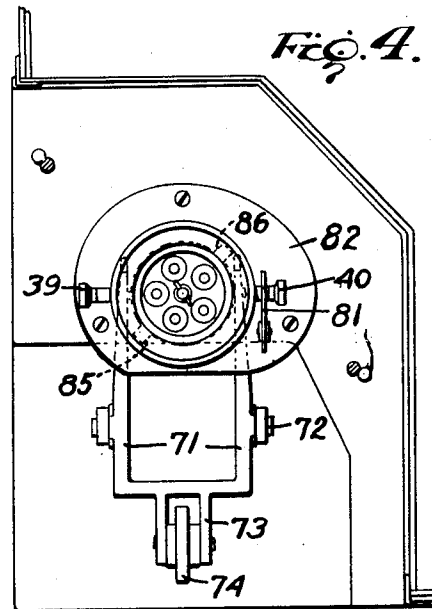
C. D. GILMORE

2,915,992

DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

Filed April 27, 1953

7 Sheets-Sheet 1



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Dec. 8, 1959

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DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

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7 Sheets-Sheet 2

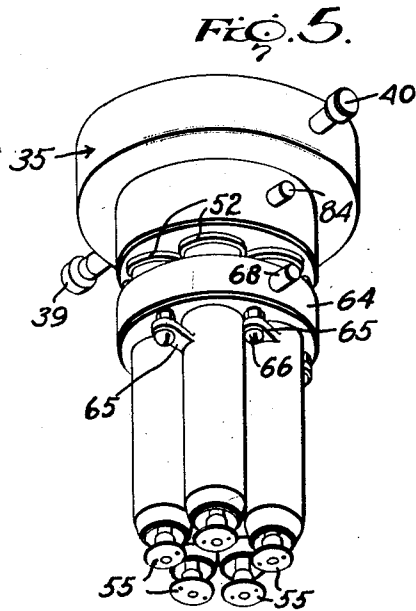
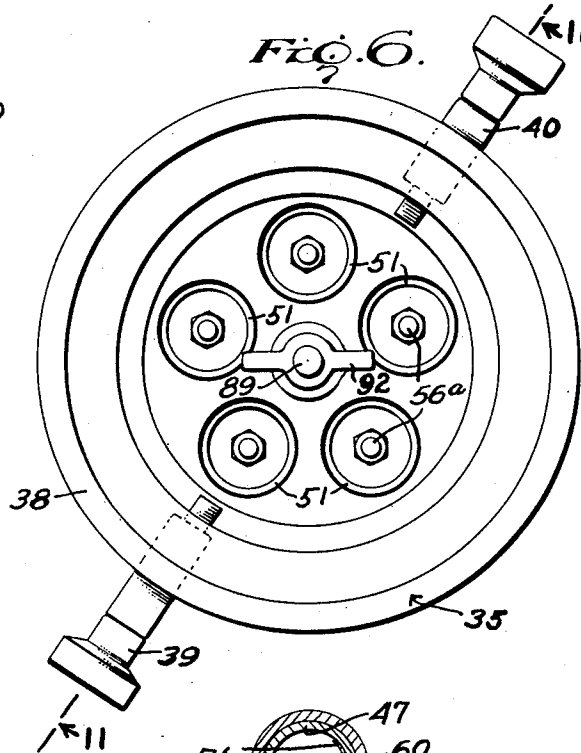
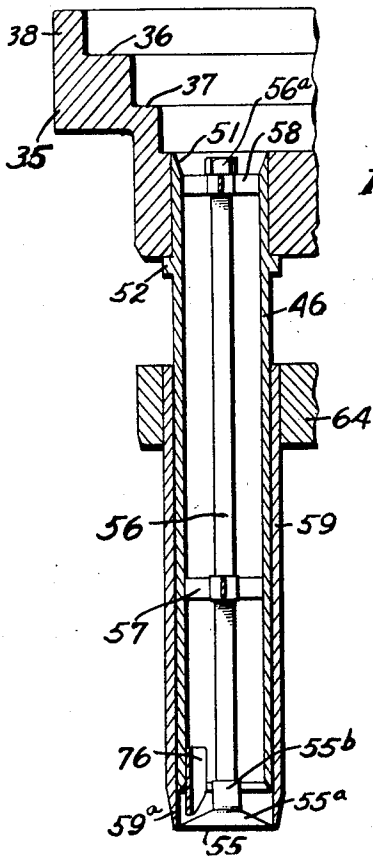


FIG. 7.

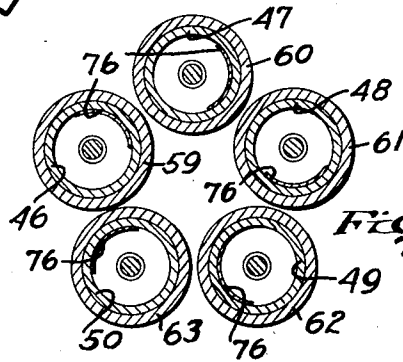
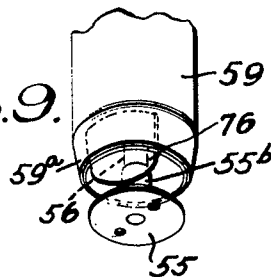


FIG. 8.

FIG. 9.



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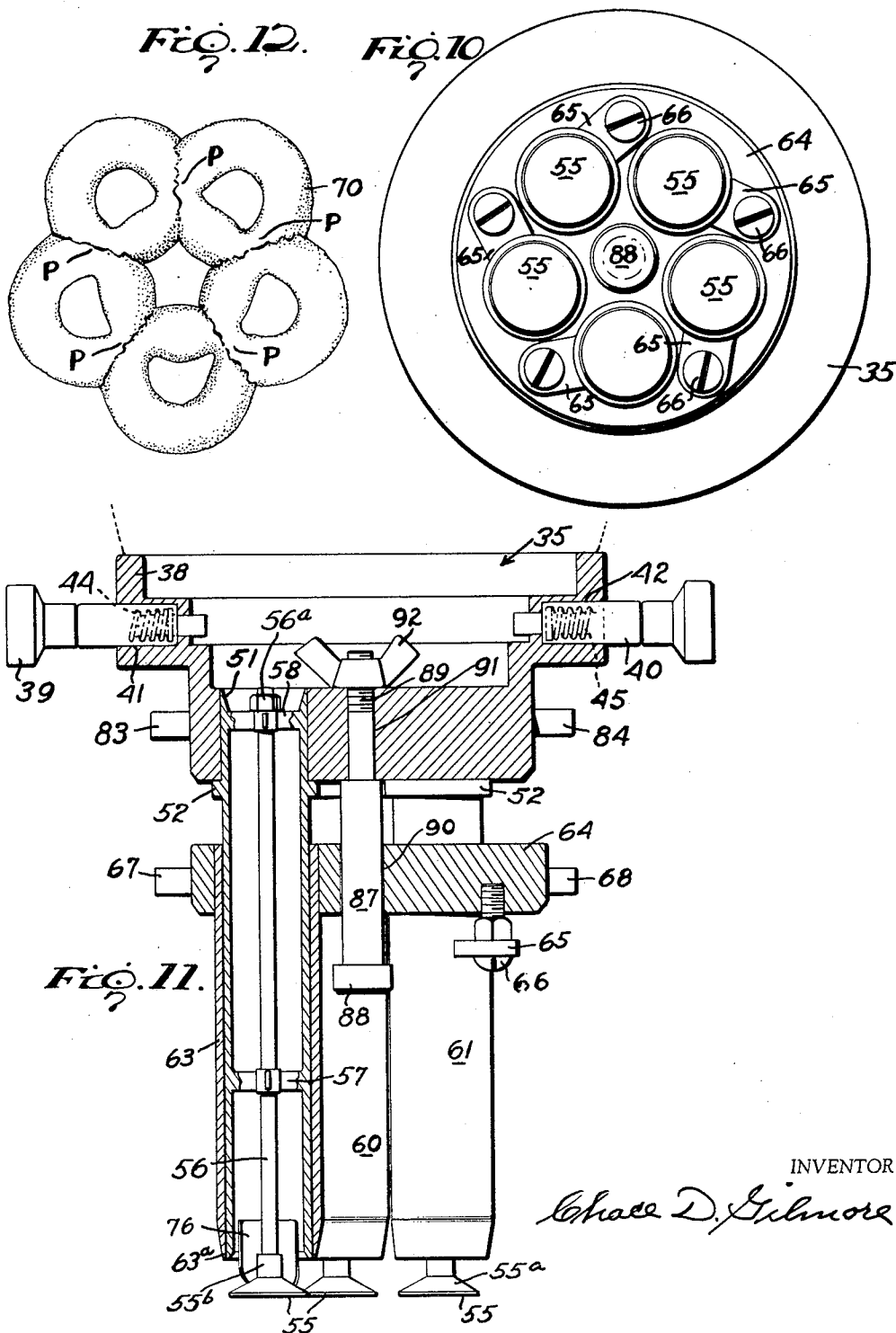
C. D. GILMORE

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DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

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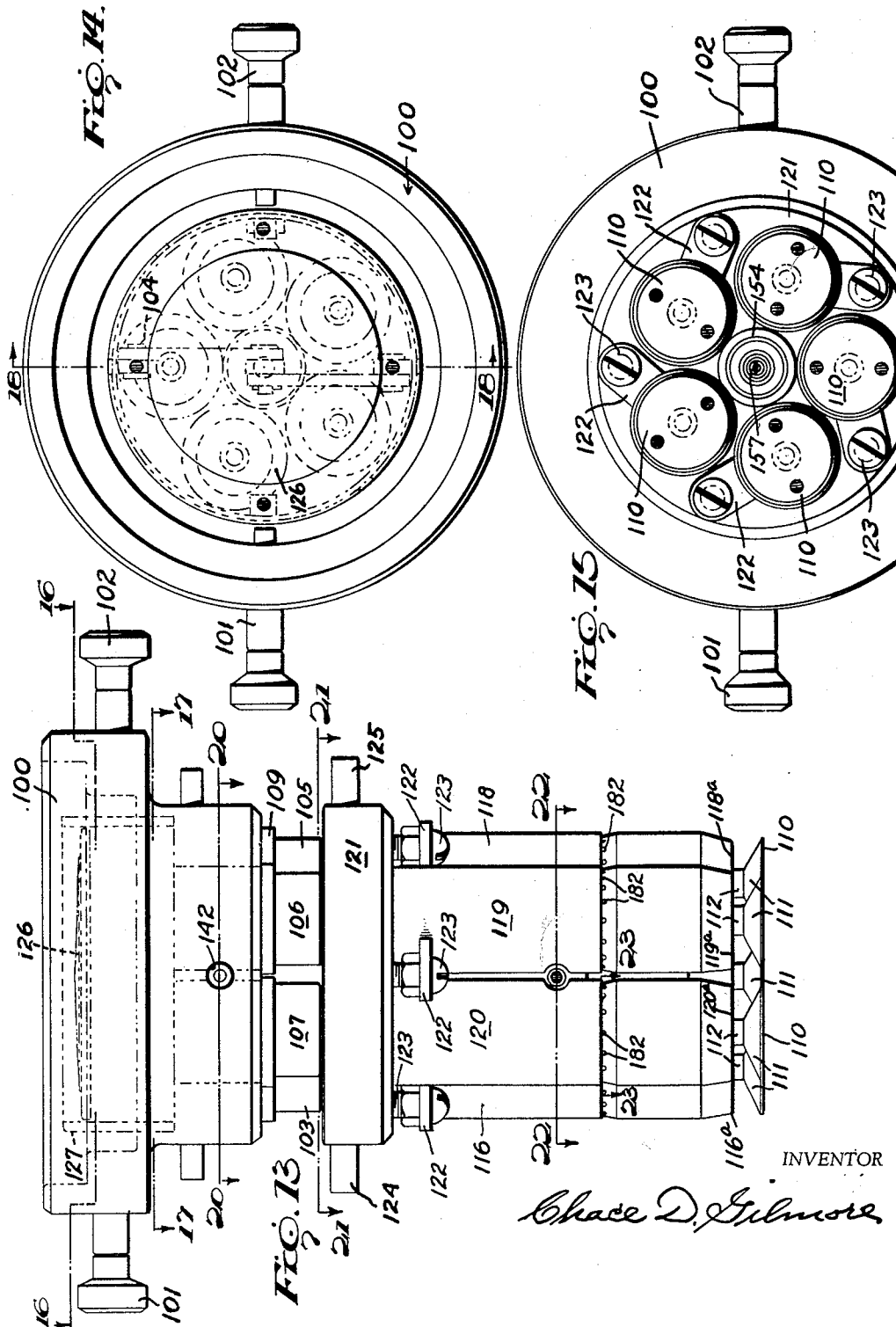
C. D. GILMORE

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DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

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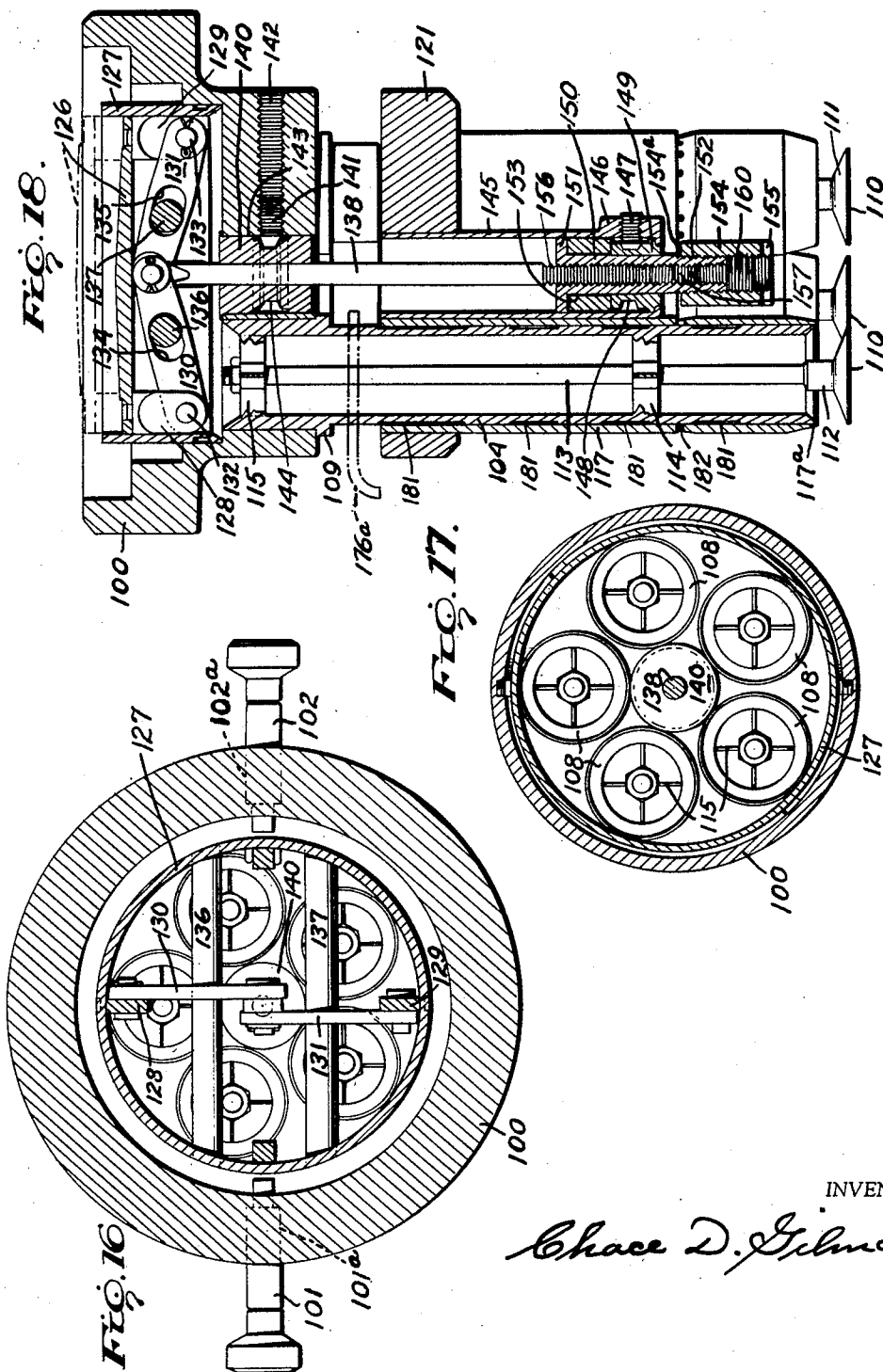
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DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

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DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

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2,915,992

DIE ATTACHMENTS FOR DOUGHNUT-MAKING MACHINES

Chace D. Gilmore, West Chester, Pa.

Application April 27, 1953, Serial No. 351,087

17 Claims. (Cl. 107—14)

This invention relates to attachments for doughnut-making machines.

An important object is to provide a die attachment which may be added to a known type of doughnut machine without substantial change in the latter and which will make doughnuts of unusual shape, involving three or more rings joined together to make a unitary doughnut of novel design, well calculated to arouse interest and stimulate sales.

Another object is to provide an attachment of the character indicated which is quickly removed for inspection and cleaning.

Another object is to provide a die attachment which is adjustable.

Another object is to provide for the constant lubrication of the die attachment so as to obviate the present tendency of the newly formed doughnuts to stick to and hang from the lower end of the die, causing many operating difficulties. An ancillary object is to lubricate the die attachment by means of the cooking oil or fat used to fry the doughnuts.

A further object is to make it possible to handle the die attachment as a unit, or to disassemble it for cleaning, etc.

Another object is to provide for an improved mechanical feeding and measuring of the dough to the die, which eliminates operating difficulties inherent in present machines of the type employing pneumatic feed of the dough.

A further object is to provide dough can guiding and supporting means. Still another object is the provision of latch means to engage the die attachment when on the dough can and to lock the dough can and die attachment during operation of the machine.

An additional object is the provision of means on the die attachment which will hold the dough can against rising.

A still further object is to make doughnuts which are more thoroughly cooked, hence more digestible and of superior flavor.

Other objects will be apparent from the following description of two embodiments of the invention and of a product of either embodiment.

In the accompanying drawings forming a part of this specification,

Fig. 1 is a perspective view of part of a prior art doughnut-making machine equipped with the attachment of the present invention;

Fig. 2 is an elevation of the dough can, the cutter sleeve, the pivoted yoke, and certain associated parts;

Fig. 3 is a top plan view on a larger scale showing the pivoted yoke for operating the cutter sleeve of the doughnut forming device, and certain associated parts of the prior art machine;

Fig. 4 is a top plan view like Fig. 3 but showing a different view of the parts;

Fig. 5 is a perspective view of one form of die attachment embodying the invention;

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Fig. 6 is a top plan view of the same, on a scale approximately full size;

Fig. 7 is a full size sectional elevation of one of the five dough-extruding tubes of the attachment;

Fig. 8 is a cross section through the lower ends of the five dough-extruding tubes;

Fig. 9 is a detail in perspective showing the lower end of one of the dough-extruding tubes;

Fig. 10 is a bottom plan view of the attachment, scale approximately full size;

Fig. 11 is a section on line 11—11 of Fig. 6;

Fig. 12 is a plan view, on a reduced scale, of a doughnut made with the die attachments of the invention;

Fig. 13 is a side elevation of another form of die attachment having lubricating features and a positive measured feed of the dough;

Fig. 14 is a top plan view of the die attachment of Fig. 13;

Fig. 15 is a fragmentary bottom plan view of the die attachment of Fig. 13;

Fig. 16 is a cross section on line 16—16 of Fig. 13;

Fig. 17 is a cross section on line 17—17 of Fig. 13;

Fig. 18 is a longitudinal section on line 18—18 of Fig. 14;

Fig. 19 is a sectional view similar to Fig. 18 but showing a different position of the parts;

Figs. 20, 21 and 22 are respectively cross sections on lines 20—20, 21—21, and 22—22 of Fig. 13;

Fig. 23 is a detail in cross section on line 23—23 of Fig. 13;

Fig. 24 is a fragmentary elevation of a lubricating attachment;

Fig. 25 is a top plan view of the attachment of Fig. 24; and

Fig. 26 is a fragmentary sectional elevation showing the preferred means for forcing the dough mix through a die attachment embodying the invention.

The present invention being designed for use with commercial machines which have been on the market for many years, it is only necessary, for a full understanding of the invention, to describe briefly the main features of these machines, and to refer to the following patents for exemplifying the prior art: Bergner, 1,492,542, April 29, 1924; Bergner, 1,727,857, September 10, 1929; Hunter, 1,817,887, August 4, 1931.

The particular type of doughnut-making machines for which one form of the inventive attachment is designed comprises a hermetically-sealed dough can (or "magazine"), shown at 25 herein, said dough can having a compressed air line 26 coupled to its cover 27, which is clamped in position and has a gasket (not shown) to hold the air pressure.

A yoke 28 straddles the cover and a counterweighted cable (which extends around an overhead system of pulleys to a heavy weight, not shown) makes it possible to raise the dough can manually even when full of dough.

The air line 26 extends to a compressed air tank, which with the air pump, electric motor for driving the pump, safety valve, bleed valve, air gauge, etc. are omitted as being well understood by those skilled in the art. The described dough can is designed to be partly filled with a doughnut mix, not shown, and when closed and sealed, is designed to extrude the dough (because of the air pressure) through one of the forming dies of the invention, thereby forming a dough shape which drops by gravity into a bath of hot cooking oil 176 (Fig. 24) kept at an even temperature by means of a thermostatically-controlled electric heater element (not shown).

While floating in this bath of hot oil the dough shapes are forced to travel in a circular path and are turned over; then the doughnuts are lifted out, drained and discharged by means of chute 30 (Fig. 1) onto a conveyor, for example, where the hot

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doughnuts may cool somewhat before being wrapped or packaged. These details are omitted from the drawings as they form no part of my invention.

The first form of die attachment to be described is designed to be releasably secured on the lower end of one of the dough cans 25 of a prior art machine, and is best shown in Figs. 5-11 inclusive. At its upper end, the die attachment has a heavy metal collar 35 which is circular in plan (Fig. 6) and has a plurality of circular shoulders 36, 37 (Fig. 7) permitting the collar to fit complementary surfaces provided on the lower end of the dough can. Shoulders 36, 37 and the end flange 38 provide a sealing connection between the attachment and the dough can, so that all the dough subjected to air pressure must flow through the attachment and its extrusion die members to form doughnuts of the shape desired.

A pair of locking pins 39, 40 are slidable in bores 41, 42 provided at diametrically opposite points in collar 35; each locking pin has an enlarged head to facilitate pulling it out to disengage its inner reduced end from bores (not shown) provided in the complementary or male part 43 (Fig. 2) of the dough can. Springs 44, 45 respectively project the inner reduced ends of the locking pins 39, 40 into bore-engaging position to lock the die attachment rigidly on the dough can while permitting quick manual detachment thereof at any time.

Secured by press-fitting (or otherwise) to the lower part of collar 35 are a plurality of thin metal die tubes 46, 47, 48, 49 and 50. While five tubes are shown, and this is the preferred number, there may be as few as three or as many as nine. If only three tubes are provided, each tube will be materially larger in diameter than the tubes 46-50; whatever their number, each die tube is cylindrical, is made of smoothly polished metal, is straight, and has a beveled upper or inlet end 51, as well as an integral flange 52 abutted against the underside of collar 35. Each die tube further has a valve seat 55 adjacent to but outside of its lower end, each valve seat or disk 55 having a beveled or frusto-conical inner face 55^a and a tapped boss 55^b by which it is screwed or pinned to the lower end of a stem 56. Stems 56 are straight rods which pass through spiders 57 fixed inside the die tubes, and also through spiders 58 fixed at the upper ends of the die tubes on the inside; these spiders are plural-armed spacers and braces which hold each stem 56 in the center of the die tube and allow the dough to flow past them down the die tube and out of it when the cut-off valves permit such flow. As shown in Figs. 7 and 11, the stems 56 are held against longitudinal movement by means of nuts 56^a screwed on their upper ends and abutting the top sides of spiders 58. When nuts 56^a are unscrewed, stems 56 may be withdrawn from die tubes 46-50 by sliding them out the lower ends of said tubes.

Slidably mounted on the outside of each die tube and closely fitting the same are sleeves 59, 60, 61, 62 and 63 respectively. The sleeves are secured at their upper ends to an annular collar 64 and are easily disconnected therefrom. As shown, each sleeve 59-63 has an ear fixed thereto and projecting laterally, with a stud 66 passed through a perforation in the ear and screwed into the bottom of annular collar 64. See Figs. 5, 10 and 11. A pair of diametrically opposite pins 67, 68 are fixed to and project outwardly from annular collar 64, and said pins are received in slots 69, 70 on the end of a yoke 71 (Figs. 1-4) which is pivoted at 72 upon a fixed part of the machine. (Yoke 71 is also a prior art element.) Yoke 71 has an arm 73 adapted to swing in a vertical plane, and a vertically reciprocated link 74 has a slot-and-pin connection 75 with the free end of arm 73. Link 74 is intermittently reciprocated by a cam mechanism as is known in the prior art and hence not illustrated. Obviously rocking of yoke 71 will cause the assembly consisting of annular collar 64 and sleeves 59-63 to reciprocate vertically on the die tubes 46-50. In its

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lowest position, each sleeve 59-63 will contact a valve seat 55 as shown in Fig. 7. In their uppermost positions, sleeves 59-63 will be spaced above valve seats 55 as shown in Figs. 5, 9 and 11: this spacing will permit the soft dough mix to be extruded responsive to the pneumatic pressure previously mentioned. It will now be clear that the slidable sleeves are actually cut-off valves. As shown in Figs. 7, 9 and 11, the lower ends of sleeves 59-63 are beveled to provide circular knife edges (59^a, 60^a, 61^a, 62^a and 63^a) to cooperate with the valve seats 55 to cut off the dough cleanly.

One of the features of the first form of die assembly is best shown in Figs. 7 and 11 and consists of thin baffles 76 brazed or otherwise secured to the inside of each die tube. The function of these thin baffles or barriers is to prevent excess dough mix from flowing at certain points out of the die tubes, which would form upstanding knobs on the dough shape which is to be fried in the hot oil. To understand this, reference should be made to Fig. 12, where the product of the invention is shown in plan. As there seen, the doughnut product 70 is essentially five small doughnuts joined together, each little doughnut having part of its body merged on opposite sides with parts of the bodies of two other doughnuts. If the thin baffles 76 or their equivalents are not used, an excess quantity of dough above what is needed at each junction point P may be extruded by the die assembly. This excess dough may build up on top of the dough product to form knobs and after the cooking in hot oil, a hard, high protuberance or knob is left at each junction point, which is most objectionable for three reasons, namely, it mars the appearance of the doughnut, wastes dough, and makes packaging difficult and costly. To understand better the last-mentioned objection, it should be explained that these undesirable knobs would practically double the thickness of the doughnut at five points, increasing the amount of necessary wrapping or packaging material and making the actual handling of the doughnuts during packaging far more complicated. The simple provision of the thin baffles 76 cuts down the flow of dough in certain directions during extrusion, so that only the proper amount flows to each junction point P and no knobs are formed. In other words, the doughnuts formed by the described die attachment are of substantially equal thickness at all points, and may be packaged as readily as any comparable bakery product.

As previously explained, the spring actuated locking pins 39, 40 lock the die assembly upon the lower end of the dough can; this prevents separation of these parts and also rotation or oscillation of the die assembly. To prevent rotation of the suspended dough can, a gravity latch 81 (Figs. 1-3) is pivotally mounted on a fixed horizontal shelf 82 which is part of the prior art machine. Latch 81 is so designed that it automatically lifts and then drops to lock over the shank of pin 40 when the dough can and die assembly are turned to bring pin 40 against latch 81. To prevent the dough can and die assembly from rising automatically responsive to the counterweight previously mentioned (which could occur when the dough can has discharged its contents) the heavy metal collar 35 is provided with a pair of diametrically opposite pins 83, 84 (Figs. 5 and 11) integral therewith and adapted to pass through a pair of notches or slots 85, 86 cut in the edge of shelf 82. As Figs. 3 and 4 show, the notches or slots 85, 86 are in a line which is at an angle of about 45° relative to the line of pins 83, 84, so that the die assembly must be turned about 45° to bring pins 83, 84 into registry with the notches or slots to permit the dough can to rise. In the normal position (Figs. 1-3) the dough can may neither rise nor descend nor turn. To permit any turning, the gravity latch 81 must be manually lifted; then the dough can may be turned, and once the pins 83, 84 register with the notches or slots, the dough can may be raised with the die assembly. The die assembly is

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of course removable from the dough can after both the spring latch pins 39, 40 are pulled out manually.

To hold the die assembly parts against separation, once the die assembly has been taken off the dough can, a stud 87 (Fig. 11) having a head 88 and a reduced screw threaded portion 89 is passed through a bore 90 in annular collar 64, so that collar 64 may slide on stud 87. The reduced portion 89 passes through a bore 91 in the center of the heavy metal collar 35 (see Fig. 6) and a wing nut 92 is threaded on said reduced portion 89. Thus the slidable parts of the die assembly are held on the stationary parts when the die assembly is separated from the dough can which normally supports it. While the stroke of these slidable parts is not usually more than one-half inch, and frequently is less, the position of head 88 on stud 87 (Fig. 11) permits a considerable adjustment of the stroke. By removing wing nut 92, the slidable sleeves may be slid off the die tubes, and the several parts of the die assembly are then easily cleaned and inspected for wear, etc. Usually it is preferable to raise the dough can out of the way when the die assembly has been removed. To facilitate this, a set of vertical guides 93, 94, 95, 96 are fixed to the frame of the machine, as indicated in Figs. 1 and 2, and complementary wings 97, 98 fixed to and projecting from the dough can engage the guides to insure a straight rise or descent of the dough can. This is a great convenience, as it is sometimes necessary to stop all production and examine and adjust parts of the machine or even disassemble some parts.

Employing the principles of the above described die attachment, it is apparent that three-ringed, four-ringed, six-ringed or multi-ringed doughnuts may be formed in lieu of the five-ringed doughnut shown in Fig. 12. There is, of course, a limit to the number of rings which may be put together, also there are limits (maximum and minimum) to the sizes of the individual rings. The five-ringed doughnut shown is the product presently preferred by me, but I intend to cover by the appended claims all die attachments employing the principles of the invention and capable of making three or more rings of dough integrally joined to make a unitary confection. The doughnuts made by the invention are characterized by thorough cooking, because the hot fat cooks the interior more completely than is the case with commercial doughnuts, so that products of the invention are more digestible and have a different flavor sometimes described as "nut-like." Another advantageous feature of the product is that it may be easily broken or parted along the junction areas P of the rings, and when so parted, the rings form convenient mouthfuls, being easily handled as they are each "bite-size." The lines of parting are indicated approximately by the dot-and-dash lines in Fig. 12.

It is clear from the foregoing description that the doughnut mix is extruded by gravity aided by pneumatic pressure, which pressure theoretically is kept constant; but the operating difficulties which arise because of the employment of compressed air are not apparent except to those who have had actual experience in the art. One drawback of the described machine is that if it stops with the cut-off valves 59-63 open, the air pressure is not cut off and will continue to extrude the doughnut mix, which will pour down in streams which enter the hot fat. If the machine is not stopped, the liquid hot fat in the open reservoir or "kettle" will be displaced by the streams of dough and will soon overflow and spill over onto the floor of the bakeshop or store. This drawback and others it would be tedious to describe may be eliminated by employing a gravity-actuated dough follower to force the doughnut mix out of the dough can, in conjunction with the die attachment shown in Figs. 13-23 inclusive. This second form of die attachment includes means for mechanically and positively feeding, measuring, and cutting off the flow of the doughnut mix, so that the same amount of dough mix is extruded for each doughnut re-

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gardless of variations in the mix. The second form of die attachment also has means for spreading films of edible oil, preferably the cooking fat, over the lower ends of the extrusion die so that the dough after extrusion can not stick at one point to the die, hang down, and cause serious operating difficulties. Because of the manifest advantages of the second form of die attachment, it is now the form preferred by me.

Referring to Figs. 13-23, the preferred die attachment includes a circular heavy metal collar 100 at the upper end fitting complementary surfaces provided on the bottom of the dough can. A pair of diametrically opposite locking pins 101, 102, having enlarged heads at their outer ends (Fig. 16) and inner reduced ends are slidable in bores 101^a, 102^a respectively provided in collar 100 and are adapted to lock the attachment rigidly upon the dough can. These locking pins are like pins 39, 40, have coil springs, not shown, and are readily pulled out manually when it is desired to disconnect the die attachment from the dough can. Secured by press-fitting (or otherwise) to the lower part of collar 100 are a plurality of thin metal die tubes 103, 104, 105, 106 and 107. While five die tubes are shown, and this is the preferred number, there may be as few as three or as many as nine. If only three die tubes are provided, each will be materially larger in diameter than tubes 103-107; whatever their number, each die tube is a straight cylinder of smoothly polished metal and has a beveled upper or inlet end 108, as well as an integral flange 109 abutted against the underside of collar 100. Each die tube also has a valve seat or disk 110 fixed adjacent to but outside of its lower end and each valve seat has a beveled or frustoconical upper face 111 and a tapped boss 112 by which it is screwed or pinned to the lower end of a stem 113. Stems 113 are straight rods which pass through spiders 114 fixed inside each die tube 103-107 and also through spiders 115 fixed at the upper ends of the several die tubes on the inside. These spiders 114, 115 are plural-armed spacers and braces which hold each stem 113 in the center of the die tube and permit the dough mix to flow past them down the die tube and out of it when the mechanisms to be described permit such flow.

Slidably mounted on the outside of and closely fitting each die tube are sleeves 116, 117, 118, 119, 120 respectively. These sleeves are secured at their upper ends to an annular collar 121 and are easily disconnected therefrom. As shown, each sleeve 116-120 has an ear 122 fixed thereto and projecting laterally, with a stud 123 passed through a perforation in the ear and screwed into the bottom of annular collar 121. A pair of diametrically opposite pins 124, 125 are fixed to and project outwardly from annular collar 121 and said pins are received in the previously described slots 69, 70 on the ends of yoke 71 (Figs. 1-4) which as stated above is pivoted at 72 and rocks in a vertical plane responsive to a cam-actuated mechanism forming a part of the prior art machine. Rocking of yoke 71 will cause the assembly consisting of annular collar 121 and sleeves 116-120 to reciprocate vertically on the die tubes 103-107. In its lowest position, each sleeve 116-120 has a shearing contact with a valve seat 110 (Fig. 19) and extends slightly below the same. In their uppermost positions (Figs. 13 and 18) sleeves 116-120 are spaced above valve seats 110 to permit the soft dough mix to be extruded responsive to pressure, as will be described later on. Sleeves 116-120 act as cut-off valves and have their lower ends beveled as shown to provide circular knife edges (116^a, 117^a, 118^a, 119^a, 120^a respectively) cooperating with the valve seats 110 to cut off the dough cleanly.

To control the amount of dough mix extruded during each reciprocation of the cut-off valves or sleeves 116-120, a circular plunger or disk 126 is movably mounted at the upper face of collar 100 and is operated to admit a measured quantity of dough mix to the die tubes 103-107 and force this measured quantity down through said

tubes to the discharge ends thereof. Plunger 126 is nearly flat on top, with a slight crowning as shown, and has a sliding fit inside a circular vertical cylinder 127 which is fixed inside of collar 100. Rigidly secured by rivets to the plunger 126 at diametrically opposite points are two short arms 128, 129 projecting downwardly. A pair of toggle arms 130, 131 are pivotally connected at 132, 133 respectively to the lower ends of arms 128, 129; each toggle arm has a slot 134 (or 135) for receiving a fulcrum pin 136 (or 137) which extends transversely of vertical cylinder 127 and has its ends fixed to said vertical cylinder. As shown in Fig. 16, the two fulcrum pins 136, 137 are parallel and are spaced equal distances from the central axis of vertical cylinder 127. The inner ends of toggle arms 130, 131 are both pivotally connected to the upper end of a vertical rod 138 which is reciprocated with the cut-off valves, as will be explained in more detail later on. Obviously, when vertical rod 138 is reciprocated, toggle arms 130, 131 will rock on the fulcrum pins 136, 137 to raise or lower plunger 126; upward movement of rod 138 lowering plunger 126 to the position shown in full lines in Fig. 18, and downward movement of said rod raising plunger 126 to the dotted line position. See also Fig. 19 for the elevated position of the plunger.

Reciprocating rod 138 has a sliding fit in a bearing block 140 (Figs. 18, 19 and 20) which is secured to collar 100 by means of a set screw 141 having a threaded engagement with a tapped bore 142 extending radially through collar 100 to an axial bore 143 in said collar. Bearing block 140 is received in axial bore 143 and has a circular groove 144 for the inner end of set screw 141. Secured as by a press fit to the center of collar 121 and extending downwardly is a straight tube 145 which has a lateral boss 146 at its lower end for a set screw 147. Screw 147 engages a groove 148 in a lower block 149 to hold the latter against movement. An internally threaded sleeve 150, having a circular head or flange 151 at its upper end which engages the inner walls of tube 145, also has internal screw threads 152 on its lower end. The lower block 149 has a central bore 153 in which sleeve 150 may slide. A nut 154 is threaded on screw threads 152 and has splines 155 on its lower end for turning it with a wrench or screw driver. Reciprocating rod 138 fits in sleeve 150 and is secured therein by screw threads 156. Thus sleeve 150 and its upper flange 151 may be adjusted vertically. As will be seen presently, this adjustment determines the amount of dough which will be forced out of the lower ends of the die tubes. A lock screw 157 threaded inside sleeve 150 may be jammed up against the lower end of rod 138 to secure sleeve 150 rigidly in any adjusted position. To secure nut 154 in its adjusted position on sleeve 150, a hollow lock screw 160 is threaded inside nut 154 and may be turned by a tool until it is jammed against the end of sleeve 150, as shown in Fig. 18. Lock screw 160 is hollow to permit a thin tool or wrench (not shown) to be passed through it to loosen or tighten lock screw 157. The upper end or face 154^a of nut 154 provides an annular shoulder adapted to be struck by block 149 in its down stroke. The position of nut 154 on sleeve 150 obviously determines the extent of upward movement of plunger 126, since downward movement of nut 154 carries with it rod 138 which rocks toggle arms 130, 131 to force plunger 126 above the upper end of cylinder 127 (Fig. 19) opening the upper ends of the die tubes to flow of the dough mix.

When the assembly consisting of collar 121 and the five sleeves 116-120 is moved downwardly (from the position of Fig. 18 to that of Fig. 19), tube 145 moves downwardly and carries with it lower block 149, and after a brief interval lower block 149 strikes shoulder 154^a to move sleeve 150 downwardly. Said brief interval is determined by the space between the lower end of lower block 149 and the upper face of nut 154. This space is obviously

adjustable or variable to give a lost-motion adjustment for the parts. This lost-motion adjustment is desirable because of the commercial doughnut machine mentioned above has a rocking yoke 71 whose motion is much more than is needed for operation of plunger 126. The total lost-motion permitted (considering the two movements, up and down, of the yoke) is varied by changing the position of nut 154 on sleeve 150 and the position of sleeve 150 on rod 138. Varying the position of sleeve 150 on rod 138 permits an adjustment of the movement of plunger 126 downwardly, which varies the amount of dough extruded for each doughnut. When block 149 strikes shoulder 154^a, reciprocating rod 138 moves downwardly, elevating plunger 126. Dough, which is under pressure in the dough can, flows through the annular passage between the plunger 126 and cylinder 127, then down through the die tubes 103-107. Assuming that operation of the machine has completely filled the die tubes with dough, each down stroke of plunger 126 will force a predetermined volume of dough out of the discharge end of the die assembly. This predetermined volume is the volume of the extruded doughnut shape that is dropped into the hot fat. Obviously, this volume may be changed by causing the plunger 126 to descend a little lower in cylinder 127 or not so low: a small adjustment in the travel of plunger 126 effecting a substantial change in the volume or size of the extruded dough shape.

To obviate sticking of a doughnut shape to the end of the die attachment, hot edible oil or fat (preferably the fat in which the doughnuts are cooked) is pumped or otherwise conducted to the lower ends of cut-off sleeves 116-120. If pumping is resorted to, I prefer to place a pump 170 (Figs. 24 and 25) in the fat reservoir or "kettle" 171 and operate it in any convenient way, for instance, by an arm (not shown) fixed to and extending down from one or more of the rotating spider arms 172, or by a short arm 173 fixed to the periphery of spider 174 and projecting downwardly so as to travel in a rotary path such that it must strike the end of a piston rod 175 once during each revolution of the spider. Now pump 170 is immersed in the hot fat 176 in reservoir 171 and lies at an angle of about 15° to the horizontal, so that piston rod 175 has its outer end higher than the pump. Arm 173, after striking piston rod 175, moves the piston against a coil spring, which forces the liquid fat in the pump outwardly through a tube 176^a whose discharge end is above collar 121 of the die assembly. See Fig. 18. Piston rod 175 is resilient and yields to permit traveling arm 173 to pass over it. The hot fat enters the pump through an arcuate series of small ports 177. The coil spring mentioned above returns the piston and piston rod, and a small hole (not shown) in the higher end of the pump cylinder permits the piston to move back all the way. Thus the piston rod is ready for another stroke as soon as arm 173 has passed over the pump. If the pump capacity is such that too much hot oil is carried to collar 121, I contemplate using a by-pass (not shown) to cause most of the pumped oil to flow back to the reservoir; such a by-pass may be controlled by a needle valve (not shown) to permit a desirable adjustment.

The discharge point of the hot oil is above collar 121 so that the oil may flow by gravity and capillary action between the cut-off valves and the die tubes. Preferably collar 121 has shallow grooves 179 (Fig. 21) for conducting the oil around to each die tube. Each die tube is of course vertical, so that the oil tends to flow down its walls by gravity; this flow is aided by three longitudinally extending flats 180 extending the greater part of the length of each die tube. There are also shallow circumferential grooves 181 (Fig. 18) at spaced intervals along the length of each die tube, and apertures 182 arranged circumferentially in the sliding sleeves 116-120. See Figs. 13 and 23. The flats 180, grooves 181 and apertures 182 so control and direct the flow of the oil

films that the lower ends of the cut-off valves are always bathed in the oil, thereby obviating the operating difficulty mentioned above. Also the oil films are lubricants and cut down the friction of the sliding metal parts, hence lessen wear and prolong the life of the moving parts.

To force the dough mix downwardly without resorting to compressed air as in the machine of Figs. 1-4, I prefer to use a simple weighted dough follower 190 (Fig. 26) slidable up and down in dough can 25. Other arrangements may of course be used.

What I claim is:

1. A die attachment for power-operated doughnut machines of the type employing a dough can which extrudes the dough directly above a reservoir of hot cooking fat, said attachment closely fitting the discharge end of the dough can so that all dough extruded must pass through the attachment, said attachment being adapted to form at least three doughnut shapes at points so close together that the dough flows together to join the incipient doughnuts into a single unitary multi-holed doughnut to be deposited in the hot cooking fat; said attachment comprising at least three fixed substantially vertical tubes set close together so that their extruded dough shapes coalesce at certain points, a valve member fixed to each tube and lying below the lower discharge end of said tube at right angles to the longitudinal axis of said tube, a slidable sleeve moving along the outside of each of said tubes and cooperating with the stationary valve member to cut off flow of the dough through the several fixed tubes, the several sleeves being connected together to act in unison, and power-actuated means to reciprocate the sleeves alternately to let some dough pass down and out each fixed tube and to cut off the flow of the dough through the fixed tubes at the same instant.

2. The invention defined in claim 1, wherein the attachment includes means to decrease flow of dough into the areas where the three doughnut shapes are joined together; said means being a barrier located on the inside of each fixed tube adjacent its lower discharge end and lessening the quantity of dough that flows into the areas of joinder of the doughnut rings formed at the discharge end of each fixed tube when the sleeve cuts off flow of the dough.

3. A die attachment for power-operated doughnut machines of the type employing a dough can which extrudes the dough directly above a reservoir of hot cooking fat, said attachment having its upper end closely fitting the discharge end of the dough can, means to lock the attachment upon the dough can, said attachment including at least three vertical die tubes each receiving the dough at its upper end, a slidable cut-off sleeve mounted on each of the die tubes and a horizontal stationary disk fixed to the lower end of each die tube for cooperation with the respective cut-off sleeve to form a diminutive doughnut shape, the three or more die tubes being so close together that the diminutive doughnut shapes flow together or coalesce to make a single unitary multi-holed doughnut which is dropped in the hot cooking fat.

4. The invention defined in claim 3, wherein the die tubes each has a baffle on the inside at their lower ends, each baffle extending vertically and being fixed and acting to diminish the flow of the soft dough toward the areas where the diminutive doughnut shapes are joined.

5. In combination, a supply of doughnut dough; means for exerting pressure on the upper surface of the dough to cause it to tend to flow downwardly; a die member receiving the downwardly flowing dough; said die member having a plurality of substantially vertical die tubes whose upper ends admit the dough and whose lower ends discharge the dough; said die tubes being arranged side by side and having their lower ends set close together; valve seats fixed to the die tubes and spaced from the lower ends thereof; reciprocating sleeves slidable on the outer surfaces of the several die tubes; a collar removably securing the sleeves together; a pair of pins fixed to said collar at diametrically opposite points and projecting out-

wardly therefrom; a pivoted yoke swung about a horizontal axis by a source of power and having slots in its ends receiving said pins, so that the sleeves are reciprocated by power simultaneously through the same distance to permit the same amount of dough to flow out of each die tube past the valve seat and then to cut off such flow at the same instant, so that the dough shape of a multi-holed doughnut is formed preparatory to dropping it into hot cooking fat.

6. A die attachment for doughnut-making machines and the like, said attachment having means at its upper end for fitting closely on the lower end of the dough can of the machine, and means operable manually for releasably locking the attachment upon the dough can, a vertical cylinder fixed in the upper end of the attachment, a plunger reciprocable in the cylinder and movable above the open upper end of the cylinder to permit the dough mix from the dough can to flow into the cylinder, a mechanism operable by power derived from the machine for reciprocating said plunger, a plurality of die tubes arranged vertically side by side and close together and receiving at their upper ends the dough mix pushed down in the cylinder by the plunger on its down stroke, the lower discharge ends of the tubes being in substantially the same plane, a plurality of sleeves each reciprocable over one of the die tubes synchronously with and operated by power-operable mechanism, and a valve seat complementary to the lower end of each of said sleeves and fixed to the discharge end of each die tube but spaced therefrom, the lower ends of the sleeves in their down strokes reaching the fixed valve seats to cut off the flow of the dough through all of the die tubes simultaneously.

7. The invention defined in claim 6, wherein the several reciprocable sleeves are secured to a collar which is directly connected with the extrusion die controlling member of the doughnut making machine to reciprocate up and down on the attachment; and a toggle mechanism connects the plunger and the power-reciprocated collar so that a down stroke of the collar causes the plunger to rise above the upper end of the cylinder and an up stroke of the collar causes the plunger to move down below the upper end of the cylinder.

8. The invention defined in claim 7, wherein the toggle mechanism includes a toggle directly connected to the lower side of the plunger within the cylinder, a toggle-operating rod is pivotally connected at its upper end to the toggle, slide bearings are provided on the attachment to permit vertical reciprocation of said toggle-operating rod, and an adjustable lost-motion mechanism is interposed between the lower end of said toggle-operating rod and the reciprocable collar.

9. The invention defined in claim 8, wherein the adjustable lost-motion mechanism includes a straight tube secured to said reciprocable collar centrally thereof, a lower block secured by a set-screw to the lower end of said straight tube, a sleeve having an enlarged head at its upper end slidably engaging the inner walls of said straight tube, said sleeve having screw threads at its lower end, said lower block having a central bore in which said sleeve may slide, a nut threaded on said screw threads, said toggle-operating rod fitting in said sleeve and being secured thereto by screw threads so that said sleeve may be adjusted vertically, a lock screw threaded inside the sleeve and jammed against the lower end of said toggle-operating rod to secure said sleeve in any adjusted position, another lock screw being threaded inside said nut and turnable until it is jammed against the lower end of said sleeve, said last mentioned lock screw being hollow to permit a thin tool to be passed through it to loosen or tighten the first-mentioned lock screw, the upper face of said nut being adapted to be struck by the lower end of said lower block on its down stroke, and the enlarged head on said sleeve being adapt-

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ed to be struck by the upper end of said lower block on its up stroke.

10. A die attachment for doughnut-making machines and the like, said attachment having means at its upper end for fitting closely upon the lower discharge end of the dough can of the machine, and means for releasably locking the attachment upon the dough can, a vertical cylinder fixed in the upper end of the attachment and adapted to receive dough from the dough can through its upper end, a plunger reciprocable in the cylinder and movable above the open upper end of the cylinder to permit the dough mix from the dough can to flow into the cylinder, the down stroke of the plunger when inside the cylinder determining the precise amount of dough mix which is extruded during each cycle of the apparatus, a plurality of straight vertical die tubes arranged side by side and close together and located below said cylinder and receiving at their upper ends the dough mix from the cylinder, a plurality of sleeves reciprocable over the die tubes, valve seats fixed to the die tubes and spaced below the lower discharge ends of the die tubes and each co-operating with the lower end of a reciprocable sleeve to form a dough shape of ring form, and means uniting said sleeves so that all of them work together, said last named means being reciprocated vertically by a power-reciprocated member of the doughnut-making machine.

11. In a die attachment for doughnut-making machines, a plurality of relatively immovable substantially vertical die tubes set close together, each die tube receiving dough at its upper end and discharging dough at its lower end, a valve seat fixed at the lower end of each die tube but spaced therefrom, a plurality of sleeves slidable over the lower ends of the die tubes, the lower ends of said sleeves co-acting with the valve seats to cut the dough to form the doughnut shape, means to unite said sleeves so that all of them move together, a source of edible oil, and means including narrow capillary passageways cut in the outside surfaces of the die tubes and apertures extending through the sleeves to permit edible oil from said source to flow between the sleeves and the die tubes to lubricate the adjacent surfaces, also to flow over the sleeve ends to prevent the dough shape from sticking or hanging.

12. In combination, an annular reservoir or kettle of hot liquid fat, a rotating spider surrounded by said reservoir, an arm fixed to and depending from said spider so that it traverses a circular path as the spider rotates, a reciprocating pump supported by the kettle and wholly immersed in the hot fat, said pump having a piston rod whose end only is exactly in the path of said arm, said pump also having apertures in its wall for admitting hot fat to its interior, a piston fixed to the piston rod, a spring inside the pump for returning the piston, and a tube connected with the discharge end of the pump for conveying away the hot fat forced out of the pump by the piston.

13. The invention defined in claim 12, wherein the tube has its discharge end near a doughnut-forming die attachment, so that squirts of the edible liquid fat are periodically discharged upon the die attachment.

14. In combination, a reservoir of hot, liquid fat; a pump immersed in the hot liquid fat and having inlet ports for the fat, a tube connected with the pump on its discharge side, power-operated means to operate the pump intermittently, a die attachment including a plurality of substantially vertical die tubes set close together, a valve seat fixed at the lower end of each die tube but spaced therefrom, a plurality of sleeves slidable over the

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lower ends of the die tubes, the lower ends of the sleeves co-acting with the fixed valve seats to cut dough to form a doughnut shape of coalesced rings of dough, a collar uniting said sleeves, power means to reciprocate the collar so that all of the sleeves move together, said tube discharging the hot fat upon the collar, narrow capillary passageways being cut in the outside walls of the die tubes below said collar and apertures being formed in the sleeves so that the hot fat discharged on the collar will flow between the sleeves and the die tubes and through the apertures to the outside walls of the sleeves and down to the lower cutting edges of said sleeves.

15. In doughnut making machines of the type employing a vertical die tube, a sleeve reciprocating over the die tube and a valve seat fixed to the lower end of the die tube and co-operating with the sleeve, and a reservoir of hot liquid fat, that improvement which comprises a pump immersed in the hot liquid fat and having inlet ports for said fat, a tube connected with the discharge side of the pump, and power-operated means to operate the pump intermittently, said discharge tube being positioned to discharge the hot fat intermittently upon the reciprocating sleeve to lubricate the same.

16. A doughnut-making machine having a reservoir of hot fat in which the doughnuts are cooked, a container for a doughnut dough mix, a die attachment through which the dough mix from said container is extruded directly above the surface of the hot fat, a pump immersed in the hot fat and having inlet ports for the fat, power-operated means for working the pump intermittently, and a hot-fat-conducting tube coupled with the discharge side of the pump and having its discharge end adjacent said die attachment, so that films of the hot fat intermittently flow over parts of said die attachment to prevent the dough mix from sticking thereto during said extrusion.

17. A die attachment for doughnut-making machines having means at the lower end for extruding the doughnuts, a measuring and forcing device at the upper end of said attachment for receiving a quantity of the doughnut mix, measuring it, and forcing it down toward the extrusion end, operator-controlled means for adjusting the measuring and forcing device to regulate the size or volume of the doughnuts, means to cut off the dough mix as it is extruded, and reciprocating means adapted to be operated by power for simultaneously operating said device and said dough cutting-off means.

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