June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 1

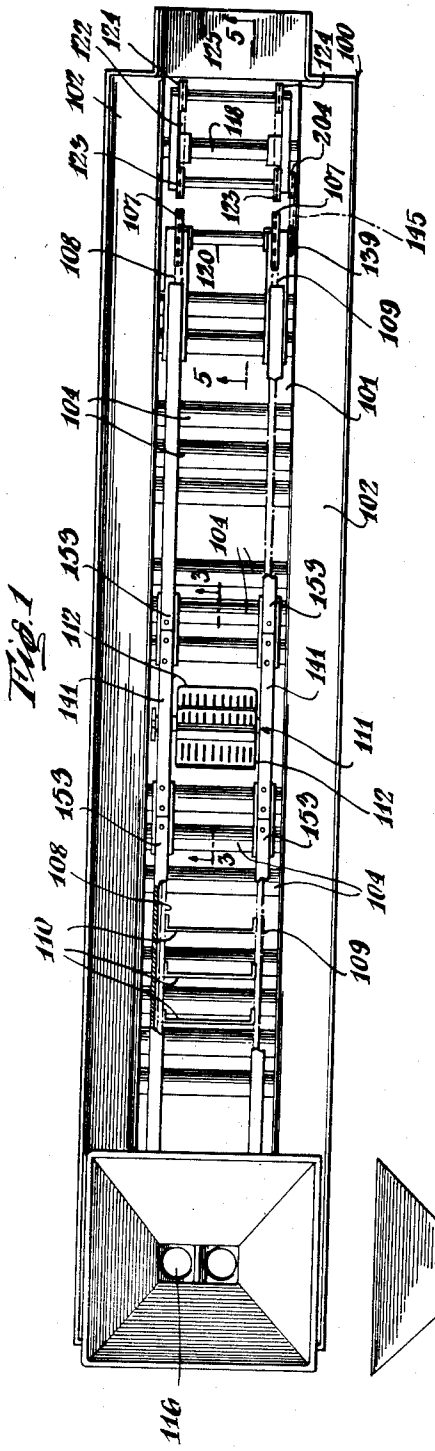


Fig. 1

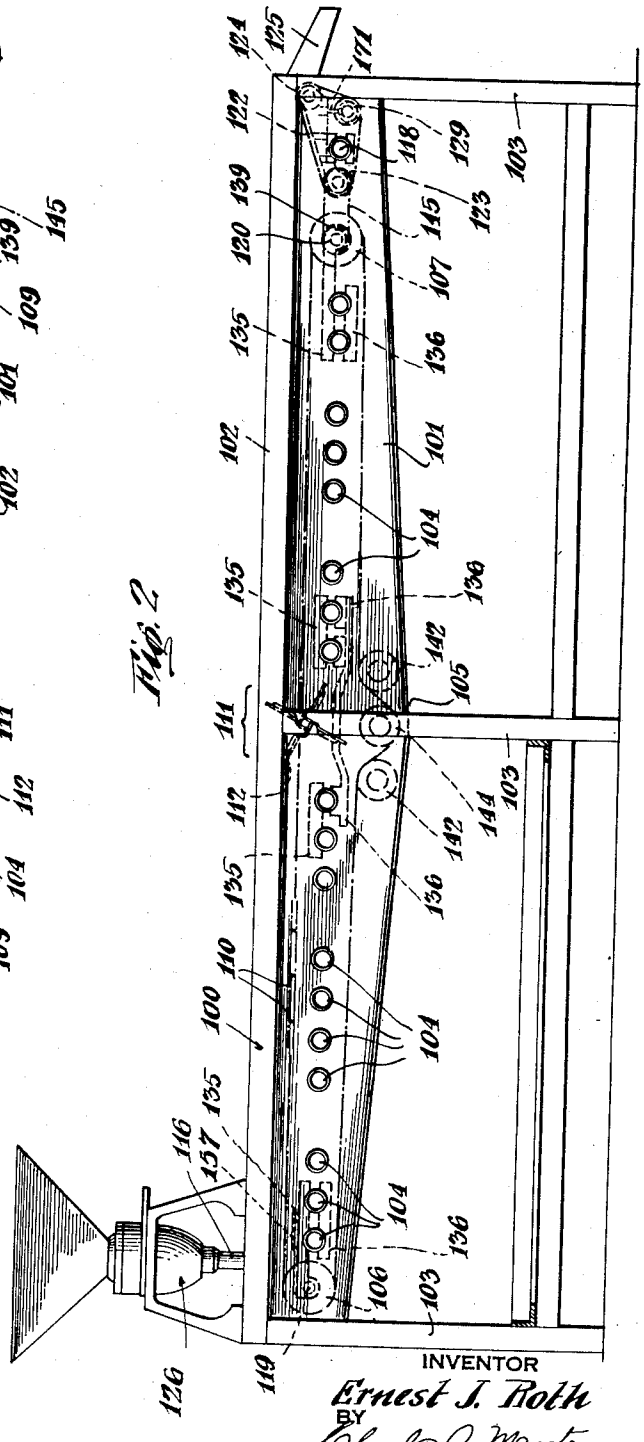


Fig. 2

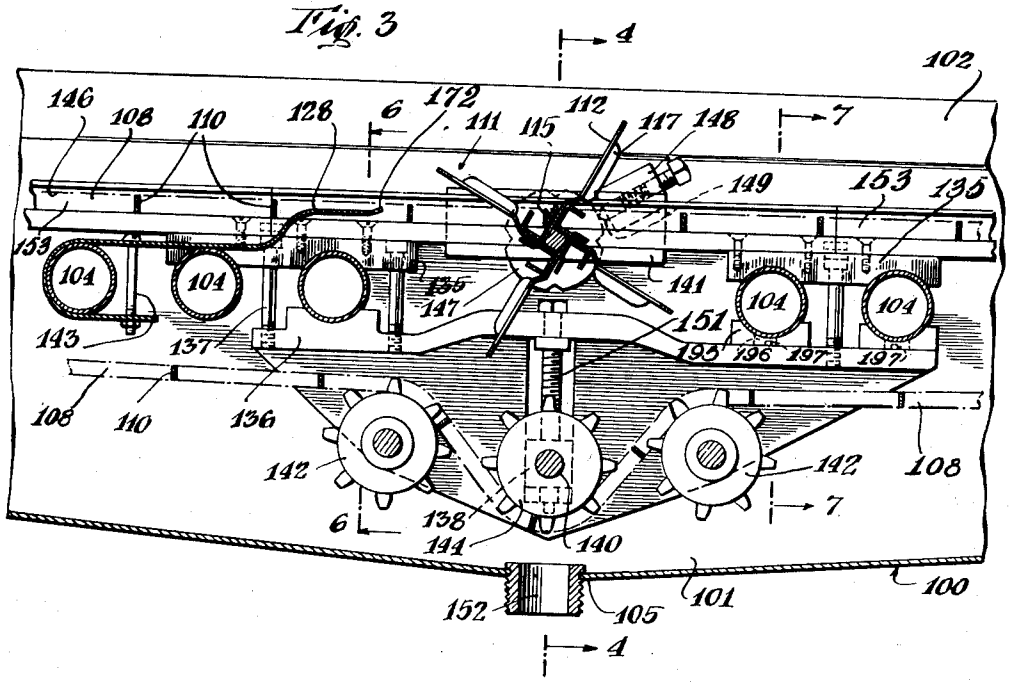
INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 2

Fig. 3



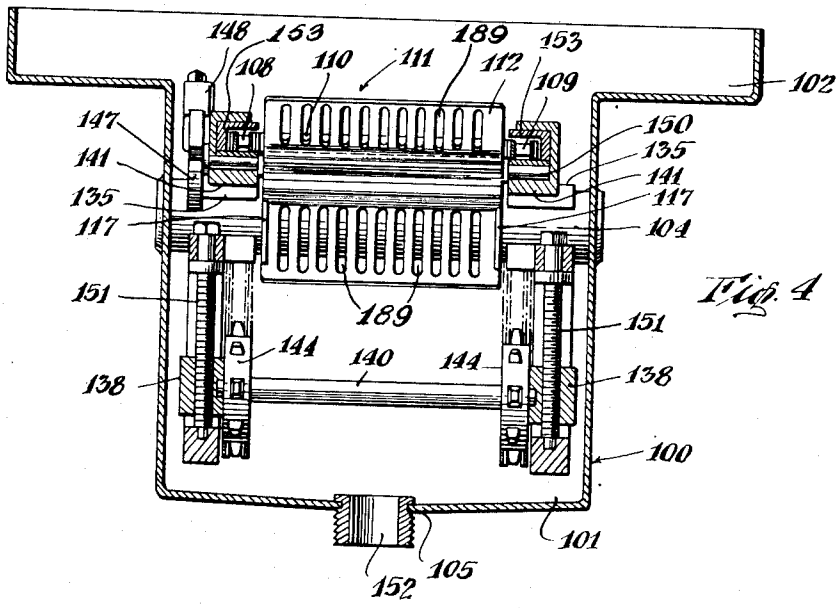


Fig. 4

INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 3

Fig. 5

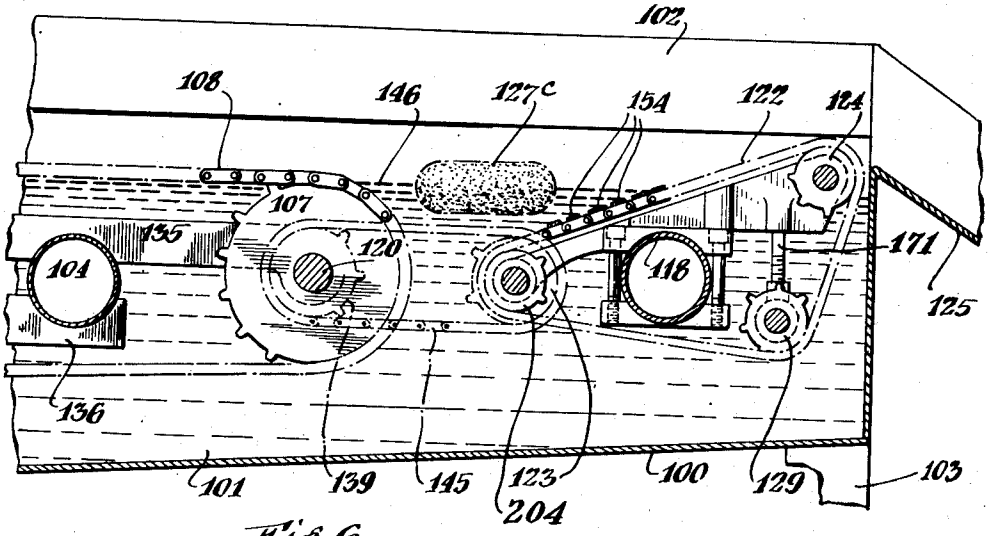


Fig. 6

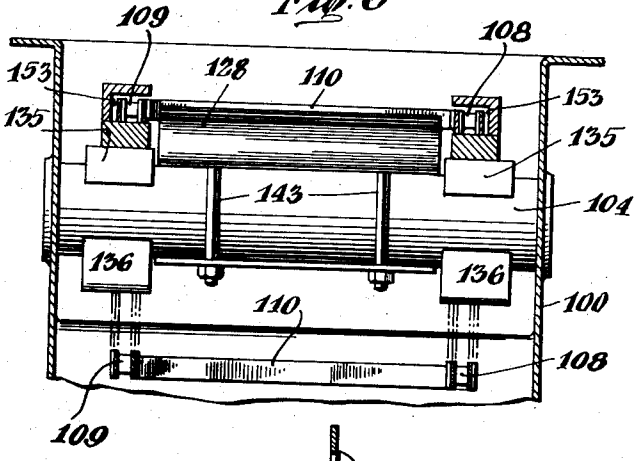


Fig. 7

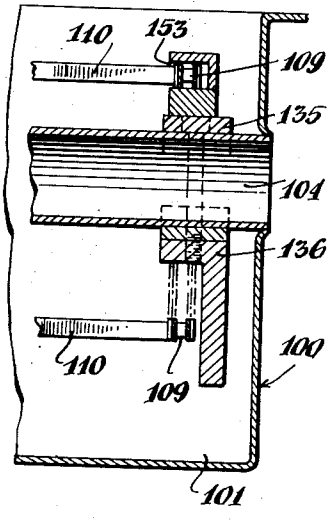
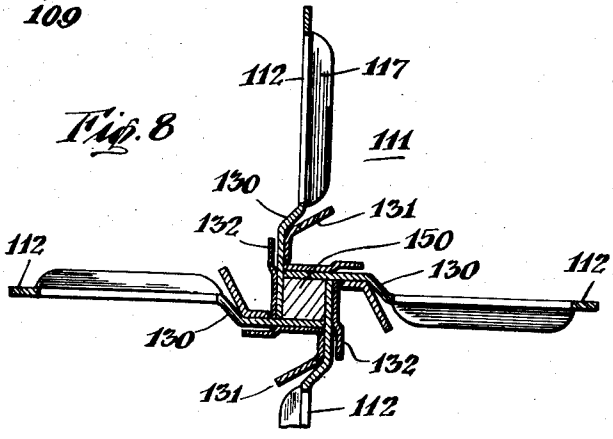


Fig. 8



INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 4

Fig. 9

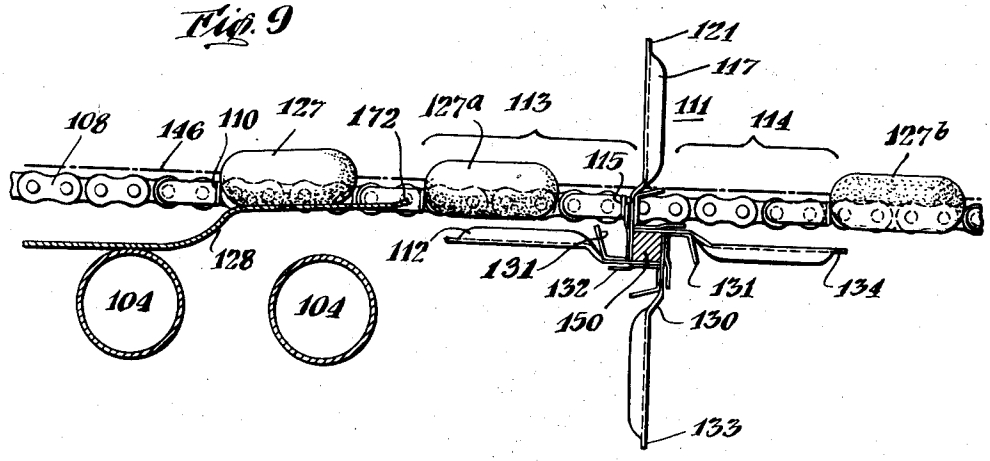


Fig. 10

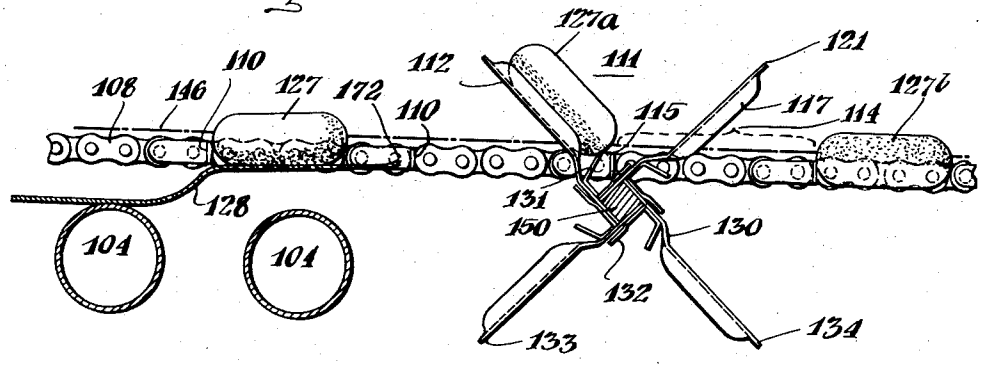
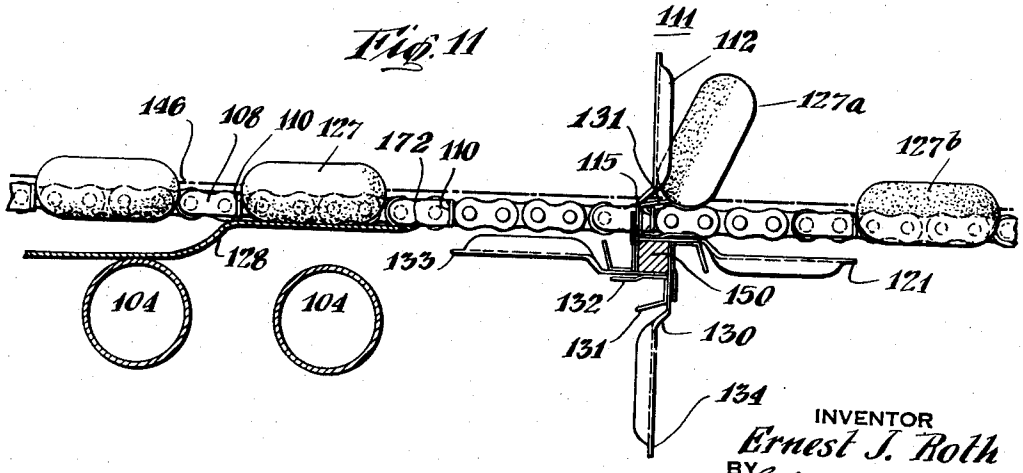


Fig. 11



INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 5

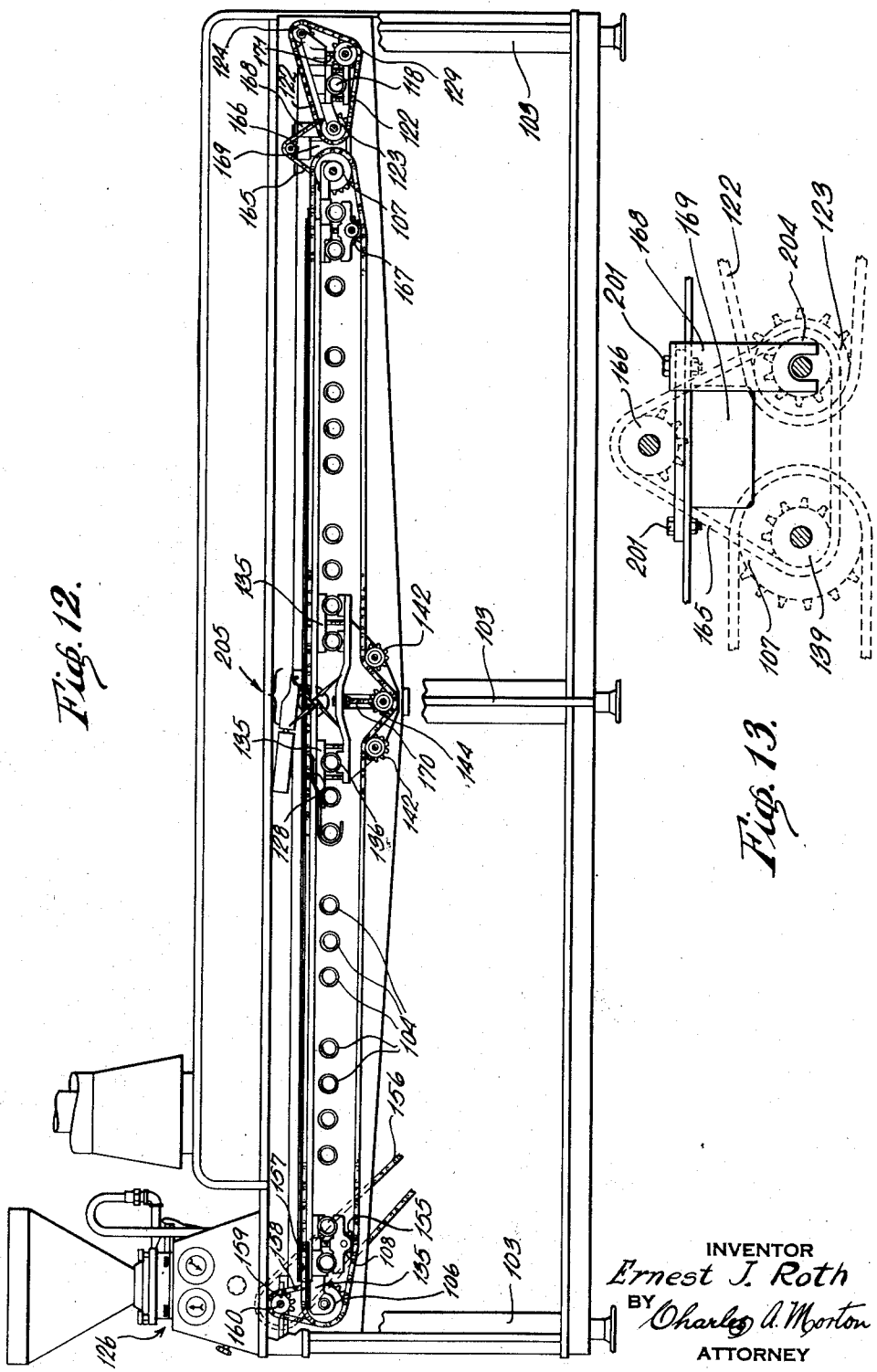


Fig. 12.

Fig. 13.

INVENTOR
Ernest J. Roth
BY Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 6

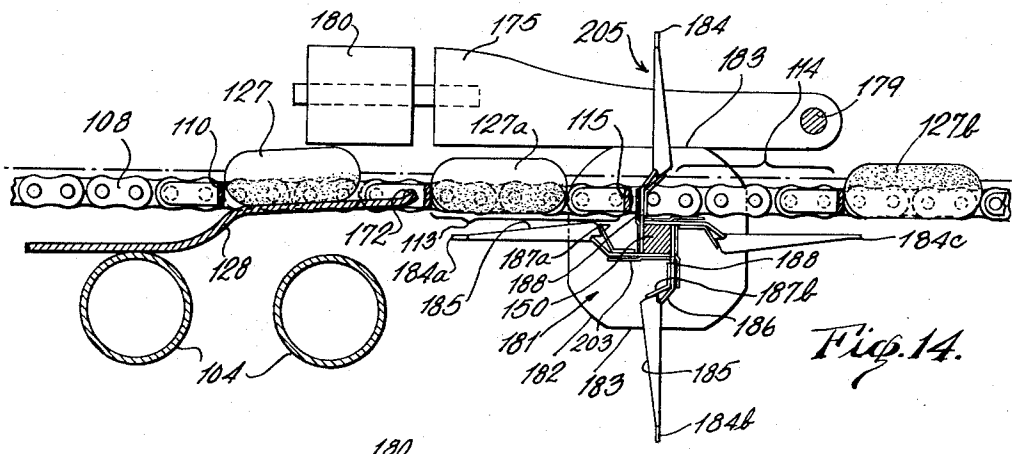


Fig. 14.

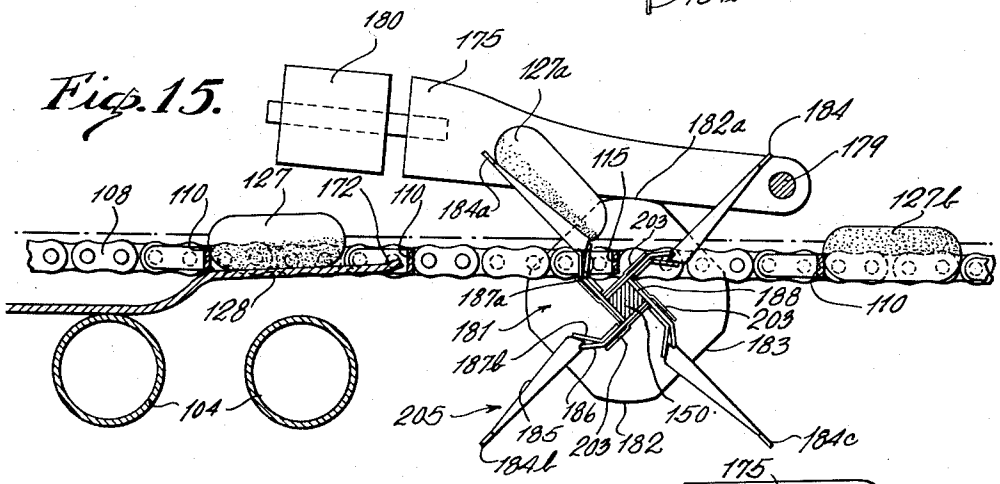


Fig. 15.

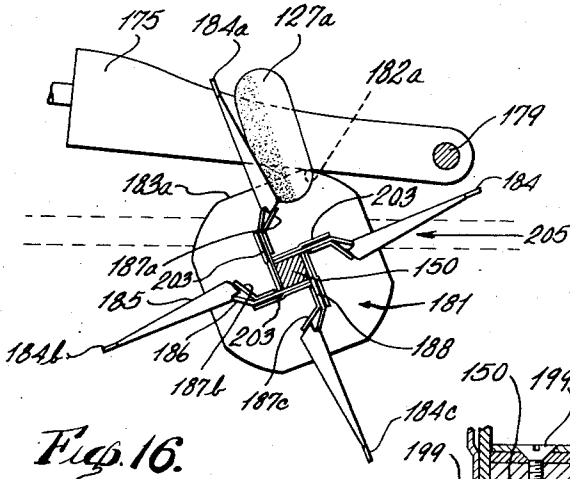


Fig. 16.

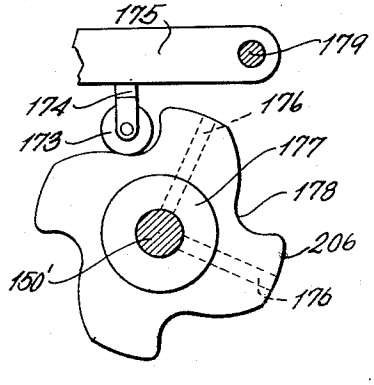


Fig. 17.

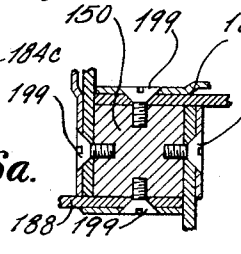


Fig. 16a.

INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

June 9, 1942. E. J. ROTH 2,286,013

DOUGHNUT MACHINE

Filed Jan. 30, 1941 7 Sheets-Sheet 7

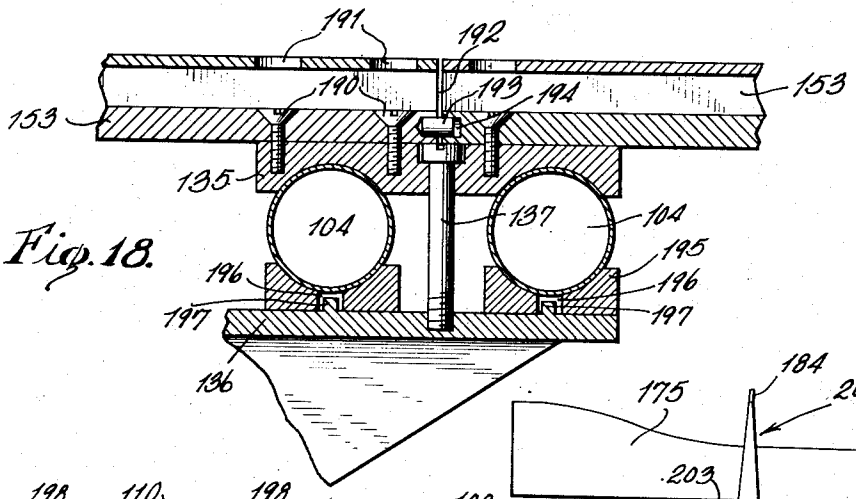


Fig. 18.

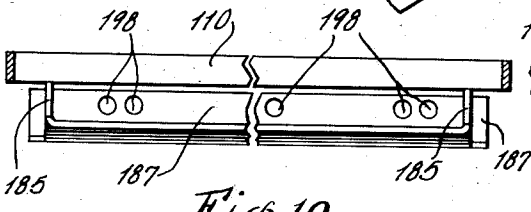


Fig. 19.

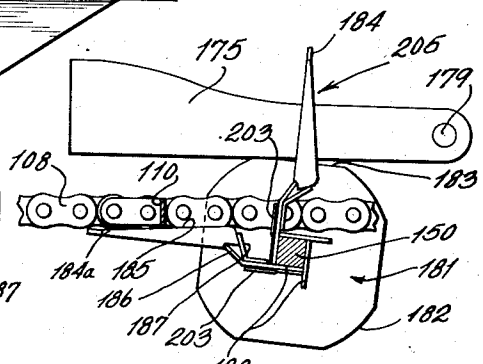


Fig. 20.

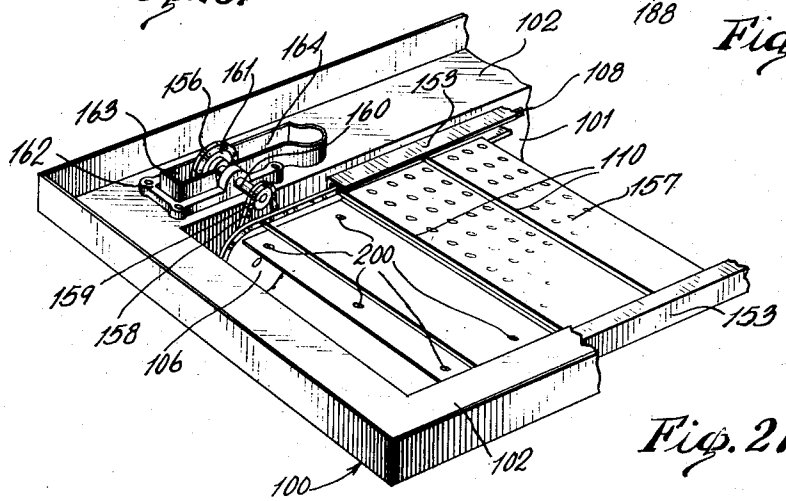
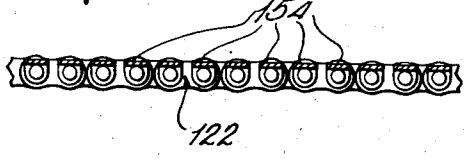


Fig. 21.

Fig. 22.



INVENTOR
Ernest J. Roth
BY
Charles A. Morton
ATTORNEY

Patented June 9, 1942

2,286,013

UNITED STATES PATENT OFFICE

2,286,013

DOUGHNUT MACHINE

Ernest J. Roth, Norwood, N. J., assignor to Joe Lowe Corporation, New York, N. Y., a corporation of Delaware

Application January 30, 1941, Serial No. 376,578

19 Claims. (Cl. 53—7)

This invention relates to doughnut machines and more particularly to doughnut machines for frying doughnuts by the flotation process.

The object of this invention is an inexpensive doughnut machine of the flotation type of few and simple movable parts.

In accordance with this invention the raw uncooked doughnuts are continuously conveyed along one single main conveyor from the receiving end of the machine (or point where they are deposited by the doughnut cutter) towards the delivery end of the machine (or point of discharge), the raw doughnuts floating near the surface of the frying fat, and the timing of the conveyor being such that in their progress through the first half of the frying kettle the lower section of each doughnut is thoroughly fried, and successive doughnuts or groups of doughnuts are then turned over by a turnover device actuated solely by contact with an advancing cross flight of the main conveyor, and the doughnuts thus turned over continue to cook in the frying fat by the flotation process while being progressed by the main conveyor to the delivery end of the machine, by which time the cooking operation is completed and the fully cooked doughnuts are then discharged from the frying kettle as by a short delivery conveyor.

In the drawings comprising seven sheets of twenty-three figures numbered Figs. 1 to 16, 16*a*, and 17 to 22 inclusive.

Fig. 1 is a top plan view of one form of doughnut machine embodying my invention.

Fig. 2 is a side view thereof.

Fig. 3 is a longitudinal section taken along the line 3—3 of Fig. 1, looking in the direction of the arrows.

Fig. 4 is a vertical cross section taken along the line 4—4 of Fig. 3, looking in the direction of the arrows.

Fig. 5 is a longitudinal section taken along the line 5—5 of Fig. 1, looking in the direction of the arrows.

Fig. 6 is a vertical cross section taken along the line 6—6 of Fig. 3, looking in the direction of the arrows.

Fig. 7 is a vertical cross section taken along the line 7—7 of Fig. 3, looking in the direction of the arrows.

Fig. 8 is a cross sectional view of the turnover device partially broken away.

Figs. 9, 10 and 11, are diagrammatic views showing various phases of the progress of a doughnut relative to the main conveyor during the turning operation.

Fig. 12 is a side view of another form of doughnut machine embodying my invention.

Fig. 13 is a side view of a detail.

Figs. 14, 15 and 16 are diagrammatic views showing various phases of the progress of a doughnut relative to the main conveyor and turner of the machine of Fig. 13 during the turning operation.

Fig. 16*a* is a cross sectional view of the turner shaft showing how the turner blades are attached thereto.

Fig. 17 is a fragmentary view of an alternative form of turner centering cam.

Fig. 18 is a vertical cross sectional view of a detail of the turner supporting casting.

Fig. 19 is a horizontal cross sectional view showing how the doughnut rest is protected by the turner blade from injury by an advancing cross flight.

Fig. 20 is a fragmentary side view partly in cross section showing how the cross flight recenters the turner.

Fig. 21 is a perspective view of a fragment of the receiving end of the doughnut machine of Fig. 13; and

Fig. 22 is a vertical cross section of a fragment of the delivery conveyor.

Like reference characters designate corresponding parts throughout the several figures of the drawings.

Frying kettle 100 which may be of the straight-away type, is preferably formed in cross section as shown in Fig. 4, with a relatively deep section 101 and relatively shallow overhanging lips 102—102 on either side of said deep section. The bottom of the kettle may incline upwardly (Figs. 2 and 3) in both directions from a drainage nipple 152 connected to the deep central portion 105, towards the receiving and delivery ends of the kettle. Frying kettle 100 may be supported in any convenient manner as by a supporting frame 103 or the like. The kettle may be heated in any convenient manner as by a battery of gas burners, electrical coils, or other heating apparatus. A series of groups of tubes 104—104 may extend transverse the deep section 101 of frying kettle 100, said tubes extending through the side walls of the kettle and being arranged in spaced relation at suitable intervals along the kettle (Fig. 2) to facilitate the rapid heating of the frying fat.

The moving parts of the machine, such as the conveyor chains 108—109, and the turner 111, are not secured directly to the walls of the kettle; but are all mounted upon the several sets of plates 135—136 which are clamped to the burner

tubes 104. For this purpose each upper plate 135 and its associated lower plate 136 (see Fig. 2), are clamped by suitable bolts, such as the socket head bolts 137 (Fig. 3), to one or more of the burner tubes 104. At the receiving end of the frying kettle 100 (Figs. 1 and 2), the upper plate 135 supports a baffle plate 157 which extends beneath the forming dies 116 of doughnut cutter 126 to form a support whereon the raw doughnut formations come to rest momentarily after being released from the forming dies 116 of the doughnut cutter, until the expanding doughnuts become sufficiently buoyant to rise adjacent the surface of the frying fat and engage the spaced cross flights 110 of the conveyor as hereinafter described.

A plurality of chain sprockets 106—106 (Fig. 2) are mounted upon a shaft 119 which is journalled at the receiving end of the frying kettle to the upper plate 135, and a plurality of chain sprockets 107—107 (Fig. 1) are similarly mounted upon a shaft 120 similarly journalled upon the upper plate 135 positioned (Fig. 2) adjacent the delivery end of the frying kettle. An endless chain 108 extending substantially the full length of the kettle engages the teeth of one pair of sprockets 106—107, and a similar endless chain 109 engages the teeth of the other pair of sprockets 106—107, so that as the main drive sprocket revolves in the right direction the upper flight of each endless chain 108, 109 advances from the receiving towards the delivery end of the frying kettle 100. The upper flights of endless chains 108, 109, travel through guide channels 153 (Figs. 1, 4, 6, 7), which serve to maintain said upper flights at the proper level relative to the fat level 146 (Figs. 3 and 5). At suitable intervals the endless chains 108, 109 are joined together by spaced cross flights 110 extending transverse the kettle, the cross flights being attached to the endless chains in any preferred manner as by means of screws, rivets, or the like. Idler sprockets 142—142 and 144 (Fig. 3) maintain proper clearance between the lower extremity of the downwardly projecting turner blade and the cross flights 110. Each idler sprocket 144 is journalled on a shaft 140 to an adjustable block 138 (Figs. 3 and 4) which is screw-threaded to a worm screw 151 whereby each adjustable block 138 may be raised or lowered on plate 136 (Fig. 3), to regulate the amount of tension or slackness in the endless chains 108, 109. The grease drainage nipple 152 is secured in the bottom of kettle 100, (Figs. 3 and 4).

To protect the turner mechanism from injury due to expansion of lower casting 136 (Fig. 3) the pads 195—195 are cast separate from lower casting 136. Each pad is provided with an opening 196 for receiving a stud 197 projecting from lower casting 136. The opening 196 in pad 195 is substantially larger than stud 197, thus permitting relative movement between lower casting 136 and pads 195—195 to compensate for expansion.

The spaces between adjacent cross flights 110—110 form cells or compartments for containing the doughnuts or other articles 127 to be fried, and as the endless chains 108, 109 move towards the delivery end of the frying kettle to advance the cross flights 110, said cross flights contact the partially cooked doughnuts or other articles 127 which are floating adjacent the surface of the frying fat, and convey them from the receiving end (or point of deposit), towards the delivery end, of the frying kettle. Approximately mid-way between the receiving and delivery ends of frying kettle 100, a turner 111 is mounted to revolve on a suitable shaft 150 journalled to the frames 141 (Fig. 4). Turner 111 (Fig. 8) preferably consists of four turner blades 112 mounted 90° apart upon a rotatable shaft 150. The shank 130 of each blade 112 is offset (see Fig. 8). A doughnut rest 131 is secured to the forward side of each shank; rest 131 serves both to hold the doughnut back as the turner rotates to lift doughnut 127a out of compartment 113 (see Figs. 9 and 10), and to trip the doughnut when the turner blade reaches an upright position (see Fig. 11) to insure positive overturning of the doughnut before it is deposited in the empty compartment 114. A leaf spring 132 (Fig. 8) may be attached to the rear side of each shank 130. Each leaf spring 132 functions: firstly as a contact member for engagement by the advancing cross flight 110; secondly to yield to the pressure applied by the contacting cross flight in advancing thus momentarily retarding the commencement of rotation of turner 111 until the spring controlled cam centering and holding latch 149 disengages the notch in turner centering cam 147 (Fig. 3); and thirdly, to increase the speed of rotation of turner blade 111 by rapidly dissipating the energy stored up in leaf spring 132 after holding latch 149 disengages the notch in turner centering cam 147 (Fig. 3). Shaft 150 of turner 111 is journalled beneath the level of the upper or advancing tier of spaced cross flights 110 of the endless conveyor, so that the cross flights pass over the rearwardly projecting blade 112 (Fig. 9) and the shaft 150 of turner 111, while the lower or returning tier of cross flights 110 (Figs. 3 and 4) pass around idler sprockets 142—142 and adjustable idler sprocket 144 positioned beneath the lower extremity of the downwardly projecting turner blade of turner 111. As the endless conveyor advances each successive spaced cross flight 115 engages the leaf spring 132 of the upwardly projecting blade, thus causing the turner 111 to rotate in a clockwise direction through an angle of 90° to move the blade from an upright to a forwardly projecting horizontal position in which position cross flight 115 passes over leaf spring 132 in feathering contact (Fig. 11). With the turner blades in position thus insuring sufficient clearance between cross flight 115 and the turner blade (Fig. 11), holding latch 149 engages one of the slots in the turner centering cam 147 (Fig. 3) thus momentarily retaining the turner in a stationary position. Fig. 9 shows the position of a cross flight 115 relative to an upwardly projecting blade (which is designated 121 for convenience of description) at the moment that cross flight 115 engages the leaf spring 132; and Fig. 11 shows the relative position of the cross flight 115 and of the now horizontally disposed turner blade 121 after the turner has rotated in a clockwise direction through an angle of 90° to turn doughnut 127a over in the operation of depositing the said doughnut in the formerly empty compartment 114.

The offset shank 130 of the turner (Fig. 8) substantially increases the depth of the fat above forwardly projecting blade 121 (Fig. 11), so that as doughnut 127a (Fig. 11) is deposited in compartment 114 the depth of the fat above blade 121 is sufficient to prevent any injury to the doughnuts due to any momentary contact with blade 121 which now functions in effect as a baffle plate. The side edges of each blade 112

are bent over (Fig. 8) to form guard members 117 for preventing sidewise movement of the doughnuts during the rotation of the turner. Each blade may be provided with a series of spaced elongated openings 189 (Fig. 4) to reduce resistance to the movement of the turner in the frying fat, and to allow the fat to drain off as the turner blade is lifted above the grease level.

Suitable mechanism is provided (Fig. 3) to retard the advance of the doughnuts thus preventing them from moving prematurely into the path of the rotating blades of turner 111. This device may consist of a resilient plate 128 (Figs. 3, 9, 10, 11) mounted either directly or indirectly upon one of the burner tubes 104. The brown underside of the partially cooked doughnut 127 (Fig. 9) engages the curved lip 172 of plate 128 thereby retarding the forward progress of doughnut 127 until the cross flight 110 positioned in rear of the doughnut 127 advances thereby forcing the resilient plate 128 downwards against its natural tension until the curved lip 172 is depressed far enough to permit the cross flight 110 to advance the doughnut 127 into the position occupied by doughnut 127a (Fig. 9) for engagement by the rearwardly projecting blade 112 of the turner 111 (Fig. 9). The curved lip 172 thus herds the doughnuts 127 at the rear of their compartment, so that when they reach the position of doughnut 127a (Fig. 9), the doughnuts will be in rear of the rest 131 rather than in contact with cross flight 115 at the forward end of their compartment. If the doughnuts 127a were permitted to contact cross flight 115 of compartment 113 (Fig. 9), then as the turner blade 112 rotated into position shown in Fig. 10 doughnut 127a would be pinched between the now rapidly rotating rest 131 of turner blade 112 and the slowly advancing cross flight 115 thus damaging the partially cooked doughnut.

A delivery conveyor 122 which may be of the endless chain type provided with cross slats 154 (Figs. 5 and 22) may be mounted on suitable sprockets 123—123, 124—124, and 129—129, so as to receive the completely cooked doughnuts from the main conveyor and deliver them through a chute 125 to a suitable collecting device (not shown) which may be a basket or tray, a conveyor system, or a cooling, or a sugaring, machine. The sprockets 129—129 can be adjusted by means of worm screw adjusting pin 171 to regulate the amount of tension in the endless chains of the delivery conveyor 122. Sprockets 107 and 139 are both mounted upon shaft 120 (Fig. 5) and rotate together, the former being driven by one of the endless chains of the main conveyor and the latter driving the endless chain 145 which in turn drives sprockets 123 and 204 which operate delivery conveyor 122.

With this construction only one power drive is required to operate all of the conveyors and the turner 111; this power drive may be suitably connected to drive shaft 119 of the main conveyor at the receiving end of the machine. As turner 111 is rotated solely by contact with the advancing spaced cross flights 110 of the main conveyor, no independent drive is required to operate the turner.

A very satisfactory commercial form of automatic doughnut machine embodying the invention is shown in Figs. 12 to 16a and 18 to 21.

Adjustable idlers 155 and 167 (Fig. 12), positioned at the receiving and delivery ends respectively of the main conveyor, help to control the tension of the endless chains 108—109 of the main conveyor. Baffle plate 157 (Fig. 21) which is immediately beneath the forming dies (not shown) of cutter 126, is mounted upon an upper plate 135 with screws 200. Main drive chain 156 moves in a well 164 (Fig. 21) formed in the overhanging lip 102, the well has an upstanding well-wall 163. The U shaped counter-shaft bearing block 162 fits around well-wall 163. A counter-shaft 160 which extends into well 164 is journaled in bearing block 162. Sprocket 161 driven by main drive chain 156, and sprocket 159, are both keyed to counter shaft 160. Sprocket 159 drives endless chain 158 to control drive sprocket 106 which drives the main conveyor.

Sprocket 204 which drives delivery conveyor 122 via sprocket 123, and pump drive sprocket 166 which drives fat circulating pump 169, are both driven by the endless chain 165 from a sprocket 139 (Fig. 13). Sprocket 139 rotates in unison with sprocket 107. Sprockets 123—204 and 107—139 may be double sprockets. A forked clamp 168 (Fig. 13), bolted at 201 to the frame of the machine, engages the shaft of sprocket 123, thus retaining delivery conveyor 122 in correct position. Adjustable idler sprocket 129 which is regulated by worm screw 171 controls the tension of the delivery conveyor.

To allow for expansion the abutting ends of the guide channels 153 (Fig. 18) are separated by a suitable air gap 192, and the abutting ends are retained in correct alignment by a stud 193 press fitted in one guide channel 153, and projecting into an expansion groove 194 formed in the abutting end of the next section of guide channel. The guide channels are secured to the upper plates 135 by means of the flush screws 190—190, the screws being inserted and screwed into place through the openings 191 in the upper wall of the guide channel. Similarly to allow for expansion of lower casting 136, the pads 195 which engage the burner tubes 104 are provided with enlarged openings 196 for loosely receiving the studs 197 of the lower casting 136.

The turner mechanism 205 of the machine shown in Fig. 12 will be better understood from Figs. 14 to 16. The notched cam 147 and spring latch 148 (Fig. 3) of the machine of Fig. 1, are replaced by a cam 181 and weighted lever arm 175 (Fig. 14), the latter including an adjustable weight 180. The lever arm is pivoted at 179. Cam 181 is in effect a flattened wheel having rounded segments 182 alternating with flattened segments 183. When the turner is at rest (Fig. 14) the flat underside of lever arm 175 engages a flattened segment 183 of cam 181, thus centering the turner mechanism (Fig. 14) with its blades 184 in vertical and horizontal position. When the turner mechanism is centered, it does not obstruct the path of the advancing cross flights 110. Each successive advancing cross flight 110 if unobstructed advances until it reaches the position indicated by cross flight 115 (Fig. 14) when it engages either the shank 188 of the upstanding turner blade 184, or the leaf spring 203 if the shank 188 is equipped with a leaf spring. If leaf spring 203 is used, it may be spot welded to shank 188, and shank 188 and leaf spring 208 may be mounted upon square shaft 150 by means of screws 199 (Fig. 16a).

The end walls 185 of each turner blade are bevelled so that if for any reason centering cam 181 should fail to function properly and blades 184 should overstep (Fig. 20), cross flight 110 in advancing would ride up the incline formed by

bevelled wall 185 and force the turner mechanism 205 to move counter-clockwise until it is re-centered with its blades in the position shown in Fig. 14. The transverse step 187 (187a, 187b) upon which the doughnuts rest momentarily during the turning operation (Figs. 15 and 16) is preferably made shorter than bevelled wall 185 (Fig. 19) of turner blade 184, to protect the step 187 against injury by an advancing cross flight 110. Thus should the turner mechanism overstep (Fig. 20), the advancing cross flights 110 (Fig. 19) must ride over bevelled wall 185 (Fig. 19) and re-center the turner, but since the transverse step 187 (Fig. 19) terminates below the top of the bevelled wall 185, the cross flight can not engage and injure transverse step 187.

As the conveyor moves from left to right (Figs. 14 and 15), the cross flights 110 successively pass through the position of cross flight 115 (Fig. 14) to engage shank 188 of the turner blade and rotate shank 188 and turner shaft 150 in a clockwise direction. Cam 181 which is keyed to turner shaft 150, rotates with the shaft, thus lifting weighted lever arm 175. The continued advance of cross flight 115 causes the turner and cam 181 to continue to rotate in unison through the successive positions of cams 181 shown in Figs. 20, 15, 16 and 14. Turner blade 184a in rotating engages the browned underside of doughnut 127a and lifts it (Figs. 15 and 16) until the trailing edge of rounded segment 182a (Fig. 16) passes the vertical center line of the axis of rotation of shaft 150, whereupon the flattened surface of the weighted lever arm 175 seeks to contact the entire length of the flattened segment 183a (Fig. 16) thereby accelerating the rotation of cam 181 until it reaches re-centering position (Fig. 14) when the further rotation of the turner mechanism 205 is abruptly arrested by the pressure of the weighted lever arm 175 against the flattened segment 183a. When the rotation of turner mechanism 205 is thus arrested, the doughnut 127a which is supported by the rest 187a is "kicked" or flipped off turner blade 184a, outer end first, and turns over and falls clear of cross flight 115 into the empty compartment 114, one compartment in advance of the compartment 113 from which it was removed. If the doughnuts were not flipped off blade 184a by the arresting action of weighted lever 175 against flattened cam 181, some of the doughnuts might fall on top of the cross flight 115 and would then be pinched between the cross flight and the rest 187a of turner blade 184a thus crippling the doughnuts.

One advantage of pivoting the lever arm in the manner shown in Figs. 14 to 16 is that in initiating the lifting movement of the weighted lever arm 175 (Fig. 20) the force is applied to lever 175 at a greater distance from its pivot 179 than when the lever arm 175 is accelerating the rotation of the turner mechanism (Fig. 16). Weighted lever arm may be reversed and pivoted upon the opposite side of the vertical center line of the axis of rotation of shaft 150, but in this case the advantage last indicated would be lost.

The swastika cam 177 (Fig. 17) may be used instead of the flattened wheel cam 181 (Figs. 14 to 16). Cam 177 is provided with a series of shoulders 206 separated by the cuttings 178. A roller cam follower 173 mounted on weighted lever arm 175 by a fork bearing 174 follows the contour of cam 177 to lift and drop weighted lever arm 175 as before. Cam 177 may be keyed to shaft 150' by means of the pins 176—176. As cam 177 rotates clockwise with shaft 150', cam follower 173 rides along cutting 178 to shoulder 206 thus lifting weighted lever arm 175. As the blade 184a reaches the position shown in Fig. 16, cam follower 173 falls into a cutting 178, momentarily accelerating and then arresting the movement of turner blade 184a, to flip doughnut 127a over in the manner previously described. When the weighted lever arm and swastika cam 177 are in the position shown in Fig. 17 the turner mechanism 205 will be in the position shown in Fig. 14.

Principle of operation

The formations of plastic dough 127 formed by the cutter 126 are deposited at the receiving end of frying kettle 100 (Fig. 1), the doughnuts sinking momentarily into the frying fat towards the baffle plate 157 until they obtain sufficient buoyancy to rise adjacent the surface of the frying fat when they are engaged by the spaced cross flights 110. Curved lip 172 of retarding plate 128 (Fig. 9) tends to arrest the momentum of the doughnuts propelled by cross flight 110, so that doughnut 127 will remain in the rear of its compartment in contact with the cross flight 110 as the latter advances and depresses retarding plate 128 to move the doughnuts into compartment 113 occupied by doughnut 127a in Fig. 9. That portion of each doughnut which is immersed in the frying fat cooks quite rapidly as the cross flights 110 advance the doughnuts 127 towards the turner 111 and by the time the cell or compartment containing the doughnut occupies the space immediately above the rearwardly projecting turner blade 112 of turner 111 indicated as compartment 113 (Fig. 9) the doughnut 127a is sufficiently cooked to be covered with a browned crust on the underside, while the upper side of the doughnut is substantially raw. The compartment 114 immediately in front of the turner mechanism is empty (Fig. 9). The continued advance of the main conveyor causes cross flight 115 forming the front end wall of compartment 113 (Fig. 9) to first engage and compress the leaf spring 132 attached to the rear side of the upwardly projecting turner blade (designated 121) of turned 111, and then to force turner 111 to rotate in a clockwise direction (see Fig. 10). As the turner 111 rotates through compartment 113 (Fig. 10) its rearwardly projecting blade 112 engages the underside of doughtnut 127a positioned in compartment 113 and the continued forward movement of cross flight 115 forces the unwardly projecting blade 121 (Fig. 10) of turner 111 to rotate in a clockwise direction during which movement the forward end of doughnut 127a engages rest 131 (Fig. 10). Turner 111 continues to rotate until the blade 121 occupies a horizontal position substantially as shown by the blade 121 (Fig. 11), thus bringing blade 112 and partially cooked doughnut 127a into an upright position (Fig. 11), whereupon the doughnut 127a trips, turns over, and falls of its own weight into the formerly empty compartment 114, one compartment in advance of the cross flight 115 and of the compartment 113 formerly occupied by doughnut 127a. The doughnut 127a now floats in the frying fat raw side downwards, and by the continued advance of the main conveyor the doughnut while still cooking is progressed by the cross flight 110 as indicated at 127b (Fig. 11) towards the delivery end of frying kettle 100.

As the rest 131 attached to turner blade 112 (Fig. 11) is formed at an obtuse angle, the cross flight 115 (Fig. 11) can move forward without contacting rest 131, thus preventing rest 131 from jamming cross flight 115 and avoiding injury to the various moving parts. By the time the doughnut reaches the delivery end of the frying kettle as indicated by doughnut 127c (Fig. 5) it is thoroughly cooked, and it is here transferred to the delivery conveyor 122 which in turn deposits the said fully cooked doughnut upon the delivery chute 125

In the machine shown in Fig. 12 et seq., the doughnuts are formed and advanced by the cross flights 110 until they occupy compartment 113 immediately behind the turner mechanism 205 as previously described. The continued advance of the conveyor causes cross flight 115 (Fig. 14) to engage either the shank of blade 184 or the spring 203 (if used) to rotate shaft 150 and turner mechanism 205 through the positions shown in Figs. 20, 15 and 16 in succession, causing cam 181 to lift weighted lever arm 175 while blade 184a lifts doughnut 127a. When the trailing edge of rounded segment 182a (Fig. 16) passes the center line of the vertical axis of rotation of turner shaft 150, weighted lever arm 175 moves rapidly downwards first accelerating the speed of rotation of cam 181 and of the turner mechanism 205, and then arresting the rotation of the cam and of the turner mechanism to flip doughnut 207a off blade 184a, thus turning the doughnut over and depositing it in the empty compartment 114 which is in advance of the turner (see Figs. 14 and 15).

When the swastika cam 177 (Fig. 17) is substituted for the flattened wheel cam 181 and the roller cam follower 173 is journalled beneath the weighted lever arm 175, the principle of operation of the machine shown in Fig. 12 as thus modified remains unchanged.

What is claimed is:

1. A turnover device useful in a doughnut frying apparatus, said turnover device comprising a rotatable shaft and a rotor secured to said shaft, said rotor in turn consisting of a series of blades mounted upon said shaft, said blades being spaced 90 degrees apart and extending radially outwardly therefrom, the shank of each blade being bent to advance the position of the blade relative to its shaft-attaching shank, a spur plate secured to the forward wall of each of said blade shanks and extending laterally outwardly therefrom to define a supporting rest for doughnuts positioned upon its associated blade during the operation of turning said doughnuts over incident to frying, and a leaf spring secured to the rear wall of each of said blade shanks and extending in parallel spaced relation to its said rear wall.

2. A turnover device useful in a doughnut frying apparatus, said turnover device comprising a rotatable shaft and a series of blades mounted upon said shaft, said blades being spaced 90 degrees apart and extending radially outwards from said shaft, each blade having a shank portion for attachment to said shaft, a ledge secured across the shank portion and projecting outwardly therefrom to define a rest for doughnuts positioned upon the blade during the operation of turning the doughnuts incident to frying, and a guard rail extending along the shank portion from the outer edge of the ledge downwards towards the tip of the blade.

3. A turnover device useful in a doughnut frying apparatus, said turnover device comprising a rotatable shaft and a series of blades mounted upon said shaft, said blades being spaced 90 degrees apart and extending radially outwards from said shaft, each blade having a shank portion for attachment to said shaft, a ledge secured across the shank portion and projecting outwardly therefrom to define a rest for doughnuts positioned upon the blade during the operation of turning the doughnuts incident to frying, and the side edges of the blade terminating in a pair of bevelled guard rails extending from the ledge downwardly towards the tip of the blade.

4. A turnover device useful in a doughnut frying apparatus, said turnover device comprising a rotatable shaft and a series of blades mounted upon said shaft, said blades being spaced 90 degrees apart and extending radially outwards from said shaft, each blade having a shank portion for attachment to said shaft, a ledge secured across the shank portion and projecting outwardly therefrom to define a rest for doughnuts positioned upon the blade during the operation of turning the doughnuts incident to frying, and the side edges of the blade being bent upwards to form a pair of tapering guard rails abutting the ledge and extending downwardly from the top of the ledge towards the blade tip.

5. A turnover device useful in a doughnut frying apparatus, said turnover device comprising a rotatable shaft and a series of blades mounted upon said shaft, said blades being spaced 90 degrees apart and extending radially outwards from said shaft, each blade having a shank for attachment to said shaft, a ledge secured across the shank, the angle between said ledge and the shank being greater than a right angle, said ledge projecting outwardly from said shank to define a rest for doughnuts positioned upon the blade during the operation of turning the doughnuts over incident to frying, and the side edges of the blade being bent upwards to form a pair of tapering guard rails abutting the ledge and extending downwardly from the top of the ledge towards the blade tip.

6. In a doughnut machine and in combination, a kettle for containing frying fat, said kettle having a row of burner tubes extending across the width of the kettle and passing through the side walls thereof in parallel spaced relation to each other and to the bottom and end walls of the kettle, one single main conveyor mounted to be supported solely by certain of said burner tubes for forward movement of its upper flight above and for return movement of its lower flight beneath said burner tubes, said main conveyor extending for substantially the entire length of the kettle and including a series of cross flights attached to the conveyor at equally spaced intervals for sub-dividing said conveyor into an unbroken series of separate compartments for containing, separating and progressing the articles to be fried throughout their entire cooking period, but one single turnover device, said turnover device being freely rotatably mounted, said mounting being supported solely by certain other burner tubes, said turnover device extending across the kettle substantially mid-way the length of said main conveyor, the shaft of said turnover device being square in cross section and having its axis of rotation positioned immediately beneath the upper flight of said main conveyor, said turnover device including four blades mounted upon said squared shaft at right angles, and said blades being successively en-

gageable by successively advancing spaced cross flights to intermittently rotate said turnover device thereby swinging the rearwardly projecting blade thereof upwardly through the compartment in rear of the turner-engaging cross flight to lift the partially fried articles out of the said compartment and redeposit them in over-turned condition in the compartment immediately in front of said turner-engaging cross flight.

7. In a doughnut machine the combination with a kettle for containing frying fat, one single main conveyor mounted for forward movement of its upper flight adjacent the frying fat level of the kettle for progressing frying articles through the frying fat for substantially the entire length of the kettle and for return movement of its lower flight adjacent the bottom of the kettle from the delivery to the receiving end thereof, and but one single turnover device, said turnover device being freely rotatably mounted transverse the kettle substantially midway the length thereof, said turnover device including a plurality of vanes rotatable in the direction of movement of the upper flight of the conveyor, a spur plate secured to the forward wall of each vane and extending laterally outwardly therefrom to define a supporting rest for doughnuts positioned upon its associated vane, a leaf spring secured to the rear wall of each vane, means including a cam mounted on the shaft of the turnover device, said cam having a plurality of notches formed therein and a spring latch engageable in successive cam notches for centering accelerating and re-centering said turnover device, of a series of cross flights attached to the conveyor at equally spaced intervals thus subdividing the conveyor into an unbroken series of separate compartments for containing and separating the articles to be fried, said cross flights being operable in advancing to engage and depress successive leaf springs until the energy stored in said spring is sufficient to overcome the tension of said spring latch and rotate said turnover device thus lifting the doughnuts out of the compartment wherein they were originally deposited supporting them upon the spur plate as the turnover device continues to rotate and redepositing said doughnuts in overturned condition in the compartment one step in advance of the compartment from which they were lifted preparatory to turning.

8. A turnover device useful in a doughnut frying machine of the advancing conveyor type, said turnover device comprising a shaft and a series of blades mounted upon said shaft, said blades extending radially outwards from said shaft, said shaft being mounted for free intermittent rotation in one direction under control of the conveyor in advancing, mechanism for intermittently arresting the movement of the turnover device and for centering said turnover device in the correct position of rest, and means on the turnover device, engageable by the conveyor in advancing when said turnover device has overstepped, to rotate the turnover device in the reverse direction to re-center said turnover device.

9. A turnover device useful in a doughnut frying machine of the advancing conveyor type, said turnover device comprising a shaft and a series of blades mounted upon said shaft, said blades extending radially outwards from said shaft, said shaft being mounted for free intermittent rotation in one direction under control of the conveyor in advancing, mechanism for intermittently arresting the movement of the turnover device and for centering said turnover device in proper position, and an inclined plane surface associated with said turnover device, engageable by the said conveyor in advancing when said turnover device has overstepped, for rotating the turnover device in the reverse direction to re-center said turnover device.

10. A turnover device useful in a doughnut frying machine of the moving conveyor type, said turnover device comprising a shaft and a series of blades mounted upon said shaft, said blades extending radially outwards from said shaft, said shaft being mounted for free intermittent rotation in one direction under control of the conveyor in advancing, cam and brake mechanism for intermittently arresting the movement of the turnover device and for centering said turnover device in proper position, and a guard rail attached to the turnover device, said guard rail inclining upwardly in the direction of movement of the conveyor and being engageable by the conveyor in advancing when said turnover device has overstepped, to reverse the direction of rotation of and thus re-center the turnover device.

11. A turnover device useful in a doughnut frying machine of the moving conveyor type, said turnover device comprising a shaft and a series of blades mounted 90 degrees apart upon said shaft, each blade having a shank for attachment to said shaft, a ledge secured across the shank and projecting outwardly therefrom to form a support for doughnuts positioned upon the blade during the operation of turning the doughnuts over incident to frying, and a guard rail inclining upwardly towards and terminating beyond the outer extremity of the ledge, said shaft being adapted to be mounted for free intermittent rotation in one direction under control of the conveyor in advancing, cam and lever mechanism for intermittently arresting the movement of the turnover device and for centering said turnover device in proper position, and said guard rail being operable to engage the moving conveyor when said turnover device has overstepped to reverse the direction of rotation of and thus re-center the turnover device and to space the conveyor away from the ledge to guard said ledge against injury by the conveyor.

12. A doughnut machine comprising a conveyor for moving doughnuts through the machine during the cooking operation, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over while cooking, a weighted member, a cam adapted to rotate with said turnover device under control of said conveyor to lift said weighted member off normal, to accelerate the rotation of said turnover device under control of said weighted member while the latter is returning to normal, and to brake against the weighted member when it reaches normal to arrest the rotation of the turnover device and to center said turnover device in the correct position of rest, and means associated with the turnover device and effective only when the turnover device oversteps to engage the moving conveyor and rotate the turnover device back to the correct position of rest.

13. A doughnut machine comprising a conveyor for moving doughnuts through the machine during the cooking operation, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the

doughnuts over while cooking, a lever, a cam adapted to rotate with said turnover device under control of said conveyor to lift said lever off normal, to accelerate the rotation of said turnover device under control of said lever while the latter is returning to normal, and to brake against the lever when it reaches normal to arrest the rotation of the turnover device and to center said turnover device in the correct position of rest, and means associated with the turnover device and effective only when the turnover device oversteps to engage the moving conveyor and rotate the turnover device back to the correct position of rest.

14. A doughnut machine comprising a conveyor for moving doughnuts through the machine during the cooking operation, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over while cooking, a lever, a weight slidably associated with said lever, a cam, said cam being adapted to rotate with said turnover device under control of said conveyor and to engage and lift said weighted lever off normal, to accelerate the rotation of said turnover device under control of said weighted lever while the latter is returning to normal, and to brake against the weighted lever when it reaches normal to arrest the rotation of the turnover device and to center said turnover device in the correct position of rest, and means associated with the turnover device but effective only when the turnover device oversteps to engage the moving conveyor and rotate the turnover device back to the correct position of rest.

15. A doughnut machine comprising a conveyor for moving doughnuts through the machine while cooking, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over while cooking, a movable weighted member, a cam follower carried by said weighted member, and a cam adapted to rotate with said turnover device under control of said conveyor to control the movement of said cam follower thereby lifting said weighted member from its normal position and to arrest the rotation of the turnover device and center it in the correct position of rest when the weighted member returns to its normal position.

16. A doughnut machine comprising a conveyor for moving doughnuts through the machine while cooking, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over while cooking, a movable weighted member, a cam follower carried by said weighted member, a cam adapted to rotate with said turnover device under control of said conveyor to control the movement of said cam follower thereby lifting said weighted member from its normal position and to arrest the rotation of the turnover device and center it in the correct position of rest when the weighted member returns to its normal position, and means associated with the turnover device and effective only when the turnover device oversteps to engage the moving conveyor and rotate the turnover device back to the correct position of rest.

17. A doughnut machine comprising a conveyor for moving doughnuts through the machine while cooking, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over, a lever, a weight adjustably mounted on said lever, a cam follower carried by said lever, and a cam adapted to rotate with said turnover device under control of said conveyor to control the movement of said cam follower thereby lifting said lever from its normal position and to arrest the rotation of the turnover device and center it in the correct position of rest when the lever returns to its normal position.

18. A doughnut machine comprising a conveyor for moving doughnuts through the machine while cooking, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over, a lever, a weight adjustably mounted on said lever, a cam follower carried by said lever, a cam adapted to rotate with said turnover device under control of said conveyor to control the movement of said cam follower thereby lifting said lever from its normal position and to arrest the rotation of the turnover device and re-center it in correct position of rest when the lever returns to its normal position, and means associated with the turnover device and effective only when the turnover device oversteps to engage the moving conveyor and rotate the turnover device back to the correct position of rest.

19. A doughnut machine comprising a conveyor for moving doughnuts through the machine while cooking, a turnover device intermittently rotated in one direction by the movement of the conveyor for turning the doughnuts over, a cam mounted to rotate in synchronism with said turnover device, said cam having rounded segments alternating with flattened segments, a weighted member engaging with, and intermittently oscillated by the rotation of, said cam, said weighted member normally engaging a flattened segment of the cam to arrest the motion of the cam so as to center the turnover device in the correct position and being moved off normal when engaged by a rounded segment of the rotated cam, said weighted member in returning to normal co-operating with a flattened segment of the cam to accelerate the rotation of the cam and of the turnover device before the motion of the cam is again arrested to center the turnover device in the correct position of rest, and means associated with the turnover device engageable by the conveyor in advancing when the turnover device has overstepped to rotate said turnover device in the reverse direction to re-center said turnover device.

ERNEST J. ROTH.