

June 6, 1939.

W. M. YOUNG ET AL

2,161,267

PRETZEL MACHINE

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Fig. 1.



Fig. 2.

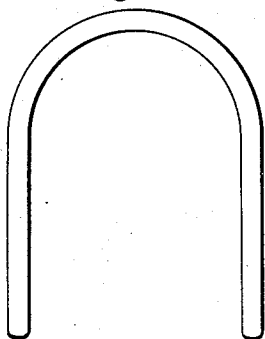


Fig. 3.

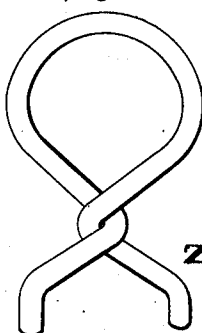


Fig. 4.

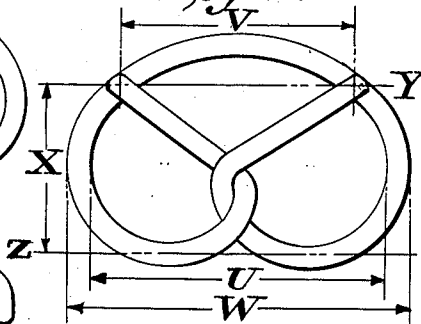


Fig. 5.

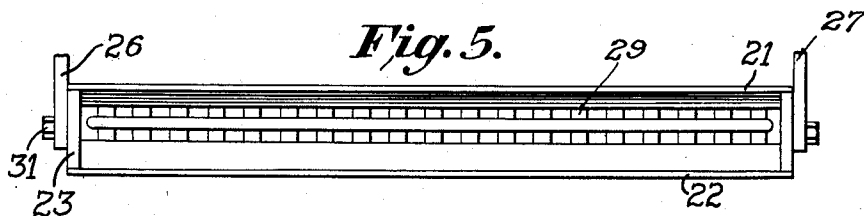


Fig. 6.

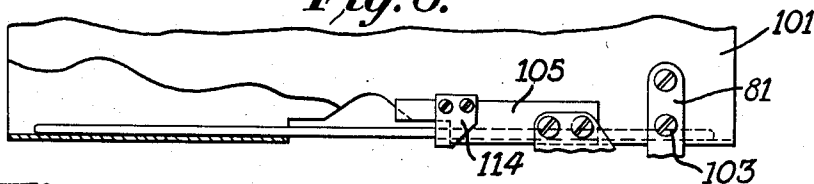


Fig. 7.

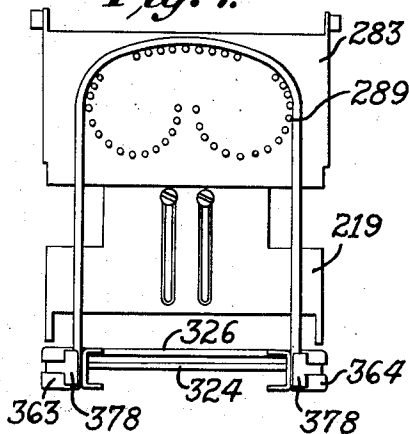
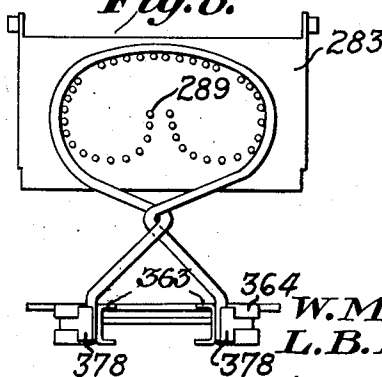


Fig. 8.



Inventors

W.M. Young,
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Attorney

June 6, 1939.

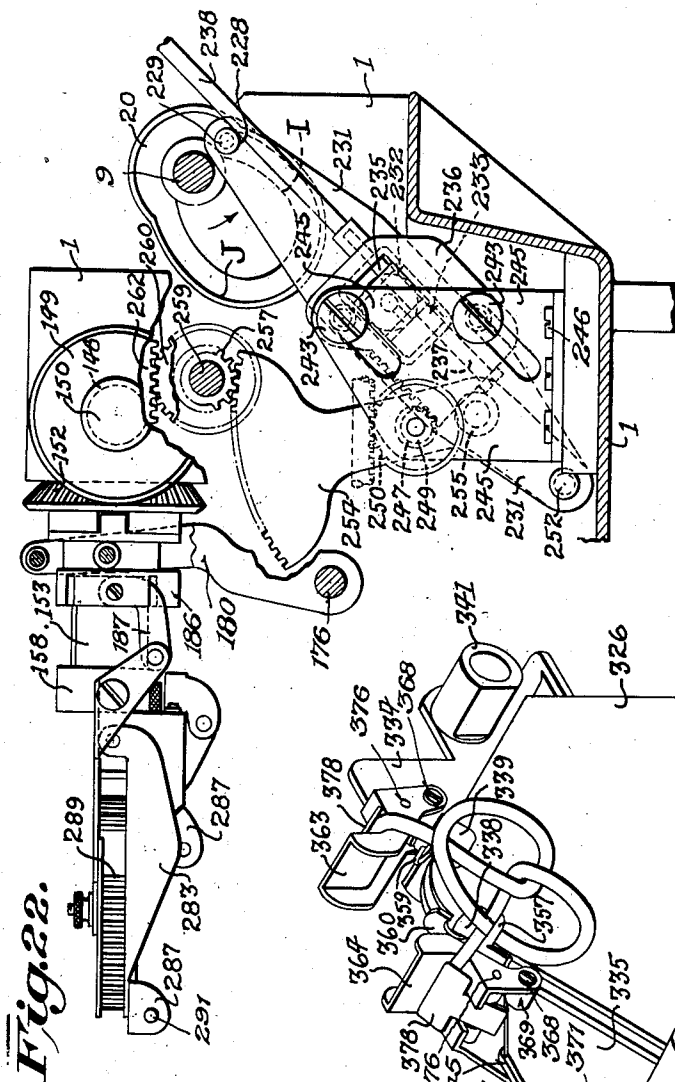
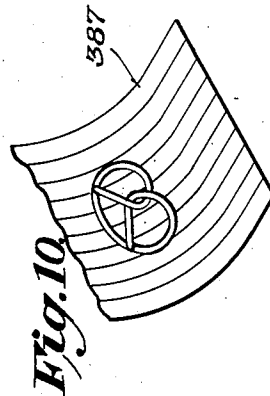
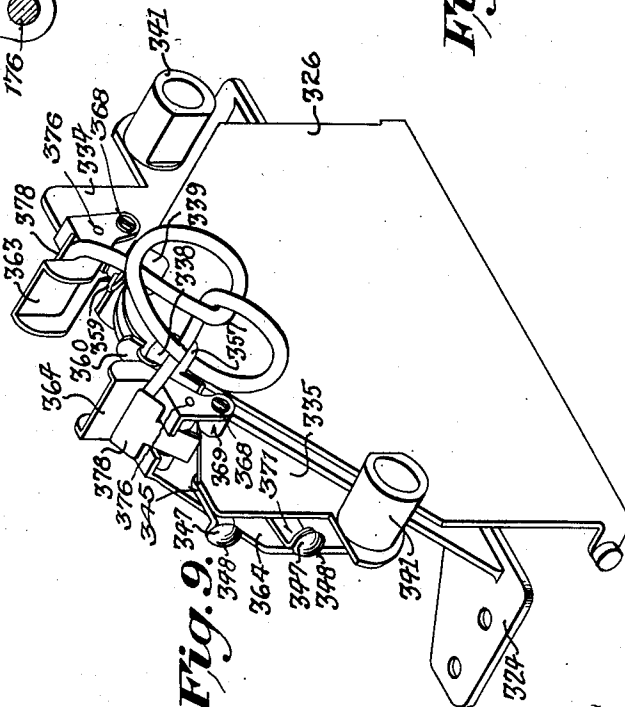
W. M. YOUNG ET AL

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PRETZEL MACHINE

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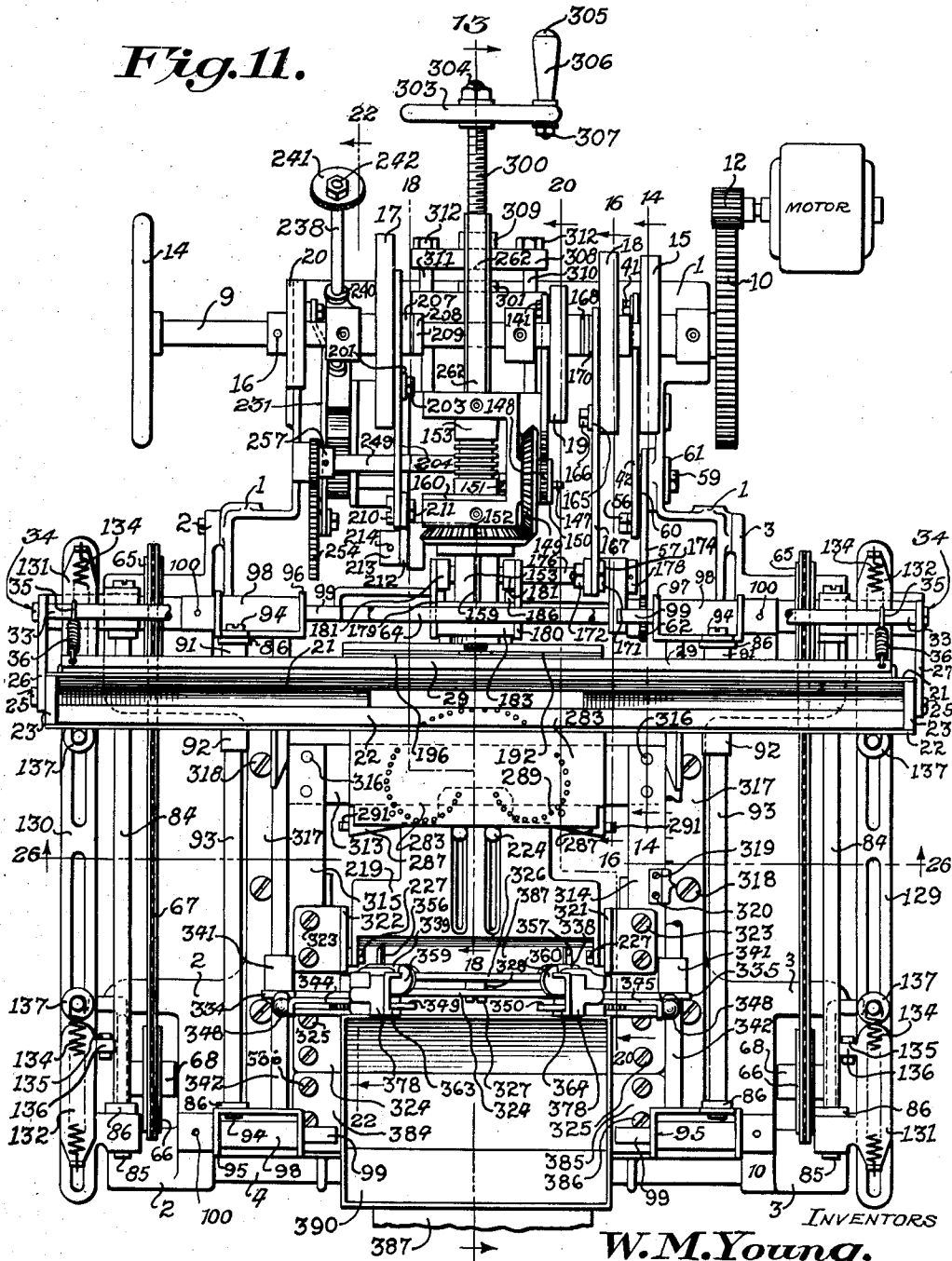
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Fig. 11.



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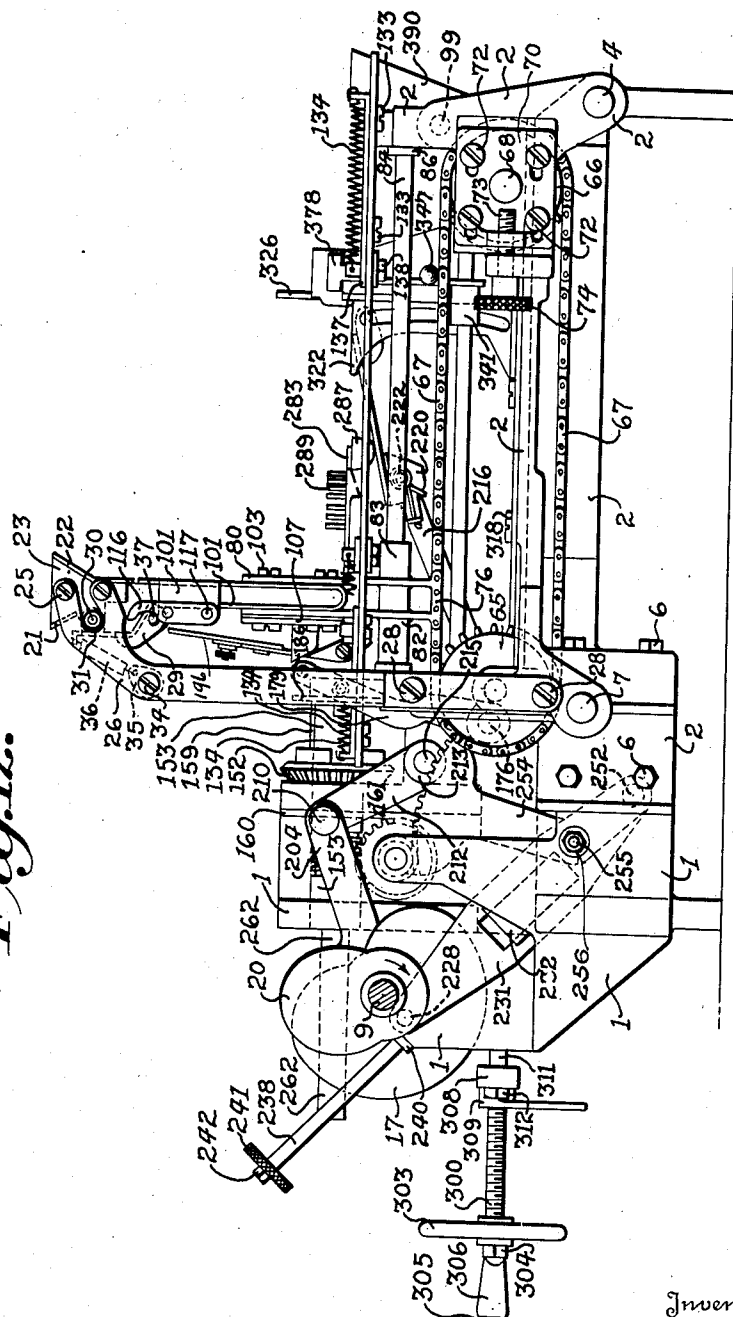
2,161,267

PRETZEL MACHINE

Filed March 24, 1938

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Fig. 12.



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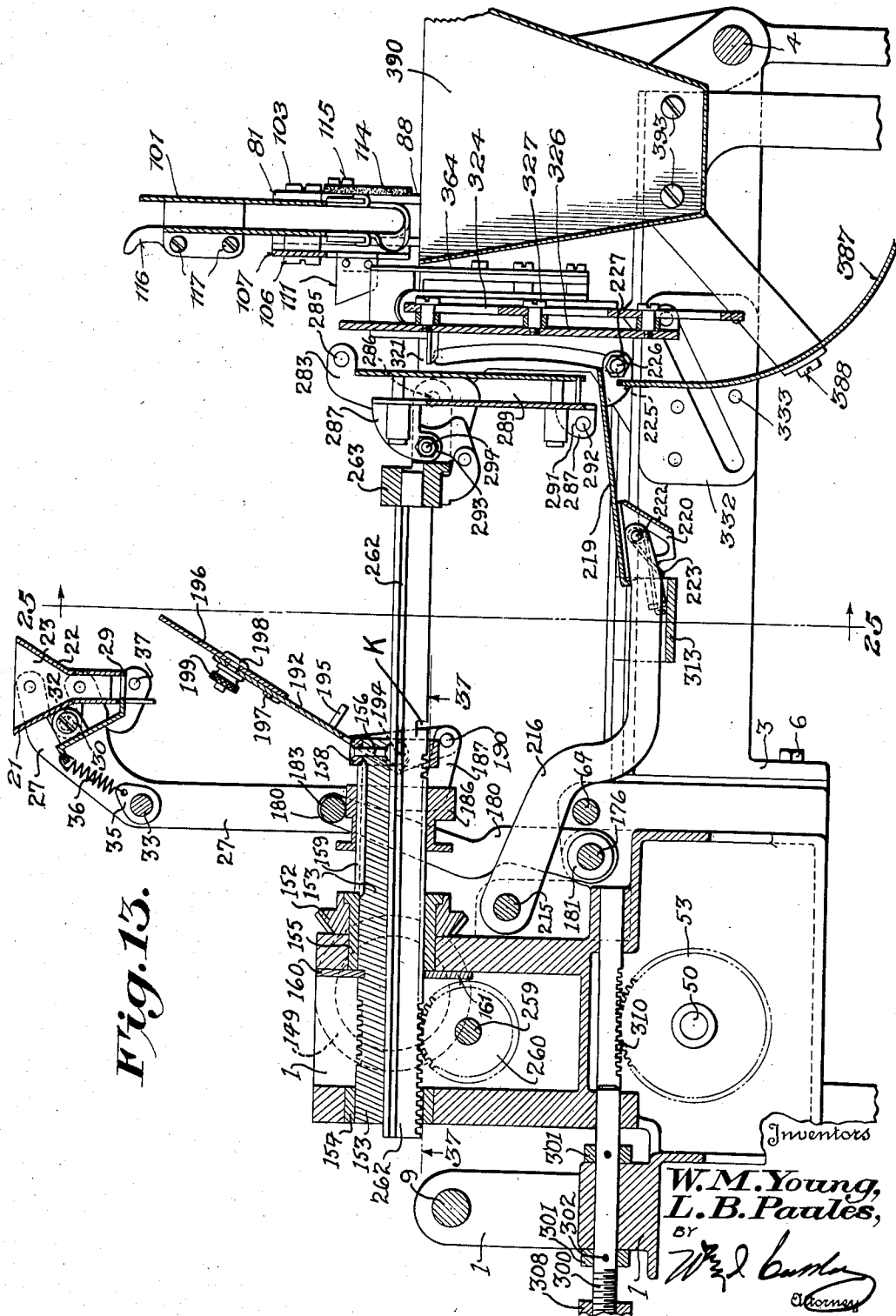
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June 6, 1939.

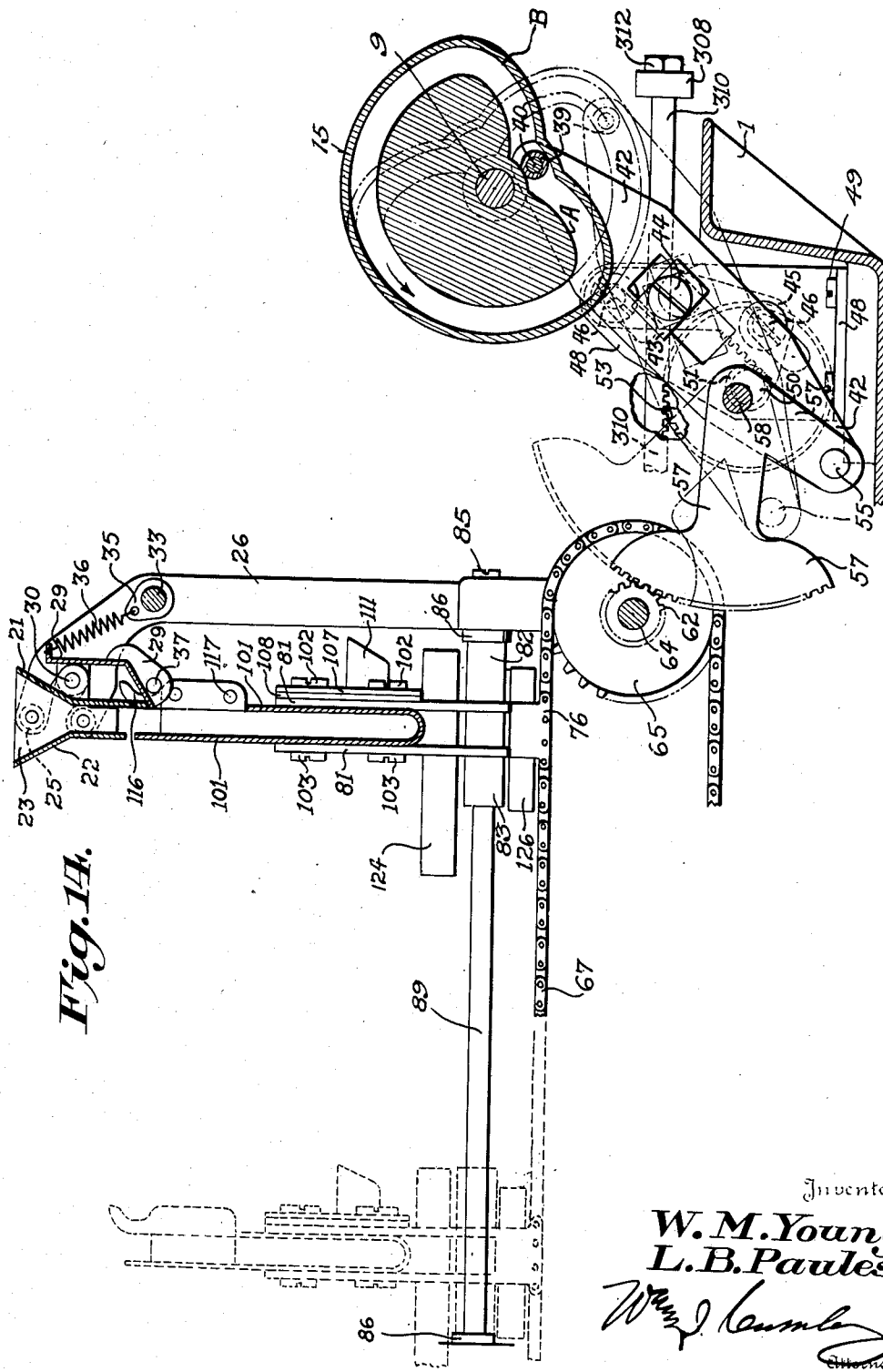
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June 6, 1939.

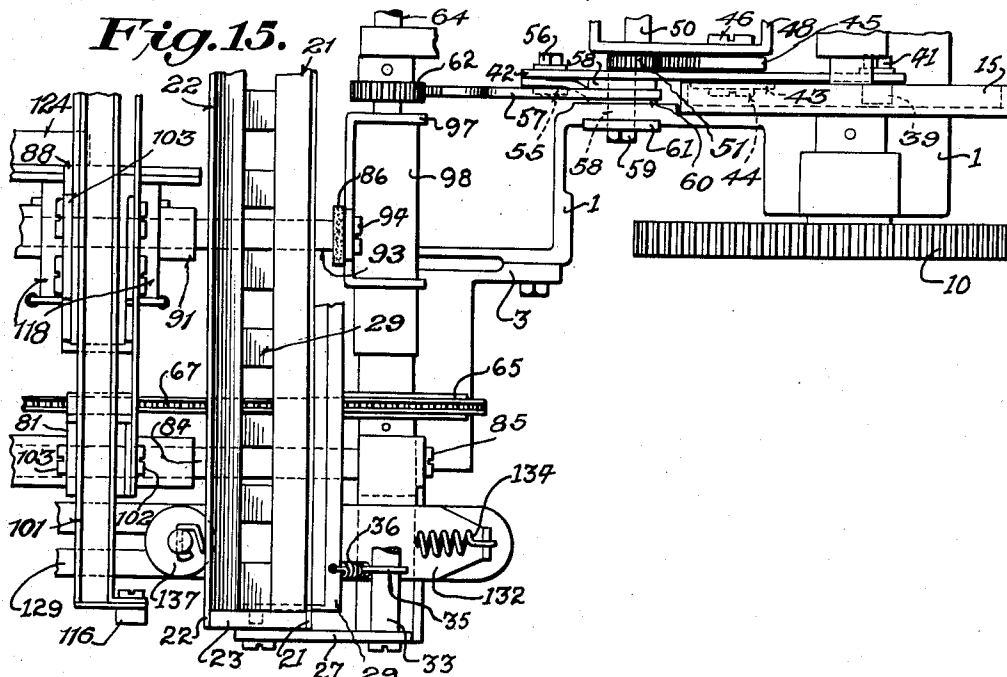
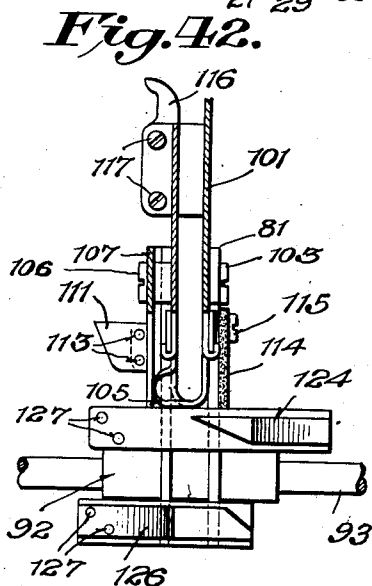
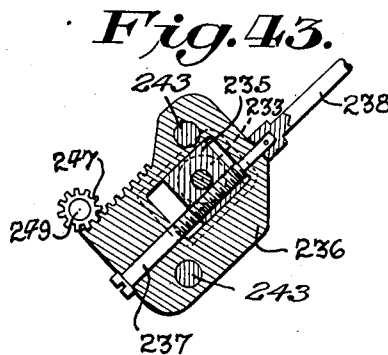
W. M. YOUNG ET AL

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PRETZEL MACHINE

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Inventors
W.M. Young,
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W. M. YOUNG ET AL

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PRETZEL MACHINE

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Fig. 16.

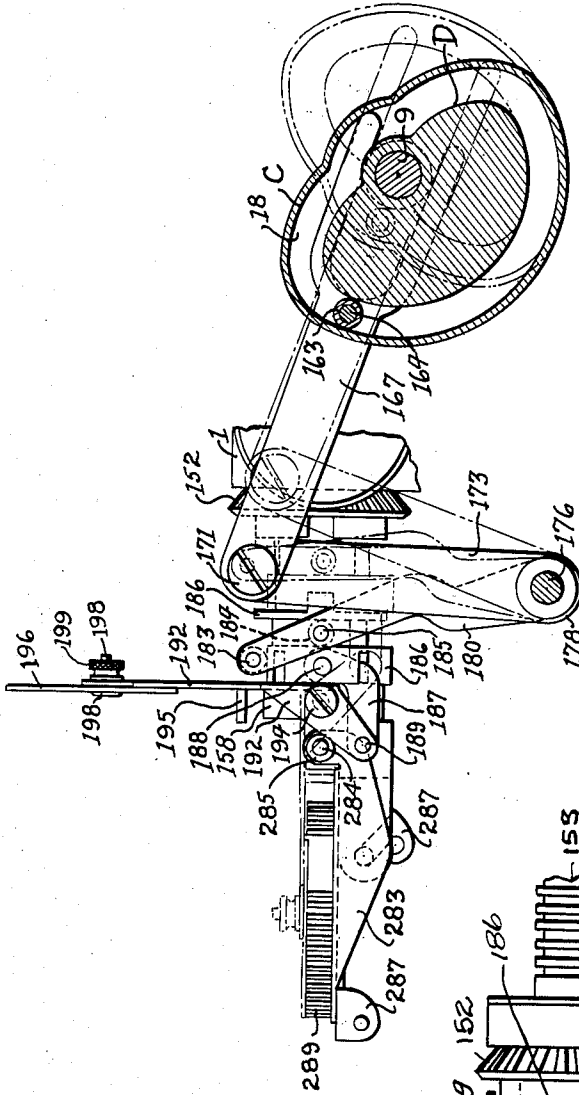
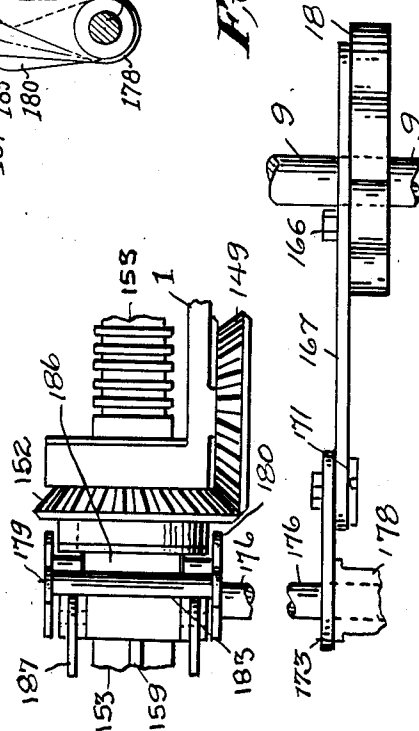


Fig. 17.



Inventors

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PRETZEL MACHINE

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Fig. 18.

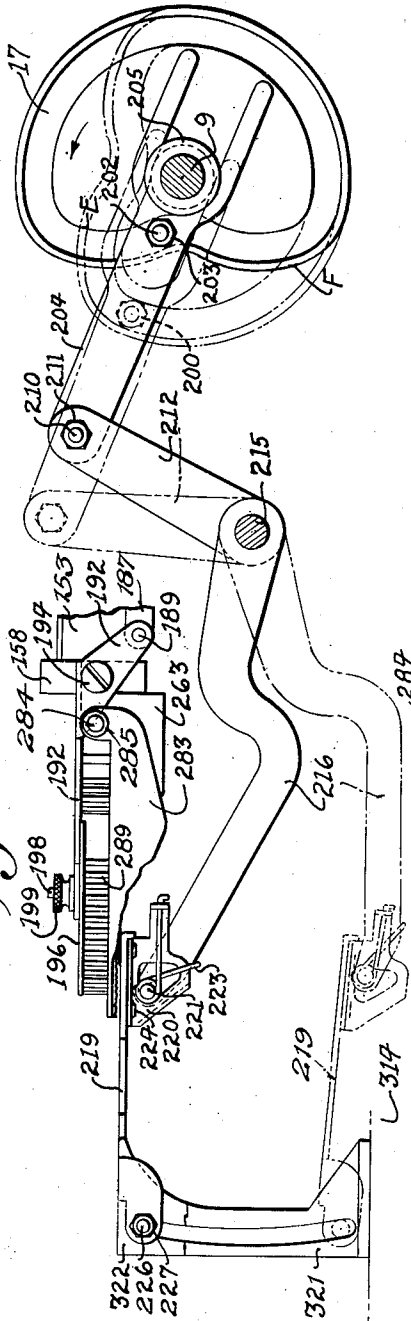
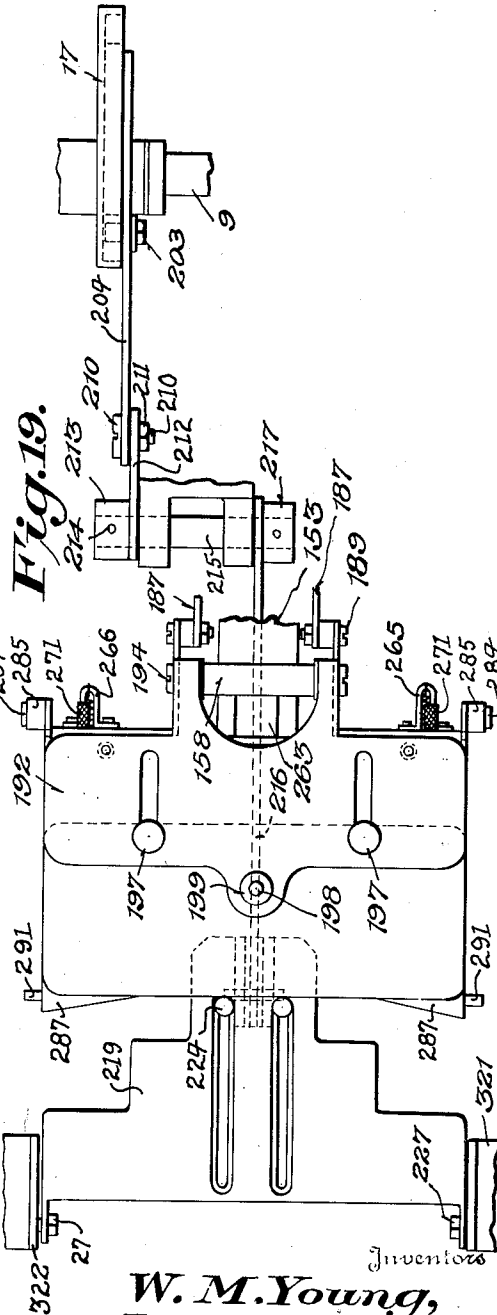


Fig. 19.



Inventors

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W. M. YOUNG ET AL

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PRETZEL MACHINE

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Fig. 20.

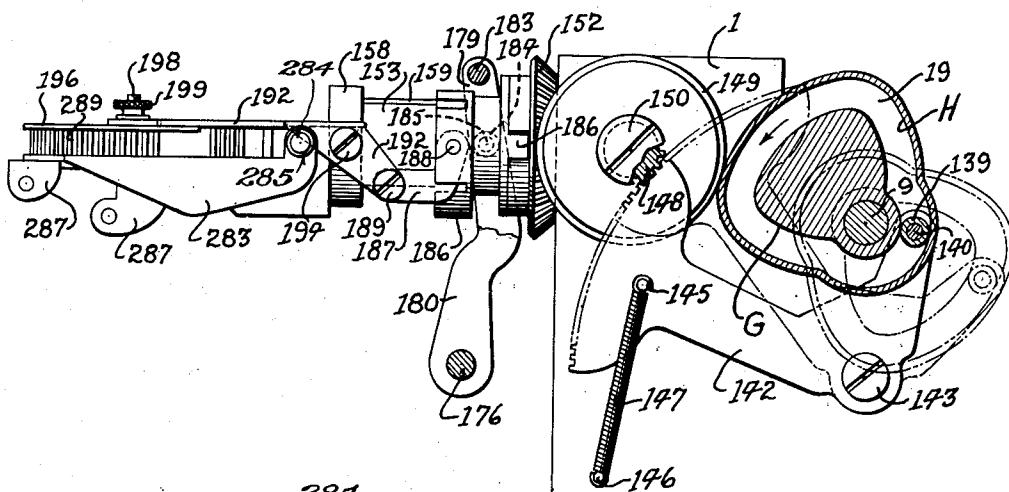
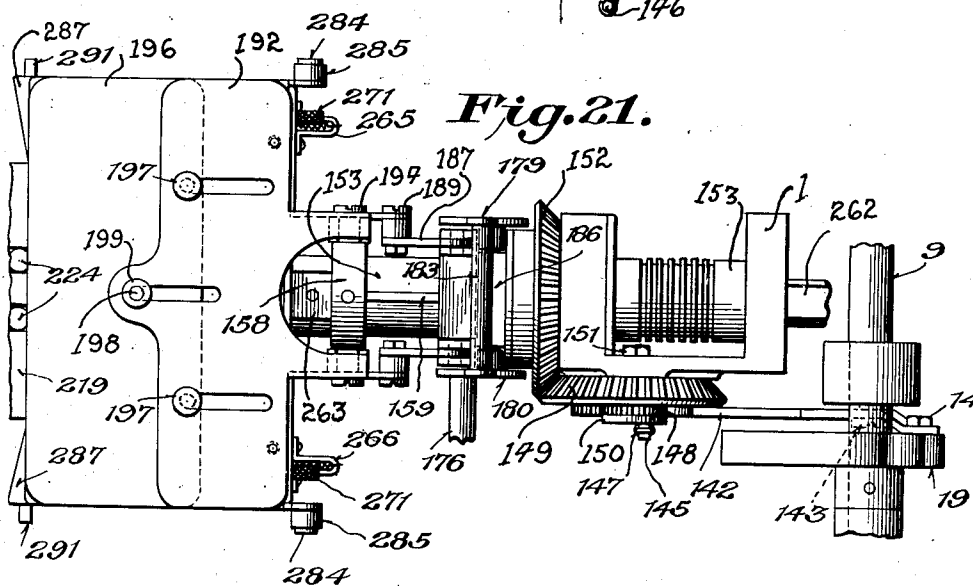


Fig. 21.



Inventors

*W.M.Young,
L.B.Pawles,*

दिनांक २०/११/२०२०

Attorney

June 6, 1939.

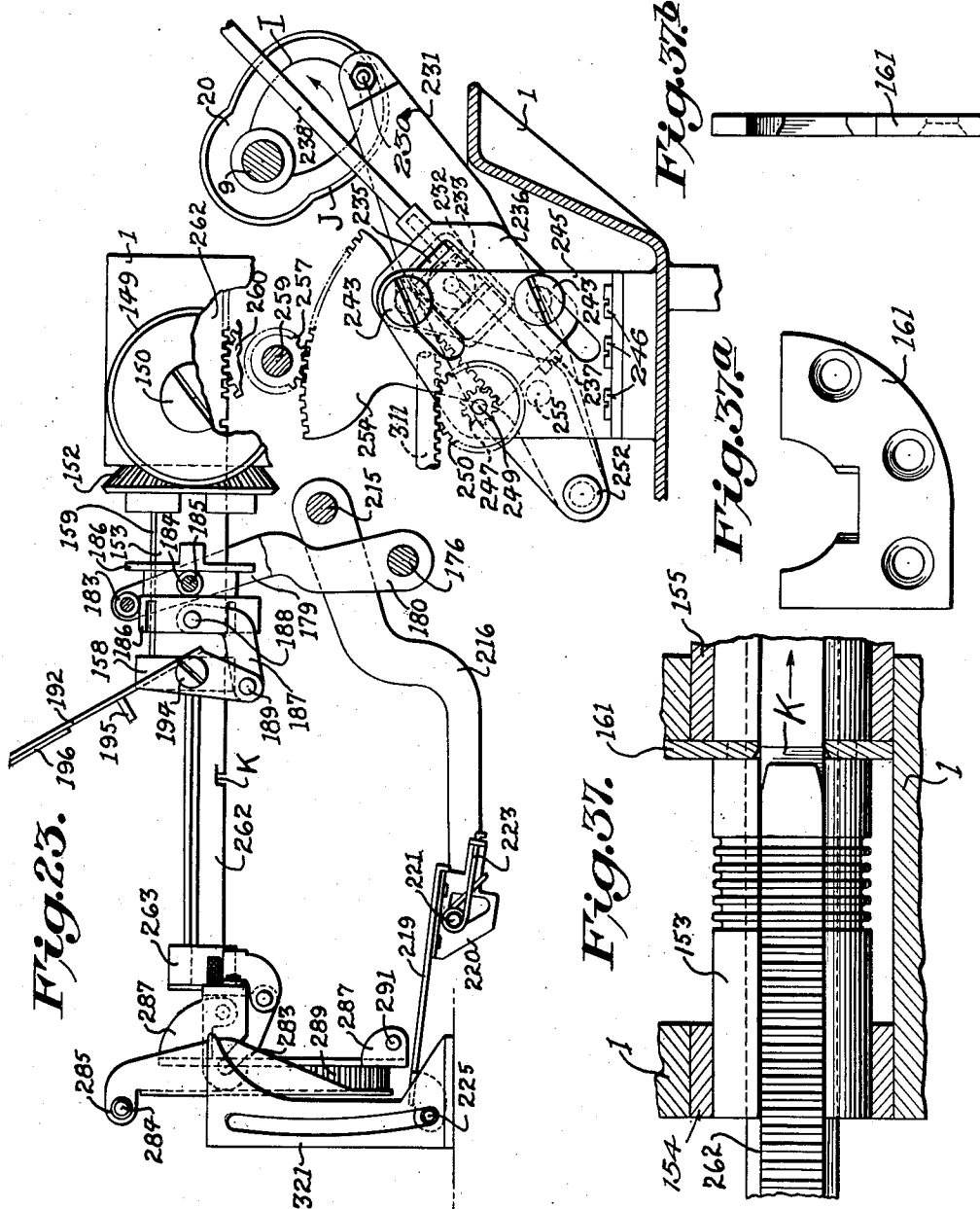
W. M. YOUNG ET AL

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PRETZEL MACHINE

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Inventors
W.M. Young,
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W. M. YOUNG ET AL

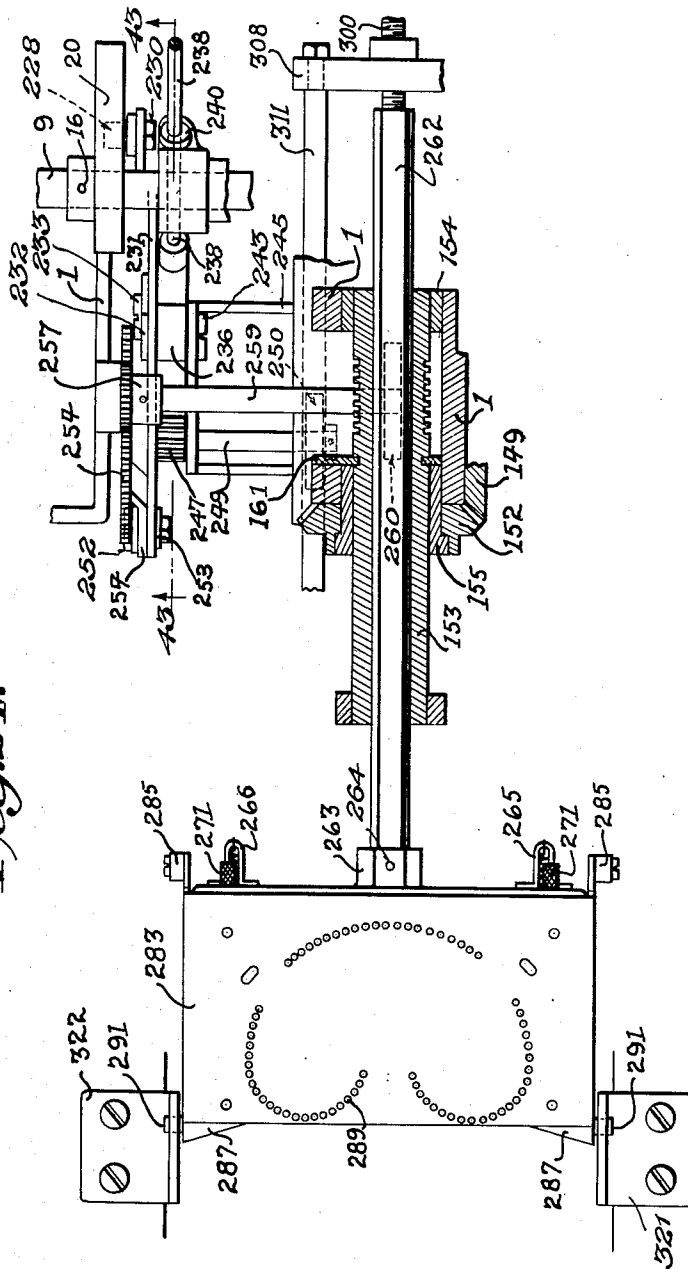
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PRETZEL MACHINE

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22 Sheets-Sheet 12

Fig. 21.



Inventors
W.M. Young,
L.B. Pauls,
By *Wm. I. Kunkley*
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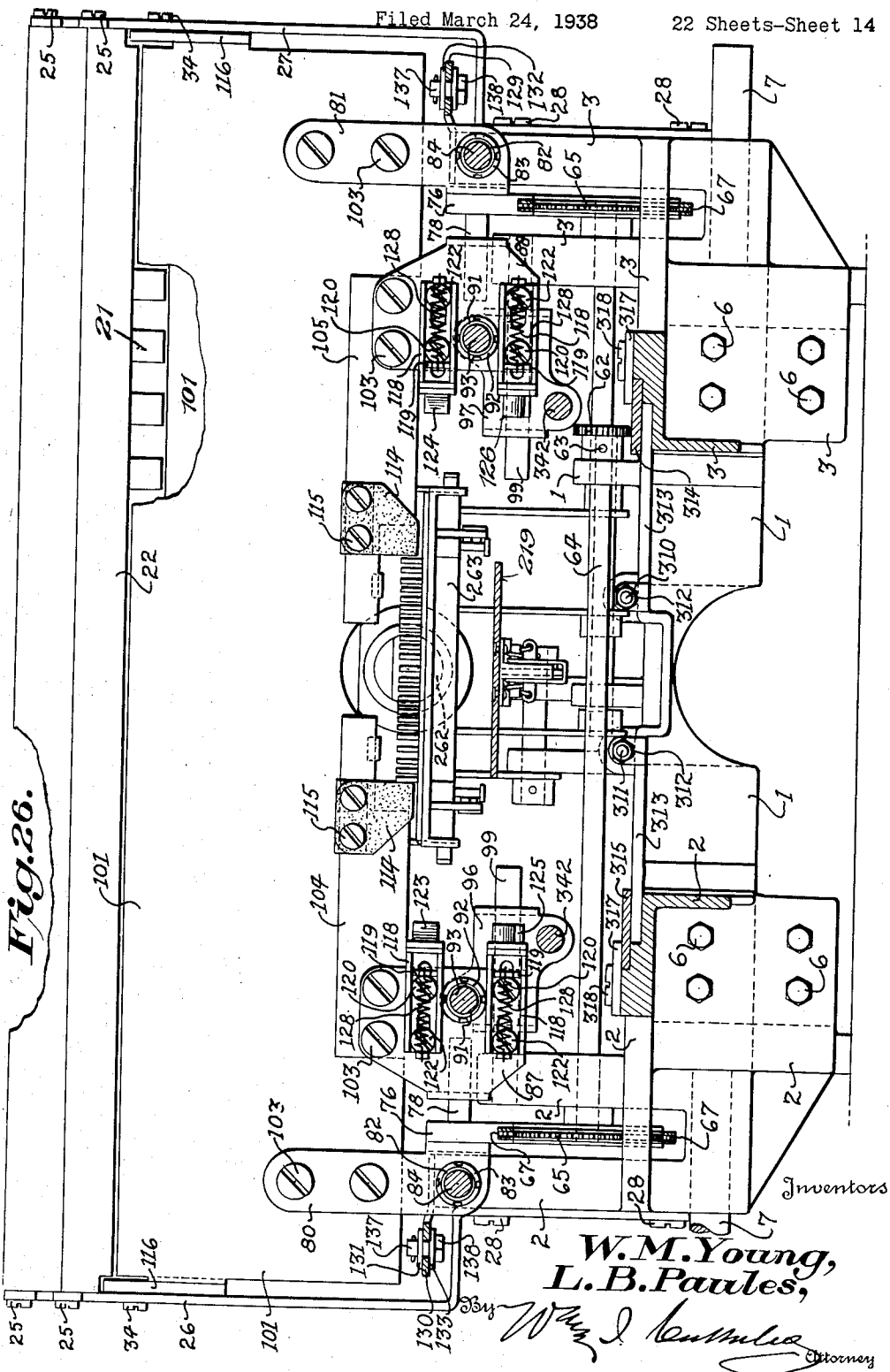
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June 6, 1939.

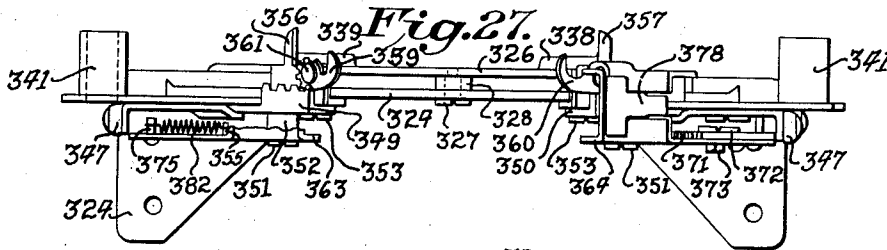
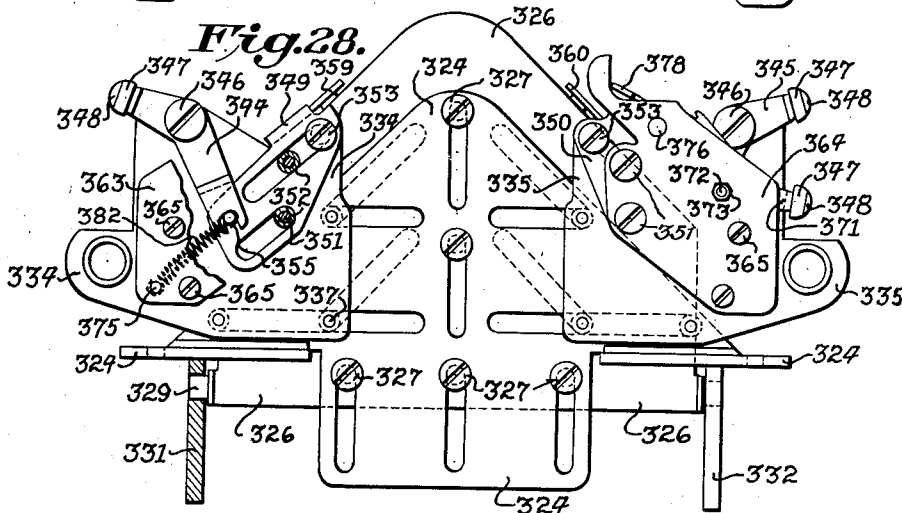
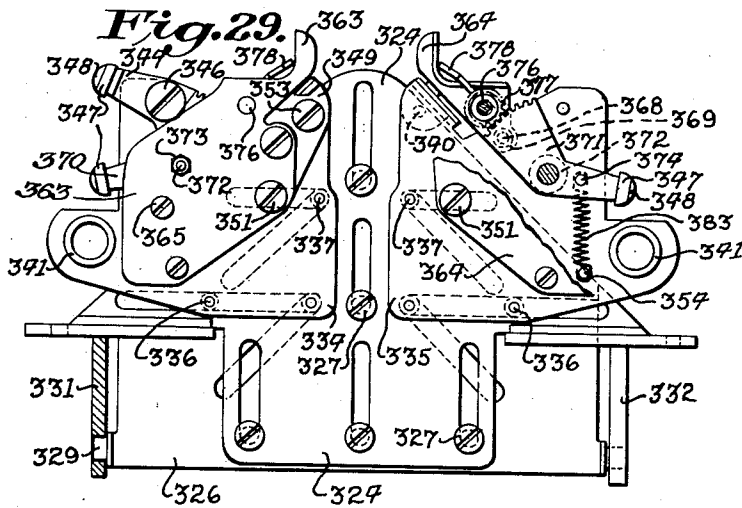
W. M. YOUNG ET AL

2,161,267

PRETZEL MACHINE

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22 Sheets-Sheet 15



Inventors

W. M. Young,
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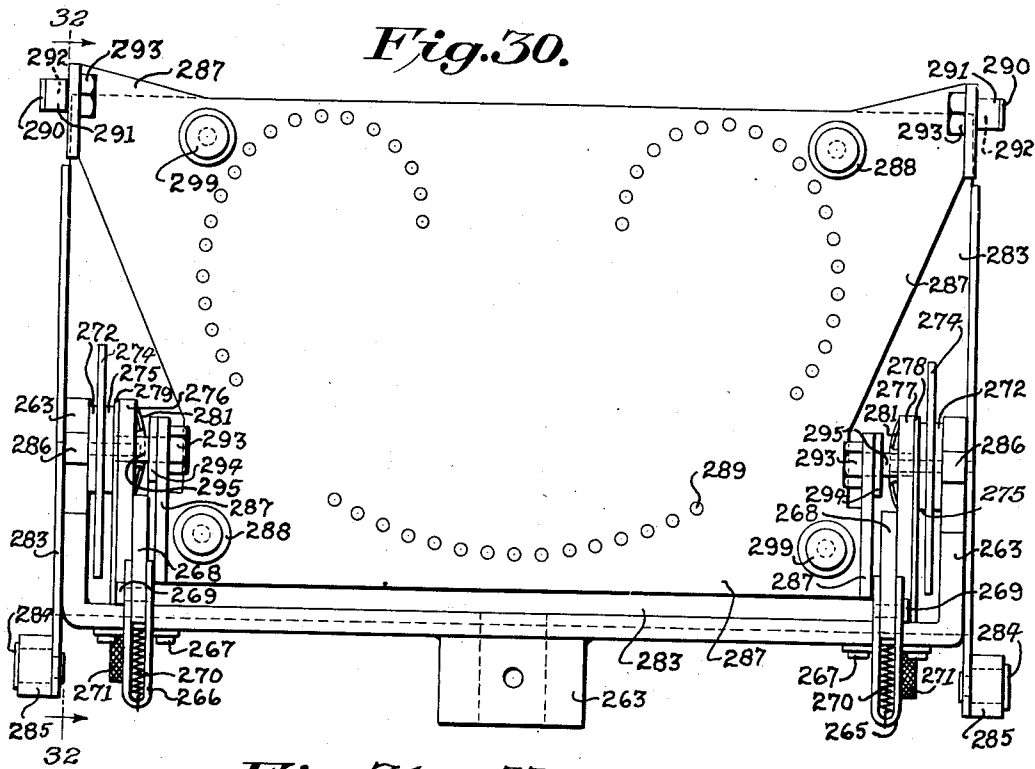
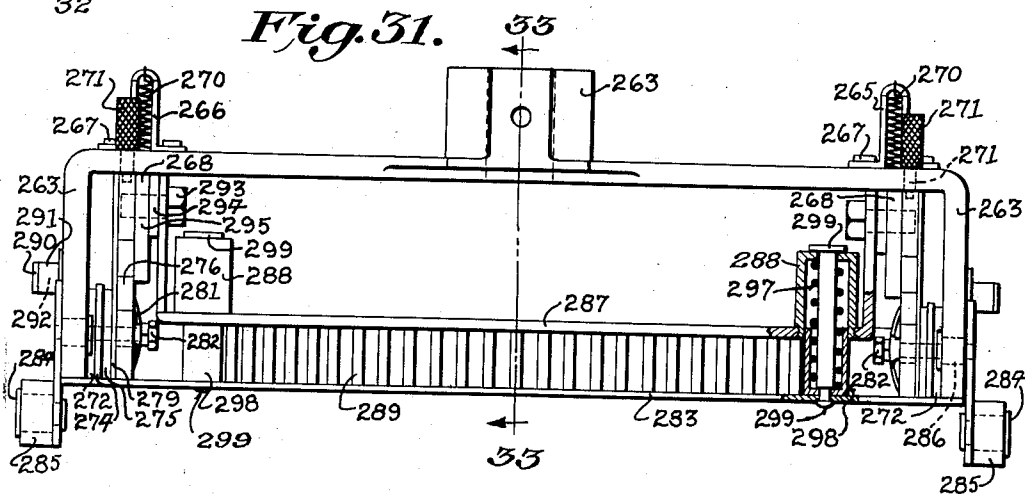
W. M. YOUNG ET AL

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PRETZEL MACHINE

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22 Sheets-Sheet 16



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PRETZEL MACHINE

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Fig. 34a

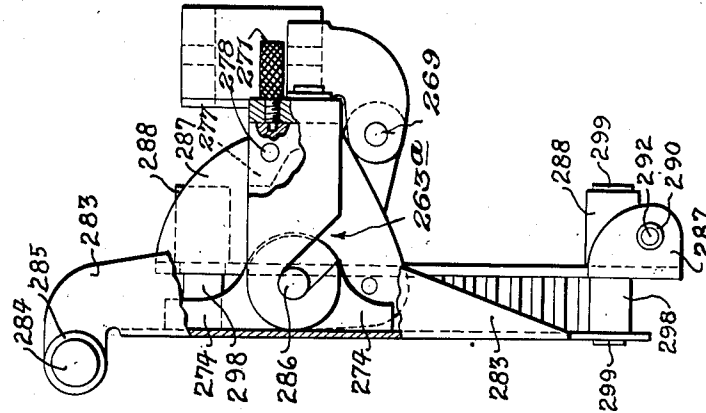


Fig. 32.

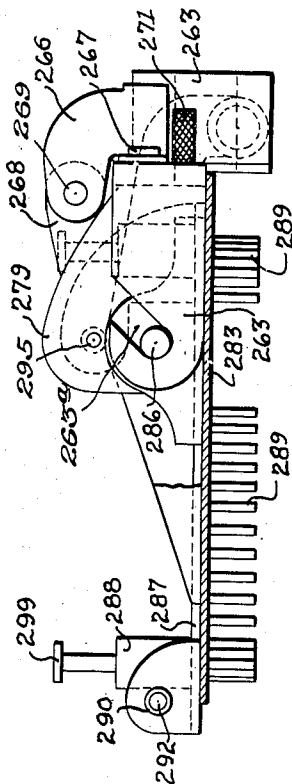
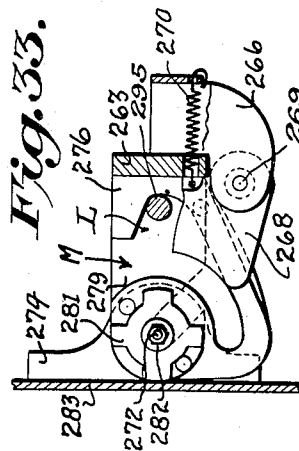


Fig. 33.



Inventors

W. M. Young,
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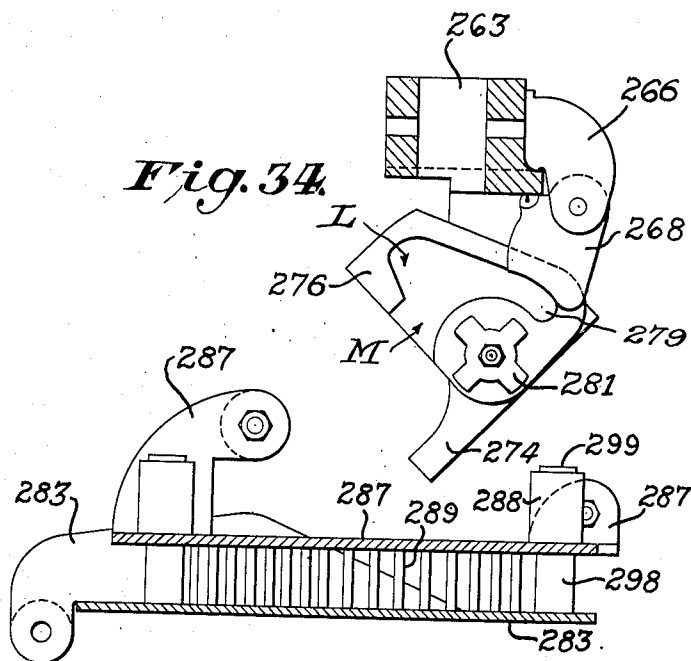
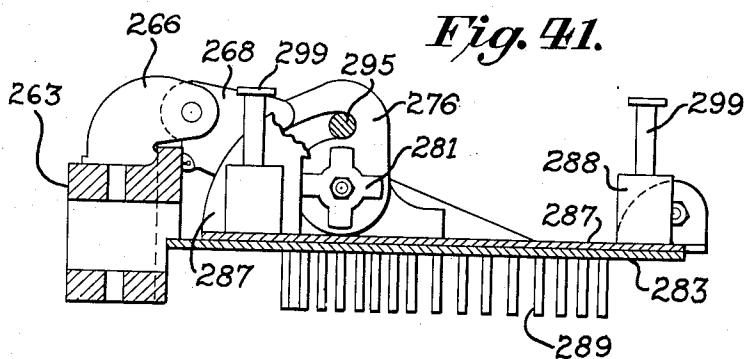
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2,161,267

PRETZEL MACHINE

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22 Sheets-Sheet 18



Inventors

W. M. Young,
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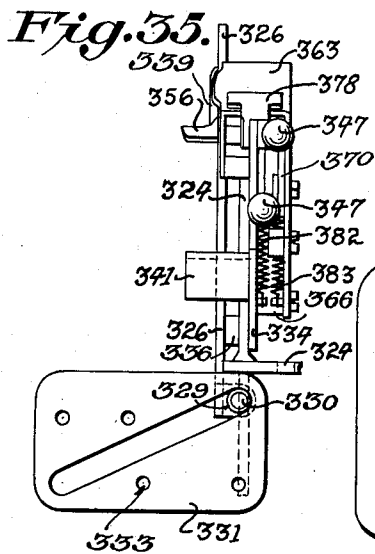
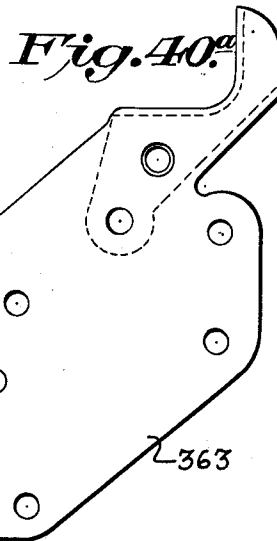
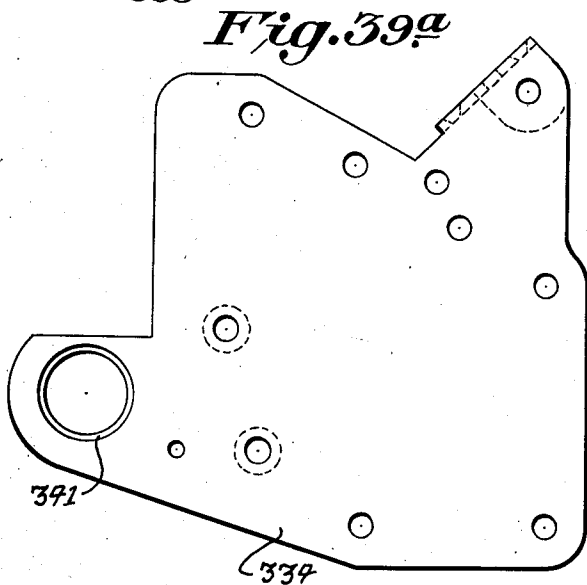
W. M. YOUNG ET AL

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PRETZEL MACHINE

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22 Sheets-Sheet 19



Inventors

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Attorneys

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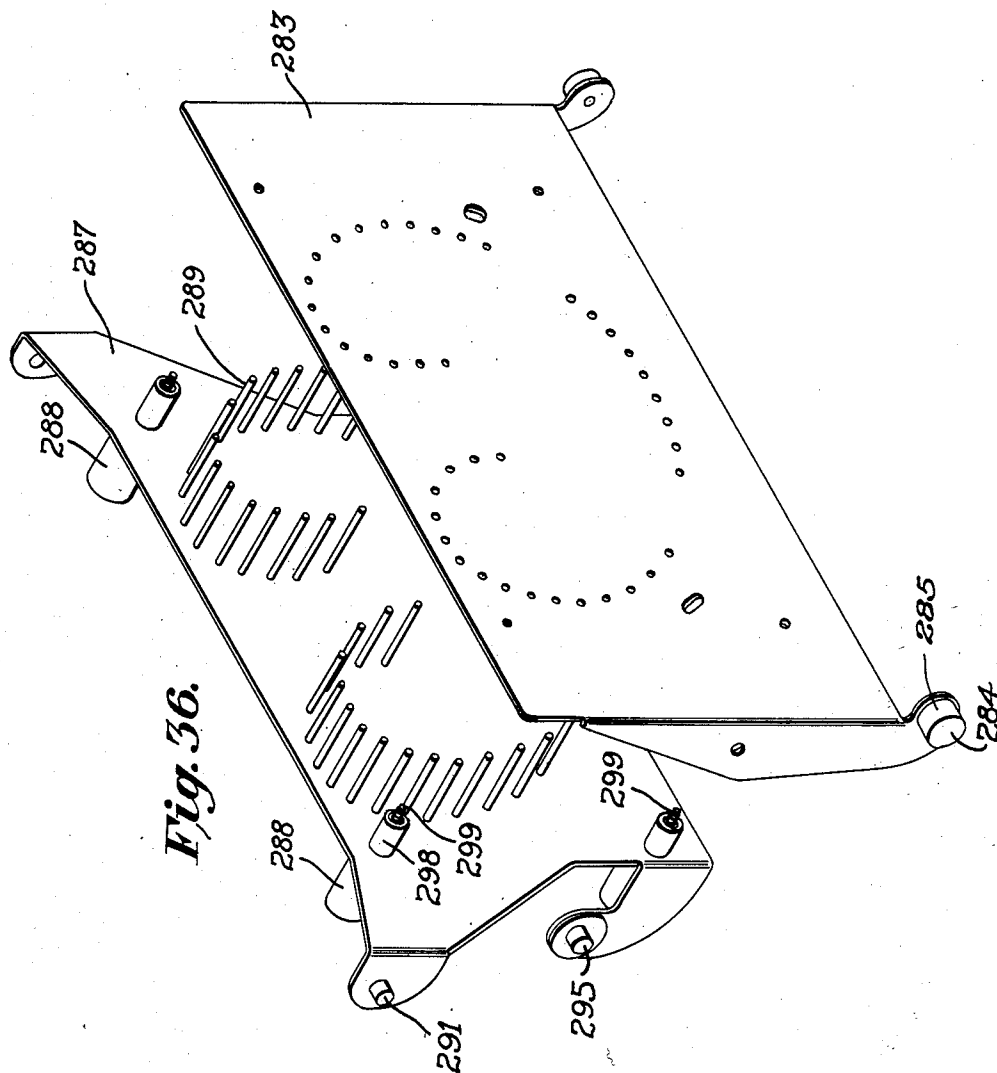
W. M. YOUNG ET AL

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PRETZEL MACHINE

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22 Sheets-Sheet 20



Inventors

W.M. Young,
L.B. Paules,

Wm. J. Young

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W. M. YOUNG ET AL

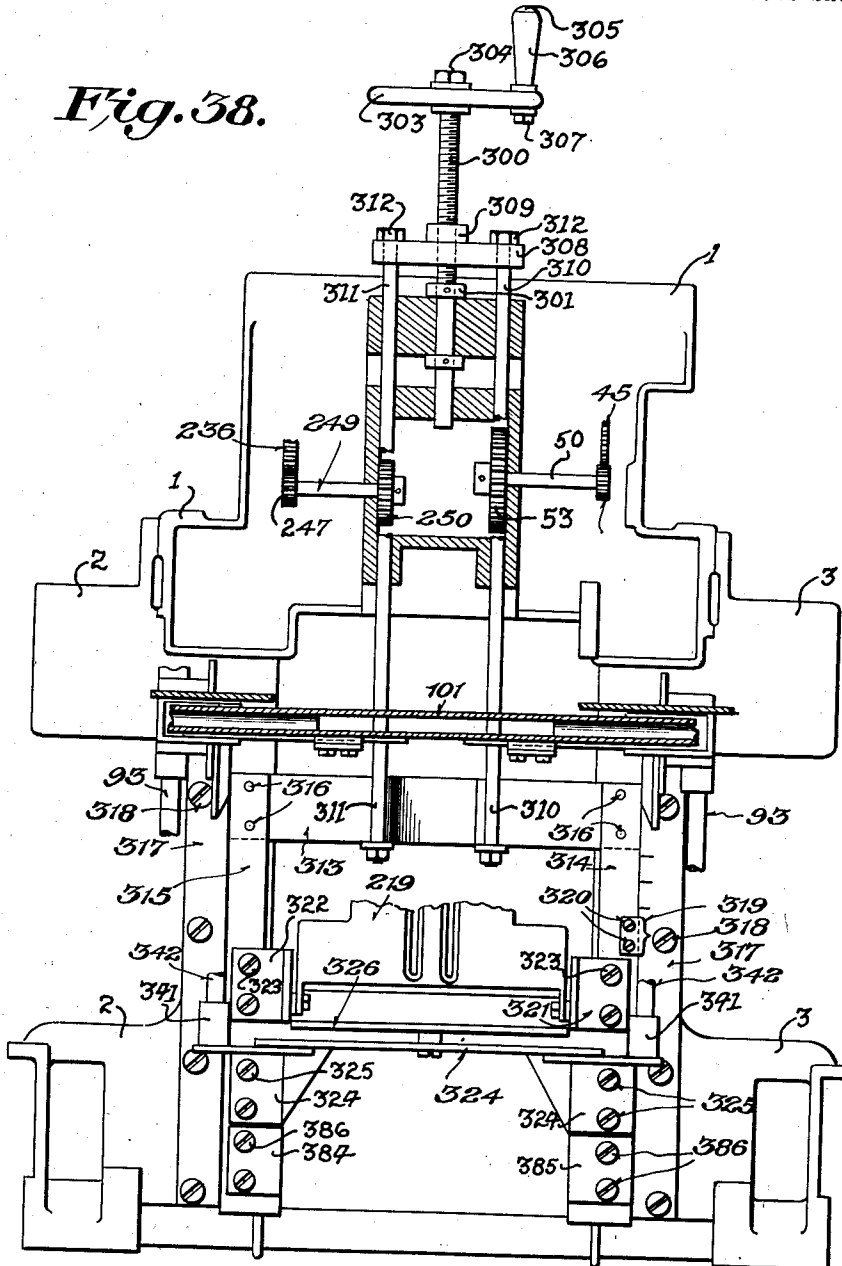
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Fig. 38.



Inventors

*W.M. Young,
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W. M. YOUNG ET AL

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PRETZEL MACHINE

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Fig. 40.

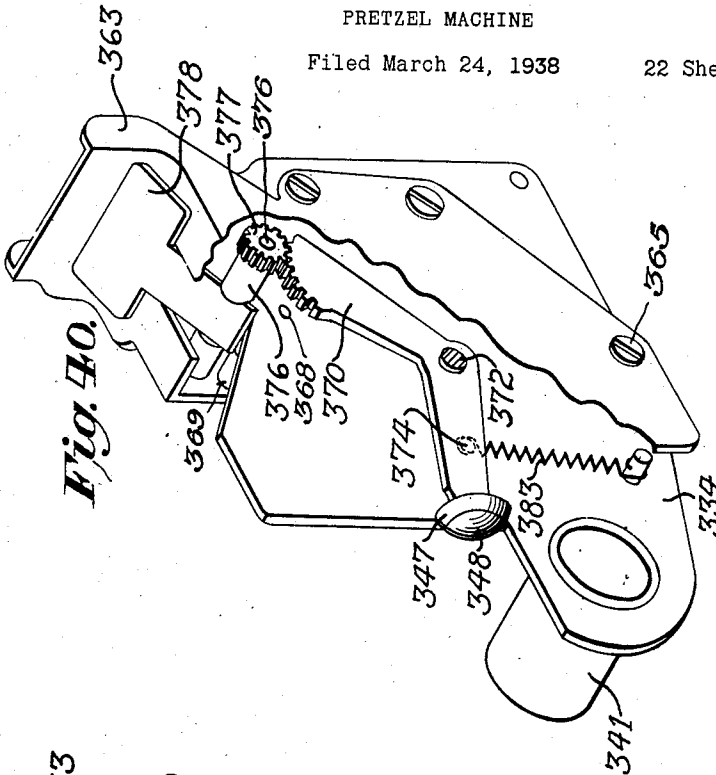
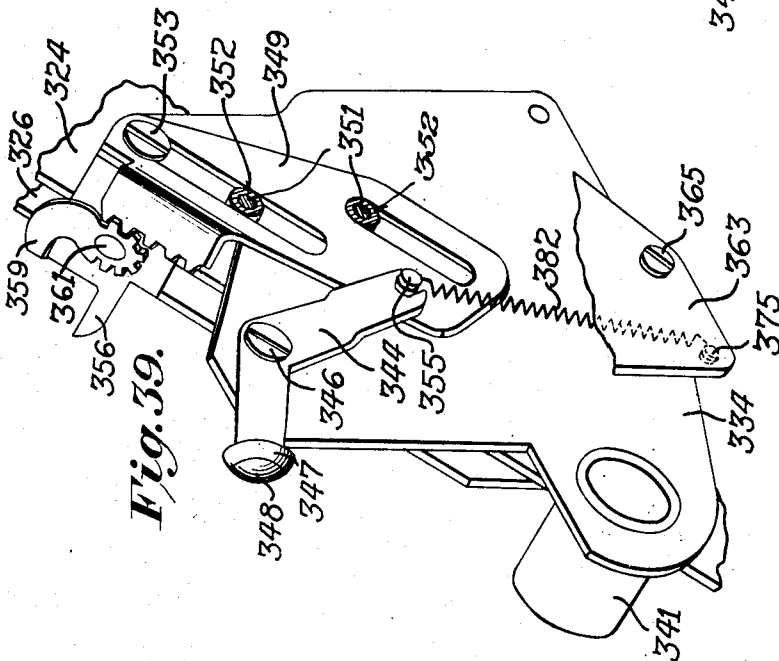


Fig. 39.



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UNITED STATES PATENT OFFICE

2,161,267

PRETZEL MACHINE

William M. Young and Lemon Blair Paules,
Harrisburg, Pa.

Application March 24, 1938, Serial No. 197,954

55 Claims. (Cl. 107—8)

Our invention has reference to improvements in pretzel making machines; particularly, a machine for completely forming, shaping and handling a pretzel which is obtained from a rod or strip of dough, which has been rolled and delivered to our invention by the much used present dough rolling machine, and is an improvement upon the machine described, shown and claimed in our application, Serial No. 42,318, filed September 26, 1935, which issued April 19, 1938, as Patent No. 2,114,951. After our invention has completed the few simple operations necessary in the formation of a pretzel, the finished pretzel is delivered to a conveyor belt, or other suitable means, in preparation for proofing, dipping, salting, and, finally, baking. The intention, with our broad conception, is to do mechanically the operations which are at present accomplished with manual labor.

Pretzel twisting and folding machines, although not entirely new to the industry, have not proven satisfactory under all and varied conditions. The majority of the patented inventions produce one size of pretzels only. Since it is well known that the industry has been built by the manufacture of a variety of sizes, weights and materials of pretzels that are adopted to serve that end, we have, therefore, developed our invention along these lines. Embodied in our conception is a fundamental principle of operation, which applies itself very satisfactorily to all conditions incidental to the making of pretzels in the industry today.

Our principle of completely forming a petzel from a rod of dough is very novel, and simple enough to permit our invention to distinguish itself in the small size of the unit, minimum movements necessary for the complete twisting and the folding of a pretzel, and its flexibility in using the identical unit for all sizes and weights of pretzels made of a variety of materials.

Our invention is so designed as to permit the operation of a single unit, which is greatly welcomed by the smallest pretzel manufacturers, or units may be employed and operated in multiple or battery formation, of any desired number, driven by a single power drive, which would be very acceptable even to the largest pretzel manufacturers.

Aside from the unique principle of making a pretzel, we have also included in our invention, a very practical and simple centralized adjustment, which, when manually moved, is instrumental in a unified adjustment of all movements

which require adjustment when changing from the making of one size pretzel to a different size. The time necessary for this adjustment is negligible, and does not require skilled labor, which in itself is an outstanding feature of our invention.

The pretzel rod rolling machines, which are so universally used at present, have adjustment features which permit changes in the rolling machines necessary for the production of a length and diameter of a rod of dough required for making the various sizes of pretzels. We, therefore, complete with our invention the mechanical means of manufacturing all size of pretzels.

Although we have embodied in our invention a co-ordinated mechanism for twisting, folding and forming a complete pretzel, and a companion mechanism for adjustment purposes, this does not necessarily mean they must be operated together.

One of the many important features of our invention is that the adjustment mechanism can be entirely eliminated from the unit without any effect on the construction, principle and operation of the pretzel twisting, folding and forming mechanism. The result would be the production of a predetermined standardized size of pretzel. This would permit use of a cheaper machine, and would be acceptable to pretzel manufacturers who are only interested in one standard size pretzel of uniform shape.

We are aware of the fact that several pretzel twisting and folding machines have been developed but they appear to be lacking in several important functions, which create peculiarities in the finished pretzel, and are, therefore, not acceptable to the trade. For this reason they are not practically useable.

The principal reason for rolling the rod of dough is to produce a non-porous finish, which gives a smooth finish to the finished product, and, most important, closes the pores of the dough, preventing an over absorption of the dipping solution which is used for browning. It is just as important that the twisting and folding machine does not destroy this finish throughout the conformation of a pretzel. Our invention is conceived with these disadvantageous conditions eliminated.

Another serious fault of the present finished pretzel is the breakage, caused by the seasoning after the baking, and the handling in the packing and the shipping. This is not true if the two ends of the rod of dough adhere at the juncture of the twist or knot and at the points where

the two legs of the rod of dough meet the curved section of the pretzel. Our invention applies a tension to the rod of dough momentarily, when making the twist of the two legs, thereby causing an adhesion at the juncture of the twist. A most important feature of our invention is to provide means of adjusting the pressure required for the adhesion of the two legs of the rod of dough to the curved section of the pretzel. This permits setting the machine by a very simple and independent mechanism for a uniform pressure that is necessary for the size pretzel in question. An uneven pressure is obtained by the human element in the production of the hand made pretzels and is not satisfactory. For a number of years a pretzel, when finished, was placed with the top side down on a board or belt for proofing, dipping, salting and baking. The reason for this was because of the legs coming loose from the curved section of the pretzel, the result being the pretzel was salted on the bottom side while the top received very little. Our invention produces an adhesion at the juncture of the twist and where the two legs attach to the curved section of the pretzel, with such dependence as to permit the proofing, dipping, salting and baking with the top side of the pretzel up.

In the formation of pretzels by hand, there are no two hand twisters who twist pretzels alike, which results in a large assortment of shapes and sizes when finished. The hand twister, also, through carelessness, causes an unevenness in the length of the legs which extend outside of the curved section of the pretzel at the points of attachment. The result of this is breaking off of the ends of the legs in handling, causing a damaged pretzel or the legs extended out is a detriment to packing evenly. Because of these conditions, it has always been necessary that the pretzel manufacturers pack and store the finished pretzels in bulk, which requires very large storage and shipping facilities. In our invention we have provided a form which conforms to the size pretzel the machine is set to make. Its simplicity of design facilitates easy change when it is desired to adjust the machine from one size pretzel to another. This form guarantees uniform shape of the particular size pretzel being manufactured. Our invention, by the use of two mechanical shears, removes the excess lengths of the two legs of the pretzel which extend beyond the outside of the curved section of the finished pretzel. This eliminates any protrusion of the ends of the legs.

Our present pretzel machine is designed to take a rod or strip of dough from a machine now on the market for making such rods or strips and deliver the same to operating parts, arranged in a compact unit, which will bend the rod or strip into substantially a U-shape; then twist the bent body to form a closed loop and angularly arranged leg portions; then place the looped part on the leg portions, clip the ends, and deliver the completed pretzel form to a conveyor for baking in an oven; all these operations being accomplished without crushing, appreciably squeezing, pressing or otherwise affecting the texture of the dough. Furthermore, in taking delivery of rods or strips of dough, our machine is so arranged that delivery from the machine making the rods or strips need not be absolutely timed with commencement of the operation of our machine, resulting in the initial bending operation, and any excess dough, and the like, resulting from the clipping operation, is preserved for further use

so that no scraps are left which would result in waste.

Furthermore, suitable safety means are provided whereby it is impossible for the various parts of our machine to "get out of time" or bind, so that the machine acts with precision and is largely fool proof in its operation. All of the parts of the machine are driven from a common drive element, and all of the cams governing the action of the machine are arranged on a single shaft thereby simplifying the operation of the machine, and all parts are so arranged as to be accessible, replaceable, if necessary, and readily cleaned and kept in first class operating condition.

Our present invention contemplates the use of a dough rod or strip receiving hopper, which receives the rod or strip from a machine producing the same; this hopper is designed to be tripped to deliver a rod or strip into a movable carriage which is aligned beneath the hopper and above a forming member at the beginning of the operation of our machine; the forming device is designed to receive that portion of the dough rod between its ends, and has forming means, so that when the carriage is moved, the dough rod is bent substantially U-shape, without pressing, or otherwise affecting its texture, and a movable table is provided to prevent the legs of the U-shaped rod of dough from sagging improperly. The forming device is arranged to twist to form the loop, the twist in the dough, and the angularly arranged legs, and means are provided to prevent displacement of the dough during this operation, and, again, no pressing, squeezing or other deleterious action is impressed on the dough. The loop is then carried to position upon the legs, and then the ends are clipped so that the completely formed pretzel is dropped, in proper position, upon a conveyor, to an oven for baking. The manner, extent and other detail of action of the parts accomplishing the above results are adjustable from a common source to form pretzels of different sizes, and the forming devices, including the forming means, are replaceable for pretzels of different sizes. The frame of our machine is preferably a one-piece casting so that the parts may be arranged on it with precision, but attention is called to the fact that we do not wish to be limited in this respect. The several operations of our machine are controlled and actuated by cams, aligned and fixed on a common cam shaft associated with the source of power, and the levers and centers thereof, which are associated with the cams to affect operation of the parts, have means of adjustment through a common source, together with means for adjusting the stroke of the movable carriage, and means for adjusting the mechanism carried by the finishing plate, whereby pretzels of different sizes may be formed without appreciably interrupting production. The clutch and associated parts are uniquely formed to accomplish the twisting action of the forming device, while the dough forming device itself is adapted for forward and backward movement to place the loop on the legs of the dough body to form a pretzel. Trip means are provided to evacuate or deliver the hopper, suitable camming means are provided to actuate the end clipping means, and suitable means are provided to wipe the clipped ends into a receiving receptacle so that no scraps are lost. Furthermore, the form means, which includes the retractable form pins, is replaceable for different sizes of pretzels, and

a unique and practical means is provided for accomplishing this result quickly and expeditiously without resort to tools and the like.

Our invention is a unit complete in itself, as a pretzel making machine, which is driven by a common power element. Where more than one unit is in operation, they do not have any direct relation to each other, so far as operation is concerned. They, therefore, can be replaced with a spare unit at any time without affecting the operation of other units. This is especially true where a multiplicity of units is in operation.

Although our invention is here shown in a particular embodiment with respect to size, form, shape, mechanical arrangement and construction of parts, it is to be distinctly understood that changes can and may be made without departing from the spirit of our invention or its broad concept.

As stated, our unit is designed with a fool proof timing of movements. Its operation is continuous and at no time is there a pause in the cycle of operation. This permits a speed equivalent to that which the rod of dough will permit, without tearing, during its conformation into a pretzel. The entire operation is fully automatic, without manual assistance, except when it is desired to change from the production of one size pretzel to the production of another.

Briefly stated, among the objects of our invention may be defined:

1. A method of machine base, or frame assembly, whereby the complete mechanism of a pretzel twisting and folding unit may be operated, transported and manipulated thereon with convenience and utility.

2. A means whereby a common power drive can serve as the exclusive motive power of a pretzel twisting and folding unit.

3. A method of operation, consisting of a single main driving shaft, which, when rotated one revolution, completes a cycle of operation of the component mechanisms producing the conformation of a pretzel, and which are respectively associated with a series of eccentric discs (also known as rotating track cams), which are mounted as integral parts of the main driving shaft.

4. A means for receiving a straight strip or rod of dough from a conventional pretzel dough rolling machine.

5. A means for retaining and supporting each strip or rod of dough in a straight shape, ready for release to the carriage, when it is in position to receive the same.

6. An automatic means for releasing the straight strip or rod of dough from its retained position, when the carriage is in position to receive it.

7. A means for diverting the straight strip or rod of dough downward onto the carriage while still retaining the straight shape during the operation of releasing from its retained position.

8. A means which provides a guide for the straight strip or rod of dough while it is descending into the carriage magazine.

9. A means for receiving and support when the straight strip or rod of dough is on the carriage.

10. A means for producing a reciprocating action to the carriage through a co-operating mechanism, powered by a rotating cam on the main drive shaft, to cause the straight strip or rod of dough to assume its proper position around the form on the form assembly.

11. A means for extrusion of the straight strip

or rod of dough through an opening in the bottom of the carriage magazine.

12. A means for guiding the rod of dough while it is being extruded through the opening of the carriage magazine.

13. A means for the placement and subsequent removal of a table through a co-operating mechanism, powered by a rotating cam on the main drive shaft, to support the legs of the rod of dough as they are extruded through the opening in the bottom of the carriage magazine. This changes the straight strip or rod of dough into a substantial U-shape.

14. A means for guiding the ends of the U-shaped rod of dough into the path of two gripping fingers.

15. A means for moving two fingers, with the reciprocating movement of the carriage in such a manner as to cause gripping of the two ends of the U-shaped rod of dough, retaining the ends during the twisting operation.

16. A locking device for retaining the form assembly in a fixed transverse and level position while the rod of dough is being extruded from the opening in the bottom of the carriage.

17. A form about which the rod of dough is engaged at an approximate central point, whereby it is given a shape which conforms with the curved section of a pretzel, resulting in a corresponding curve in the rod of dough at the time of extrusion from the opening in the bottom of the carriage magazine.

18. A friction brake for preventing tipping of the form assembly on its transverse axis during the extrusion of the rod of dough from the opening in the bottom of the carriage magazine.

19. A means for engaging a clutch, through a co-operating mechanism, powdered by a rotating cam on the main drive shaft, to prepare the twisting mechanism for operation and release of its non-movement safety lock for holding the form assembly in a fixed transverse and level position.

20. A means, in the form of a hinged guard plate, for guarding the curved section of the rod of dough against removal from the form while in the act of twisting the legs of the U-shaped rod of dough.

21. A means, in the form of pins, engaging the top surface of the form assembly for preventing rotation of the form assembly on its transverse axis during the twisting operation.

22. A means for rotating the form assembly and the curved section of the rod of rough for causing a twist of the two long legs of the rod of dough at points about half way between the curved section and the ends being held by the two fingers.

23. A means, including a plate engaged in a slotted rack, for the prevention of any longitudinal movement of the form assembly and curved section of the rod of dough, in the direction of the ends, while twisting, thereby eliminating any looseness in the twist of the two long legs of the rod of dough.

24. A means for inducing a reciprocating movement of the form assembly and the curved section of the rod of dough, in a direction toward the ends of the rod of dough, through a co-operating mechanism powered by a rotating cam on the main drive shaft, thus preparing the rod of dough for the folding operation.

25. A means for tilting the form assembly on its transverse axis to a position at right angle to its normal position, and in so doing to place the

curved section of the rod of dough in register with the two legs, at points close to where they are gripped, the rod of dough making a natural fold, forming a pretzel.

26. A means, including a pair of spaced presser plates on the finishing plate against which a pressure is inserted at the points where the two legs of the pretzel meet with the curved section of the pretzel, to fix the legs on the curved section.

27. A means, including a cam controlled form plate, for extraction of the form from the pretzel.

28. A means for reversal of the cycle of movement of the form assembly on its longitudinal axis, releasing the pretzel from the form assembly.

29. A means for shearing the excess lengths of the legs of dough flush with the outside of the curved section of the pretzel, through reciprocation of the carriage, resulting in a finished pretzel.

30. A means for receiving the finished pretzel right side up as it is released by shearing of the two ends.

31. A means for conveying the finished pretzel from the machine.

32. A means on the carriage for removing from two fingers, on the finishing plate assembly, the excess ends of dough which were sheared from the pretzel when released.

33. A means for receiving the sheared ends of the pretzel which are returned to the rolling machine to be worked over again in the making of pretzels.

34. A means for adjustment of the reciprocating movement of the carriage to that which is necessary for each size pretzel.

35. A means for adjustment of the guiding means at the opening in the bottom of the carriage as needed for each size pretzel.

36. A means for the adjustment of the location of the table for supporting the legs of the U-shaped rod of dough.

37. A means for adjustment of the longitudinal movement of the form assembly to that which is necessary for each size pretzel.

38. A means for adjusting, in a transverse direction, the presser plates which co-operate in exerting the pressure against the legs of the pretzel when they meet with the curved section of the pretzel.

39. A means for adjustment of the gripping fingers to the locations that suit the various sizes of pretzels.

40. A means for adjustment of the shears to the locations that suit the various sizes of pretzels.

41. A means for adjusting the cam elements associated with the shearing mechanism and the gripping fingers mechanism.

42. A means for adjustment of the pretzel finishing plate, the unloading chute and the sheared off pretzel ends receiving bin to positions suitable for the various sizes of pretzels.

43. A means for a centralized master adjustment which controls proportionately each of the adjustments disclosed in the preceding paragraphs 33 to 40, inclusive, to permit proper set-up for each size pretzel.

44. A means for indicating how much adjustment is necessary or at what size the machine should be set to produce a predetermined size of pretzel.

45. A means for adjustment of the guarding means for the form assembly required for each size pretzel.

46. A means, including a supplementary adjustment element for adjustment of the pressure exerted on the pretzel at the points where the legs meet with the curved section.

47. A cushioning means for prevention of shock to the carriage when reciprocating.

48. A means for adjustment of the shock preventing means to suit the varied reciprocating movements of the carriage necessary for the various sizes of pretzels.

49. A means for easy change of the form assembly, when necessary to change from one size pretzel to another.

50. A means, unique in construction, for retaining the form assembly on its axis regardless of position.

It is to be understood in the detailed description annexed hereto, and in applying the principles of constructions of the various parts as shown in the drawings forming a part of this application, that all rights are reserved with regard to making changes in construction, form, arrangement, size, position or relationship of parts, provided such changes fall within the broad concept of our invention, and provided such changes fall within the scope and interpretation of the claims appended hereto, and forming a part of this application.

In the drawings, wherein we have shown one form of our invention, for purposes of illustration,

Figure 1 is a view of a straight strip or rod of dough in the shape received from the rolling machine.

Figure 2 is a top view of a strip or rod of dough after passing through the first forming operation.

Figure 3 is a top view of a strip or rod of dough as it appears after receiving the twisting operation.

Figure 4 is a top view of a completely finished pretzel.

Figure 5 is a top plan view of the hopper, showing the straight strip or rod of dough in a position on the shelf of the hopper, waiting to be released by the carriage reciprocation.

Figure 6 is a view looking from front to rear of the carriage, showing the relative position of the straight strip or rod of dough in the carriage magazine, and ready to be extruded from the carriage magazine opening.

Figure 7 is a top view of that section of the machine which is instrumental in supporting the strip or rod of dough while it is forming, and has gone through the formation of a U shape, as shown in Figure 2.

Figure 8 is a top view of that section of the machine which is responsible for the support of the strip or rod of dough after completion of the twisting operation, and prior to the start of the folding operation.

Figure 9 is a perspective showing the shape and the relative position of the pretzel after completion of the fold operation, and prior to its being released from the machine by shearing of the two ends.

Figure 10 is a perspective showing the completely finished pretzel on a chute, leaving the front of the machine.

Figure 11 is a top plan view of our machine, assembled with some parts omitted, to clarify the construction of the parts shown.

(For a clearer knowledge of the location of the various parts of our machine, we might be guided by the following:

As you read Figure 11, that part of the machine nearest you, is to be understood as the front of the machine, and the opposite side, which discloses the hand wheel, is to be understood as the rear of the machine. The left side of the figure is to be understood as the left side of the machine, and the right side of the figure is to be understood as the right side of the machine).

Figure 12 is a view in elevation of the left side of the machine, with some parts omitted to clarify the construction of the parts shown.

Figure 13 is a sectional view of a vertical plan, longitudinal through the machine, upon a substantially median line, 13—13 of Figure 11. Some parts are omitted to clarify the construction of the parts shown.

Figure 14 is a diagrammatic sectional view of a right side elevation on line 14—14 of Figure 11 of that section of the mechanism which comprehends the carriage movement when the carriage is located at its extreme rear position. Also on the figure is shown a skeleton view of this same movement, with the carriage in its extreme front position.

Figure 15 is a diagrammatic view of a top plan of the carriage movement, with the carriage moved substantially one-half its front to rear movement. Some parts are omitted to avoid part duplication and to clarify the construction of the parts shown.

Figure 16 is a diagrammatic sectional view of a right side elevation on line 16—16 of Figure 11 of that section of the mechanism which comprehends the twisting clutch movement, when the clutch is disengaged. Also on this figure is shown a skeleton view of this same movement with the twisting clutch engaged.

Figure 17 is a diagrammatic view of a top plan of the twisting clutch movement with the twisting clutch engaged.

Figure 18 is a diagrammatic sectional view of a right side elevation on line 18—18 of Figure 11 of that section of the mechanism, which comprehends the legs support movement when the legs support table is in the position of supporting. Also on this figure is shown a skeleton view of this same movement when the legs support table is in the non-supporting position.

Figure 19 is a diagrammatic view of a top plan of the legs support movement with the legs support table in a supporting position.

Figure 20 is a diagrammatic sectional view of a right side elevation on line 20—20 of Figure 11 of that section of the mechanism which comprehends the twisting movement, when the movement is in its neutral position. Also on this figure is shown a skeleton view of this same movement when it is at the extreme of the twisting operation.

Figure 21 is a diagrammatic view of a top plan of the twisting movement when the movement is in its normal or non-operating position.

Figure 22 is a diagrammatic sectional view of a right side elevation on line 22—22 of Figure 11 of that section of the mechanism which comprehends the folding movement, when the movement is in its neutral position.

Figure 23 is a diagrammatic sectional view of a right side elevation of that section of the mechanism shown in Figure 22, when the movement is at the extreme of the folding operation.

Figure 24 is a diagrammatic sectional view of a top plan of the folding movement, when the movement has moved the form assembly sub-

stantially one-half its rear to front movement.

Figure 25 is a transverse sectional view taken on line 25—25 of Figure 13.

Figure 26 is a transverse sectional view taken on line 26—26 of Figure 11.

Figure 27 is a top plan view of that section of the mechanism which is responsible for the gripping and the shearing of the ends of dough with their operative adjustment facilities all assembled in conjunction with the pretzel finishing plate.

Figure 28 is a view in front end elevation of that section described in Figure 27. This is shown adjusted to facilitate making a large pretzel. Some parts are omitted to clarify the construction of the parts shown.

Figure 29 is a view, in duplicate, of Figure 28, except it shows the mechanism adjusted to facilitate making a small pretzel.

Figure 30 is a bottom plan view of the form assembly and its mounting bracket.

Figure 31 is a plan view of the top of the form assembly mounting bracket, with the form assembly in a position, after folding of the rod of dough, and after the form has been withdrawn from the completely formed pretzel.

Figure 32 is a sectional view in right side elevation on line 32—32 of Figure 30 of that section of the mechanism known as the form assembly and mounting bracket.

Figure 33 is a sectional view of a vertical plan, longitudinal through Figure 31, upon a substantially median line 33—33.

Figure 34 is a sectional view of a vertical plan, longitudinal, through the form assembly mounting bracket, with the form assembly in the position of being removed, the view being on a substantially median line.

Figure 34A is a plan view of a side elevation of the form assembly mounting bracket with the form assembly in a position, after folding of the rod of dough, and after the form has been withdrawn from the completely formed pretzel.

Figure 35 is a view in left side elevation of that section of the mechanism shown in Figure 27.

Figure 36 is a perspective illustration bringing out in detail the various parts of the form assembly. This view is of the exploded type, showing the parts removed from one another, but in their relative positions.

Figure 37 is an enlarged sectional view of a bottom plan on line 37—37 of Figure 13, of the twisting shaft, the folding slide rack and the two thrust plates, which are all closely related in the proper timing of their movements.

Figure 37A is a plan view, in detail, of a rear side elevation of the lower thrust plate, which is responsible for accurate timing of the folding rack and twisting shaft.

Figure 37B is a top plan view, in detail, of the part disclosed in Figure 37A.

Figure 38 is a diagrammatic sectional view of a top plan showing the centralized master adjustment parts, with all of its related smaller adjustments which it controls.

Figure 39 is an enlarged view, in detailed perspective, of that section of the mechanism which comprehends the shears and their operating parts.

Figure 39A is a front side plan view, in detail, of the bracket responsible for support of the finger movement parts as disclosed in Figure 39.

Figure 39B is a right side plan view, in detail, of the part disclosed in Figure 39A.

Figure 40 is an enlarged view, in detailed per-

spective, of that section of the mechanism which comprehends the dough ends gripping fingers and their operating parts.

Figure 40A is a front side plan view, in detail, of the bracket responsible for support of the shear movement parts as disclosed in Figure 40.

Figure 40B is a right side plan view, in detail, of the part disclosed in Figure 40A.

Figure 41 is a sectional view of a vertical plan, longitudinal, on a substantially median line, through the form assembly and mounting bracket, with the form assembly in an upside down level position, showing the mechanism which controls the form plate.

Figure 42 is a sectional view of a vertical plan, longitudinal, on a substantially median line, through the carriage, to show more clearly the gripping fingers and shears movements operating cams.

Figure 43 is a longitudinal sectional view taken on line 43-43 of Figure 24. This shows the dough pressure hand adjustment mechanism.

Throughout the several views of the drawings similar reference characters are used to designate like or similar parts, and to impart an understanding of our invention to one skilled in the art; the following is descriptive of the construction of our invention throughout its complete operation, like marks of reference corresponding to the marks on the accompanying drawings:

In the drawings of our invention we disclose an assembled base and the attached hopper assembly for receiving the strip or rod of dough; a carriage movement and its operating parts; a twisting movement and its operating parts; a twisting clutch movement and its operating parts; a pretzel rod legs support table movement and its operating parts; a fold movement and its operating parts; a centralized adjustment movement and its operating parts; and a finishing plate assembly with its component pretzel rod ends gripping fingers with their operating parts, and the shears with their operating parts.

We will, therefore, describe the construction of our machine in that sequence.

The base and hopper assembly

Referring to Figures 11, 12, 13, 25 and 26, our machine is constructed with a base or frame made up of three castings, or the like, which comprises a rear main section 1 on which is assembled the greater number of the closely related operating parts, and a left front section 2, and a right front section 3. The two front sections 2 and 3 are attached to the left and the right front corners, respectively, of the main section 1 by the cap screws 6. The front ends of the left and the right front sections 2 and 3 are aligned and held rigidly with the tie bar 4, and since the ends of the tie bar 4 are inserted and pass through a hole in the front ends of each of the front sections 2 and 3, they form a substantially integral part of the machine base by being pinned permanently to the front sections 2 and 3. The combined sections of the frame provide a suitable means for the assembling of the entire mechanism for the production of a pretzel. Near the bottom, along both sides, at a position to the rear of a median point of the frame, are inserted rods 7, which extend outward a predetermined distance. The tie rod 4 extends beyond the sides of the frame sufficiently to bring its ends in alignment and level with the rods 7. These four extensions, on the rods 4 and 7, provide a very convenient four point suspension of

the entire machine upon any suitable base. On the bottom of the assembled frame are provided sufficient bosses and legs to provide a level setting of the machine, when it is not suspended, thereby facilitating easy access for change, repair or handling, when necessary.

At a position above the suspension rods 7 are mounted on the left side of the frame a bracket 26, and on the right side of the frame a bracket 27. The bracket 26 and bracket 27 are attached to the frame rigidly by the screws 28. The brackets 26 and 27 extend upward above the machine and are transversely aligned and supported by the tie rod 33, which is held permanently in place with the screws 34. Integrally mounted, at the uppermost ends of the brackets 26 and 27, through the medium of the screws 25, is a pretzel rod receiving hopper, which has the form of a long trough, disposed in a transverse position on the machine. The hopper is composed of the end pieces 23 at each side, a front piece 22, a rear piece 21 and a bottom piece 29. The front piece 22, and the rear piece 21, are affixed to the end pieces 23 with the screws 24. The bottom piece 29 is a swinging member, with a bearing 32 at each end, which permits movement on its shoulder mounting screws 30, inserted in the hopper end pieces 23, and locked in place by the nuts 31. The bottom piece 29 is held in place at the bottom of the hopper by the two springs 36, which gain their tension by being stretched between the two spring clips 35 attached to the rod 33, and a top flange of the bottom piece 29. In each end of the bottom piece 29 is inserted a cam stud 37; said cam studs 37 are retained by the lock nuts 38. The bottom piece 29 is moved at an instance of the cams on the carriage, coming in contact with the cam studs 37, which will be explained more fully later in the description. The front level section of the bottom piece 29 has a series of open slots located along its entire length. The bottom edge of the rear piece 21 is fabricated to obtain a series of tongues, located along its entire length. When the bottom piece 29 is in a normal position, the tongues of the rear piece 21 extend down through the slots in the bottom piece 29. The purpose will be explained later in the description.

At the rear of the frame is a main drive shaft 9, and it is journaled in the bearings, which are structural parts of the main section 1 of the frame. When looking at Figure 12, the rotation of shaft 9 is clockwise. Pinned to the right end of shaft 9 is a gear 10, which is rotated by a pinion 12, pinned on the motor shaft. Although this is one means of motive power, it is to be understood any common power element is applicable. Pinned to the left end of the shaft 9 is a hand wheel 14, which permits of hand rotation when desired. The motive powers for all the mechanical movements, namely, the carriage, the twisting movement clutch, the legs support table, the twisting and the fold, are superimposed upon the movements through the medium of the five rotating track cams 15, 18, 17, 19 and 20, respectively, which are mounted and pinned as integral parts of the drive shaft 9. The further explanation of their functions will be outlined in the description of the respective movements.

The carriage movement assembly

Referring to Figures 11, 12, 13, 14, 15, 25 and 26, we will describe that section of the mechanism, which we would define as the carriage movement. When references are made to rota-

tions in this movement we will be looking at Figure 14. Track cam 15, mounted and pinned as an integral part of shaft 9, rotates counter-clockwise when in operation. The cam roller 39 rotates on shoulder screw 40, which is held in cam lever 42 with lock nut 41. Cam roller 39 is engaged in the track of cam 15, and when cam 15 rotates, it imparts a crank action to cam lever 42, which is mounted through the means of a shoulder block 43, and a shoulder screw 44, to a sliding mounting piece 45. The sliding mounting piece 45 is assembled by the shoulder screws 46 to the bracket 48, which is a supporting means through its attachment to a pad on the base of the main casting 1, by the holding screws 49. Along an angular edge of the sliding mounting piece 45 are several rack teeth which mesh with the teeth on the pinion 51, mounted integrally on the outer end of the rotating shaft 50, journaled in the bracket 48. The other end of the shaft 50 is journaled in an inner casting wall of the main casting 1, and mounted integrally on its extreme inner end is a gear 53, which serves as a driving member when adjusting. The shoulder block 43 is permitted to slide in the slot of the lever 42, when adjusting, and the shoulder screw 44 allows a free movement of the block 43, and the lever 42, when oscillating. Connected to the lower end of the lever 42, by the shoulder screw 55 and the lock nut 56, is the tail of a gear segment 57, which has as its axial means, a shoulder screw 58, inserted in the bushings 60 and 61, held in place with the lock nut 59. The gear teeth on the gear segment 57 are meshed with the teeth on the small gear 62, which is mounted integrally on the shaft 64. The shaft 64 extends close to the full width of the machine and is journaled in one bearing on the casting 2, one bearing on the casting 1, and one bearing on the casting 3. Mounted integrally on both ends of the shaft 64 is one sprocket 65 for the left side of the machine, and one sprocket 65 for the right side of the machine, thus forming a dual driving means for the reciprocation of the carriage. Meshed in the teeth of, and driven by the two sprockets 65, are the two endless silent link chains 67, that is, one for each side of the machine, completing the dual drive, which operates as a unitary action. To support the two chains 67, in a parallel and a level position, at the front of the machine, and to provide adjustable means for an even tension, we have mounted at the front of the machine, the two movable rotating idler sprockets 66. Referring to Figure 12, in particular, at the left side of the machine, the sprocket 66 is integrally mounted on the shaft 68, which is journaled in the sliding bearing 70. The sliding adjustable movement of the bearing 70 is obtained by turning the knurled knob 74, which is integrally mounted on the screw 73. The screw 73, which is journaled in a small bearing, that is, a part of the casting 2, obtains its thrust from the ends of the bearing, and rotates in a threaded lug, which is a part of the slide bearing 70. After the adjustment is obtained, the slide bearing 70 is locked in position by tightening its mounting screws 72. On the right side of the machine the assembly is identical, with the exception of using the slide bearing 71 in place of the slide bearing 70.

The chains 67, and the carriage, are connected through the medium of the attachment pieces 76, which are pinned to the chains 67. The attachment pieces 75 are integrally assembled to the carriage left bracket 80, and the right bracket

81, with the screws 79. The brackets 80 and 81 are the supporting brackets for the carriage, and have inserted in them the long bearings 82, which are held in place by the sleeve nuts 83. The long bearings 82 support the brackets 80 and 81 by sliding on the two slide rods 84, when the carriage is reciprocated; however, tracks and suitable parts running on the same may be substituted for the rods 84 and companion parts. The rubber bumpers 86 are at both ends of the slide rods 84 to facilitate a quiet stop of the carriage when reciprocating. The two slide rods 84, that is, one in a longitudinal position at each side of the machine, are each supported by two posts, and held fast by the screws 85. These four posts are vertically extended sections of the casting 2 on the left, and the casting 3 on the right. Also assembled to the two posts on the casting 2, at the left side of the machine, with the screws 85, is a shock absorber mounting bracket 130, and on the two posts on the casting 3, at the right side of the machine, with the screws 85, is a shock absorber mounting bracket 129. In the rear slot of the bracket 130, and the front slot of the bracket 129, is assembled the sliding shock absorbers 131, and in the rear slot of the bracket 129, and the front slot of the bracket 130, is assembled the sliding shock absorbers 132, retained in the slots by the screws 133. Assembled in these same slots of the brackets 130 and 129 are the adjustable spring studs 137, which are clamped in place by the nuts 138. Riveted fast to an ear of the shock absorbers 131 and 132 are the cups 136, which retain the rubber bumpers 135. From a spring connection on the ends of the shock absorbers 131 and 132 to the adjustable spring studs 137 are assembled springs 134. When the carriage reciprocates, coming in contact with the rubber bumpers 135, the shock absorbers 131 and 132 slide in the slots of the brackets 130 and 129, thus generating a tension on the springs 134, which are held at a designated position by the spring studs 137. The position of the spring studs 137 is determined by the reciprocation of the carriage required for the size pretzel being produced. The shock absorbers resist the shock of the sudden stops of the carriage when reciprocating at high speeds.

The bifurcated upper sections of the brackets 80 and 81 provide a substantial supporting means at both the rear and the front of the carriage magazine 101. The carriage magazine 101 receives its conformation, which is substantially U in shape, from a flat plate formed around a curve until both ends are parallel with each other. The curvature of the magazine 101 is substantially that which would be required for the support and the extrusion of the largest diameter of rod of dough used in the making of a pretzel. The length of the magazine 101 would correspond to the largest length rod of dough required for making a pretzel, and would set in a transverse position on the machine. The parallel ends of the magazine 101 extend upward and the curve of the bend constitutes the bottom. In the central area, at the bottom of the magazine 101, is provided an opening sufficiently large for extrusion of a rod of dough, such as required for the largest pretzel. The left end of the magazine 101, at both the front and the rear, is supported and attached to the bracket 80 with the screws 102 and 103, and, likewise, on the right end of the magazine 101, at both the front and the rear, is supported and attached to the bracket 81 with the screws 102 and 103. At the top of the maga-

zine 101, at both the left and the right ends, are the cams 116, attached with the screws 117. These cams 116 are instrumental in releasing a rod of dough from the hopper, which will be explained later in more detail.

Around the bottom of the magazine 101, to the left of the opening in the bottom, is enveloped around the curve, and slidably engaged with the same, and sufficient distance above, on the front and the rear sides, a U-shaped auxiliary magazine bottom 104, which has a bell mouth on the rear right edge for the purpose of guiding the left leg of a U-shaped rod of dough, when being extruded. Around the bottom of the magazine 101, to the right of the opening in the bottom, is enveloped around the curve, and slidably engaged with the same, and sufficient distance above, on the front and the rear sides, a U-shaped auxiliary magazine bottom 105, which has a bell mouth on the rear left edge, for the purpose of guiding the right leg of a U-shaped rod of dough when being extruded. Just above the opening, at the bottom of the magazine 101, are the two small ears at the rear, and the two small ears at the front, formed outward, which are a structural part of magazine 101. These ears, slidably, support the right ends of the magazine bottom 104, and the left ends of the magazine bottom 105. Attached to the front of each of the magazine bottom pieces 104 and 105, with the screws 115, are the elastic pieces 114, the use of which will be explained later. When adjusting, the bottom pieces 104 and 105, slide transversely toward each other or away from each other, to decrease or increase the opening in the bottom of the magazine 101, and they also provide the adjustable bell mouth guiding means for the legs of the U-shaped rod of dough for all size pretzels.

The magazine bottom piece 104 is supported at the left end, in its proper relation to the bottom of the magazine 101, by the bifurcated top of the bracket 87, to which it is attached at the front with the screws 103, and at the rear with the screws 106. The magazine bottom piece 105 is supported at the right end in its proper relation to the bottom of the magazine 101 by the bifurcated top of the bracket 88, to which it is attached, at the front, with the screws 103, and at the rear with the screws 106.

The bracket 87 is supported by a long bearing 91, which is attached to the bracket 87 with the sleeve nut 92. The long bearing 91 supports the bracket 87 by sliding on the slide rod 93 when the carriage reciprocates. The slide rod 93 is supported by, and attached to, the bracket 95, at the front end, and the bracket 96 at the rear end, with the screws 94. Mounted on the rod 93, at each end, are the rubber bumpers 86, to further facilitate a quiet stop of the carriage when reciprocating. The supporting brackets 95 and 96 have assembled on each of them, a long bearing 98, which, aside from supporting, also permits sliding in a transverse direction on the supporting rods 99. This functions when making a machine adjustment. The supporting rods 99 are inserted and held permanent in a transverse position in two upright posts with the screws 100 maintaining them in that position. The posts are a structural part of the casting 2. Assembled at the bottom of, and between the brackets 95 and 96, is the slide rod 342, which is instrumental in adjusting this section. This will be explained later more fully.

At the left side of the bracket 87 is a rod 78,

which is effective as additional support and prevents any turning of the bracket 87 while sliding on the rod 93. Before the rod 78 is assembled in the machine, there is fixed permanently on its left end, a flange 77. Prior to assembling the bearing 82, the sleeve nut 83, and the slide rod 84, as a means for support of the bracket 80, the end of the rod 78, which does not have the flange 77, is inserted, from left to right, through a hole in the right side of the bracket 80, a hole in the attachment piece 76 and a hole in the left side of the bracket 87, the flange 77 on the left end of the rod 78 attaching fast with the screws 79 to the inside surface of the right side of the bracket 80. The rod 78 is a sliding fit in the hole in the left side of the bracket 87, to facilitate a transverse movement of the bracket 87, when the machine is adjusted.

The bracket 88 is supported by a long bearing 91, which is attached to the bracket 88 with the sleeve nut 92. The long bearing 91 supports the bracket 88 by sliding on the slide rod 93 when the carriage reciprocates. The slide rod 93 is supported by and attached to the bracket 95 at the front end, and the bracket 97 at the rear end with the screws 94. Mounted on the rod 93 at each end are the rubber bumpers 86 to further facilitate a quiet stop of the carriage when reciprocating. The supporting brackets 95 and 97 have assembled on each of them a long bearing 98, which, aside from supporting, also permit sliding in a transverse direction on the supporting rods 99. This functions when making a machine adjustment. The supporting rods 99 are inserted and held permanent with the screws 100, maintaining them in a transverse position in two upright posts, which are a structural part of the casting 3. Assembled at the bottom of and between the brackets 95 and 97 is the slide rod 342, which is instrumental in adjusting this section, which will be explained later more fully.

At the right side of the bracket 88 is a rod 78, which is effective as additional support, and prevents the turning of the bracket 88 while sliding on the rod 93. Before the rod 78 is assembled in the machine, there is fixed permanently on its right end a flange 77. Prior to assembling the bearing 82, the sleeve nut 83 and the slide rod 84, as a means for support of the bracket 81, the end of the rod 78, which does not have the flange 77, is inserted from right to left through a hole in the left side of the bracket 81, a hole in the attachment piece 76, and a hole in the right side of the bracket 88, the flange 77 on the right end of the rod 78 attaching fast with the screws 79 to the inside surface of the left side of the bracket 81. The rod 78 is a sliding fit in the hole in the right side of the bracket 88 to facilitate a transverse movement of the bracket 88, when the machine is adjusted.

Assembled on the front side and on the rear side of each of the brackets 87 and 88 are two sliding brackets 118, which have the structural resemblance of a channel, with slots to permit sliding in a transverse direction on their mounting screws 120 and 122. The mounting screws 120 in addition to providing an assembly and sliding means for the bracket 118, also retain the spring clips 119 in a secure position. Attached to each of the spring clips 119 is one end of one of the springs 128, and the other end is attached to the outer end of each of the sliding brackets 118. This creates tensions which pull the sliding brackets 118 toward the center of the machine until the outer ends of their slots rest against

the assembly screws 120 and 122, which are the normal positions for the brackets 118.

That end of each of the brackets 118, which is toward the center of the machine, has a structural formation resembling a pad. On the pads of the two brackets 118, at the top of the bracket 87, that is, one on the front and one on the rear, is mounted as an integral part of the two brackets 118 the intermittent operating parallel cam 123, which is affixed with the screws 127.

The cam 124 is assembled to the left ends of the brackets 118 at the top of the bracket 88; the cam 125 is assembled to the right ends of the brackets 118 at the bottom of the bracket 87; the cam 126 is assembled to the left ends of the brackets 118 at the bottom of the bracket 87, and they are all affixed with the screws 127 and assembled substantially the same as the cam 123.

The cams 123 and 124 are parallel to a longitudinal line of the machine and they operate the shear movements for the cutting of the ends of the pretzel.

The cams 125 and 126 are parallel to a longitudinal line of the machine, and they operate the fingers movements for the gripping of the ends of the U-shaped rod of dough.

Across the rear of the magazine 101, attached to the support brackets 80 and 81, is the cam mounting 107, secured by the screws 102. The cam mounting 107 is also supported by the shoulder screws 106, which are inserted through the slots in the cam mounting 107, and screwed into the brackets 87 and 88. This method of mounting permits the brackets 87 and 88 to move transversely when adjusted. Attached to the front of cam mounting 107, with the rivets 109, are the two elastic buffers 110 which provide additional support against the rear of the magazine 101. At each side of the opening, along the bottom edge of the cam mounting 107, are two ears, extended rearward, which are part of the structural formation of the cam mounting 107. Assembled on these ears, with the rivets 113, is the cam 112 on the left ear, and the cam 111 on the right ear. These cams are responsible for the return of the pretzel form assembly to its normal position, after the folding operation. This will be explained later more fully.

The twisting movement assembly

Referring to Figures 11, 12, 13, 20, 21, 25, 26 and 37, we will describe that section of the mechanism which we shall define as the twisting movement. When references are made to the rotations in this movement, we will be looking at the Figures 20 and 26.

The track cam 19 is mounted and pinned on the drive shaft 9, which rotates counter-clockwise. Rotating on the shoulder screw 143, held fast by the lock nut 144, is the gear segment 142. Assembled on the tail of the gear segment 142 is a cam roller 139, which rotates on the shoulder mounting screw 140, held secure by the lock nut 141. The roll 139 is engaged in the track of the cam 19, which conveys an oscillating action to the segment 142, when the shaft 9 is rotated. The teeth of the gear segment 142 are meshed with the teeth of the small gear 143, which is assembled as a unitary part of the bevel gear 149. The bevel gear 149 rotates on the shoulder mounting screw 150, which is attached to the center section of the main casting 1, and is secured by the lock nut 151. In substantially a central longitudinal position, the center line of which is the same level as the center line of the

bevel gear 149 is journaled the twisting shaft 153.

Through its entire length, and opening at the bottom of the twisting shaft 153 is a T slot, which provides a sliding means for the T-shaped sliding rack 262. To provide uninterrupted bearing surface for the shaft 153, there is mounted on the rear end, the collar 154, for journaling in the rear bearing, and at the front bearing there is mounted on the shaft 153, the long shouldered collar 155, for journaling in the front bearing. The shaft 153 is located and obtains its thrust bearing with the plates 160 and 161, which are screwed fast to the rear of the front bearing with the screws 162. The plates 160 and 161 are engaged in a groove around the shaft 153 and permit free rotation of the shaft 153. The shaft 153 extends in front of the front bearing a sufficient length to provide a means for mounting a number of interrelated operating parts. Referring particularly to Figure 13, the part 152 is a combined bevel gear and female clutch member, which rotates on the shouldered long collar 155; the shoulder provides the front thrust, and the front of the front bearing provides the rear thrust. The gear teeth of the bevel gear 152 are meshed with the gear teeth of the bevel gear 149. Extending from the front of the shouldered long collar 155, to the rear of the collar 158, is a small key 159, permanently imbedded in the top of the shaft 153. Mounted on the shaft 153, and engaged with the key 159 is the male clutch piece 166, which slides longitudinally and rotates with the shaft 153, through engagement with the key 159. At the extreme front end of the shaft 153 is the collar 158, retained in place by the rivet 156.

The sliding rack 262, which is supported in the T-slot of the shaft 153, is more closely related, in operation, to the fold movement, therefore the construction of the parts assembled on it will be described in the fold movement description.

The parts connected to the clutch piece 166 are more closely related to the twisting clutch movement, therefore, they will be described in the description of that movement.

Riveted to the right side of the gear segment 142 is the spring stud 145. Riveted to the casting 1, directly below the segment 142, is the spring stud 146. Assembled between the spring studs 145 and 146 is the coil spring 147. When the segment 142 is in motion a tension is created on the spring 147, which prevents shock to the twisting movement at high speed operation.

The twisting clutch movement assembly

Referring to Figures 11, 12, 13, 16 and 17, we will describe that section of the mechanism which we would define as the twisting clutch movement. When references are made to rotations in this movement, we will be looking at the Figure 16.

The track cam 18 is mounted and pinned on the drive shaft 9, which rotates counter-clockwise. In engagement with the track of the cam 18, on the screw 164, held secure in the cam lever 167 by the lock nut 166, is the rotating cam roller 163. The bifurcated end of the cam lever 167 straddles a roller bearing 170, mounted on the shaft 9, and thereby receives both support and alignment when reciprocating. The front end of the cam lever 167 connects with the shaft arm 173 by the shoulder screw 171, and the lock nut 172. Integrally attached to the shaft arm 173, at the lower end, is a hub 174, which provides a suitable mounting for rigid assembly with the pin 175 on the oscillating shaft 176. The oscillating shaft 176 is journaled in two

bearings which are a structural part of the main casting 1. Also assembled on the right end of the shaft 176 is the locating collar 178. The yoke arms 179 and 180 have each affixed to their lower end, a hub 181, which provides a suitable integral mounting on the shaft 176. The yoke arms 179 and 180, astride the twisting shaft 153 and the clutch member 186, at their upper ends, are attached to and supported by the tie rod 183, and this, with their fixed mounting on the shaft 176, at the bottom, provides structurally a clutch yoke. Rotating on the studs 185, which are attached to the inner sides of the yoke arms 179 and 180, at a substantially central line of the clutch member 186, are the rollers 184. These rollers 184 are in engagement with the groove in the clutch member 186, and convey a reciprocating movement to the clutch member 186, when the yoke arms 179 and 180 are oscillated by the shaft 176.

Connected to the clutch member 186, on both the left and the right sides, by the screw studs 188, are the links 187, and through their connections to the tails of the guard bracket 192, with the shoulder screws 189 and the lock nuts 190, they are the medium for oscillation of the guard bracket 192 on its axis, the shoulder screws 194, which are assembled to the shaft collar 158. Riveted fast to the guard bracket 192 are the two studs 195, which prevent the pretzel form assembly from moving on its axis, while performing the twisting operation, which will be described later in detail. Referring to Figure 16, at the upper end of the bracket 192, against the front side, is assembled the guard plate 196, which is held in place by the shoulder rivets 197, inserted through the outer slots of the bracket 192 and fastened in the plate 196, and the stud 198 inserted through the center slot of the bracket 192 and fastened in the plate 196. This mounting of plate 196 permits sliding adjustment for the lengthening or the shortening of the guard assembly for the various sizes of pretzels, and the plate 196 is clamped after adjustment with the knurled nut 199 screwed tight on the threaded end of the stud 198.

The legs support table movement assembly

Referring to Figures 11, 12, 13, 18, 19 and 25, we will describe that section of the mechanism which we would define as the legs support table movement. When references are made to rotations in this movement, we will be looking at the Figure 18.

The track cam 17 is mounted and pinned on the drive shaft 9, which rotates counter-clockwise. In engagement with the track of the cam 17, on the screws 202, held secure in the cam lever 204 by the lock nut 203, is the rotating cam roller 200. The bifurcated end of the cam lever 204, straddles a roller bearing 207, which is held in place by the shaft collar 208, both of which are mounted on the shaft 9, and thereby receives both support and alignment when reciprocating. The front end of the cam lever 204 connects with the shaft arm 212 by the shoulder screw 210 and the lock nut 211. Integrally attached to the shaft arm 212, at the lower end, is a hub 213, which provides a suitable mounting for rigid assembly, with the pin 214, on the oscillating shaft 215. The oscillating shaft 215 is journaled in two bearings, which are a structural part of the main casting 1.

Assembled on the right end of the shaft 215

is the hub 217, which is integrally affixed to the support arm 216. Thus, through an oscillation of the shaft 215, the supporting arm 216 is raised and lowered in its proper sequence. At the extreme other end of the support arm 216 is assembled a screw 221 and a slotted nut 222, which provides a suitable mounting for the universal support table bracket 220, and the tension spring 223. The center loop of the spring 223 is astride the lower edge of the support arm 216, and the ends are drawn upward on both sides of the bracket 220, wound counter-clockwise several turns around the screw 221 and the slotted nut 222, and entered into two holes in the two rear ears of the bracket 220, and looped on each end as a holding means. This causes the bracket 220 to turn clockwise, unless otherwise restrained, and forces the bracket 220 downward until the upper side of the angular shape hole in the bracket 220 is against the assembly screw 221 and the nut 222. This can be seen in the skeleton drawing on Figure 18. Assembled on top of the bracket 220 is the legs support table 219, which is retained by the rivets 224, inserted through the slots in the table 219, and riveted fast to the bracket 220. These slots provide a sliding means for the table 219, when the machine is adjusted. At the front, left and right corners, of the table 219, are provided ears, which are a structural part of the table 219, and assembled to each is a screw stud 226, retained by a nut 227, which provides a suitable mounting for the cam rollers 225. The cam rollers 225 are engaged on the left side with a slot in the cam bracket 322, and on the right side with a slot in the cam bracket 321, which supplies a guiding means and an adjustment means for the table 219, which will be explained later in detail, as will also the cam brackets 322 and 321.

The folding movement assembly

Referring to Figures 11, 12, 13, 22, 23, 24, 25, 26, 30, 31, 32, 33, 34 and 37, we will describe that section of the mechanism which we would define as the folding movement. When references are made to rotations in this movement, we will be looking at the Figures 22, 23 and 34.

The track cam 20 is mounted and pinned on the drive shaft 9, which rotates counter-clockwise. The cam roll 228, which rotates on the shoulder screw 229, assembled on the cam lever 231, and held tight with the lock nut 230, is engaged in the track of the cam 20. When the cam 20 revolves, it causes the cam lever 231 to oscillate on its axis, the shoulder screw 233. The cam lever 231 is retained on the screw 233 through the medium of a shouldered bearing 232, which, preferably, is a sliding bearing that permits sliding adjustment in the slot of the lever 231, to facilitate making different oscillations, when folding different sizes of pretzels. The bearing screw 233 is screwed fast to an auxiliary adjusting nut 235, which is a sliding fit in the slot of the movable block 236. Journaled at both ends in the sliding block 236 is the finely threaded adjusting screw 237, which is threaded where it passes through the auxiliary adjusting nut 235. When the screw 237 is rotated, its threads engaged with the threads in a hole in the auxiliary adjusting nut 235, causes a movement of the nut 235 on its sliding means in the movable block 236. The movable block 236 is assembled in an angular position on the left side of the mounting bracket 245, which is slotted for the admission of the two shoulder screws 75

243, fixed tight in the movable block 236. This permits the movable block 236 to adjust itself when the machine is adjusted for a different size pretzel. To the upper end of the screw 237 is attached an extension stem 238, which turns and slides freely in a guide bushing 240, which is fitted rigidly in the lower section of the left bearing of the main drive shaft 9. On the uppermost end of the extension stem 238 is a knurled hand knob 241, held in place with a lock nut 242. This provides an important individual adjustment, which will be explained later. The mounting bracket 245 is supported by and attached to a pad, which is a structural part of the main casting 1, with the mounting screws 246.

Along a top angular edge of the movable block 236 are a number of teeth, which constitute a gear rack. The teeth of the pinion 247, which is integrally mounted on the left end of the shaft 249 which is journaled in the support bracket 245, is in mesh with the rack teeth on the movable block 236. The right end of the shaft 249 passes through and is journaled in the left wall of the central section of the main casting 1. On the extreme right end of the shaft 249 is mounted, as an integral part, the spur gear 250. By this means an adjustment is conveyed to the movement when making use of the centralized adjustment, to adjust for a different size pretzel. This will be explained later in more detail.

Connected to the lower end of the cam lever 231, with the shoulder screw 252, and the lock nut 253, is the tail of the gear segment 254, which has as its axis and support the shoulder screw 255, secured in the left wall of the casting 1, and locked in place by the lock nut 256. The teeth of the gear segment 254 are meshed with the teeth of the gear 257, which is integrally mounted on and near the left end of the shaft 259. The shaft 259 is journaled at the left end in a raised bearing, which is a structural part of the left side wall of the main casting 1, and is journaled at the right end in the right side support wall of the two bearings for the twisting shaft 153. On the shaft 259, immediately to the left of its right bearing is integrally mounted a spur gear 260, which is in register with the sliding rack 262, mentioned previously, in the twisting movement description. The teeth of the gear 260 are engaged with the teeth, which cover substantially two-thirds of the rear length of the bottom side of the sliding rack 262; and when the gear 260 is rotated, it conveys a reciprocating action to the sliding rack 262, while in its supporting means, the T-slot in the twisting shaft 153. Since the sliding rack 262 is a component part of the twisting shaft 153, and the twisting shaft 153 rotates, the teeth in the sliding rack 262 will move out of engagement with the teeth in the gear 260. To prevent the teeth in the gear 260 from moving out of alignment until the re-engagement with the teeth in the sliding rack 262, there is provided a series of grooves around the twisting shaft 153, which have a shape suitable for the reception of and the passing through of the teeth of the gear 260, when the twisting shaft 153 is turning, and the gear 260 is in a normal stopped position. When the sliding rack 262 is in the normal position, a slot K in its bottom side is in register for the passing through of the two thrust plates 160 and 161, while the twisting shaft 153 is rotating. By this arrangement, when the teeth of the rack 262 pass out of engagement with the teeth of the

gear 260, the teeth in the rack 262 continue to retain their alignment for re-engagement, as the position of the rack 262 does not change longitudinally because of its slot K being engaged by the plates 160 and 161 as it revolves.

Assembled on the front end of the sliding rack 262, and held rigidly in a transverse level position by the pin 254 is the pretzel form assembly support bracket 263. At both the left and the right sides of the bracket 263 is a front extending arm, and on the inner sides of these arms are mounted as integral parts the flanged posts 272, which face each other in a transverse position, and are located on the same center line, which is identical with the axial point of movement of the form assembly when it rotates during the fold operation. Assembled on the posts 272 are several parts, being, substantially, two friction brakes for the purpose of retaining the form assembly in whatever position it is moved on its transverse axis, and a camming means for moving the form in position for reception of the rod of dough, relative to the form assembly movement on its transverse axis. Assembled on the post 272, on the left arm of bracket 263, is the brake shoe 274, the friction washer 275, the cam mounting plate 279, the front end of the cam 276, the tension spring 281 and the tension adjustment and lock nuts 282. Assembled on the post 272, on the right arm of the bracket 263, is the brake shoe 274, the friction washer 275, the cam mounting plate 278, the front end of the cam 277, the tension spring 281, and the tension adjustment and lock nuts 282. The cam 276 is riveted to the cam mounting plate 279, which permits them to move as a unit in rotary motion on the flanged post 272, when so desired. This is likewise true with the cam 277, riveted to the cam mounting plate 278, and they are only moved when changing the pretzel form assembly to a different size. The rear ends of the cams 276 and 277 are supported and held in location by two knurled screws 271, which are screwed through the bracket 263 from the rear, and into a hole in the end of each cam 276 and 277. On the rear side of the bracket 263 are attached a bracket 266 on the left, and a bracket 265 on the right, with the rivets 267. The formation of the brackets 266 and 265 is such that each provides an extension of two walls under the support bracket 263, and between these walls on each bracket 266 and 265 is mounted a dog 268, which rotates on the mounting rivet 269. The upper end of each of the dogs 268 are held normally against the front side of the bracket 263, by the springs 270, which are attached to the dogs 268 at one end, and to the brackets 266 and 265 at the other ends. When the dogs 268 are in the normal positions their contours are instrumental in completing the cam tracks during one movement of the form, and when the form is making another movement, the dogs 268 are moved on their axis, the rivets 269 to a non-operative position. In each of the left and the right arms of the support bracket 263, opening on the bottom, are diagonal slots 263A which provide an assembly means for the form assembly, which will be explained later in detail.

The following newly described parts are parts of the folding movement, but they comprise the complete form assembly, which is changed as a unit when adjusting the machine to a different size pretzel, and is easily attached to, or removed from, the support bracket 263. The attachment and the removal will be explained in detail when describing the operation of the machine.

The form assembly is made up principally of two major parts, that is, the stripper plate 283 and its functioning parts, and the form plate 287 and its functioning parts.

5 The stripper plate 283 is disposed in a level position on top of the support bracket 263, and its formation provides sides which are formed downward, adjacent to the outer sides of the arms of the bracket 263. Attached to the inner surface of
10 each of the sides of the stripper plate 283 are the studs 286, which are engaged with the arced sections of the diagonal slots 263A in the arms of the support bracket 263, thereby providing the axis for the stripper plate 283, as well as the
15 means for attachment, through the entrance of the studs 286 into the diagonal slots 263A in the arms of the bracket 263. The studs 286 will enter the diagonal slots only when the stripper plate 283 is at a position that leaves the top of the
20 stripper plate 283 parallel with the diagonal slots, and when the studs 286 are inserted far enough in the slots to bring them into contact with the arced end of the slots 263A, the stripper plate 283 can then be rotated on its axis into the level
25 position on top of the bracket 263. The long straight edge of the two brake shoes 274, on the flanged studs 272, come in contact with the under side of the stripper plate 283, and in this way they retain the stripper plate 283 in any prefer-
30 able position, and prevent any movement of the stripper plate 283 of its own volition. Along both sides, at the rear of the stripper plate 283, is mounted on the shoulder rivets 284, the cam rolls 285, the reason for which will be explained later.
35 Before the form plate 287 is described in its position on the stripper plate 283, we will describe the construction of the parts which attach to the form plate 287. The form itself is not a single piece but a series of small pins 289,
40 which are riveted to the top of the form plate 287, in a formation corresponding to the inside shape of the pretzel with certain eliminations at pre-determined places. Inserted in four holes, from the bottom up, in the form plate 287, and riveted
45 at the top, are four cylinders 288. At both front corners of the form plate 287 there are ears, formed downward along the sides, which provide a suitable mounting place for the two cam rollers 291, assembled, with the aid of two washers 290,
50 on the two screw studs 292, which screw into the ears of the form plate 287, and are secured by the lock nuts 293. At both rear corners of the form plate 287 there is sufficient formation of material, downward, along the sides, to provide a
55 suitable mounting place for the two form cam roller studs 294, which are retained by the lock nuts 293, and provide assembly means for the two form cam rollers 295.

60 There is a small hole in the bottoms of the four large cylinders 288, attached to the bottom of the form plate 287, the diameter of which corresponds to the body diameter of the shoulder rivet 299. Inserted in each of these large cylinders 288, from the bottom up, are the rivets 299.
65 From the top of the form plate 287, in each of the large cylinders 288, and down around the rivets 299, is placed the open wound coil springs 297. The four smaller cylinders 298 are provided with outside diameters, which correspond to the
70 inside diameters of the large cylinders 288, and inside diameters which will permit easy movement of the coil springs 297, and their approximately closed ends have a small hole which is a fit for the pilot or riveting ends of the shoulder
75 rivets 299. The open ends of the small cylinders

298 are placed down over the coil springs 297 and the shoulder rivets 299, and the outside diameters of the small cylinders 298 are inserted into the inside diameters of the larger cylinders 288 until the inside of the approximately closed ends of
5 the small cylinders 298 are against the shoulders of the rivets 299, with the riveting or pilot ends of the rivets 299 fitting and extending through the small hole in the approximately closed ends of
10 the small cylinders 298. The form plate 287 is now ready for assembly to the stripper plate 283. There are two holes at the front and two holes at the rear of the stripper plate 283, which will register with, and receive, the small pilot ends
15 of the shoulder rivets 299; also, there are a series of holes in the stripper plate 283, which will register with, and receive, the series of pins 289, known as the pretzel form. After the form plate 287, with its component parts, is in place below
20 the stripper plate 283, the small pilot ends of the four shoulder rivets 299 are riveted tight to the stripper plate 283. The assembly now results in the small cylinders 298, and the rivets 299, being integral and rigid parts of the stripper plate 283,
25 with the springs 297 coiled around the bodies of the rivets 299, and exerting an expanding pressure against the inside of the approximately closed ends of the large cylinders 288, and the inside of the approximately closed ends of the
30 small cylinders 298. In this way the form plate 287 is forced away from the stripper plate 283 a distance sufficient to prevent the form pins 289 from extending above the top surface of the
35 stripper plate 283, and this distance is controlled by the heads of the shoulder rivets 299 acting as a stop against the outside bottoms of the large cylinders 288, which are integral parts of the
40 form plate 287. The surfaces of the inside diameter of the large cylinders 288 slide on the surfaces of the outside diameter of the small cylinders 298, and the surfaces of the diameters of the
45 holes in the bottoms of the large cylinders 288 slide on the surfaces of the diameters of the shoulders of the rivets 299, resulting in a very uniform level movement of the form plate 287, when such is desired.

When the stripper plate 283, and its assembled parts, are attached to the arms of the support bracket 263, the two cam rolls 295, which are on
50 the form plate 287, engage with the cams 276, on the left, and 277 on the right. These cams 276 and 277 have a shape, which conforms to the movement desired of the form plate 287, when the stripper plate 283 rotates on its axis, the pins 289, this movement being imposed at the instance
55 of the cam rolls 291 on the front of the form plate 287, becoming engaged with a cam surface which is a structural part of the cam brackets 321 and 322. When the stripper plate 283 is in a level position, the top of the form plate 287 is
60 against the bottom of the stripper plate 283 and the form pins 289 extend through, and above, the stripper plate 283 a sufficient distance for the shaping and retention of the rod of dough. When the stripper plate 283 is rotated on its axis, to a
65 position substantially at right angles to a level position, through the force of the coil springs 297 and the shape of the cams 276 and 277, the form pins 289 are withdrawn by the movement of the
70 form plate 287 to a position just flush with the top of the stripper plate 283.

The description of the construction of this last group of parts, known as the form assembly, does not necessarily apply to one size pretzel. When
75 changing to different sizes of pretzels, the form

assembly is removed and another attached, which conforms to that size and shape of pretzel the machine is set to make. All these form assemblies are constructed the same although the form pins 289 are in a suitable arrangement on each assembly so they conform, respectively, to each shape and size of pretzel. It is not necessary to change the form assembly when the diameter of the rod of the dough is changed, and the shape and size of the pretzel remain the same. Further explanation will follow in the description of the operations.

The centralized adjustment movement assembly

Referring to Figures 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 28, 29, 35 and 38, we will describe that section of the mechanism, which we would define as the centralized adjustment movement.

At the rear of the machine is a hand wheel 393 to which is assembled a handle 306, with the bolt 305 and the nut 307. The hand wheel 303 is rigidly attached to the rear end of the adjustment screw 300 by the acorn nut 304. The adjustment screw 300 is journaled in two bearings, one at the rear of the main casting 1, while the other is at the front end of the screw 300, which is a bearing in a lower section of the rear twisting shaft 153 bearings. At the rear and the front of the screw 300 rear bearing are the thrust collars 301, which are attached to the screw 300 by the pins 302, and these prevent any longitudinal movement of the screw 300, when it is rotated in adjusting. The threaded section of the screw 300 passes through and its threads are meshed with the threads in the threaded hole of the screw plate 308 so that the screw plate 308 moves longitudinally when the screw 300 is rotated. Also on the screw 300, to the rear of the screw plate 308, is the hand locking nut 309, which turns tight against the screw plate 308, and holds it rigidly in the position to which it has been adjusted. In a hole in the right side of the screw plate 308 is the rod 310, which is rigidly attached to the screw plate 308 with the hex nut 312. In a hole in the left side of the screw plate 308 is the rod 311, which is rigidly attached to the screw plate 308 with the hex nut 312. When the screw plate 308 is moved longitudinally, the rods 310 and 311 move in unison. The rods 310 and 311 pass through several walls of the main casting 1, which provide bearings for sliding, and they extend far enough through, and beyond, the front of the main casting 1 to permit attachment to the plate 313 with the hex nuts 312. The sections, substantially central, of the rods 310 and 311 pass through a pocket in the main casting 1, which opens from the bottom side of the casting. In this pocket are the adjustment gears 53 for the carriage movement, and 250 for the fold movement. These sections of the rods 310 and 311, which pass the gears 53 and 250, when adjustments are made, are provided with rack teeth on the bottom sides, which mesh with the teeth in the gears 53 and 250. The rod 310 is aligned directly over, and is engaged with, the gear 53. The rod 311 is aligned directly over, and is engaged with, the gear 250.

Attached to the left end on top of the tie plate 313, with the screws 316, is the left slide bar 315, and attached to the right end, on top of the tie plate 313, with the screws 316 is the right slide bar 314. Both of these slide bars 315 and 314 extend to the front of the machine, and provide a means for the assembly and attachment of a number of parts which require adjustment of

their positions, when changing the machine for a different size pretzel. The left slide bar 315 is supported, and slides in a guideway which is a structural part of the right top surface of the casting 2, and it is retained in position by the gib plate 317, which is attached to the top of the casting 2 with the gib screws 318. The right slide bar 314 is supported and slides in a guide way which is a structural part of the left top surface of the casting 3, and it is retained in position by the gib plate 317, which is attached to the top of the casting 3, with the gib screws 318. The right slide bar 314 has attached to its top surface, with the screws 323, an adjustment indicator 319, the point of which is in close contact with the top surface of the gib plate 317. There are a number of lines scribed in the top surface of the gib plate 317, which represent the amount of adjustment necessary when changing the machine to make a different size pretzel. Therefore, since the indicator 319 moves with the adjustment, the point of the indicator 319, when in alignment with a scribed line, will indicate to the operator, by reading that particular line, what size pretzel the machine is adjusted to make, and what form assembly should be attached to the arms of the support bracket 263.

At a position substantially central between the rear and the front ends, attached to the top surface of the left slide bar 315, with the screws 323, is the cam bracket 322, and attached to the top surface of the right slide bar 314, with the screws 323, is the cam bracket 321. The contours of the rear edges of the cam brackets 322 and 321 provide a cam surface for the cam rolls 291 on the form plate 287, to contact and cause a rotating movement of the form assembly, on its transverse axis when the reciprocating action takes place during the folding movement. Also contained in the cam brackets 322 and 321 are the radial slots, which permit engagement of the cam rolls 225 on the support table 219, and by this connection, the table 219 is guided in its up and down movement, and adjusted to longitudinal position by sliding in its slots on the rivets 224, keeping the same relation at all times with the cam brackets 322 and 321.

A short distance farther front on the machine, setting erect in a transverse position, is the assembly plate 324, and at both sides of the plate 324 are structurally formed feet, which facilitate the transverse mounting of the plate on the top surfaces of the slide bars 315 and 314, the feet being attached rigidly to the two slide bars 315 and 314, with the mounting screws 325. The finishing plate assembly, with its component gripping fingers and their operating parts, and the shears with their operating parts are all assembled on the assembly plate 324, and by its mounting to the slide bars 315 and 314, when adjustments are made, this complete group of parts move as a unit. The construction of this group will be described later in the description titled, "The finishing plate assembly".

At the front ends, on the top surfaces, the left slide bar 315 has attached with the screws 386 a bracket 384 and the right slide bar 314 has attached, with the screws 386, a bracket 385. The bifurcated ends of the brackets 384 and 385 extend downward to a point beneath the machine, and their ends have a structural formation, which provides ears for support of the finished pretzel unloading chute 387, which is attached to the ears of the brackets 384 and 385, with the screws 388 and the nuts 389. The rear edge of the chute

387 is in alignment with the front edge of the table 219, and with its curved shape it extends downward, and then toward the front, to a position in front of the machine where the finished pretzel leaves the machine. The top surface of the chute 387 is corrugated lengthwise as a means for eliminating friction, and to prevent the finished pretzel from changing its position, relative to the position it was in when dropped on the chute 387, and to assure its sliding in a straight line of travel. Located a suitable distance above the chute 387, adjacent to the front of the finishing plate assembly, between and attached to the brackets 384 and 385, with the screws 393, is the dough bin 390 for the reception of the dough ends, which are sheared from the pretzel. The chute 387 and the bin 390, through their mountings, also are adjusted to a position, which is always the same relation to the finishing plate assembly.

The finishing plate assembly

Referring to Figures 9, 11, 12, 13, 25, 27, 28, 29, 35, 39 and 40, we will describe that section of the mechanism which we would define as the finishing plate and its component parts, the gripping fingers movements and the shears movements.

Referring particularly to the Figures 27, 28, 29, 35, 39 and 40, we disclose diagrammatic drawings of this assembly exclusively without the showing of any other parts.

It is to be recalled that in the preceding descriptive writing the assembly plate 324 is arranged erect in a transverse position, supported on the slide bars 315 and 314. Assembled on the plate 324 are four distinct operating movements, that is, the two gripping fingers movements and the two shears movements. To avoid complications in the description, we will describe the construction of each of the operating movements separately, and then assemble them in their respective positions on the plate 324.

The left finger movement mounting bracket 363 forms at right angles toward the rear, and after leaving a suitable flat surface on top, it makes another right angle bend downward, which results in a bridge formation of the top of the bracket. The right side of the bridge formation is then formed around an arc until it is at right angles to the flat surface on top of the bridge formation. This upwardly extended section of the bridge formation of the bracket 363 might be called the stationary gripping finger. The curve, which is the result of forming, is substantially the same as the curve of the largest diameter rod of dough. The bridge formation results in the bracket 363 having a rear wall, and a front wall, the two of which straddle and support the operating parts of the finger. The rear wall is parallel with the front wall, and extends far enough downward to provide another means for mounting and support in addition to the front wall. The shaft 376, under the bridge formation, is journaled in both the rear and the front walls of the bracket 363. On the shaft 376, at a substantially central position, is integrally mounted the gripping finger 378, which extends upward through a slot in the top flat surface of the bridge formation of the bracket 363. The finger 378 has a suitable length and shape at the upper end to move the end of a rod of dough into place in the curve, and against the stationary finger, and continuing its movement until the dough is clamped secure-

ly, the movement being the result of a clockwise rotating action of the shaft 376. Also integrally mounted on the shaft 376, adjacent to the rear side of the front wall of the bracket 363, is the small gear 377 and meshed with the teeth of this gear 377 are the teeth of the gear segment 370, which is mounted and rotatable on the shoulder screw 372, attached to the rear side of the front wall of the bracket 363, and locked with the lock nut 373 on the front side of the front wall of the bracket 363. Riveted to the rear surface of the segment 370 is the spring stud 374. The tail end of the segment 370 is formed to a right angle, providing a suitable surface for mounting a rotatable cam roller 347 with the shoulder rivet 348. At the lower corner, on the rear side of the front wall of the bracket 363, is riveted a spring stud 375.

The right finger movement assembly is identically the same as the left finger movement assembly, with the following exceptions: use bracket 364 in place of bracket 363 and use gear segment 371 in place of gear segment 370. The only difference in these parts is that bracket 363 and gear segment 370 are constructed for left side operation, and bracket 364 and gear segment 371 are constructed for right side operation. All other parts of the right finger movement are identical in construction with the corresponding parts of the left finger movement.

The left shear movement mounting bracket 334, through a structural formation rearward, at the top, is provided with a suitable surface, which is inclined substantially forty-five degrees to a transverse line, and from this inclined surface a right angle bend is made in a right diagonal downward direction, which results in an inclined bridge formation for the top of the bracket. The rear wall of the bridge formation, which extends diagonally downward, does not support the bracket 334, but its rear vertical surface provides a suitable mounting for the depresser plate 339, which is attached rigidly in a diagonal position with the rivet 340. The depresser plate 339 has a shape, which can be compared to the print side of the end section of the human thumb, and is the means for contacting the legs of the rod of dough at the juncture of the curved section and the legs of the pretzel, so that when pressure is exerted to cause an adhesion, the resultant characteristics of the pretzel are likened to those of the hand made pretzel. (The legs of the hand made pretzel are pressed by the thumbs while the curved section of the pretzel is backed by the forefingers.)

Attached rigidly to the inclined top surfaces of the bracket 334, and extending rearward, is the stationary shear blade 356. Assembled adjacent to the top surface of the inclined shear blade 356 is the rotatable shear blade 359, which is mounted, and revolves on the shoulder screw 361. A thrust tension is provided to effect passing contact of the moving blade 359 with the stationary blade 356, by the spring washer 362, which is also assembled on the shoulder screw 361, between the underneath surface of the head of the screw 361 and the top surface of the moving blade 359. Along the small curved edge of the shear blade 359 is provided a series of gear teeth, which have a radial relation to the axis, the screw 361 of the shear blade 359. The gear teeth of the shear blade 359 are meshed with the rack teeth in the right angle formation of the sliding rack piece 349, which is assembled adjacent to the front surface of the front wall of the

bracket 334, and is mounted through the diagonal slots of the rack piece 349 by the shoulder screw 353, and the shouldered collars 352, which are attached to the front wall of the bracket 334.

5 The shoulder screw 353 and the shouldered collars 352 permit a sliding diagonal movement of the rack piece 349, through the medium of the diagonal slots in the rack piece 349, and this movement, through the teeth engagement, 10 causes an oscillation of the shear blade 359 that is required for the shearing of an end of the pretzel. Riveted to the front side of the rack piece 349 is the stud 355, which serves the purpose of both a spring connection and a fulcrum or driving stud. The bifurcated end of the cam lever 15 344 is engaged with the stud 355, and the cam lever 344 is capable of rotating on its mounting shoulder screw 346, which is attached to the front side of the front wall of the bracket 334. 20 The tail end of the cam lever 344 is formed to a right angle, providing a suitable surface for mounting a rotatable cam roller 347, with the shoulder rivet 348. Near the bottom, on the front side of the front wall of the bracket 334, 25 is riveted a spring stud 354. At the lower left corner, at the rear side of the front wall of the bracket 334, is attached rigidly a long hub 341.

The right shear movement assembly is identically the same as the left shear movement assembly, with the following exceptions: use bracket 335 in place of bracket 334; use plate 338 in place of plate 339; use shear blade 357 in place of shear blade 356; use shear blade 360 in place of shear blade 359; use rack piece 350 in place of rack piece 349, and use cam arm 345 in place of cam arm 344. The only difference in these parts is bracket 334, plate 338, shear blade 356, shear blade 359, rack pin 349 and cam arm 344 are constructed for left side operation, and bracket 335, shear blade 357, shear blade 360, rack piece 350 and cam arm 345, are constructed for right side operation. All other parts of the right shear movement are identical in construction with the corresponding parts of the left shear 45 movement.

The left finger movement bracket 363, with its assembled parts, is assembled to the left shear movement bracket 334. The bridge formation of the bracket 363 straddles the front wall of the bracket 334, and is suspended over the top of the shears mechanism. The rear side of the rear wall of the bracket 363 is in transverse alignment with the front side of the rear wall of the bracket 334. Between the front side of the rear 50 wall of the bracket 363, and the rear side of the front wall of the bracket 334, is a spacing collar 369, and the screw 368 passes through a hole in the rear wall of the bracket 363, a hole in the spacing collar 369, and screws rigidly into the front wall of the bracket 334, thus providing a substantial support and mounting for the rear rear wall of the bracket 363. It is recalled that in the preceding descriptive writing the shouldered collars 352 provide a mounting in the slots 65 of the rack piece 349. They are also essential parts as spacers between the front side of the front wall of the bracket 334, and the rear side of the front wall of the bracket 363. The two screws 351 pass through two holes in the front wall of the bracket 363, the two holes in the two 70 shoulder collars 352, and screw rigidly into the front wall of the bracket 334, affording substantial support and mounting for the front wall of the bracket 363. Additional support and mounting is supplied by the two screws 365, which pass

through two holes in the front wall of the bracket 363, and screw into the two spacing nuts 366, which are mounted to the front wall of the bracket 334, with the two screws 367, which pass through two holes in the front wall of the bracket 334, and screw into the two spacing nuts 366. 5 The spring 382 is attached at one end to the stud 355 on the cam arm 344, and at the other end it is attached to the stud 375 on the bracket 363. This maintains a tension which assures an open 10 position of the shears at all times, unless a movement otherwise is instigated to perform the shearing operation. The spring 383 is attached at one end to the stud 374 on the gear segment 379, and at the other end it is attached to the stud 354 on the bracket 334. This maintains a 15 tension, which assures clamping of the end of the rod of dough at all times, unless a movement otherwise is instigated to perform a release of the end of the rod of dough for replacement by 20 an end of another rod of dough.

The right finger movement bracket 364, with its assembled parts, is assembled to the right shear movement bracket 335 in identically the same way, using the parts that are identical in 25 numbers and characteristics.

It is to be understood that there is now a left finger and shear movements assembly, and a right finger and shear movements assembly ready for further assembly. 30

We now refer again to the assembly plate 324, which is erect in a transverse position on the machine. It is to be noticed that the top edges compare to a pyramid, having an incline on each side, which is substantially forty-five degrees to a transverse line. In the plate 324 are four 35 slots, which are parallel to a transverse line, that is, two to the left and two to the right of a vertical center line. These slots provide the means for the mounting and the transverse movement of the left and the right fingers and the shears movements assemblies. The left finger and the shear movements assembly is suspended above the left inclined edge of the plate 324, with the rear side of the front wall of the 40 bracket 334, adjacent to the front side of the plate 324, and the two shouldered screw studs 337, and the shouldered screw 336, are inserted from the rear side of the plate 324 through the two transversely parallel slots to the left of the vertical center line in the plate 324, and screwed 45 rigidly into the front wall of the bracket 334. The right finger and shear movements assembly is assembled on the right side of the plate 324, in identically the same manner, with the shouldered screw studs 337, and the shouldered screw 336, inserted from the rear side of the plate 324, through the two transversely parallel slots, to the right of the vertical center line in the plate 324, and screwed rigidly into the front wall of 60 the bracket 335. The slide rods 342, one on the left and one on the right, which were described in the carriage movement parts, connect to the left and the right finger and shear movements assemblies by their insertion in the holes of the long hubs 341. These connections help in the support of the fingers and shears movements assemblies, but, most important, they are the connections to the carriage movement, which are 65 instrumental in adjustment of the carriage parts that require adjustment. 70

Again, in reference to the plate 324, there are five vertical slots which facilitate the assembling of the finishing plate 326, which is suspended to the rear of the plate 324. Between the finishing 75

plate 326 and the plate 324 are five spacing collars 328. The five shouldered screws 327, from the front of the plate 324, are inserted through the five vertical slots, through the five spacing collars 328, and screwed rigidly into the finishing plate 326. This type of mounting permits an up and down sliding movement of the finishing plate 326, which has four diagonal bottomed slots with their openings from the front side. The rear pilot heads of the four shouldered screw studs 337, which are movable transversely in the transversely parallel slots of the plate 324 are engaged and movable in the four diagonal bottomed slots of the finishing plate 326.

When the finishing plate 326 is moved up and down, when adjusting, the four diagonal slots act as cams against the pilot ends of the four shoulder screw studs 337, which, through their mountings and connections, move both the left and the right fingers and shears movements assemblies toward and away from each other, transversely, on their mountings, the transversely parallel slots in the assembly plate 324. The rear side of the finishing plate 326 has a perfectly smooth surface for backing of the finished pretzel, and the top edge is shaped in comparison to the top edge of the assembly plate 324. The bridge formations of the tops of the brackets 334 and 335 straddle the inclined edges of both of the plates 324 and 326, and the front sides of the rear walls of the brackets 334 and 335 are against the rear side of the finishing plate 326. Since the rear walls of the brackets 334 and 335 are the mounting places of the depressor plates 339 and 338, in this way they are located in their proper relation to the finishing plate 326, when the pretzel is completed and the ends are given pressure to cause an adhesion.

At the bottom corners of the finishing plate 326 there are formed, at right angles, toward the front, ears of sufficient size for the assembly on their outer sides of the cam rollers 329 on the shouldered rivets 330.

At the left side the came roller 329 is engaged with a diagonal cam slot in the cam 331, which is attached rigidly to the right side of the casting 2, with the screws 333, and at the right side the cam roller 329 is engaged with a diagonal cam slot in the cam 332, which is attached rigidly to the left side of the casting 3, with the screws 333.

When the entire finishing plate assembly, through its mounting on the slide bars 315 and 314, moves in a longitudinal direction on the machine, when making an adjustment, the cams 331 and 332 cause the finishing plate 326 to move up or down, effecting a complete adjustment of the entire finishing plate assembly and its connecting members.

Having completed the description of the construction and assembly of our invention, before describing the operation in conjunction with the detailed figures of the drawings, particular reference is here made to the Figures 1 to 10, inclusive, 14 to 24, inclusive, and 27 to 43, inclusive, all of which are essentially diagrammatic, and are designed to facilitate a ready understanding of what might be a series of rather intricate operations and the results of such operations. As will be described hereinafter, these parts, when actuated, function to receive a rod of dough of the shape in Figure 1; are responsible for placement of the rod of dough in position in the hopper, as shown in Figure 5; are responsible for placement of the rod of dough in position in the carriage magazine, as shown in Figure 6; function of the carriage

movement to produce a shape in the rod of dough, as shown in Figure 2, and the relation of this shape to the machine parts, especially the support table movement and the gripping fingers, as shown in Figure 7; functioning of the twisting clutch and the twisting movement to produce the shape of a rod of dough, as shown in Figure 3, and the relation of this shape to the machine parts, as shown in Figure 8; functioning of the folding movement to place the pretzel in a position and relation to the machine parts, especially the shears, as shown in Figure 9; the purpose of the unloading chute, as shown in Figure 10, with the final result of a finished pretzel, as shown in Figure 4; functioning of the centralized adjustment and its related parts, as shown in Figure 38, to change the machine for the production of different sizes and shapes of pretzels.

In the foregoing we have described the various parts making up the mechanical organization of the operating movements of our invention, and, in some respects, such parts have been identified with the functions which they perform; however, in order that the full operation of our invention may be thoroughly understood, we have defined in the following the various stages through which a strip or rod of dough passes when operated upon by our machine.

There are several types of pretzel dough rolling machines, and any machine which is capable of producing a strip or rod of dough, whether by rolling or other means, can be used in conjunction with our invention. The rod of dough may even be produced and fed manually to our machine.

Therefore, when a strip or rod of dough is produced by any means, and fed to our machine, it will receive a series of operations of such a nature as to produce a completely finished pretzel, having the well known complete twist and fold, ejecting the same from our machine and conveying it to a location convenient for dipping, salting and baking.

The several mechanisms in operation

It is evident that several of the mechanisms are in operation simultaneously, therefore, we will describe them in their proper sequence relative to the sequence of operations, a strip or rod of dough passes through when in the machine during the conformation of a complete pretzel.

It is to be understood in the following description, when references are made to rotations of parts, we will either be looking at the right side of our machine at Figures 14, 16, 18, 20, 22, 23, 32, 33 and 34, or at the front end of our machine at Figures 26, 28 and 29, or at the top side of our machine at Figures 11, 15, 17, 19, 21, 24, 27 and 31.

The dough producing machine is in a position suitable for expulsion of a strip or rod of dough in a horizontal position, parallel to the width of our invention. The strip or rod of dough (see Figure 1), from its own gravitation, drops into the large top opening of the hopper, which is composed of the rear piece 21, the front piece 22, and the two side pieces 23, and the movable bottom piece 29, which is retained in the normal or support position by the two springs 36, as disclosed in Figure 13. The rod of dough is guided by the rear piece 21 and the front piece 22 to a straight position (see Figure 5) on the movable bottom piece 29, which has a series of clearance slots its entire length, from the left side to the right side, opening to the front edge, which permits a series of tongues, along the en-

tire length, from the left side to the right side, at the bottom edge of the rear piece 21, to locate and extend downward a distance which compares to the tangential point of the radial swing of the bottom piece 29 when in the act of releasing a rod of dough. The bottom piece 29 is never moved except at an instance of the cams 116, which are attached to the carriage magazine 101, coming in contact with the cam studs 37, which are attached to the bottom piece 29. The release of the bottom piece 29 takes place momentarily at the finish of the reciprocating movement of the carriage from a front to a rear position, this being the only time at which a rod of dough should be released to the carriage magazine for further operations. The cams 116 push rearward against the cam studs 37, thereby causing a rearward movement of the bottom piece 29 on its axis, the screws 30, and against the spring tension of the springs 36, thus causing the bottom piece 29 to move from under the straight strip or rod of dough, which is retained in a straight position by the tongues of the stationary rear piece 21, the slots of the bottom piece 29 providing the clearance for the tongues as the bottom piece 29 makes its rearward movement. At substantially the time at which the bottom piece 29 has completed its full release of the rod of dough, the opening at the top of the carriage magazine 101 is in direct vertical alignment with the opening in the bottom of the hopper, thereby providing a means for receiving the straight rod of dough as it drops from its own gravitation, downward, to a position on the bottom inside of the carriage magazine 101 (see Figure 6). When the carriage is in this position, it is the extreme rear stopping position in its reciprocation from front to rear, and it is the position from which the formation of the rod of dough is started, regardless of the size of the pretzel being made. The carriage magazine 101, now located in a transverse position on the machine, is also in vertical alignment at the bottom, with a position on the stripper plate 283, which is adjacent to and at the rear of the pretzel form, that is, the form pins 289, while the bottom of the magazine, particularly the bottom pieces 104 and 105 are adjacent to the top surface of the stripper plate 283, which is in a transverse level position, the essential position for receiving the rod of dough. The central section of the bottom of the magazine 101 has an adjustable opening, which, in length, corresponds substantially to the over all width of the pretzel the machine is set to produce. Incidentally, the pretzel form is of such shape as to correspond to the inside measurements of the pretzel the machine is set to produce. Since the magazine 101 has a central opening in the bottom, and the stripper plate 283 is directly under and adjacent to the bottom, then, when the rod of dough drops of its own gravitation into the magazine 101, the central section of the rod of dough contacts, and is supported by, the stripper plate 283, while the long ends of the rod of dough are supported in the magazine.

The form pins 289, which are attached to the form plate 287, are extended vertically through and above the stripper plate 283 a distance which is relatively greater than the diameter of the rod of dough, so as to form an obstruction for the central section of the rod of dough, when the carriage magazine 101 carries it toward the front of the machine, which, in effect, causes the rod of dough, through its central section, being in contact with the obstructing form pins 289 to

be extruded, central section first, out through the rear of the opening in the central section of the bottom of the magazine 101. By referring to Figure 41, you will see the form pins 289 extending above the stripper plate 283, being supported in this position by the form plate 287, which is retained in its relative position by the engagement of its cam rollers 295, with the cams 276 and 277. The extrusion of the rod of dough from the opening in the bottom of the carriage takes place when the carriage is reciprocated, frontward, from the position in which it received the rod of dough.

Since all of our automatic mechanical actions are imposed by the drive shaft 9, and its component five rotating cams, we will describe the source of our reciprocating action of the carriage from that point. One complete revolution of the drive shaft 9 is responsible for the operation of all the mechanical movements required for one cycle of the machine, or the production of one complete pretzel.

The design of the five cams are similar, with each of them having a cam roller path or track with a curve relation to the axial center of the cam, that will produce a push and pull action to a cam lever, through engagement in the cam track by a cam roller mounted on the cam lever, and a dwell period for the cam lever at the end of each push and pull action of sufficient length to permit a synchronized action of the five cams, thus producing a fool proof timing of the various operating movements in their proper sequence of operation.

Referring in particular to Figure 14, the carriage is in the rear position, where the hopper bottom 29 is released, the carriage magazine 101 being in the position where it has received the rod of dough, the carriage is ready to be reciprocated by its operating parts to the front position of the machine. The drive shaft 9 rotates counter-clockwise with its integral parts the cams 15, 18, 17, 19 and 20 doing likewise. The cam 15 is at the dwell, following its pull operation on the cam roller 39 and cam lever 42. When the cam 15 revolves counter-clockwise, the lobe A, which is the push lobe of the cam 15, exerts a pressure against the cam roller 39 and the cam lever 42, causing a clockwise movement of the cam lever 42 and its axial bearing 43 on their axis, the mounting screw 44 which is attached to its adjustable mounting block 45. The clockwise rotation of the cam lever 42, through its connection to the gear segment 57 by the connecting screw 55, delivers a clockwise movement to the gear segment 57 on its axis, the mounting screw 58. The clockwise rotation of the gear segment 57, because of its teeth being meshed with the teeth of the gear 62, which is integrally mounted on the shaft 64, causes a counter-clockwise rotation of the gear 62 and the shaft 64. Since the two driving sprockets 65, that is, one at each side of the machine, are integral parts of the shaft 64, they also rotate counter-clockwise. The two endless link chains 67, that is, one at each side of the machine, which are driven by and engaged with the teeth of the sprockets 65, and are supported and engaged with the teeth of the idler sprockets 66, rotate in a counter-clockwise movement; in other words, the top sections of the chains 67 move from rear to front, and the bottom sections move from front to rear, thereby providing the power means for the reciprocation of the carriage, through their carriage attachment pieces 76, 75

which are attached to each of the chains 67. By referring to Figure 26 you will see the attachment pieces 76 as integral parts of the carriage magazine support brackets 80 and 81, and they are connected to the rods 78, which are responsible for the transverse alignment and the unitary longitudinal movements of the magazine support brackets 80 and 87, also 81 and 88. Since these four bracket 80, 87, 81 and 88 are the supporting means for the carriage and its component parts, and the four slide rods, that is, the two rods 84 and the two rods 93, are the supporting means for the four brackets 80, 87, 81 and 88, then the carriage, through its connections with the pieces 76 to the chains 67, moves in reciprocation toward the front of the machine, sliding with its two bearings 82 and its two bearings 91 on the two slide rods 84 and the two slide rods 93.

The carriage moves toward the front of the machine; the form pins 289 by their obstruction of the central section of the rod of dough are pulling the rod of dough, the central section first, from the opening in the bottom of the carriage magazine 101. The long legs of the rod of dough as they come from the magazine 101 are guided by the guide pieces 104 and 105 into the formation of a substantial U.

The cams 116 on the carriage magazine 101 move away from the hopper bottom 29 and its cam studs 37, permitting return of the hopper bottom 29 to its normal position in preparation for receiving another strip or rod of dough.

Attention is directed to the fact that the timing of the strip or rod forming machine need not be exactly in uniformity with that of our machine since a rod or strip of dough may be delivered to the hopper immediately the hopper bottom is returned to normal, and any time thereafter, while the hopper bottom is in the normal position during the operation of our machine in the conformation of the pretzel.

The carriage has now reached a point which is the front edge of the stripper plate 283. There is an open space between the front edge of the stripper plate 283 and the gripping fingers 378, which must be guarded to keep the long legs of the rod of dough from falling down through. This is accomplished by putting in this space, at a level which is substantially the same as the stripper plate 283, the legs support table 219.

The movement of this table 219 is controlled by the cam 17 on the drive shaft 9. Referring in particular to Figure 18, the support table 219 is in the supporting position or the position it has reached when the carriage in its frontward movement passes the front edge of the stripper plate 283. The skeleton drawing of Figure 18 shows the position of the table 219 movement just prior to the start of the carriage in its frontward movement at the time of receiving the rod of dough. Describing this action from the skeleton drawing in Figure 18, the cam 17 on the shaft 9 is at the end of the dwell, which follows its push operation against the cam roller 200 and the cam lever 204. When the cam 17 revolves counter-clockwise, the lobe F, which is the pull lobe, exerts a pull action against the cam roller 200, and the cam lever 204, causing an endwise movement rearward of the cam lever 204, which at its pronged end is supported and straddling the shaft 9, and at its other end is supported by its connection to the shaft arm 212 with the screw 210 and because of this connection, the shaft arm 212 moves in clockwise rota-

tion with its integral mounting piece, the shaft 215. The table support arm 216, integrally mounted on the shaft 215, also moves in clockwise rotation.

In describing the construction we make mention of the bracket 220 as being the supporting and attachment means for the table 219. It is also the connecting means to the end of the arm 216. The triangular shaped slot, and the connecting screw 221, afford a flexible connection, which compensates for variations in the table 219 movement, caused by adjustment to suit different size pretzels. It has been mentioned that the spring 223 is so wound that it diverts a clockwise motion to the table 219, which is responsible for the table 219 moving in unison with the arm 216. In other words, if the two cams 322 and 321 were removed, the table 219 relation to the arm 216, because of the spring 223 tension, would normally be that shown in the skeleton drawing in Figure 18. Therefore, when the shaft 215 is rotated clockwise, the arm 216, and the table 219 move as a unit, upward, until the table cam rollers 225, which are engaged in the cam slots of the cams 322 and 321, contact the upper ends of the cam slots, offering a resistance to the front end of the table 219, and as the arm 216 continues upward, the table 219, and its bracket 220, rotate counter-clockwise on their axis, the screw 221, against the tension of the spring 223, until the table 219 is in the level position, shown in Figure 18. When this position has been reached, to retain it, the cam 17, still revolving, has reached a section of the cam track, which is the dwell, following the lobe F.

Another movement which is taking place while the carriage is moving from rear to front is the twisting clutch movement for which we refer principle to Figure 16. This movement is controlled by the cam 18, on the drive shaft 9. Figure 16 shows the clutch 186 disengaged, and the guard plates 196 and 192, which are parts of this movement, in the vertical position over the front end of the twisting shaft 153, or the positions they are in when the carriage is directly under the hopper, in the act of receiving a rod of dough, the start of the frontward movement of the carriage. The cam 18, on the shaft 9, is at the end of the dwell, which follows its push operation against the cam roller 163 and the cam lever 167. When the cam 18 revolves counter-clockwise, the lobe C, which is the pull lobe, exerts a pull action against the cam roller 163 and the cam lever 167, causing an endwise movement, rearward, of the cam lever 167, which at its pronged end is supported and straddling the shaft 9, and at its other end is supported by its connection to the shaft arm 173 with the screw 171, and because of this connection, the shaft arm 173 moves in clockwise rotation with its integral mounting piece, the shaft 176. The two yoke arms 179 and 180, integrally mounted on the shaft 176, and located at each side of the twisting shaft 153, are rotated in clockwise motion. Since the rolls 184, assembled one each on the yoke arms 179 and 180, are engaged in the groove in the male clutch piece 186, on the twisting shaft 153, an endwise, rearward, sliding movement of the clutch piece 186, is in effect, to the extent of engagement of the male clutch piece 186 in the female clutch piece 152. In the movement of the clutch piece 186 a like action is in evidence on the links 187, which are connected to the clutch piece 186 by the screws 188, and the other end of the links 187, being con-

nected to the tail of the guard bracket 192 by the screws 189, they are instrumental in a counter-clockwise rotation of the guard bracket 192 on its axis, the mounting screws 194. The guard plate 196 is an integral part of the guard bracket 192, which, at the end of their counter-clockwise movement, provide a guarding means over the form to prevent the curved section of the rod of dough, when it is in the U shape, from moving out of place around the form. The guards 192 and 196 have attained their guarding position at the same time as the clutch piece 186 is completely engaged with the clutch piece 152, which is the end of the engaging movement or the arrangement of the movement parts and cam 18, as seen in the skeleton drawing in Figure 16. When this position of the movement has been reached, to retain it, the cam 18, still revolving, has reached a section of the cam track, which is the dwell, following the lobe C.

At the completion of the twisting clutch engagement, the twisting movement is substantially ready for operation, as it will be recalled from the construction. The clutch piece 186 revolves with the shaft 153 because of its longitudinal key 159 connection, and the clutch piece 186 is engaged with the clutch piece 152, which, in reality, is the driven bevel gear of the twisting movement, and is free running on the shaft 153, when the clutch is not engaged. At the uppermost ends of the yoke arms 179 and 180, and attached between them, is the tie rod 183 which contacts a flat surface on the top side of the clutch piece 186, when the clutch is disengaged, thereby preventing any rotation of the twisting shaft. When the arms 179 and 180 rotate clockwise to engage the clutch, the tie rod 183 moves out of contact with the flat surface of the clutch piece 186 to a position in the groove of the clutch piece 186, which provides a clearance for the rod 183, when the twisting shaft 153 and the clutch piece 186 rotate. When the guard pieces 192 and 196 are in their guarding position, the studs 195, which are attached to the guard bracket 192, contact the top surface of the stripper plate 283, to prevent any counter-clockwise rotation of the stripper plate 283 on its axis, the studs 286, while going through the twisting operation.

Again, with reference to the carriage moving frontward, the carriage was passing the front edge of the stripper plate 283; the table 219 is in the upraised level position, the guard plates 192 and 196, with the studs 195 are in the guarding position; the twisting clutch is engaged in preparation of the twisting operation; the rod of dough is being extruded, its central section first, through obstruction by the form pins 289, from the rear side of the central opening on the bottom of the carriage magazine 101; the long legs of the rod of dough are being guided by the adjustable guide pieces 104 and 105, which are assisting in the formation of a substantial U shape; the long legs of the rod of dough as they come from the carriage magazine are being supported by the table 219.

When the carriage in its frontward movement reaches a position to the rear of the finishing plate 326, the cam 125 on the slide members 118, assembled on the magazine support bracket 87, contacts and cams upward the roller 347 on the gear segment 370, which rotates clockwise on its mounting screw 372, and being meshed with the gear 377, integrally mounted on the shaft 376, it imparts a counter-clockwise rotation to the shaft 376, which carries the integrally mounted gripping

finger 378, moving the finger 378 on its axis until the finger is to the left far enough for the admittance of the left end of the rod of dough in a space to the left of the stationary finger, which is an upward extended section of the bracket 363. The cam 126 on the slide members 118, assembled on the magazine support bracket 88, contacts and cams upward the roller 347 on the gear segment 371, which rotates counter-clockwise on its mounting screw 372, and being meshed with the gear 377 integrally mounted on the shaft 376, it imparts a clockwise rotation to the shaft 376, which carries the integrally mounted gripping finger 378, moving the finger 378 on its axis until the finger is to the right far enough for admittance of the right end of the rod of dough, in a space to the right of the stationary finger, which is an upward extended section of the bracket 364.

The cam 123 on the slide members 118, assembled on the magazine support bracket 87, contacts the rounded head of the roller mounting rivet 348 on the cam arm 344, and the cam 123 on its slides, the members 118, moves to the left to avoid a cam movement of the roller 347 and the arm 344, which are non-operating when the carriage moves frontward. The cam 124 on the slide members 118, assembled on the magazine support bracket 88, contacts the rounded head of the roller mounting rivet 348 on the cam arm 345, and the cam 124 on it slides, the members 118, moves to the right to avoid a cam movement of the roller 347 and the arm 345, which are non-operating when the carriage moves frontward.

The cams 125 and 126 are a length suitable for retaining the gripping fingers 378 in the open position while the carriage continues its movement frontward. The elastic pieces 114, which are attached to the front of the carriage magazine bottom pieces 104 and 105, by the screws 115 pass through the opening left by the gripping fingers 378 for the purpose of removing the sheared ends of the previously formed pretzel, the ends being pushed toward the front of the machine and dropping into the bin 390 to be worked over again into rods of dough.

When the carriage has reached its extreme frontward position, the long legs of the U-shaped rod of dough are completely withdrawn from the opening in the bottom of the magazine 101, and they have fallen in the spaces between the gripping fingers and the stationary fingers, where the sheared ends of the previously formed pretzel were removed. The cams 125 and 126 have released the gear segments 370 and 371, and their actions are reversed by the tensions of the springs 383, with the result the gripping fingers 378 have reversed their movements until they are in contact with and gripping the ends of the U-shaped rod of dough, as seen in Figure 7. The cams 123 and 124 are released from their non-operating position, and they are pulled into an operating position, and held there by the springs 128.

The arrangement of the carriage movement parts and their cam 15 now are positioned as seen in the skeleton drawing in Figure 14. When this position of the movement has been reached, to retain it, the cam 15, still revolving, has reached a section of the cam track which is the dwell, following the lobe A.

Since the ends of the U-shaped rod of dough are held by the gripping fingers 378, and the curved section of the U-shaped rod of dough are entwined around the form, which constitutes the series of pins 289, held in place by the guards 192 and 196, and supported by the stripper plate

283, we have no further use for the support table 219. The table 219 movement cam 17 has now reached the end of the dwell, following the lobe F, and, still revolving, comes to the lobe E, which is the push lobe, and causes a movement of the cam lever 204, which is a reversal of the previously described motions, bringing the table 219 to a normal position, as seen in the skeleton drawing in Figure 18. When this position of the movement has been reached, to retain it, the cam 17, still revolving, has reached a section of the cam track, which is the dwell following the lobe E.

The rod of dough now has the shape as shown in Figure 2, and the machine is prepared for the start of the twisting operation. Referring particularly to Figure 20, the twisting movement parts are in the normal or non-operating position. Their movements are controlled by the cam 19 on the drive shaft 9, and it is at the end of the dwell that follows its pull operation against the cam roller 139 and the gear segment 142. When the cam 19 revolves counter-clockwise, the lobe G, which is the push lobe, exerts a push action against the cam roller 139, and the tail of the gear segment 142, causing a clockwise rotation of the gear segment 142 on its axis, the mounting screw 143. The teeth of the gear segment 142 are meshed with the teeth of the gear 148, which is integrally attached to the bevel gear 149, thus causing a counter-clockwise rotation of the gears 148 and 149 on their axis, the screw 150. The teeth of the bevel gear 149 are meshed with the bevel gear teeth of the female clutch member 152, and through its engagement with the male clutch member 186, which is in engagement with the shaft key 159, provide the means for the clockwise rotation of the twisting shaft 153 and all parts assembled or supported thereon. This would include the slide rack 262, the form assembly support bracket 263, the complete form assembly, which would constitute such parts as the stripper plate 283, the form plate 287, and its form pins 289, the guard plate 196, the guard bracket 192, the links 187 and the clutch member 186. This rotation is one complete revolution and is necessary to make the complete twist of the two long legs of the substantially U-shaped rod of dough, at a position on the two long legs which is substantially central between the curved section and their gripped ends, as seen in Figure 8. While this revolution is taking place, the groove in the clutch member 186 provides a clearance for the rod 183 and the rollers 184, assembled to the yoke arms 179 and 180, and the slide rack 262 is prevented from moving longitudinally in the shaft 153 by engagement of the thrust plates 160 and 161 with the slot K, of the slide rack 262.

There are a series of grooves in the twisting shaft 153 which are suitably shaped to provide clearance for the teeth of the gear 260 which are engaged with the teeth in the bottom of the sliding rack 262. The sliding rack 262 is a component part of the twisting shaft 153 and, therefore, moves in rotation with the shaft when performing the twisting operation. When the sliding rack 262 moves out of engagement with the gear 260, the grooves in the shaft 153 move into engagement, thereby preserving the teeth alignment of the gear 260, facilitating a retention of perfect timing for the slide rack 262.

As the two long legs of the rod of dough entwine in the formation of the twist, there is no release of the tension on the dough which natu-

rally accumulates from the twisting. This is important in the formation of a tight twist so as to cause an adhesion of the doughs where they contact each other.

The rod of dough now has the shape shown in Figure 3, and the machine is prepared for the start of the folding operation.

Referring particularly to Figure 22, the folding movement parts are in the normal or non-operating position. Their movements are controlled by the cam 20 on the drive shaft 9, and it is at the end of the dwell that follows its pull operation against the cam roller 228 and the cam lever 231. When the cam 20 revolves counter-clockwise, the lobe I, which is the push lobe, exerts a push action against the cam roller 228 and the cam lever 231, causing a clockwise movement of the cam lever 231 and its axial bearing 232 on their axis, the mounting screw 233, attached to the screw adjusting mounting block 235, which is supported in a slot of the adjustable mounting block 236. The clockwise rotation of the cam lever 231 through its connection to the gear segment 254 by the connecting screw 252, delivers a clockwise movement to the gear segment 254 on its axis, the mounting screw 255. The clockwise rotation of the gear segment 254 because of its teeth being meshed with the teeth of the gear 257, which is integrally mounted on the shaft 259, causes a counter-clockwise rotation of the gear 257 and the shaft 259. Since the gear 260 is also integrally mounted on the shaft 259, it also rotates in counter-clockwise motion. The gear 260 is located directly under the twisting shaft 153 and the slide rack 262, and its teeth are meshed with the rack teeth on the bottom side of the slide rack 262 and thereby impart a frontward longitudinal slide movement to the sliding rack 262 while the twisting shaft 153 serves as its support.

At the start of the frontward sliding movement of the slide rack 262, it passes through the slot in the bottom thrust plate 161; the slot corresponds in width to the width of the slide rack 262. The sides of the slot are in moving contact with the sides of the sliding rack 262 during the folding operation, and this prevents any rotation of the shaft 153 which would tend to move out of transverse level position, the form assembly. If by any chance the sliding rack 262 is not in perfect alignment with the slot in the plate 161, the cam surfaces at the rear of the slot K, in the bottom of the slide rack 262, would contact the beveled sides of the slot in the plate 161, and as the frontward longitudinal movement would progress the cam action would align the slide rack 262, suitable for passing through the slot in the plate 161. After the folding movement has progressed far enough, so that the slide rack 262 has entered the slot in the plate 161, the twisting shaft 153 can not rotate and cause a misalignment of parts, therefore, the twisting clutch can now be safely disengaged, and the guard pieces 192 and 196 returned to their normal positions to prevent interference of the folding operation.

The twisting clutch movement cam 18, has now reached the end of the dwell following the lobe C, and, still revolving, comes to the lobe D, which is the push lobe, and causes a movement of the cam lever 167 which is a reversal of the previously described motions, disengaging and returning to the normal position the clutch member 186 and the guard pieces 192 and 196.

also the rod 183 which positions itself in contact with the top flat surface of the clutch member 186 to lock the twisting shaft 153 against any rotating movements. The movement is in the position shown in the Figure 16. When this position of the movement has been reached, to retain it, the cam 17, still revolving, has reached a section of the cam track, which is the dwell, following the lobe D.

Since the twisting clutch is disengaged, the twisting movement is prepared for a return to its normal position.

The twisting movement cam 19 has now reached the end of the dwell, following the lobe G, and, still revolving, comes to the lobe H, which is the pull lobe, and causes a movement of the gear segment 142, which is the reverse of the previously described motion, and instead of the clutch member 152 rotating in unison with the formerly engaged clutch member 186 and the twisting shaft 153, it rotates freely on the shouldered collar bearing 155, on the twisting shaft 153, without causing any movement whatsoever of the twisting shaft 153 and its component parts. The clutch member 152 has reverse rotated one revolution to the position it was prior to the twisting operation, this being also true of the whole twisting movement. This position is seen in the Figure 20. When this position of the movement has been reached, to retain it, the cam 19, still revolving, has reached a section of the cam track, which is the dwell following the lobe H.

As the slide rack 262, and its component parts, the form assembly, which is supporting the curved or loop section of the rod of dough, continue their movement frontward, that section of the rod of dough which is between the gripping fingers 378, and the front edge of the stripper plate 283, is released from the tension it acquired while going through the twisting operation, and from its own weight it sags into the open space that the table 219 was removed from, and accepts a natural fold which gradually completes itself as the movement progresses to a finish. As the slide rack 262 and the form assembly continue their movement frontward, the cam rollers 291, on the form plate 287 contact the curved sections of the cams on the rear edges of the cam brackets 322 and 321, and as the rollers follow the cams, the complete form assembly supporting the loop section of the rod of dough rotates counter-clockwise on its transverse axis, the studs 286 attached to the stripper plate 283, until the form assembly and the loop section of the rod of dough are at right angles to their former level position, thereby assisting in the completion of the fold of the rod of dough. During this movement, the loop section of the rod of dough is still being retained and supported by the stripper plate 283, and the form, which is the form pins 289.

It was mentioned previously that the protrusion of the form pins 289, through and above the stripper plate 283, was controlled by the cam rollers 295 on the form plate 287 being engaged with the cams 276 and 277, also the dogs 268 which are assembled on the form assembly support bracket 263.

Referring in particular to Figure 41, the form assembly is in the level position, the form pins 289 are extended upward above the stripper plate 283, the cam rollers 295 are disposed in the lower section of the cam slots in the cams 276 and 277, and as the form assembly rotates coun-

terclockwise on its axis, the studs 286, the cam rollers 295 follow the cam path until they contact the cam edge surface of the dogs 268, and as the rotation continues the cam rollers 295 follow these cam edge surfaces of the dogs 268, until the form assembly in rotation has arrived at a position substantially at right angles to the level position, and the cam rollers 295 have arrived at the end of the cam edge surface of the dogs 268 where the rollers 295 leave the cam edge surface of the dogs 268, and from the expanding force of the four coil springs 297 enter and move to the bottoms of the spaces L, which are structural formations of the cams 276 and 277 in combination with the dogs 268. When the cam rollers 295 enter and move to the bottoms of the spaces L, see Figure 33, the form plate 287, with its large cylinders 288, sliding on the smaller cylinders 298, and the rivets 299, which are integral parts of the stripper plate 283, moves away from the stripper plate 283 a distance sufficient for extracting the form pins 289 from support and contact of the loop section of the rod of dough, and to a position where the pins 289 are flush with the top surface of the stripper plate 283.

The extraction of the form pins 289 from the loop section of the rod of dough takes place at the same time as the slide rack 262, and the form assembly are finishing their frontward movement, so that the curved section of the rod of dough contacts the two legs of the rod of dough at a position in register with the depressor plates 339 and 338. The two legs of the rod of dough, when the folding operation was taking place, of their own gravitation, positioned themselves diagonally downward over the rear surface of raised depressor plates 339 and 338 in preparation for contact of the curved section of the rod of dough.

The frontward movement of the slide rod 262 and the form assembly is not complete until enough pressure is exerted by the stripper plate 283 against the curved section of the rod of dough, to cause an adhesion to the two legs of the rod of dough, which are backed to receive this pressure by the rigidly supported raised depressor plates 339 and 338, and the finishing plate 326. Since the stripper plate 283 is perfectly smooth, and the raised depressor plates 339 and 338 are similar in formation to the human thumb, the characteristics of the formed rod of dough at this stage of the pretzel formation are likened to those of the hand made.

It is evident that all sizes and types of pretzel dough are used in the formation of pretzels, and this would cause a variation in the adhesion of the two legs and curved section of the rod of dough, if the machine were only able, through its folding movement, to exert one standard pressure. We have, therefore, provided a manual adjustment, which permits setting of the fold movement parts so they will produce a frontward movement of the slide rack 262 a distance that will conform with that distance which is required for the pressure necessary for causing adhesion of the doughs being operated upon, and when the adjustment is made to conform with the requirements for a specific type or size of dough that pressure will be uniform on that type or size of dough until such time as it would be again changed manually.

The manual adjusting knurled knob 241, rigidly attached to the extension rod 238, with the lock nut 242, to increase the pressure, is turned

clockwise. The rod 238 is free turning, and extended diagonally downward through the bushing 240, rigidly inserted in the lower section of the support of the drive shaft 9 left journal, where it is rigidly attached to the fine threaded screw 237, which is rotated clockwise in its supporting means the movable mounting block 236. The screw 237 passes through and its fine threads are meshed with the fine threads in the hole of the block 235, which is slidably fit and supported in the slot of the movable mounting block 236. Since the axis, the screw 233, of the cam lever 231, and the shouldered axial block 232, is attached to the block 235, then with a clockwise rotation of the screw 237, the block 235 moves diagonally upward in the slot of the block 236, moving the axis 233 and the axial block 232 diagonally upward in the slot of the cam lever 231. This, in reality, is nothing more than a change in the rotation center of the cam lever 231, which in effect creates a greater movement of the lower end of the cam lever, and on through the operating parts of the movement to the increased frontward stroke movement of the slide rack 262, and subsequent increased pressure of the stripper plate 283 against the dough. A reverse rotation of the knob 241 results in less pressure on the dough.

The horizontal center line of the depressor plates 339 and 338, the center line Y in Figure 4, and the horizontal center line of the rotation of the form assembly are on the same level so that when the pressure of the stripper plate 283 is exerted against the dough there is no undue strain on the form assembly that would tend to move it from its right angled position. As can be seen in Figure 33, when the form assembly is in the right angle position the pressure of the slide rack 262 and the support bracket 263 is not against the axial studs 286 of the stripper plate 283, but it is at the point where the rounded ends of the support bracket 263 arms contact the bottom of the stripper plate 283. When the fold movement and the form assembly have completed the fold operation we find the parts positioned as seen in Figure 23.

Having completed the folding of the rod of dough and the attachment of the curved section of the rod of dough to the two legs of the rod of dough, the folding movement, and its component parts, are now ready to be returned to their normal positions. When this takes place, the form assembly does not change its right angled position in any way on the support bracket 263.

When the folding movement returns and the form assembly moves rearward, away from the finishing plate 326, the loop section of the rod of dough stays attached to the two legs of the rod of dough while the stripper plate 283 breaks contact with it and moves rearward away from it. This leaves the almost finished pretzel suspended by its two ends, which are being held by the gripping fingers 378 adjacent to the rear side of the finishing plate 326, as seen in Figure 9. Its shape is retained by its natural structural formation and the adhesion of the doughs where they contact each other.

Referring to Figure 23, the folding movement cam 20 has reached the end of the dwell, following the lobe I, and, still revolving, comes to the lobe J, which is the pull lobe, and causes a movement of the cam lever 231, which is the reverse of the previously described motion, and its reverse effect on the component parts of the movement results in the slide rack 262, moving in a

rearward longitudinal direction, until it has returned to the normal or non-operating position, as shown in Figure 22. When this position of the movement has been reached, to retain it, the cam 20, still revolving, has reached a section of the cam track, which is the dwell following the lobe J.

The pretzel is finished in all respects except the shearing of the excess ends, that is, the ends by which it is suspended. This operation takes place when the carriage makes its rearward movement of the reciprocating action.

Just prior to the arrival of the folding movement parts to the normal or non-operating positions, the carriage starts its movement from front to rear.

Referring to Figure 14, the skeleton drawing shows the carriage at the start of its movement from front to rear. The carriage cam 15 has reached the end of the dwell following the lobe A, and, still revolving, comes to the lobe B, which is the pull lobe, and causes a movement of the cam lever 42 which is the reverse of the previously described motion, and its reverse effect on the component parts of the movement results in the carriage moving from front to rear.

At substantially the start of the carriage front to rear movement the two ends of the pretzel are sheared off flush with the outside of the curved section of the pretzel. Since the gripping fingers 378 are positioned above the shears, and the pretzel is suspended by its two ends, which are held by the gripping fingers, then the natural suspended position places the pretzel and its two legs in a correct vertical alignment with the shear blades 356, 359, 357 and 360, so that when the shear blades 359 and 360 are operated the pretzel is severed from the two legs, and the finished pretzel leaves the machine, curved section up, by dropping down through the space between the front edge of the table 219 and the rear surface of the finishing plate 326, on to the curved unloading chute 387 with the top side of the pretzel up. The speed attained during the dropping is responsible for the sliding of the finished pretzel on the chute 387, which is suspended under the bin 390 and extends to a position in front of the machine, where the pretzel leaves the chute 387 to be dipped, salted and baked. See Figure 10.

In the movement of the carriage from front to rear, the cam 123 on the sliding supports 118, assembled on the carriage bracket 87, is in alignment with and contacts the cam roller 347 on the tail of the cam arm 344, pushing the cam roller 347, and the tail of the cam arm 344, downward, thereby causing a counter-clockwise rotating movement of the cam arm 344 on its mounting screw 346. The bifurcated end of the cam arm 344 straddles the stud 355, which is an integral part of the sliding rack member 349, and the rotating action of the cam arm 344 imparts a sliding movement diagonally upward to the rack member 349 on its mounting screws 351 and 352. The teeth of the rack member 349 are meshed with the gear teeth on the movable shear blade 359, thereby causing a counter-clockwise rotation of the shear blade 359 on its axis, the shoulder screw 361. The shear blade 356 is stationary, and when the shear blade 359 is rotated in cooperation with the stationary blade 356, there is accomplished a very satisfactory shearing of the left leg of the pretzel, adjacent to and flush with the outside of the curved section of the pretzel. The cam 124 on the sliding sup-

port 118, assembled on the carriage bracket 88, is in alignment with and contacts the cam roller 347 on the tail of the cam arm 345, pushing the cam roller 347 and the tail of the cam arm 345 downward, thereby causing a clockwise rotating movement of the cam arm 345 on its mounting screw 346. The bifurcated end of the cam arm 345 straddles the stud 355, which is an integral part of the sliding rack member 350, and the rotating action of the cam arm 345 imparts a sliding movement diagonally upward to the rack member 350, on its mounting screws 351 and 352. The teeth of the rack member 350 are meshed with the gear teeth on the movable shear blade 360, thereby causing a clockwise rotation of the shear blade 360 on its axis, the shoulder screw 361. The shear blade 357 is stationary, and when the shear blade 360 is rotated in co-operation with the stationary blade 357, there is accomplished a very satisfactory shearing of the right leg of the pretzel, adjacent to and flush with the outside of the curved section of the pretzel.

The cams 123 and 124 operate the separate shears mechanism simultaneously so that when the ends of the pretzel are sheared there will be no relative change in the position of the pretzel to the finishing plate 326 during its drop movement from the suspended position until its bottom side contacts the curve of the chute 387. After the finished pretzel contacts the chute 387 surface, it is prevented from changing its relative position by the longitudinal parallel corrugations in the chute.

The elastic pieces 114 on the front side of the carriage magazine bottom pieces 104 and 105 will bend and drag over the gripping fingers without any operative effect.

The cam 125, on its slide members 118, assembled to the bracket 87 and the cam 126 on its slide members 118, assembled to the bracket 88, contact the rounded heads of the cam roller studs 348 on the cam arms 370 and 371, and the cams 125 and 126, with the slide members 118 sliding on the mounting screws 120 and 122, move out of alignment with the cam rollers 347 and the cam arms 370 and 371, to a non-operating position as the gripping fingers movements do not operate on a front to rear movement of the carriage. As the carriage moves rearwards, beyond the gripping fingers movements, the cams 125 and 126 slide into their normal or operating position again through the pull tension of their four springs 128.

When the carriage has moved rearward enough to complete the operation of shearing the ends from the pretzel, the shear blades 359 and 360 are returned to their normal or non-operating positions by a reverse of the previously described motions of the shear mechanisms. This reverse action is accomplished by the tensions of the return springs 382.

The sheared ends of the pretzel, which are still retained by the gripping fingers 370, are not removed until immediately before the gripping of the ends of a new rod of dough, which takes place near the completion of the rear to front movement of the carriage.

The carriage, still continuing its movement from front to rear, causes the resetting of the form assembly to its level or normal position on its supporting bracket 263.

The cams 111 and 112, integrally attached to the cam plate 107, which is suitably mounted to the rear side of the carriage magazine 101,

with the screws 102 and 106, are in alignment with the cam rollers 285, which are assembled to the sides at a rear position on the stripper plate 283 with the rivets 284, when the form assembly is at the right angle position on its supporting bracket 263. During the rear movement of the carriage the cams 111 and 112 contact and force rearward the cam rollers 285 and the stripper plate 283 with its component parts, and in this way cause a clockwise rotation of the complete form assembly on its axis, the studs 286, attached to the stripper plate 283, and engaged in the slotted bearings in the arms of the support bracket 263. This rotating movement of the form assembly continues until it is in the level position for the receiving of a new rod of dough.

We have mentioned previously that the positions of the form pins 289, through and above the stripper plate 283, were controlled entirely by the form plate 287 and its cam rollers 295, which contact and are moved along the cam surface of the cams 276 and 277, also the dogs 268, their contact of the cam surfaces being caused by the expanding action of the four coil springs 297. Referring to Figure 33, the form assembly is at the right angled position with the cam rollers 295 contacting the bottoms of the spaces L. When the form assembly moves in clockwise rotation, the cam rollers 295 follow the cam surfaces of the cams 276 and 277, and when the cam rollers 295 move against the dogs 268, the dogs move out of interference by rotating counter-clockwise on their axis, the rivet 269. When the cam rollers 295 move beyond the dogs 268 the tension of the springs 270 are responsible for the return of the dogs 268 to their normal positions. The cam rollers 295 continue on the cams 276 and 277 until the cam rollers 295 are at the lower end of the cam, and when this position has been reached the form assembly is in the level position, and the form pins 289 are extended through and above the stripper plate 283, as seen in Figure 41.

The carriage rearward movement is completed, another rod of dough has been released from the hopper into the carriage magazine, the form assembly is in the level position for receiving the new rod of dough, the support table 219 has started its upward movement.

Referring again to Figure 14, the carriage movement cam 15 has reached the end of the dwell, following the lobe B, or the position from where the cycle of operation of the machine was started.

All of the movements described in the foregoing description take place in one cycle of the machine, which is one complete revolution of the drive shaft 9, and each revolution represents the complete formation of one pretzel ready for dipping, salting and baking. The rotary cams are so designed and assembled rigidly on the drive shaft 9 that they will assure positive operation of the various movements in the necessary sequence regardless of the speed at which the drive shaft 9 is operated.

The foregoing description does not necessarily cover the operation when forming any particular size, shape, weight or material of pretzel, as the operations are identically the same for all pretzels.

The following is a description of the necessary adjustments and the changes on our invention when it is desired to change from the production of one size pretzel to a different size. We will also describe the procedure in the selection of the proper form assembly to be attached to

our machine for producing a selected size or type of pretzel.

The sequence of the changes and adjustments would be as described in the following:

- 5 Our machine in operation would be stopped just immediately following the shearing of the two ends of the pretzel while the carriage is in the act of moving from front to rear.

- 10 While the machine is not in operation we proceed in the removal of the form assembly in the following manner:

- The machine attendant would stand at the rear of the machine, and with both his right and his left hands, he would release, by turning counterclockwise, the small knurled screws 271 until their piloted ends are removed from engagement with the cams 276 and 277. See Figures 32 and 34. This permits rotation of the cams 276 and 277 on the flanged studs 272 while the form assembly is going through its removal movements. The attendant grasps with both hands the form assembly, and, looking at Figures 32 and 34, moves it in counterclockwise rotation on its axis, the studs 286, until the form plate 287, and the stripper plate 283 are parallel with the slots in the arms of the support bracket 263, which is a position substantially forty-five degrees from the former right angled position. By referring to Figure 33, which is the position the form assembly was in prior to this last movement, the cam rollers 295 are disposed in the slot L, therefore, since the cams 276 and 277 are permitted to rotate, they rotate in unison with the form assembly, being driven by the cam rollers 295. See Figure 34. The form assembly is moved diagonally downward, in a movement that is parallel in alignment with the diagonal slots 263A, until the studs 286 are released from engagement with the diagonal slots. The form assembly is then moved toward the front, until the studs 286 are in diagonal alignment with the front ends of the extended arms of the support bracket 263, the cam rollers 295, moving out of the spaces L until they contact the circular edges of the cams 276 and 277. The form assembly is now moved bodily in a direction that will allow the cam rollers 295 to move upward while they keep contact with the circular edges of the cams 276 and 277, the cam rollers 295 passing out through the spaces M of the cams 276 and 277, until the entire form assembly is clear and free of the arms of the support bracket 263, and the cam rollers 295 are free of any engagement with the cams 276 and 277. The form assembly is now removed and is laid aside and the cams 276 and 277 are in the positions shown in Figure 34.

We are now ready for the selection of a different form assembly, and in so doing, we are guided by the following procedure:

- 60 It is to be distinctly understood that a series of form assemblies, each of them being different in the arrangement of the form pins 289, are included as parts of our machine. The arrangement of the form pins 289 on each assembly represents a different size or shape of pretzel and the pretzel manufacturer would be supplied with one form assembly, with the required form pins 289 arrangement for each different size and shape of pretzel he desires to manufacture. It is not necessary to change the form assembly when only the diameter of the rod of dough is different, as the only required change of the machine would be the manual adjustment, to increase or decrease the pressure for attachment of the curved section of the rod of dough to the legs.

A line drawn transversely across the stripper and form plates in a center alignment with their rotating axis, the studs 286, we will designate for descriptive purpose, the form center line. In referring to Figure 4, line Y, of the pretzel, is identically the same as the form center line, regardless of the size or shape of the pretzel. The distance on the form assembly, between the form center line and the front edges of the stripper and form plates should be identical with the dimension X between lines Y and Z of the pretzel. The dimension over all of the width of the form, that is, the form pins 289 arrangement, should be identical with the dimension U of the pretzel. The dimension V of the pretzel is of no value when selecting the form assembly, as it is automatically taken care of in the machine's main adjustment. Having selected the form assembly by the above methods, we are now ready to proceed with the adjustment of the machine, which has a definite relation to the dimension W of the pretzel.

The form assembly is not attached to the support bracket 263 at this time.

The knurled lock nut 199 on the stud 198 on the guard plate 196 is now released, and the guard plate 196 is moved downward, by sliding in the slots of the guard bracket 192 until the upper edge of the plate 196 is flush with the upper edge of the bracket 192. The knurled lock nut 199 is again screwed tight.

We now refer in particular to Figure 38. Our machine is now operated to the position just immediately before the gripping of the ends of the rod of dough and the ends support table 219 is in the upward level position, where it is again stopped. The attendant, still standing at the rear of the machine, releases the locking hand nut 309 on the adjusting screw 300. Grasping the handle 306 on the hand wheel 303, the wheel 303 is rotated clockwise if the pretzel you intend producing is smaller than the previously produced pretzel, and counter-clockwise if the pretzel you intend producing is larger than the previously produced pretzel. For descriptive purposes we will presume that the attendant wishes to produce a smaller size pretzel than the previously produced pretzel.

The hand wheel 303 and the adjusting screw 300 to which it is rigidly attached, both are rotated clockwise. The screw 300 is prevented from movement in a longitudinal direction by its thrust collars 301. The screw 300 passes through a hole in the screw plate 308, and the threads of the screw are engaged with the threads in the hole of the screw plate, so that when the screw 300 is rotated clockwise, the screw plate 308 moves rearward on the screw, a distance equivalent to the lead of the screw and the number of rotations required for the complete adjustment. The slide rods 311 and 310 are rigidly attached to the screw plate 308 and extended frontward through several walls of the main casting 1, and are attached rigidly to the tie plate 313, which is the means of rigid connection to the slide bars 315 and 314, and moves in a longitudinal rearward direction in unison with the screw plate 308. There are a number of parts assembled on the slide bars 315 and 314 which also move in unison with the last described connecting parts. The parts referred to and the effects of their movements are as follows:

The cam brackets 322 and 321, through their connections with the support table 219, cause a sliding movement of the table 219 on its supporting bracket 220, sliding being permitted by 75

the table 219 longitudinal slots and its mounting rivets 224, and in this way retaining the same relation of the front edge of the table 219 to the finishing plate 326, regardless of the size of the pretzel. The cams on the rear edges of the cam brackets 322 and 321 also receive their proper positions in relation to the folding movement adjustment. The complete finishing plate assembly with its component parts, the gripping fingers and the shears movements, which are all assembled on the assembly plate 324, also move in unison, and since the cam rollers 329, on the corners at the bottom of the finishing plate 326, are engaged in the diagonal cam slots of the cams 332 and 331, this causes a downward movement of the finishing plate 326, and the finishing plate 326 diagonal cam slots cause a transverse movement toward the center of the machine of the brackets 334 and 335, which is responsible for the fingers and shears movements adjustment to their proper transverse positions while the longitudinal movement of the assembly plate 324 is responsible for the longitudinal positions of the fingers and shears movement, also the finishing plate 326. Since the brackets 334 and 335 are connected to the slide rods 342, and they are parts of the assembly of the carriage magazine bottom pieces 104 and 105 assembled supporting means, then as the brackets 334 and 335 move transversely toward the center of the machine, the brackets 95, 96 and 97 slide on their support rods 99, carrying the assembled brackets 87 and 88 sliding on the rods 78 and the carriage bottom pieces 104 and 105 also move transversely toward the center of the machine and in this way the opening in the bottom of the carriage magazine 101 is adjusted, the guides on the pieces 104 and 105 are adjusted for extrusion of the rod of dough from the magazine 101, and the cams 123, 124, 125 and 126 receive their proper alignment to correspond with the adjusted position of the fingers and shears movements.

We remind you at this time that in the adjustment of the magazine bottom pieces 104 and 105 the distance between the bell mouths of these pieces at the rear of the magazine corresponds to the dimension W of the pretzel. See Figure 4.

The bin 390 and the unloading chute 387 also move in adjustment longitudinal to retain their relations with the finishing plate assembly.

The indicator 319 moves in longitudinal movement also and registers at intervals with scribed and marked lines on the gib plate 317. When the form assemblies are constructed, they are given stamped marks of identification. The scribed lines on the gib plate 317 represent the stopping points when adjusting and they are marked with identification marks that are identical with those on the form assemblies, therefore, when a form assembly is selected, by reading its identification mark and then adjusting the machine until the indicator 319 registers with the scribed line of a like marking, the machine will then be adjusted to its proper position for that particular form assembly.

Referring to Figure 14, the teeth on the bottom side of the slide rod 310 are meshed with the teeth of the gear 53, thus with the rearward movement of the slide rod 310, the gear 53 is rotated clockwise, and since the gear 53 is integrally mounted on the shaft 50 and the small gear 51 is likewise mounted on the shaft 50, they, too, rotate in clockwise motion. The teeth of the small gear 51 are meshed with the rack teeth

on the movable mounting block 45, thereby causing a diagonal downward sliding movement of the block 45 on its mounting screws 46 in the diagonal slots of the mounting bracket 48. We have mentioned previously that the axial screw 44, and the axial bearing 43, the mounting means and axis for the cam lever 42, are assembled on the block 45, therefore, when the block 45 moves diagonally downward, the axis of the cam lever 42 is changed sufficiently to cause a movement of the lower end of the cam lever 42 when operating that will produce the required reciprocating movement of the carriage necessary in the production of the pretzel in question.

Referring to Figures 22 and 23, the teeth on the bottom side of the slide rod 311 are meshed with the teeth of the gear 250, thus with the rearward movement of the slide rod 311, the gear 250 is rotated clockwise, and since the gear 250 is integrally mounted on the shaft 249, and the smaller gear 247 is likewise mounted on the shaft 249, they, too, rotate in clockwise motion. The teeth of the small gear 247 are meshed with the rack teeth on the movable mounting block 236, thereby causing a diagonal downward sliding movement of the block 236, on its mounting screws 243, in the diagonal slots of the mounting bracket 245. We have mentioned previously that the axial screw 233, and the axial bearing 232, the mounting means and axis for the cam lever 231, are assembled on the adjustable block 235, which is disposed in a slot of the block 236, therefore, when the block 236 moves diagonally downward, the axis of the cam lever 231 is changed sufficiently to cause a movement of the lower end of the cam lever 231, when operating that will produce the required reciprocating movement of the slide rack 262, and the form assembly, necessary in the production of the pretzel in question. When the block 236 makes its movement the pressure adjustment screw extension 238 slides endwise in its support bushing 240. The clockwise adjusting movement of the hand wheel 303 is now complete, therefore, the hand locking nut 309 is tightened against the screw plate 308 to eliminate any change in the adjustment while the machine is in operation.

When making adjustments for producing a larger sized pretzel than the previously produced pretzel, the hand wheel 303 is rotated counterclockwise, with the result that all of the previously described motions of the adjusted parts will reverse their actions.

The machine is now operated again until the original stopped position has been reached, that is, just immediately following the shearing of the two ends of the pretzel, while the carriage is in the act of moving from front to rear.

While the machine is not in operation we proceed with the attachment of the selected form assembly to the arms of the support bracket 263. The attendant, still standing at the rear of the machine, grasps the form assembly with both hands, holding it in the position shown in Figure 34, with the cams 276 and 277 in the position shown in Figure 34, and the various movements described in the removal are now followed in reverse action and sequence and when the form assembly has reached the right angle position on the support bracket 263, it is continued in rotation on its axis until it is in the level position on the support bracket 263, and finally the knurled screws 271 are screwed tight into the cams 276 and 277 to retain them in their operative positions.

The machine is now operated again until a position, which is the start of the twisting movement, is arrived at, where the machine is again stopped.

5 The knurled lock nut 199 on the stud 198 on the guard plate 196 is released, and the guard plate 196 is moved frontward, by sliding in the slots of the guard bracket 192 until the front edge of the guard plate 196 is flush with the front edges of the form plate 237 and the stripper plate 233. The knurled lock nut 199 is again screwed tight.

The shock absorbed studs 137 are adjusted to a position in the slots of the brackets 139 and 129, which will conform to the carriage reciprocation.

The machine is now ready to be operated, and while in operation the hand knob 241 is turned to obtain the required pressure for the particular size of dough being formed.

From the foregoing it is believed that the construction and operation of the various parts, the adjustments and changes of the machine, and the advantages of our compact machine will be 25 apparent, and in conjunction therewith it is again pointed out that any number of these units may be set up and operated, depending on the quantity of production desired; however, it is to be understood that each can operate in the conformation of a different size of pretzel without affecting the operation of the other, although they may all be operated by a common power element or may be operated with each having its individual power element.

35 It is again pointed out that changes may be made in size, form, shape, mechanical arrangement, and construction of the parts without departing from the spirit of our invention or its broad concept. Furthermore, while a single unit machine of a certain number and arrangement of parts and operating and adjustment structure has been shown and described herein, it is manifest that variations in practical application will dictate and perhaps necessitate changes in timing, organization and the like, to conform to necessities of production and shop practice, therefore, in interpreting the scope of our invention, reference is to be had to the subjoined claims:

50 We claim:

1. In a pretzel making machine having a hopper into which rods of dough are delivered, a movable carriage beneath the hopper, means associated with the hopper and carriage to release 55 a rod of dough from the hopper to the carriage at the commencement of the operation of the machine, a forming device mounted for both turning and reciprocating movement, and located beneath the carriage at the commencement of the operation of the machine, said carriage having an opening above the forming device so that a rod of dough is supported at its ends by the carriage and intermediate its ends by the forming device, said carriage being movable with respect to the forming device to bend the dough about the forming device to give it a substantially U-shaped conformation, a finishing plate, means adjacent to the finishing plate for grasping the ends of the dough, a cover and retaining element for holding the curved portion of the U shaped rod of dough on the forming device, drive means including a cam shaft, cams on the cam shaft, and means operatively associated with cams on the shaft for moving the carriage to 75 give the dough a U-shaped configuration on the

forming device, for raising and lowering the cover and retaining element to retain and release the dough on the forming device, and for turning and reciprocating the forming device to give the dough body a twist between the curved portion and the ends and carrying the looped portion to the finishing plate for disposition on the legs of the dough body to form the shape of a pretzel, and means for releasing the pretzel from the forming device and clipping the ends to release the completed pretzel from the machine. 10

2. In a pretzel making machine having a hopper into which rods of dough are delivered, means beneath the hopper for receiving a rod of dough, a forming device mounted for both 15 turning and reciprocating movement, and located beneath the receiving means to receive that portion of the rod of dough between its ends at the commencement of the operation of the machine, the first mentioned means being movable with respect to the forming device to carry the ends of the rod of dough away from the forming device to dispose the dough body about the forming device in a substantially U-shaped configuration, means for holding the 25 dough body on the forming device, a finishing plate, means adjacent to the finishing plate for grasping the ends of the U-shaped dough body, means for turning the forming device to twist the dough body between the curved portion and the ends, means for moving the forming device to carry the looped part toward the finishing plate to place the loop on the legs in the shape of a nearly completed pretzel, means for clipping the ends of the formed pretzel, and means 35 on the forming device for releasing the pretzel therefrom, a cam shaft, cams on the shaft, and operative connections associated with the cams and the aforementioned elements to actuate the same. 40

3. In a pretzel making machine, means for receiving the portion of a rod of dough between its ends, means for clamping the ends, said first named means being mounted for turning movement and reciprocating movement, means for 45 shaping the dough body about the first named means to give it a substantial U-shape, means for holding the dough body on the first named means, and means for releasing the same therefrom, all of said means having a normal starting position at the beginning of the operation of the machine, and cam controlled operating members including a reciprocating shaft and a clutch element for, first, forming a loop in the dough, by rotating the curved portion to twist the legs, 55 second, moving the looped portion to the legs to form the configuration of a nearly completed pretzel, and third, returning said hereinbefore mentioned means to their normal starting position. 60

4. In a pretzel machine, a forming device mounted for reciprocating and turning movement, a movable member for bending a strip of dough about the forming device to give it a substantial U-shape, means for grasping the ends of the U-shaped dough body, a guard plate for holding the dough on the forming device, and movable to release the dough from the forming device, a finishing plate, and cam operated means 70 for turning the forming device to twist the dough body, and moving the forming device toward the finishing plate to dispose the loop on the legs to give the body the shape and configuration of a nearly completed pretzel, and 75

other cam devices for actuating the movable member and the guard plate.

5 5. In a pretzel machine, a forming device mounted for reciprocating and turning movement, a hopper for receiving a rod of dough, a movable member between the hopper and the forming device for receiving and forming a strip of dough about the forming device to give it substantially U-shape, a finishing plate, means
10 adjacent to the finishing plate grasping the ends of the U-shaped body of dough, a guard plate for holding the dough on the forming device, and movable to release the dough from the forming device, a movable supporting table for the
15 part of the dough body between the ends and curved portion, cam operating means for turning the forming device to twist the dough body between the ends and the curved portion, cam operating means for moving the forming device
20 to place the looped part on the legs in the shape of a nearly completed pretzel, and other cam devices for actuating the movable member, the guard plate and the supporting table as and for the purpose defined.

25 6. In a pretzel machine, a forming device mounted for reciprocating and turning movement, a hopper for receiving a rod of dough, a movable member between the hopper and the forming device for receiving and forming a strip
30 or rod of dough about the forming device to give it substantially a U-shape, a finishing plate, means adjacent to the finishing plate for grasping the ends of the U-shaped body of dough, a guard plate for holding the dough on the forming
35 device, and movable to release the dough from the forming device, a movable supporting table for the part of the dough body between the forming device and the finishing plate, a cam shaft, and cams on the cam shaft having respectively operating elements connected with the
40 forming device, the movable member, the guard plate, and the supporting table, whereby same are actuated respectively, and means for clipping the ends of the dough, and for releasing the
45 nearly completed pretzel from the forming device.

7. In a pretzel machine, a forming device having a series of pins arranged to provide a form
50 for the looped portion of a rod like dough body, a stripper plate for leasing the loop from the pins, a hopper for receiving a rod of dough, a movable member for receiving the rod of dough from the hopper and forming it about the pins
55 to provide a dough body of substantially U-shape, a finishing plate, means adjacent to the finishing plate for grasping the ends of the U-shaped dough body, guard plate for holding the curved portion of the dough on the forming device, and
60 movable to release the dough from the forming device, a movable supporting table for the part of the dough body between the finishing plate and the forming device, and separate cam operated means carried on a common cam shaft for
65 actuating said forming device, movable member, guard plate and supporting table for the purpose defined.

8. In a pretzel machine, a hopper for receiving rods of dough suitable for forming a pretzel, a
70 forming device mounted for reciprocating and turning movement, a carriage mounted between the hopper and forming device for reciprocating movement and designed to form a strip or rod of dough on the forming device to assume a substantial U-shape, a finishing plate, means adja-

cent to the finishing plate for grasping the ends of the U-shaped body of dough, a guard plate mounted for rotating and hinged movement and cooperating with the forming device for holding a dough body thereon, and movable to release
5 the dough body therefrom, a movable supporting table for the part of the dough body between the forming device and the finishing plate, a cam shaft, and cams on said shaft, said cams being operatively and respectively connected with said
10 aforementioned elements to move said carriage, to turn said forming device to twist and form a loop in the dough body, to move said forming device to place the loop on the legs of the dough body on the finishing plate, to actuate said guard
15 plate, to actuate said supporting table, and to return all of said elements to initial position, and means for releasing said dough body when formed into the shape of a pretzel from the form assembly and clip the ends of the dough body to
20 release the same.

9. In a pretzel machine of the type designed to operate upon a rod or strip of dough, relatively movable parts for receiving and bending said
25 strip into substantially U-shape, one of said means being turnable to twist said body of dough to form a closed loop, means for retaining the ends of the substantially free legs of the dough body extending from the loop, and said turnable
30 means being reciprocable for placing the loop on the legs to form the shape of a nearly completed pretzel, and means for actuating the aforementioned parts.

10. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a plurality of relatively movable parts, a cam assembly
35 having operative connection with said parts, two of said parts being relatively movable and cooperating to form the rod of dough in substantially a U-shape, one of said parts being turnable, a finishing plate, means adjacent to the
40 finishing plate for grasping the ends of a U-shaped dough body, said turnable part adapted to twist the dough body and form a loop therein, said turnable part being movable toward the finishing plate to place the loop on the substantially
45 free legs of the dough body extending from the loop to form the shape of a nearly completed pretzel, and a plurality of cam actuated means including a clutch element and a reciprocating shaft, for actuating said several parts respectively, and means for clipping the ends of the
50 dough body when at the finishing plate.

11. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a plurality of relatively movable parts, a unitary
55 frame carrying said parts in assembled relationship to function as a unit, a cam assembly having operative connection with said parts, two of said parts being relatively movable and cooperating to form the rod of dough on one of said
60 parts into a substantial U-shape, a supporting table for the dough extending from the curved-shape to retain same as the two said parts are moved in cooperation to form the rod of dough into a substantial U-shape, a finishing plate,
65 means adjacent to said finishing plate for grasping the ends of the U-shaped body of dough, one of said parts being turnable to twist said dough body and form a closed loop therein, said turnable part being movable toward said finishing
70 plate to place the loop on the substantially free legs of the formed dough body in the form of a nearly completed pretzel, and means for releasing the dough body from said turnable plate,

and other means for clipping the ends of the dough body.

12. In a pretzel of the type designed to operate upon a rod or strip of dough, a plurality of relatively movable parts, a cam assembly having operative connection with said parts, two of said parts being relatively movable and cooperating to form the rod of dough into substantially U-shape, one of said parts mounted for both rotating and reciprocating movement, a finishing plate, a movable supporting member for the dough between the finishing plate and the rotatable parts when said dough is being formed substantially U-shaped, means adjacent to the finishing plate for grasping the ends of the U-shaped body of dough, said rotatable part adapted to twist the dough body and form a closed loop therein, said rotatable part being movable toward the finishing plate to place the loop on the free legs of the dough body to form the shape of a nearly completed pretzel, means for removing the dough body from the rotatable part, means for clipping the ends of the dough body to release the completely formed pretzel from the machine, and a guard plate operatively associated with the rotating part to retain the curved portion of the dough thereon during process of formation.

13. A pretzel machine comprising a drive element, a cam shaft, cams on the cam shaft, a hopper, a movable carriage beneath the hopper to receive a rodlike segment of dough, a forming device mounted for both rotational and reciprocal movement, a finishing plate, said forming device having removable and replaceable form assemblies designed to form pretzels of different sizes, said finishing plate adjustable toward and away from the hopper to accommodate different sizes of pretzels, connecting means from the respective cams to the operating parts, certain of which have adjustable centers to form pretzels of different sizes in conformity with the type of form assemblies used, said carriage cooperating with the forming device to form a body of dough having substantially a U-shaped configuration, means adjacent to the finishing plate for grasping the ends of the dough body, said forming device being rotatable to twist said dough body, a guard plate for holding said dough body on the forming device, said forming device being movable toward the finishing plate to place the loop, formed by twisting the dough, against the legs suspended adjacent to the rear of the finishing plate, means for releasing the dough body from the forming device, and means for releasing and subsequent means for removal of the ends of the dough from the grasping means.

14. A pretzel machine comprising a drive element, a cam shaft associated therewith, cams on the shaft, a plurality of movable parts actuated and controlled by said cams, one of said parts carrying a removable form assembly, said assembly being of predetermined size to form a pretzel of desired size, said latter part being mounted for both reciprocation and rotation, another part designed to receive a rod of dough and associated with the rotationally mounted part to produce a U-shape configuration of the dough body, said latter part turning to twist the dough body and movable toward the finishing plate to place the looped part on the legs to complete the form of a pretzel, and means for adjusting the relative operation of said parts with respect to each other whereby different form assemblies

may be used to form pretzels of various sizes on the same machine.

15. A pretzel machine comprising a drive element, a cam shaft associated therewith, cams on the cam shaft, a plurality of movable parts designed to bend a rod of dough into a U-shaped configuration, twist said dough body, and then press the looped portion of the twisted dough body on the substantially free legs of the formed dough body to nearly complete the shape of a pretzel, associated with said cams for actuation and control, and means whereby the operation of said parts may be adjusted to produce different sizes of pretzels, said means including a removable form assembly of a size to produce a given size pretzel.

16. A pretzel machine comprising a drive element, cam actuating and control means associated with said drive element, a plurality of movable parts operatively associated with said cam means respectively and designed to bend a strip of dough into substantially a U-shape, twist said body of dough, and then press the looped portion of the dough body against the substantially free legs of the formed dough body to nearly complete the shape of a pretzel, a removable form plate of a size depending on the size of the pretzel designed associated with one of said parts, and means whereby the degree of movement and the relationship of said parts may be adjusted to conform to the size of the form plate used in making a pretzel of predetermined size.

17. A pretzel machine comprising a drive element, cam actuating means associated with said drive element, a plurality of movable parts operatively associated with said cam elements respectively and including a reciprocal carriage, a rotatable and reciprocal forming device, a guard plate, and a supporting table, for bending a rod of dough into a U-shaped configuration, then twisting said dough body, and then pressing the looped portion of the twisted dough body on the substantially free legs of the formed dough body to nearly complete the shape of a pretzel, a finishing plate, and means whereby the operation of said parts may be adjusted individually and with respect to each other to produce pretzels of different sizes, said means including a removable form assembly for accommodating a pretzel of a predetermined size.

18. A pretzel machine having relatively adjustable dough receiving, bending, twisting, and loop positioning means designed for cooperative action to produce a pretzel, and adjusting means for said aforementioned receiving, bending, twisting and loop positioning means to produce pretzels of different sizes without modifying the structure of the machine or substitution of any of its working or actuating parts, said adjusting means including means for changing centers of operation of certain of said first mentioned means from a common control, and a removable form assembly for a pretzel of predetermined size.

19. A pretzel machine having a drive element, cam actuating means associated with the drive element and including a plurality of cams on a common cam shaft, a plurality of relatively movable parts associated with said respective cams, and actuated thereby to form a strip of dough into a substantially U-shape configuration, twist the dough body, and superimpose the looped portion of the dough body on the legs thereof in the form of a pretzel, the connections between said cams and said parts including a clutch as-

sembly and a reciprocable shaft, means for controlling the timing and precision of said parts with respect to each other throughout a cycle of movement, and means whereby the movement of said parts with respect to each other can be adjusted to pretzels of different sizes, and a removable form assembly for producing pretzels of the predetermined size.

20. A pretzel machine having a drive element, cam actuating means associated with the drive element and including a plurality of cams on a common shaft, a plurality of relatively movable parts associated with the respective cams, actuating members between the respective cams and the movable parts and including a clutch element, a reciprocating shaft, and means for controlling the timing and precision of operation of said movable parts and said actuating members, said parts relatively cooperating to bend a strip of dough into substantially U-shape, twist said dough body, and place the looped section upon the substantially free legs of the substantially twist-shaped dough body in the form and shape of a nearly completed pretzel, and means for adjusting said movable parts and associated actuating members to form pretzels of different sizes, and a removable form assembly for producing pretzels of predetermined sizes.

21. In a pretzel machine of the type designed to operate upon a rod or strip of dough, relatively movable parts for receiving and bending said strip into substantially U-shape, one of said means being turnable to twist said body of dough to form a closed loop, means for retaining the ends of the substantially free legs of the dough body extending from the loop, said turnable means being reciprocable for placing the loop on the legs to form the nearly completed shape of a pretzel, and a pair of cams on a common cam shaft, one of said cams having a lever and rack associated therewith for urging said latter means forward and backward, and the other cam having a lever, rack and gear operating means associated therewith, and a clutch member whereby said latter member is turned, and means for operating said other means.

22. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device mounted for both reciprocating and twisting movement, a reciprocable carriage, a finishing plate, and a movable table element, a cam member having lever and rack connections associated therewith for actuating said reciprocable carriage, said carriage being mounted on cooperating gear and chain assemblies, and said gear and chain assemblies being operatively associated with the rack connection to said cam whereby to move said carriage, and means for actuating said forming device and said table element.

23. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device mounted for both reciprocating and twisting movement, a reciprocable carriage, a finishing plate, and a movable table, a cam element, and a lever connection to said cam element from said movable table camming supports for said table, and cam means for actuating said forming device and said carriage, all of said cams being mounted on a common actuating shaft.

24. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device mounted for both reciprocating and twisting movement, a cover element for said forming device, a reciprocable carriage, a fin-

ishing plate, and a movable table, a clutch element having a movable member, means for actuating said clutch element, and said cover element having link connections to the movable member of said clutch element whereby the cover is lowered when the clutch is engaged thereby to hold dough on said forming member during the twisting operation, and means for actuating said forming device, said carriage and said table for the purpose defined.

25. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device mounted for both reciprocating and twisting movement, a cover element for said forming device, a detachable form assembly on said forming device, a reciprocable carriage, a finishing plate and a movable table, said form assembly being hingedly mounted to move to a position substantially in the same plane as the finishing plate, camming supports for said table, and said supports having exterior camming surfaces engaging said form assemblies whereby to tip the same to a position in the plane of the finishing plate, and means for actuating said forming device, cover element, form assembly, carriage, finishing plate and table.

26. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device mounted for both reciprocating and twisting movement, a reciprocable carriage arranged to move above said forming device, a hopper above said carriage, a finishing plate, and a movable table, said carriage having spaced sides and a bottom portion for holding a strip of dough, said bottom having a central opening whereby a length of said dough passes about the forming device, and trip means associated with the carriage and hopper for releasing a strip of dough from the hopper to the carriage when the carriage is above the forming device, and means for actuating the forming device, the carriage and the movable table, said means including a plurality of cams and connections associated with a common drive element.

27. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device including a detachable form assembly, a cover for the form assembly, and an actuating assembly for the forming device and cover, said assembly including a sliding bar on which the forming device is mounted, means including a rack element for actuating said bar, said forming device being mounted for rotation, a clutch assembly including a movable element, link connection from the movable element of the clutch to the cover plate whereby to raise and lower the same in conformity with opening and closing of the clutch, and cam members, one connected with said rack of said sliding bar, one connected with said means for rotating said forming device, and said cams connected with a common source of power.

28. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device including a detachable form assembly, a movable carriage, a movable table, and a finishing plate; means for imparting to said forming device both reciprocating and turning movement, means for reciprocating said carriage, means for moving said table, and means adjacent to said finishing plate for grasping the ends of a strip of dough, said grasping means being adjustable, and cam means on the carriage for actuating said grasping means.

29. In a pretzel machine having a front and a

back part, a finishing plate mounted on the front part of the pretzel machine and arranged vertically, means adjacent to said finishing plate for grasping the ends of a formed pretzel body
 5 when at the finishing plate, a conveyor below the finishing plate, actuating means on the rearward end of the machine, a hopper, a forming device, actuating means for the forming device including a reciprocating and a turning element,
 10 a carriage, and means for reciprocating said carriage from the hopper to the finishing plate, means for turning the forming device, and means for moving said forming device toward the finishing plate, and means on the carriage for operating the means for the clipping of the ends
 15 of the pretzel when at the finishing plate to discharge same to the conveyor.

30. In a pretzel machine having a frame, tracks on the frame, a finishing plate adjustably carried on certain of said tracks, a reciprocable carriage on the other tracks, a gear assembly and a clutch for controlling the same, said gear assembly associated with a slidable rack bar, and a forming device carried on the slidable rack bar for reciprocating movement and associated
 25 with the gear assembly for rotating movement, and means for actuating said carriage, and said gear assemblies and said rack bar.

31. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a hopper for receiving the rod or strip of dough, a forming device, a movable carriage between the hopper and the forming device, and designed to receive the rod or strip from the hopper and deposit a
 35 predetermined length of the central portion thereof on the forming device, said hopper having downwardly depending, vertically arranged guiding means for the rod or strip of dough, and a spring controlled movable rod supporting bottom part, means on the carriage engaging means
 40 on the movable bottom for releasing the rod or strip of dough when the carriage is in position to receive it, and means for actuating the forming device and the carriage.

32. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a hopper for receiving the rod or strip of dough and provided with means for guiding the rod or strip, and means for releasing said rod or strip,
 50 a forming device, and a movable carriage including a magazine portion having an adjustable opening therein formed with a bell mouth for guiding the rod or strip of dough at its ends when the part thereof between the ends is located between the mouth portions, resilient shock absorbing means for the carriage, and means for
 55 actuating said forming device and said carriage, and means for adjusting the size of the opening in said magazine.

33. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device, a carriage cooperating with said forming device and means for actuating the same to give the rod or strip of dough a substantially
 65 U-shaped formation about the forming device, a clutch, a gear and rack assembly, a slidable member, and a rotatable member, the rack associated with the slidable member and receivable within the rotatable member, the rotatable member associated with the clutch, the forming device associated with both said rotatable member and said slidable member for both turning and reciprocating movement, and means whereby
 70 said slidable member is held in a passive position in said rotatable member when said rotat-

able member is actuated, means for maintaining the timing of said slidable and rotatable members, means for actuating said gear members and said rack to actuate said rotatable member and said sliding member to give said forming device both reciprocating and turning movement,
 5 means for actuating said clutch, and means for actuating said carriage.

34. In a pretzel machine of the type designed to operate upon a rod or strip of dough, a forming device, a hopper, a movable carriage, a movable table member, and a finishing plate, means for actuating said forming device, carriage and table member, means adjacent to said finishing plate for engaging the ends of a rod or strip of dough, means adjacent to and associated with the finishing plate for clipping the ends of the rod or strip of dough when it has been formed into the shape of a pretzel, and means cooperating with the carriage whereby said gripping means are positively moved to an open position to receive said rod ends, and means cooperating with the carriage whereby said shearing means are given a positive shearing movement from a normal inactive position, said means including cooperating cam members, and springs associated with the gripping and shearing means for returning same to their normal positions.

35. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the curved section and the ends thereof, and means for placing the looped part on the legs, means for simultaneously adjusting said receiving means, bending means, twisting means, and means for placing the looped part on the legs whereby to produce pretzels of different sizes, means for indicating the extent of said adjustment, and independent means whereby adjustments may be made for variations in the size of the rod or strip of dough or dough body.

36. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the curved section and the ends thereof, and means for placing the looped part on the legs, means for simultaneously adjusting said receiving means, bending means, twisting means, and means for placing the looped part on the legs whereby to produce pretzels of different sizes, and means independent of said foregoing adjusting means for adjusting said machine to variations in the size of the strip or rod of dough and the dough body, said means including an adjusting rod associated with a part of the actuating mechanism.

37. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the curved section and the ends thereof, means for placing the looped portion on the legs thereof, and a finishing plate against which the nearly completed pretzel form is retained in a substantially vertical position, means associated with said finishing plate for pressing the legs of the pretzel form on the looped portion to adhere the same thereto, said means for pressing being adjustable to the size of pretzel being made, and cooperating with the forming device on which the looped portion is carried for dis-
 70 position on the legs to be adhered thereto.

38. In a pretzel machine having means for 75

receiving a rod or strip of dough, means for bending said rod or strip of dough into substantially U-shape including a forming device co-operatively associated with a reciprocating carriage; means for twisting the body of dough between the bent portion and the ends to form a loop and twisted leg portions including means for gripping the ends of the legs and means for twisting or rotating the bent portion and parts adjacent thereto; means for placing the loop so formed on the legs including a reciprocating member on which the forming device is carried; means for adhering the legs to the looped portion to complete a substantially formed pretzel, means for stripping the pretzel from the forming device, and means for releasing the pretzel so formed.

39. In a pretzel machine having means for receiving a rod or strip of dough; a carriage for receiving said rod or strip of dough; means for guiding the same to the carriage; means for releasing said rod or strip from the receiving means cooperating with said carriage; a forming device cooperating with said carriage for bending said rod or strip of dough into substantially U-shape; said carriage having an opening through which the part of the rod between its ends is projected to the forming device and being reciprocable with respect to the forming device; means for mounting said forming device for both reciprocating and turning or rotating movement; means for engaging the ends of the dough body to retain the same; means for holding the dough body on the forming device when it is rotated to form a twist between the bent portion and the ends to form a loop and twisted legs; a finishing plate cooperating with the forming device in its reciprocating movement to place the looped part on the twisted legs adjacent to the ends thereof; and a movable and adjustable table for supporting the part of said dough body, which forms the legs of the substantially U-shaped dough body.

40. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape; means for twisting said rod or strip between the bent part and the ends to form a loop and twisted legs; and means for placing the looped parts on the legs to form a substantially completed pretzel form, means for tensioning the dough body as it is twisted to form a tight, adhering twist, and means for pressing the legs on the loop to form a tight, adhering connection.

41. In a pretzel machine having means for receiving a rod or strip of dough, means for bending a rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a loop and twisted legs, means for placing the looped part on the legs to form a nearly completed pretzel form; and a front or finishing plate assembly including an assembly plate and a finishing plate; a pair of slide bars, a slidable carriage on two pairs of slide bars having a magazine formed with an opening therein, clipping means for the ends of the substantially completed pretzel carried on the assembly plate; gripping means for the ends of the formed dough body carried on the clipping means; means engaging diagonal slots in the finishing plate for adjusting said clipping means and said gripping means transversely to operative positions of said clipping means and said gripping means; and means whereby said clipping means are operatively con-

nected to the said pair of slide bars for causing transverse adjustment of adjustable parts of said slidable carriage, and means associating the said pair of slide bars with one pair of the said two pairs of slide bars for adjusting the opening in the magazine and the operating cams for the said clipping means and said gripping means, of the said slidable carriage, the other pair of slide bars of the said two pair of slide bars being non-adjustable; and means including cooperating slots and pins on said assembly plate and finishing plate for causing adjustments co-operatively, by adjusting the position of the assembly plate and parts assembled thereto and connected with the finishing plate to pretzels of different sizes.

42. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a loop and twisted legs, a front or finishing plate, means adjacent to the finishing plate for gripping the ends of the dough body, means for placing the looped part on the twisted legs to form a substantially completed pretzel shape, means associated with the finishing plate for pressing the legs on the loop to adhere the same thereto, means for clipping the ends carried on the assembly plate associated with the finishing plate, and a conveyor for receiving the completed pretzel body right-side up when the ends are clipped and the finished pretzel body released from the ends of the legs being retained by the gripping means.

43. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a loop and twisted legs, a front or finishing plate, an assembly plate on which the finishing plate is carried, and means for adjusting the position of the finishing plate including a pair of plate cams engaged with the finishing plate for adjustment of same up and down and the associated means the cooperating slots and pins arranged to position the finishing plate in predetermined positions with reference to the assembly plate, and also cause transverse adjustments of the clipping means and gripping means, and means for twisting the pretzel, means for gripping the ends of the formed pretzel dough, means for clipping the ends of the substantially formed pretzel, means adjustably mounting said clipping means and the thereon gripping means on the assembly plate, and means for placing the looped part on the twisted legs to form a substantially completed pretzel form, and means adjustably carried on the clipping means for pressing said legs on the loop to adhere the same thereto.

44. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a closed loop and twisted legs, a front or finishing plate having associated thereto adjustable means for gripping the ends of the formed pretzel dough body, means for placing the looped part on the legs to complete substantially a pretzel form, and shock absorbing devices arranged to cushion the action of said above mentioned parts to prevent derangement of said parts under the stress of continued relatively high speed operation.

45. In a pretzel machine having means for receiving a rod or strip of dough, means for bending

said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a closed loop with crossed legs, a front or finishing plate having associated thereto means for gripping the ends of the formed pretzel dough body, a supporting table or floor plate for the legs of the said U-shape dough body, and adjusting means for said aforementioned parts arranged to be actuated simultaneously from a single source whereby to adjust said means to form pretzels of different sizes, means for indicating the extent of said adjustment, and supplementary independent adjusting means for adjusting certain of said means whereby said machine will operate efficiently on dough bodies of different thicknesses.

46. In a pretzel machine having a unitary, compact structure, and means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a closed loop and twisted legs, a front or finishing plate having associated thereto means for gripping the ends of the pretzel dough body, a unitary frame on which said parts are assembled in a compact structure, and adjusting means for said aforementioned parts arranged to be actuated simultaneously from a single source whereby to adjust said means to form pretzels of different sizes, and supplementary, relatively independent adjusting means for adjusting certain of said means whereby said machine will operate efficiently on dough bodies of different thicknesses.

47. In a pretzel machine having means for receiving a rod or strip of dough, means for bending said rod or strip into substantially U-shape, means for twisting said rod or strip between the bent part and the ends to form a closed loop and twisted legs, a front or finishing plate having associated thereto means for gripping the ends of the dough body and against which the substantially completed pretzel is formed to assume a final substantially vertical position suspended by its ends, means for placing the looped portion on the legs to form the pretzel body, means for clipping the ends to release the completed pretzel form, a conveyor means to receive said pretzel in right-side-up position when released, and adjusting means for said aforementioned parts arranged to be actuated simultaneously from a single source whereby to adjust said means for pretzels of different sizes, and supplementary, relatively independent adjusting means for adjusting certain of said means whereby said machine will operate efficiently on dough bodies of different thicknesses.

48. In a pretzel machine having a hopper for receiving a rod or strip of dough, a carriage for receiving said rod or strip of dough, a forming device cooperating with said carriage to bend said rod or strip into substantially U-shape, a front or finishing plate having associated thereto means for grasping the ends of the pretzel dough body, said forming device being rotatable to twist said bent dough body between the bent part and the ends to form a closed loop and twisted legs, said forming device being reciprocable to place the looped part on the twisted legs to produce a substantially complete pretzel form, means for stripping the looped part from the forming device, means for clipping the ends of said substantially completed pretzel form to release the same, and conveyor means for receiving said completed

pretzel form in right-side-up position as and for the purpose described.

49. In a pretzel machine having a hopper for receiving a rod or strip of dough, a carriage for receiving said rod or strip of dough, said carriage being reciprocally mounted, a forming device cooperating with said carriage to bend said rod or strip into substantially U-shape, a front finishing plate having associated thereto means for receiving and grasping the ends of the rod or strip after it has been bent, said carriage having means for delivering said ends to said grasping means, said forming device being rotatable to twist said bent dough body between the bent part and the ends to form a closed loop and twisted legs, said forming device being reciprocable to place the looped part on the twisted legs to produce a substantially complete pretzel form, means for stripping the looped part from the forming device, means for clipping the ends of said substantially completed pretzel form to release the same, means for receiving said clipped ends to preserve the same, and conveyor means for receiving the completed pretzel form in a right-side-up position as and for the purpose described.

50. A unitary pretzel machine having means for receiving a rod or strip of dough, means for bending the same, means for twisting the same, and means for placing the loop formed by the twist on the twisted legs to produce a substantially complete pretzel form; adjusting mechanism associated with said receiving, bending, twisting, and loop disposing means for adjusting the said respective means to produce pretzels of different sizes.

51. A unitary pretzel machine having means for receiving a strip or rod of dough, means for bending the same, means for twisting the same, and means for placing the loop formed by the twist on the twisted legs, to produce a substantially complete pretzel form; adjusting mechanism associated with said aforementioned receiving, bending, twisting, and loop disposing means and operable from a single source to adjust all of said respective means simultaneously to produce pretzels of different sizes.

52. A unitary pretzel machine having means for receiving a rod or strip of dough, means for bending the same, means for twisting the same, means for placing the loop formed by the twist on the twisted legs to produce a substantially complete pretzel form, and cam actuating means arranged as a unit and operatively connected with said means to actuate the same; adjusting mechanism associated with said aforementioned means and operable from a single source to adjust all of said means simultaneously to produce pretzels of different sizes.

53. A unitary pretzel machine having means for receiving a rod or strip of dough, means for bending the same, means for twisting the same, means for placing the loop formed by the twist on the twisted legs to produce a substantially complete pretzel form, operating means for actuating said aforementioned means, and adjusting means associated with said aforementioned means whereby to adjust said means to produce pretzels of different sizes.

54. A unitary pretzel machine having means for receiving a rod or strip of dough, means for bending the same, means for twisting the same, means for placing the loop formed by the twist on the twisted legs to produce a substantially complete pretzel form, operating means for actuating said aforementioned means, adjusting

means associated with said aforementioned means whereby to adjust said means to produce pretzels of different sizes, and other adjusting means for certain of said parts whereby to operate on dough
5 bodies having different thicknesses.

55. A unitary pretzel machine having means for receiving a rod or strip of dough, means for bending the same, means for twisting the same, means for placing the loop formed by the twist
10 on the twisted legs to produce a substantially complete pretzel form, means for positively at-

taching the loop to the legs, operating means for actuating said aforementioned means, adjusting means associated with said aforementioned means whereby to adjust said means to produce pretzels of different sizes, a single operating member for
5 said adjusting means to actuate the same, and other adjusting means for certain of said parts whereby to operate on dough bodies having different thicknesses.

WILLIAM M. YOUNG. 10
LEMON BLAIR PAULES.