Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

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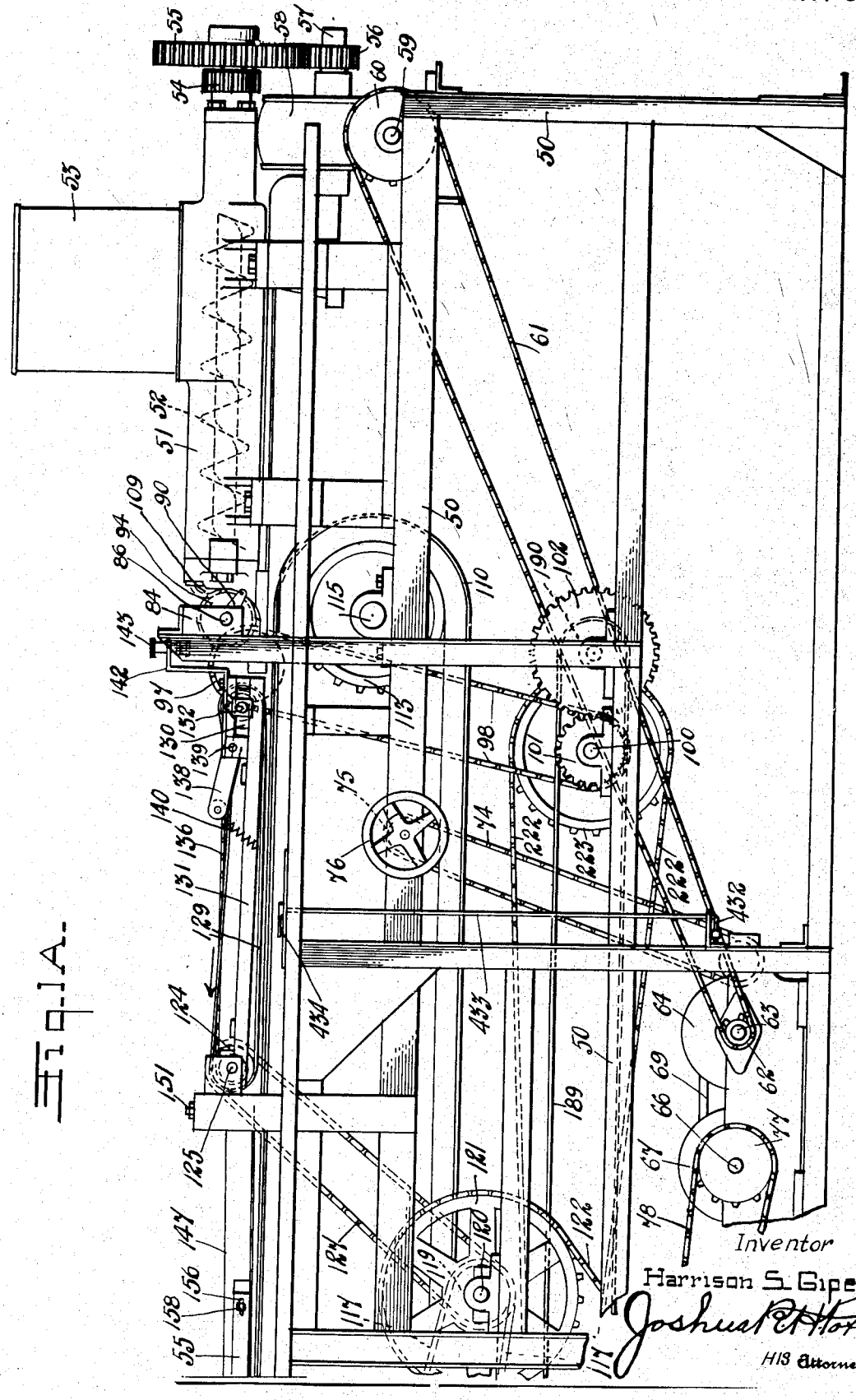


Fig. 1A.

Inventor
Harrison S. Gipe
Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 2

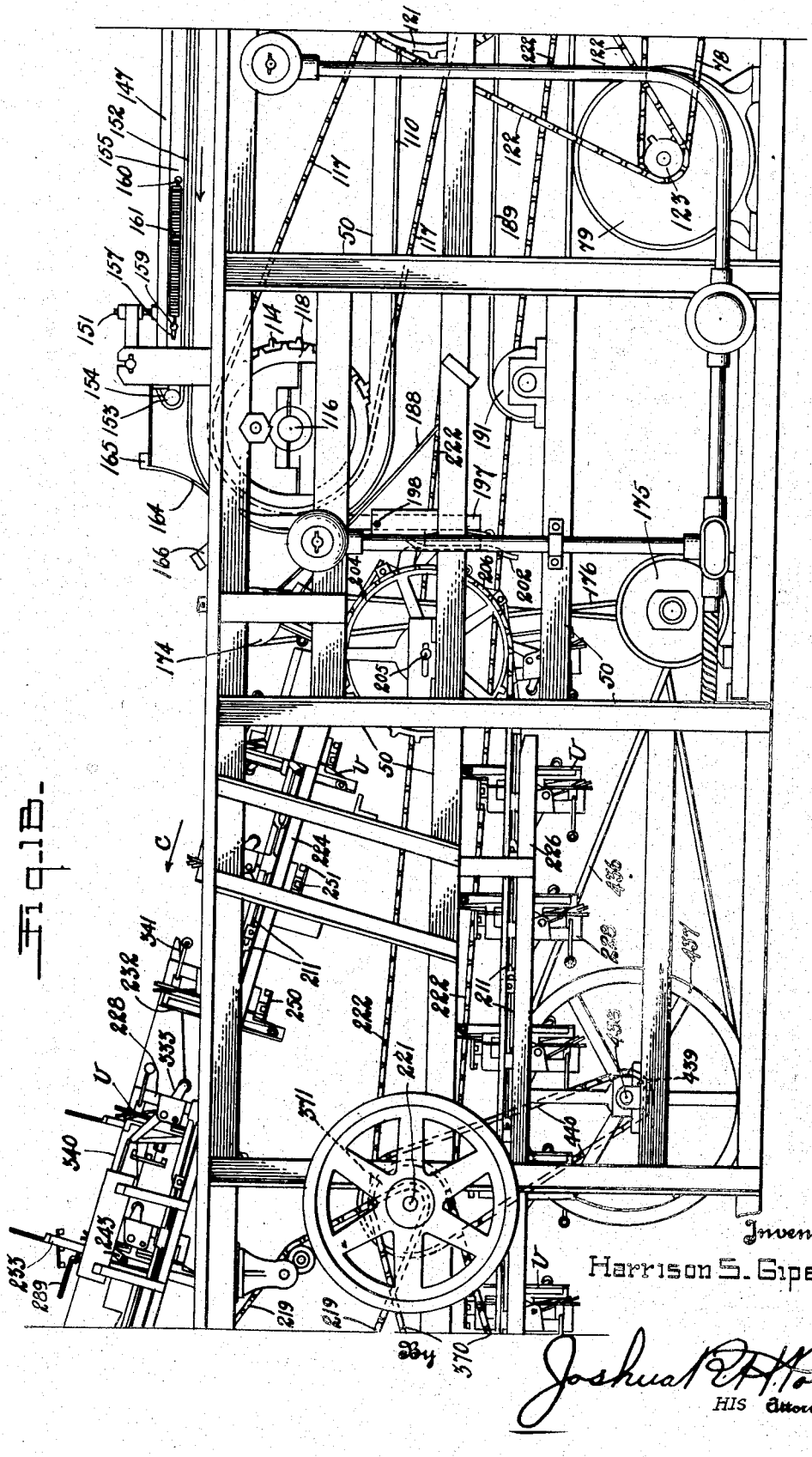


Fig. 1B.

Inventor
Harrison S. Gipe

Joshua R. H. Potter
HIS Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 3

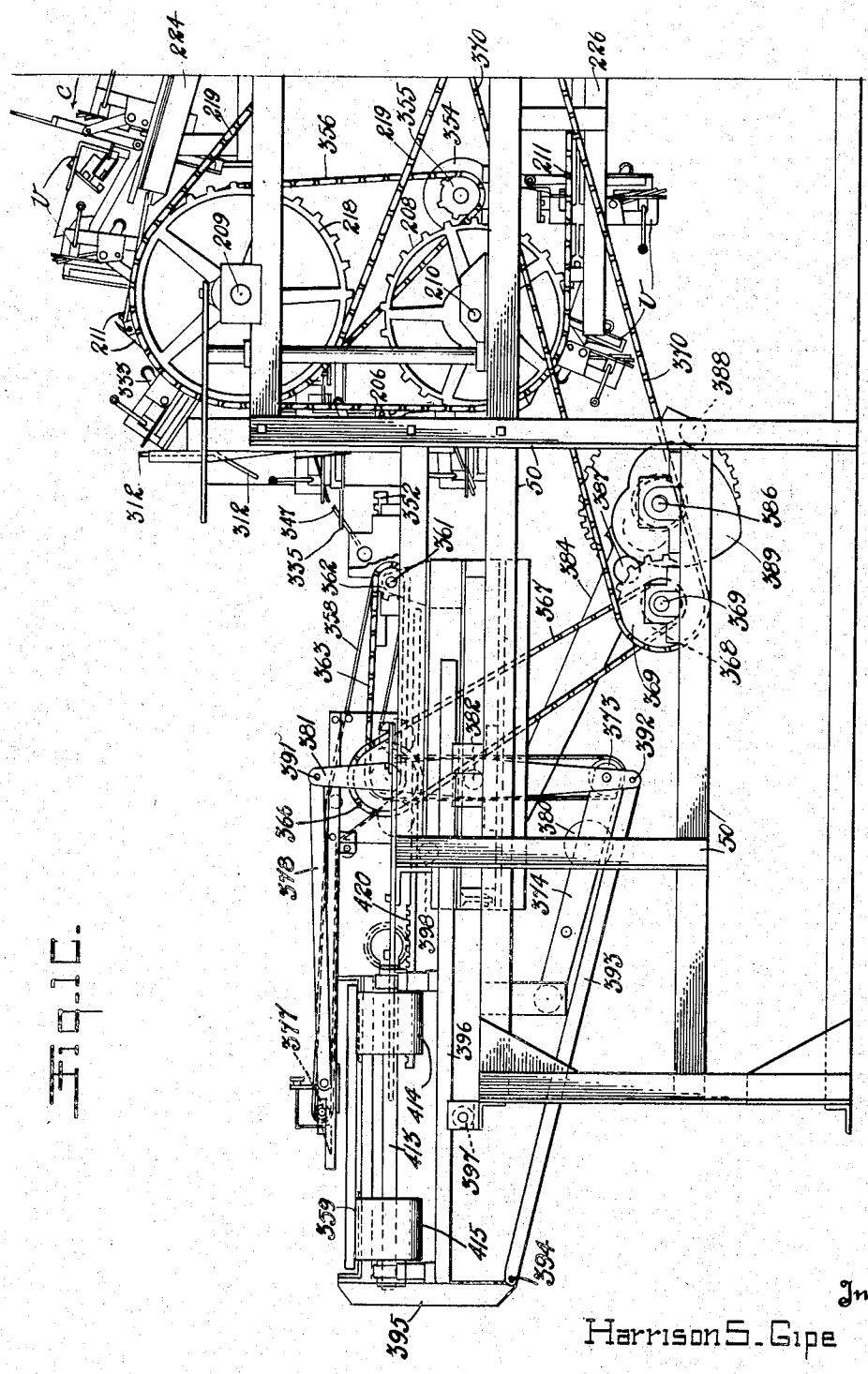


Fig. 1C.

Inventor

Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 4

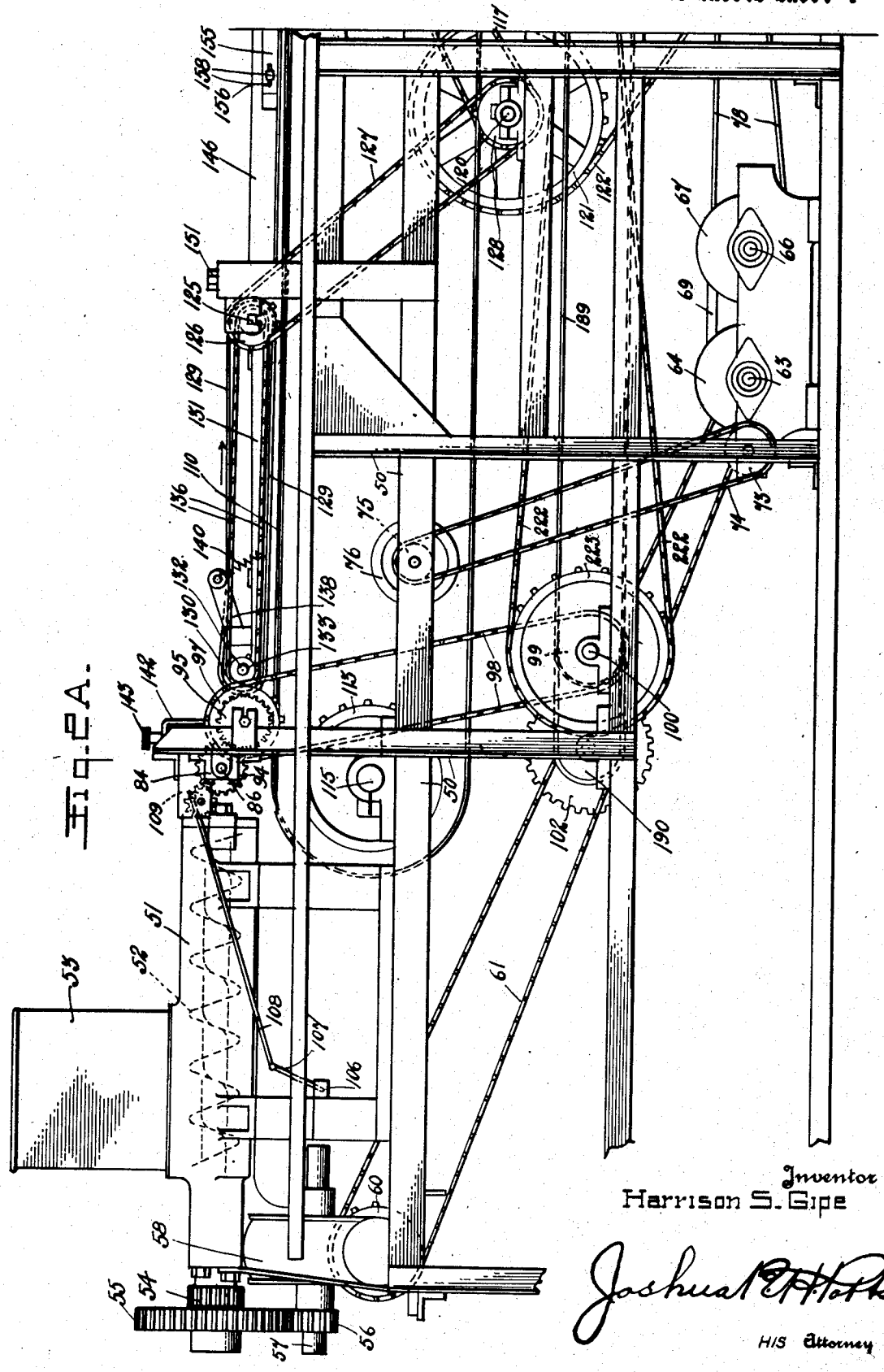


Fig. 2A.

Inventor
Harrison S. Gipe

Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 5

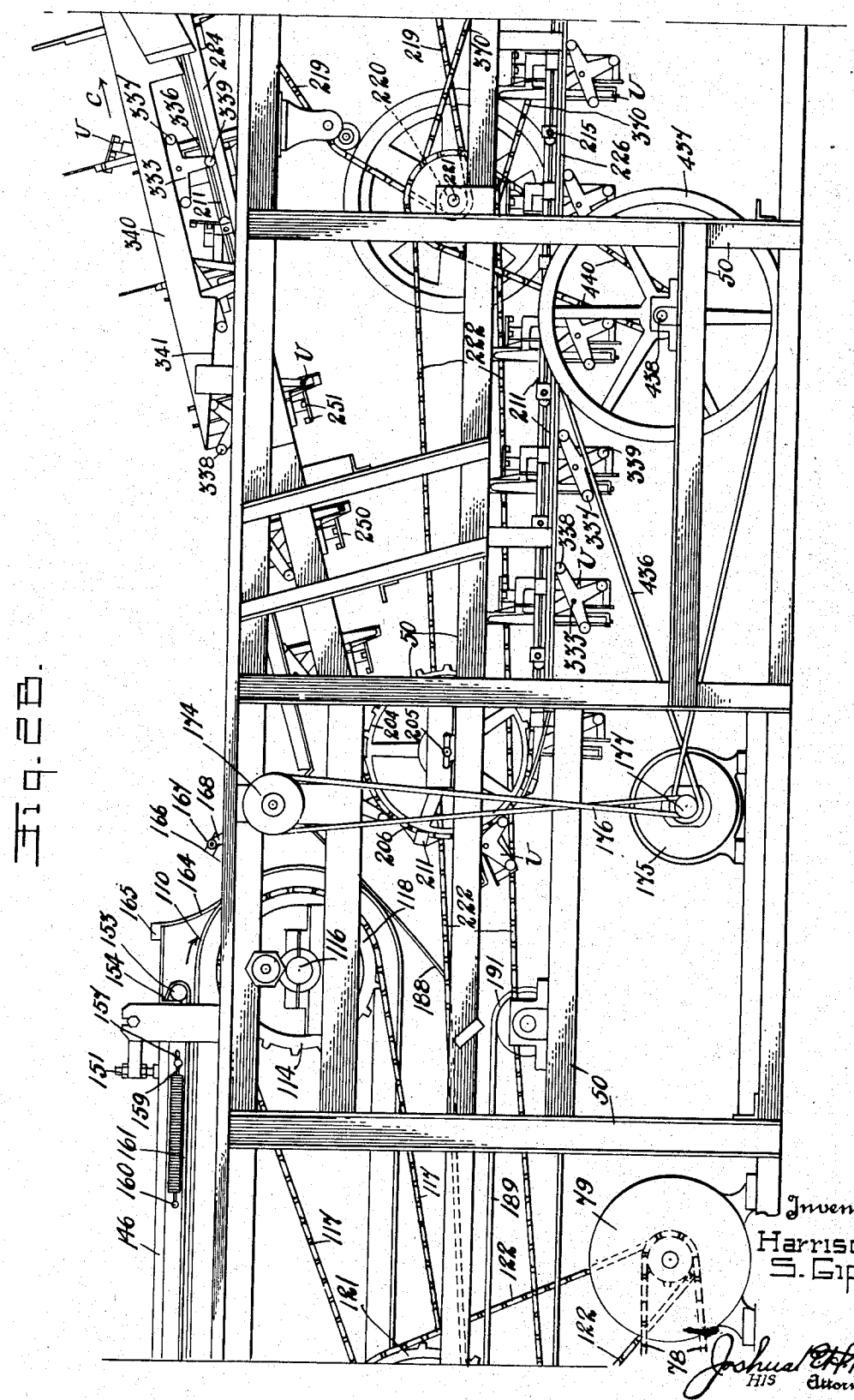


Fig. 28.

Inventor
Harrison S. Gipe

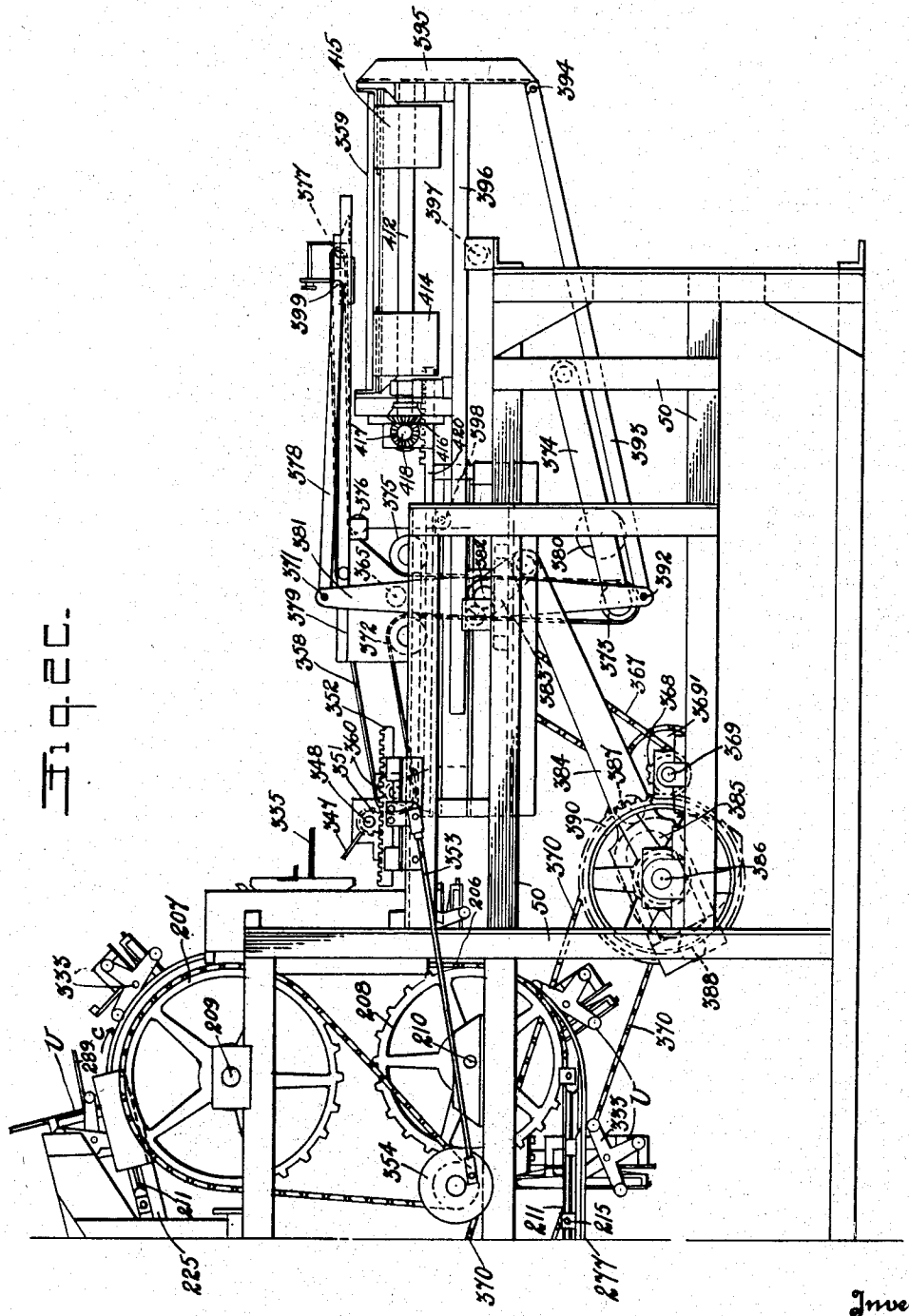
His Attorney Joshua E. Hoffpauir

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 6

Fig. 2C.



Inventor
Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 7

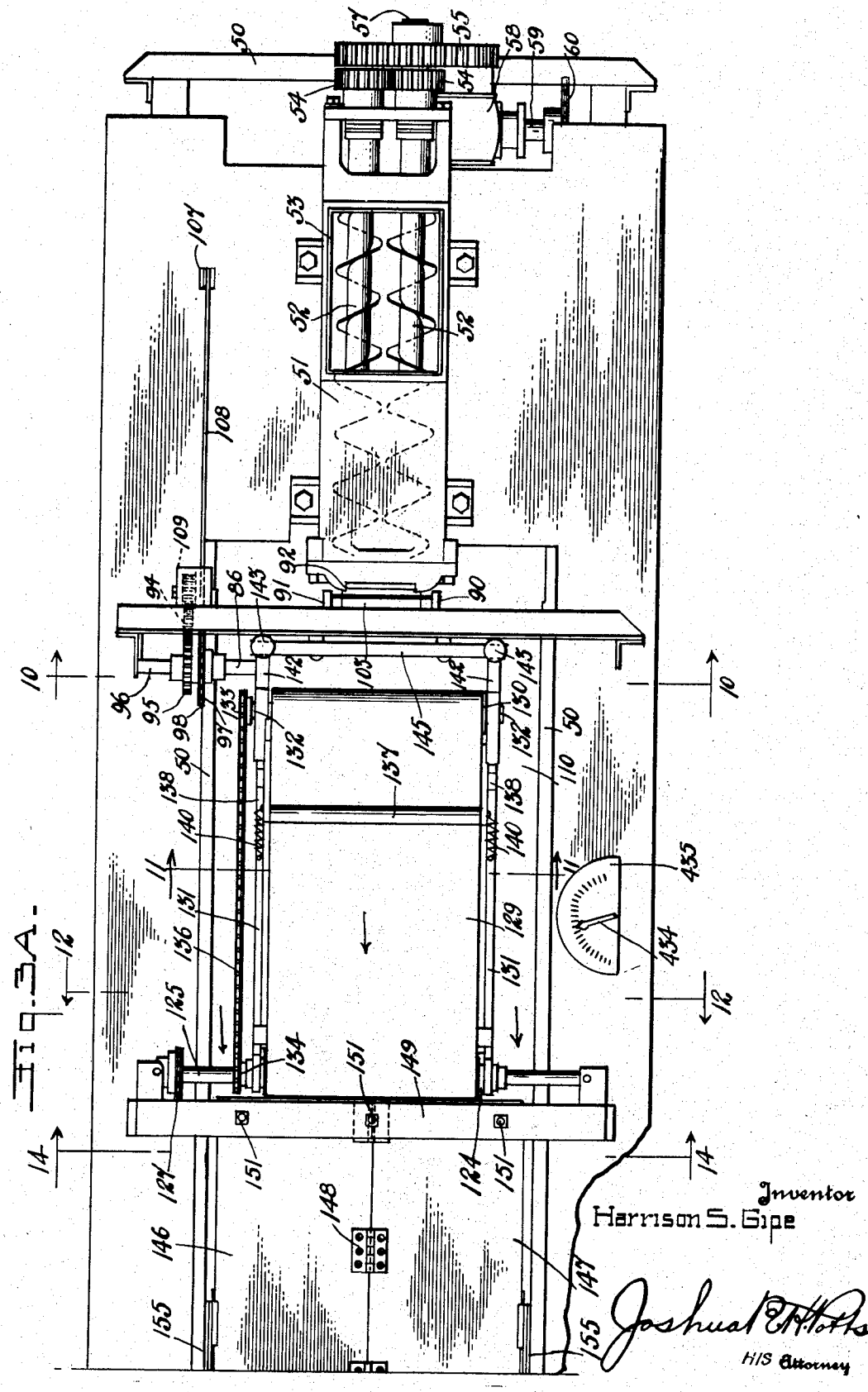


Fig. 3A.

Inventor
Harrison S. Gipe

Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 8

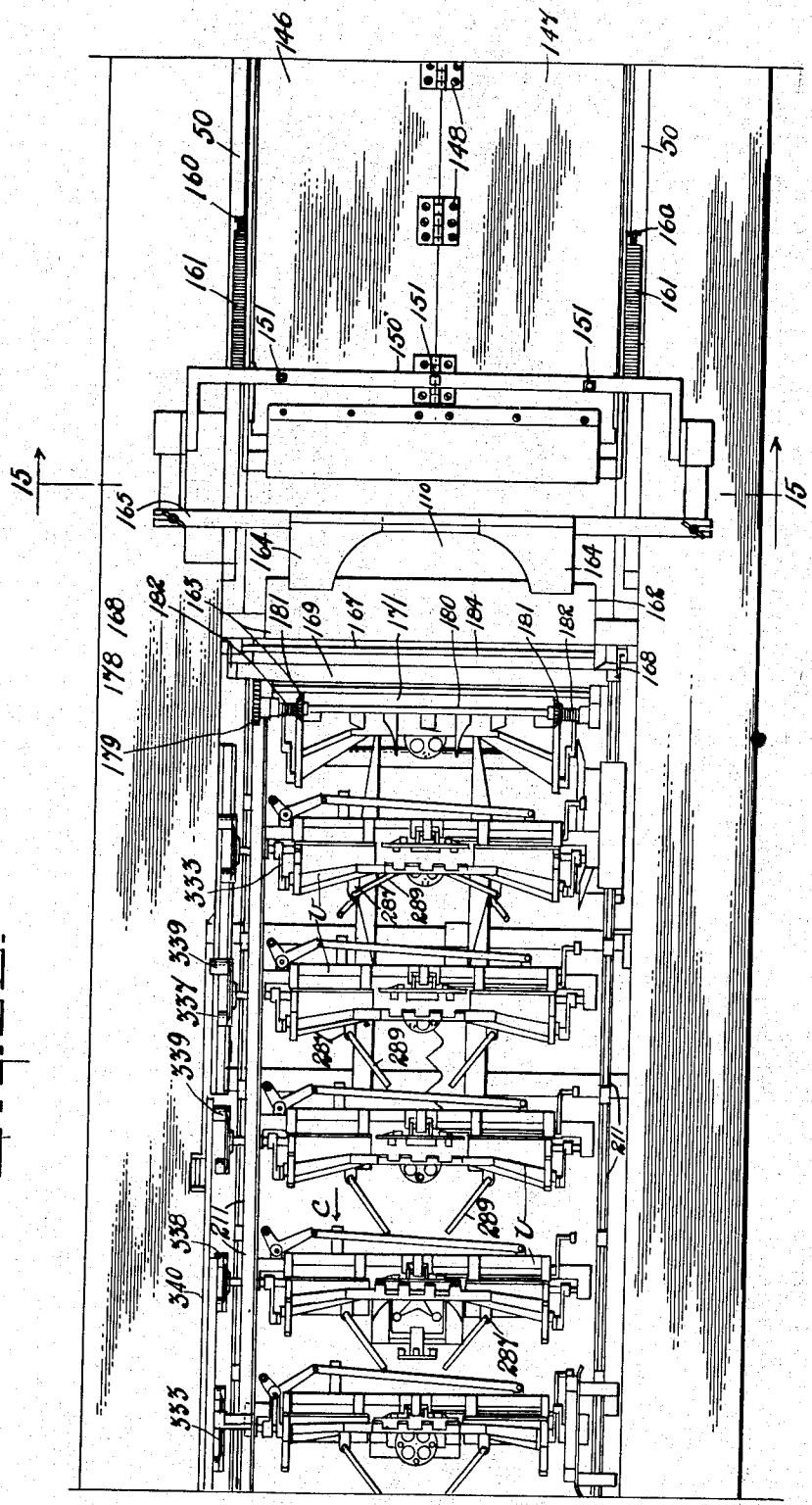


Fig. 3B.

Inventor

Harrison S. Gipe

By Joshua R. H. Potts

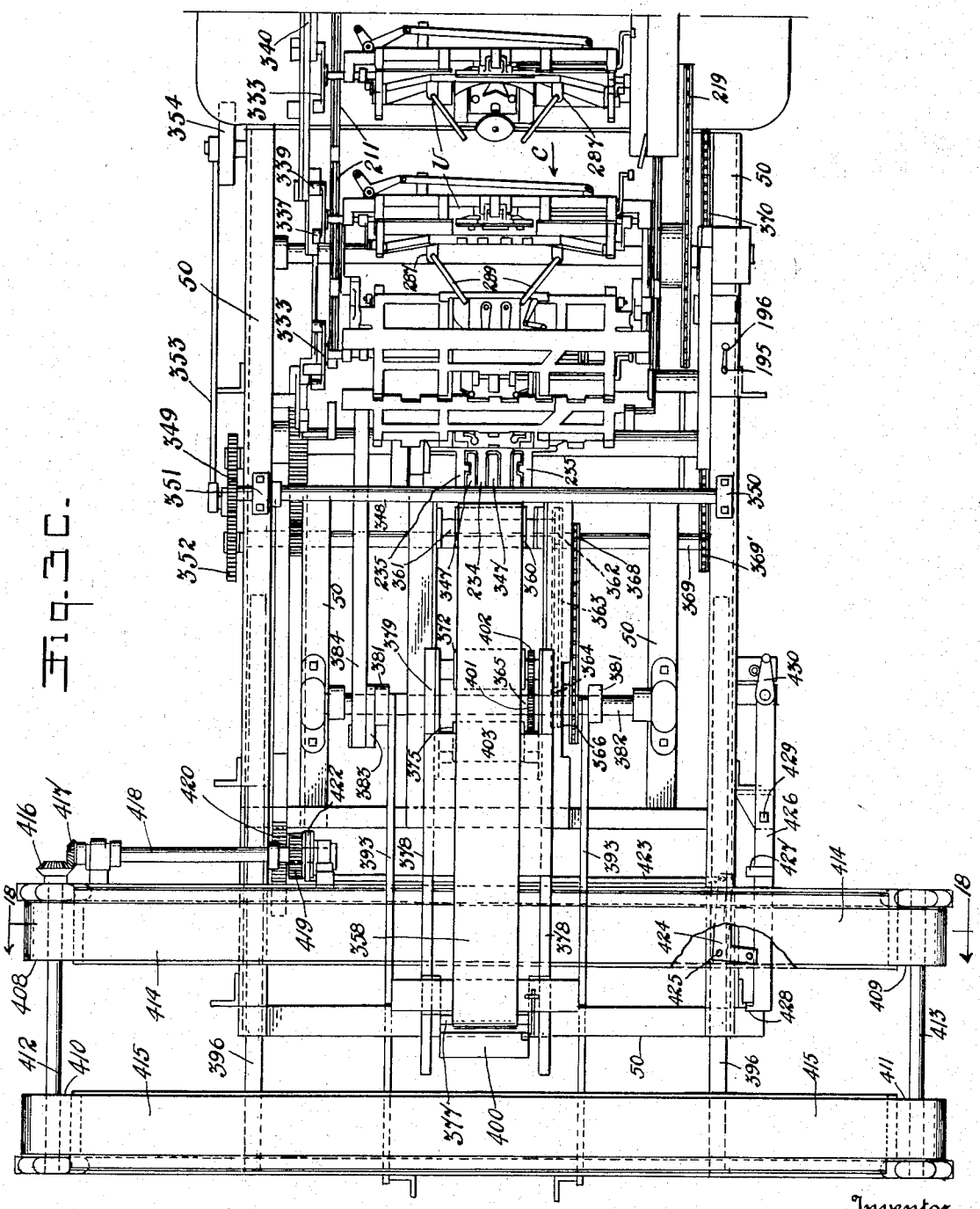
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 9

Fig. 3C.



Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 10

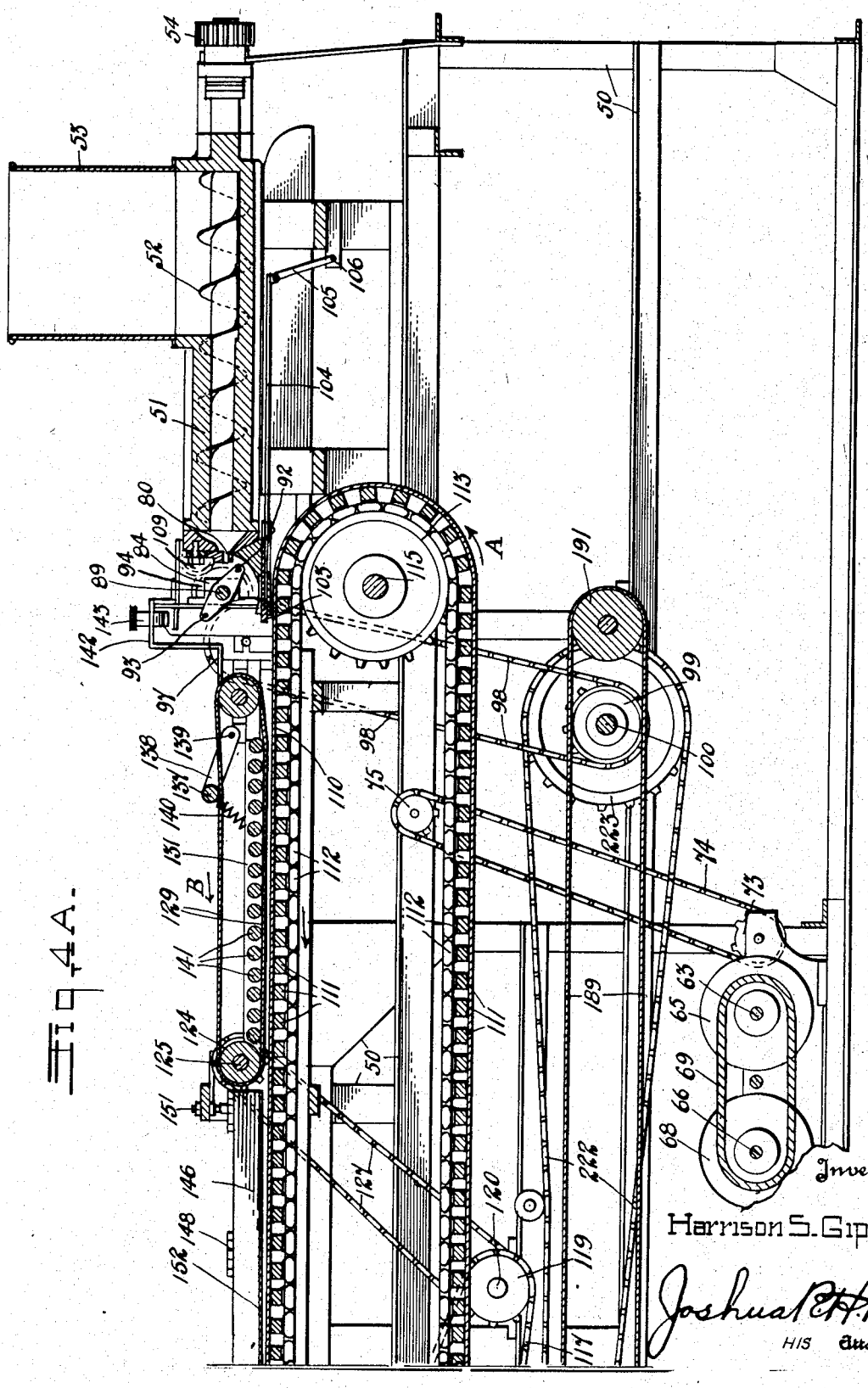


Fig. 4A.

Inventor

Harrison S. Gipe

Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 11

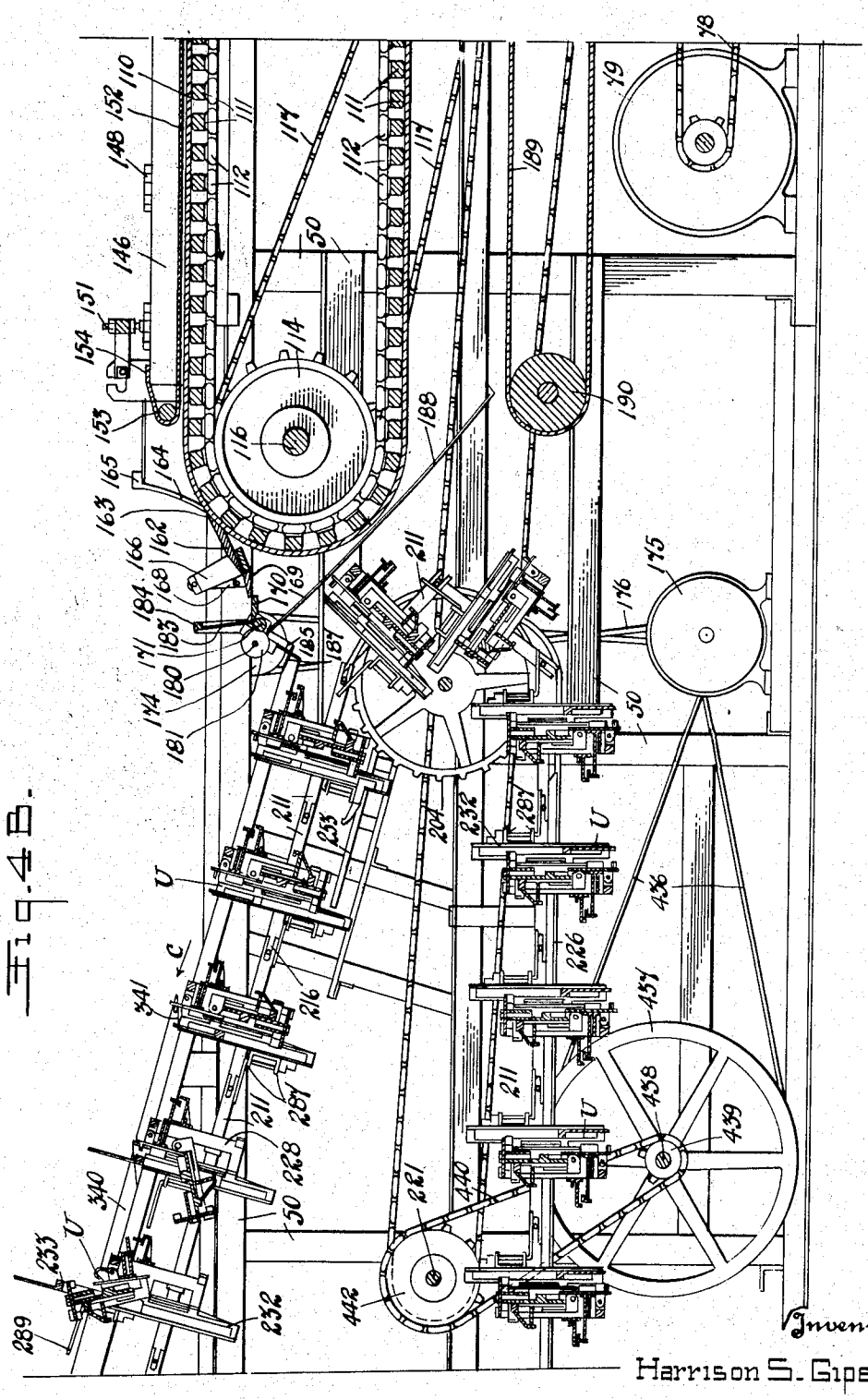


Fig. 4B.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
HIS Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 12

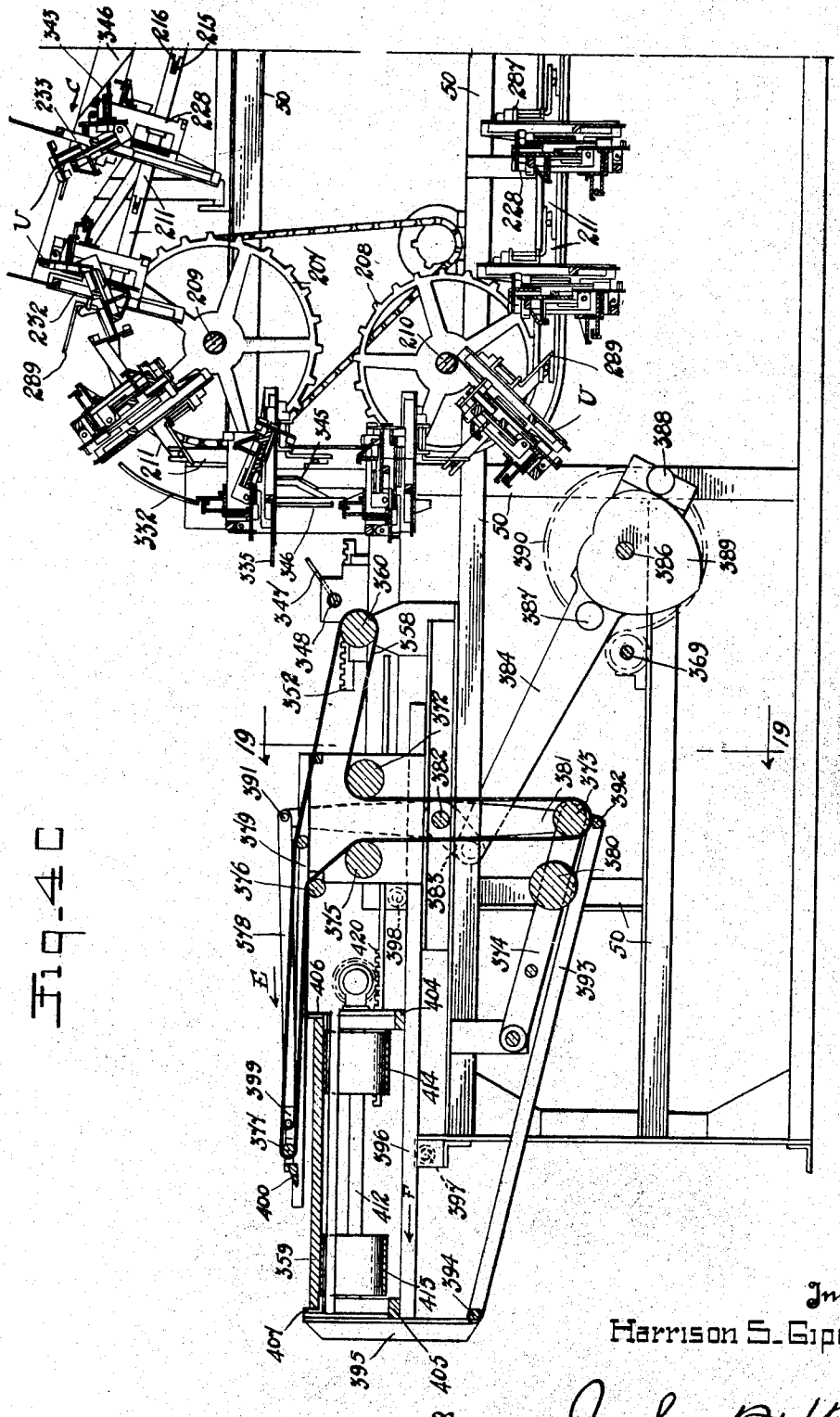


Fig. 40

Inventor
Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 13

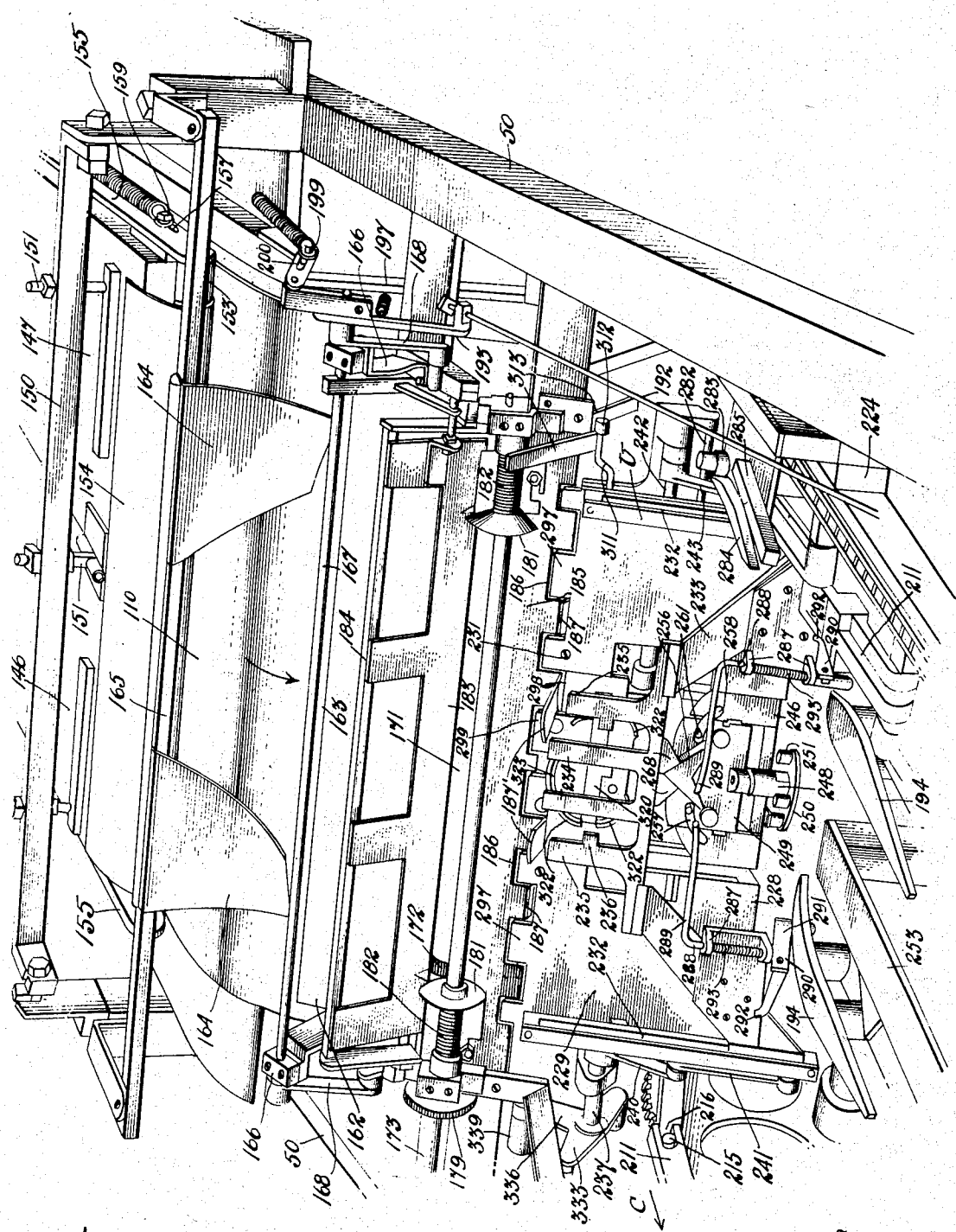


FIG. 5.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 14

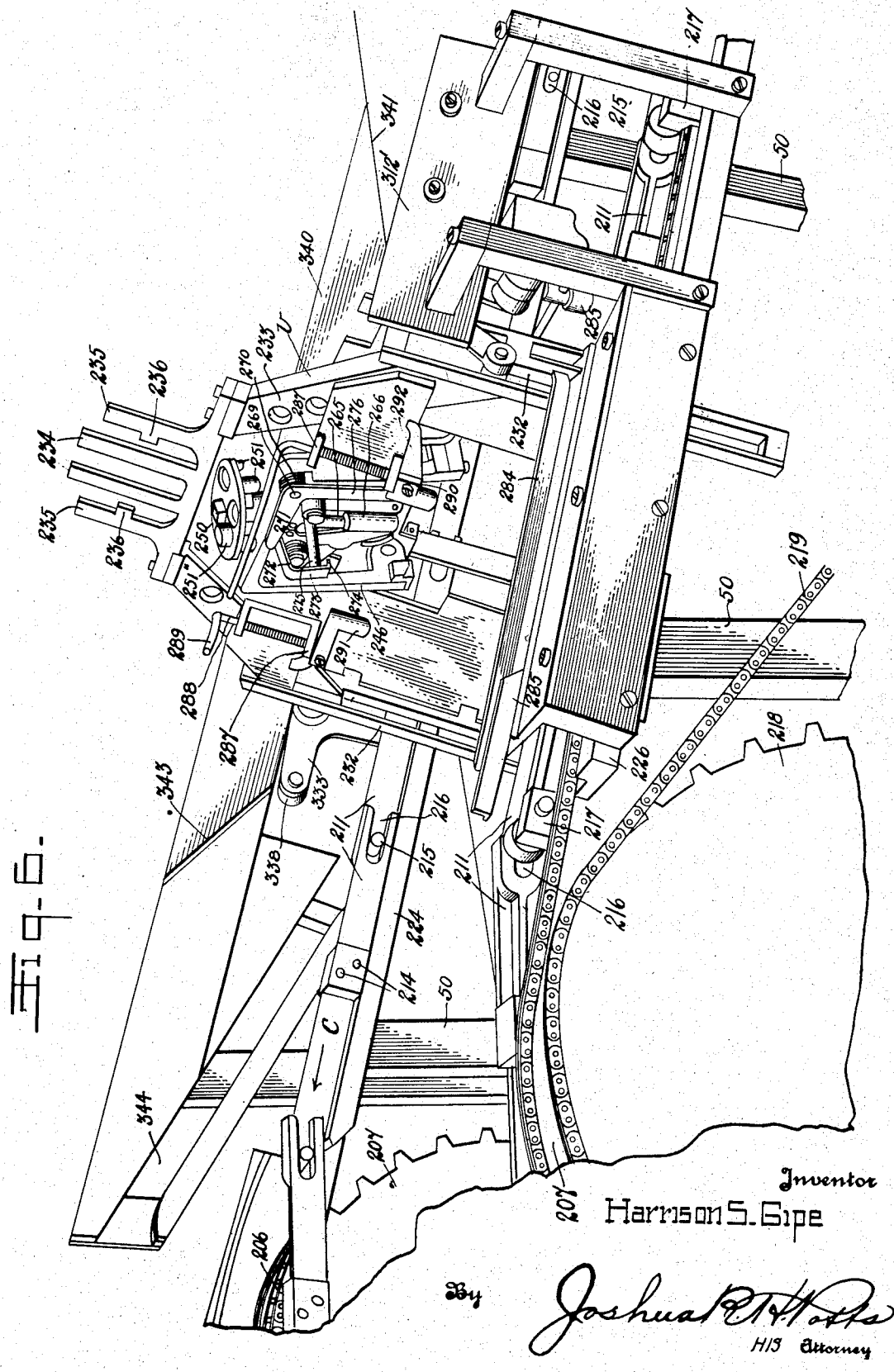


Fig. 6.

Inventor
Harrison S. Gipe
By Joshua R. H. Watts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 15

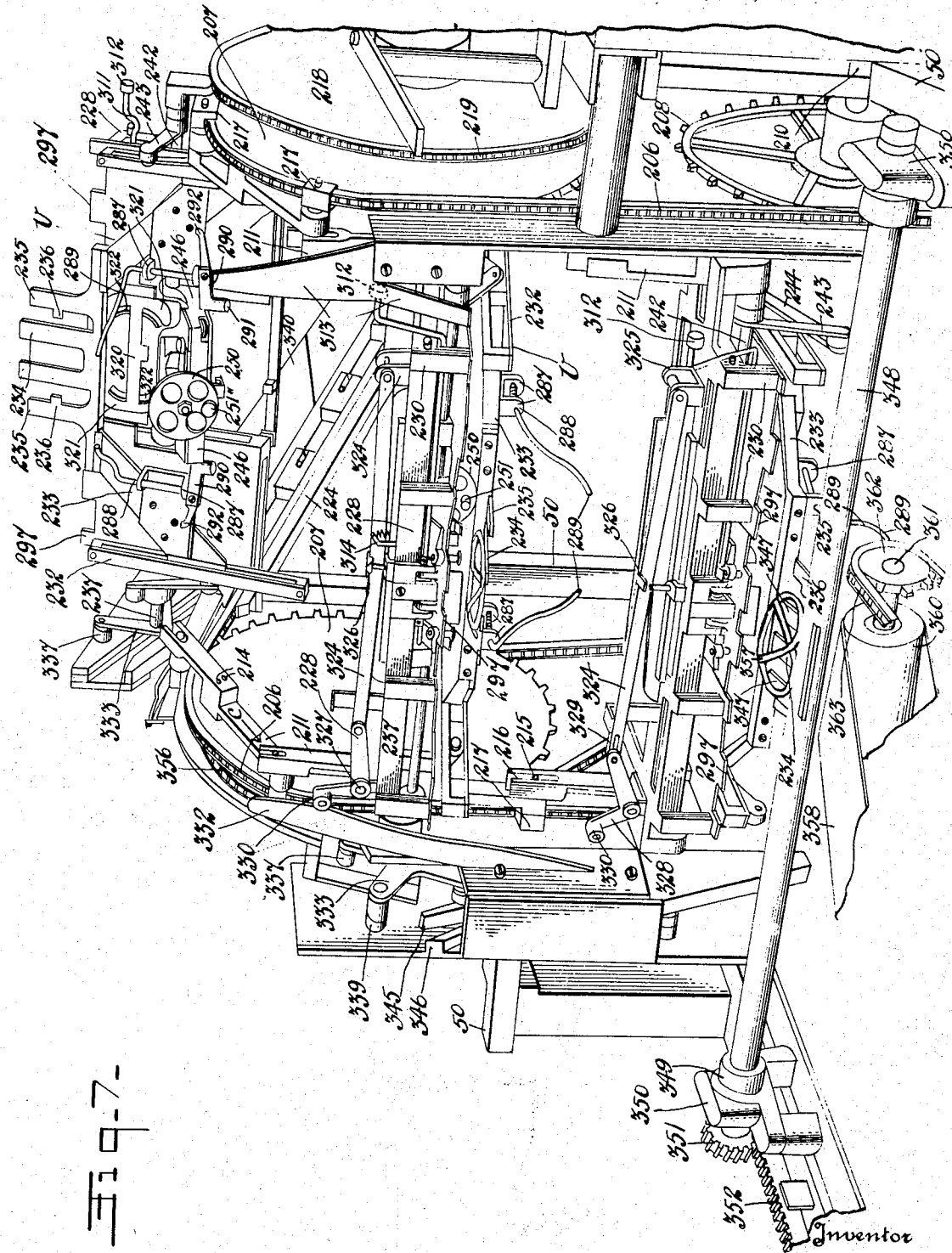


Fig. 7.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 16

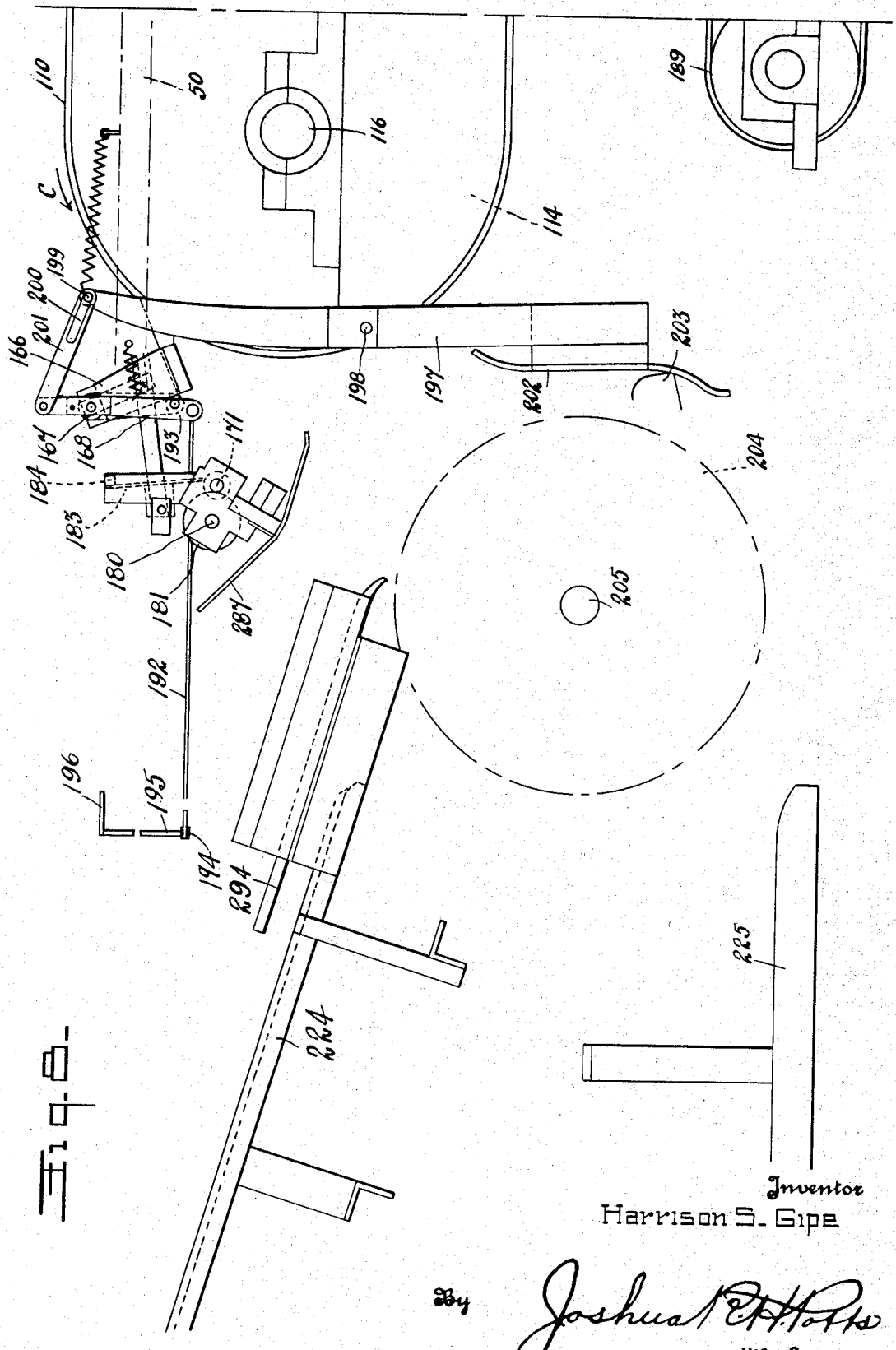


Fig. 8.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 17

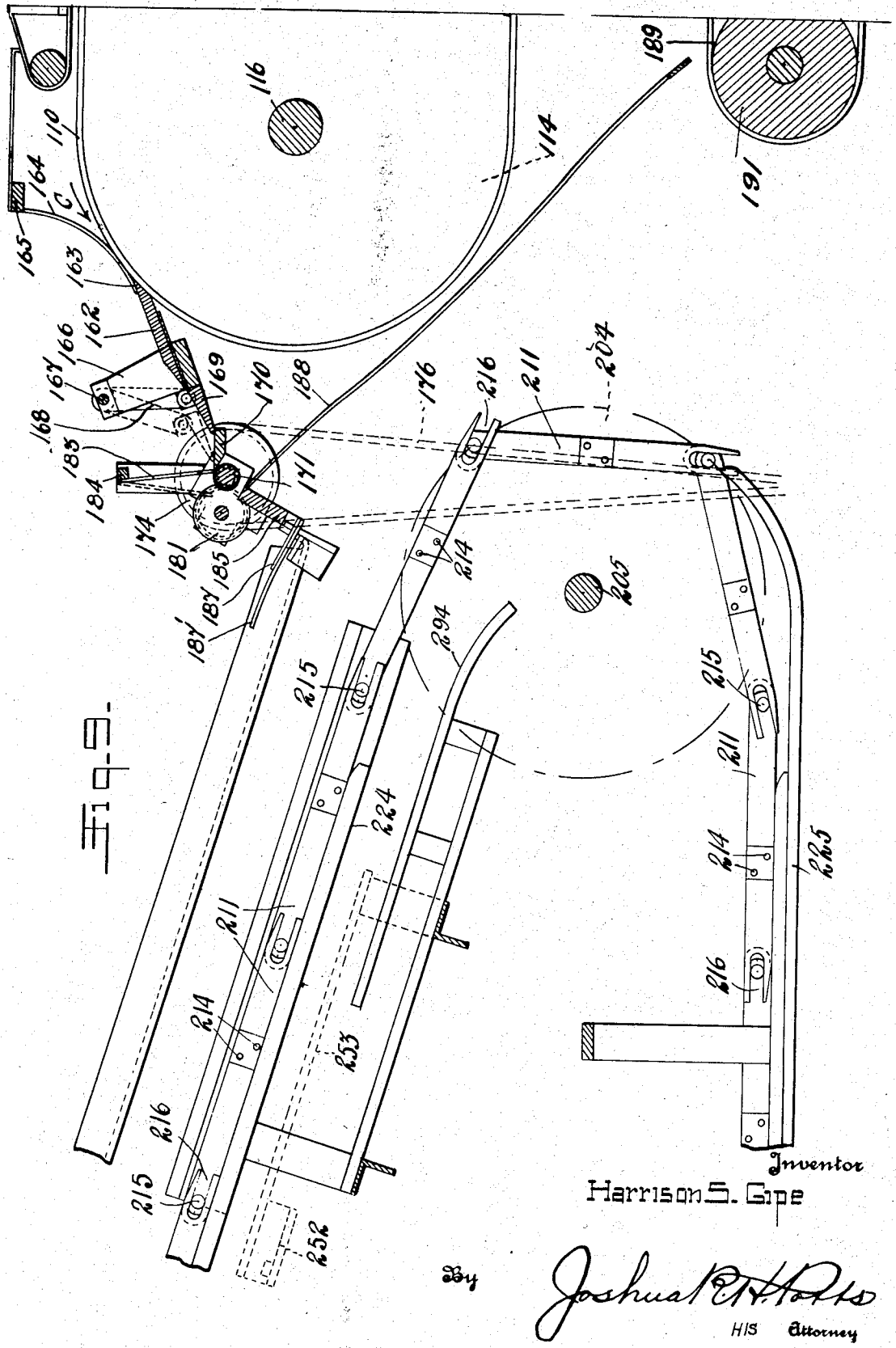


Fig. 5.

Inventor

Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 18

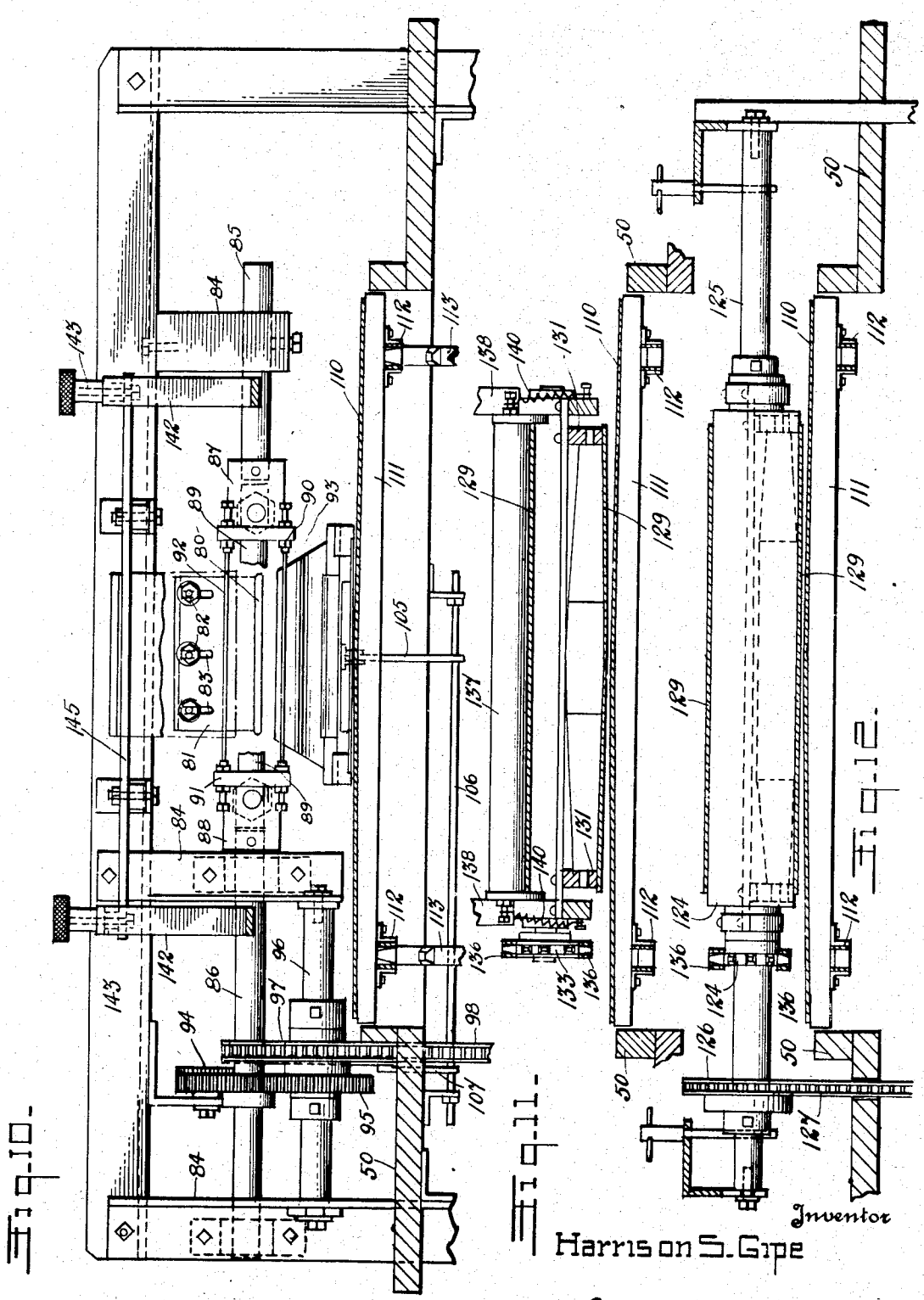


Fig. 10.

Fig. 11.

Fig. 12.

Inventor

Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 19

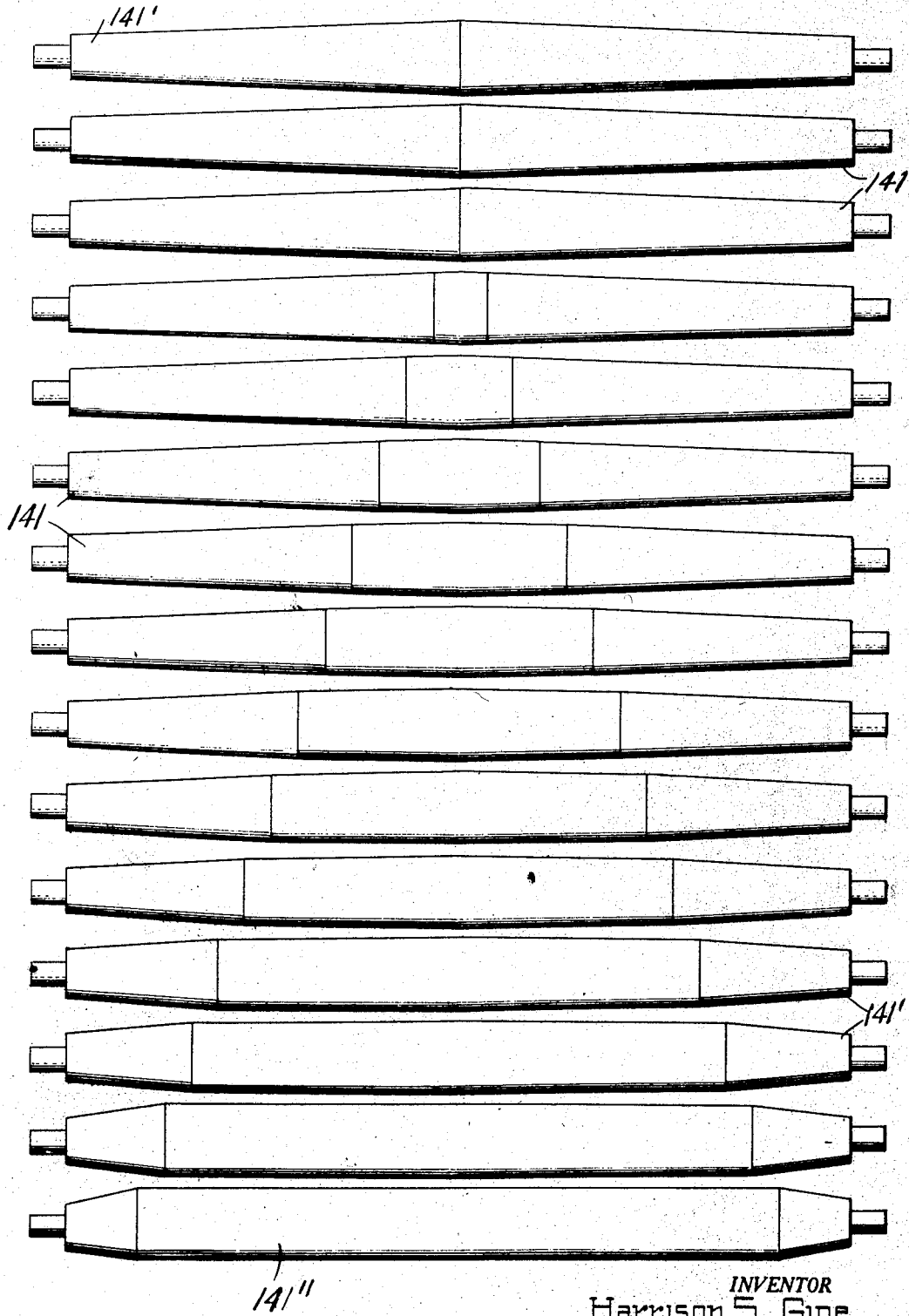


Fig. 13.

INVENTOR
Harrison S. Gipe
BY
Joshua R. H. Potts
HIS ATTORNEY

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 20

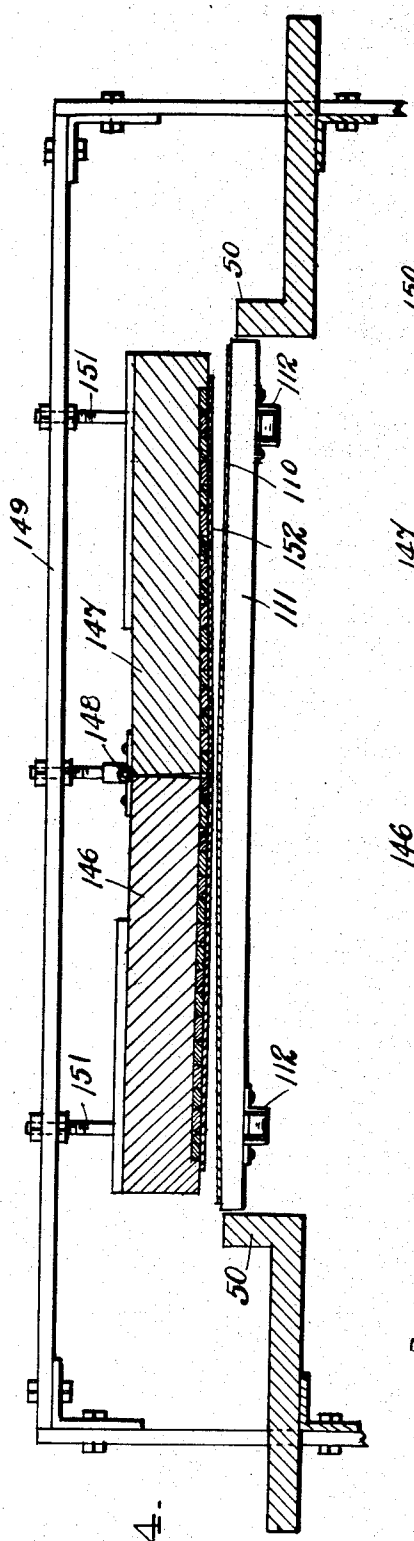


Fig. 14.

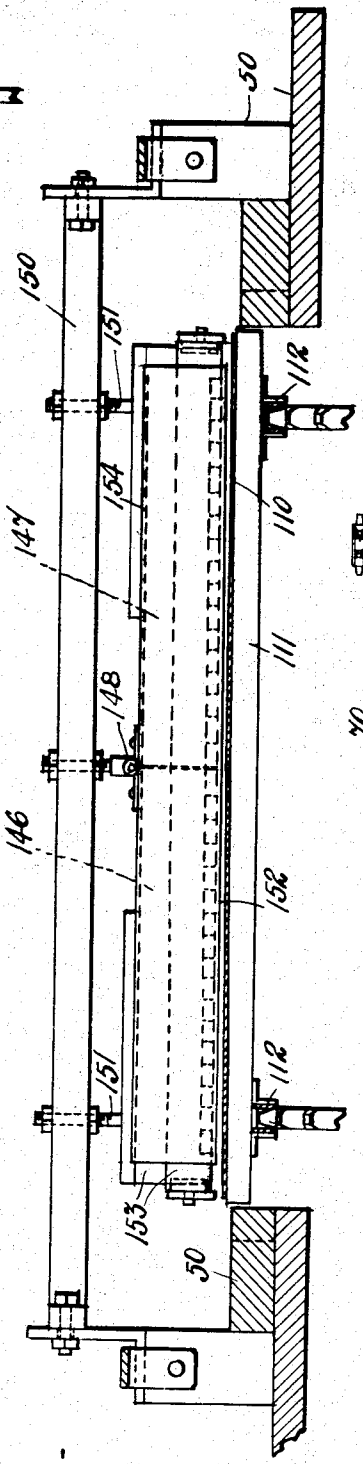


Fig. 15.

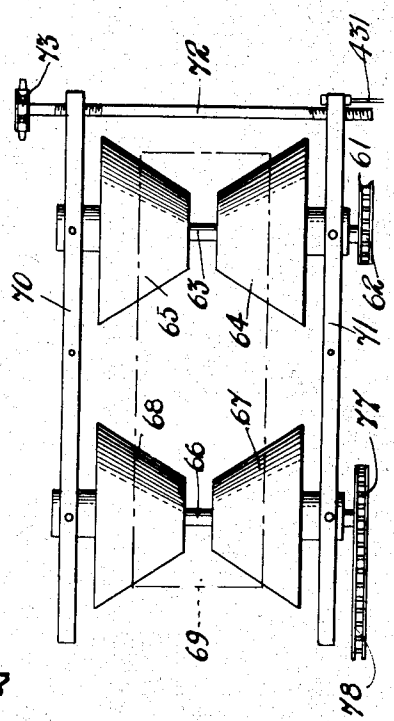


Fig. 16.

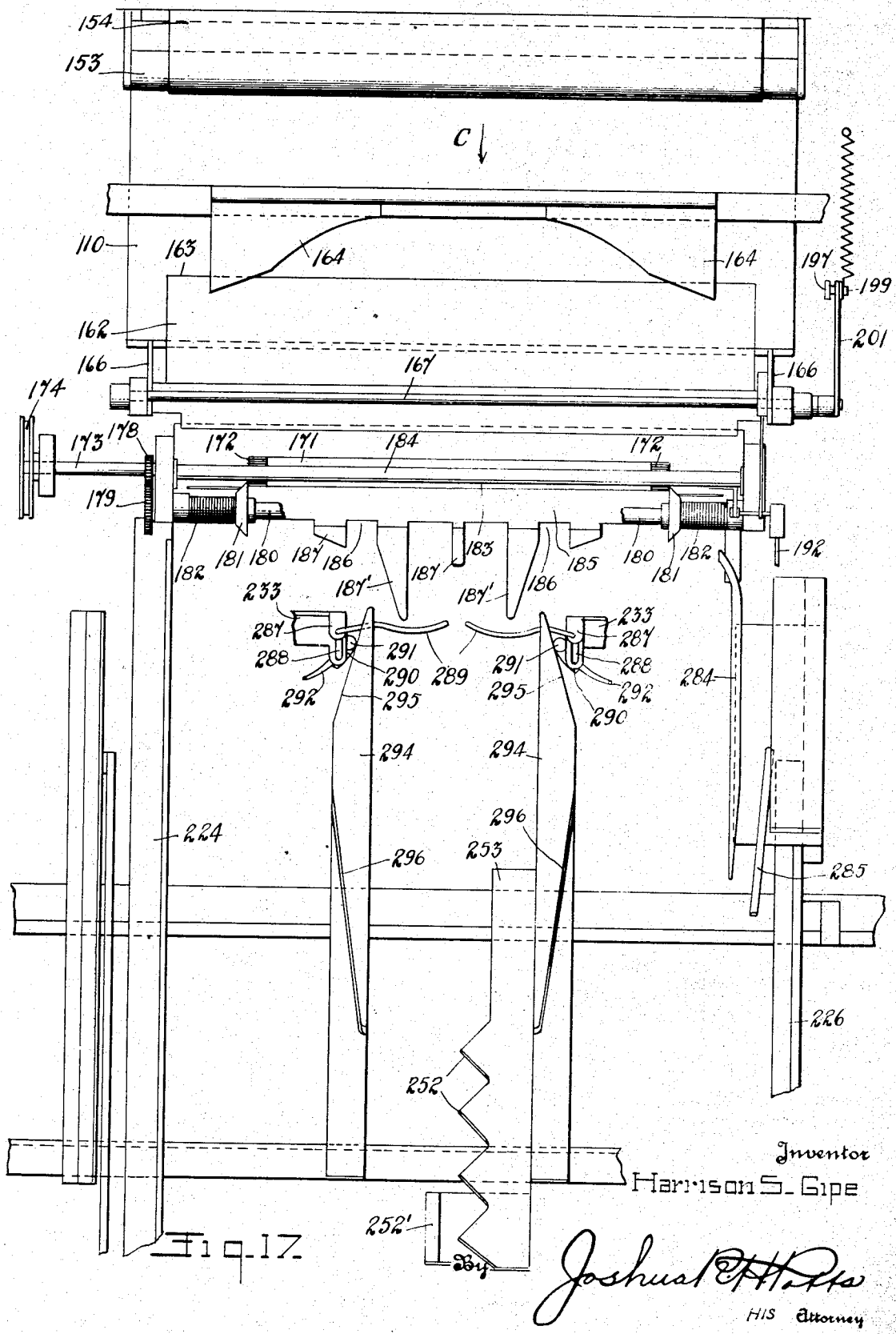
Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 21



Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 22

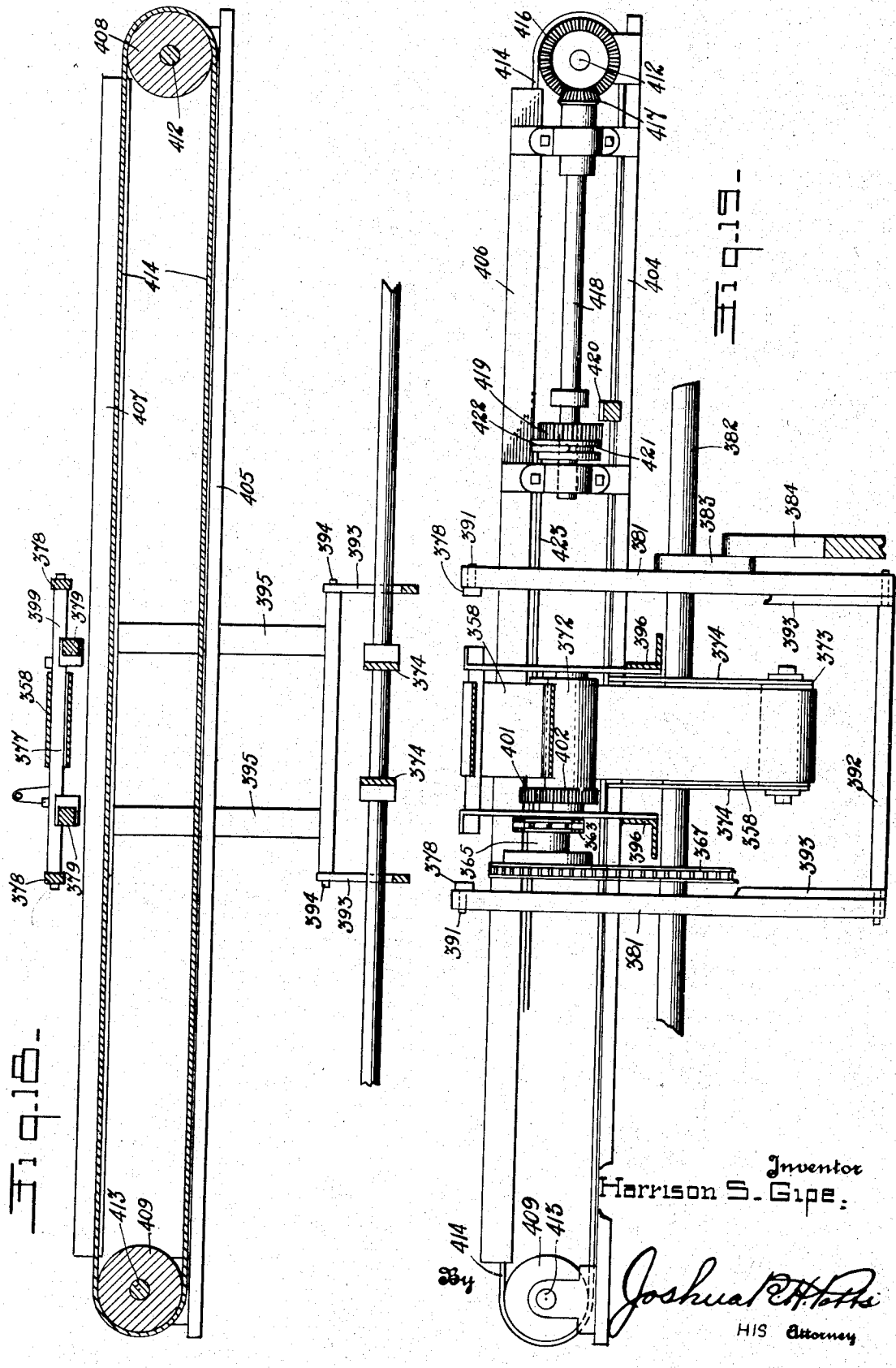


Fig. 18.

Fig. 19.

Inventor
Harrison S. Gipe.

By Joshua R. H. Potts
HIS Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 23

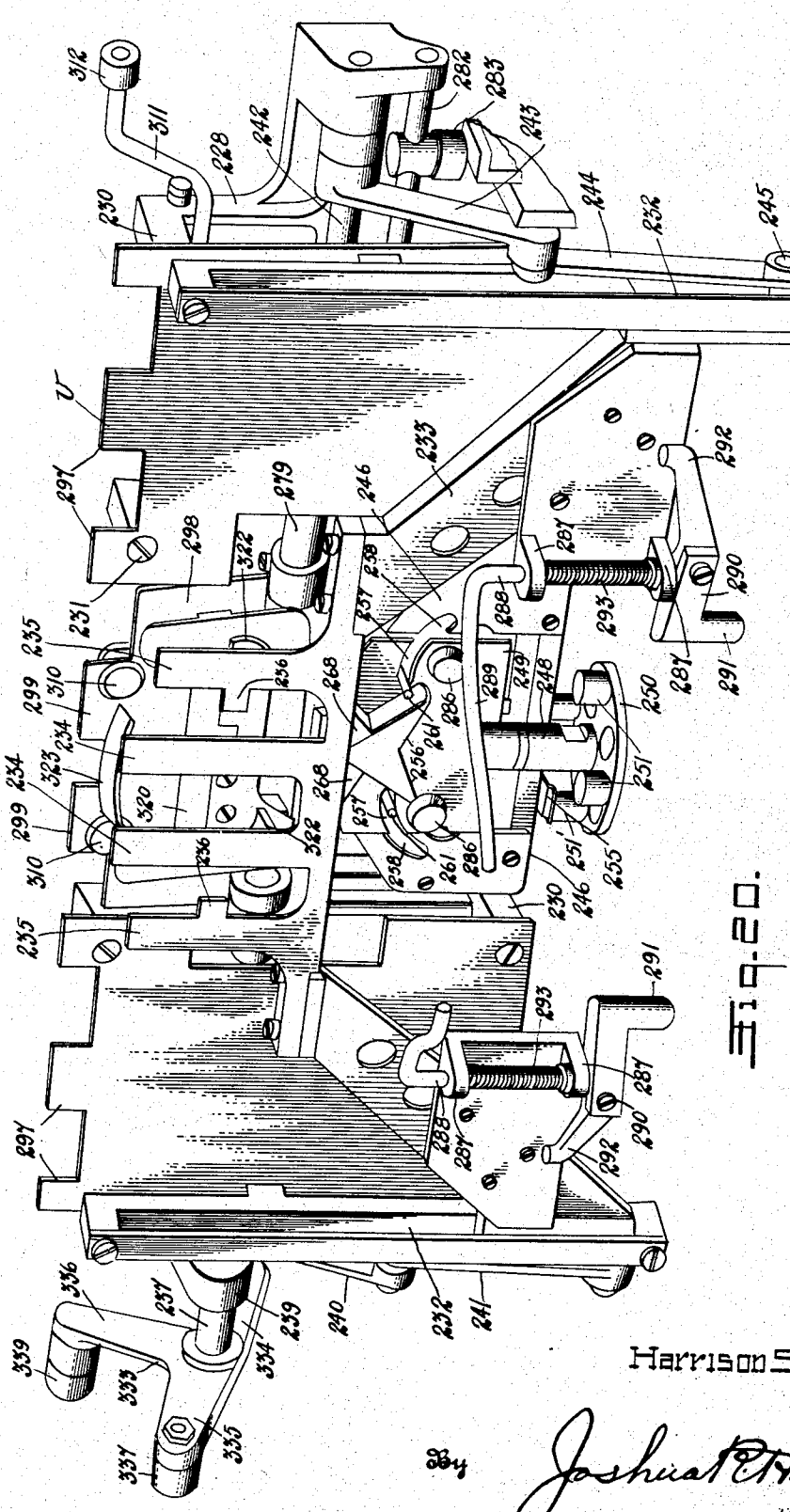


Fig. 20.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 24

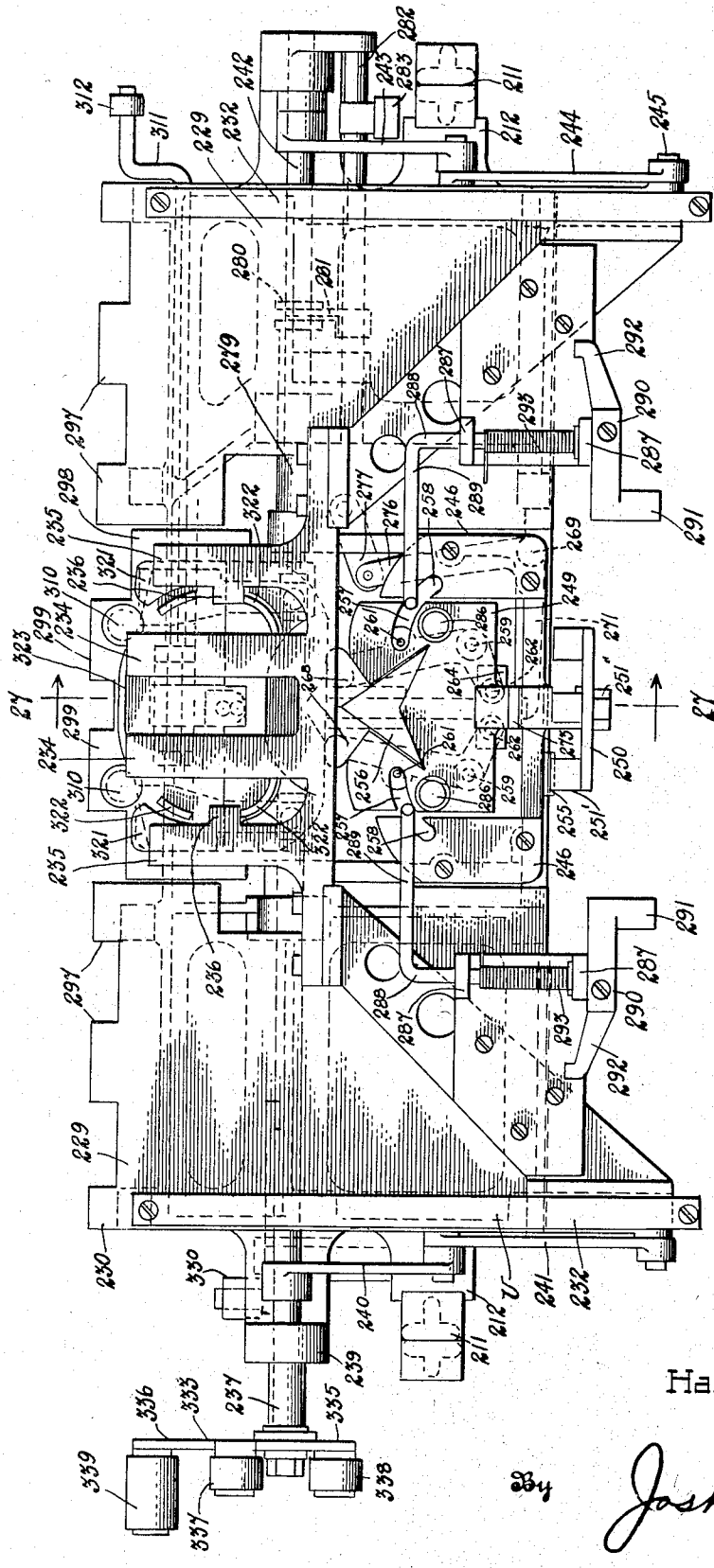


Fig. 21.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 25

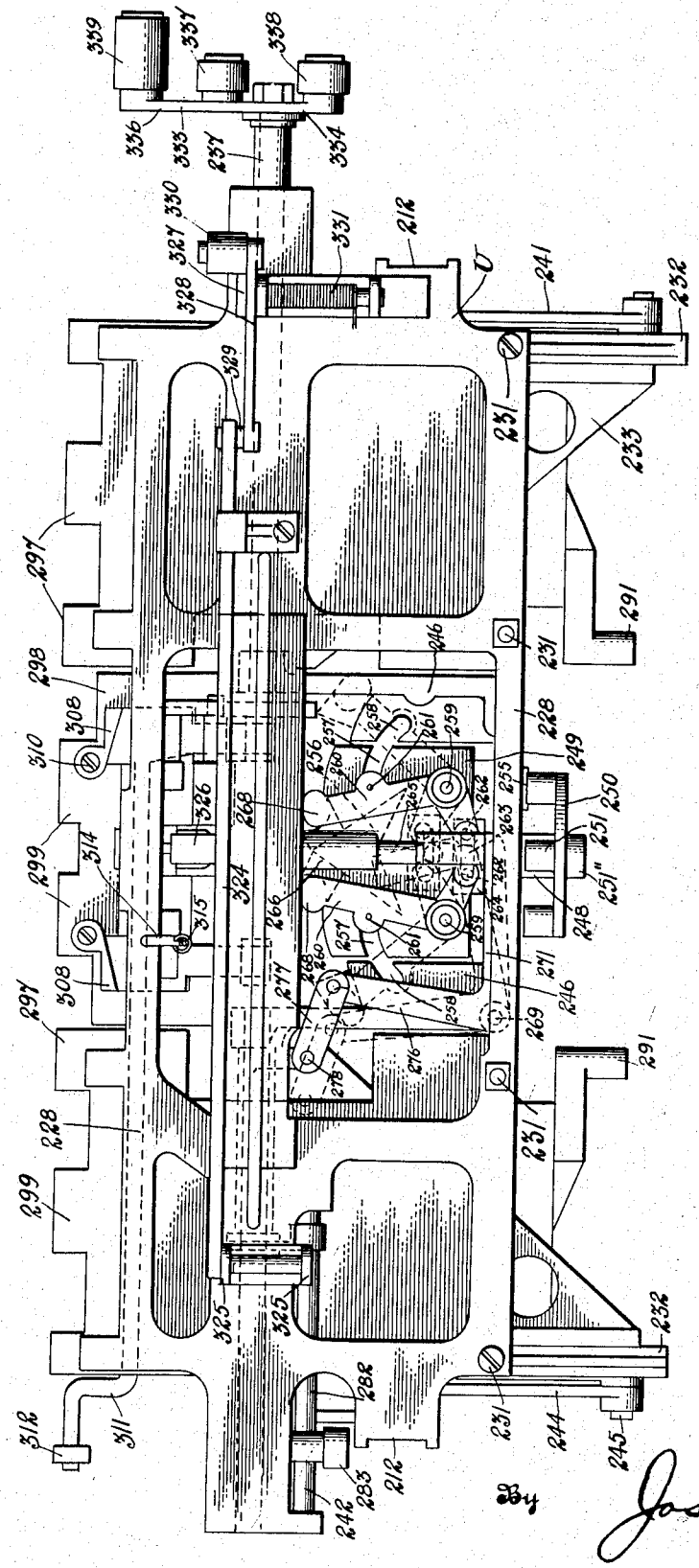


Fig. 22.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
H/S Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 26

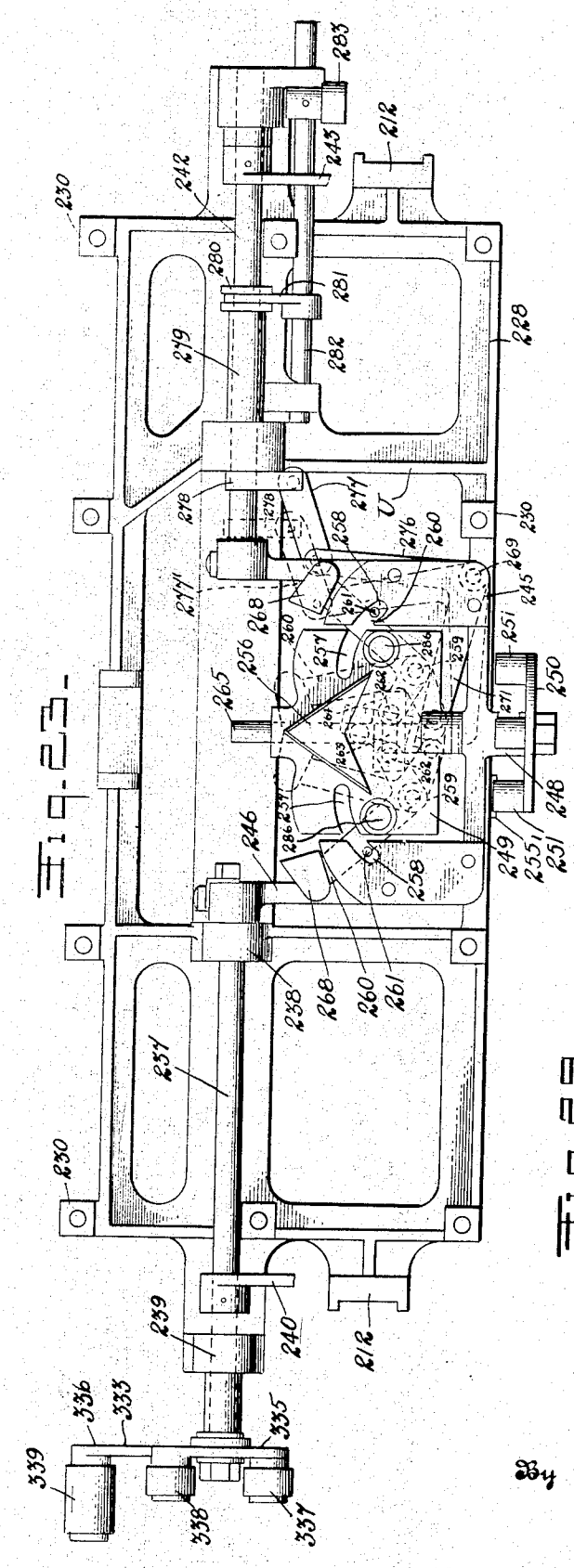


Fig. 23.

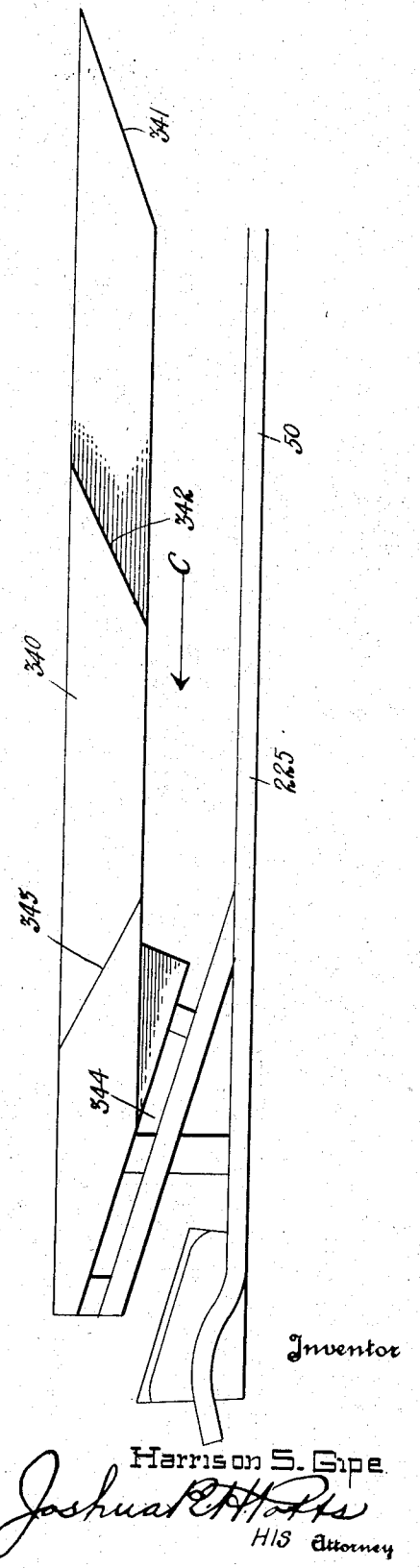


Fig. 25.

Inventor

Harrison S. Gipe

By Joshua R. H. Potts

His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 27

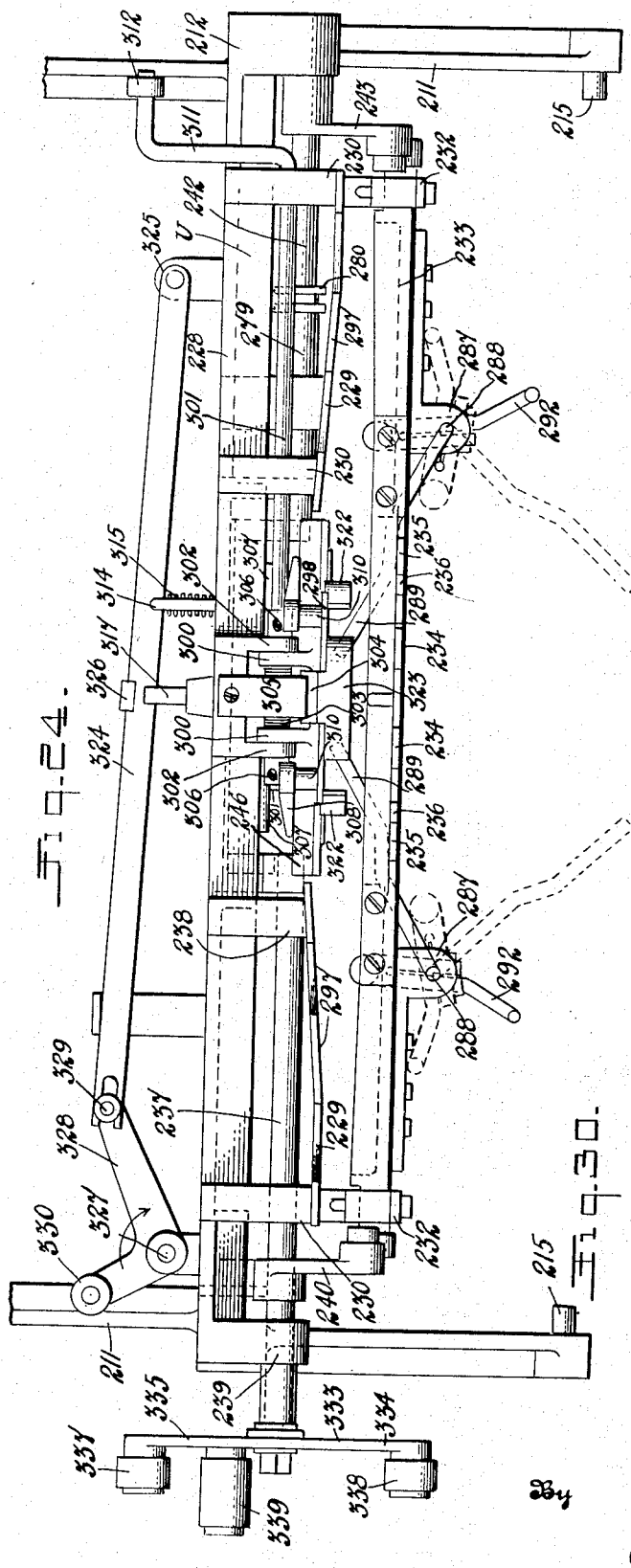


Fig. 24.

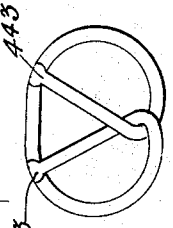


Fig. 33.

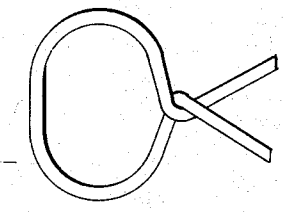


Fig. 32.

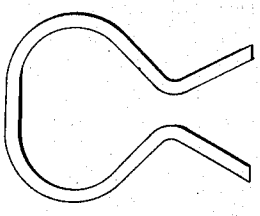


Fig. 31.

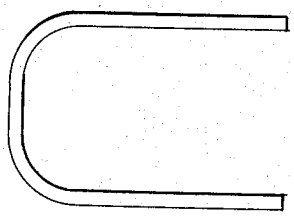


Fig. 30.

Inventor
Harrison S. Gipe

By Joshua R. H. Potts
His Attorney

Jan. 7, 1936. H. S. GIPE 2,026,526

PRETZEL FORMING MACHINE

Filed June 21, 1933 28 Sheets-Sheet 28

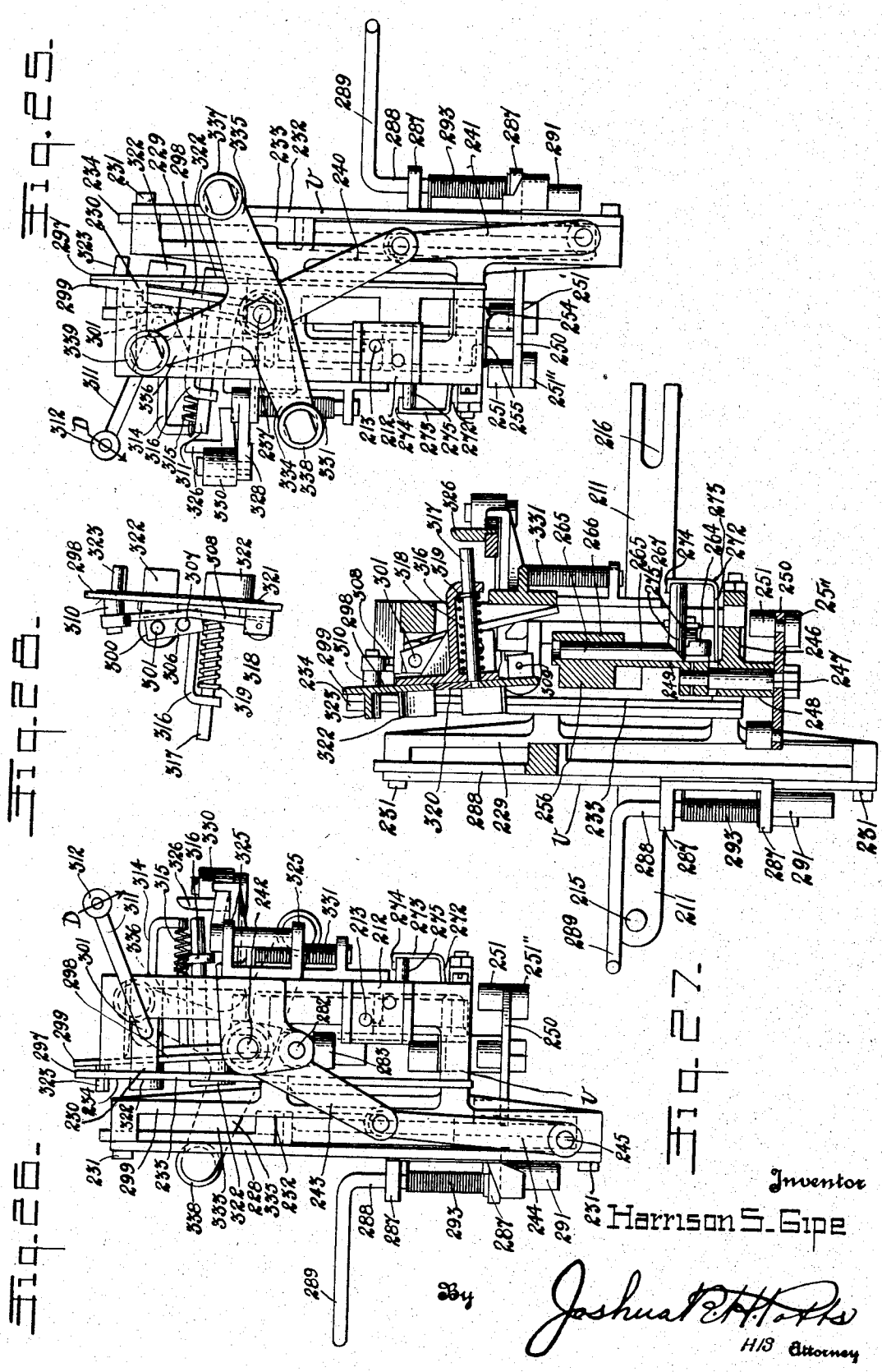


Fig. 25.

Fig. 28.

Fig. 26.

Fig. 27.

Inventor
Harrison S. Gipe
By Joshua R. H. Potts
His Attorney

Patented Jan. 7, 1936 2,026,526

UNITED STATES PATENT OFFICE

2,026,526

PRETZEL FORMING MACHINE

Harrison S. Gipe, York, Pa., assignor to Quinlan Pretzel Co. Inc., Reading, Pa., a corporation of Pennsylvania

Application June 21, 1933, Serial No. 676,855

18 Claims. (Cl. 107—8)

This invention relates to pretzel forming machines, and has for an object to provide a machine which in improved form and by improved mechanism forms a pretzel complete from a lump of dough to the formed article in a single progressive operation.

A further object of the invention is to provide a machine having improved means for severing a section of dough from a storage reservoir and rolling it to the proper dimensions, both in length and thickness, and delivering it to a further mechanism which bends and knots the dough string into pretzel form, and delivers it together with other thus formed articles properly ranked upon a processing board.

A further object of the invention is to provide in a pretzel forming machine improved means for severing a section of dough from a body with further improved means for rolling the severed section to the proper dimensions progressively through the machine.

A further object of the invention is to provide a machine having a plurality of forming units operating in endless succession arranged to receive a string of dough rolled by a prior part of the device, and to bend and knot the dough into a conventional pretzel form.

A further object of the invention is to provide a plurality of forming units traveling in endless succession individually taking up strings of dough previously prepared in the machine, transporting such strings of dough, and in the meantime bending and knotting the dough to pretzel form, and delivering the completely formed pretzel to a carrier which places the formed articles in proper serial relation upon a processing board.

A further object of the invention is to provide in a pretzel forming machine a new and improved bending and knotting unit.

A further object of the invention is to provide in a pretzel forming machine a new and improved conveyor for conveying a formed pretzel to a processing board.

A further object of the invention is to provide improved means for supporting and moving a processing board in consonance with the delivery of formed pretzels thereto by the conveying mechanism.

A further object of the invention is to provide improved structural parts, members, units, and combinations for carrying forward the several steps.

The invention, therefore, comprises a machine which employs a lump of dough, which is forced through an orifice at the mouth of which it is severed into uniform sections and delivered to a rolling mechanism, which continuously rolls the delivered section, beginning at the center and rolling outwardly toward each end until the required or desired thinness has been secured, whereby the original section of dough has been elongated to the extent required to complete the pretzel, which rolled attenuated string of dough is passed through a clipping mechanism, clipping the string to the required uniform length and delivering to a unit, a plurality of which are traveling successively in endless succession, each of which said units in its progression bends the string of dough, twists the string to form a knot, and then pastes the free ends upon the curved part of the dough string, after which the said article, so formed, is delivered to a conveyor, which conveys the formed articles to and successively deposits them upon a processing board, said processing board and conveyor having mutually interacting reciprocation for forming a rank of articles laid transversely of the board and the board provided with independent movement to present a position for the laying of an adjacent rank of articles.

In the drawings,

Figures 1—A, 1—B, and 1—C are together a view in side elevation of the machine,

Figures 2—A, 2—B, and 2—C are together a view in elevation of the opposite side of the machine,

Figures 3—A, 3—B, and 3—C are together a top plan of the machine,

Figures 4—A, 4—B, and 4—C are together a sectional view of a vertical plan longitudinal through the machine upon a substantially median line,

Figure 5 is a perspective view of the delivery end of the rolling mechanism together with the length clipping mechanism and one of the forming units,

Figure 6 is a perspective view of the machine a step in advance of that shown in Figure 5, showing one of the forming units in an upward position and associated with the cams for operating the same,

Figure 7 is a perspective view of the delivery end of the unit organization,

Figure 8 is a diagrammatic view of the section delivering the rolled string to the unit organization,

Figure 9 is a diagrammatic view at the same position as Figure 8, but on a different plane,

Figure 10 is a transverse sectional view taken on line 10—10 of Figure 3—A,

Figure 11 is a transverse sectional view taken on line 11—11 of Figure 3—A,

Figure 12 is a transverse sectional view taken on line 12—12 of Figure 3—A,

Figure 13 is a top plan view of the battery of rollers progressively rolling the dough section to elongation,

Figure 14 is a transverse sectional view taken on line 14—14 of Figure 3—A,

Figure 15 is a transverse sectional view taken on line 15—15 of Figure 3—B,

Figure 16 is a top plan view of the timing mechanism,

Figure 17 is a skeleton view in plan of the section of the machine delivering the rolled string to the length clipper and forming unit,

Figure 18 is a transverse sectional view through the laying mechanism taken on line 18—18 of Figure 3—C,

Figure 19 is a sectional view taken on line 19—19 of Figure 4—C,

Figure 20 is a perspective view of one of the forming units showing the advance side in its progress,

Figure 21 is a view of the forming unit in elevation seen from the advance side in its progression,

Figure 22 is a view in elevation of one of the units seen from the rear side in its progression,

Figure 23 is a view in elevation of a skeleton of the unit shown in elevation from the advance side in its progression,

Figure 24 is a top plan view of one of the units,

Figure 25 is a view of one of the units in end elevation,

Figure 26 is a view of one of the units in end elevation seen from the end opposite that of Figure 25,

Figure 27 is a transverse sectional view through the unit taken on line 27—27 of Figure 21,

Figure 28 is a detail view of the pasting and discharging mechanism,

Figure 29, on Sheet 26, is a view of the main cam, and

Figures 30, 31, 32, and 33 are views in elevation of the several progressive steps in the formation of the pretzel.

Like characters of reference indicate corresponding parts throughout the several views.

The pretzel forming machine, which forms the subject-matter of this application, is mounted upon a frame 50 which may be of any improved type, construction, material or formation, and the particular frame shown in the drawings is to be considered as no limitation upon the use of other types or forms of frames as may be found useful or desirable.

Mounted upon the frame 50 is a housing 51 within which a worm 52 is mounted. As shown more particularly at Figure 3—A, two of these worms are employed, but it is to be understood that the number shown is no limitation upon the number included within the present invention. The worms are surmounted by a hopper 53 adapted to receive and retain one or more lumps of dough until and as said lumps are acted upon by the worms. The action of the worms is provided by intergeared pinions 54 and a driving gear 55. The gear 55 is driven by a pinion 56 carried upon the shaft 57, which is connected within the gear box 58 with the shaft 59. The shaft 59 is provided with a sprocket 60, with a sprocket chain 61 driven from a sprocket 62, (see Figure 16). The sprocket 62 is a part of a change speed or timing mechanism of substantially a well known type. The sprocket 62 is mounted upon the shaft 63, which carries the conical rollers 64 and 65. A second shaft 66 carries the conical rollers 67 and 68. Over these conical rollers a belt or traction member 69 connects the two pairs of rollers. These rollers are slidable upon their respective shafts 63 and 66 and are manually controlled by means of levers 70 and 71, which in turn are controlled by a right and left screw 72. The shaft 72 has a sprocket 73 with chains 74 thereon connecting with a sprocket 75, which in turn is controlled by the hand wheel 76. The shaft 66 with its rollers are driven by means of a sprocket 77 and sprocket chain 78 from the motor 79.

As the motor is driven the worms 52 will be operated in such manner as to force the dough from the hopper 53 into the housing 51. The housing 51 is provided with an extruding orifice 80, which is made adjustable laterally by means of the plate 81, (see Figure 10, Sheet 18), which is movable and fixed in adjusted position by any approved means as the bolts 82 in the slots 83.

Journalled in brackets 84 rigidly secured to the frame 50 are shafts 85 and 86. These shafts 85 and 86 have respectively blocks 87 and 88, which may detachably connect with a shaft 89 in alignment with both of said shafts 85 and 86. The shaft 89 carries headers 90 and 91 with wires or other cutting members 92 and 93, which, when rotated, pass in shearing engagement with the extruding orifice 80. This relation is shown more particularly at Figure 4—A. The shaft 86 is a driven shaft and the shaft 85 an idle one. The shaft 86 is driven by a gear 94, mounted upon said shaft and inter-geared with a gear 95, mounted upon the shaft 96. The shaft 96 also carries a sprocket 97 over which extends a chain 98, from a sprocket 99 upon the shaft 100. The shaft 100 also is provided with a gear 101 which intermeshes with the gear 102, which is driven by the chain 61 passing over a sprocket fixed to said gear 102.

As will be understood from an examination of Figure 4—A, the wires or cutters 92 and 93 rotating in juxtaposition to the extruding orifice 80 will clip a section of extruded dough and carrying it about the arcuate surface will deposit it upon the sliding member 103, which operates in timed relation to the cutting. This sliding member 103 is carried by the link 104 pivoted to the arm 105. The arm 105 is carried by a shaft 106 (see Figures 4—A and 2—A). At its opposite end, the shaft 106 carries an arm 107 with the link 108 pivoted thereto and driven by a wrist pin carried by the gear 109.

Still examining Figure 4—A, it will be noted that the pusher 103 will tend to push the severed section of dough onto the endless apron 110. The endless apron 110 is carried upon an endless slatted support comprising the slats 111 and sprocket chain 112 to which the slats are fixed. The chain 112 passes over the sprocket 113 adjacent to the position just last mentioned, and at its opposite end over the sprocket 114.

The sprockets 113 and 114 are carried respectively upon shafts 115 and 116. The endless apron is driven by means of a chain 117 upon the sprocket 118 over the shaft 116 to the sprocket 119 upon the shaft 120. The shaft 120 also carries a sprocket 121 over which is a chain 122 engaging the sprocket 123 upon the motor 79.

Mounted immediately above the upper run of the apron 110 is a roller 124 mounted upon the shaft 125. The shaft 125 is provided with a sprocket 126 over which passes a chain 127 upon the sprocket 128 corresponding to the sprocket 119 and driven in consonance therewith.

Over the roller 124 is an endless apron 129, a second roller 130 being employed to support said endless apron 129, frame pieces 131 spacing the two rollers apart and supporting the trunnions 132 of the roller 130, one of which said trunnions supports a sprocket 133, a sprocket 134 being mounted upon the shaft 135, and the sprocket chain 136 connecting the two sprockets 133 and 134, and, therefore, the two rollers 124 and 130. A tensioning member is provided for the endless apron 129 comprising a roller 137 journalled in arms 138 pivoted at 139, the tension being applied thereto by springs 140.

The side bars 131 also serve to journal a series of rollers 141 shown in their journalled relation at Figure 4—A, and their several tapers shown more especially in Figure 13. The single roller especially designated as 141' is the initial roller, that is to say, the roller first exerting tension through the endless apron 129 upon the dough section which has been submitted thereto by the movement of the endless apron 110. The roller 141'' is the ultimate roller from which the dough is discharged. It will be noted that these rollers are tapered at their ends and that the tapers vary in stepped relation beginning at the third roller from the initial roller. While these identical tapers are not absolutely essential to the operation of the device, it has been found that the particular tapers applied thereto, as shown, have been efficient and are therefore considered desirable. The function of the tapers and their operation will be more specifically described hereinafter.

The frame consisting of the side bars 131 and the rollers and their shafts or trunnions carry brackets 142, which are provided with adjusting screws 143, which bear upon frame parts, as indicated specifically at 144 in Figure 4—A, so that the relation of the endless apron 129, and other parts associated with said frame, may be raised and lowered at the introduction end, as may be found desirable for the introduction of the initial section of severed dough. The frame is further interconnected by means of cross pieces 145, so that in addition to the adjustment provided by the screws 143, the entire frame may be swung upwardly upon the shaft 125 as a pivot.

After passing from under the endless apron 129, the dough rolled then into an elongated and somewhat attenuated string, passes, by reason of the movement of the endless apron 110, under the leaves 146 and 147. The relation of these leaves 146 and 147 to the endless apron 110 is best disclosed at Figure 14. These leaves are hinged together at 148 along their center lines, and the abutting center as well as the edges are made adjustable. The adjustment comprises truss bars 149 and 150 at the opposite ends of the leaves with adjusting screws 151, as shown at Figures 3—A and 3—B, 14 and 15 so that the edges and center may be independently adjusted.

The under side or side adjacent to the endless apron 110 is preferably covered by a fabric 152, which passes over a roller 153, as shown more particularly at Figure 4—B, and is secured at 154, so that there is a space intervening between the endless apron 110 and the fabric covering 152 on the leaves 146 and 147 as the use of the device may indicate as necessary or desirable and the functioning of which will be hereinafter more fully explained.

The roller 153 functions with the attached end 154 for tensioning the apron 152. The means for tensioning comprise bars 155 slidable along the side of the frame supporting the apron 152 by means of slots 156 and 157. Through these slots are respectively inserted bolts 158 and 159. A bolt 160 is also permanently fixed to the bar 155 and a spring 161 is connected, and therefore exerts tension upon the bolt 160 tending to move the bars 155 and roller 153 to tensioning position.

It will be noted especially from Figures 1—B, 2—B, 3—B and 5 that the endless apron 110 extends beyond the end of the apron 152 represented by the roller 153. Bearing upon this extended end of apron is a board 162, which is tapered substantially to an edge 163, where it bears upon and serves to strip the apron 110. As the dough strings discharged from beneath the fixed apron 152 are sometimes delivered by the apron 110 otherwise than exactly transverse as in fact the ends of the dough strings are apt to be in advance of the center, baffles 164 are provided in the form of fabric strips attached to a cross bar 165 and merely frictionally engaging the opposite ends of the dough string as delivered from the apron 110 to the stripper board 162.

Adjacent to the stripper board 162 brackets 166 are erected at opposite ends of such board, and a rod 167 is mounted in said brackets as a pivot member. To this pivot member are journalled arms 168 which carry a swinging strip 169 adapted to swing, as disclosed more particularly at Figures 4—B and 9, from a position to receive a dough strip from the stripper board 162 and moving to dotted line position (Figure 9) over the board 170.

The board 170 is positioned to deliver the dough string upon a roller 171 which has an intermediate diameter greater than the ends, and at the ends of this enlarged section are knurled parts 172. This roller 171 is provided with an extended shaft 173 and with a pulley 174.

A second motor 175 is provided fixed to the frame 50 and a belt 176 extends from the pulley 177 on the arbor of the motor to the pulley 174, whereby the roller 171 is constantly driven.

The shaft 173 is also provided with the pinion 178 which is intergeared with a gear 179 upon the shaft 180. This shaft 180 is therefore constantly driven in step with the shaft 173 and carries disk cutters 181, which are slidably mounted upon said shaft and held resiliently by means of springs 182 in shearing engagement with the enlarged portion of the roller 173 at the knurled ends. The dough string being delivered therefor upon the roller 171 passes between the rotary cutters 181 and is sheared to uniform lengths.

A second baffle 183 is attached to a bar 184 and swings freely, as indicated more particularly at Figure 9, to permit the passage of the dough string over the roller 171 and between the cutters 181, but serves to straighten the dough string, so that it will be uniformly cut to the proper and required length.

After passing between the cutters, the dough string is precipitated down a plate 185, which is set at an inclination, as shown more particularly in Figures 4—B and 9, and is provided with a plurality of cut-outs 186 forming interlying fingers, the ends of which are turned upwardly, as indicated at 187, two of said fingers 187' being longer than the other fingers 187. The dough string de-

livered from the cutters 181 and precipitated down the inclined plate 185 is therefore delivered to and lays along upon the several fingers 187 and 187'.

Underlying the length cutter, the roller 171 and the swinging strip 169 is an inclined deck 188, which is directed toward and discharges upon an endless apron 189. This endless apron 189 is carried upon and driven by a roller 190 driven by the gear 102. At its opposite end the apron 189 is carried by a roller 191.

All trimmings which are sheared by the rotary cutters 181 are dropped downwardly upon the inclined deck 188, discharged on the endless apron 189, and returned to a position adjacent to the hopper 53. Also in cases where it is desirable to interrupt the further processing of dough strings, momentarily or the like, the swinging strip 169 may be held in dotted position (Figure 9), so that the dough strings may drop directly from the stripper board onto the inclined deck 188, directed upon the endless apron 189, and may be returned to a position adjacent the hopper. To manually provide for thus controlling the strip 169, a wire 192 extends along the frame of the machine from the lever 193, which is fixed to the shaft 167, and is connected with an arm 194 upon the rod 195 and is connected with a manual arm 196 upon the top of the frame (see Figures 3—C and 8).

By manually oscillating the arm 196, the swinging strip 169 may be held in such position that the dough string will drop between such strip and the stripper board 162. The strip 169 is, however, normally swung in timed relation to the other functions of the machine by means of a lever 197 pivoted at 198 and connected by a pin 199 through the slot 200 in the link 201 with the arm 168.

As shown more particularly at Figures 1—B and 8, the lever 197 is provided with a cam 202 positioned to be engaged by a lug 203 carried upon or in consonance with one of the sprocket wheels 204 mounted upon the shaft 205. These sprocket wheels 204 carry each a sprocket chain 206 which said chains pass over vertically spaced sprockets 207 and 208 carried respectively upon shafts 209 and 210. These sprocket chains 206 carry a plurality of forming units which will hereinafter be referred to simply as "units" and are designated in their entireties by the letter "U". The several units "U" are fixed to bars 211 which are rigidly secured to the units by means of abutments 212 formed upon the units "U" by means of bolts or rivets through the registering openings 213 of the units 214 of the bars. The opposite ends of these bars are offset laterally and are connected together by means of pins 215 in the outwardly offset part engaging in slots 216 in the inwardly offset parts.

These bars 211 are fixed to the chains 206 at the pins 215 by means of a block 217 shown more particularly at Figures 6 and 7, and by reason of the slip connection between the pins 215 and the slots 216 are enabled to pass about the sprockets 204, 207, and 208 in the manner most clearly disclosed in the diagrammatic Figure 9. The chain 206 and the several sprockets 204, 207 and 208 are driven by means of a second sprocket 218 upon the shaft 209 and a chain 219 from the sprocket 220 on the shaft 221. The shaft 221 is driven by a chain 222 from the sprocket 223 mounted upon the shaft 100, which said shaft is driven in the manner hereinbefore described, from the motor 79 through the timing mechanism shown in detail at Figure 16.

As the chain 206 is rotated through the mechanism just described, it is obvious that the bars 211 will travel therewith and the units "U" attached to the bars.

It is found desirable to maintain the units in a generally upright but somewhat inclined position throughout their travel from the point of pick-up to the point of discharge, and for this purpose guide rails 224, 225, 226, and 227 are provided along which the bars 211 slide and maintain the units in the position in which their attachment to the bars provides. It will be noted that the guide rails 224 and 225 are inclined and that the units secured to the bars 211 will therefore occupy inclined positions during their travel along the guide rails 224 and 225, as shown at Figures 2—B, 6, and 7. The purpose of this inclination of the unit will be hereinafter more fully explained.

At several figures, as for instance, at Figures 1—B and 1—C, a plurality of the units "U" are shown. It is to be understood, of course, that the number disclosed in the drawings are merely illustrative, and may be increased or decreased as circumstances or choice may make necessary or desirable.

The units are as nearly identical as can be mechanically produced. Each unit comprises a base plate 228 (see Figure 23). It is this base plate 228, which is attached rigidly to the bars 211 at the abutments 212. To this base plate 228 is fixed the auxiliary plate 229 by means of lugs 230, some of which are formed upon the base plate 228 and some upon the auxiliary plate 229, such attachment being by any approved means as by the bolts 231.

Attached also to the supplemental plate, and preferably also to the base plate are guides 232.

Mounted to slide in these guideways 232 is the pick-up plate 233. In the drawings, this pick-up plate 233 is indicated as built up of a considerable number of fixedly interconnected sections. Such construction, however, is merely a matter of convenience in manufacture when desired, and integrality is as much within the scope of the invention as the assembly. This pick-up plate 233 comprises central fingers 234 somewhat longer than the fingers 235, which are spaced upon opposite sides of the fingers 234. The fingers 235 are also provided with insets 236, the utility of which will be hereinafter more fully described.

The sliding of the pick-up plate 233 is brought about by means of a shaft 237 which is journalled at 238 and 239 in the base plate 228. To this shaft 237 a lever 240 is rigidly attached, pivotally connected with which is the link 241, which is also pivotally connected to the pick-up plate 233. When, therefore, the shaft 237 is oscillated, the pick-up plate 233 is reciprocated in the guides 229.

There is also journalled in the base plate 228 a shaft 242 in alignment with the shaft 237. Upon this shaft 242 is also rigidly secured a lever 243, which is connected by means of a link 244 with the pick-up plate 233 at the pivot 245, so that as a pick-up plate is reciprocated by the lever 240, its sliding movement is imparted through the link 244 and lever 243 to the shaft 242.

There is also rigidly attached to the proximate ends of the shafts 237 and 242, the twister yoke 246. This is best seen at Figure 23. This twister yoke 246 being a rigid plate also assists in oscillating the shaft 242 in consonance with the shaft 237.

Upon the twister yoke 246, the twister is

mounted. The mounting is by means of a shaft 247 which is journalled at 248 in the twister yoke. Mounted rigidly upon this shaft 247 is the twister plate 249. This twister plate may be rotated upon the shaft 247 as an axis independently of the movement of the twister yoke. Such independent action is provided by means of a disk 250 rigidly mounted upon said shaft 247.

The disk 250 is provided with a plurality of lugs 251, and when the unit is traveling along the rails 224 and 226, these lugs will come in contact with the cogs 252 carried upon the member 253 (see Figures 4—B and 17). The engagement of the lugs 251 with the cogs 252 will rotate the twister plate upon its axis 247. The number of cogs 252 should correspond to the number of lugs 251, so that the twister plate may be given one complete rotation. In the drawings, four lugs 251 and four cogs 252 have been shown, but it will be understood that the number will be increased or decreased as found desirable. One of the lugs, particularized as 251' and shown more particularly at Figure 25, is provided with a notch 254 in its extremity and a spring detent 255 is provided for properly positioning the twister plate after one complete revolution imparted thereto by the cogs 252. Cooperating with the cogs 252 is an abutment plate 252' against which a lug 251'' will engage to limit the rotary movement of the disk 250 and stop the rotation of such disk at its normal position.

It will, therefore, be seen that the twister plate has already been provided with two independent motions, one the folding, together with the twister yoke under the impulse of the shaft 237; the other, the rotation upon its own axis 247 when the twister yoke is in normal position.

Mounted upon or formed integral with the twister plate is an abutment 256 which, as will be noted more especially from Figures 5, 20, and 23, is approximately A shaped.

The twister plate 249 is provided with arcuate slots 257 and the twister yoke with arcuate slots 258, which are continuations of the slots 257 and struck upon the same arcature.

Fulcrumed to the twister plate at 259 opposite the abutment 256 are bell crank levers 260. These bell crank levers 260 are provided with pins 261 which project through the slots 257 and 258 according to the position of the levers. These levers 260 carry at one leg of the bell crank lever, pins 262 engaged in the slot 263 of the block 264 which is rigidly connected with the rod 265 mounted to slide in the bearing 266, so that the arms 256 operate synchronously. About the bearings 259, springs 267 are provided tending to hold the arms together, so that the lugs 268 carried by the arms and projected over the curvature of the twister plate and beyond the surface upon the side next to the abutment 256 will open and close from and toward said abutment synchronously.

To operate these lugs and the arms 260 which carry them, a bell crank lever is pivoted at 269 and is provided with a spring 270 at such pivot. One arm of the bell crank lever 271 is provided with an outwardly extending arm 272, which engages under the block 264, so that when the bell crank lever is operated, the arms 260 are actuated. This outwardly extending arm 272 is provided with an upturned part 273 and an inturned hook 274, which engages a finger 275 offset from the rod 265 to insure the movement in both directions of the arm 271 and the rod 265.

The opposite arm of the bell crank lever 276 is connected by means of a link 277 with a lug 278 rigidly mounted upon the sleeve 279 slidably mounted upon the shaft 242 and rotatable therewith. This sleeve 279 carries a furrowed collar 280, which is engaged by a shifter yoke 281 carried rigidly upon the rod 282 slidably mounted in the base plate 228. This rod is provided with a cam roller 283 which engages the cam 284, as shown more particularly at Figures 5 and 17, a second cam 285 being provided to cooperate with the springs 267 and 270. Mounted also upon the twister plate 249 are paster lugs 286, the function and operation of which will be hereinafter more fully explained.

The pick-up plate 233 is provided with bearing ears 287 with rods 288 journaled therein. The rods 288 carry guide fingers 289. The rods 288 also carry a clamping member 290, best shown at Figure 20, which said clamping member is provided with cam engaging parts 291 and 292 (seen also to best advantage in the same figure). The rod 288 is also embraced by a spring 293 which tends to hold the fingers 288 to open position, as shown at Figure 24 and diagrammatically at Figure 17. These fingers are actuated by the cams 294, as shown diagrammatically at Figure 17 to be closed to the position shown at Figure 24. This cam 294 has initial cam inclination 295 and the final cam inclination 296, so that the fingers are moved to closed position only during that period while the unit carrying these fingers brings the cam 191 into engagement with the cam 294 riding up the inclination 295 and reverse along inclination 296.

The pick-up plate 233 is provided with a plurality of fingers 297 and there is mounted on the base plate a plate 298 having fingers 299 corresponding to the fingers 297. These fingers 297 and 299 are adapted to pass through the cut-out 286 in the board 171, as shown more particularly at Figure 5.

The plate 298 is pivotally mounted upon the base plate by means of ears 300 with the rod 301 passing through said ears and ears 302 formed upon the base plate. A spring 303 is mounted upon the shaft 301 and tends to move the plate 298 upon the shaft 301 as a pivot when the shaft is oscillated. The plate, however, is provided with a stop 304, which engages against an abutment 305, secured to the base plate, and therefore limits the movement of the plate 298, as will be hereinafter more fully described.

The shaft 301 carries blocks 306 rigidly secured thereto as by the set screws shown more particularly at Figure 24, which said blocks carry arms 307 extending in alignment and in opposite directions from the median line. Cam plates 308 are provided against which the arms 307 engage, said cam plates being pivoted to the plate 298 at 309 (see Figure 27). These cam plates 308 carry paster lugs 310, which at times project through the plate 298 under the action of the arms 307, which in turn are actuated by the shaft 301. The shaft 301 is actuated by means of a crank arm 311 having a cam roller 312 thereon. This cam roller is properly positioned to engage the cam 313 mounted upon the main frame 50 as shown more particularly at Figures 1—C, 5, and 7.

The main plate 229 also carries an arm 314 having a spring 315 extending therefrom to one of the fingers 307 tending to retract the plate 298. There is also attached to the plate 298 a bracket 316 through which extends a rod 317 with a spring 318 (see Figure 27) with a collar 319 on the said rod 317, so that the movement of the

rod through the instrumentality of the collar 319 exerts tension upon the spring 318. At one end the rod 317 is rigidly connected with a push-off plate 320. This push-off plate 320, as will be seen more particularly from Figure 7, comprises a bar extending longitudinally of the plate 298 with crescent-shaped extremities 321. The pusher 320 normally lies flush with the plate 298 and its position is partially surrounded by upstanding arcuate flanges 322 and an upper arcuate flange 323. The pusher pin 317 is actuated by means of a lever 324 fulcrumed to the main plate 228 at the ears 325 and provided with a cam-shaped offset 326. Fulcrumed at 327 on the main plate 228 is a bell crank lever 328, one end being connected by pin and slot connection, as shown at 329 in Figure 24, to the lever 324, and the other end provided with a cam roller 330. The fulcruming of the bell crank lever 328 at 327 is provided with a spring 331 which tends to hold the joint 329 away from the main plate until the roller 330 is acted upon by the cam 332 more particularly shown at Figure 7, but also shown at Figure 4—C.

For the purpose of actuating the shaft 237 to effect the various operations of the twister frame, a spider 333 is mounted upon said shaft 207.

As will be apparent more particularly from Figure 25, the spider is provided with three arms 334, 335 and 336. Each of the arms 334 and 335 is provided with a similar cam roller 337 and 338, while the arm 336 is provided with a longer cam roller 339.

There are mounted upon the frame 50, a plurality of cams for cooperating with the several cam rollers 337, 338 and 339. There is shown at Figure 29, the main cam 340 which is also shown in many of the other figures. As the units move in the direction indicated by the arrow at Figure 29, the long cam roller 339 first comes in contact with the cam incline 341 which serves to rotate the spider and the shaft 242 one-quarter of a revolution, whereupon the cam incline 342 engages the cam roller 338 and rotates the shaft 242 another quarter turn, whereupon both of the cam rollers 337 and 338 travel beneath the central part of the main cam with the cam roller 339 depending. When the roller 338 has passed beneath the cam incline 342, the long cam roller 339 again engages the cam slot 344 to return the shaft 237 and its associated parts to normal. After the spider 333 and the shaft 237 have been returned to normal, as shown in edge elevation at Figure 7, the long cam roller 339 again makes engagement with the cam 345 and the short roller with the cam 346 to again rotate the shaft as before described.

When the cam rollers have been acted upon as just described to rotate the shaft 237, the pick-up fingers 234 and 235 are, of course, advanced to the position shown at Figures 3—C and 7. In this position, they cooperate with fingers 347 of the flipper which is carried upon the shaft 348. This shaft 348 is journalled to the main frame 50 at 349 and 350 and carries a pinion 351. The pinion 351 is engaged by a rack 352 mounted to reciprocate, such reciprocation being accomplished by means of a pitman 353 through a pitman wheel 354, which is driven by means of a sprocket 355 (see Figure 1—C) and sprocket chain 356 from the gear 207 on the shaft 209. The reciprocation of the rack 352 oscillates the shaft 348 and therewith the fingers 347 and serves to pick up a completely formed pretzel from the fingers 234 and 235 of the pick-up plate, as shown more particularly at Figure 7. The oscillating of the fingers 347 serves to deposit the pretzel indicated at 357 upon the belt 358, the relation of the fingers 235, 347, and belt 358 being shown more particularly at Figure 1—C.

This belt 358 is designed to receive the pretzel forms and deposit them on series upon the processing board 359 (see Figures 1—C, 2—C, and 4—C). The belt is mounted upon a roller 360 carried upon the journal shaft 361. The shaft 361 carries a sprocket 362 with a sprocket chain 363, which passes over a sprocket 364 upon the shaft 365. The shaft 365 also carries a sprocket 366 from which a sprocket chain 367 leads to a sprocket 368 upon the shaft 369. The shaft 369 is driven by a chain 370 from a sprocket 371 on the shaft 221.

The belt 358 also runs over a roller 372 downwardly about a roller 373 which is journalled between arms 374, then upwardly over roller 375 inclining to a small roller 376 and to a roller 377 journalled between the arms 375 mounted to slide upon the guide rails 379.

Mounted also between the arms 374 is a weight 380 which tends to hold the belt 358 taut and yielding to the movement of the roller 377. To move this roller 377, arms 381 are mounted rigidly upon the shaft 382. The shaft 382 is oscillated and therewith the arms 381 by means of a lever 383 also fixed to the shaft with a pitman 384 pivotally connected to said lever 383. The pitman 384 is provided with a slot 385 embracing the shaft 386 and is also provided with two cam rollers 387 and 388 engaging a heart-shaped cam 389 carried upon said shaft 386.

The shaft 386 is driven by a gear 390 fixed thereon and intergeared with the gear on the shaft 369.

The arms 378 are pivoted at 391 to the upper ends of the arms 381 while a pivot 392 in the shape of a shaft at the lower end of the arms 381 pivotally engage links 393 which extend to the pivot 394 in the form of a cross bar connecting the frame pieces 395. The frame pieces 395 are part of a frame, the lower rails 396 of which are mounted to reciprocate, the reciprocation being facilitated by rollers 397 and 398. The reciprocation of this frame is in step with the reciprocation of the roller 377, but as they are connected to the opposite ends of the arms 381 they naturally reciprocate in opposite directions.

The arms 378 are connected directly to a shaft 399 and between the sliding arms 378 a discharge block 400 is mounted. This discharge block has an inclined upper surface, as shown more particularly at Figure 4—C and assists in discharging the pretzel from the belt 358. In addition to driving the belt 358 from the roller 360, a drive is also provided applied to both rollers 372 and 375. This drive comprises a gear 401 which intergears with the gears 402 and 403 carried respectively by the rollers 372 and 375. This gear 401 is mounted upon the shaft 365 which is driven by the sprocket 367 and in turn drives the sprocket 363.

Upon the rails 396 a framework is erected comprising the transverse bars 404, 405, 406, and 407. At the opposite ends of the frame so constructed rollers 408, 409, 410 and 411 are journalled. The rollers 408 and 410 are carried upon the shaft 412 and the rollers 409 and 411 are carried upon the shaft 413. Over the rollers 408 and 409 a belt 414 is employed, and over the rollers 410 and 411 a similar belt 415 is employed. These belts 414 and 415 move transversely relative

to the movement of the belt 358. Upon these belts 414 and 415 the processing board 359 is carried as shown more particularly at Figures 1—C, 2—C, and 4—C.

For moving the belts 414 and 415 together with their respective rollers, the shaft 412 is provided with a gear 416, and an intermeshing gear 417 is carried upon the shaft 418. The shaft 418 also carries a pinion 419 splined thereon and adapted to move into and out of position for engagement with the fixed rack 420.

A means for moving the splined gear 419 into and out of engagement with the rack comprises a furrowed collar 421 with yoke 422 (see Figure 19). A bar 423 extends transversely of the frame 50 (see Figure 3—C), which extends to a bell crank lever 424 pivoted at 425. Mounted adjacent to this bell crank lever 424 is a lever 426 which provides two stops 427 and 428 for engagement with the bell crank lever and to therefore operate the rod 423 and the gear 419. This bar 426 is pivoted at 429 with the manual control 430 whereby the reciprocation of the gear 419 into and out of engagement with the rack 420 may be discontinued at will.

The timing and synchronization of the machine and its various parts is an important feature tending to the satisfactory operation. As has been heretofore pointed out, timing is accomplished by means of the change speed mechanism shown at Figure 16.

One of the levers, as 71, is provided with a wire 431 which connects with a lever 432 upon the rod 433 (see Figure 1—A). At its upper end this rod 433 is provided with a pointer 434 (see Figure 3—A), which cooperates with a dial 435. This pointer and dial have no part in the regulation of the speed which is manually brought about by the use of a hand wheel 76 (see Figure 1—A), but indicates the position of the parts making up the change speed mechanism. As shown in the drawings also, two motors 79 and 175 are shown. It is necessary that these two motors shall synchronize so that the parts shall operate in proper timed relation. For this purpose, motor 175 is provided with a pulley 177 upon which a belt 436 is employed extending to a wheel 437 upon a shaft 438. The shaft 438 carries a sprocket 439 and a chain 440 extends from said sprocket 439 to a sprocket 442 on the shaft 221.

In operation, dough lumps, previously mixed to the proper consistency, are introduced into the hopper 53 and are acted upon by the worms 52 and thereby extruded through the extrusion orifice 80. The cutter comprising the wires or like devices 92 and 93 and their associated parts rotating in close proximity to the extruding orifice cut off sections of the extruded dough. It is the purpose that the length of extruded dough cut off shall be substantially equal to its other lateral dimension which would in general form a substantially square section of dough, but owing to the dough consistency, the square formation is not maintained, but swells and almost instantly approaches nearly to cylindrical. From this point, the dough section is deposited upon the reciprocating member 104, which, at that instant, is extended to such position as to receive the dough pushed thereto by the cutter.

The withdrawal of the reciprocating member 104 deposits the dough section upon the traveling apron 110. The apron 110 is traveling in the direction indicated by the arrow "A" at Figure 4—A, whereby the top run of the apron travels away from the extruding position. This travel carries the dough section under the endless apron 129 which is moving in the opposite direction, as indicated by arrow "B" at said Figure 4—A.

The movement of the endless apron 129 is slow compared to the movement of the apron 110, so that while there is a rolling action between the two aprons, the more rapid movement of the apron 110 carries the dough eventually from under the apron 129.

It will be noted that there are a plurality of rollers 141 bearing upon the lower run of this apron 129. The formation of these rollers is quite important to the proper rolling of the dough string. At Figure 13, the formation of these rollers is shown. The roller at the initial end of the apron 129 is shown at 141' in said Figure 13. As will be noted, this roller as well as the two succeeding rollers are tapered from a center line entirely to the ends.

It has been found that the rolling action is best accomplished by first constricting the dough section at the center and working the constriction outwardly toward the ends. Hence, the succeeding rollers have constantly elongated cylindrical sections at the center. The later rollers are also tapered at the center, but for a central section the sections are less acute than the terminal sections until the final roller 141'' has been reached, where the central section is cylindrical and the end tapers are very short. By this structure, the rolling of the string from the initial section is accomplished in a more satisfactory manner. After being discharged from beneath the apron 129, the dough string is carried by the endless apron 110 beneath the wings 146 and 147.

From Figure 14, which is taken adjacent to the initial end of these wings, as indicated by line 14—14 of Figure 3—A, it will be seen that the greater compression at the center is still maintained beneath the leaves 146 and 147, but that at the emergency end, as shown at Figure 15, taken on line 15—15 of Figure 3—B, the angle of greater compression at the center has largely disappeared. It has been found in the handling of such dough string that they are subject to contraction and that the greater contraction occurs at the center. Hence, in the production of a satisfactory string for making a pretzel, it has been found desirable to roll the center of the string to a smaller diameter than the ends. This variation in the angle of compression is brought about by the use of the adjusting screws 151. The leaves 146 and 147 are preferably constructed of wood and are subject to distortion to a limited extent by the actuation of the screws as mentioned.

Upon emerging from the end of the leaves, which position is shown more particularly at Figures 3—B and 4—B, the dough string, then attenuated to its required diameter, becomes in contact with the flaps 164. It has been found that in the discharge of the dough string, the ends are usually in advance of the middle of the string, and sometimes the string does not come out exactly transversely of the apron, but engaging against the flaps 164 corrects this condition.

The dough string is now removed from the apron 110 by the tapered board 162. This is best illustrated in the diagrammatic Figure 9. Under the lower or remote edge of the board 162, the swinging strip 169 is positioned to receive the dough string from the board, and to move forward to push the dough string against the swinging baffle 183, and deliver it upon the roller 171. This roller 171, as will be noted more

particularly from Figure 5, is knurled at shoulders formed in the proper spaced relation to provide for the required length of the dough string, and the cutters 181 cooperate with these shoulders in shearing fashion, the knurling serving to feed the dough string through and under the cutters. The dough string so cut drops upon the fingers 187 and 187' where it is held still in its elongated position. The positions of these fingers are best shown at Figures 5 and 17.

The series of units traveling in the direction indicated by the arrows "C" in the several figures now pick up the dough string upon the tongues 297 of the auxiliary plate and 299 of the swinging plate. The position of picking up is best shown at Figure 5, where it will be understood that the dough string is still supported upon the fingers 187 and are about to be removed therefrom by the fingers 297 and 299. It will be noted especially from Figures 5 and 17 that there are two fingers 187', which are longer than the fingers 187, and the dough string tends to droop at its opposite ends over the fingers 187', so that it is removed from the fingers 187' in a bowed condition.

While still maintained upon these fingers 187' the bow is located immediately over the arcuate flanges 322 and 323 of the swinging plate 298, and that as soon as it is removed from these fingers 187', its own weight causes it to droop about these forming flanges 323 and 322 to assume the shape shown at Figure 30. At this time, the ends will hang downwardly upon opposite sides of the forming abutment 256. At this time also, the arms 289 have been closed to the position shown in full lines at Figure 24. These serve as a further guide for the drooping ends of the dough string to assure their proper placement upon the flanges 323 and 322. Also at this time, the arms 260 and their forming heads 268 will be in the position shown in full lines at Figure 23.

These arms it will be recalled are controlled by the sliding sleeve 279, the shaft 282 and roller 283. The timing is such that when the dough string has had ample opportunity to droop to the position just outlined, the roller 283 will pass off from the cam 284, which has held the arms in open position, and will permit the springs 267 to close the arms 260 to the position shown in Figure 21, whereby the dough string is formed over the forming abutment 256 to the shape shown at Figure 31. Not only do the heads 268 serve to form the dough string as shown, and to hold it in position, but also the pins 261 engage the dough string farther down and hold it in position with its ends over the pasting lugs 286.

At this point, the arms 289, which have been in closed position, are opened by engagement of the rollers 291 with the incline 295 of the cam 294 (see Figure 17). This removes the arms 289 to permit further manipulation of the twister and twister yoke. As the unit further advances, the lugs 251 upon the disk 250 engage the cogs 252 upon the member 253 (see Figure 17), and the twister is given one complete rotation. It will be apparent that the upper part of the dough string is still held about the forming flanges 323 and 322, and that the twist will occur below this position and will form the dough string, as shown at Figure 32. The complete rotation of the twister has performed this function, but the dough string is still held in position.

When the long roller 339 of the spider 335 engages the cam incline 341, the spider begins to turn and to turn the shaft 237. As shown at Figure 23, this shaft 237 is rigidly connected with the twister yoke, so that when the shaft begins to turn, the twister yoke moves therewith.

The further engagement of one of the short rollers 337 with the cam incline 342 produces, together with the previous rotary action, a substantial half turn, whereby the lower part of the dough string is turned upwardly against the upper loop to the position shown at Figure 33. It will be recalled that the free ends of the dough string are against the paster lugs 286, and when the twister yoke has been folded to its completely folded position, as shown at Figure 6, the paster lugs 286 are in register with the paster buttons 310.

While in this folded position, the cam roller 312 will engage the cam 312' to move the roller in the direction indicated by the arrow "D" in Figures 25 and 26. This will cause the finger 307 (see Figure 28) to bear upon the cam plate 306 and project the pasting button 310 through the plate 298, and as they are now in register with the paster lugs 286 of the twister, the result will be a flattening of the ends against the curvature of the loop, as indicated at 443 at Figure 33.

The dough string is now completely shaped in the form of a pretzel, as shown in said Figure 33, and the twister plate now recedes from the position by the engagement of the roller 338 with the cam incline 344 and the further engagement of the long roller 339 with the cam slot 344, so that the twister plate returns to normal position the formed pretzel still encircling the former flanges 323 and 322.

The next step is to discharge the formed pretzel. The roller 312 is again brought into action by engagement with a cam whereby the tilting plate 298 is first tilted, the pasting buttons 310 again extended. Simultaneously the cam roller 330 (see Figure 24) engages the cam 332, whereby the stripper plate 320 and its crescent shaped parts 321 are raised to the surface of the supporting flanges 323 and 322, and together with the action of the pasting buttons, discharges the formed pretzel from its engagement with said flanges.

This takes place only when the unit is moving downwardly from the gear 207 and the fingers 234 and 235 of the pick-up plate are in their normal position as shown at Figure 5, and underlie the forming flanges 323 and 322, so that the pretzel discharged from these flanges is deposited upon these fingers 234 and 235. The spider now makes engagement with the cams 245 and 246 (see Figure 7) which advances the pick-up plate quickly carrying therewith the pretzel, so that it assumes the position shown at said Figure 7 whereby it passes through the flipper fingers 347, and the pretzel is therefore deposited upon these flipper fingers.

The pretzel deposited upon the flipper fingers 347, as shown at Figure 7, is now suddenly turned through an arc by the actuation of the rack 352 upon the pinion 351 to deposit the formed pretzel upon the belt 358.

At this time the roller 377 (see Figure 4—C) is retracted toward the flipper plate and the belts 414 and 415 are projected to their limit in the opposite direction, so that the discharge member 400 is projected over the edge of the processing board 359.

As the roller 377 moves in either direction, the roller 373 raises or lowers, the raising being at-

tained by the movement of the roller 377 in the direction indicated by the arrow "E" at Figure 4—C, and the lowering being accomplished when the roller moves in the opposite direction and the slack is taken up by the weight 380.

With the discharge strip 400 located over the edge at the frame piece 406, the flipper 347 will begin to deposit pretzels upon the belt 358. Coincidentally with this, the roller 377 is moved in the direction indicated by the arrow. The movement of the roller 377 is timed with the movement of the belt, so that during this movement there is no relative movement of the belt at the roller 377, but merely an advancement.

The pretzels being deposited upon the belt, as the belt moves in the direction indicated by the arrow "E" will, upon the second reciprocation of the arms 381, be directly at the roller 377, and when the roller is retracted in the direction opposite to the arrow "E", the pretzels will be laid in a row transversely of the processing board 359. During all of this time, however, the belt 358 has been moving in the direction indicated by the arrow "E", so that the flipper continues to deposit the formed pretzels upon the moving belt irrespective of whether the belt is depositing the pretzels upon the processing board or not.

In other words, the roller 377 moves toward the frame piece 407 without depositing pretzels upon the processing board, but in its movement toward the frame piece 406 deposits a row of pretzels transversely of this board. As soon as this row of pretzels has been laid the board is advanced by the actuation of the belts 414 and 415 which is brought about by the engagement of the pinion 419 with the rack 420 as the frame carrying the belts reciprocates.

On the movement of the frame in the direction indicated by the arrow "F", the processing board remains fixed upon the frame, but upon the movement in the direction opposite to the arrow "F", the pinion 419 is brought into engagement with the rack 420 and the belts and processing board carried thereby are advanced a sufficient distance to receive a second row of pretzels.

It will be understood, of course, that all of these various steps are absolutely timed, so that from the severing of a section of dough at the extruding orifice to the depositing of the line of pretzels across the processing board every movement is in step.

It is one of the peculiarities of dough of the consistency required for pretzels that it must act and be acted upon relatively slowly, and that to provide mechanism for producing a considerable number of pretzels permitted, the organization must be such that each part may act slowly and yet in combination provide for quantity production. The rolling of the dough string is accomplished slowly by the slow movement of the apron 110. It will be understood, of course, that any required number of these dough strings may be simultaneously advancing upon this belt 110.

They are discharged from the belt 110 to the trimmers in proper timed relation, so that each dough string, as it is deposited upon the fingers 187 and 187' will be almost instantly picked up by the fingers 297 and 299. The machine is provided with such a number of the units "U" that each action of each part of the unit, as hereinbefore described, may take place slowly as the unit progresses from its pick-up to its discharge position. After being formed and ready to discharge the formed pretzel, the action may be quicker as it entails no distortion or change in the form of the dough.

By the use of such a device, the thickness of the pretzel may be accurately controlled by the control of the extruding orifice, as the final formed pretzel naturally depends upon the quantity of dough which enters into it. The pretzels will be formed with uniformity for the reason that they are, in each instance, formed over the forming flanges which are uniform in each unit.

While the construction and operating parts of this machine have been described and shown in the drawings with great particularity, it is to be understood that many of the features so described are in their exact form not essential, and that changes may be made in a great number of instances and great variety of form while accomplishing the same result and falling within the terms of the invention.

I claim:—

1. In a pretzel forming machine, a forming unit comprising a base plate, means carried by the base plate to pick up and support a dough string in inverted U-form, a twister unit positioned to engage the depending ends of the supported U-form, means to move the unit as an entirety, means incident upon the movement to rotate the twister unit, means further actuated by the movement of the unit to fold the twister member to bring the free ends of the dough string into engagement with the bow of the U, and means to pretrim the ends of the dough string to proper length to coincide with the U part when so engaged.

2. In a pretzel forming machine a traveling unit comprising a base plate, means upon the base plate to support a dough string in U-form, a twister adapted to twist the legs of the U-form intermediate the ends and the bend, means to fold the twister to lap the ends of the legs upon the bend, means to unfold the twister, means to push the folded and twisted form off the support upon a slatted support and juxtaposed slatted means oscillatable about a fixed axis to receive the form pushed off.

3. In a pretzel forming machine a traveling unit comprising a base plate, means upon the base plate to support a dough string in U-form, a twister adapted to twist the legs of the U-form intermediate the ends and the bend, means to fold the twister to lap the ends of the legs upon the bend, means to exert additional pressure subsequent to the folding to insure adhesion at the lapped parts, and means to unfold the twister, said additional pressure means tending to push the folded and twisted form off from the support.

4. In a pretzel forming machine a base plate, means upon the base plate to support a dough string in U-form, a twister adapted to twist the legs of the U-form intermediate the ends and the bend, means to fold the twister to lap the ends of the legs upon the bend, means to exert additional pressure to insure adhesion at the lapped parts, means to unfold the twister, and means including said additional pressure means to push the folded and twisted form off from the support.

5. In a pretzel forming machine a unit having a base plate, means upon the base plate to support a dough string in U-form, a twister provided with a circular series of lugs and positioned

to support the legs of the U-form, means to move the unit, a rack fixed in the path of movement of the lugs to rotate the twister, means to fold the twister to impress the ends of the legs upon the bend, and means to preclip the ends of the string so that the ends of the legs coincide with the impressed parts of the bend.

6. In a pretzel forming machine a unit having a base plate, means upon the base plate to support a dough string in U-form, a twister provided with a series of lugs encircling its axis, said twister positioned to support the legs of the U-form, means adapted to swing to position to guide the legs to operative position upon the twister and then swing to non-guiding position, means to move the unit, a rack fixed in the path of movement of the lugs to rotate the twister, and means to fold the twister to impress the ends of the legs upon the bend.

7. In a pretzel forming machine a unit having a base plate, means upon the base plate to support a dough string in U-form, a twister provided with a circular series of lugs and positioned to support the legs of the U-form, means to guide the legs to operative position upon the twister, means to bend the legs of the U-form to approximate convergence upon the twister, means to remove the guiding means subsequent to the bending, means to move the unit, a rack fixed in the path of movement of the lugs to rotate the twister, and means to fold the twister to impress the ends of the legs upon the bend.

8. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted upon and adapted to reciprocate relative to the base plate, a twister mounted upon and adapted to rotate and fold relative to the base plate, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, means to discharge from the twister to the pick-up at one reciprocation, and means to operate the parts in synchronism.

9. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted upon and adapted to reciprocate transversely relative to the base plate, a twister mounted upon and adapted to rotate and fold relative to the base plate, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, means to discharge from the twister to the pick-up at one reciprocation, and means to actuate the several parts in step.

10. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted upon and adapted to reciprocate relative to the base plate, a twister mounted upon and adapted to rotate and fold relative to the base plate, movable fingers mounted upon the base plate and tending to guide a dough string to position upon the twister in U-form, means to bend the legs of the U-form between the bend and the ends and to maintain the bends during twisting, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, said pick-up plate at one position being under and adapted to receive the dough string from the twister, and means to operate the parts in synchronism.

11. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted upon and adapted to reciprocate relative to the base plate, a twister mounted upon and adapted to rotate and fold relative to the base plate, means upon the base plate to support a dough string in U-form with its opposite ends upon the twister, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, one of said reciprocations bringing the pick-up under and in position to receive the dough string from the twister, and means to operate the parts in synchronism.

12. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted to reciprocate relative to the base plate, a twister mounted to rotate and fold relative to the base plate, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, means cooperating with the twister at the first reciprocation of the plate to lay a formed dough string thereon, and means cooperating at the second reciprocation to lift the formed string therefrom.

13. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted to reciprocate transversely relative to the base plate, a twister mounted to rotate and fold relative to the base plate, movable fingers tending to guide a dough string to sag by its own weight into position upon the twister in U-form, means to support a dough string in U-form with its opposite ends upon the twister, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, one of said reciprocations bringing the pick-up under the twister, means cooperating with the twister at the first reciprocation of the plate to lay a formed dough string upon the then underlying pick-up, and means cooperating at the second reciprocation to lift the formed string from the pick-up.

14. In a pretzel forming machine a series of orbitally moving forming units each embodying a reciprocating member having spaced fingers, means to convert a dough string into pretzel form and lay it upon the fingers of said member at one limit of its reciprocation, a conveyor belt, an oscillating member having spaced fingers adapted to pass between the fingers of the reciprocating member and lift the pretzel form therefrom, and means to oscillate the oscillating member in time to lift a pretzel form from each reciprocating member at the other limit of its reciprocation and lay said form upon said conveyor belt.

15. In a pretzel forming machine a series of orbitally moving forming units each embodying a reciprocating member having spaced fingers, means to convert a dough string into pretzel form and lay it upon the fingers of said member at one limit of its reciprocation, a conveyor belt, an oscillating member having spaced fingers adapted to pass between the fingers of the reciprocating member and lift the pretzel form therefrom, and means to oscillate the oscillating member in time to lift a pretzel form from each reciprocating member at the other limit of its reciprocation and when the unit carrying said member is moving downwardly in its orbit, lay said form upon said conveyor belt.

16. In a pretzel forming machine a unit following an orbital path, part of said path being along straight lines and having a base plate, means upon the base plate to support a dough string in U-form, a twister provided with a circular series of lugs and positioned to support the legs of the U-form, means to move the unit, and a straight rack fixed in the path of movement of the lugs to rotate the twister.

17. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted upon and adapted to reciprocate relative to the base plate, a twister mounted upon and adapted to rotate and fold relative to the base plate,

movable fingers mounted upon the base plate and tending to guide a dough string to position upon the twister in U-form and to move away from guiding position, means to reciprocate the pick-up plate twice to each rotation and folding of the twister to receive the formed dough string at one reciprocation, and means to drive the twister.

18. In a pretzel forming machine a unit comprising a base plate, a pick-up plate mounted to reciprocate transversely relative to the base plate, a twister mounted to rotate and fold relative to the base plate, fingers movable to open and closed position and when in closed position tending to guide a dough string to position upon the twister in U-form, means to bend the legs of the U-form between the bend and the ends, means to support a dough string in U-form with its opposite ends upon the twister, means to reciprocate the pick-up plate twice to each rotation and folding of the twister, one of said reciprocations placing the pick-up plate under and to receive a dough form from the twister, the other reciprocation extending the pick-up plate beyond the margin of the base plate, means cooperating with the twister at the first reciprocation of the plate to lay a formed dough string upon said pick-up plate, and means cooperating at the second reciprocation to lift the formed string from the pick-up plate.

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