United States Patent [19]

Griner

[11] **3,818,675**

[45] **June 25, 1974**

[54] **HIGH SPEED WRAPPING MACHINE**

[75] Inventor: **Arthur J. Griner,** Delray Beach, Fla.

[73] Assignee: **Nabisco, Inc.,** New York, N.Y.

[22] Filed: **May 7, 1973**

[21] Appl. No.: **357,788**

[52] **U.S. Cl.** **53/133,** 53/233, 53/234

[51] **Int. Cl.** **B65b 61/18,** B65b 11/42

[58] **Field of Search** 53/133, 225, 230, 231, 53/229, 234, 233; 93/1

[56] **References Cited**

UNITED STATES PATENTS

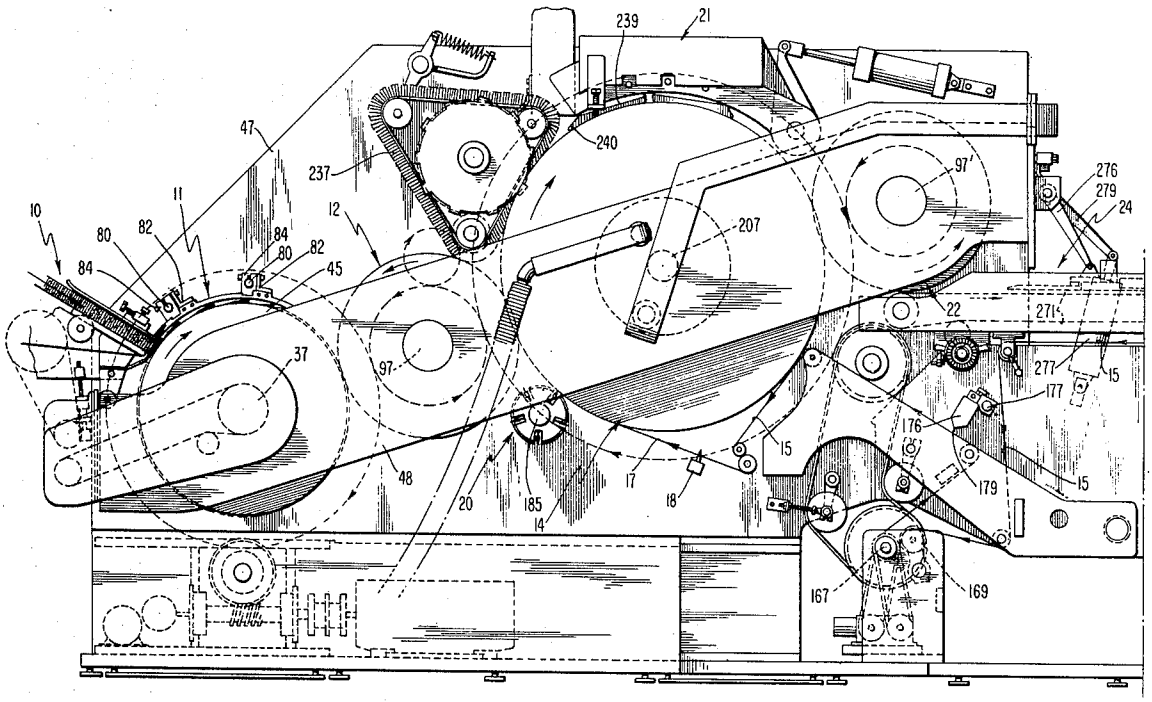
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Primary Examiner—Travis S. McGehee
Assistant Examiner—J. Sipos
Attorney, Agent, or Firm—Gerald Durstewitz; I. Allen Strombeck

[57] **ABSTRACT**

A machine for wrapping a plurality of stacked biscuits in a single package. The biscuits are fed to the machine stacked on edge in a continuous column. A pick-off wheel removes the biscuits from the column two at a time as a unit and a transfer wheel transfers this unit to a wrapping wheel upon which the unit is partially wrapped and sealed. A second transfer wheel removes the unit from the wrapping wheel and delivers it to a folding plow arrangement which completes the wrapping operation whereupon a final sealing of the wrapping takes place.

10 Claims, 36 Drawing Figures



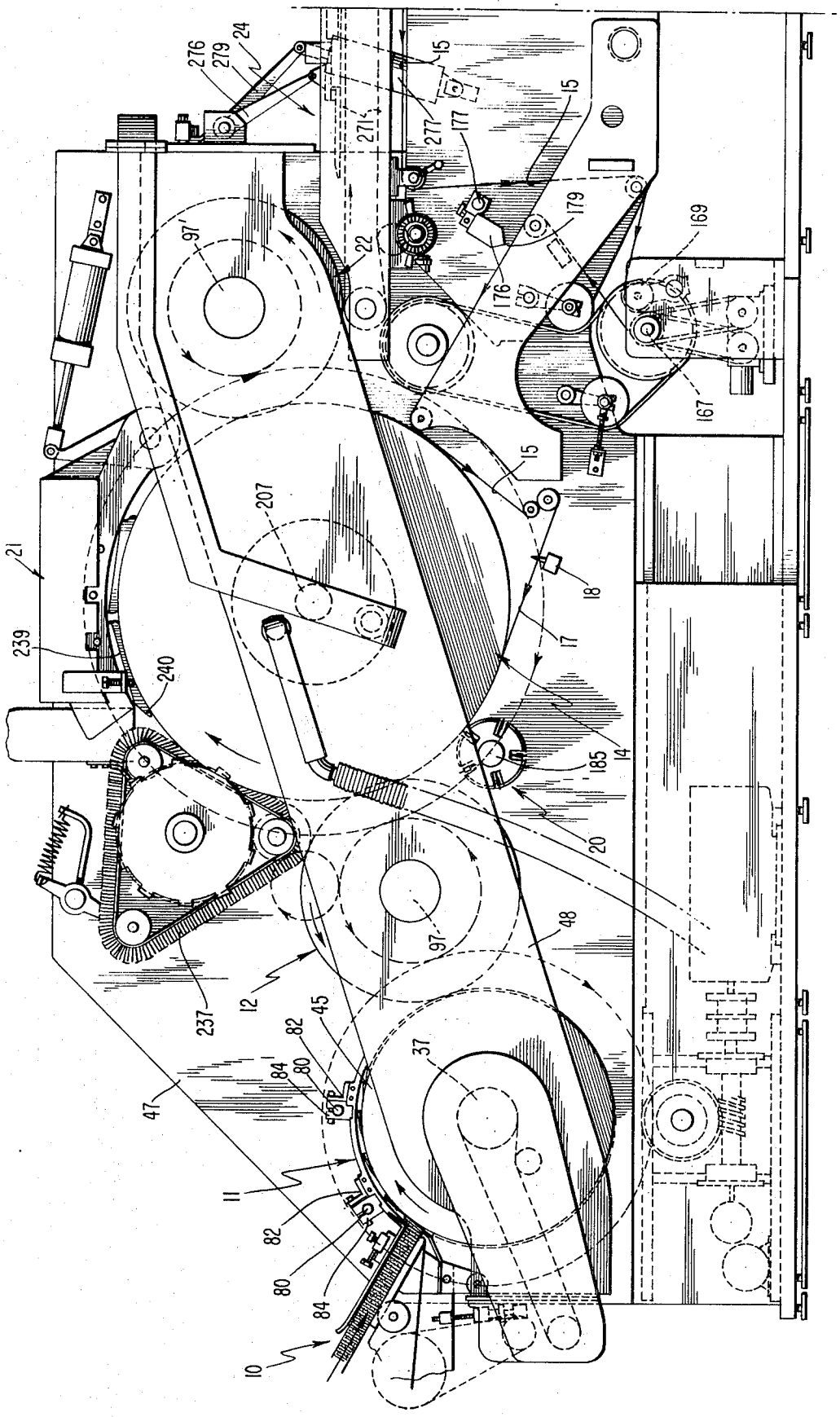

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FIG. 1Z

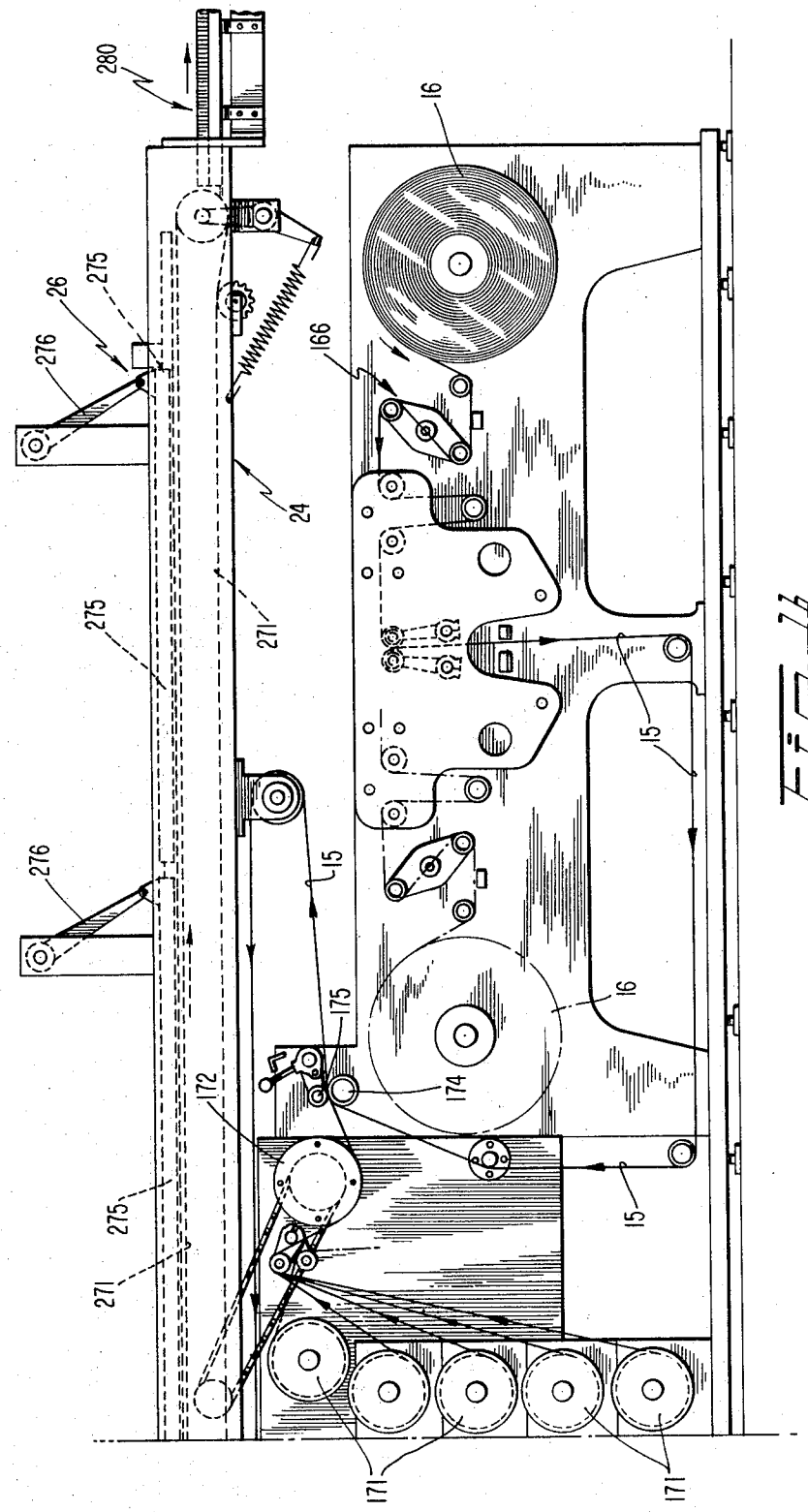


FIG. 1A

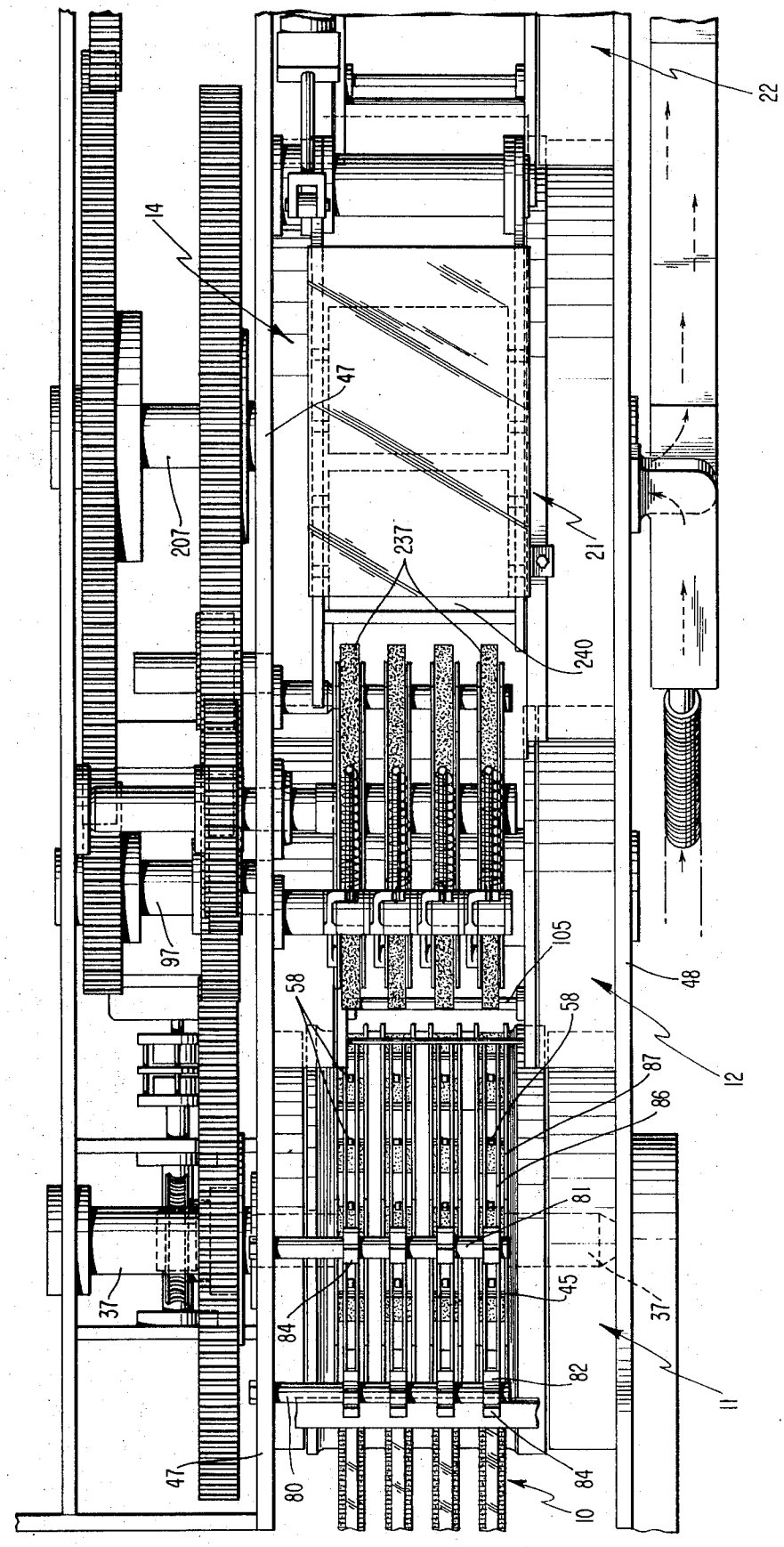

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FIG. 2

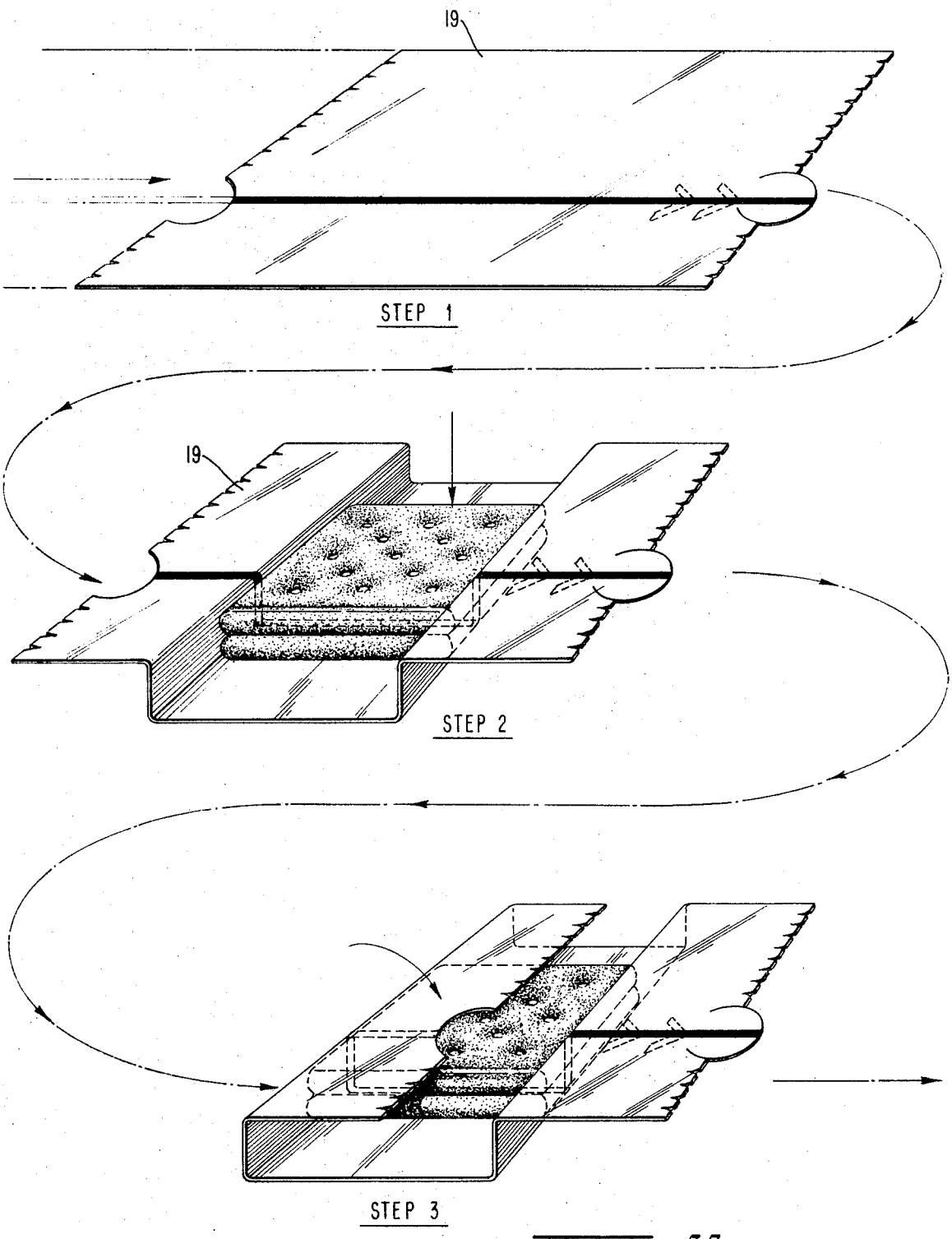
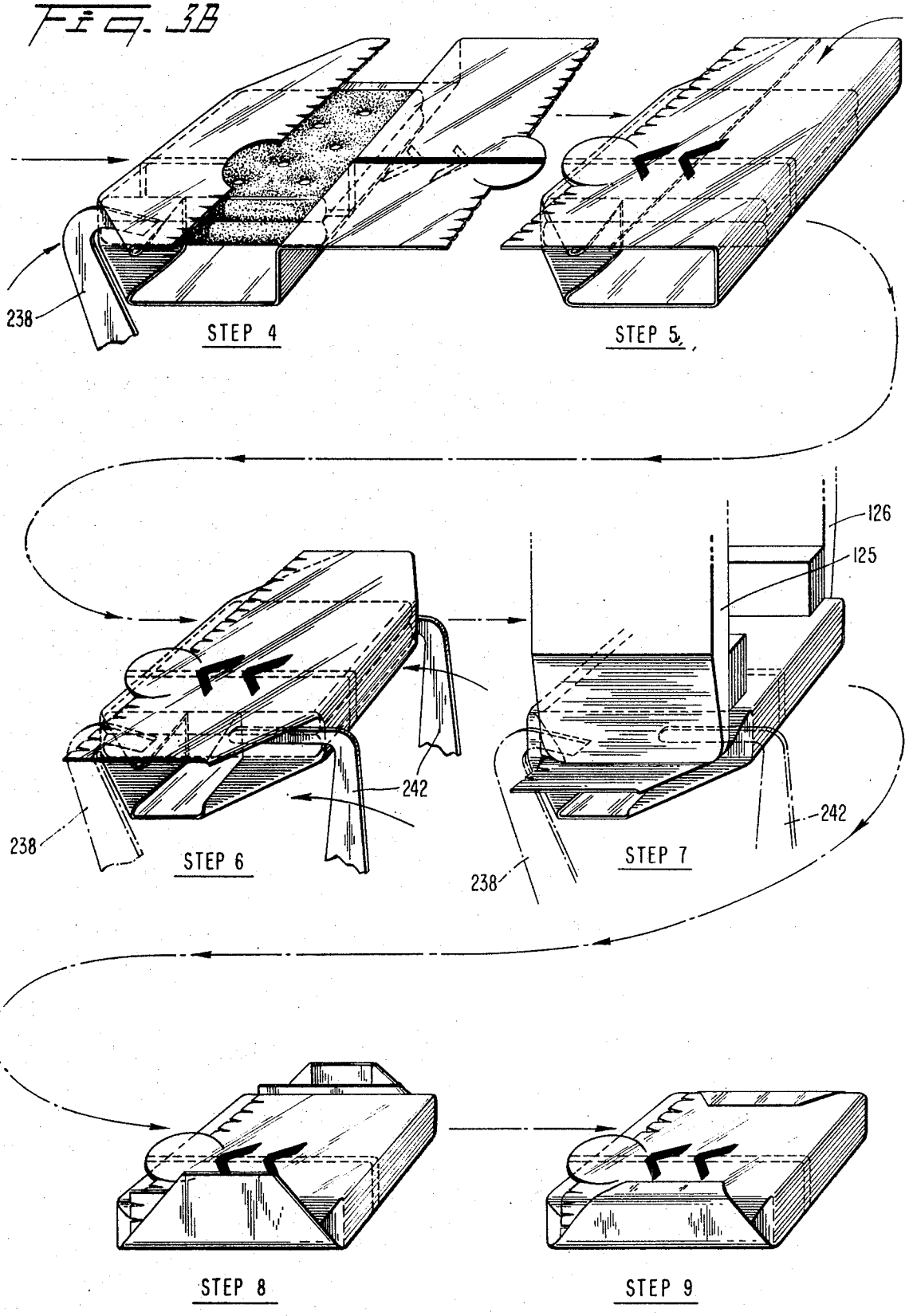


FIG. 3A

Fig. 3B


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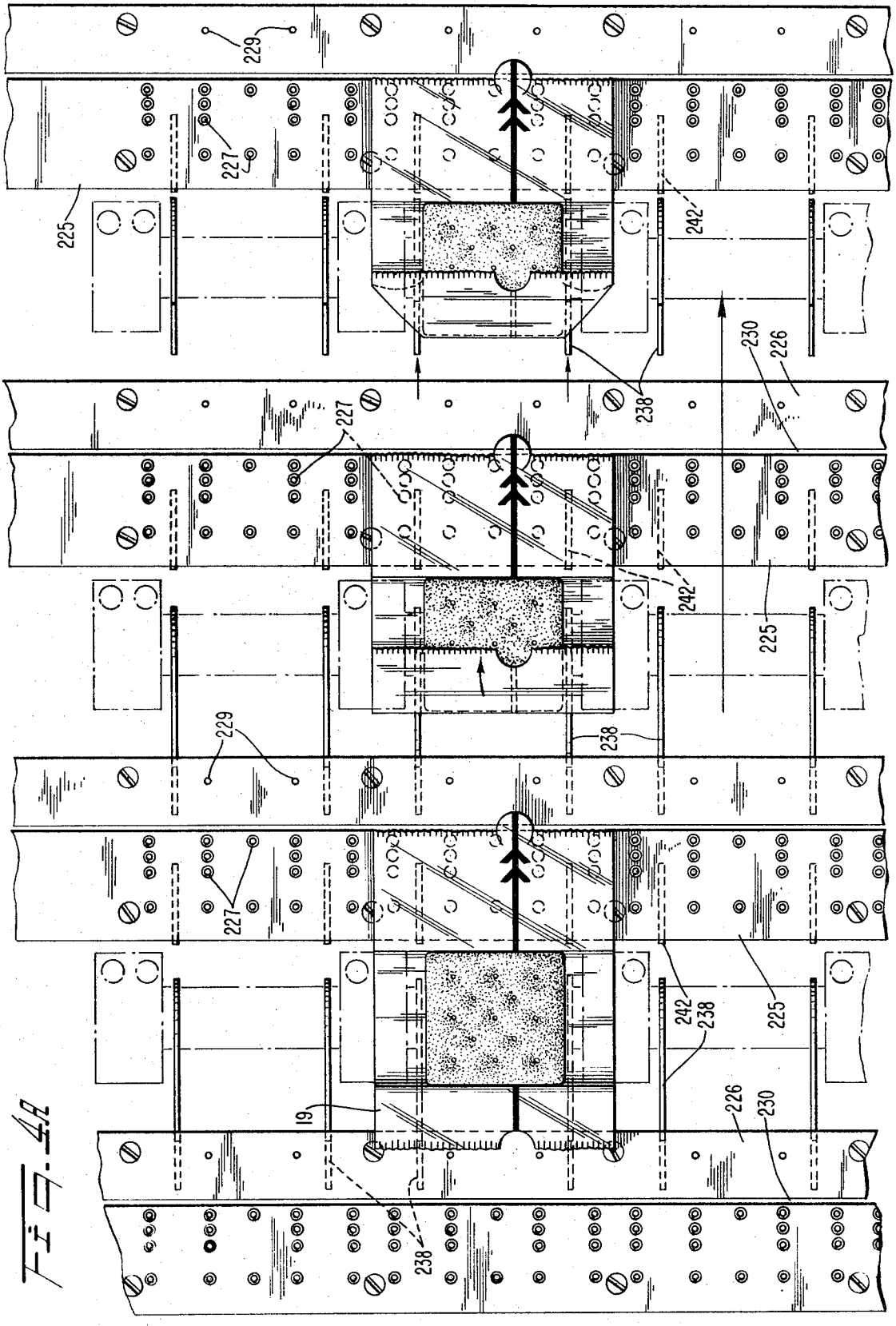

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FIG. 4A

FIG. 47

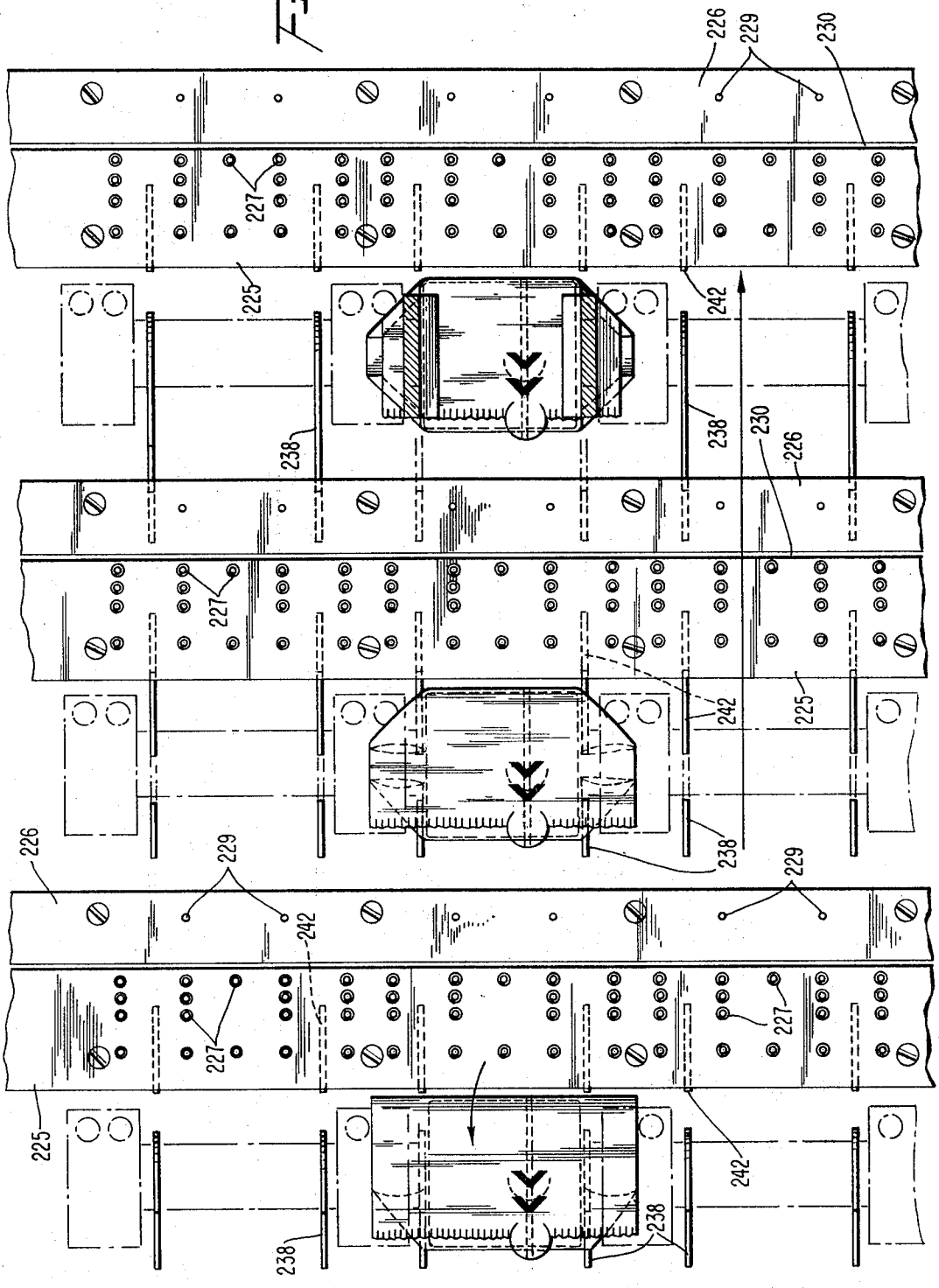
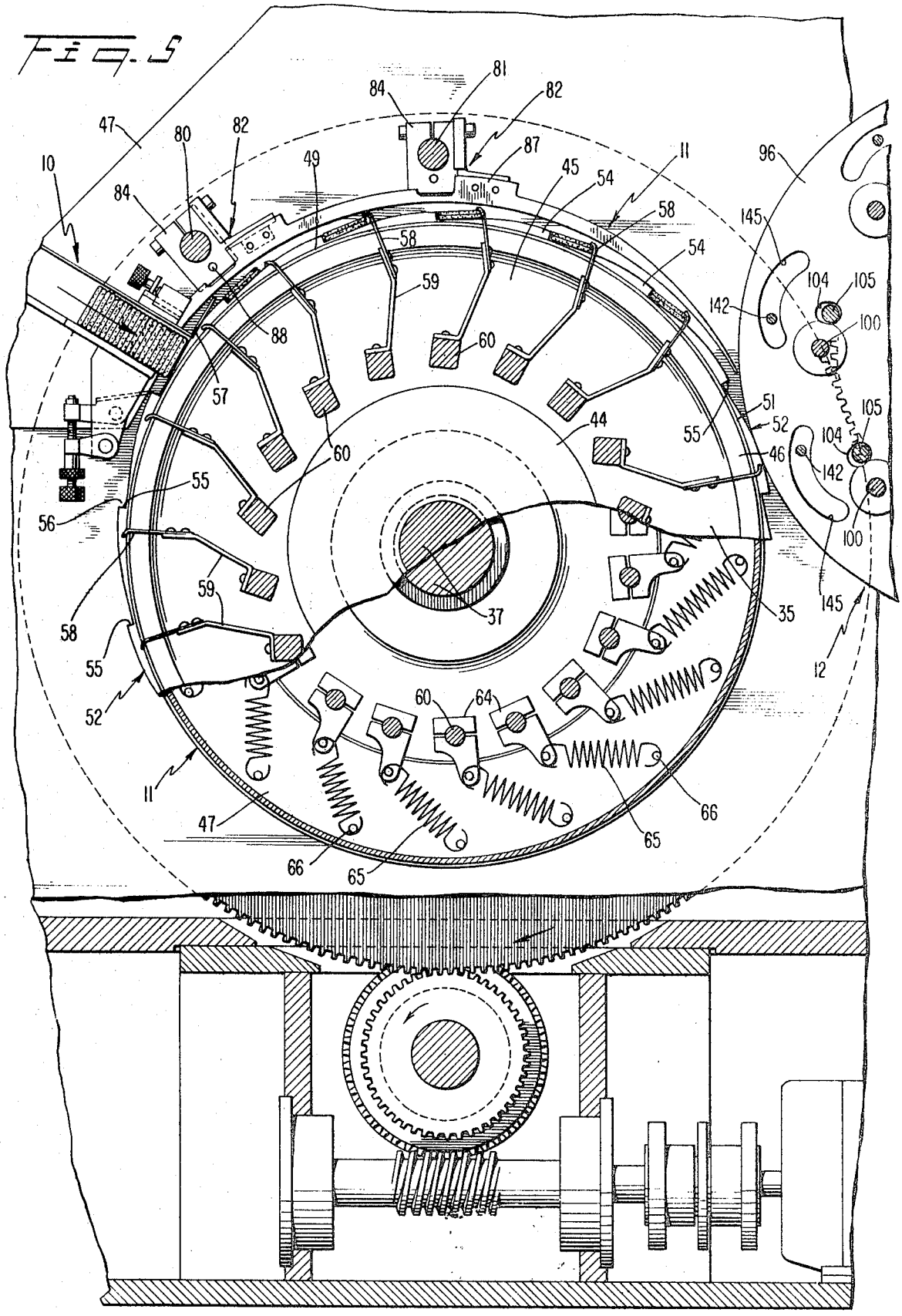

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Fig. 5


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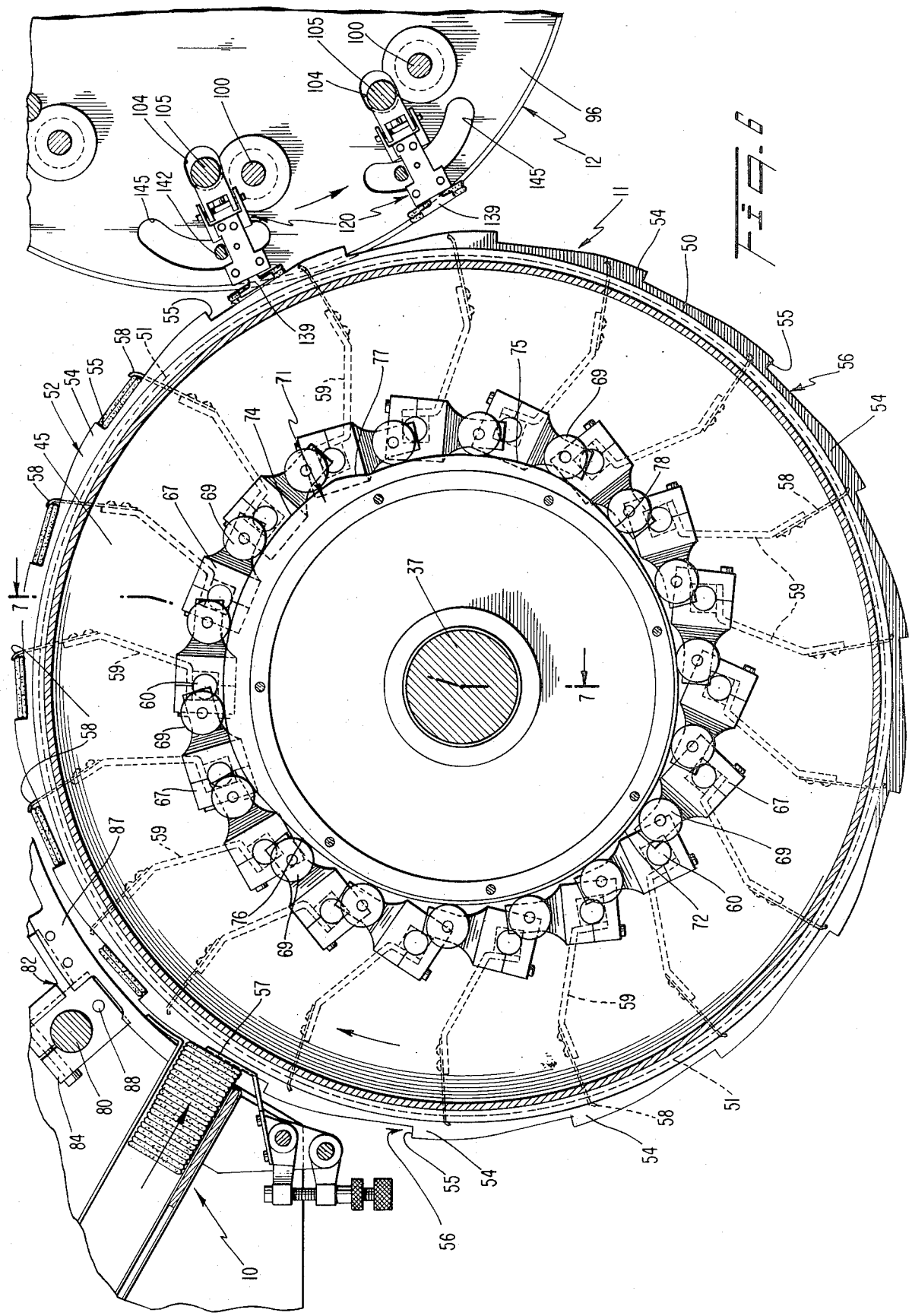

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FIG. 6

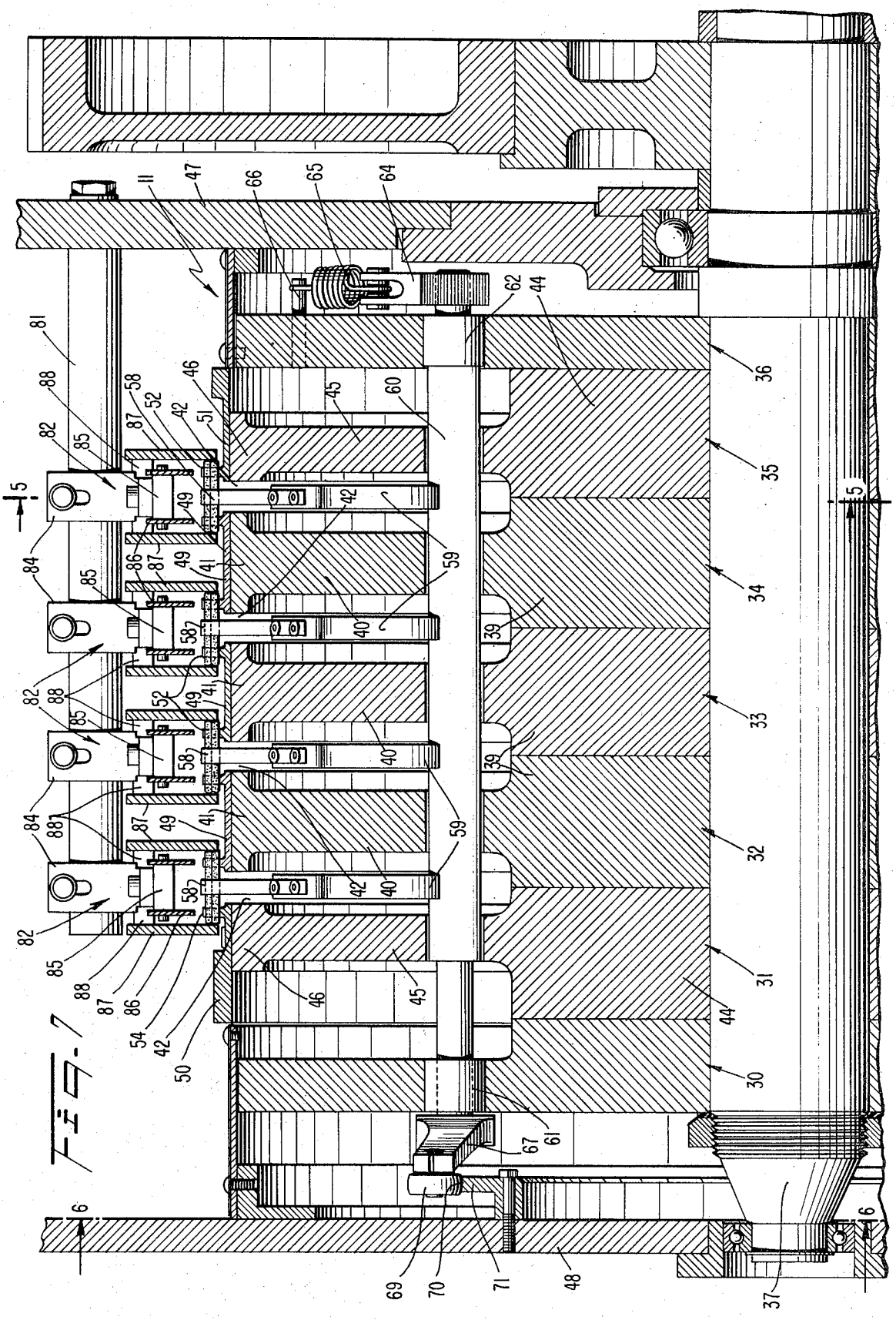


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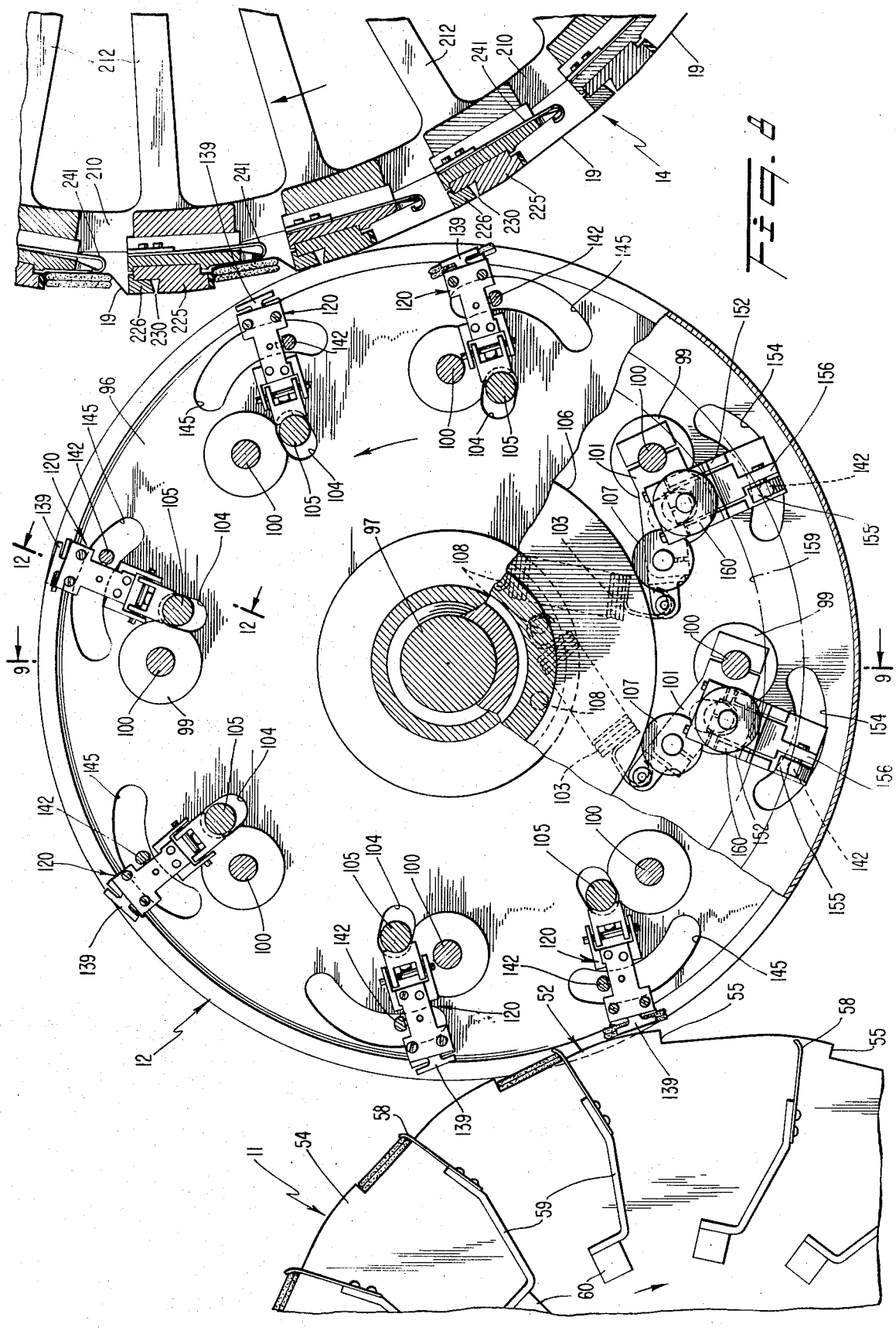
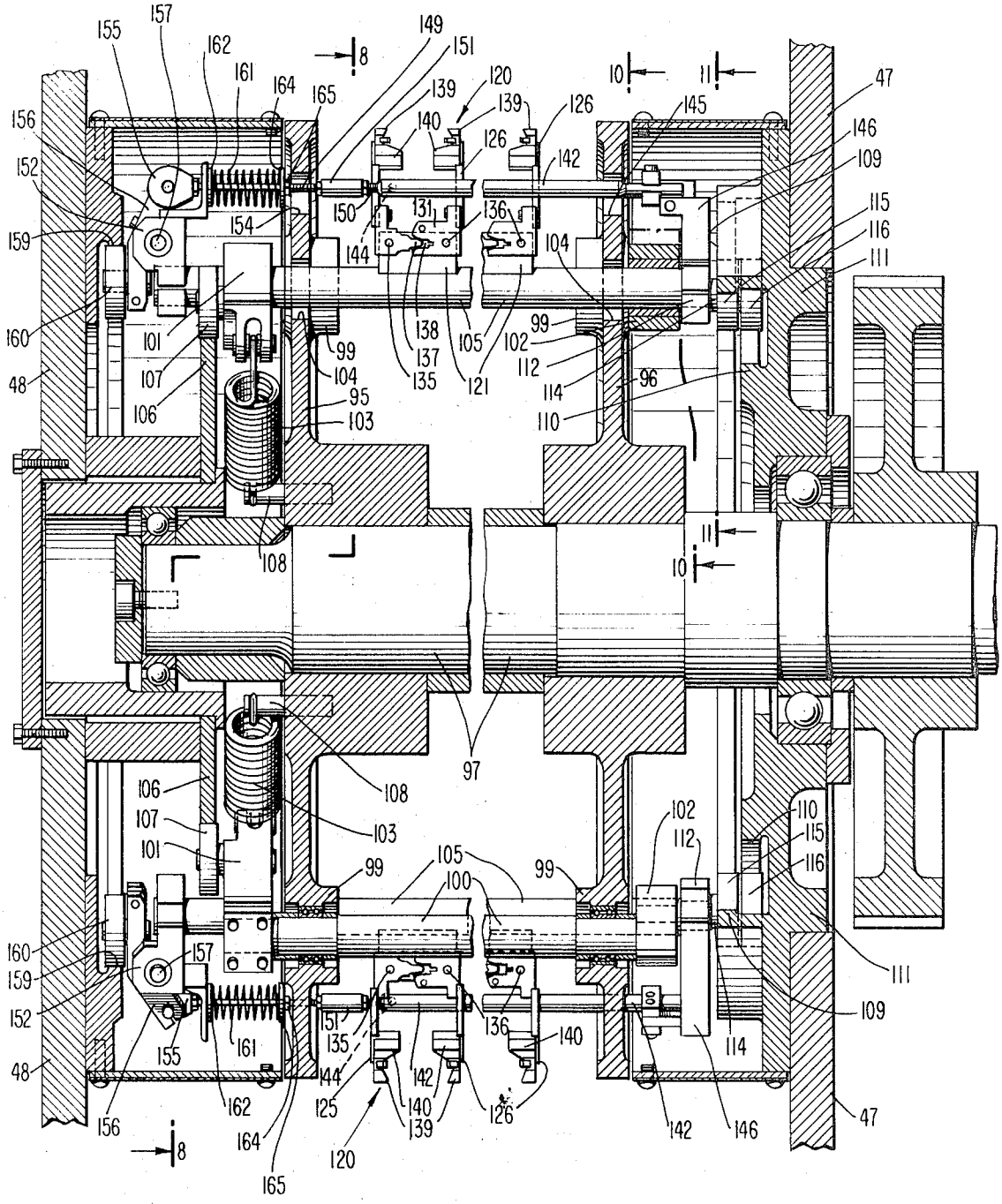


Fig. 4

Fig. 9


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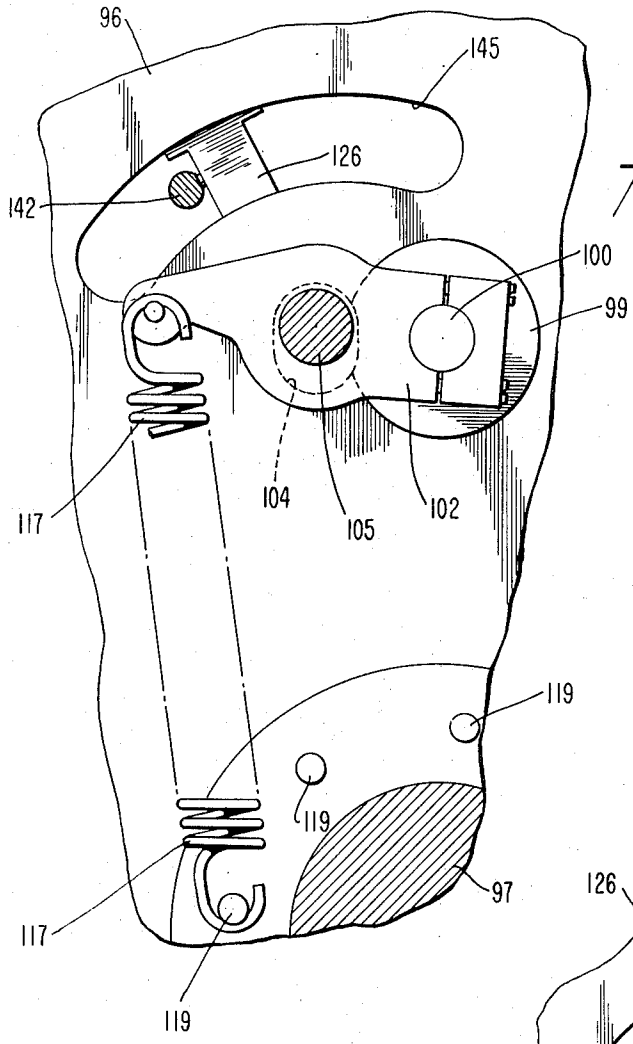

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Fig. 10

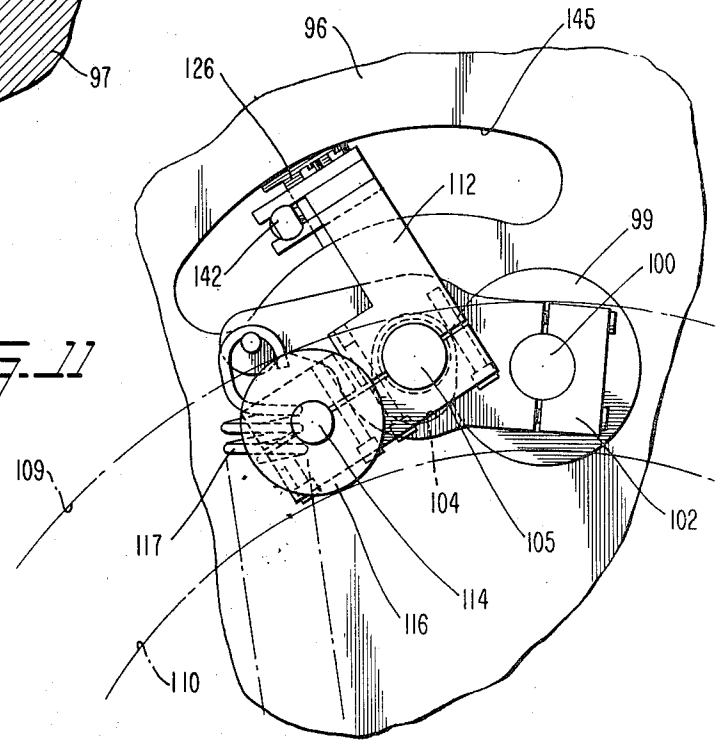

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Fig. 11

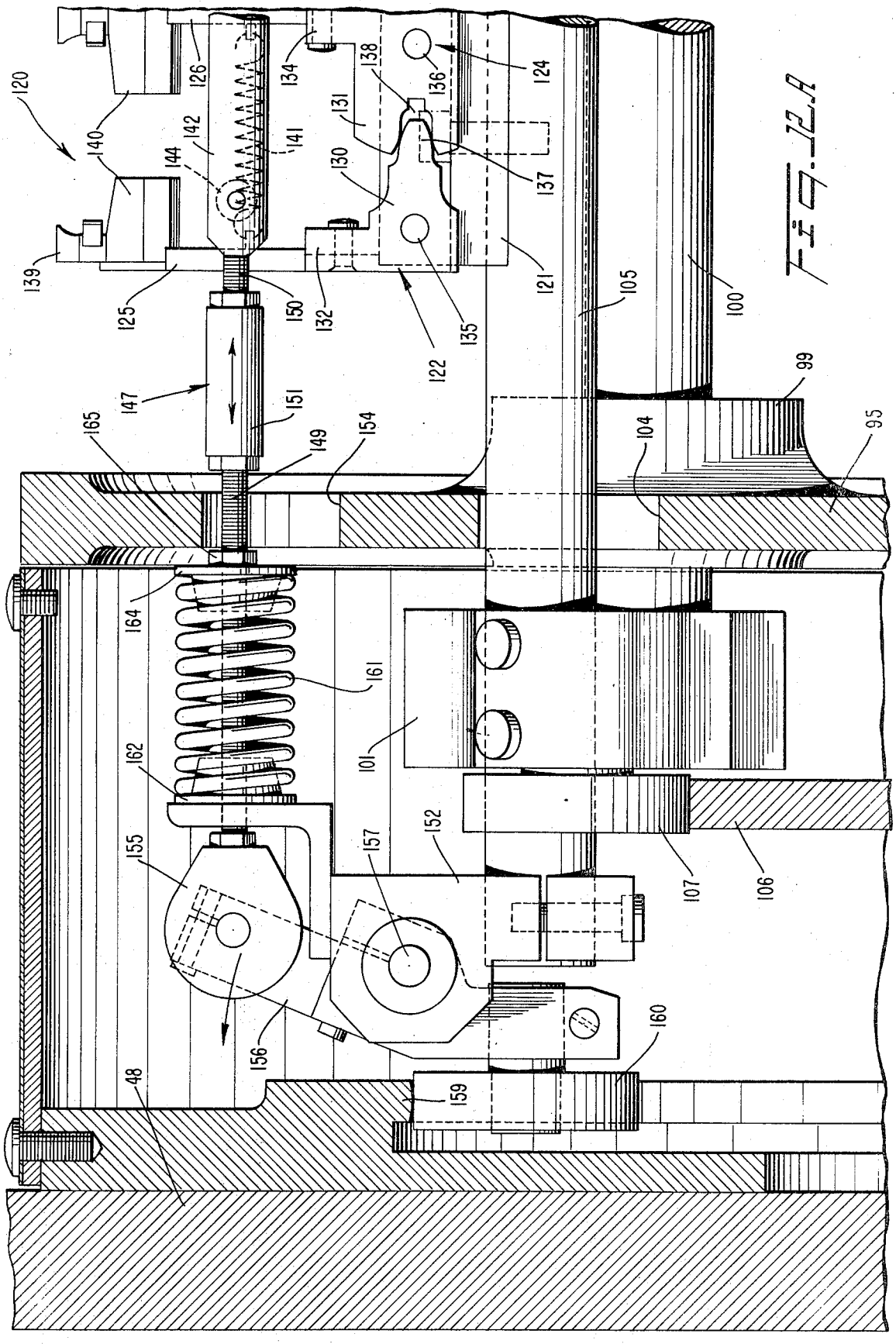

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FIG. 12A

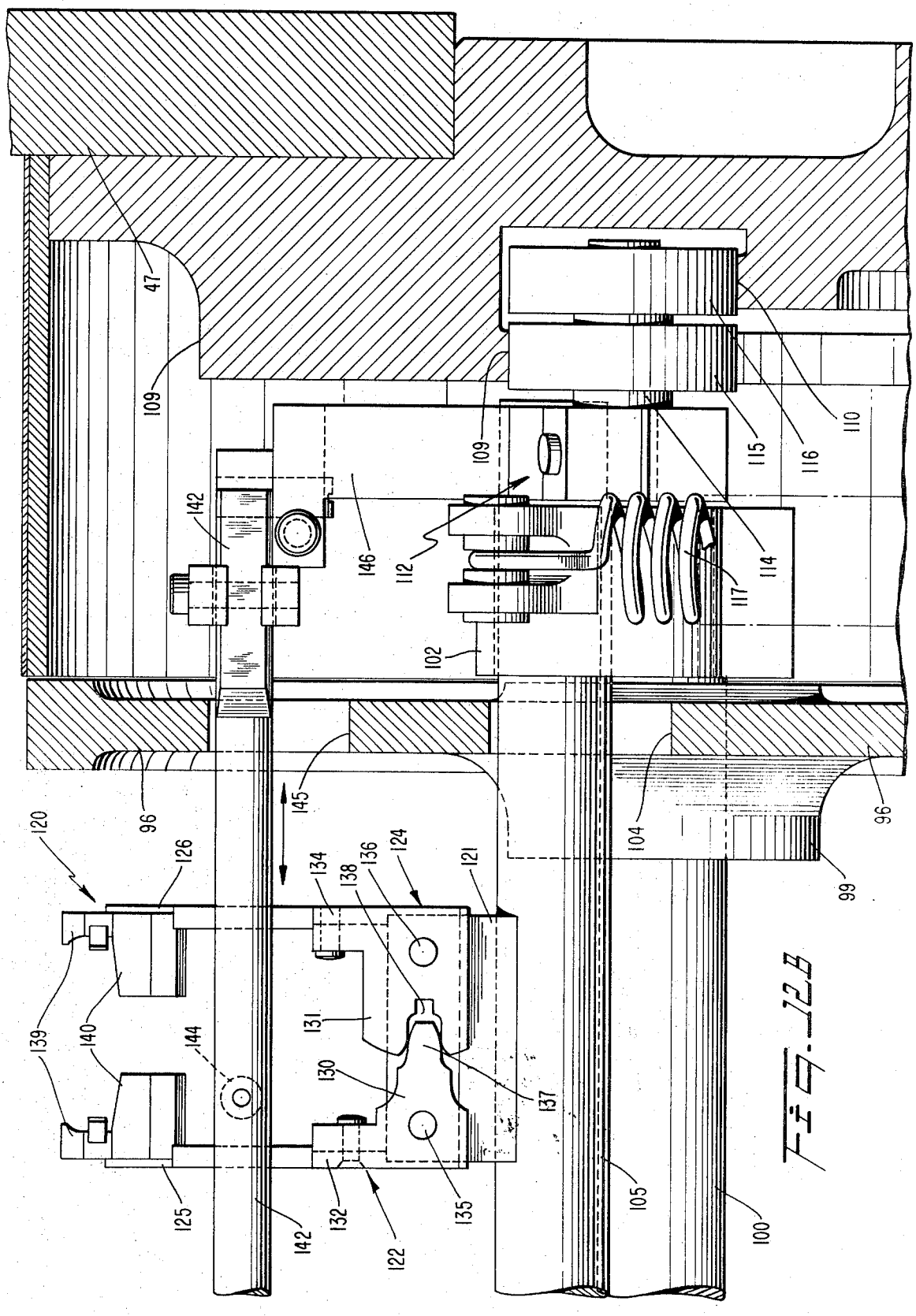

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FIG. 12B

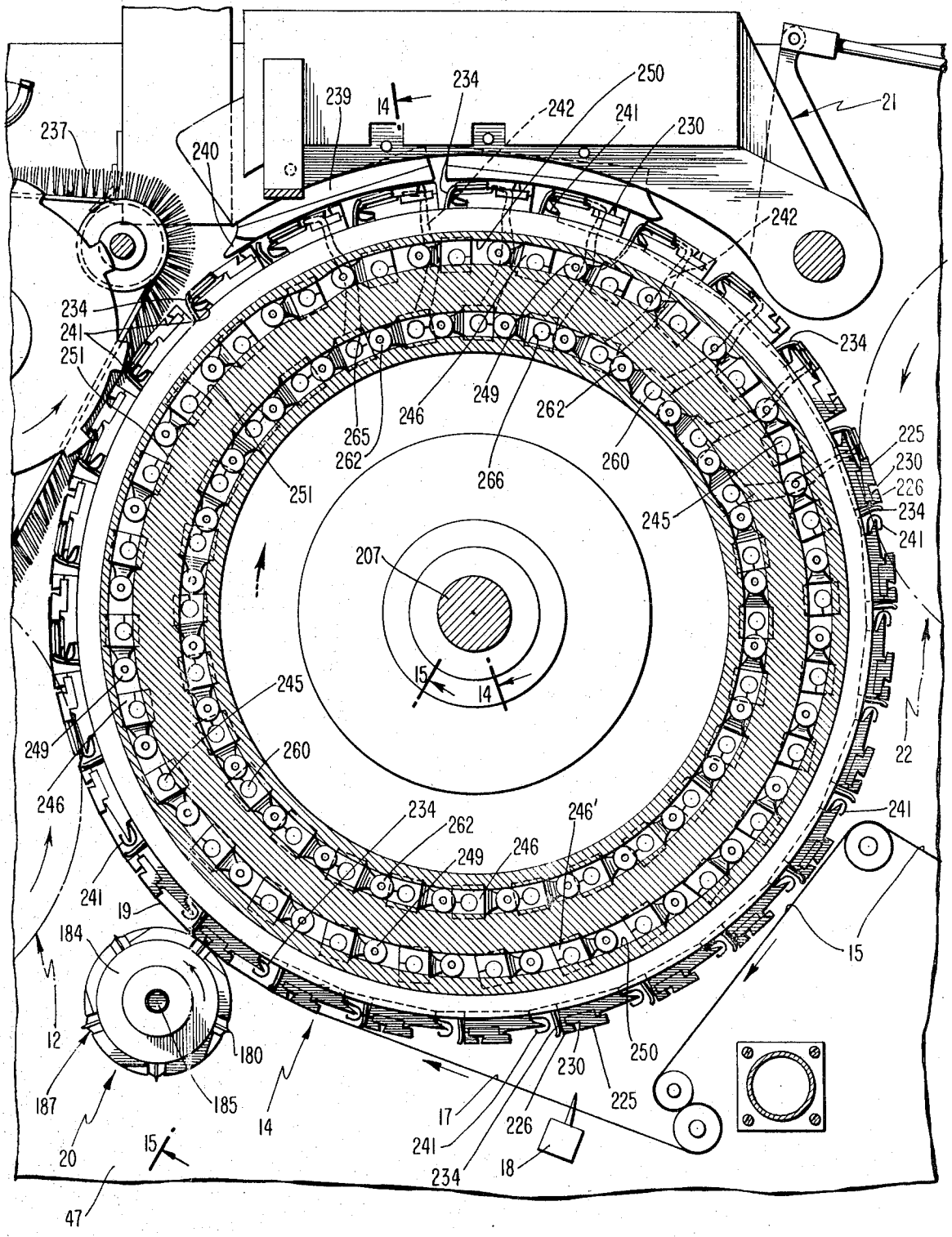

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Fig. 13

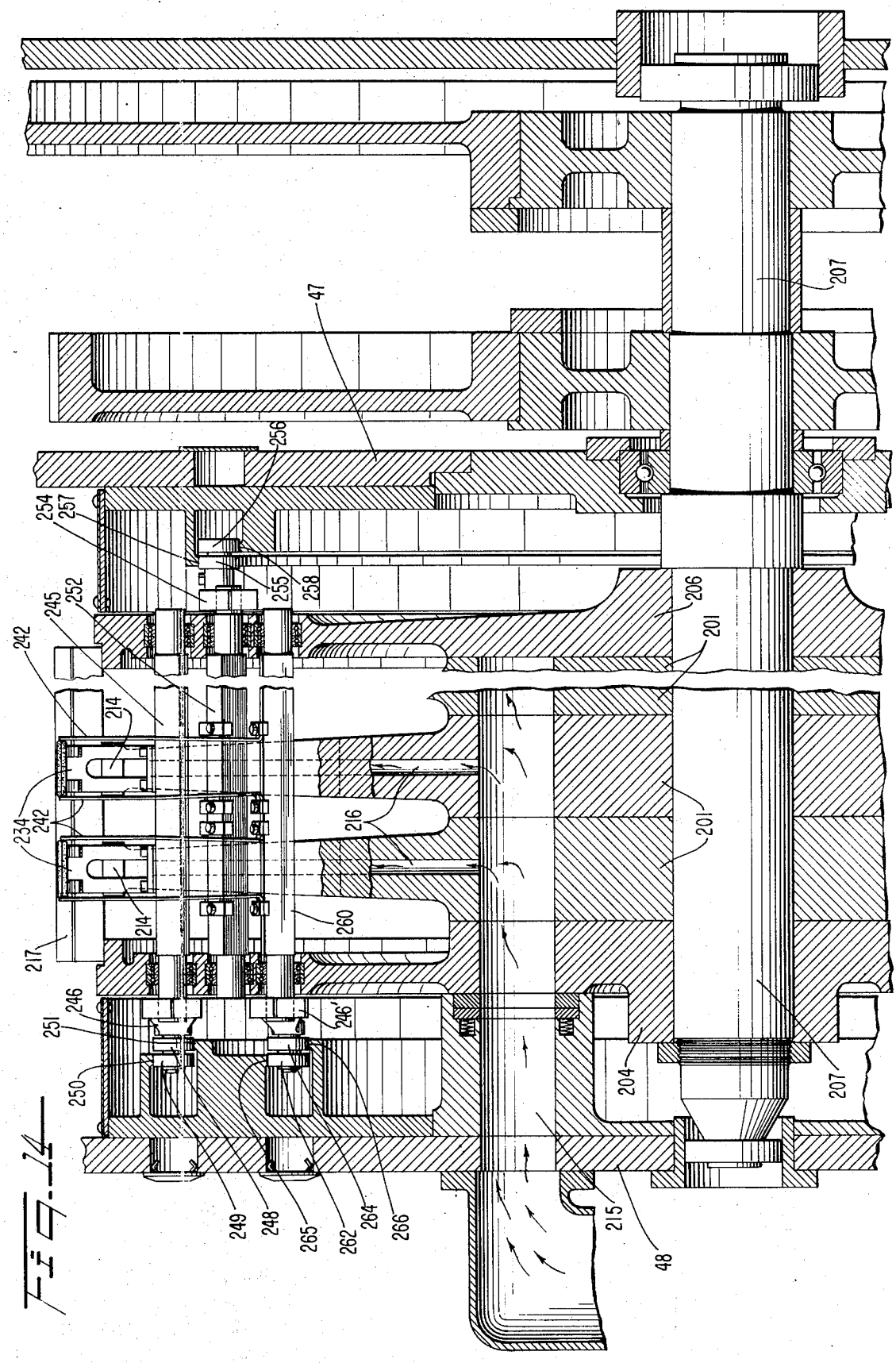

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FIG. 14

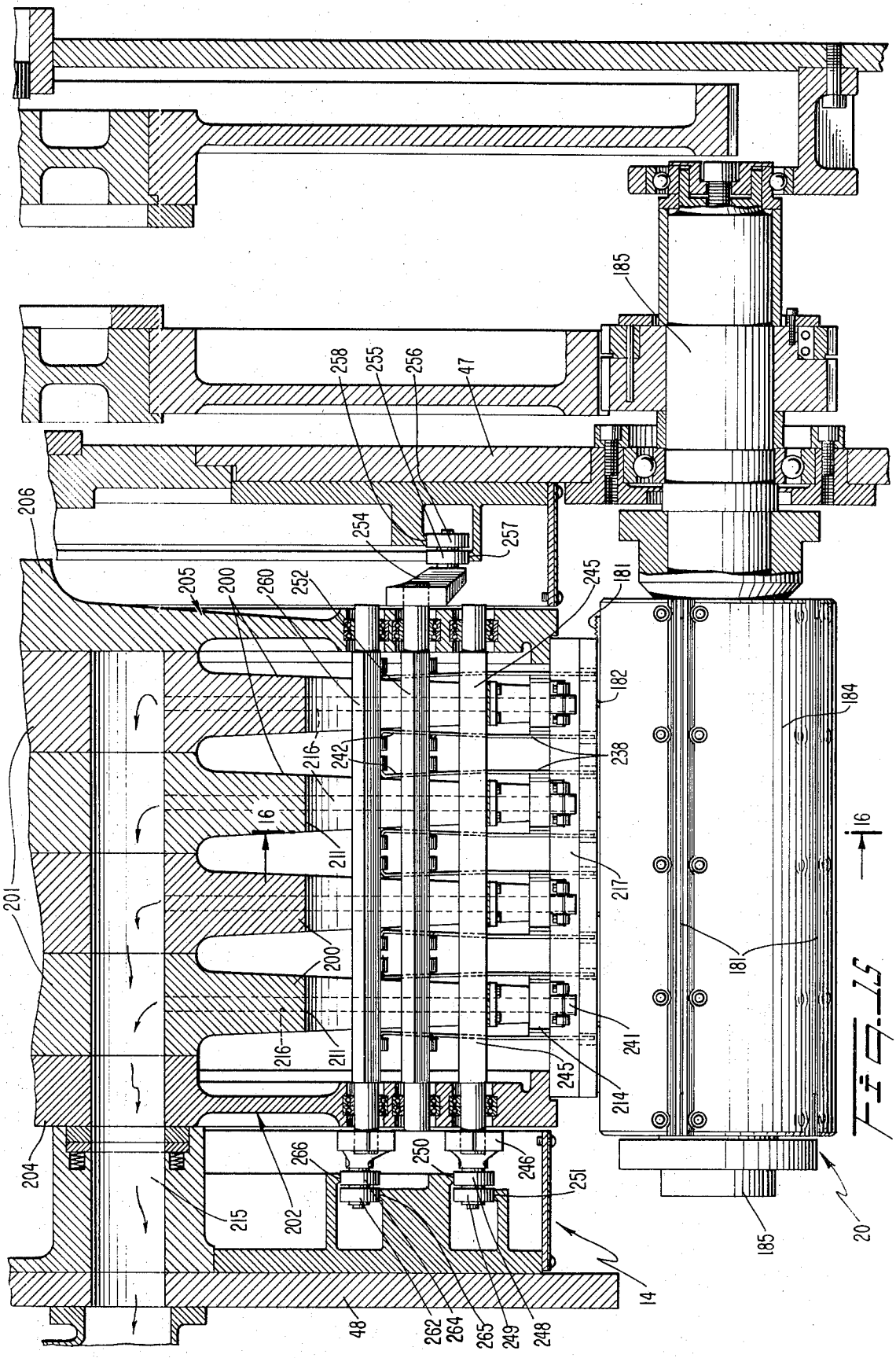

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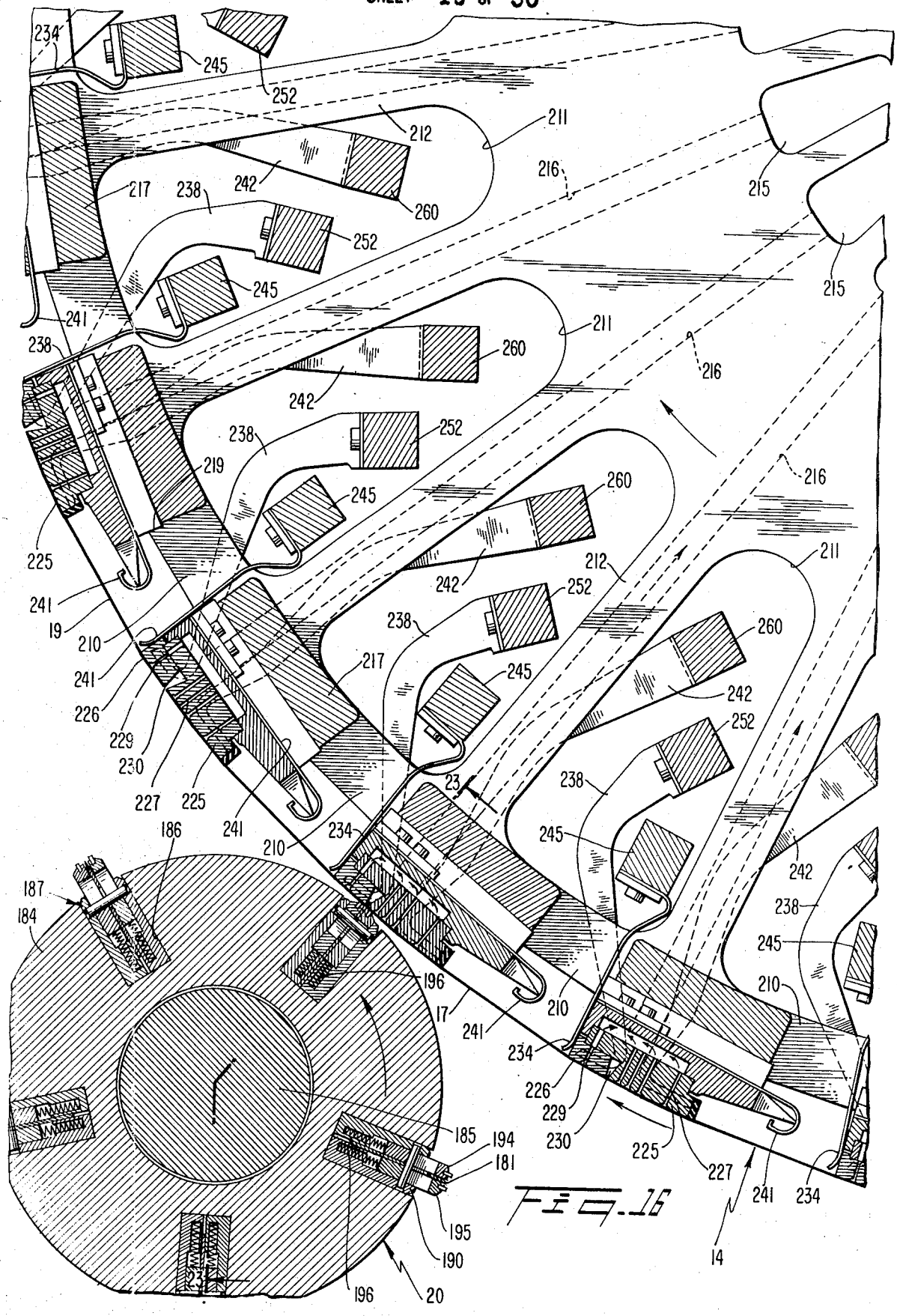
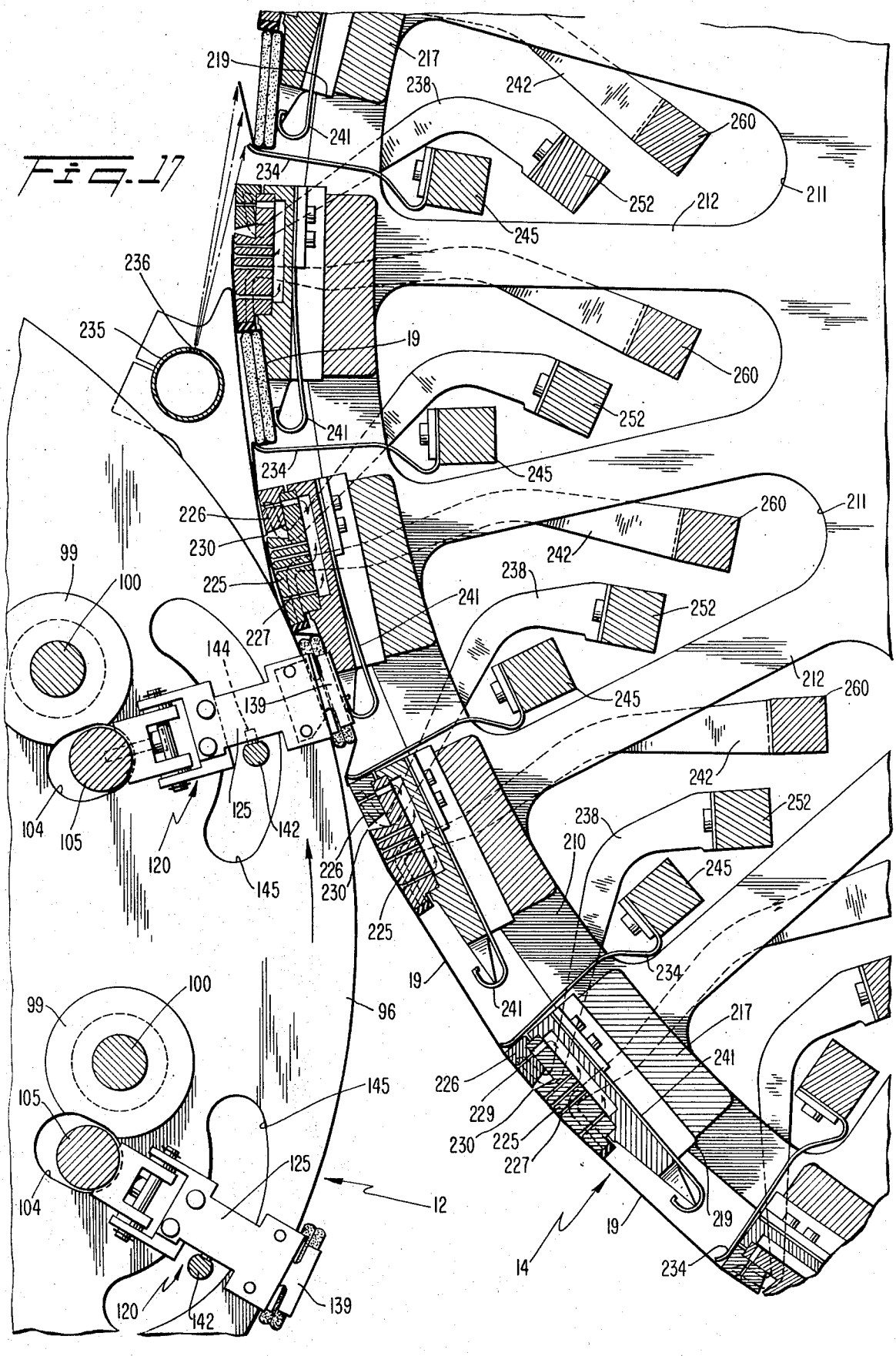

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FIG. 16

Fig. 17


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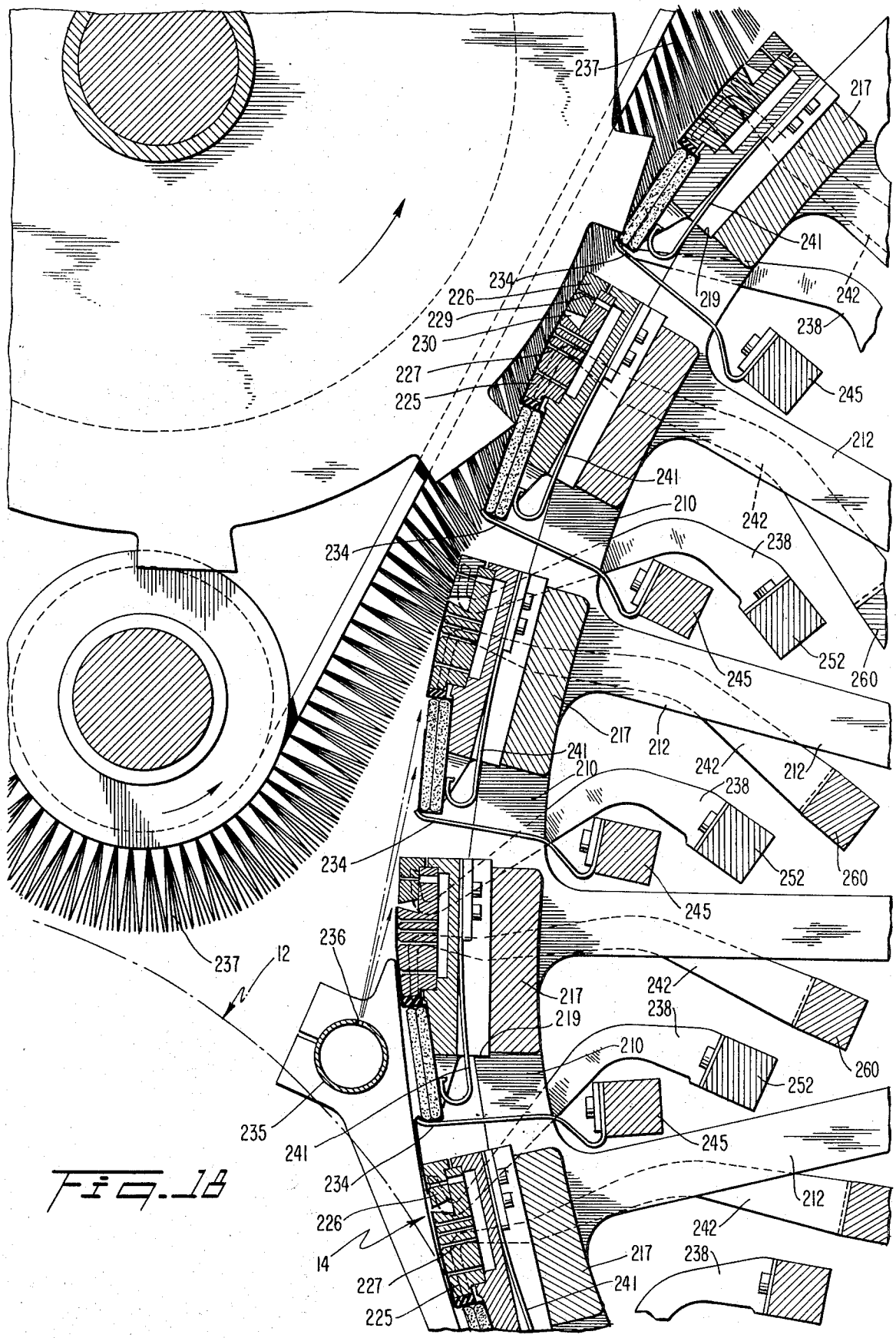

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Fig. 18

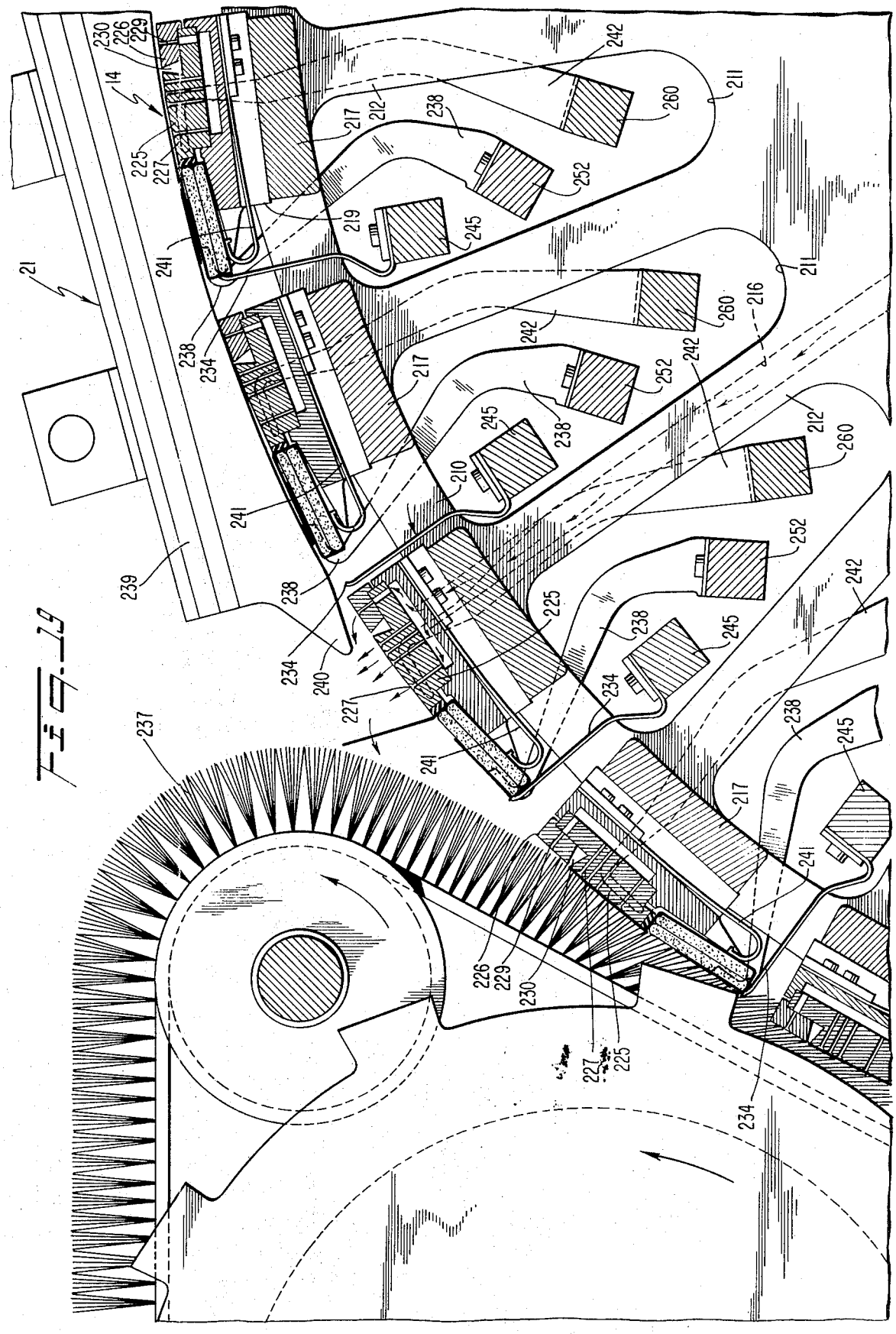

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Fig. 19

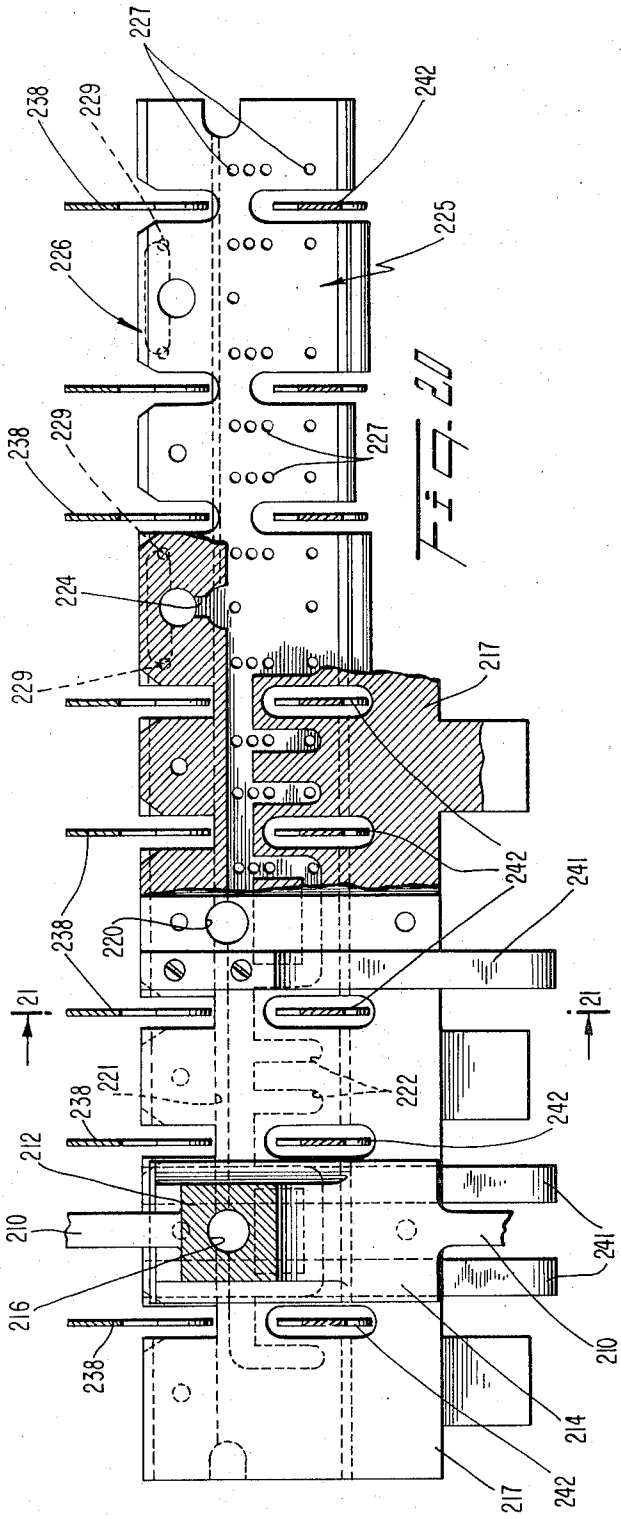


FIG. 20

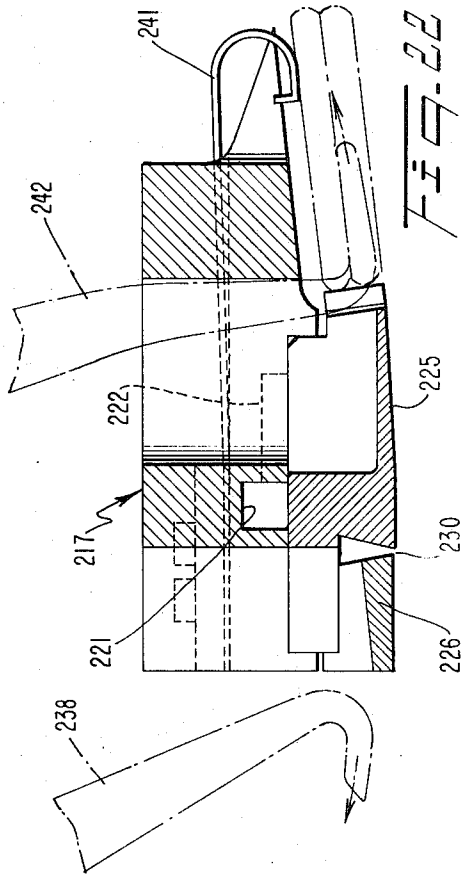


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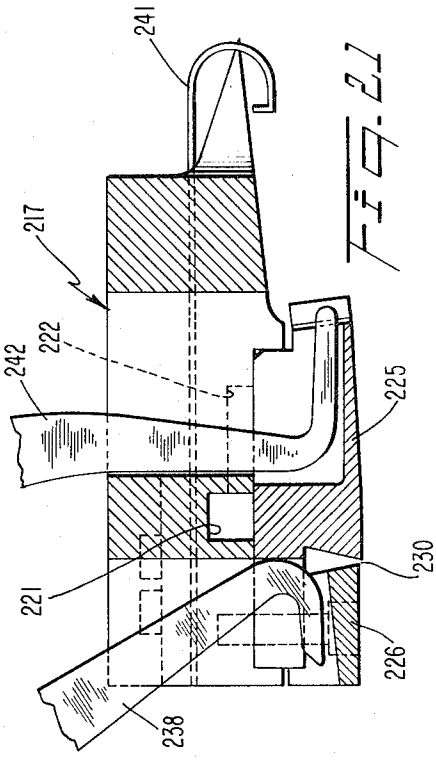


FIG. 21

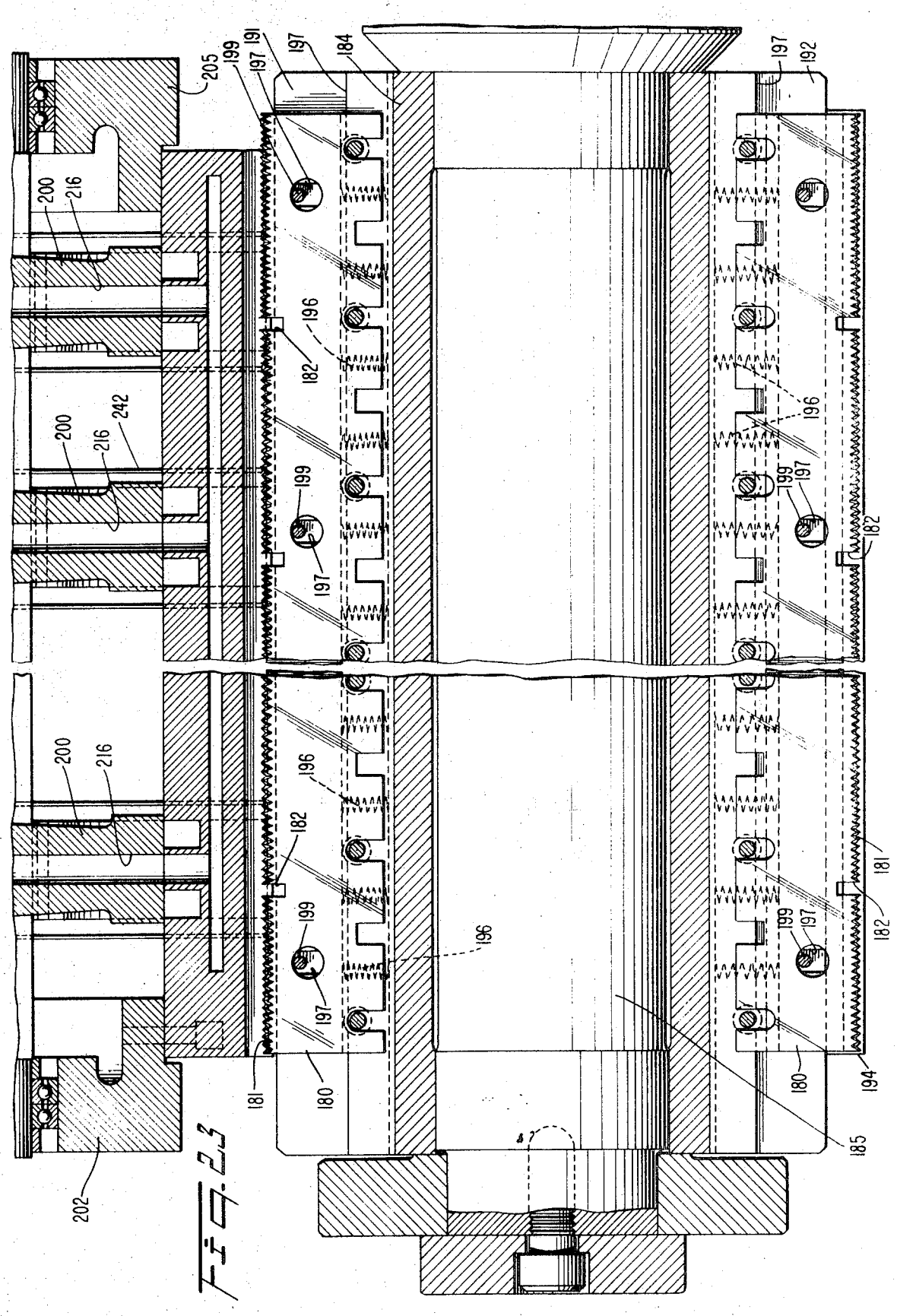


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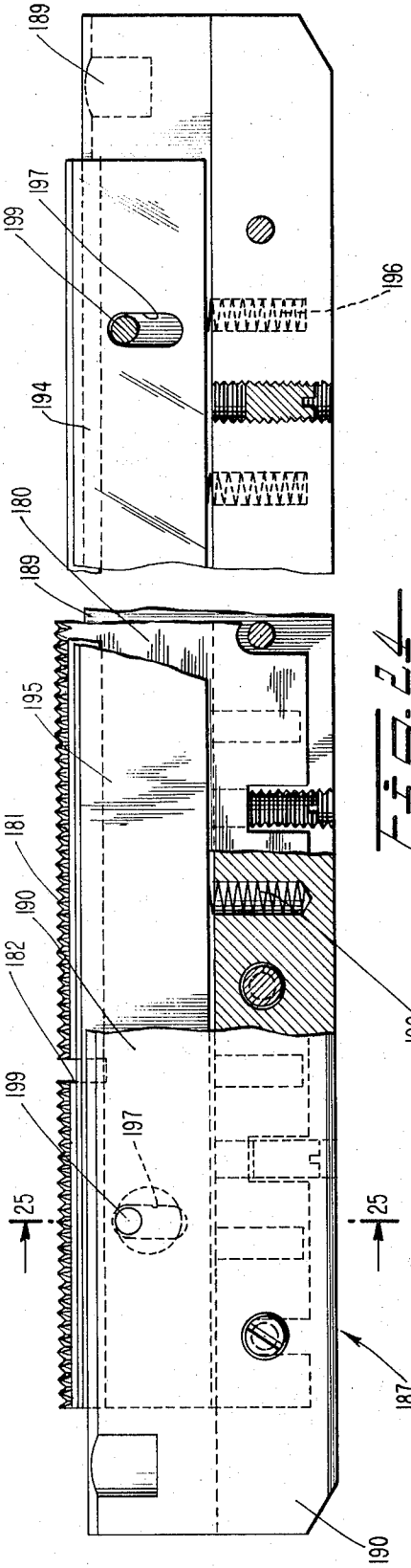


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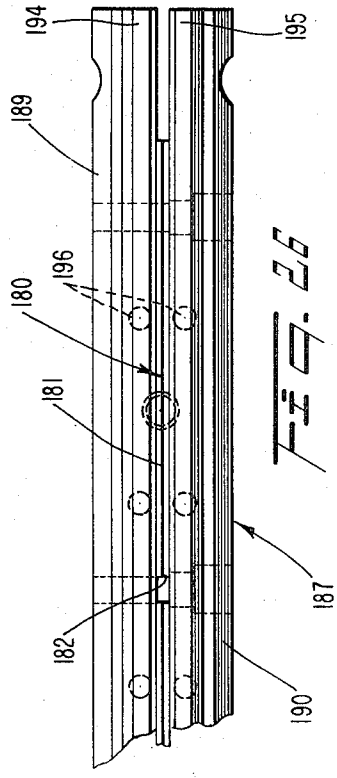


FIG. 26

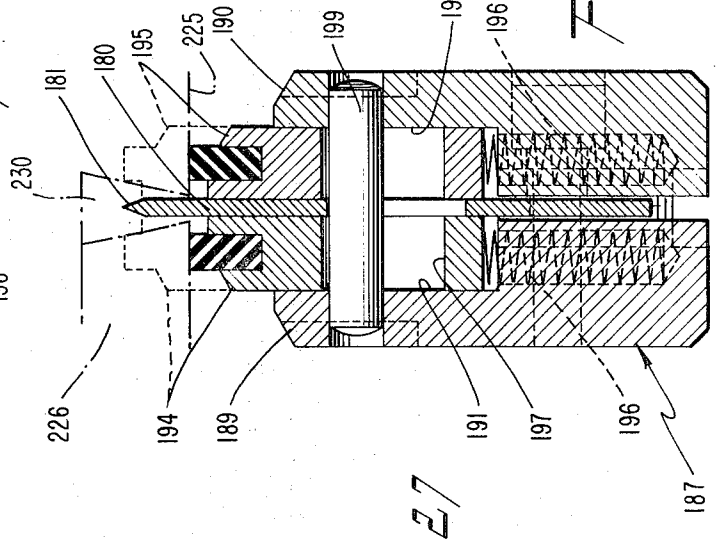


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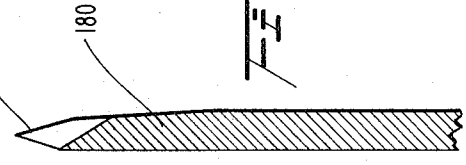


FIG. 27

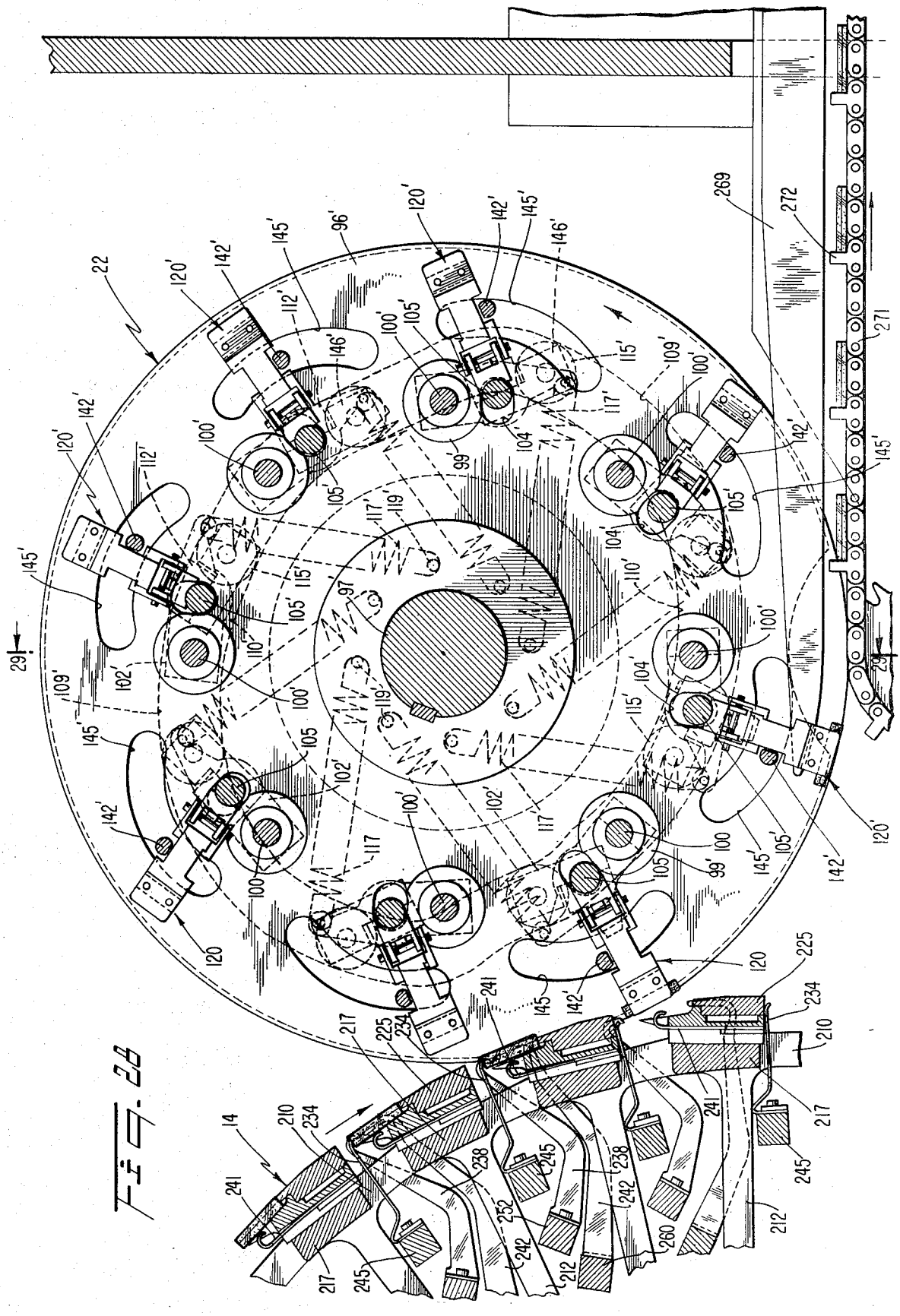


FIG. 28

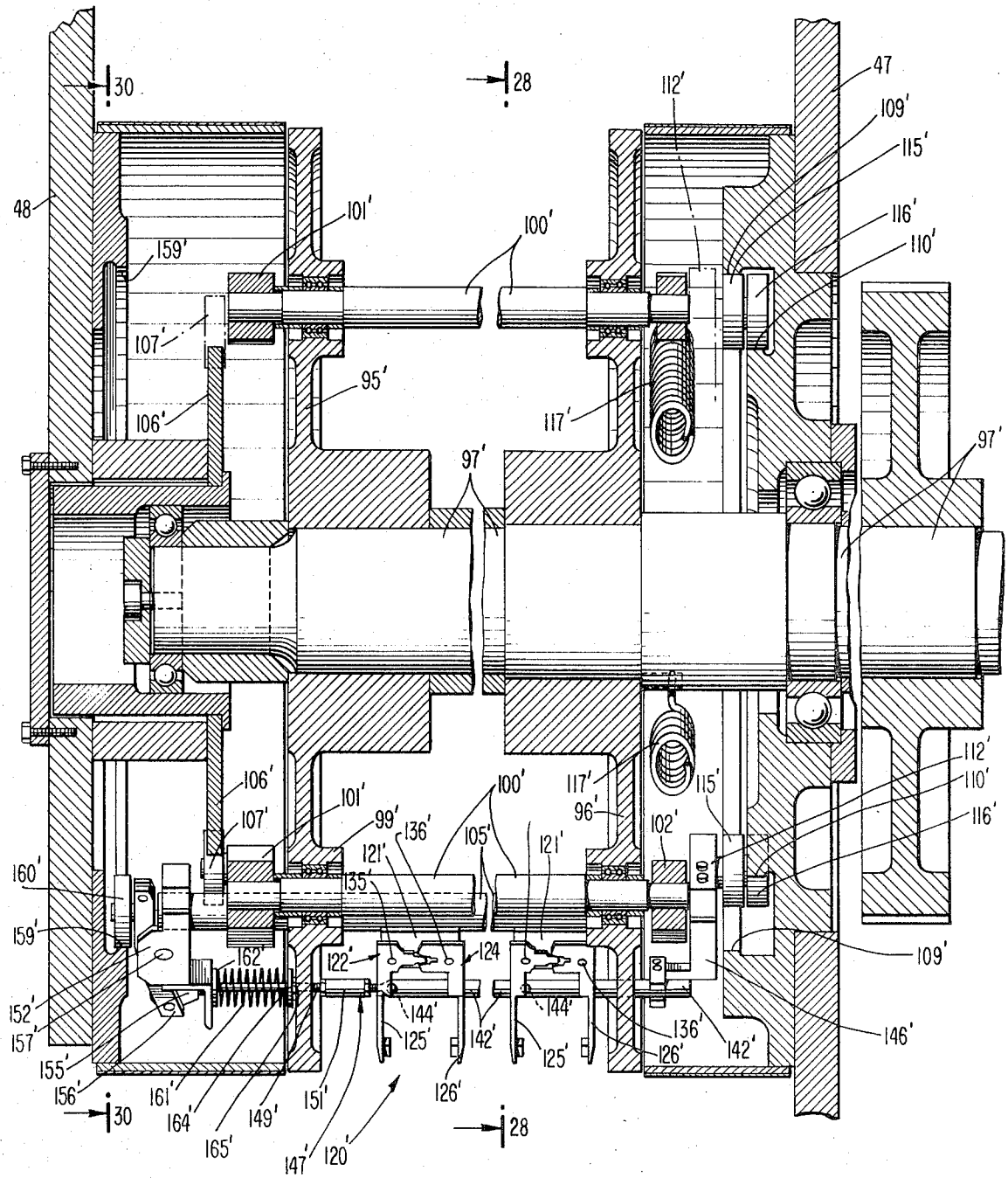

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Fig. 29

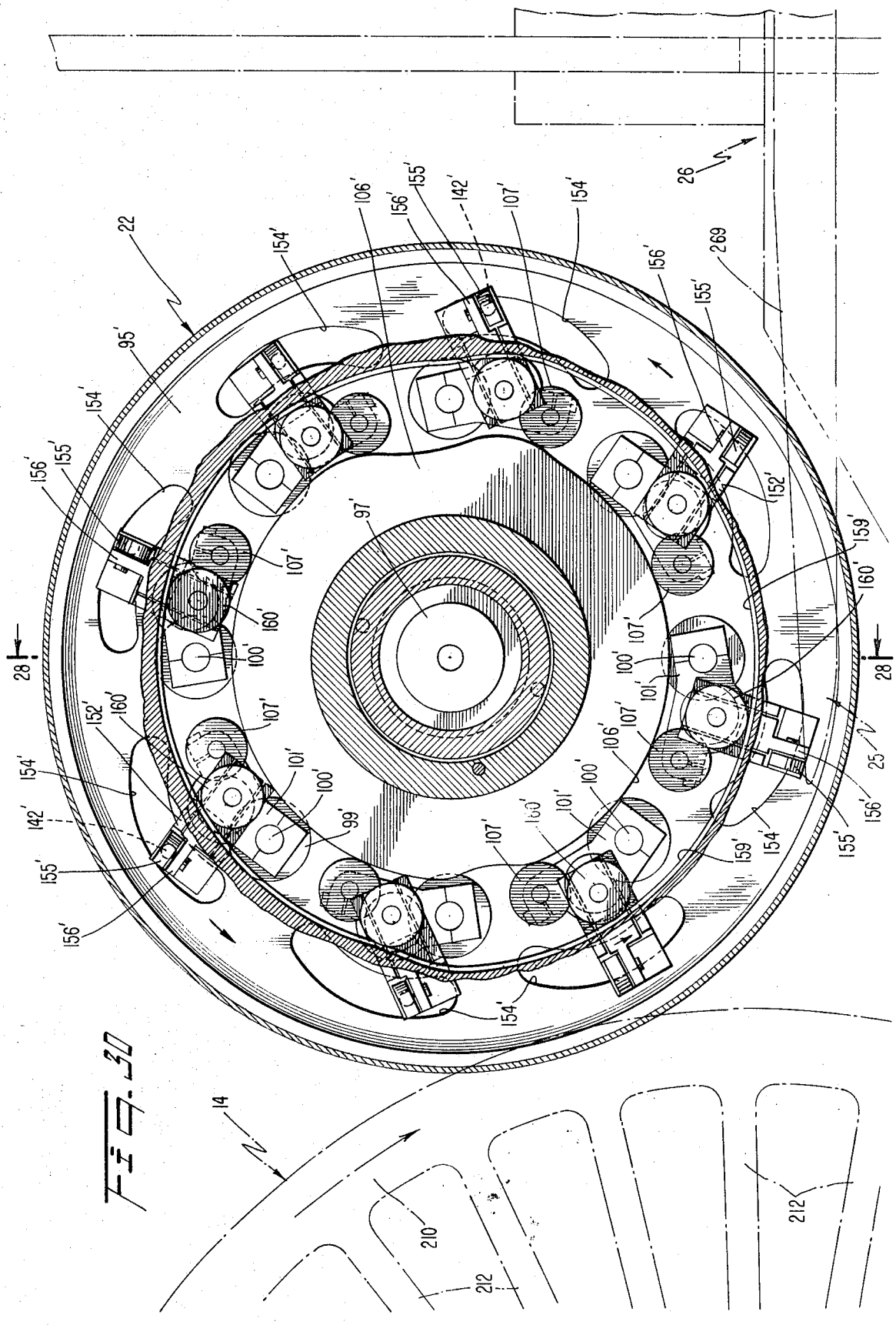


FIG. 30

FIG. 11

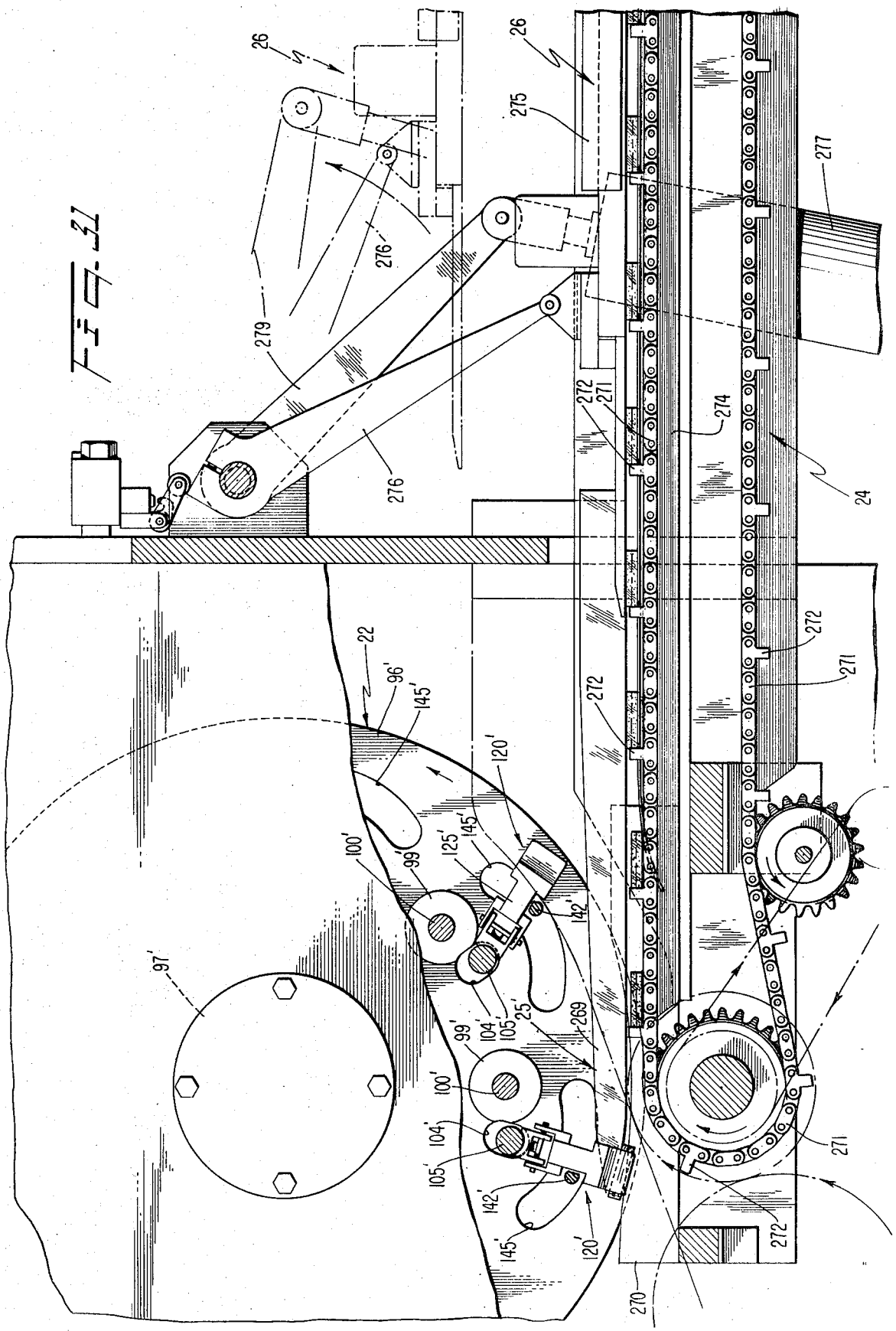
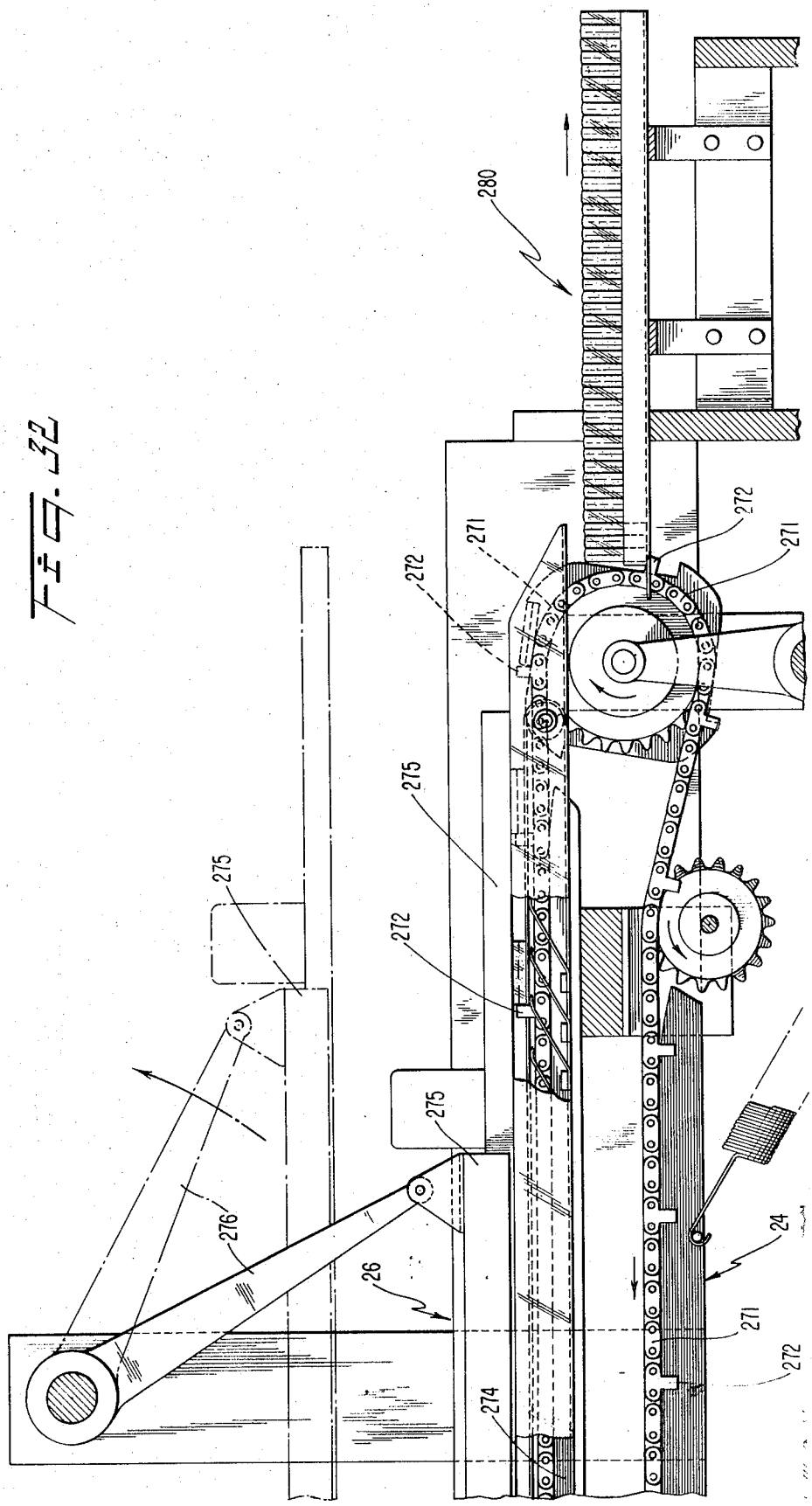

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104'
105'
142'
145'
120'
271
272
270

FIG. 32



HIGH SPEED WRAPPING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to wrapping machines, and, more particularly to machines for wrapping a plurality of flat articles in a single package.

In the past, pluralities of stacked biscuits have been wrapped in a single package by linear machines in which single sheets of wrapping material are placed on a moving conveyor belt, a stack of biscuits is placed on each sheet and the sheets are subsequently folded about the stack and are sealed. The prior art machines utilize reciprocating elements and their speed of operation is limited to a relatively slow speed.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel high speed wrapping machine.

Another object is to provide such a machine for wrapping a stack of flat articles in a single package.

Another object is to provide such a machine in which the articles are segregated and wrapped by rotary elements in continuous motion.

The foregoing objects are accomplished by providing a wrapping machine comprising a conveyor for feeding a column of stacked flat articles, a continuously rotating pick-off wheel for repetitively removing a group of articles as a unit from the end of the column, a continuously rotating wrapping wheel provided with recesses for receiving the article units, means for applying a sheet of wrapping material over each of the recesses, a continuously rotating transfer wheel for removing the units from the pick-off wheel and inserting them into the recesses, means at the outer periphery of the wrapping wheel for folding the ends of the sheet over the outer surface of the units and for sealing the overlapped ends, means for folding the side edges of the sheet against the overlapped ends, and means for sealing the side edges to the overlapped ends.

BRIEF DESCRIPTION OF THE DRAWING

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and as shown in the accompanying drawings, forming a part of the specification wherein:

FIG. 1*a* is a side elevational view of a portion of a wrapping machine in accordance with the present invention.

FIG. 1*b* is a side elevational view of the remainder of the machine shown in FIG. 1*a*.

FIG. 2 is a top plan view of the portion of the machine shown in FIG. 1*a*.

FIGS. 3*a* and 3*b* illustrate the sequence of steps involved in wrapping the article units.

FIGS. 4*a* and 4*b* are views taken normal to the peripherial surface of the wrapping wheel during a wrapping operation.

FIG. 5 is a sectional side elevation view of the pick-off wheel taken along the line 5—5 on FIG. 7.

FIG. 6 is a sectional view of the pick-off wheel taken along line 6—6 on FIG. 7.

FIG. 7 is a sectional partial rear elevation view of the pick-off wheel taken along a vertical plane.

FIG. 8 is sectional side elevation of the transfer wheel taken along line 8—8 on FIG. 9.

FIG. 9 is a sectional rear elevation of the transfer wheel taken along line 9—9 on FIG. 8.

FIG. 10 is a sectional view taken along line 10—10 on FIG. 9.

FIG. 11 is a sectional view taken along line 11—11 on FIG. 9.

FIGS. 12*a* and 12*b* are sectional views taken along line 12—12 on FIG. 8.

FIG. 13 is a sectional side view of the wrapping wheel. FIG. 14 is a sectional view taken on line 14—14 on FIG. 13.

FIG. 15 is a sectional view taken on the line 15—15 on FIG. 13.

FIG. 16 is a sectional view taken on line 16—16 on FIG. 15.

FIG. 17 is an enlarged sectional view showing the interaction of the wrapping and transfer wheels as the article unit is transferred.

FIGS. 18 and 19 are enlarged sectional views of portions of the wrapping wheel, showing wrapping steps in progress.

FIG. 20 is a sectional view taken on line 20—20 on FIG.

FIG. 21 is a sectional view taken on line 21-21 on FIG. 20.

FIG. 22 is a view similar to FIG. 21 illustrating the tucking fingers in their operated positions.

FIG. 23 is a sectional view taken on line 23—23 on FIG. 16.

FIG. 24 is a view partly in section of a knife wheel blade assembly.

FIG. 25 is a sectional view taken on line 25—25 on FIG. 24.

FIG. 26 is a top edge view of a section of the blade assembly shown in FIG. 24.

FIG. 27 is a sectional view of the blade shown in FIGS. 24 and 25.

FIG. 28 is sectional side elevational view of the second transfer wheel showing also the plow elements.

FIG. 29 is sectional view taken on line 29—29 on FIG. 28.

FIG. 30 is a sectional view taken on line 30—30 on FIG. 29.

FIG. 31 is a side elevational view showing details of the plow elements, the final sealing mechanism, and the associated conveyor.

FIG. 32 is a side elevational view showing the mechanism for stacking the wrapped packages.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, FIGS. 1*a*, 1*b* and 2 show the general arrangement of a machine in accordance with the present invention for wrapping a stack of biscuits or the like. FIGS. 3*a* and 3*b* show schematically the sequence of the steps performed by the machine in the wrapping operation.

GENERAL ARRANGEMENT

Referring to FIGS. 1*a* and 1*b* of the drawings, four columns of biscuits, stacked on edge, are fed to the wrapping machine by means of four infeed conveyors 10 positioned side by side. Biscuits are removed from each of the chutes two at a time by a pick-off wheel 11 and are transferred by means of a transfer wheel 12 to a wrapping wheel 14. The wheels 11, 12 and 14 are continuously rotating, wheels 11 and 14 rotating clock-

wise while wheel 12 rotates counterclockwise. A web 15 of wrapping material is fed to the wheel 14 from a supply roll 16 over a series of rollers. The web 15 is divided into four parallel strips 17 by knives 18 just before application to the wheel 14.

The surface of the wrapping wheel 14 is provided with slots for receiving the biscuit stacks. The wrapper strips 17 are applied to the wheel so as to span the slots and are held to the wheel by vacuum ports in the surface of the wheel. A knife wheel 20 cuts the strips 17 between the slots to provide individual wrappers 19 for each biscuit stack, as shown in FIG. 3*a*, step 1. The transfer wheel 12, in transferring the stacks to the wrapping wheel, place the stacks against the wrappers spanning the slot and push the stacks into the slot, as shown in step 2 of FIG. 3*a*, carrying the wrappers into the slots beneath them.

As the wrapper wheel continues its rotation, the trailing end of the wrapper is folded over the stack (step 3 of FIG. 3*a*), the side edges of the trailing surface of the wrapper are tucked in (step 4, FIG. 3*b*), the leading end of the wrapper is folded over the stack and the overlapping ends are sealed to each other by a heat sealer 21 (step 5, FIG. 3*b*), and the side edges of the leading surface of the wrapper are tucked in (step 6, FIG. 3*b*). The partially wrapped packages are removed from the wheel 14 by a transfer wheel 22 (step 7, FIG. 3*b*) which rotates in a counterclockwise direction. The wheel 22 places the packages on a conveyor 24 which carries the packages through a plow arrangement 25 to fold the ends of the wrapper against the package (step 8, FIG. 3*b*) and then moves the packages past a heater 26 to heat seal the folded ends to the package (step 9, FIG. 3*b*).

Pick-Off Wheel 11

The construction and operation of the pick-off wheel 11 will now be described with reference to FIGS. 5, 6 and 7. As shown in FIG. 7, the wheel 11 is formed of seven circular plates 30 to 36 mounted on a rotating shaft 37. The three central plates 32, 33 and 34 are identical each having a wide hub portion 39, a narrow web portion 40, and an outer flange portion 41. The flange portions 41 are of less width than the hub portions to provide a space 42 between facing flange ends. The plates 31 and 35 have hub portions 44, narrower off center web portions 45 and flange portions 46, the inner ends of which are speced from the facing ends of flanges 41 to provide spaces 42 therebetween.

The shaft 37 is journalled to a rear frame member 47 and a front frame member 48 as shown in the drawing. A rim 49 is positioned on each of the flamges 41 and rims 50 and 51 are positioned on the two flanges 46. Each of the rims 49, 50 and 51 are formed with serrated ribs 52 at each edge thereof which is adjacent the spaces 42.

As shown in FIG. 6, the ribs 52 each carry eighteen teeth 54. Each tooth 54 has a leading edge 55 and its outer surface tapers inwardly to the base of the leading edge 55 of the following tooth to form a notch 56 for receiving a stack of two biscuits from the conveyor 10. The notches 56 in each rim are aligned across the width of the wheel 11 in a row. The conveyors 10 are aligned with the spaces 42 so that the biscuits span the two ribs on either side of the space 42.

As each row of notches 56 passes the end of the conveyors 10, a reciprocating lever 57 allows each column of biscuits to advance into the path of the teeth 54. The leading edge 55 of the teeth engage the lower edge of the two end biscuits in each column and strip these from the stack. Each of the two biscuit stacks are held in place within the notches 56 by a spring finger 58 mounted on an arm 59. The arms 59 operating on one row of biscuit stacks are mounted on a shaft 60 which extends through the web portions of the plates 31 to 35 and is journalled in the end plates 30 and 36 by means of bearings 61 and 62. On the rear end of each shaft 60 is mounted an arm 64. A spring 65 extends between the arm 64 and a pin 66 positioned in the plate 36. On the front end of each shaft 60 an arm 67 is mounted. A roller 69 at the free end of the arm 67 engages the surface 70 of an annular cam member 71 which is bolted to the front framework member 48. The spring 65 holds the roller 69 against the surface 70 so that the shaft 60 rotates about its longitudinal axis in accordance with the contour of the cam member 71.

As shown in FIG. 6, the member 71 includes a portion 72 of constant minimum radius, a portion 74 of constant maximum radius, a portion 75 of intermediate radius, a gradual transition portion 76 between portions 72 and 74, a rapid transition portion 77 between the portions 74 and 75, and a gradual transition portion 78 between the portions 75 and 72.

Still referring to FIG. 6, as the notches approach the end of conveyors 10, each shaft 60 has a rotational position which places the spring fingers 58 near the leading edge of the teeth 54 so that they do not contact the biscuits. After the biscuits have been deposited in the notches, the continued rotation of the wheel moves the rollers up the transition portion 76 of the cam member rotating the arm 67 to rotate the shaft 60 counterclockwise and move the spring fingers against the biscuits. The spring fingers are held in this position as the roller moves over the cam portion 74. As the biscuits are gripped by jaws on the transfer wheel, the rollers move along the transition cam portion 77 to quickly swing the fingers away from the biscuits.

Above the wheel 11, two shafts 80 and 81 (FIG. 5), extend from the rear frame member 47 toward the front of the machine. Four L shaped brackets 82 are secured to each of the shafts 80 and 81 by means of four split clamping blocks 84. A block 85 is secured to the bottom surface of each of the brackets 82. A guide rail 86 is bolted to each side of the block 85 in alignment with the serrated ribs 52. Side guide plates 87 are also mounted to the clamping blocks 84 by means of pin 88 extending into the blocks 84. The guide rails 86 are vertically adjustable and are positioned to prevent the biscuit stacks from lifting out of the notches. The side guide plates 87 maintain the alignment of the biscuit stacks with the gripping jaws of the transfer wheel.

TRANSFER WHEEL 12

Referring to FIGS. 8–13, the transfer wheel 12 includes, as best shown in FIG. 9, circular end plates 95 and 96 mounted on a rotatable shaft 97 supported by the frame members 47 and 48. The end plates 95 and 96 are each provided with 8 bushings 99 and shafts 100 extending through the plates are journalled within the bushings. An arm 101 is clamped to the front end of the shaft 100 and an arm 102 is clamped to the rear end of the shaft. Each of the plates is also provided with 8 slots 104 which have a generally radial orientation and are

circumfrentially spaced from the bushings at about the same radial distance from the axis of the wheel. Shafts 105 extending between the plates pass through the slots 104 and are journalled at each end in the arms 101 and 102.

An outwardly facing annular cam track 106 is mounted to the front frame member 48 and a cam following roller 107 is mounted on each of the arms 101 for engaging the surface of the cam track 106. A spring 103 extends between a pin 108 secured in the hub and the end of the arm 101 to hold the roller 107 against the surface of the cam. Changes in the contour of the cam track 106 causes the arm 101 to rotate about the axis of the shaft 100 moving along the slots 104.

At the rear of the machine, an inwardly facing cam 109 and an outwardly facing cam 110 are formed on an annular insert 111 which is mounted on the rear frame member 47 and in which the inner end of shaft 97 is journalled. The rear end of the shaft 105 passes through the arm 102, in which it is journalled and an arm 112 is clamped to the end thereof. Also clamped to the arm 112 is a shaft 114 carrying a pair of cam following rollers 115 and 116 which engage the cam surfaces 109 and 110 respectively and are held captive thereby. The arm 102 is provided with a spring 117 which extends to a pin 119 in the end plate 96 and acts to aid in holding the roller 107 against the cam track 106. As the contour of the cam surfaces 109 and 110 changes with respect to the axis of the shaft 105, the captive rollers cause the arm 112 to rotate the shaft 105 to which it is clamped.

Upon the shaft 105 is mounted four jaw assemblies 120, each of which consist of a mounting block 121 bolted to the shaft, bifurcated jaw mounting members 122 and 124 rotatably pinned to the block, and jaws 125 and 126. The member 122 and 124 include spaced gear elements 130 and 131 on opposite sides of the block and a connecting base portion 132 and 134. A pin 135, 136 extends through the block and the elements 130 and 131. The gear element 130 is formed with a single gear tooth 137 and the gear element 131 is formed with a single gear tooth space 138 for receiving the tooth 137.

The jaws 125 and 126 which are fastened to the members 122 and 124 are provided with tip elements 139 for engaging the edges of the biscuit stacks. The tip elements are provided with stop blocks 140 to position the biscuit stacks within the jaws. A spring coil 141 is fastened between the jaws to urge them toward each other.

The jaws are operated by axial motion of a rod 142 provided with laterally extending fingers 144 for engaging the inner surface of the jaws 125. Movement of the rod 142 toward the front of the machine rotates the jaw 125 outwardly, and the jaw 126 is simultaneously rotated in the opposite direction by the action of the gear elements 130 and 131.

The rear end of the rod 142 passes through an arcuate slot 145 in the rear plate 96 and is slideably supported by a portion 146 of the arm 112. The front end of the rod 142 is attached to a rod assembly 147 including a long threaded rod 149, a short threaded rod 150 extending from the end of rod 142, and a turnbuckle type adjustor 151. An arm 152 is clamped to the front end of the shaft 105, and the rod 149 passes through an arcuate slot 154 in the front plate 95 and through an opening in the arm 152, and is threaded into a connector 155. The connector is mounted on a lever 156 which is pivoted to the arm 152 by means of a shaft 157. An annular cam member 159 is mounted on the front frame member and a cam following roller 160 is mounted on the lever 156 to alter the axial position of the rod 142 in accordance with the contour of the cam 159. A coil spring 161 is mounted on the rod 149 between a bushing 162 engaging the lever 156 and a bushing 164 positioned by a nut 165. The action of the spring holds the rod 142 in a rearward or unoperated position and maintains the roller 160 in engagement with the cam 159.

With reference to FIGS. 8–10, as each set of four jaw assemblies approach the pick-off wheel 11, the contour of the cams 109 and 110 change to rotate the shaft 105 counterclockwise about its axis to point the jaws toward the pick-off wheel while the cam 106 swings the shaft 105 about the axis of shaft 100 to extend the jaws past the edge of the transfer wheel. At the same time the cam 159 moves the rod 142 to open the jaws to receive the stacks of biscuits carried on the pick-off wheel. As the shaft 105 moves past the junction point of the wheels 11 and 12, it is rotated clockwise to reduce the relative velocity of the tips of the jaws with respect to the biscuit stacks as the jaws close to grip the stacks. This operation is repeated for the transfer of the biscuit stacks to the wrapping wheel 14.

Web Supply

Referring to FIGS. 1a and 1b, the web 15 is drawn from the roll 16 through a tension compensator 166 and over a series of idler rollers by a pair of driven rollers 167 and 169. Four narrow tear tape strands 170 are drawn from separate supply rolls 171 by a driven roller 172 and are applied to the web 15 in spaced parallel relation. The strands 170 are provided with a coating of meltable glue on the surface which contacts the web 15. The roller 172 is heated to melt the glue and the strands and the web are pressed together as they pass between a rigidly mounted idler roller 174 and a spring loaded roller 175.

After the web 15 leaves the driven rollers 167 and 169, it passes beneath a cutting member 176 mounted on a shaft 177 which is given a reciprocating rotary motion. The member 176 is provided with four arcuate knives 179 which are positioned to sever the tear tapes and cut an arcuate slit in the underlying web portion to form a tab. The reciprocating motion of the rod is synchronized with the motion of the web so that the distance between the tabs is equal to the length of the individual wrappers cut by the knife wheel 20.

CUTTING WHEEL 20

As shown in FIGS. 16 and 23 the knife wheel 20 carries five knife blades 180 with serrated edges 181 (FIG. 27). In each blade, the cutting edge is interrupted by four notches 182 which are positioned to be aligned with the tear tapes. The knives thus sever the strips 17 up to the edge of the tear strip on a line which intersects the arcuate cut line of the knives 179. In this manner, a wrapper is formed with a tear tape tab extending from its leading edge as is shown in step 1 of FIG. 3*a*.

The cutting wheel 20 includes a sleeve 184 mounted on a rotating shaft 185. The sleeve 184 is provided with five slots 186 spaced equally around the circumference thereof. A knife assembly 187 is positioned in each slot.

The assembly **187** (FIGS. **24** and **26**) include two knife holding plates **189** and **190** which are positioned on either side of the blade **180** and are bolted together to clamp the blade therebetween. The plates are formed with recesses **191** and **192** on each side of the outer portion of the blade. Blade protectors **194** and **195** are slideably positioned within the recesses **191** and **192** and springs **196** are provided to normally maintain the protectors in an extended position. The protectors are provided with vertical slots **197** and a pair of pins **199** each extend through the plate **189**, a slot **197**, and the plate **190**, to retain the protectors within the recesses **191, 192.**

The springs **196** normally hold the blade protectors **194** and **195** in an extended position as shown in FIG. **16.** When the knife assembly contacts the outer surface of the wrapping wheel, the protectors are forced inwardly exposing the blade which severs the web strip **17** to form the wrapper **19.** In FIGS. **24** and **25,** the knife assembly **187** is shown with the protectors in the retroacted position.

The Wrapping Wheel

Referring now to FIGS. **13–22,** the wrapping wheel comprises four identical central plates **200** having hub portions **201,** a front end plate **202** having a hub portion **204,** and a rear end plate **205** having a hub **206.** The plates are mounted on a driven shaft **207** (FIG. **14**) which is journalled in the front and rear frames.

The central plates **200** are each formed with a gradually tapered web portion **209** and a narrow rim **210** (FIGS. **16** and **20**). The web **209** is provided with a plurality of spaced aperatures **211** forming spoke portion **212** therebetween. Flanges **214** are formed on the rim **210** at the outer edges of each of the spokes **212.**

A vacuum port **215** extends axially through the hubs **201** and the hub **204** aligned (radially) with each of the spokes **212.** A bore **216** extends through each spoke from the port **215** to the rim **210.**

A plurality of plates **217** extend between the outer peripherial edges of the end plates **202** and **205,** each plate being fixed in recesses **219** provided in the rims **210** outwardly of the flanges **214.**

As shown in FIGS. **20–22,** the plates **217** are formed with vacuum passageways including vertical bores **220** aligned with the bores **216,** a longitudinally extending channel **221** intersecting the bores **220** and transverse branch channels **222** and **224.** A pair of elongated suction heads **225** and **226** are attached to the outer surface of each plate **217.** The vacuum channels **221, 222** and **224** intersect the outer surface of the plates **217** and therefore are in communication with the inner surfaces of the heads **225** and **226.** The head **225** is Z-shaped in cross section and is provided with eighteen ports **227** in alignment with each of the web strips **17.** The ports **227** are in communication with the ports vacuum channels **221** and **222** to hold the leading edge of the wrappers **19** against the wrapping wheel. The head **226** is provided with two ports **229** in communication with the passageway **224** and in alignment with each web strip **17** to initially secure the trailing edge of the wrappers.

As shown in FIG. **16,** the web strips **17** are held to the wrapping wheel by the vacuum applied at the holes **227** and **229,** as the cutting wheel severs the strips **17** into individual wrappers **19.** In severing the strips **17,** the blades **180** of the cutting wheel enter slots **230** provided between the vacuum heads **225** and **226** while the blade protectors **194** and **195** engage the surface of the heads **225** and **226** and move into the recesses **191** and **192.**

Between the plate **225** at the end of one spoke and the plate **226** at the next consecutive spoke, there exists a recess **231** in the face of the wrapping wheel for receiving biscuit stacks. Each plate **217** has a surface **232** against which the biscuit stacks are positioned by the transfer wheel as shown in FIG. **17.** As the biscuits are moved toward the surfaces **232,** the stack forces the wrapper **19** into the recess **231** and around the stack as shown in FIG. **2***b*. The front end of each wrapper is securely held by the many suction ports **227** and does not move, however, the rear end which is held by only two suction ports **229** slides forward as the biscuit stack is pressed into the recess. FIGS. **4***a* and **4***b* shown in sequence the wrapping steps which are performed upon the wrapping wheel.

When the stack is positioned in the recess, and before the jaws **125** of the transfer wheel have released the stack, a spring finger **234** is moved into contact with the stack to hold it in place. Rotation of the wrapping wheel moves the stack past an air pipe **235** having nozzle openings **236** oriented to direct an air blast toward the wheel to blow the trailing end of the wrapper over the exposed surface of the outer biscuit as also shown in step **3** of FIG. **3***a* and in FIG. **4***a*.

Referring to FIG. **18,** further rotation of the wrapping wheel brings the stack in contact with a band brush **237** which is moving in the same direction as the wrapping wheel but at a faster speed. The brush **237** smooths the previously trailing edge of the wrapper against the surface of the stack and holds it in place as a pair of tucking fingers **238** fold the wrapper edges as shown in step **4** on FIG. **3***b*. As the stack passes the brush **237,** compressed air is delivered through the bore **216** to the ports **227** to lift the leading end of the wrapper as shown in FIG. **19.** The stack is moved under a heater plate **239.** The edge **240** of the heater plate contacts the leading end of the wrapper and folds it over the stack (step **5** on FIG. 3b) as the stack moves beneath the plate. The spring finger **234** released the stack as it moves beneath the plate **239** and springs **241** lift the stack against the plate to heat seal the previously leading and trailing ends of the wrapper together. As the stack passes beneath the plate, the finger **234** is moved back against the stack and, because the stack has been displaced outwardly, engages the center of the stack.

After the stack has moved past the heater (FIG. **13**) a second pair of tucking fingers **242** fold the forward edges of the wrapper as shown in step **6** of FIG. **3***b* and the stack is moved to the transfer wheel **22.** As the jaws **125** of the transfer wheel **22** close upon the stack (step **7** of FIG. 3b) the tucking fingers **238** and **242** withdraw and the jaws **125** fold the wrapper against the sides of the stack.

Referring to FIGS. **13–19,** the spring fingers **234** are mounted on shafts **245** which are journalled in the hubs **204** and **206.** An arm **246** clamped to the front end of each shaft **245** carries a pair of cam following rollers **248** and **249** on the free end thereof which engage cams **250** and **251.** The first tucking fingers **238** are mounted to shafts **252** which are journalled in the hubs **204** and **206.** An arm **254** is clamped to the rear end of each shaft **252** and carries a pair of rollers **255** and **256** which engage cams **257** and **258.** The second tuck-

ing fingers 242 are mounted to a shaft 260 also journalled in the hubs 204 and 206. An arm 261 clamped to the front end of the shaft 260 carries a pair of rollers 262 and 264 which engage cams 265 and 266.

As the contours of the above mentioned cams change, the cam following rollers rotate the shafts 245, 252 and 260 to move the spring fingers and tucking fingers toward and away from the biscuit stacks.

TRANSFER WHEEL 22

The transfer wheel 22 is similar in construction and operation to the transfer wheel 12, and in the drawings the parts of the wheel 22 have the same reference numbers, with the prime symbol added, as the similar parts of the wheel 12.

The transfer wheel 22 removes the biscuit stacks and carries them downwardly (counterclockwise) to the conveyor 24 as shown in FIGS. 28 and 31.

PLOW ARRANGEMENT 25

As each stack approaches the conveyor, the edge of the wrapper protruding from each side of the stack (step 7, FIG. 3b) passes between an upper plow element 269 and a lower plow element 270. These elements are oriented in a vertical plane and the lower elements are spaced slightly outwardly of the upper elements. The lower element 270 gradually increases in height, so that as the stack is transported by the conveyor 24, the edges of the wrapper are folded upwardly against the sides of the stack (step 8, FIG. 3*b*). An additional plow element (not shown) positioned at an angle to the direction of motion of the conveyor folds the wrapper edges down against the top surface of the stack (step 9, FIG. 3*b*).

Conveyor 24

The conveyor 24 includes a pair of continuously moving endless chains 271 and a plurality of transverse pusher bars 272 secured between the chains at regular intervals. The pusher bars move over the surface of a flat table 274 on which the wrapped packages are deposited by the transfer wheel 22. The bars 272 engage and move the packages along the surface of the table 274 through the plow arrangement and beneath the heater 26. The bars 272 are sized so that the upper surface of the wrapped package are in contact with the lower surface of the heated plate 275 of the heater to heat seal the folded edges to the top surface of the package. The plate 275 is supported by pivoted arms 276 attached to each end thereof and raised for maintenance purposes by a piston 277 through a crank arm 279. The conveyor delivers the packages to a stacking mechanism 280 which suitably orients the packages for subsequent placement in cartons.

It will be seen from the foregoing that the present invention provides a novel high speed wrapping machine for wrapping a stack of flat articles in a single package in which the articles are segregated and wrapped by rotary elements in continuous motion.

I claim:

1. A machine for wrapping a plurality of stacked articles in a single package comprising in combination

means for feeding a continuous column of stacked flat articles to a point,

a continuously rotating pick-off wheel having means on the outer surface for repetitively removing a predetermined number of articles as a unit from the end of said column at said point,

a continuously rotating wrapping wheel provided with recesses spaced about its outer periphery for receiving said article units,

means for positioning a sheet of wrapping material on said wrapping wheel over each of said recesses,

a continuously rotating transfer wheel for removing said article units from said pick-off wheel and moving said units against said wrapping sheets and into said recesses,

means at the outer periphery of said wrapping wheel for folding trailing and leading ends of said wrapping sheet over the outer surface of said units in overlapping relationship,

means at the outer periphery of said wrapping wheel for sealing said overlapping ends,

means for folding the side edges of said wrapping sheet against said overlapping ends,

and means for sealing said side edges to said overlapping ends.

2. A machine according to claim 1 including means at the outer periphery of said wrapping wheel for partially folding the side edges of said sheet to form flaps,

and a second transfer wheel for removing said units from said wrapping wheel and delivering them to said side edge sealing means.

3. A machine according to claim 2 wherein said second transfer wheel is provided with a plurality of jaws for gripping the side edges of the units, said jaws contacting and folding one of said flaps down against the edge of said unit to cause it to overlie the other of said flaps,

said side edge sealing means including members for folding said flaps against said edges of said unit and members for folding the ends of said flaps against said overlapping ends.

4. A machine according to claim 1 wherein said wrapping wheel is provided with first and second vacuum port means positioned on the surface thereof adjacent each of said recesses to initially be covered by said ends of said sheet to hold said sheet to said wheel spanning said recess, said first port means developing substantially lesser suction than said second port means so that when said article is moved into said recess said sheet moves with respect to said second port means, said second port means being positioned so that said sheet is moved out of contact therewith to free the end thereof when said unit is seated in said recess.

5. A machine according to claim 4 including means for directing a steam of air at said free end of said sheet to fold said free end over the outer surface of said article unit.

6. A machine according to claim 5 including means for directing a stream of pressurized air outwardly through said first port means to lift the other end of said sheet from the surface of said wrapping means,

and means for folding said other end of said sheet over said outer surface of said unit.

7. A machine according to claim 1 including vacuum port means on the surface of said wrapping wheel on opposite sides of each recess,

means for applying a web of wrapping material to the surface of said wrapping wheel,

vacuum producing means connected to said port means for holding said wrapping material to said wrapping wheel,

means for cutting said web into sheets so that each sheet extends across a recess.

8. A machine according to claim **7** including means for adhering a continuous strand of strong plastic material to said web, and

means for periodically severing said strand and producing a tab shaped cut in the portion of the web to which it is attached prior to the operation of said web cutting means,

said web cutting means being synchronized to cut said web at a location spaced from the point at which said strand is severed, said web cutting means having a blade which is interrupted across the width of the tab shaped cut to produce a sheet having a tab extending from one end thereof.

9. A machine according to claim **1** wherein said transfer wheel includes

a plurality of pairs of jaws for gripping the side edges of said article units, said jaws extending generally radially with respect to said transfer wheel, means for moving said jaws in each pair toward and away from each other,

a rod parallel to the axis of said transfer wheel for supporting each pair of jaws

means for rotating said rod as said jaws approach said pick-off wheel and as said jaws approach said wrapping wheel to decrease the rate of relative movement between said jaws and said pick-off wheel and said wrapping wheel to facilitate transfer of said article units.

10. A machine according to claim **9** including means for moving said rod radially with respect to said transfer wheel to extend said jaws during transfer operations.

* * * * *