No. 870,664. PATENTED NOV. 12, 1907.

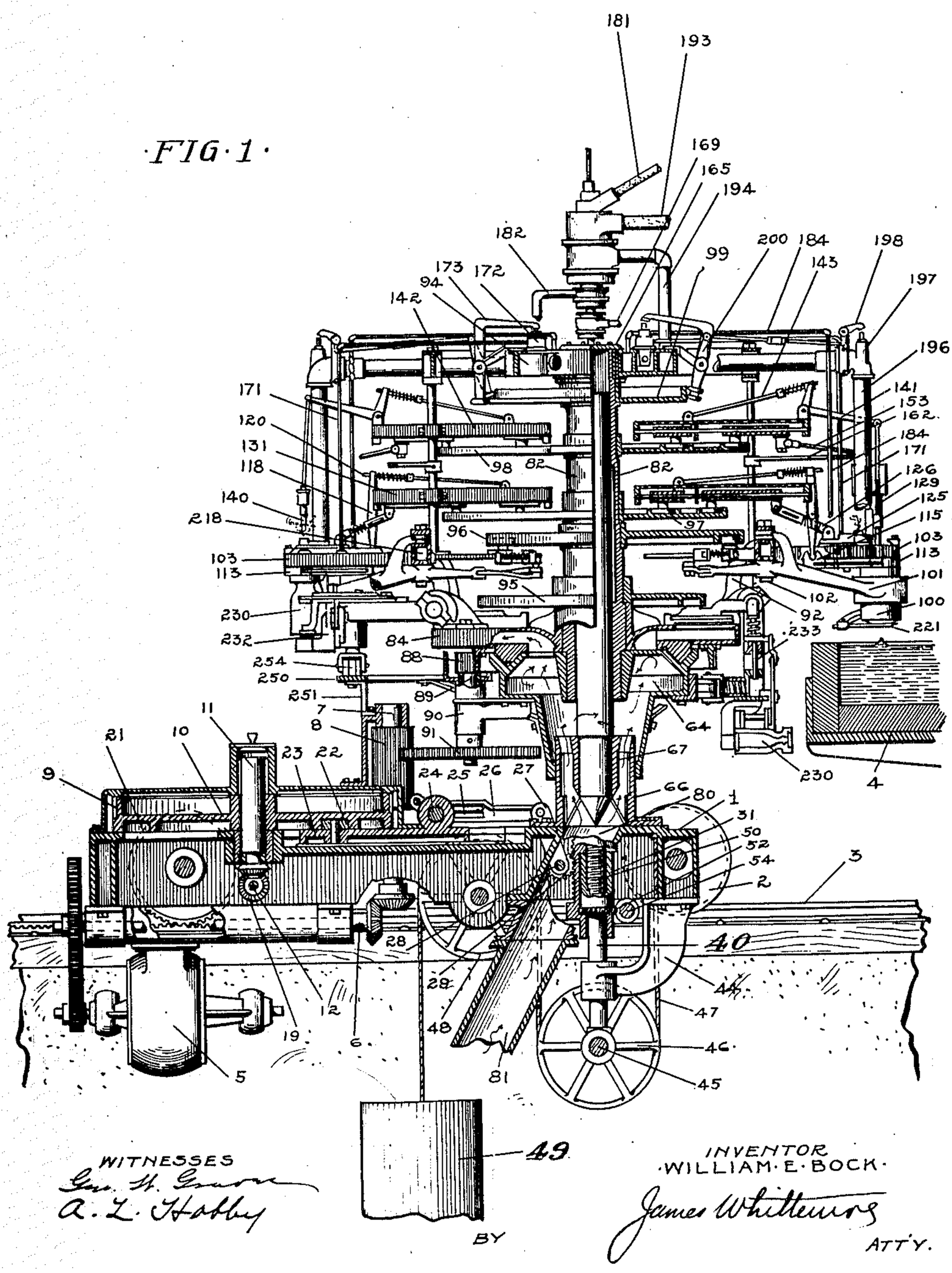
W. E. BOCK.

# MACHINE FOR GATHERING AND SHAPING GLASS.

APPLICATION FILED MAY 2, 1905.

13 SHEETS—SHEET 1.

·FIG·1·

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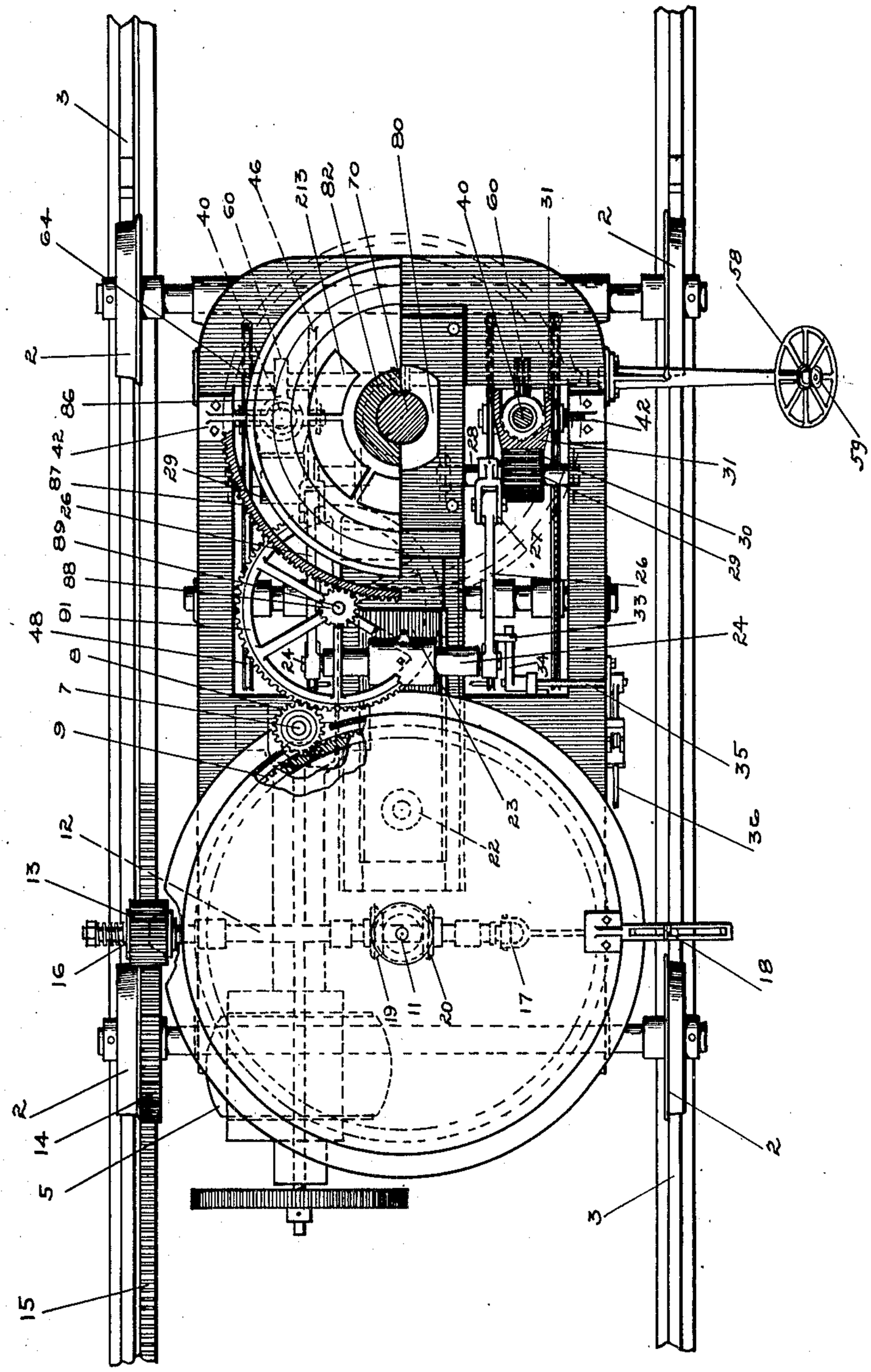
13 SHEETS—SHEET 2.

FIG. 2.

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13 SHEETS—SHEET 3.

FIG. 4.

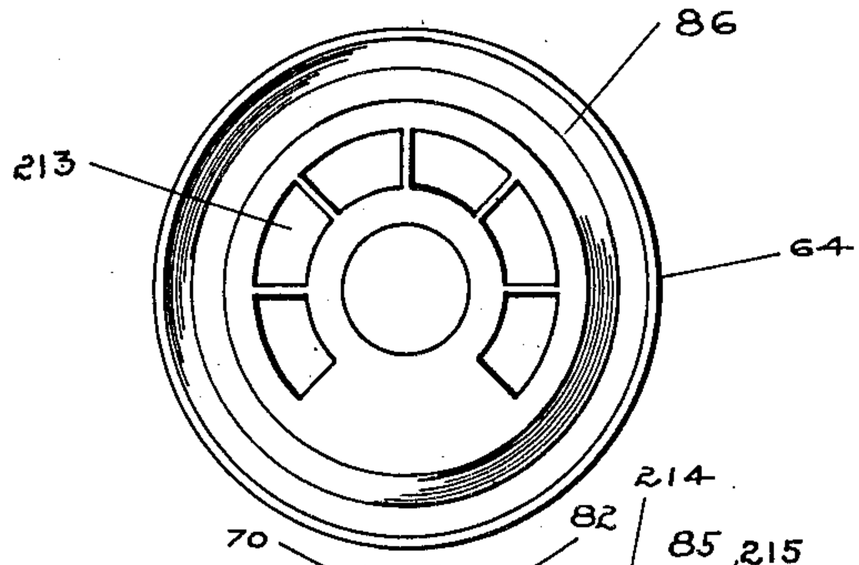


FIG. 3.

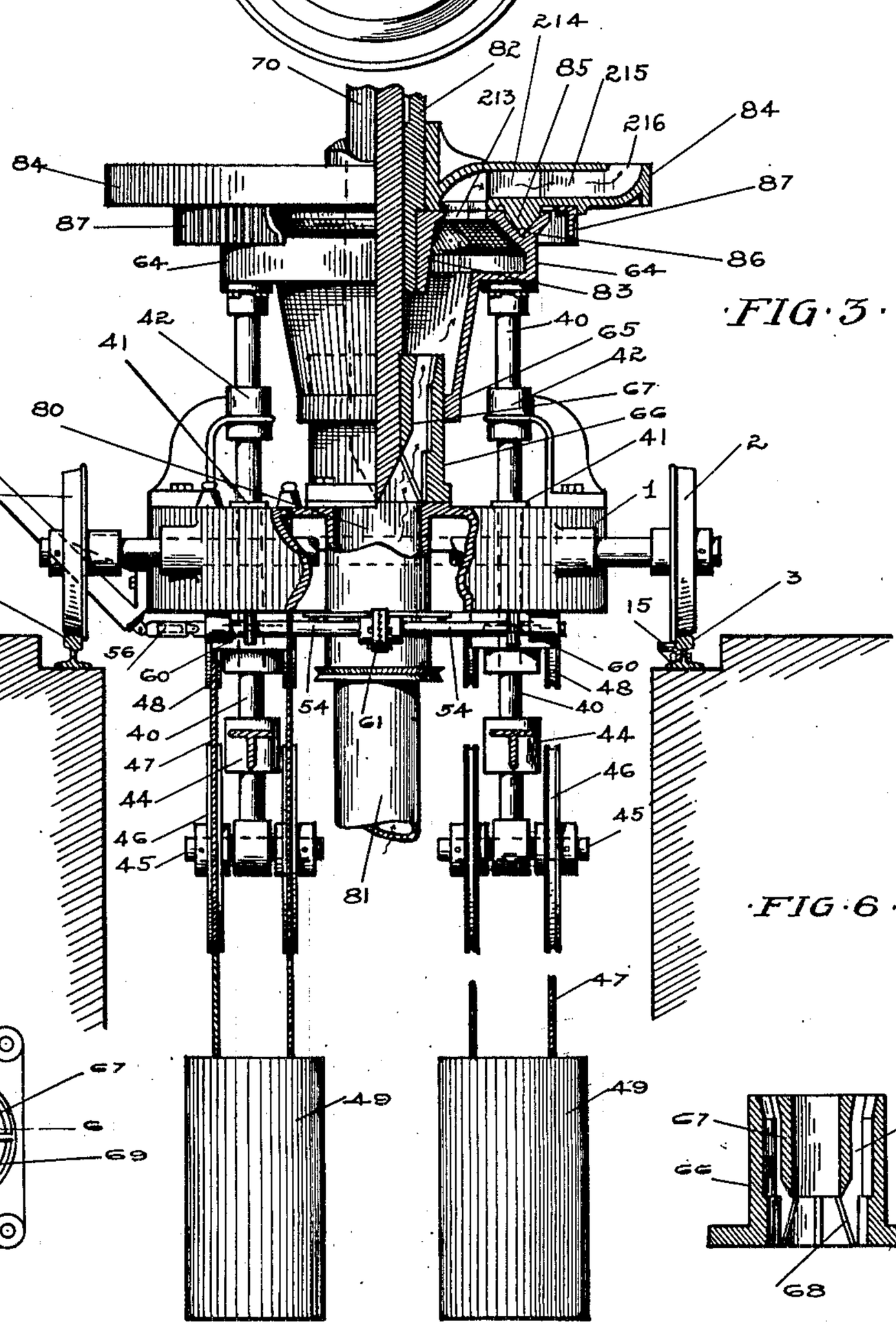


FIG. 5.

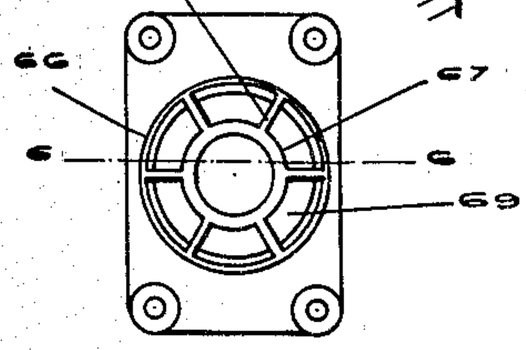


FIG. 6.




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13 SHEETS—SHEET 4.

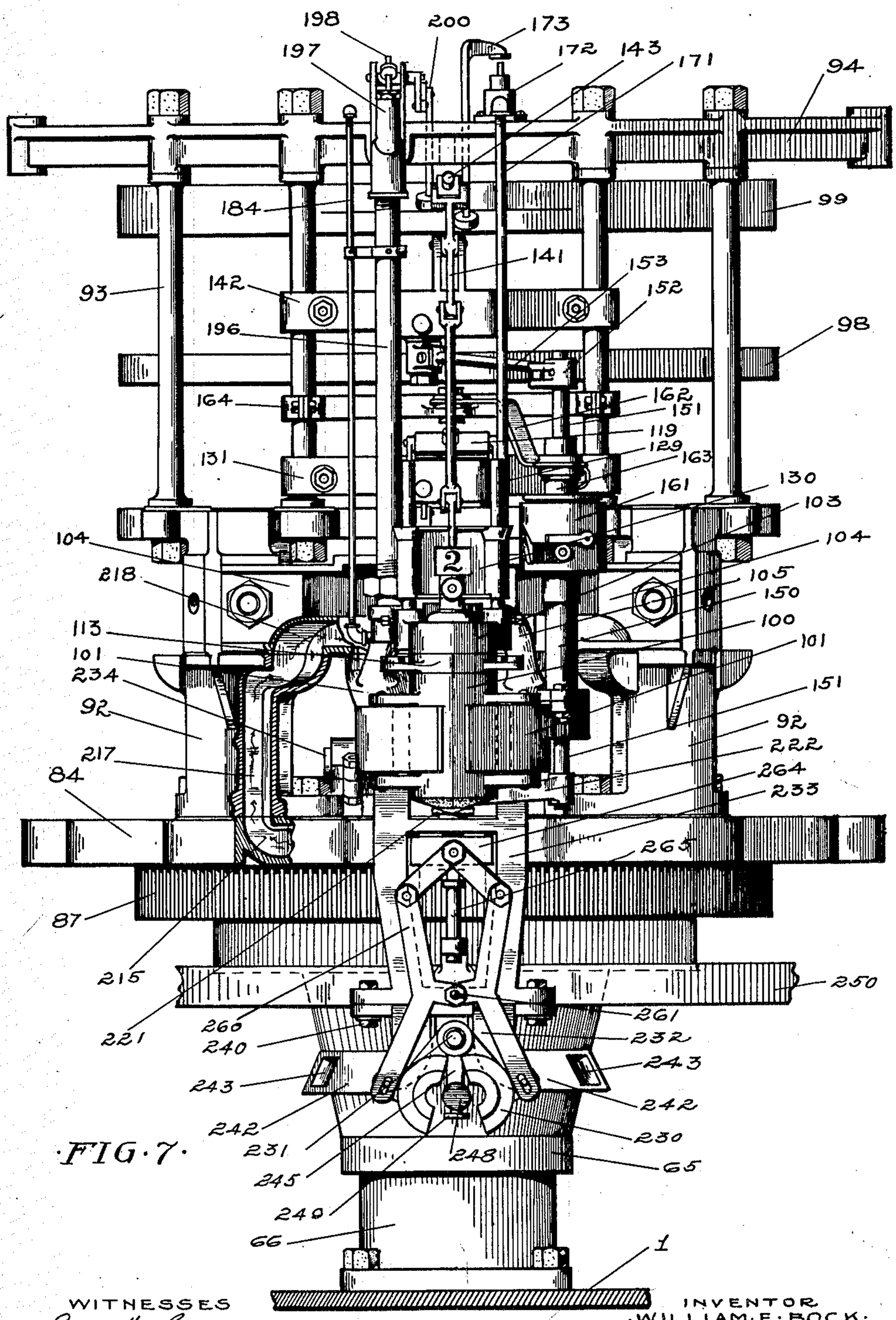


FIG. 7.

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13 SHEETS—SHEET 5.

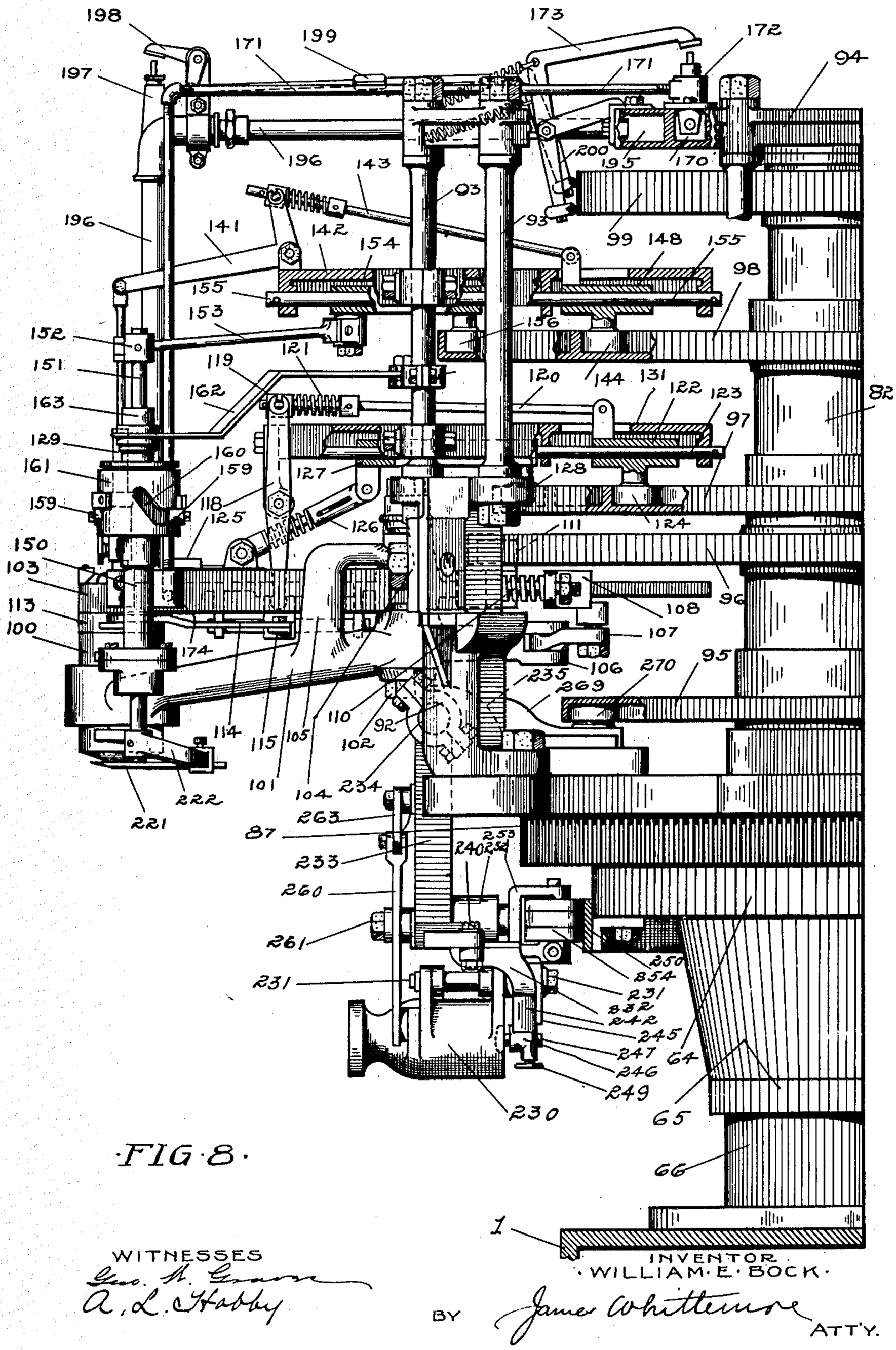


FIG. 8.

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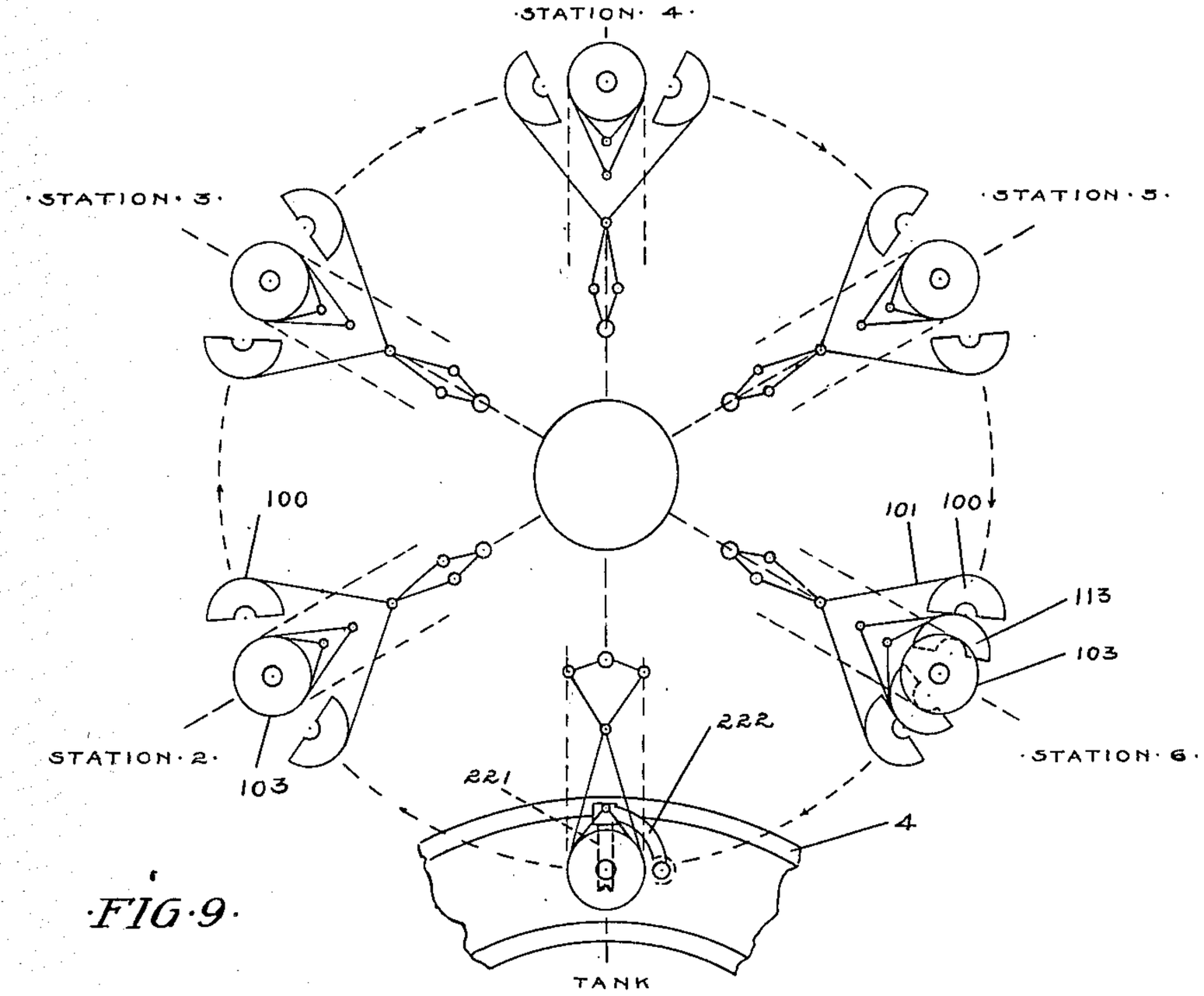
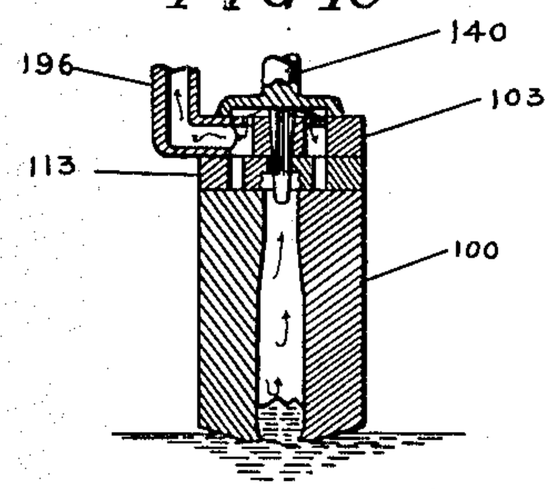
13 SHEETS—SHEET 6.

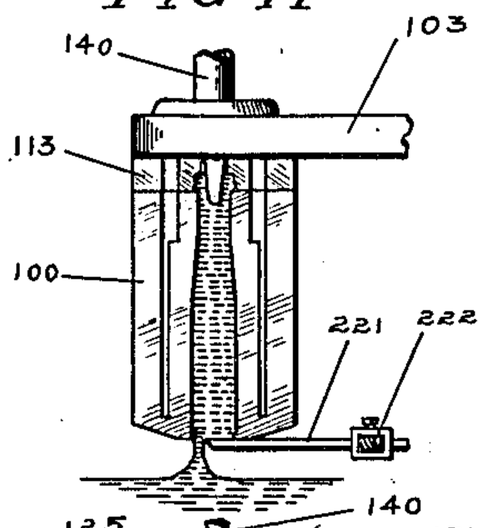



·FIG·9·

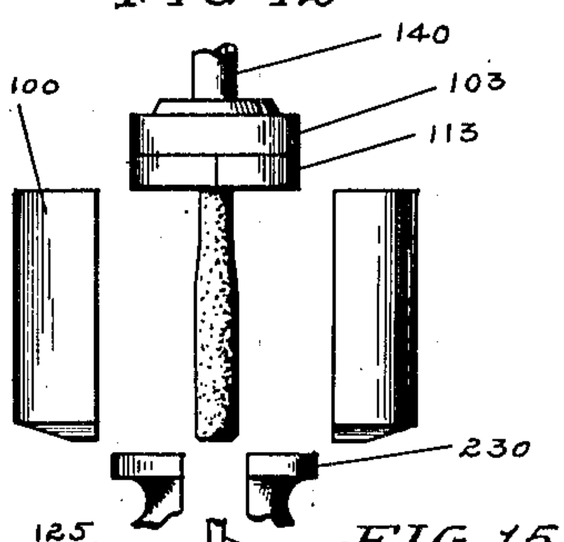
·FIG·10·



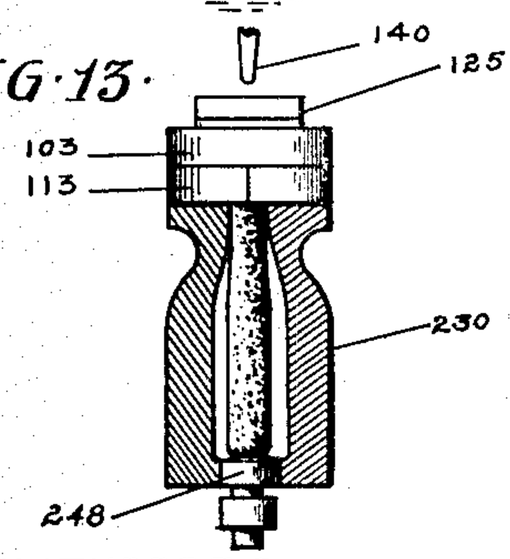

·FIG·11·



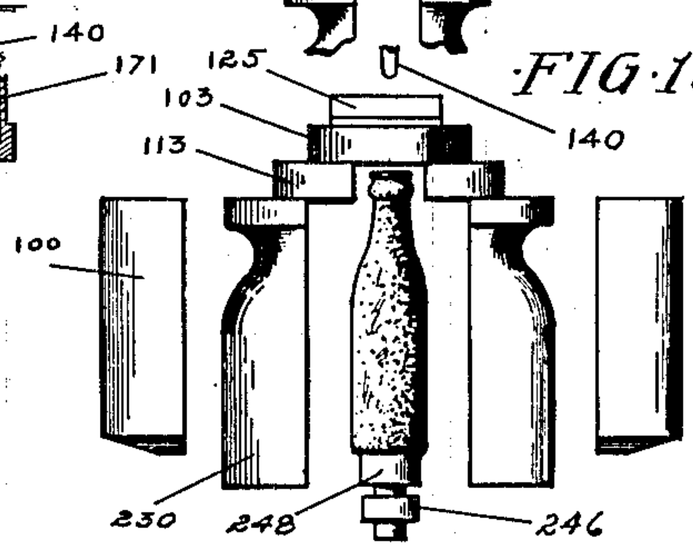

·FIG·12·




·FIG·13·




·FIG·14·




·FIG·15·

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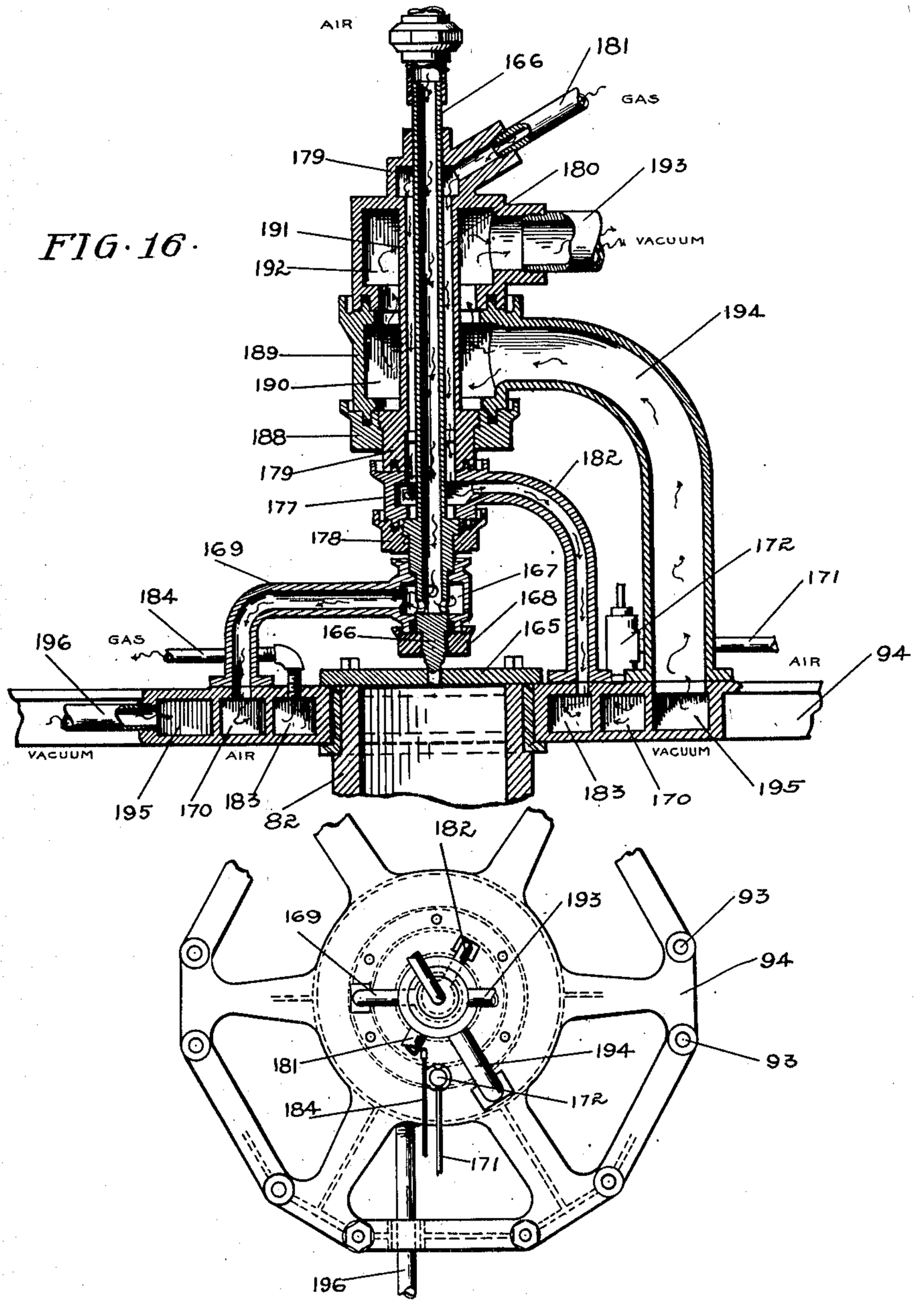
13 SHEETS—SHEET 7.

*FIG·16·*




*FIG·17·*

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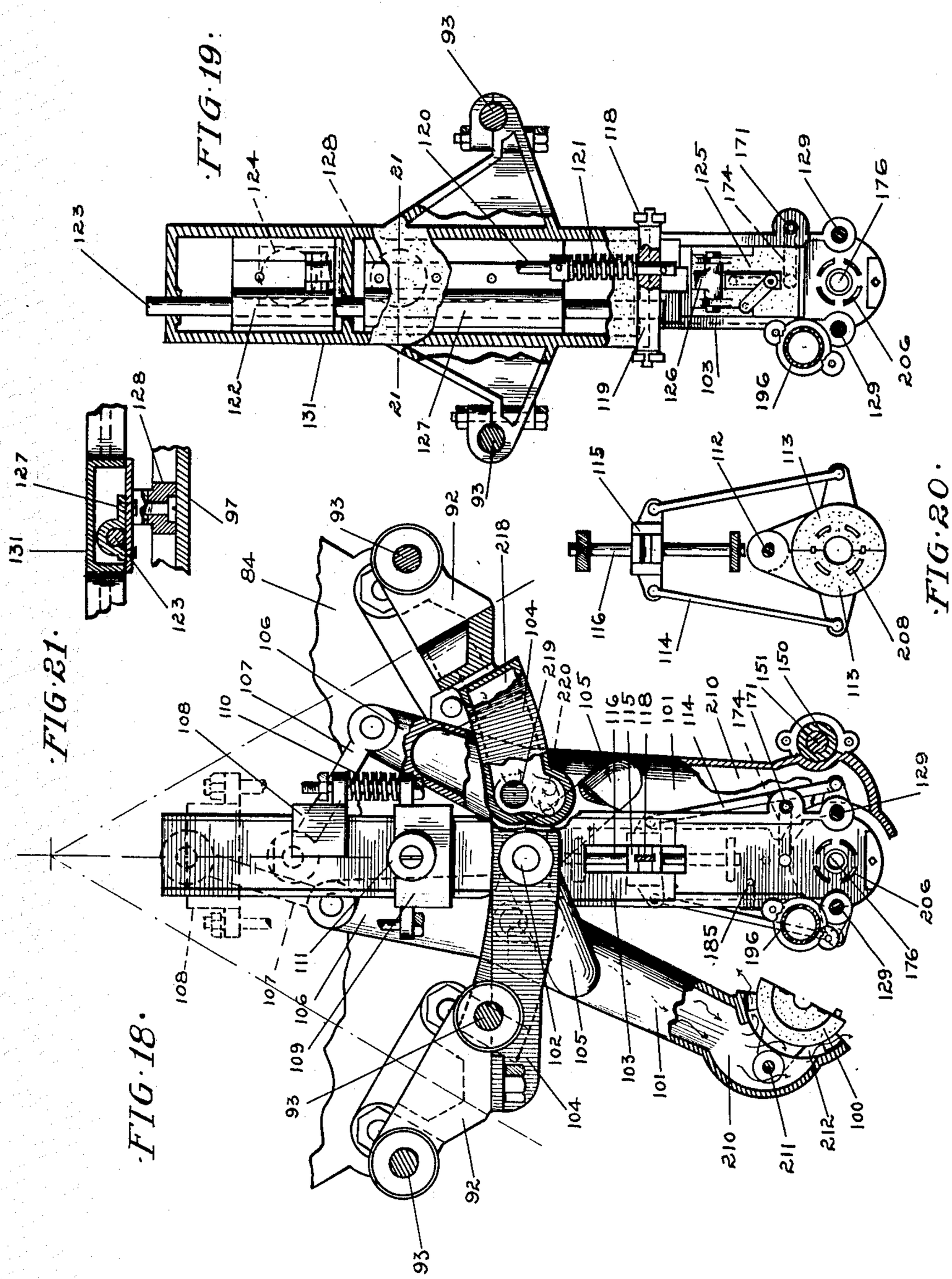
13 SHEETS—SHEET 8.

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13 SHEETS—SHEET 9.

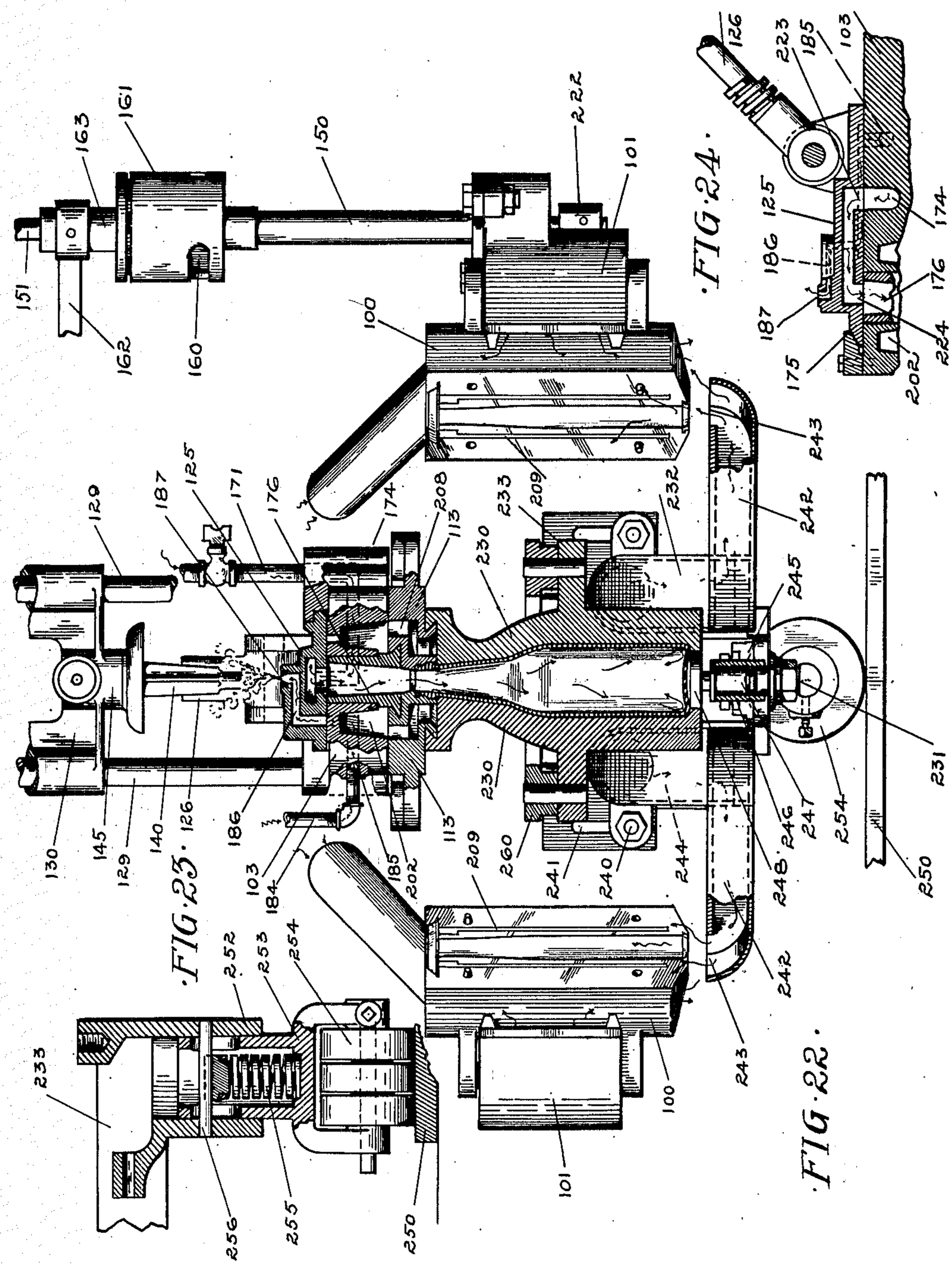


FIG. 24.

FIG. 23.

FIG. 22.

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13 SHEETS—SHEET 10.

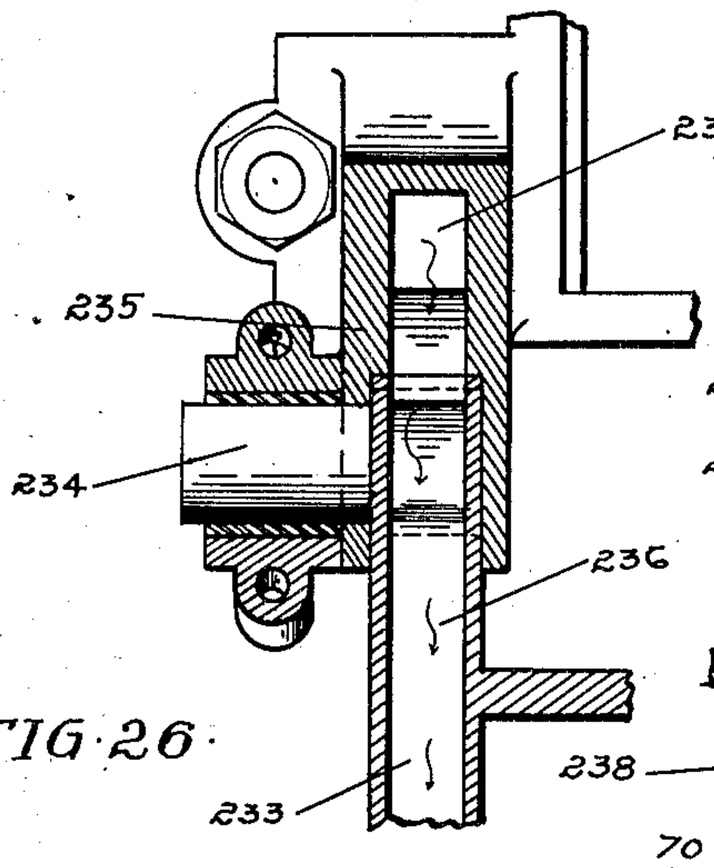


FIG. 26.

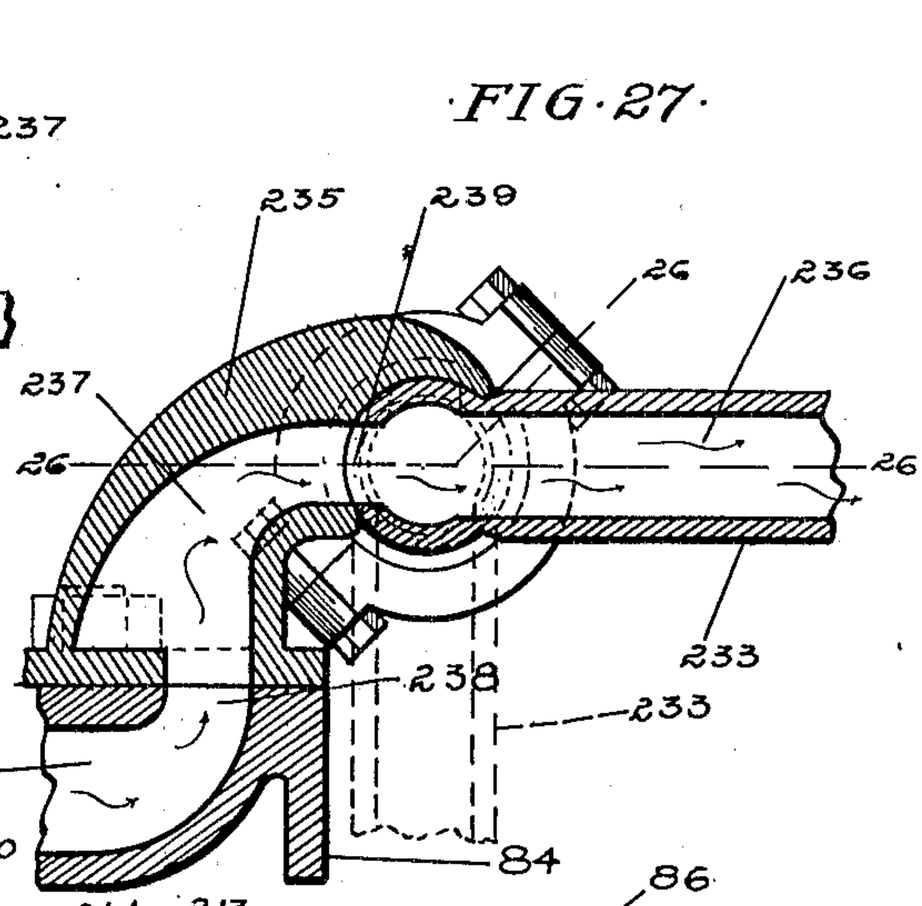


FIG. 27.

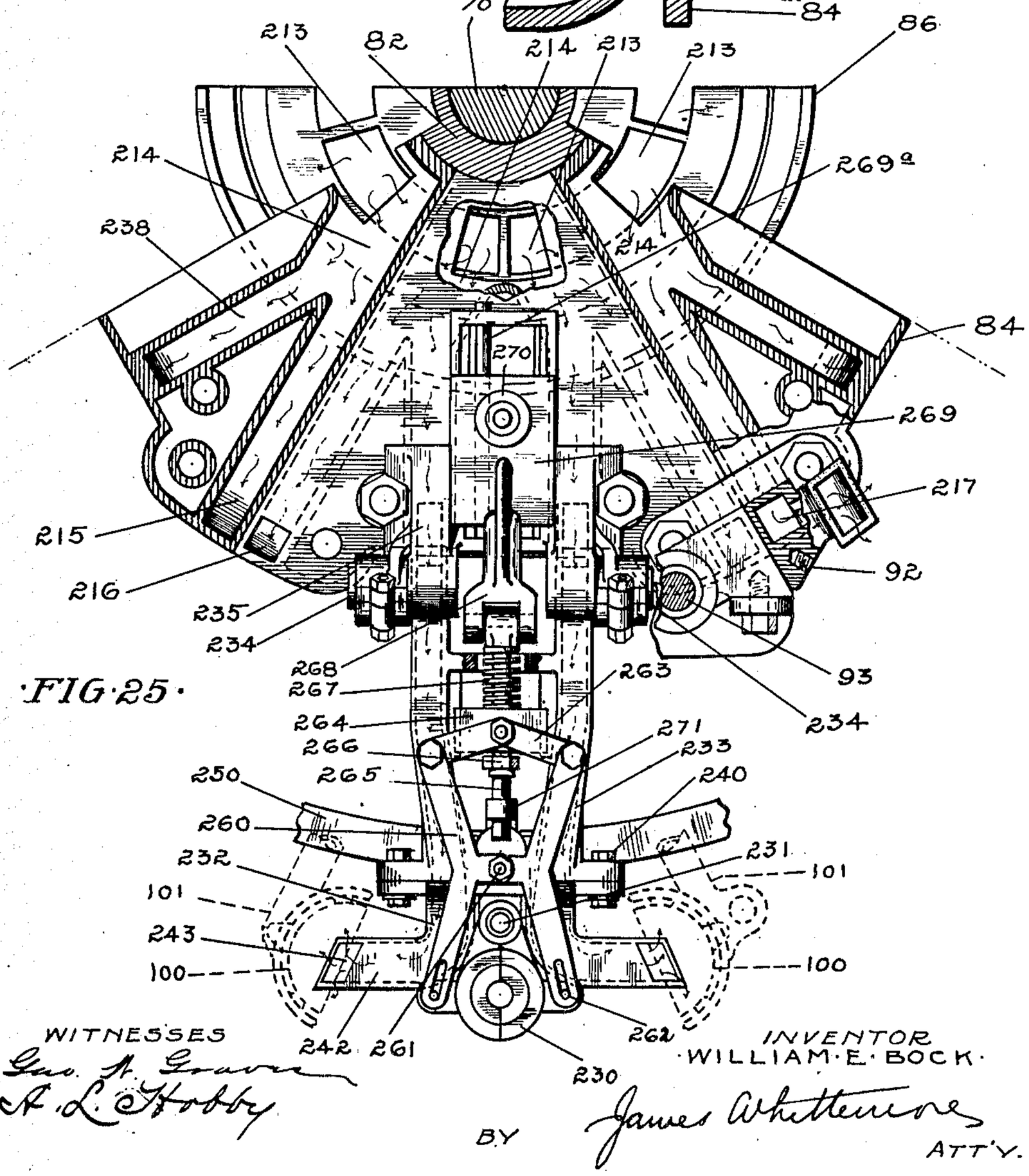


FIG. 25.

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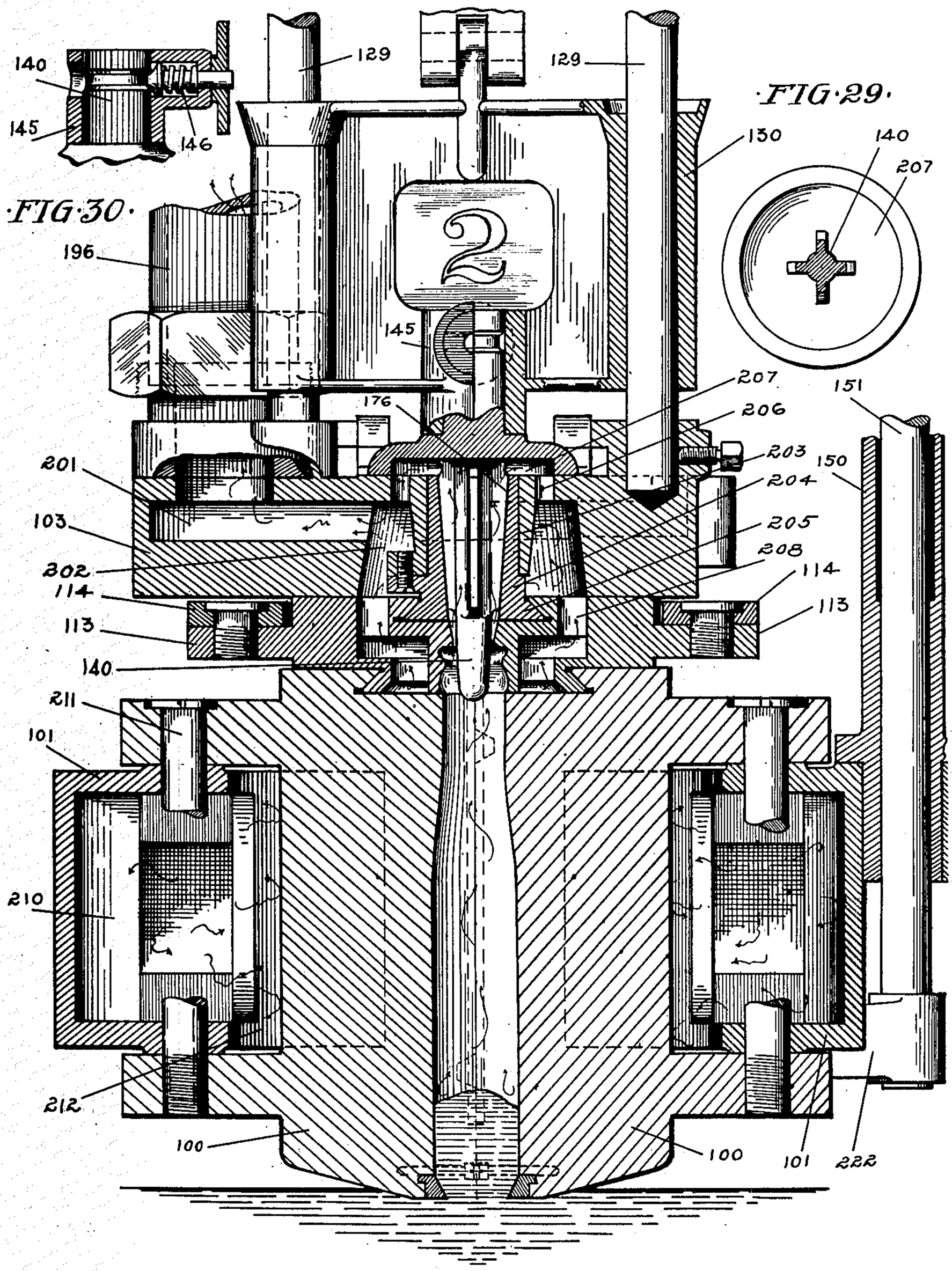
18 SHEETS—SHEET 11.




·FIG·30·

·FIG·29·

·FIG·28·

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13 SHEETS—SHEET 12.

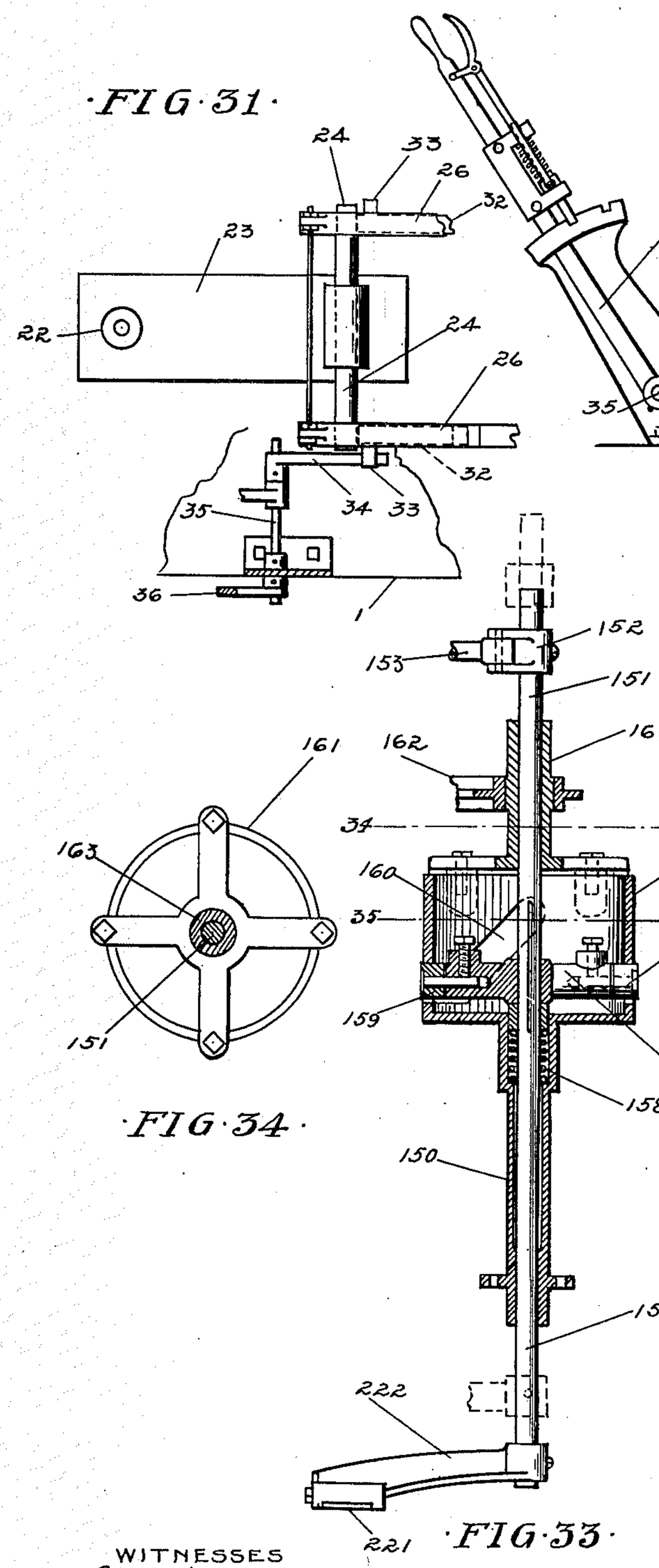


FIG. 31.

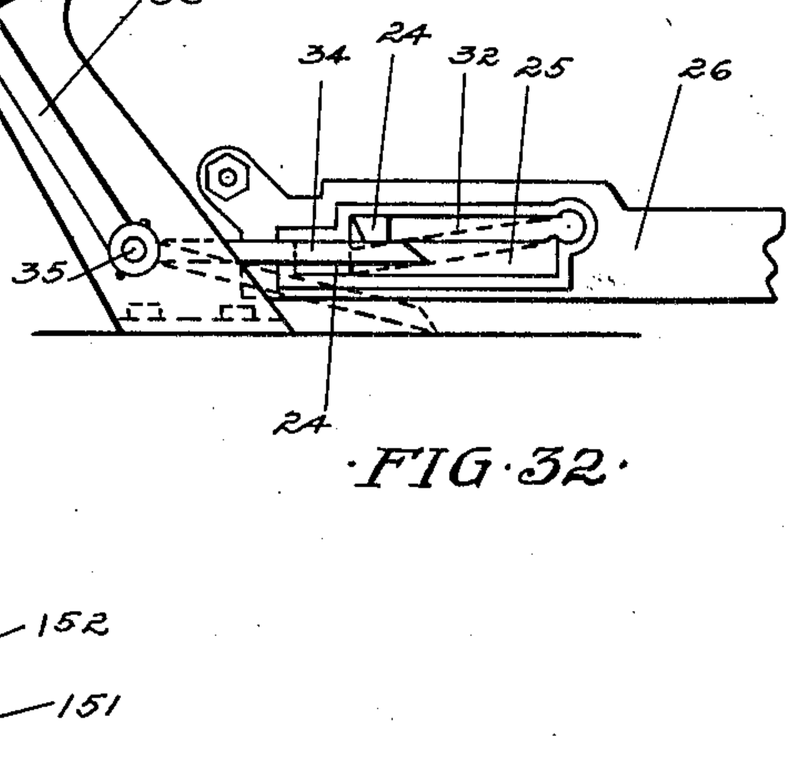


FIG. 32.




FIG. 34.

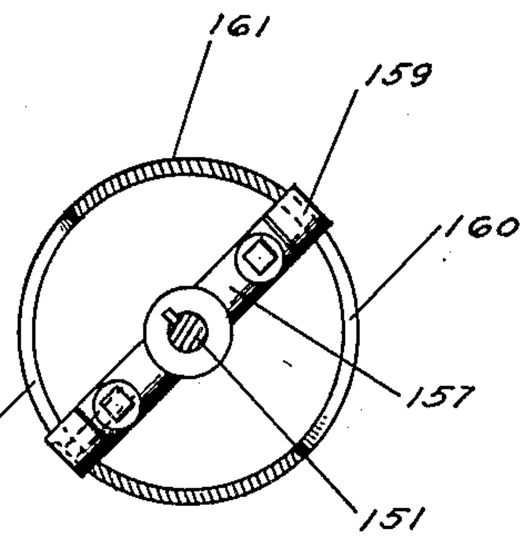


FIG. 35.

FIG. 33.

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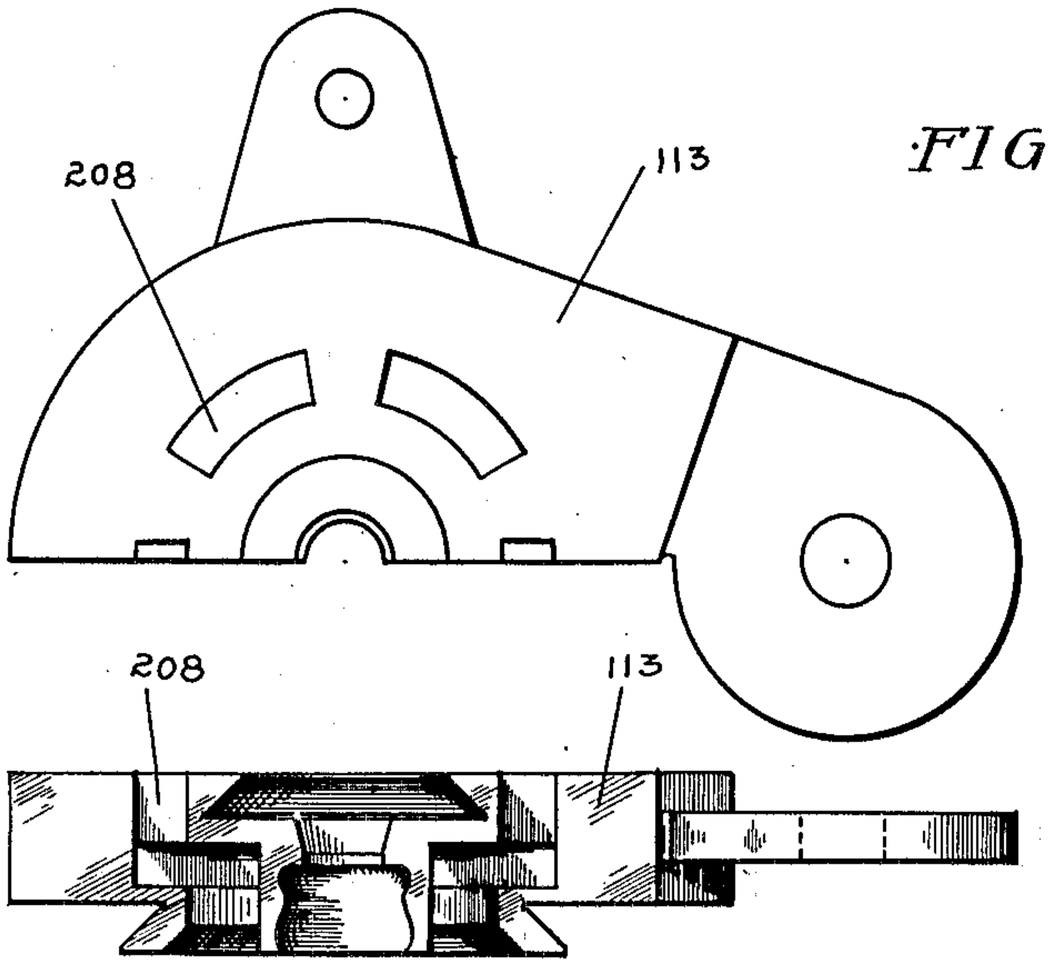
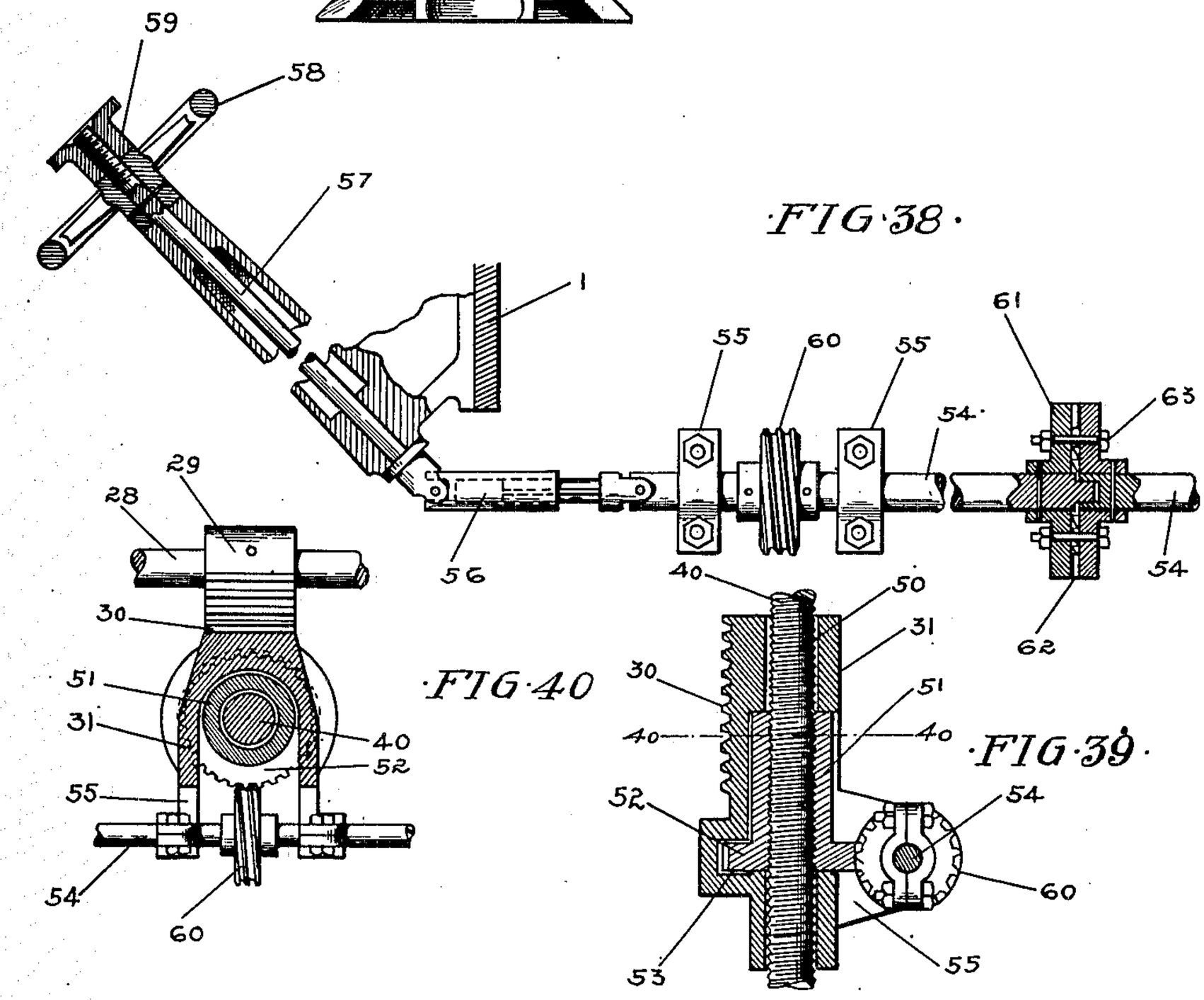
13 SHEETS—SHEET 13.




FIG·36·

FIG·37·




FIG·38·

FIG·40

FIG·39·

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# UNITED STATES PATENT OFFICE.

WILLIAM EMIL BOCK, OF TOLEDO, OHIO, ASSIGNOR TO THE TOLEDO GLASS COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

## MACHINE FOR GATHERING AND SHAPING GLASS.

No. 870,664. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed May 2, 1906. Serial No. 258,562.

*To all whom it may concern:*

Be it known that I, WILLIAM EMIL BOCK, residing at Toledo, in the county of Lucas and State of Ohio, a citizen of the United States, have invented certain new and useful Improvements in Machines for Gathering and Shaping Glass, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to new and useful improvements in machines for gathering and for shaping glass, and consists in an improved machine for gathering glass in definite quantities from a pool or tank of molten metal, together with coöperating mechanism for blowing the gathered glass to shape.

The mechanism consists particularly in the following:—In a rotary, reciprocating frame, which carries a series of gathering molds, and in the means for operating the frame, the molds, and in counterbalancing the frame and attached parts. In the cooling of the gathering mold, and the means for doing this cooling. In the construction of the blowing head and adapting it to molds having different-sized top openings; and the means for heating the pin core or plunger which makes the initial blow-opening in the blank. In the manner of supporting and operating the blowing molds, and providing means for attaching blowing molds of different size. In the construction of the cut-off knife, its operating means, and means for adjusting it to different sizes of molds, and further in the construction, arrangement and combination of the parts, particularly pointed out in the claims.

In the drawings, Figure 1 is an elevation of the machine, parts being broken away and omitted to more clearly illustrate their connections, and showing the relation of the machine while in operation with the tank and after blowing the finished article; Fig. 2 is a top plan view, partly in section, of the carriage frame; Fig. 3 is an enlarged front elevation of the lower part of the machine, partly in section; Fig. 4 is a top plan view of the base ring or frame; Fig. 5 is a top plan view of the hollow pedestal for the stationary center post; Fig. 6 is a section on line 6—6 of Fig. 5, of the hollow pedestal; Fig. 7 is an enlarged elevation of the rotary frame, showing one set of blank molds, its operating parts, and also one of the blowing molds in its lowered position; Fig. 8 is an enlarged side elevation of one half of the rotary frame, showing one blank mold and one of the blowing molds, and the cam rings and their connections to the various parts shown in elevation, partly in section; Fig. 9 is a diagram plan, illustrating a six-arm machine, and illustrating the position of the molds at different points in the movement of the rotary frame; Figs. 10, 11, 12, 13, 14 and 15 are diagrams, illustrating the gathering, cutting off of the glass, the suspending of the blank, the blowing molds closing about same, the blank being blown to the finished article, and finally, the molds opened to discharge the finished article; Fig. 16 is a vertical central section of the air, gas and vacuum connections to the annular chambers in the upper spider, and means for supporting same. Fig. 17 is a top plan view of Fig. 16; Fig. 18 is a top view of the blowing head arm, some parts being broken away, the right-hand side showing the mold in a closed position and the left hand lever being shown in an open position; Fig. 19 is a top plan view, partly in section, of one of the brackets, carrying the cam rollers for operating the blowing valve, neck molds, the knife and the plunger; Fig. 20 is a top view of the neck molds and operating rods and block in a closed position; Fig. 21 is a cross section on line 21—21 of Fig. 19, showing the connection between the slides, supported on the slide rods and the cam rings; Fig, 22 is an elevation partly in section through the blowing head, neck mold and blowing mold, the parts being in the position when the article is being blown in the blowing molds, the blank molds being open; Fig. 23 is a detail section of the spring-pressed roller supporting the blowing mold frame; Fig. 24 is a longitudinal section of the blowing valve; Fig. 25 is a top plan view, partly in section, of the lower spider, also a top plan view of the operating parts of the blowing mold; Fig. 26 is a horizontal section on line 26—26 of Fig. 27; Fig. 27 is a cross-section through the joint of the blowing mold frame, the bracket and a portion of the lower spider, illustrating the air conduit in one of the furcations of said frame; Fig. 28 is an enlarged section through the blowing head, neck molds, blank molds, illustrating the parts as in place during the gathering operation; Fig. 29 is a cross-section of the plunger, illustrating the annular port at the top; Fig. 30 is a vertical section showing the detachable connection between the plunger and head; Fig. 31 is a top plan view of some of the operating mechanism controlling the raising and lowering of the rotary frame; Fig. 32 is a side elevation of the parts shown in Fig. 31; Fig. 33 is a vertical section of the operating mechanism for the cut-off knife; Fig. 34 is a section on line 34—34 of Fig. 33; Fig. 35 is a section on line 35—35 of Fig. 33; Fig. 36 is a top view of one of the neck mold sections; Fig. 37 is a side view thereof showing the ports; Fig. 38 is an elevation, partly in section, of the adjusting mechanism for the raising and lowering of the machine; Fig. 39 is a vertical section of the rack and the adjusting nut, on the slide shafts by which the rotary frame is raised and lowered; Fig. 40 is a cross-section on the line 40—40 of Fig. 39.

1 is the carriage frame, which is supported on suitable wheels 2, which run on tracks 3, so that the machine may be moved to and from the glass tank indicated at 4.

On the frame is a motor, which I have shown as an electric motor 5, which furnishes the power for operating the machine. This drives, through suitable gears, the shaft 6 geared to and driving the vertical shaft 7. On the shaft 7 is a pinion 8, which meshes with a gear ring 9 at the outer edge of the cam wheel 10, and gear 91 for rotating the machine. The cam wheel 10 is secured to a vertical stub shaft 11, which at its lower end is geared to a horizontal shaft 12, which has a pinion 13 loose on the shaft and meshes with the gear wheel 14 on one of the axles. The gear wheel 14 meshes with a rack 15 beside the track.

16 is a suitable clutch operated through the connecting rod 17 and the lever 18, so that when the clutch is thrown in, the wheel 14 and the carriage may be caused to travel along the track. In order to provide a drive mechanism for the carriage either way, I provide on opposite sides of the gear wheel on the shaft 12, the bevel gear wheels 19 and 20, either of which may be moved into engagement, and the engagement of either of which will operate the clutch 16.

It is desired to raise and lower the operating parts of the machine to and from the glass, and this is accomplished through the cam wheel 10, which has a cam groove 21, with which a roller wrist 22 engages. This roller wrist is connected to a slide 23, sliding in suitable bearings in the carriage frame. On this slide is a shaft 24 (Figs. 2 and 31), the ends of which are squared and engage in the slots 25 (Figs. 1, 32), in the push-rods 26, which at their outer ends are connected to the rock arms 27 on the rock shafts 28. These rock shafts 28 carry segmental gears 29 (Figs. 2, 40), engaging rack bars 30 on the sleeves 31 (Fig. 39), which are respectively connected to slide shafts which support the machine and through which it is raised and lowered in the manner to be hereinafter described.

On one side of each push bar 26 is a hinged latch 32 (Fig. 32), which is adapted to be dropped in front of the squared ends of the shaft 24, when it is desired to rotate the frame of the machine, as shown in dotted lines, Fig. 32. The latch may also be lifted out of engagement with the shaft 24, and the latter will reciprocate in the slot 25 without operating the push bars, as shown in full lines, Fig. 32. On each latch 32 is a lug 33 (Fig. 31), adapted to be operated by the levers 34 on the shaft 35, which in turn is operated by the hand lever 36, having a suitable spring catch for holding it in its adjusted position.

When the latches are down in the position shown in dotted lines in Fig. 32, the reciprocation of the shaft 24 will cause the push rods 26 to be moved back and forth and the shafts 28 will be rocked, likewise the gear segments 29, and the rack bars 30 with their sleeves 31 will be raised and lowered, and with them the entire operating parts of the machine above.

40 are two slide shafts supporting the machine and by means of which it is raised and lowered. These shafts slide in suitable guide bearings 41 in the carriage frame, and also are guided by the brackets 42 also on the carriage frame; and also in guide sleeves formed on the brackets 44, on the under side of the carriage frame. At the lower end, each of these shafts carries the transverse sheave shafts 45, upon which are the sheaves 46. From these sheaves run suitable cables 47, anchored at one end to the carriage frame and passing over the idler sheaves 48, and carrying at their ends suitable balance weights 49 (Figs. 1, 3). These weights are of the proper size to counterbalance the operating parts of the machine above.

On each of the slide shafts 40 is a screw threaded portion 50 (Fig. 39) and on these screw-threaded portions are the nuts 51, having a worm wheel 52, which engages in a groove 53 in the sleeve 31, previously described.

54 is a shaft journaled in the brackets 55, on the lower end of the sleeves 31 (Fig. 39). This shaft 54 carries worm wheels 60 meshing with the worm wheels 52. The shaft 54 has a sliding feathered engagement with a stub shaft 56, which in turn has a universal joint connection with the actuating shaft 57, supported in suitable bearings on the carriage frame and having a hand wheel 58 for operating the same. The shaft 57, at its upper end, is proveded with a clamping nut 59 which, when the proper adjustment is obtained of the nut 51, may be tightened up and will lock the shafts 54 and 57 from accidental rotation.

The shaft 54 is made in two parts, with a mortise and tenon engagement between them, and the meeting ends of the shafts are provided with collars 61 provided with complementary teeth and notches 62 and clamping bolts 63, so that the two worm wheels may be adjusted to exactly the same position and then the bolts 63 put in position and the two sections of the shaft locked together.

The upper ends of the slide shafts 40 support the grooved base ring 64 (Fig. 3), which supports the upper portion of the machine. This base ring 64 has a guide ring 65 guided by the vertical sleeve 66, which is in turn bolted to the carriage frame. Within the sleeve 66 is the supporting sleeve 67 (Figs. 1, 3, 5, 6), spaced from the sleeve 66 by the webs 68, and forming between the webs the air passages 69. Supported in and secured to the sleeve 67 is the post 70, being a stationary post, *i. e.*, non-rotating, and around which the parts above are adapted to rotate.

80 is a cooling air conduit secured to the under side of the carriage frame, directly beneath the sleeve 66 and registering therewith.

81 is a stationary cooling air conduit in the pit below the machine, connected to a fan or pump, and when the machine is moved into operating position with the tank, the upper end of the conduit 81 and the lower end of the conduit 80 are in alinement, as shown in Fig. 1, and cooling air will be supplied to the working parts of the machine.

82 is a sleeve, sleeved on the post 70, adapted to vertically slide thereon but held from rotation by suitable spline, or it may be merely secured to the collar 83, which is a part of the base ring 64 (Figs. 1, 3).

84 is the lower spider, sleeved on the sleeve 82, having on its under face a projecting V-shaped circular rib 85, resting and turning in a complementary V-shaped bearing 86 on the top of the base ring 64. This lower spider forms an air chamber for cooling purposes for the blank molds, and it also supports the upper frame of the machine. It carries an annular gear wheel 87 depending from its under face, with which meshes the pinion 88 on the vertical shaft 89 supported in the bracket 90 secured to the base ring 64, and carrying at its lower end the gear wheel 91,

which meshes with the long vertical pinion 8, previously described as being driven by intermediate drive connection from the motor 5. The rotation of the pinion 88, it is obvious, engaging with the gear 87, will cause the rotation of the lower spider and the rotating frame carrying the operating parts.

The parts rigidly carried by the lower spider form in effect a frame carrying the operating parts around the center post, these parts comprising a series of blank molds, neck molds, blowing molds, means for opening and closing these molds and admitting the vacuum and air under pressure for carrying out the various functions as will be hereinafter described.

The frame supported on the lower spider carrying the operating parts is formed as follows:—Secured on top of the lower spider 84 are a series of pedestals 92. These are castings bolted to the upper face of the lower spider 84, and are arranged in circular series around the outer edge thereof, as shown particularly in Figs. 7, 8, 25. At the top they are connected by the rods 93 with the top spider 94 (Figs. 1, 7, 8). This top spider 94 is supported at the top of the sleeve 82 and rotates thereon with the lower spider 84. Supported on the sleeve 82 are a series of horizontal cam rings, having cam ways therein stationarily secured to the sleeve. These rings I number respectively 95, 96, 97, 98, 99, Figs. 1, 7, 8. The revolving frame, composed of the lower and upper spiders, the pedestals, and the tie rods, carries a series of six sets of gathering and blowing molds, as illustrated in diagram in Fig. 9. As all the sets are alike, a description of one will suffice for a description of all, and I will therefore describe the construction and operation of one gathering mold, one blowing mold, the air, vacuum, gas and cooling connections, and it will be understood that the construction and operation of the other five are alike.

The operation of the machine is shown in diagram in Figs. 9, 10, 11, 12, 13, 14 and 15, in which the first step of the operation is to lower the blank mold to the glass, then gather a blank from the molten glass, then cut off the glass in the mold from that in the tank, while raising, then open the blank mold and inclose the blank within the blowing mold, and then to blow the blank to its finished shape, finally lowering the blowing mold to its vertical position and opening it to drop out the finished article, and I will endeavor to describe the parts in their sequence of operation. The blank mold 100 which is in two sections is illustrated in enlarged section in Fig. 28, the sections being carried at the outer ends of the hollow arms 101. These arms are pivoted on the vertical pivot 102, which passes through the blowing head arm 103, which, near its middle portion, is provided with the lateral hollow brackets 104 on opposite sides and connecting to adjacent pedestals 92. This arm 103 supports the blank mold and neck mold sections, forms the suction and blowing head and carries a core or plunger for making an initial blow opening in the blank. The arms 101 have the brackets 105, which extend above the arm 103 and engage the pivot 102 to simply give the necessary strength and rigidity to the pivotal support for these blank molds. The arms 101 have the lever extensions 106 beyond their pivot, which with the links 107 form a toggle lever connection which is actuated to open and close the blank molds. The ends of the links 107 are pivotally connected to the sliding block 108, which slides on the inner end of the blowing head arm 103. This block 108 is connected to the roller wrist block 109 by the rod and spring connection 110 (Fig. 18), and the block 109 is provided with a roller wrist 111, which engages a suitable cam way in the under face of the cam ring 96. By having a spring connection between the block 108 and the block 109, the cam may cause the blank molds to be closed, and then move the block 109 still further, so that the springs 110 tend to hold the blank molds yieldingly together, and also so that if any glass should come between the two sections of the blank mold, the parts will not be broken.

Pivoted to the under side of the blowing head arm on the pivot pin 112 (Fig. 20) are the two neck ring sections 113. These neck ring sections are connected by the links 114 to the sliding block 115, sliding on the rod 116, secured to the under side of the arm 103 and are operated by a vertical lever 118 (Fig. 8), which at its upper end is bifurcated and connects to a cross-head 119 (Figs. 8 and 19). This cross-head has an aperture through which slides the rod 120, and the cross-head is actuated by the spiral spring 121, abutting against a collar on the rod, as shown in Fig. 19. The rod is connected to the sliding block 122, which slides on a rod 123 in the bracket 131, and carries a roller wrist 124 working in the camway on the upper face of the cam ring 97, all as plainly shown in Fig. 8, this camway being properly shaped to open and close the neck mold at the times to be hereinafter described.

On the blowing head arm and working in suitable sliding guides on the upper face thereof is the blowing valve 125, which is substantially a D-valve. This blowing valve is operated by the spring link 126 connected to the slide 127 sliding on the other end of the rod 123, in the bracket 131. On the under face of the slide 127 is a roller wrist 128, as shown in dotted lines Figs. 8 and 19 and full lines Fig. 21, engaging another camway also on the upper face of the cam ring 97.

Secured at the outer end of the blowing head arm 103 are the two guide rods 129 (Figs. 22 and 28) and on these two rods slides the cross head 130 detachably carrying the core or plunger 140, which is adapted to make the initial blow opening in the glass blank. This plunger is made detachable in any suitable manner by engaging a socket 145, in which it is held by a spring pin 146 (Fig. 30). This cross head 130 is raised and lowered by means of a bell crank lever 141 (Fig. 8), journaled on a bracket 142 and connected by a spring link 143 with the slide 148, sliding on the rod 155, and carrying a roller wrist 144, said roller wrist engaging with a camway on the upper face of the cam ring 98.

Supported near the outer end of one of the blank mold levers is a vertical tubular bearing 150 (Figs. 28 and 33), in which is journaled the rock shaft 151, which at its upper end has the crank arm 152, pivotally connected to the link 153, which in turn is pivotally connected to the slide 154 on the slide rod 155 in the bracket 142. The slide 154 has a roller wrist 156 engaging another camway in the upper face of the cam ring 98. The connecting link 153 being pivoted at opposite ends permits lost motion through a slotted pivotal connection to take care of the angular move-

ment up and down of the shaft 151; at the lower end of this shaft is secured the arm 222 carrying the cut-off knife 221.

On the shaft 151 is the head 157 normally held in its upper position by the tension of a spring 158 beneath the same. This head, at opposite ends, has the roller wrists 159 engaging in cam grooves 160 in the circular cam flange 161 at the top of the guide sleeve 150, so that when the shaft 151 is rotated, it will first run down the inclined portion of the grooves 160 and then be moved laterally, for a purpose to be hereinafter described.

162 is a stay rod extending from the sleeve 163 secured to the cam flange 161, and tied to a cross bar 164 between two of the tie rods 93 of the frame (Figs. 1, 7, 8). The knife may be adjusted vertically by connecting the head 158 and the crank arm 152 at the desired points. Thus the knife can be adjusted to molds of varying length.

On the top of the sleeve 82 is secured a top plate 165 (Figs. 1 and 16), to which is secured a stationary air tube 166, to which is connected from any suitable source means for supplying air under pressure. Near the bottom this tube is provided with lateral ports which discharge into the hollow head 167, which head revolves on the nut 168. Leading from this head is an elbow pipe 169 which connects into an annular air chamber 170 in the top spider 94. From this annular air chamber the air is taken for blowing through the pipe 171, which is controlled by a spring-closed valve 172 operated by a bell crank lever 173 operated by a cam formed on the outer face of the cam ring 99 (Figs. 7, 8). The pipe 171 leads down to and connects with the outer end of the blowing head arm, and leads into a passage 174 (Figs. 18, 22 and 24) which is controlled by the blowing valve 125. This blowing valve has in it two connected ports 223 and 224, and the forward end of the valve at 175 acts as a shut-off when the valve is retracted. When the valve is pushed forward into the position shown in Fig. 24, it connects the port 174 with the port 176, through the blowing head.

Above the hollow head 167 (Fig. 16) is a hollow head 177 held between the nut 178 and the lower end of the sleeve 179, which is separated from the tube 166 to make a gas passage 180, to the upper end of which is connected the gas pipe 181. The hollow head 177 is connected by the elbow pipe 182 with the chamber 183 in the upper spider and it is piped from there through the pipe 184 which leads to the outer end of the blowing head arm, where it connects with a port 185 (Figs. 18, 22, 24). This port communicates with a passage 186 in the blowing valve 125, which leads to the upper part thereof and terminates in the gas nozzle 187, so that the flame will impinge upon the core or plunger 140 when it is withdrawn, as shown in Fig. 22.

Secured to the lower part of the outer face of the sleeve 179 (Fig. 16), is a ring-shaped nut 188, and journaled thereon is the hollow head 189 having a chamber 190 formed therein. Above this head 189 and connected to and preferably formed integral with the sleeve 179 is the ring-shaped flange 191. This flange 191 forms the upper bearing for the ring 189. Within the flange 191 is the chamber 192, and connecting into this chamber is a pipe 193, which is connected to an air-exhausting means, such as a pump or fan. Connecting into the chamber 190 is the elbow-pipe 194 which connects to a vacuum channel 195 in the upper spider 94. From this channel is a pipe connection 196 leading to the outer end of the blowing head arm (Fig. 28). In this pipe is a spring-closed valve 197 (Fig. 8) adapted to be opened by a bell crank 198, to which is connected the connecting rod 199, which is operated by the lever 200 bearing against and operated by a cam on the cam ring 99. The pipe 196 (Fig. 28) connects into a chamber 201 formed in the outer end of the blowing head arm (which, for convenience of description, I call the blowing head), which passage communicates with the annular chamber 202. Centrally of this chamber is a ring 203, to which is secured the bushing 204, detachably secured in position as shown. This bushing 204 has a tapering opening 176 through it, and in this tapering opening the plunger 140 is adapted to be projected and withdrawn. The lower end of the bushing 204 is provided with a circular inclined flange 205, and the neck mold sections are provided with complementary grooves to engage therewith.

In the top of the chamber 202 (Figs. 18 and 28) are ports 206, which connect into an annular passage 207 (Fig. 28) formed in the shank of the plunger (Fig. 29).

It is obvious from the description given that the air drawn out through the pipe 196 will be drawn from the chamber 202 through the ports 206 from the passage 207, opening 176 and from the interior of the blank mold, when the sections are close together, while gathering, as shown in Fig. 28. From the chamber 202 there are ports 208 (Figs. 28, 36 and 37), which extend through the neck mold and communicate with vertical passages 209 between the meeting faces of the section of the blank mold (Fig. 22) so as to prevent the ingress of air through the joint between the two sections. This feature is shown in previous patents and is no part of my present invention and therefore I do not deem it necessary to more fully describe it.

As previously described, the levers or arms 101, which carry the sections of the blank mold, are hollow, having a passage 210 therethrough. Between the blank mold sections and the arms to which they are secured by the vertical bolts 211, there is a space or passage 212, through which the air will blow upon blank molds, to cool the same. The air for this cooling purpose is supplied from the base of the machine through the pipe 81 (Figs. 1 and 3), the pipe 80, the sleeve 66 and the hollow base ring 64. The top of the base ring 64 (Fig. 4) is provided with ports 213 which communicate with corresponding ports in the lower spider 84, in which there is a chamber 214. This chamber has the passages 215 (Fig. 25) which communicate through the ports 216 with the passage 217 in the pedestal 92 (Fig. 7), and thence into a passage 218 formed in the lateral projections 104 of the blowing head arm 103 (Figs. 7, 18). On the under side of the lateral extension 104 are the ports 219, and in the upper side of the arm 101 are the ports 220 shown in dotted lines in Fig. 18, which, when the molds are open, will register with the ports 219, so that the air may flow into the chambers 210 in the mold-supporting arms or levers, and flow around these molds as shown at the left, Fig. 18. When the mold is closed, the ports 220 will be moved out of registration with the ports 219, and the air will be shut off from the chamber 210, as shown at the right, Fig. 18.

With each blank mold and neck mold there is a blowing mold, which is shown in Figs. 1, 7, 8, 22, 25. The blowing mold sections 230 are pivoted together on the pin 231, which is secured in the hollow bracket 232, detachably secured to the hinged frame 233. This frame 233 is pivoted on the horizontal trunnions 234, which are secured in the two curved brackets 235, Figs. 25 and 27, which in turn are secured to the lower spider 84. The frame 233 is bifurcated as shown, and the furcations are hollow, and the passages 236 therethrough are adapted to register in one position of the parts (Fig. 27) with the passages 237 in the brackets 235, which in turn communicate with the passages 238 formed in the lower spider 84, and which, as before described, communicate with a source of air under pressure supplied through the pipe 81. When the frame 233 is in its horizontal position, the passages 238, 237, 236 register and the air will pass therethrough. As the frame 233 turns on the trunnions 234 to the vertical position shown in dotted lines in Fig. 27, the port 239 leading into the passages 236 will be closed and the air shut off.

The bracket 232 is connected to the frame 233 by the bolts 240, which engage in vertical slots 241 (Fig. 22), so that the bracket may be raised or lowered in relation to the arms 260, in order that different heights of molds may be carried thereon. The bracket is bifurcated and the furcations 242 extend horizontally, and have at their outer ends the ports 243, which are connected to the passages 244 through the bracket 232 and communicate with the passages through the frame, so that air will be delivered through these ports 243, as shown in Fig. 22, upon the bottom of the blank mold sections, when the same are open. Between the furcations 242 of the bracket is a horizontal finger 245 (Fig. 7), at the end of which is formed the vertical socket 246 (Figs. 7 and 22), in which a shank 247 is adapted to be secured, carrying at its upper end the bottom plate 248 for the blowing mold. This bottom plate is detachably secured in position in any desired manner, as by the detachable spring-securing pin 249 in the socket 246, according to securing means for plunger as shown in Fig. 30.

The blowing mold and its frame is moved from the vertical position shown in Figs. 7 and 8 to the horizontal position shown at the left, Fig. 1, and in Figs. 22 and 25, by the track 250, secured to the base ring 64 and supported also on the frame of the carriage at points by the brackets 251a. On the under side of the blowing mold frame 233 is the vertical socket 252, in which slidingly engages the forked bearing 253, carrying at its lower end rollers 254. Interposed between the cross pin 256 and the upper face of the frame 253 is a spring 255 (Fig. 23). By this construction the track, by being properly shaped, will lift the blowing mold with the mold frame, so that the upper face of the blowing mold contacts the under face of the neck mold (Fig. 22), and is held tightly in contact therewith by the tension of the spring 255, which likewise takes up any slight inequalities in the track 250.

The sections of the blowing molds 230 are opened and closed by the following mechanism (Figs. 7, 25):—260 are two bent levers pivoted on the pin 261 and slotted at their outer ends to engage pins 262 on the blowing mold sections. At their inner ends, they are connected together by the toggle levers 263, which are in turn pivoted to the slide block 264. This slide block 264 is supported by a slide rod 265, which passes through an aperture in the block and is guided by the bracket 271 and has a nut 266 at the forward face of the slide block. On the rear face of the slide block and sleeved on the rod 265 is a spiral spring 267, bearing at one end against a shoulder on the rod 265 and at the other end against the block 264. The rod 265 is pivotally connected to the push bar 268, which in turn is connected to a slide 269, slidingly secured to the rod 269a, having on its upper side the roller wrist 270, engaging in a camway in the under face of the cam ring 95 (Figs. 1, 8), this camway being shaped to give the desired in and out movement to the slide 269 which, through the connections described, will open and close the mold sections. It will be observed, however, that the slide block 264 is operated through the spring.

The parts being thus constructed, their operation is as follows:—The machine is moved up to the glass tank by driving the wheels from the motor through the drive connections described, when it will stand in relation to the tank as shown in Fig. 1. The blank molds may then be adjusted in proper vertical relation to the glass by the hand wheel 58 rotating on the shaft and the worm wheels 60. The upper frame work of the machine is rotated constantly by the vertical pinion 8 and the drive connections therefrom to the gear ring 87 on the lower spider. This rotation will be in a horizontal plane and without vertical reciprocation as long as the latches 32 are in the upper position, but when these latches are lowered by the lever 36 into the path of the shaft 24, the push arms 26 will be reciprocated, and through the links 27, the gear segments 29 and the rack bars 30, the upper frame of the machine will be reciprocated at intervals during the rotary movement thereof. Just before each blank mold reaches the point in its travel over the glass tank, the parts will be in the position shown in Fig. 28, that is, the blank mold sections and neck mold sections will be closed, and the core or plunger 140 will be lowered through the blowing head and into the neck mold. As the blank mold comes over the glass, the upper frame will be lowered by the mechanism just described, until the lower open end of the blank mold will either come into close proximity to the glass, or dip therein as shown in Fig. 28. Just at this time, or just prior thereto, the valve 197 will be opened through the connections described, operated by a cam on the ring 99, and the air exhausted from the blank mold, which will cause the molten glass to be sucked up into the blank molds to fill the same, and the upper portion of the blank will be shaped (if a bottle is to be formed, as in the blank shown) to the shape of the finished bottle, while the core or plunger 140 will make an initial blow opening or cavity in the top of the blank. As the frame travels, the blank mold is raised free from the glass by the raising of the upper frame work, as the frame continues its travel, the roller wrist 144 working in the camway of the ring 98 will rock the shaft 151, which carries the cut-off knife, and this knife will first be lowered and then moved across beneath the blank mold, severing the glass in the tank from that in the molds, as plainly shown in Fig. 11. As the blank mold with the blank therein reaches the point in its

rotation marked station 2 (Fig. 9), or thereabout, the shaft 151 will be rocked in a reverse direction, withdrawing the knife from beneath the blank, and the blank mold sections will be opened by the roller wrist 11, working in the camway in the cam ring 96 through the connections described. As the blank mold sections open, the air connections through the ports 219, 220, into the arms 101 will be opened and the air will blow onto the blank mold as long at it remains in the open position, as shown at the left, Fig. 18. As the blank molds open the core or plunger 140 is withdrawn by the roller wrist 144 in the cam ring 98 at the time or before the blank molds open, and the blowing valve 125 is moved into the position shown in Figs. 22, 24, by the roller 128 in the cam ring 97 and the connections between the two, described. Just as soon as the blank molds are opened, the blowing mold sections in their open position are raised by the track 250 to inclose the blank, as shown in Fig. 12, and the blowing mold sections are closed about the blank by the roller wrist 27 in the cam ring 95 and the connections to the mold sections, the parts then being in the position shown in Fig. 22. At the time or just before the blowing molds inclose the blank, the air supply valve 172 is opened by the lever 173, operated from the cam ring 99, and air admitted through the connections described and through the blowing head into the top of the article, which is blown to shape as shown in Figs. 14 and 22, As the machine travels, at the proper point in its travel the air valve 172 is shut, the neck ring sections 113 are opened by the roller wrist 124, working in the camway in the ring 97, and the blowing mold opened by the connections from the roller wrist 270, and as it lowers to the vertical position shown in Fig. 8, the finished article will drop out. The neckmold sections and the blank mold sections are then again closed by the connections described, the blowing valve 125 is withdrawn, the plunger 140 is lowered, and the parts are again put into the position shown for another operation, and the operation repeated for each successive mold.

While I have described the machine as a whole, including gathering and blowing mechanisms, it is obvious that my invention, as set forth in the claims, in its parts will include parts used only for gathering, regardless of the coöperating blowing mechanism, and regardless of the shape of the gathering receptacle or mold.

What I claim as my invention is:—

1. In a glass gathering machine, a rotary and reciprocating counterbalanced frame, and the gathering molds thereon.

2. In a glass gathering machine, a rotary and reciprocating frame, and a series of gathering molds thereon.

3. In a glass gathering machine, a rotary and reciprocating frame, and a series of neck molds and body blank molds thereon.

4. In a glass gathering machine, a series of sectional neck molds, body blank molds, means for opening and closing said molds, and a rotary and reciprocating frame carrying these parts.

5. In a glass gathering machine, a rotary and reciprocating frame, a series of gathering molds thereon, nonrotating cams reciprocating with the frame, and means for opening and closing the molds from the cams during the rotational movement of the frame.

6. In a glass gathering machine, the combination of a series of traveling sectional blank-gathering molds, mechanism for operating and closing the molds, and means for simultaneously bodily reciprocating the series of molds and their operating mechanism.

7. In a glass forming machine, a rotary and reciprocating frame and a series of coöperating gathering blank molds and blowing molds carried thereby.

8. In a glass gathering machine, the combination of a base, a rotary frame above the base, the gathering molds thereon, and means for adjusting the height at which the molds on the frame rotate above the base.

9. In a glass gathering machine, the combination of a base, a rotary frame above the base, the gathering molds thereon, means for adjusting the height at which the molds on the frame rotate above the base, and means for causing the frame to reciprocate.

10. In a glass gathering machine, the combination of a base, a rotary frame above the base, the gathering molds thereon, and means for causing the frame and molds to reciprocate during the rotational movement.

11. In a glass gathering machine, the combination of a base, slide shafts guided on the base, means for reciprocating the shafts, and a rotary frame supported at the top of the shafts.

12. In a glass gathering machine, the combination of a base, slide shafts guided in the base, a base ring supported on the top of the shafts, a rotary frame supported on the base ring and means for reciprocating the shafts with the supported parts.

13. In a glass-gathering machine, the combination of a base, slide shafts passing through the base, a counterbalancing device applied to the lower end of the shafts, means for reciprocating the shafts, and a rotary mold-carrying frame supported at the upper ends of the shafts.

14. In a glass gathering machine, the combination of a base, slide shafts passing through the base, a counterbalancing device applied to the lower end of the shafts, means for reciprocating the shafts, means for adjusting the height of the shafts relative to the base without detaching said reciprocating means, and a rotary mold-carrying frame on the top of the shafts.

15. In a glass gathering machine, the combination of a base, a rotary mold-carrying frame, the slide shafts supporting the frame above the base, sleeves on the slide shafts, rack bars thereon, gear segments for reciprocating the rack bars, and adjusting nuts between the rack bars and shafts for the purpose described.

16. In a glass-gathering machine, the combination of a base, a hollow base ring supported above the base, a rotary mold-carrying frame on the base ring, and an air supply connection through the base ring to the rotary frame.

17. In a glass gathering machine, the combination of the base, the sleeve 66, the hollow base ring supported above the base and having a guide ring slidingly engaging with the sleeve, a rotary frame supported on the base ring, and air connections to the sleeve through the same into the base ring and connections therefrom to the frame.

18. In a glass gathering machine, the combination of a base, the sleeve thereon, an air connection to the sleeve, a hollow base ring communicating with the sleeve, a rotary frame on the base ring, and a lower spider on the frame having air passages communicating with the chamber in the base ring.

19. In a glass-gathering machine, the combination of the base, the base ring supported above the base, a central post on the base, a sleeve on the post to which the base ring is secured, a rotary frame supported on the base ring, sectional gathering molds thereon, cam rings secured to the sleeve, means for reciprocating the base ring, frame and sleeve, and actuating connections between the cam rings and mold sections.

20. In a glass gathering machine, the combination of a rotary frame, the sectional gathering molds thereon, the lower spider of the frame, having air channels therein connected with a source of air supply and conduits from the air channels to the gathering molds, for the purpose described.

21. In a glass gathering machine, the combination of a rotary frame, the sectional gathering molds thereon, the lower spider of the frame, having channels therein connected with a source of air supply, and valve-controlled

conduits from the air channels to the gathering molds, for the purpose described.

22. In a glass gathering machine, the combination of a rotary frame, the sectional gathering molds thereon, the lower spider of the frame, having channels connected to a source of air supply, conduits from the air channels to the gathering molds, means for opening and closing the sections of the molds, and valves controlling the conduits, opening on the opening of the blank molds and closed with the closing thereof.

23. In a glass gathering machine, the combination of a traveling sectional gathering mold, levers supporting the sections, carrying conduits, and means for opening the conduits when the sections are open.

24. In a glass gathering machine, the combination of a traveling sectional gathering mold, hollow levers supporting the sections having connections with an air supply and having discharge ports adjacent to the mold sections, and means for opening the air supply valve when the sections are open.

25. In a glass gathering machine, the combination of a sectional gathering mold, hollow levers supporting the sections having discharge ports adjacent to the mold sections, a ported air supply conduit over which the levers move in their opening and closing movement and ports in the levers adapted to register with the ports in the conduit in the open position of the levers.

26. In a glass gathering machine, the combination of a series of sectional molds, levers for opening and closing the molds, air conduits leading to the mold sections in their open positions, and means operated by the opening of the mold sections for opening the air conduits.

27. In a glass gathering machine, the combination of a series of sectional traveling gathering molds, a complementary series of neck molds, air conduits leading to the exterior and beneath the sections of the gathering molds in the open position thereof, and means for holding the neck molds closed during all or a part of the cooling period of the gathering molds.

28. In a glass shaping machine, the combination of a blank-gathering mold, means for opening and closing it, a coöperative blowing mold, and conduits carried with the blowing mold adapted to direct a cooling current on the blank mold sections in their open position.

29. In a glass-shaping machine, the combination of a blank gathering mold, means for opening and closing it, a hinged blowing mold support, a blowing mold thereon, means for moving the blowing mold into the plane of the blank mold, and air conduits on the blowing mold support, having discharge ports adapted to discharge cooling air currents on the blank mold when open.

30. In a glass-shaping machine, a blowing mold, a hinged supporting arm therefor, having valve-controlled air channels therein, means for closing the valve when the mold is in its inoperative position, and for opening it when in its operative position.

31. In a glass shaping machine, the combination of the lower spider, having air conduits, the hollow blowing mold frame hinged on the spider, the conduits of the spider communicating with the conduits in the frame through the hinge joint, and said joint, which acts as a valve to open and close communication between the conduit in the spider and the frame.

32. In a glass-shaping machine, a blowing head having an aperture therethrough, a detachable plunger adapted to be projected through the aperture, means for connecting the blowing mold thereto, and means for attaching a bushing within the aperture.

33. In a glass-shaping machine, an apertured blowing head, a detachable bushing secured therein, and a detachable plunger adapted to be projected therethrough for the purpose described.

34. In a glass-shaping machine, the combination of a reciprocating head, a pin or plunger detachably secured thereto, an apertured blowing head through which said pin is adapted to be projected, and means for varying the size of opening through the head for pins of different size.

35. In a glass-shaping machine, the combination of an apertured blowing head, a detachable bushing in the aperture projecting below the head, and a neck mold engaging the projecting portion of the bushing.

36. In a glass-shaping machine, the combination of an apertured blowing head, a detachable bushing on the aperture projecting below the head, a circular inclined flange on this projection, and neck mold sections having complementary grooves adapted to clamp upon this flange.

37. In a glass-blowing machine, the combination of a traveling sectional mold, means traveling with the mold for closing said mold including a spring member, whereby said molds are held closed by spring pressure, and whereby interposed obstacles will not break the actuating devices.

38. In a glass blowing machine, the combination of traveling neck molds and body blank molds, separate actuating devices traveling with the molds for closing the sections thereof, and a spring member included in each actuating device, for the purpose described.

39. In a glass gathering machine, a traveling gathering mold, a cut-off knife traveling therewith, and means for adjusting the knife for cutting off at the bottom of molds of varying length.

40. In a glass gathering machine, the combination of a traveling gathering mold, a cut-off knife carried thereby, means for rocking the shaft, and means for effecting a vertical adjustment of the knife in relation to the mold.

41. In a glass-gathering machine, the combination of a gathering mold, a rock shaft, a cut-off knife thereon, and means for imparting a rocking and reciprocating movement to the shaft.

42. In a glass gathering machine, the combination of a gathering mold, a rock shaft, a cut-off knife thereon, inclined guides adjacent to the shaft, members of the shaft working therein, and means for rocking the shaft to effect the operation described.

43. In a glass-gathering machine, the combination of a sectional gathering mold, levers supporting the sections, a cut-off device for the bottom of the mold carried by one of the levers, and means for operating the cut-off.

44. In a glass-gathering machine, the combination of a blank mold, a pin or plunger for forming an initial opening in the gathered blank, means for inserting and withdrawing the pin, and means for heating the pin when withdrawn.

45. In a glass gathering machine, the combination of a blank mold, a pin or plunger for forming an initial opening in the gathered blank, means for inserting and withdrawing the pin, a reciprocating gas nozzle and means for moving it to the pin when it is withdrawn.

46. In a glass gathering machine, the combination of the blowing head arm, a blank mold adapted to be closed beneath the arm, a pin or plunger for forming an initial opening in the gathered blank, means for inserting and withdrawing the pin, the reciprocating blowing valve on the blank mold arm, and a gas nozzle on the valve beneath the pin in its withdrawn position.

47. In a glass-shaping machine, the combination of a neck mold, a blowing mold, means for moving the blowing mold against the neck mold and for holding the two in contact by spring pressure.

48. In a glass-shaping machine, the combination of a traveling neck mold, a blowing mold traveling therewith, means for moving the blowing mold to and from the neck mold, and a spring acting to hold the two together when in coöperative relation.

49. In a glass-shaping machine, the combination of the traveling blowing head arm, the blowing head thereon, the neck mold below the blowing head, a hinged frame traveling with the blowing head arm, the blowing mold on the hinged frame, a camway for raising and lowering the blowing mold to and from the neck mold, and a spring roller on the camway, whereby the blowing mold will be held in contact with the neck mold by spring-pressure.

50. In a glass-shaping machine, the combination of a rotary frame, a neck mold thereon, a hinged frame on the rotary frame, a sectional blowing mold carried at the outer end of the frame, a camway for raising and lowering the mold to and from the neck mold, and means for opening and closing the blowing mold.

51. In a glass-shaping machine, the combination of a rotary frame, a neck mold therein, a hinged frame on the rotary frame, a sectional blowing mold at the outer end of the hinged frame, a camway for raising and lowering the blowing mold to and from the neck mold, a stationary cam about which the rotary frame revolves, and means operated from the stationary cam for opening and closing the mold sections.

52. In a glass-shaping machine, the combination of a rotary frame, a hinged frame thereon, a sectional blowing mold on the hinged frame, means for raising and lowering the hinged frame, a slide block on the rotary frame, means for operating the slide during the travel of the rotary frame, and connections from the slide for opening and closing the mold sections.

53. In a glass shaping machine the combination of a rotary frame, a neck mold therein, the traveling, hinged blowing mold frame, means for raising and lowering it, a sectional mold thereon adapted to be moved to and from the neck mold, and means for opening and closing the mold during the travel thereof.

54. In a glass-shaping machine, the traveling, hinged, blowing mold frame, means for raising and lowering it, a blowing mold section supported on a pivot in the frame, levers independent of the support for opening and closing the mold sections, and a spring in the actuating device for the levers.

55. In a glass shaping machine, the traveling hinged blowing mold frame, a bracket adjustably supported at the outer end thereof, and the sectional blowing mold pivoted on the bracket.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM EMIL BOCK.

Witnesses:
RAYMOND T. GARRISON,
FRED WM. GUESE, Jr.