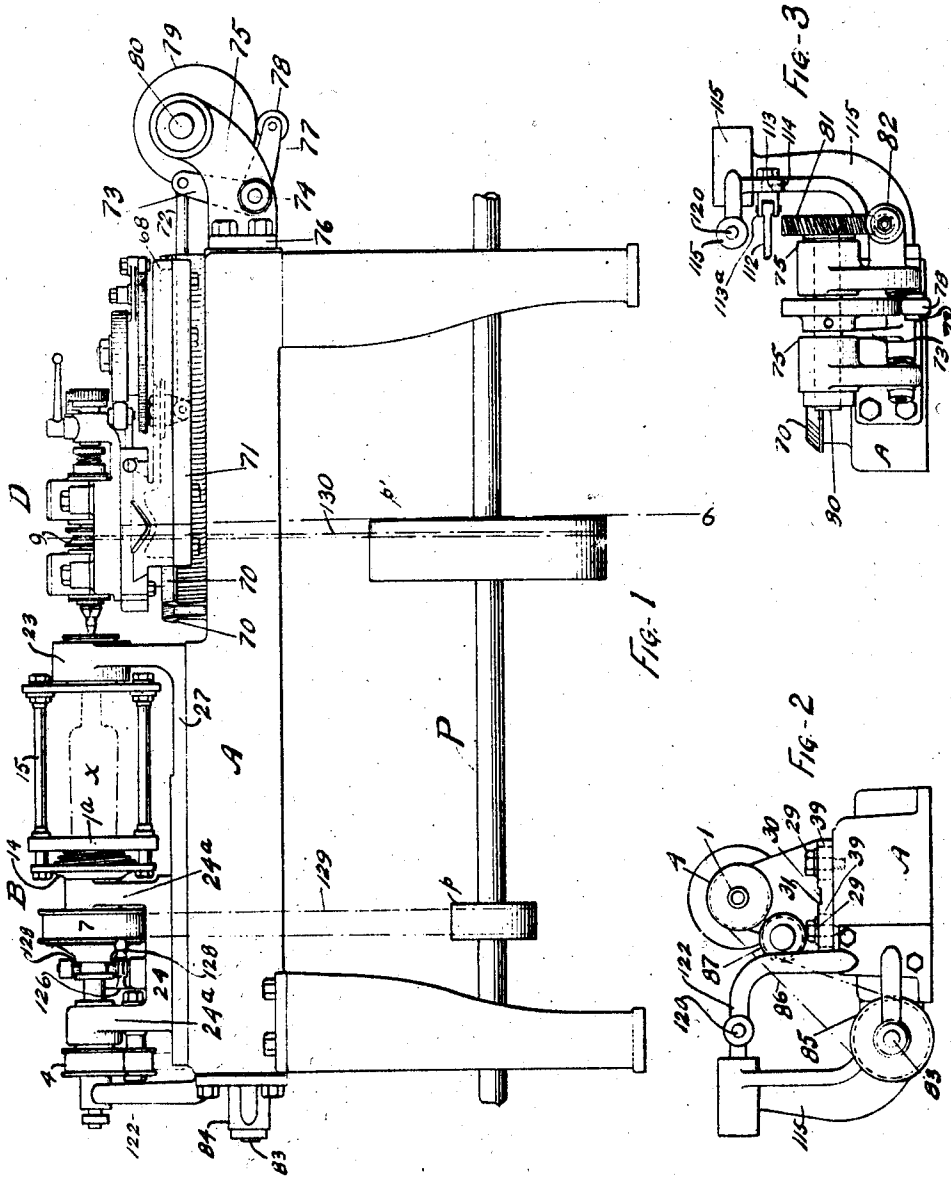


Patented Dec. 12, 1911.

4 SHEETS-SHEET 1.

1,011,478.



Witnesses:
J. S. Nares
G. Blake

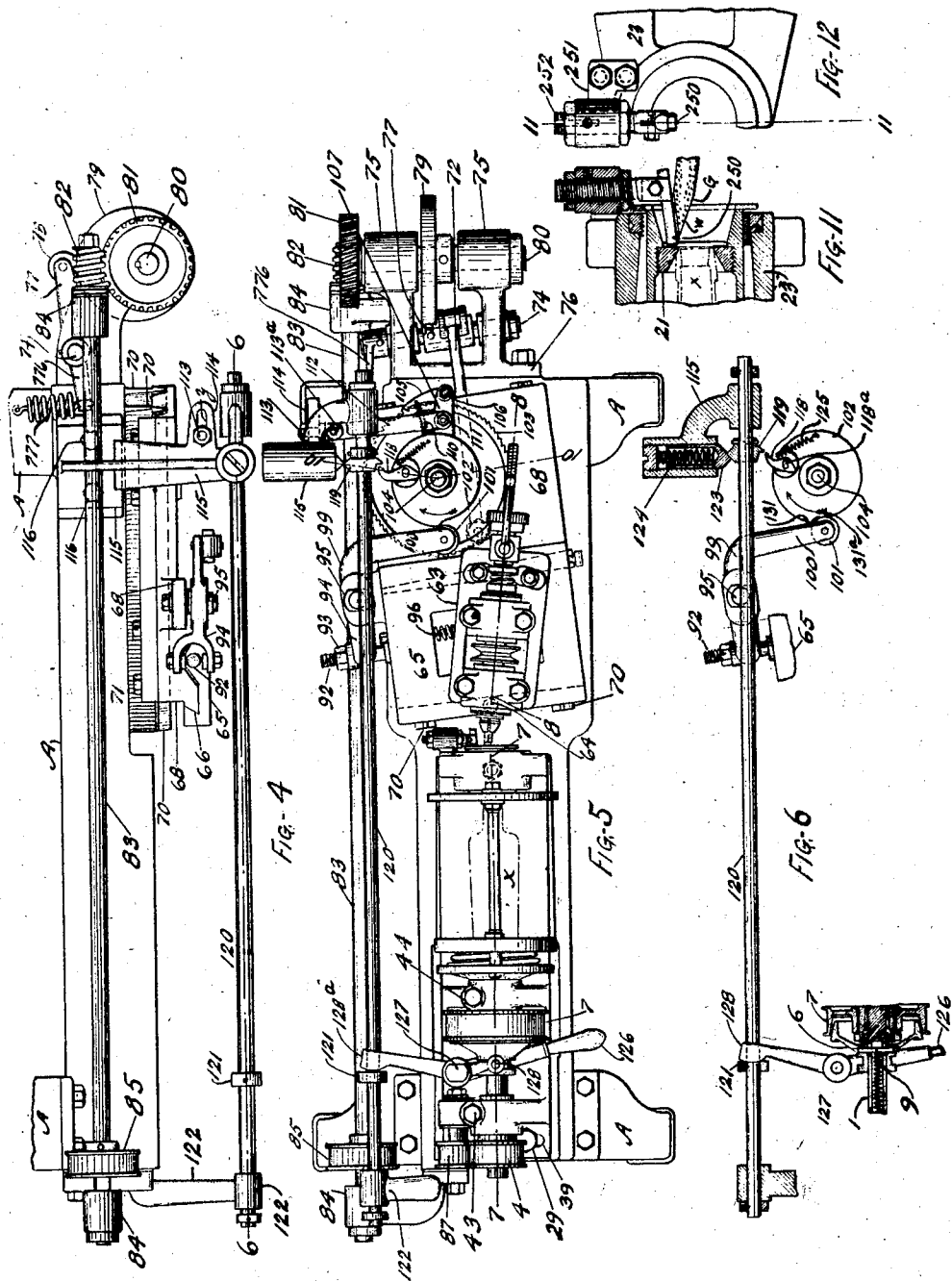
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S. D. OLSEN.
GRINDING MACHINE.
APPLICATION FILED JUNE 16, 1910.

Patented Dec. 12, 1911.

4 SHEETS—SHEET 2.

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APPLICATION FILED JUNE 16, 1910.

Patented Dec. 12, 1911

4 SHEETS-SHEET 3.

1,011,478.

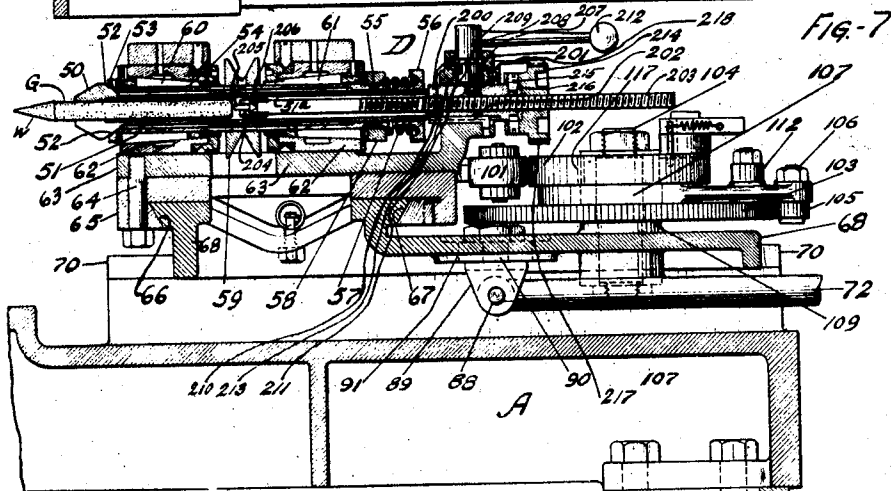
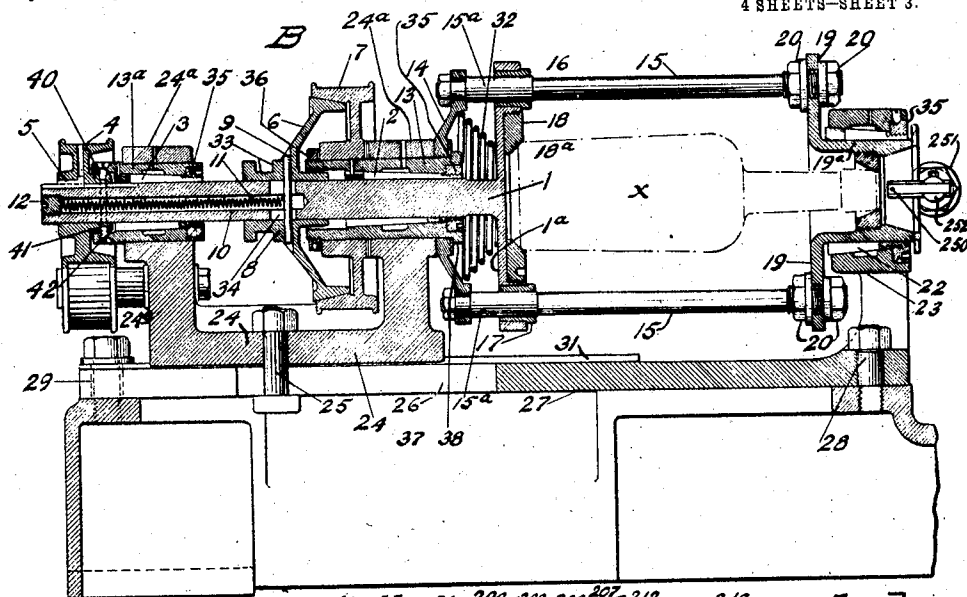


FIG-8

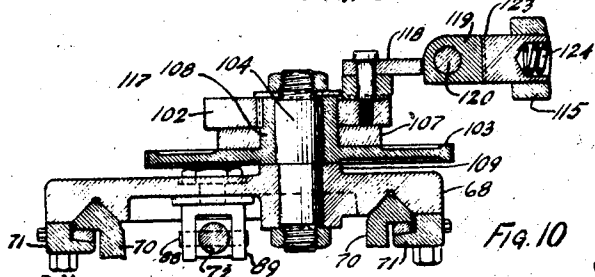


Fig. 10

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4 SHEETS—SHEET 4.

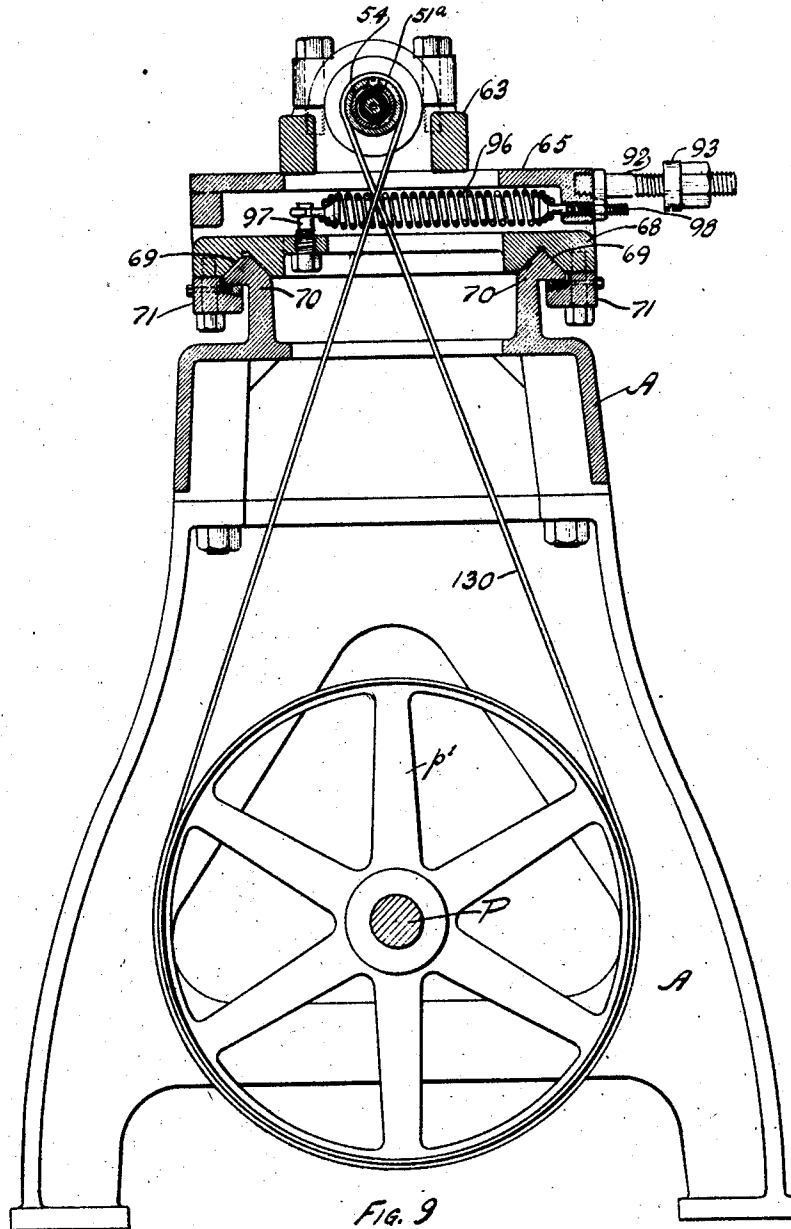


FIG. 9

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UNITED STATES PATENT OFFICE.

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GRINDING-MACHINE.

1,011,478.

Specification of Letters Patent.

Patented Dec. 12, 1911.

Application filed June 16, 1910. Serial No. 567,181.

To all whom it may concern:

Be it known that I, SIMON DOKK OLSEN, citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to a machine for interiorly grinding the necks of glass receptacles.

The special object of the invention is to produce a machine which may be practically used for the grinding of interior glass bottle necks with such uniformity, that they may be interchangeably mated with ground glass bottle stoppers, ground in supplementary machines.

20 One of the specific objects of my invention is to stop the machine automatically, when it has finished grinding a bottle, so that one attendant may take charge of a considerable number of other machines.

25 Another specific object is to make the bottle-holding and grinding mechanisms nicely adjustable one in relation to the other, so that grinding pencils of various angularity of working surface may be brought into proper working relations with the interior of bottle necks of varying contours and lengths.

Another specific object is to reform the working surface of the grinding pencil automatically as that surface is successively deformed in each grinding operation.

35 In the accompanying drawings, illustrating the principle of this invention and the best mode now known to me of applying that principle, Figure 1 is a front side elevation of a machine embodying my present invention. Fig. 2 is a partial end elevation of means for driving a feed-cam actuated mechanism that reciprocates the grinding pencil longitudinally, and also angularly to the longitudinal axis of the bottle. Fig. 3 is a partial end elevation of said feed-cam actuated mechanism. Fig. 4 is an elevation of mechanism at the rear side of the machine for actuating the aforesaid cam-actuated mechanism. This view also shows

mechanism for determining the lateral or feed movement of the grinding pencil, and also shows a portion of the mechanism for automatically stopping the grinding operation. Fig. 5 is a top-plan view of the entire machine, but with grinding pencil dressing mechanism partially broken away, for greater clearness. Fig. 6 is a view partly in vertical section, at line 6-6 of Fig. 4, illustrating the mechanism for automatically stopping the grinding operation, and partly, in plan elevation, showing grinding feed mechanism. Fig. 7 is a sectional, vertical elevation of the bottle-holding mechanism, at line 7-7 of Fig. 5; and shows a portion of a grinding tool dresser located in the path of the work surface of the grinding pencil and intermediate the bottle-holding and grinding mechanisms. Fig. 8 is a vertical, sectional elevation of the bottle-grinding mechanism, at line 8-8 of Fig. 5. Fig. 9 is a transverse, sectional elevation of the machine, at line 9-9 of Fig. 1, and illustrates means for holding the transverse slide of the grinding mechanism under tension in opposition to the counter-movement of the feed cam; and also shows means for rotating the grinding pencil. Fig. 10 is a transverse, sectional detail, at line 10-10 of Fig. 5, and illustrates the feed-cam actuated mechanism and related parts. Fig. 11 is a sectional detail of the pencil grinding mechanism, at line 11-11 of Fig. 5 or line 11-11 of Fig. 12; and Fig. 12 is a front elevational view of the dresser, looking toward the inner end of the bottle-holding mechanism.

In the drawings, A is the main frame; B the bottle or other work holding mechanism, as a whole; D the bottle or other work grinding mechanism, as a whole; and P the main power or driving shaft for the machine. A bottle, shown in dotted lines in position for grinding, is indicated by α .

The invention is described in connection with bottle-grinding operations, as such is the special kind of work for which the present embodiment of the invention is particularly intended.

The bottle-holding and bottle-grinding mechanisms are mounted on frame A, and the bottle-holding mechanism (Fig. 7) com-

prises a rotatable and lengthwise reciprocable spindle 1, shown mounted in tapered bushings 2 and 3, the bushings 2 and 3 being respectively contained in longer bushings 5 13 and 13^a. Bushings 13 and 13^a are supported in upright arms 24^a, 24^a of the lengthwise adjustable bracket 24.

Spindle 1 is provided, at its outer end, with a pulley 4 fastened to spindle 1 by 10 spline 5, so that the pulley and spindle rotate together. The spindle also carries an annular cone clutch 6 adapted to couple with cone clutch pulley 7, which is rotatably 15 mounted on bushing 13, on which bushing is mounted a collar 14 to diametrically opposite marginal portions of which the parallel rods 15 of the bottle-holding mechanism are attached. Spindle 1 is provided, at its inner 20 end, with a disk-like head 1^a, the margin of which is diametrically perforated to receive the bushings 16 and 17 through which the rods 15 respectively pass. Those portions 15^a of the rods 15, 15 that pass through the bushings 16 and 17 are preferably made of 25 larger diameter than the main portion of the rods in order that they may be ground so as to have a nicely slidable fit in bushings 16 and 17, to minimize vibration of the spindle head 1^a and parts carried by it, and 30 to steady the bottle neck when in contact with the grinding tool. To secure lateral steadiness or non-vibration of the spindle 1, the latter is mounted in vertical arms 24^a, 24^a, which are spaced apart, securing the 35 effect of a long, continuous bearing for the spindle. It is important that the bottle-holding mechanism, as a whole, be so constructed that its front end portion, where the bottle mouth is ground, is kept from 40 vibration, for otherwise the interior of the bottle neck cannot be ground true.

Spindle head 1^a has its face recessed, and provided with an annular thread which receives a threaded chuck ring 18 formed 45 with a central recess formed with an annular wall 18^a that engages and encircles the bottom corner of the bottle *x*. The front ends of rods 15, 15 pass through diametrically opposite holes in the annular flange 19 of the 50 neck-holding ring 19^a, and each rod is secured firmly in place in flange 19 by clamp nuts 20, 20, one on one side and the other on the other side of the flange. The diameters of the spindle head 1^a and of the flange 19, 55 and the distance at which they are spaced apart by the rods 15, 15, nuts 20, 20, and collar 14, depend upon the diameter and length of the bottles the necks of which are to be ground in the machine.

60 The neck-holding ring 19^a is provided interiorly with a chuck ring 21 threaded in place and provided with a central opening having a beveled wall that flares outwardly toward the spindle head. The mouth end 65 of the bottle is held in the chuck ring 18,

and the openings in the chuck rings are in line with the longitudinal axis of spindle 1. Chuck ring 21 is threaded in an annular extension 19^a of flange 19 which is mounted in a tapered bushing 22, that is supported in 70 a tapered hole in a vertical portion 23 of the adjustable support 27 for the bottle-holding mechanism as a whole and on which bracket 24 is clamped by a clamp-bolt 25.

Support 27 rests on main frame A, and is 75 pivoted to it by a pivot screw 28 at the front end of support 27, so that the latter may be adjusted laterally at its rear end portion when the clamp screws 29 at the rear end of support 27 are loosened. Such lateral ad- 80 justment is made to adjust the bottle neck laterally into a proper angular position for grinding. Support 27 has a lengthwise slot 26 through which the clamp-bolt 25 extends, and the top of support 27 is lengthwise 85 grooved at 30 (Fig. 2), the under side of bracket 24 sliding lengthwise in the ways thus formed, being confined laterally between the opposite sides 31 of groove 30.

By loosening clamp-bolt 25, the bracket 24 90 and the parts carried by it may be slid endwise to increase or diminish the distance between the opposed chuck rings 18 and 19^a to suit bottles of different lengths. Of course the rods 15 may be made in various lengths, 95 and more than two of them be used if desired; but, for convenience, two are usually preferred, in order to facilitate the putting in and taking out of the bottle. Spindle head 1^a is pressed forwardly by a coil-spring 100 32 which is interposed around the front end of the spindle and between spindle head 1^a and collar 14.

The hub 8 of the cone clutch 6 is provided with an annular groove 33 for connection 105 with a manually operable clutch-lever 126, and spindle 1 is provided with a transverse, lengthwise-extending slot 34 through which the pin 9, that holds clutch member 6 in fixed rotative position on the spindle, passes. 110 Rearwardly of slot 34, spindle 1 is lengthwise chambered at 10 for reception of a coil-spring 11, one end of which abuts on pin 9 and the other end of which is compressively held in chamber 10 by a screw plug 12. 115

Cone clutch 6 is moved out of clutching relation to the cone clutch pulley 7 against the tension of spring 11. The purpose of spring 11 is to keep clutch 6 in engagement 120 with clutch pulley 7, when the machine is in grinding operation. Tapered bushings 22, 2 and 3 are each held in place by a threaded ring 35, by movement of which the bushings are readily adjusted to take up wear, as will be readily understood by all skilled in the art. Cone clutch pulley 7 is held in place 125 on bushing 13 by a clamp collar 36; washers 37 being interposed between the hub of cone pulley 7 and frame portion 24^a; and collar 14 is held in place on bushing 13 between a 130

wall of an arm 24^a and a shoulder 38 of the bushing.

The rear end of support 27 is provided with two elongated holes 39, each in line with the other, and elongated transversely of support 27, so that when the clamp-bolts 29 are loosened, the plate 27 may have its rear end slid laterally, as before stated. Bushing 13^a extends outwardly beyond tapered bushing 3, and incloses one end of hub 40 of the pulley 4, this end portion of the hub being provided with a circumferential groove 41 in which ride screw pins 42 that pass through the surrounding and inclosing end of bushing 13^a, which is clamped stationarily in an arm 24^a by means of a screw 43. A similar screw 44 clamps bushing 13 stationarily in an arm 24^a. Clamping-screws 43 and 44 are to be loosened up when bushings 13 and 13^a are adjusted; but the reason for connecting bushing 13^a with hub 40 of pulley 4, through the instrumentality of groove 41 and screws 42, is to keep pulley 4 in a fixed, lateral position irrespective of the endwise reciprocation of spindle 1 through it.

The grinding pencil G, having a cone-shaped working surface *w*, is held in grinding mechanism D by a chuck 50 comprising a plurality of spring jaws 51 formed integrally with and at the end of a tube 51^a. These jaws impinge on the pencil, and are provided with angular surfaces 52 which are engaged by the outwardly flaring end 53 of the tube 54 that surrounds tube 51^a which extends through and has a bearing in a reduced rear end portion 55 of tube 54. Outwardly thereof, tube 51^a is threaded for reception of a nut 56 that forms one abutment for a coiled spring 57, the other end of which abuts against a collar 58 that is threaded on the outer end of tube 54. Tension is put on spring 57 by adjustment of the nut-like abutment 56, and consequently the action of the spring is to retract and to pinch the spring members of chuck 50 on the pencil by drawing surfaces 52 against the flaring end of tube 54.

Tube 54 is fixed to a driving pulley 59, by rotation of which the grinding pencil G is rotated in its tapered bearings 60 and 61, spaced apart for reception of the pulley 59 between them and for giving steadiness to the grinding pencil in its rotation. The tapered bearings 60 and 61 are secured in reversely tapered bushings 62 that are old and well known and need not be particularly described, but which are stationarily clamped in a laterally swinging grinding-pencil support 63 that is pivoted at its inner end by a pivot screw 64 to the transverse slide 65 mounted on ribs 66, 67, parallel one to another, of the lengthwise reciprocable carriage 68 which is formed with parallel lengthwise grooves 69 that ride on parallel

ribs 70, 70, being held in place by gibs 71 (Fig. 9). Ribs 70, 70 are, as shown, at an angle of six degrees to the lengthwise axis of spindle 1, and carriage 68 is reciprocated on said ribs 70 by means of a pitman connection with a bell-crank 73 that is pivoted at 74 between the opposite arms 75, 75 of a bracket 76 attached to the end of the machine next to the grinding mechanism. The free arm 77 of bell-crank 73 carries a roller 78, that engages the carriage reciprocating cam-wheel 79 that is journaled on a transverse shaft 80 between the bracket arms 75, 75. Rotation of the cam-wheel 79 therefore serves to reciprocate the carriage 68, and to rotate cam 79 its shaft 80 is provided with a worm gear 81 which meshes with a worm 82 on the end of a shaft 83 journaled in suitable bearings 84 at the rear of the machine and extending lengthwise thereof (see Fig. 5). This shaft 83 is provided with a fixed pulley 85 at its end adjacent to the bottle-holding mechanism, and an endless belt 86 runs from this pulley 85 over an idler and belt-tightener 87 and over the pulley 4 on spindle 1. Consequently, when the spindle is rotated, carriage 68 is reciprocated forward and backward on the ribs 70.

Pitman 72 is pivotally connected at 88 with a lug 89 projecting from the under side of carriage 68 and provided with a nut-headed stud 90 extending into a slot 91 which is elongated in the direction of the length of the carriage 68, whereby the carriage may be adjusted to vary the lengthwise reciprocation of the carriage from and toward the bottle neck.

The transversely movable slide 65 is reciprocated transversely of carriage 68 on the dovetails 66 and 67 as follows:—Slide 65 is provided on its rear side with a projecting stud 92 (see Figs. 5, 6 and 9) which is provided at its outer end with an adjustable collar 93 against which the yoked end of a bell-crank lever that is pivoted at 95 to carriage 68 engages to move slide 65 rearwardly. This slide is moved against the stress of a spring 96, one end of which is fast to a stud 97 (Fig. 9) on carriage 68 and the other end of which is secured to an endwise adjustable pin 98 through the side of slide 65 (Fig. 9). The bell-crank itself is indicated by 99. The other arm 100 of the bell-crank is provided with a cam roll 101 which engages the grinding feed cam 102 (Fig. 5) which, together with ratchet-wheel 103, is loose on its center-stud 104 carried by carriage 68. For ratchet-wheel 103 a pawl 105 is pivotally mounted at 106 on a pawl-carrier 107 which is pivoted on a hub 108 of the ratchet-wheel 103, the latter being supported on a boss 109 of carriage 68 (Fig. 10). The pawl is held up to the ratchet-wheel by a spring 110 (Fig. 5), and the pawl-carrier is pivotally connected at 111 to a link 112 130

the rear end of which is loosely pinned at 113^a to a horizontal fulcrum pin 113 adjustably mounted in slot *y* of arm 114 extending from the bracket 115 which is a part of frame A, being secured thereto by bolts 116. The fulcrum pin is made adjustable in order to give various vibrations to the pawl, depending on the number of ratchet teeth that it is desired to pass over to secure varying degrees of rotatory movement of cam 102. Link 112 being pivoted at a fixed point and loosely jointed to the pawl-carrier, reciprocation of carriage 68 on ribs 70 causes the pawl-carrier to vibrate, and consequently the pawl is moved over ratchet-wheel 103, compelling cam 102 to rotate. Cam 102 is fixed on hub 108 by key 117, and carries a pivotally mounted lug 118, the free end of which is adapted to engage with a collar 119 fixed on the lengthwise-extending slide rod 120 which is provided with a fixed collar 121. This slide rod is mounted at one end in a bearing 122 and at the other end in the bracket 115, the upper end of which is chambered to receive a plunger 123 which is backed up on spring 124, its free end being wedge-shaped and adapted to cooperate with the wedge-shaped outer periphery of collar 119 fixed on the slide rod 120. Collar 119 and plunger 123 are the main factors of the automatic stop-mechanism, the function of which is to arrest the rotary movement of spindle 1 of the bottle-holding mechanism when the grinding operation is completed, and then to stop the operation of the grinding mechanism.

The operation of the machine is as follows:—When a bottle is to be chucked, the automatic stop mechanism, cam 102, slide rod 120 and other parts are brought into the position shown in Fig. 6, with cone-clutch 6 and pulley 7 out of engagement. The operator then moves clutch lever 126 to the left. It is mounted on a pivot 127 (Figs. 1, 5 and 6) fixed in frame 24, and is provided with opposite pins 128 which engage in groove 33 of cone clutch 6. The left movement of lever 126 pulls spindle 1 rearwardly against the tension of springs 11 and 32, and when the disk 1^a and chuck ring 18 carried by spindle 1 are moved sufficiently away from chuck ring 21 for reception of the bottle, the bottle is put in place, as shown in Fig. 7, and chucked by the pressure of the compressed springs 11 and 32, the operator slightly diminishing his grip on the lever; but this automatic chucking movement of the parts does not start up the machine. To effect that, the rear end of lever 126 is extended rearwardly of pivot 127 and forked at 128^a for passage of slide rod 120 and engagement with the right-hand side of fixed collar 121. By a movement of lever 126 to the right, when the bottle has been chucked, cone clutch 6 and cone clutch pulley 7 are

interlocked and pulley 7 started by the belt 129 which extends to a pulley *p* on power shaft P. The bottle-holding mechanism is thus started in rotation to rotate the bottle relatively to the grinding pencil, which is driven from a cross belt 130 from pulley 59 to a pulley *p'* on power shaft P. The diameter of pulley *p* is less than the diameter of pulley *p'* in order to rotate the bottle at a slower speed than the grinding pencil, and the belt 130 is crossed to rotate the pencil in a direction opposite to the rotative direction of the bottle. Pulley 59 is continuously rotated. The rotative movement given to the bottle-holding mechanism by the coupling of cone-clutch 6 with pulley 7 is simultaneously communicated to the grinding mechanism, as already described; but to stop the rotation of the spindle 1, the following operations take place: The right-hand movement of lever 126 which results in coupling clutch 6 and gear 7, also moves the forked end 128 of lever 126 to the left against collar 121, sliding rod 120 and collar 119 to the left, the "knife-edge" of the collar then pushing against the "knife-edge" of plunger 123, pushing the latter back against its spring 124 so that the collar rides over the exposed wedge-shaped end or "knife-edge" of the plunger, which instantly after the passage over it of the collar is returned by the pressure of spring 124 into the path of the collar, as shown in Fig. 5. Cam 102 is made with a peripheral length, and so timed, that in one revolution of it a bottle neck is completely ground.

The contour of the grinding feed-cam 102 is such that the cam has a high point 131 and a low point 131^a, adjacent one to the other. When cam-roll 101 is against the low point 131^a (Fig. 6), the grinding operation has been automatically stopped and the cone clutches 6 and 7 uncoupled. Cam 102 rides in the direction indicated by the arrows in Figs. 5 and 6, and swells peripherally from low point 131^a continuously to high point 131. When lever 126 is pulled to the right to couple cone clutches 6 and 7, slide rod 120 is moved to carry collar 119 past the plunger 123, the collar 119 in this left-hand movement passing lug 118 without engagement therewith. The grinding spindle feed, by which I mean the lateral movement of the working surface *w* toward and against the bottle, is commenced and continued when cam roll 101 is pressed to the left by the rotation of cam 102 from low point 131^a (Fig. 6) to the completion of one movement, at which time the high point 131 engages cam roll 101, as shown in Fig. 5. During this movement, the grinding has been going on; but as high point 131 comes into contact with the cam roll, the bell-crank lever 99 is moved to carry its outer arm 94 rearwardly and thereby pull slide 65 rear-

wardly against the tension of spring 96. At this juncture, however, the working surface *w* of the grinding pencil is still in grinding contact with the bottle neck; and when roll 101 moves from high point 131 to low point 131^a, spring 96 automatically retracts and thereby pulls slide 65 toward the front of the machine, carrying the grinding pencil support 63 and the grinding pencil away from the interior surface of the bottle neck.

When cam roll 101 and high point 131 are in engagement, as shown in Fig. 5, the outer end of lug 118 is projecting against collar 119, and as cam 102 continues the slight rotative movement that carries high point 131 past cam roll 101, lug 118 engages collar 119 and pushes it to the right, carrying it against, past and over the projecting end of the plunger. This movement results in carrying fixed collar 121 on slide rod 120 to the right and against the forked end 128^a of lever 126, whereby the cone clutches 6 and 7 are disconnected. As soon as collar 119 passes over the free end of plunger 123, the tension of spring 124 acts instantly to return plunger 123 into the path at the left-hand side of collar 119, so that as long as the plunger and collar are in those positions, as shown in Fig. 6, the cone clutches 6 and 7 are maintained in disconnected relations, and the tension of spring 124 has to be overcome in order to again start the machine. Lug 118 is pivoted on the cam 102 at 118^a, and a spring-coil 125 is connected with the right-hand side of the pivoted lug 118 and also with cam-wheel 102, the connection with the lug being on the outward side of the pivot. Consequently, when collar 119 on slide-rod 120 is moved to the right, as shown in Fig. 6, spring 125 pulls the outer free end of lug 118 out of the path of collar 119. When the cam has rotated to bring high point 131 into engagement with the roller 101, it will have carried the outward free end of lug 118 into the path of the collar 119, as shown in Fig. 5.

The rear end of tube 51^a is engaged, (when the grinding pencil *G* is to be adjusted forwardly as it wears away) by an end-wise movable slide 200 (round in cross-section) mounted in the rear vertical arm 201 of the grinding pencil support 63, and kept from rotating by a spline 202. This slide has through it a lengthwise-extending hole for passage of the grinding pencil feed-screw 203 in line with the grinding pencil. The inner end of the feed-screw is best provided with a chambered nut 204 holding a rotatable, hardened steel pin 205, the outer end of which impinges on the butt end of the grinding pencil when the latter is shifted forwardly to compensate for wear, and the inner end of which is pointed at 206 and comes in contact with the adjacent end

of the feed-screw that is also best made of hardened steel. The reason for this desired construction is to prevent the inner end of the grinding pencil from cutting away the inner end of the feed-screw as the latter is repeatedly turned up to press the grinding pencil into fresh positions of use as its conical work surface *w* is worn away. To press the pencil forwardly, the chuck 50 has to be released, and this is done by moving slide 200 forwardly. To that end, the slide is formed with a cross-slot 207 in which the eccentric lug 208 of a round turn-block 209 extends. This block is mounted in arm 201 and kept in place by a pin 210 passing through the arm and entering an annular groove 211 in the block, which has a handle 212. Groove 211 communicates with a downwardly-extending vertical slot 213 on the turn-block, so that the latter can be lifted when slot 213 is in line with pin 210. When the block is lifted, slide 200 and the feed-screw can be removed so as to permit a new pencil to be inserted from the rear end of tube 51, point first. It would be difficult, in the organized machine, to insert the pencil butt end first through chuck 50, in consequence of the length of the pencil and the relations of various mechanisms. But to relieve the chuck jaws on the pencil, handle 212 is operated to move slide 200 forwardly against tube 51^a and thereby push the jaw shoulders 52 away from shoulders 53 and permit the jaws to spring apart and release their grip on the pencil.

The outer end of slide 200 is formed with an interiorly threaded feed nut 214 through which the feed screw extends and with which it meshes. This nut is held on the end of slide 200 by pins 215 through its hub portion, the inner ends of the pins entering an annular groove 216 in said hub portion. The periphery of the feed nut is transversely grooved with parallel grooves 217 that extend wholly around the nut, circumferentially, and are adapted to be engaged by the spring catch 218 that enters one or another of the grooves and holds the feed nut in any one of its adjusted positions.

The grinding of bottle necks so as to make them all substantially alike is a very difficult problem; and the foregoing mechanisms are very desirable in making the fine adjustments of the grinding pencil, or, rather, of its conical working surface *w*, as that surface is continuously worn away, and thereby deformed, in the grinding of bottle necks with the lengthwise axis of the bottle at an angle to the lengthwise axis of the pencil, as described.

My present invention involves one feature now to be described and which is of very general applicability in the grinding machine art. Between the bottle-holding mechanism, which is one form of a work-

support, and the grinding mechanism, which is one form of grinding tool carrier, I interpose a permanently and stationarily located grinding tool dresser 250 (which may be of any suitable construction or material) in the path of the work-surface of the grinding tool. In the present embodiment of this feature, original with myself, and now for the first time embodied in any kind of machine, so far as I am informed, a bracket 251 carries a screw 252 one end of which is provided with a grinding-tool dresser (such as a suitably shaped piece of diamond or bort, for example) in the path of the work-surface *w* of grinding-tool or spindle G. As the surface *w* is moved endwise to engage or disengage with the bottle neck or other work, the tool surface *w* is dressed; and so long as the active surface of the dresser is kept at a fixed distance from the axis of the tool, and in the path of the latter's work-surface, such surface must be repeatedly dressed alike after each deformation. The important result of this arrangement of the dresser in the path of the working surface of the grinding tool is that the surface is automatically reformed with exactitude after each deformation and before each succeeding grinding engagement with the work. Consequently, other factors in my present or any other grinding machine being of proper constructional arrangement and mode of operation, precise duplicate grinding may be automatically and expeditiously effected, for the first time. I do not intend to restrict my claims herein for this feature of my invention to any particular kind of grinding machine or to any particular form of tool dresser.

Grinding pencil support 63 is made adjustable on its pivot pin 64 in order to bring the conical work surface *w* into proper grinding relation with the interior of bottle necks of different diameters and angularity of ground surface; and the bracket 24 of the bottle-holding mechanism is made adjustable on its pivot 28 to vary the angular position of the surface to be ground in reference to the grinding surface *w* of the grinding tool. These adjustments are complementary in their nature.

As before stated, the ribs 70 are shown at an angle of six degrees to the longitudinal axis of spindle 1, and this is the best average angularity to give them, as the stopper-receiving ground surface of the bottle neck is usually at an angle of about six degrees to the longitudinal axis of the bottle. The lateral adjustments of the bottle-holding and grinding tool mechanisms enables the user to vary the angularity of the long axis of the bottle to the conical surface of the grinding tool or pencil, at will.

The roll 78 on bell-crank arm 77 which is carried by bell-crank shaft 74 is kept against

the edge of the cam-wheel 79 (for securing endwise reciprocation of the tool-carrying mechanism) by means of a rocker arm 776 fixed on bell-crank shaft 74 and connected by a spring 777 at its free end to the frame 70 A, as shown in Fig. 4.

What I claim is:—

1. The combination in a machine for interiorly grinding glass bottle necks, of a bottle-holding mechanism; endwise reciprocable grinding tool holding mechanism; said bottle-holding mechanism comprising a rotatable spindle; a rotatable bottle-chuck; means for rotating said chuck; said tool-holding mechanism comprising a rotatable tool-chucking device; means for rotating said device; means for reciprocating the tool-holding mechanism endwise; means for moving it laterally to feed the grinding tool against and away from the wall of the work to be ground; and means for automatically arresting the grinding movement.

2. The combination in a grinding machine of grinding tool holding and rotating mechanism; a feed cam mechanism; a work-holding chuck; a mechanism for rotating the chuck, said mechanism comprising clutch members; and a lever for moving the clutch members into and out of engagement; of an endwise movable rod having a thereon-fixed knife-edged collar; a lug carried by the feed cam and adapted to engage said collar and push it over and past a spring-pressed, beveled plunger; said spring-pressed, beveled plunger being adapted to project in the path of said lug and to be pressed against said collar to move the rod endwise; a projection in said rod, adapted to engage said lever and unclutch the clutch members, when the knife-edged collar and the rod are moved endwise by the spring-pressed, beveled plunger.

3. The combination of a work-holding mechanism comprising a rotatable work chuck; means for rotating the same; a clutch mechanism for said chuck; a tool-holding mechanism comprising a rotatable tool chuck; an automatically operating mechanism for stopping said chucks and comprising an endwise movable rod; a connection between the same and said clutch mechanism and a connection between the same and the work-holding chuck; all being combined and operating to stop the rotation of the grinding tool and work chuck automatically.

4. The combination of a work-holding mechanism comprising a rotatable work chuck; a grinding tool holding mechanism; and a frame supporting said mechanism; the work-holding mechanism being laterally adjustable in the arc of a circle on said frame; and the tool-holding mechanism being endwise movable on said frame in a path at an angle to the longitudinal axis of the work-holding mechanism; a tool chuck sup-

porting carriage laterally movable in said tool-holding mechanism; means for rotating the work chuck, means for rotating the tool chuck, means for reciprocating the tool holding mechanism; and automatic mechanism for stopping the rotation of the grinding chuck.

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

SIMON DOKK OLSEN.

Witnesses:

EDWARD S. BEOTH,
F. E. NARES.