E. A. RYON.

GLASS GRINDING MACHINE.

APPLICATION FILED SEPT. 2, 1914.

1,251,114.

Patented Dec. 25, 1917.

3 SHEETS—SHEET 1.

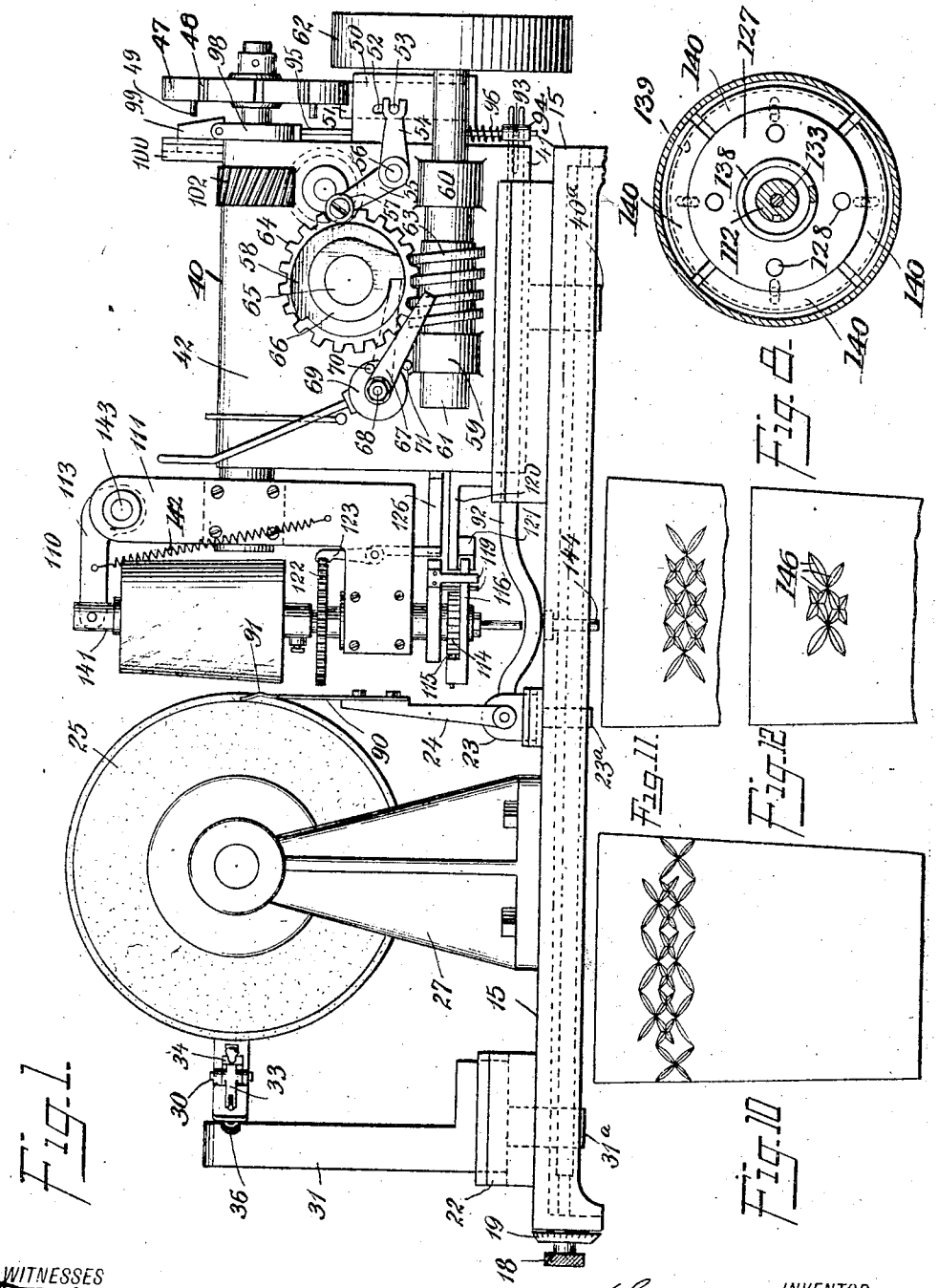


Fig. 1.

Fig. 8.

Fig. 11.

Fig. 12.

Fig. 10.

WITNESSES

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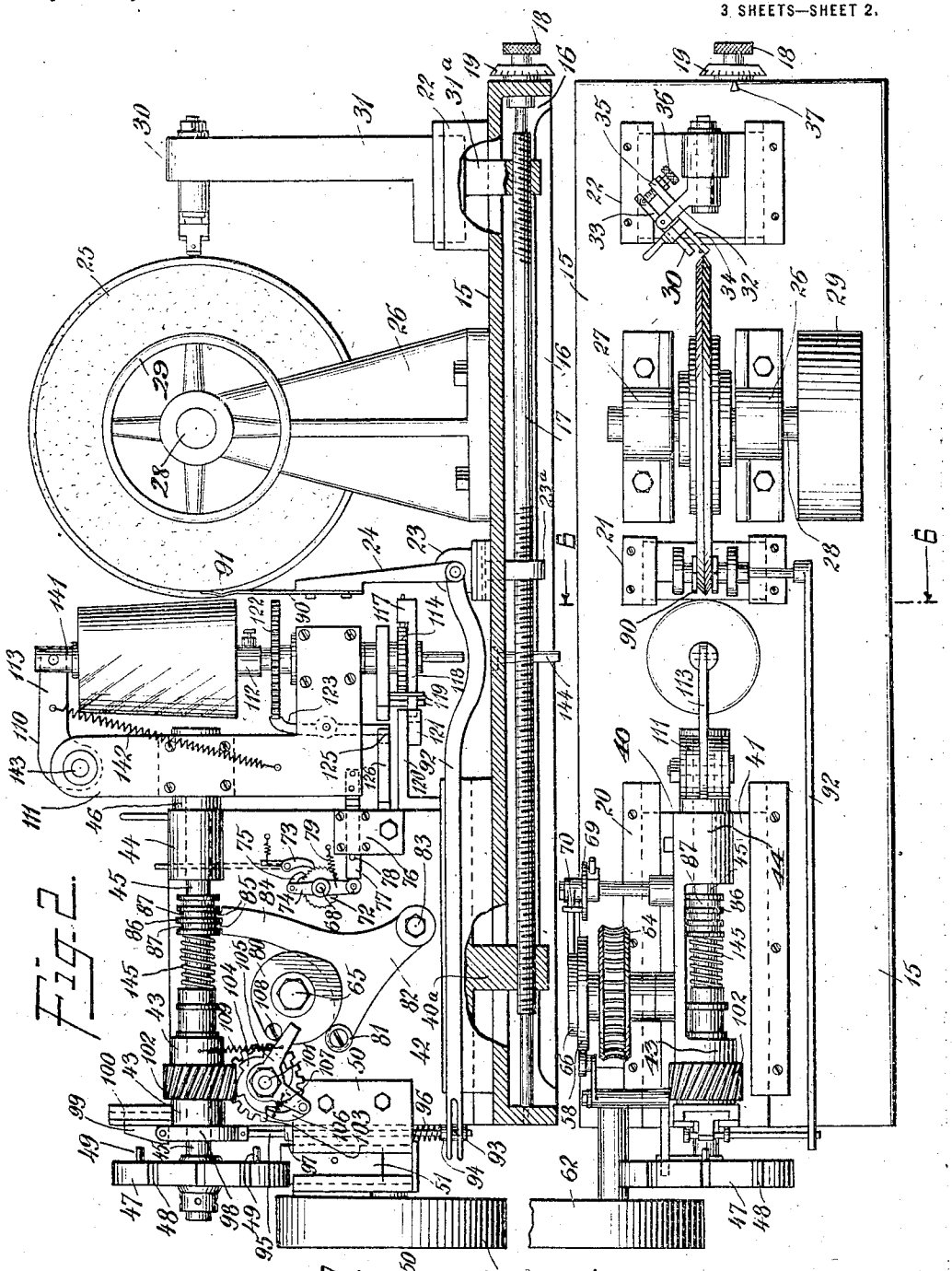


Fig. 2.

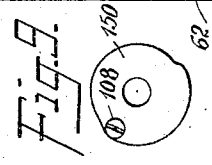


Fig. 4.

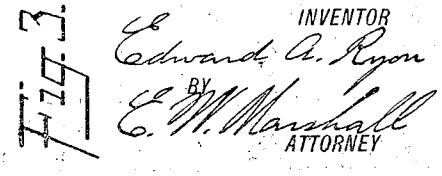


Fig. 3.

WITNESSES

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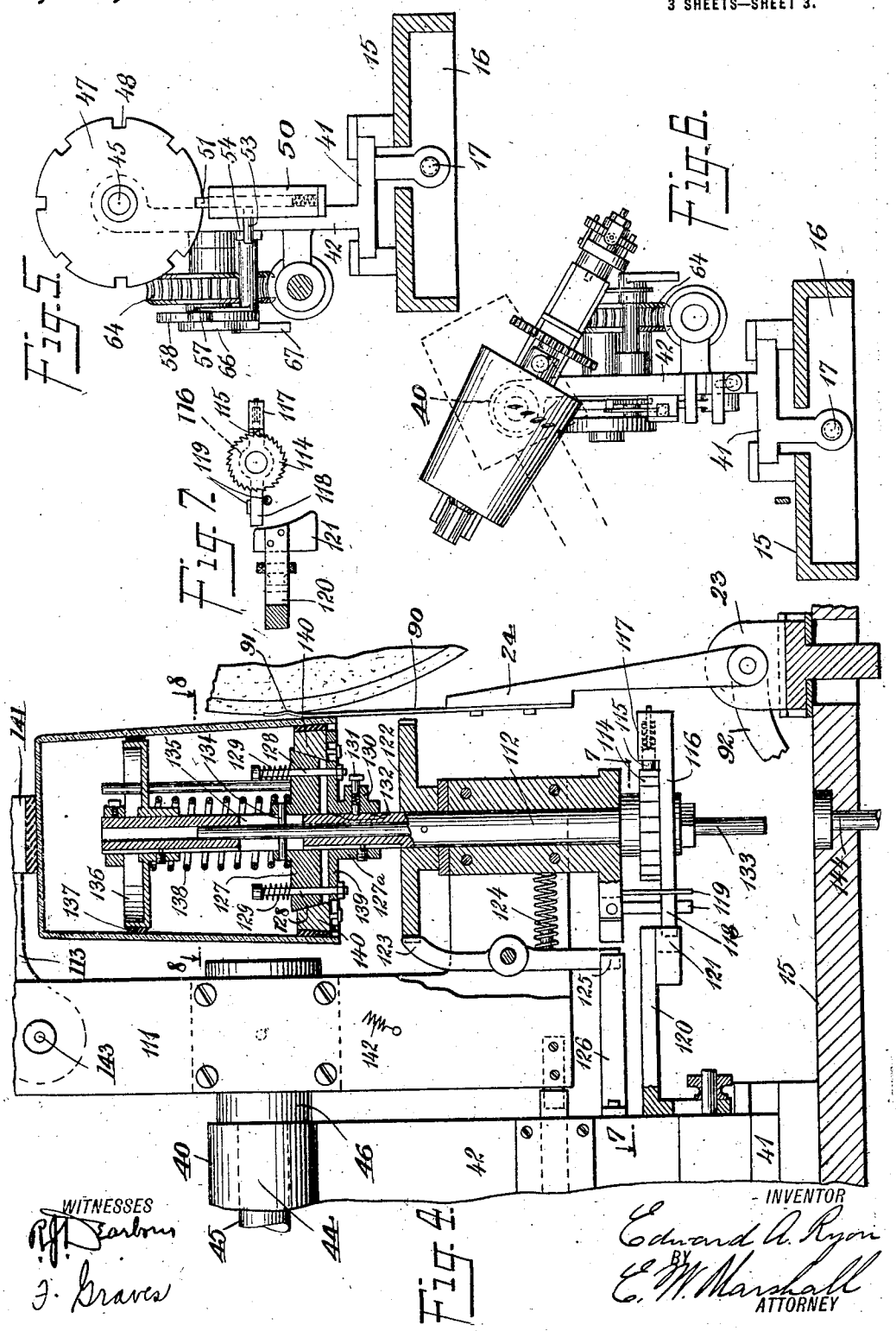
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3 SHEETS—SHEET 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

EDWARD A. RYON, OF WELLSBORO, PENNSYLVANIA, ASSIGNOR TO WELLSBORO GLASS COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

GLASS-GRINDING MACHINE.

1,251,114. Specification of Letters Patent. Patented Dec. 25, 1917.

Application filed September 2, 1914. Serial No. 859,768.

To all whom it may concern:

Be it known that I, EDWARD A. RYON, a citizen of the United States of America, and a resident of Wellsboro, county of Tioga, and State of Pennsylvania, have invented certain new and useful Improvements in Glass-Grinding Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to the art of cutting or grinding glass tumblers, bowls and the like for the purpose of decorating them to enhance their beauty and increase their value.

One object of my invention to to provide a machine for the general purpose above indicated which shall be adapted to automatically cut a predetermined design upon the outer surface of tumblers, and other glass articles, that shall be simple and durable in construction and reliable in operation.

Another object is to provide in a machine of the aforesaid character, means for maintaining a suitable cutting wheel surface, together with means for adjusting the work to correspond at all times to the size of the wheel thereby insuring uniformity in cuts and regularity in design.

It is furthermore my purpose to provide a rigid but readily releasable support for the glass article subjected to the grinding process, an accurate and replaceable member for determining the design to be cut, means for automatically stopping the machine when the design is completed on the glass article, and means for carefully determining the depth of each cut of the wheel irrespective of irregularities in the surface of the glass.

Other objects and advantages of my invention will be set forth hereinafter, and in order that my invention may be thoroughly understood I will now proceed to describe the same in the following specification and then point out the novel features thereof in appended claims.

Referring to the drawings—

Figure 1 is a side elevation of a glass grinding machine constructed in accordance with and embodying my invention.

Fig. 2 is an elevation corresponding to Fig. 1 and looking at the machine in the opposite direction, with the base broken away and shown in section to disclose the adjusting mechanism within.

A plan view of the same machine is shown in Fig. 3.

Fig. 4 is a partial side elevation drawn to a larger scale and showing the tumbler support and its coöperating parts in detail.

Fig. 5 is an end elevation with the driving shaft and the base shown in section.

Fig. 6 is a sectional elevation taken on the line 6—6 of Fig. 3.

Figs. 7 and 8 are plan views taken respectively on the lines 7—7 and 8—8 of Fig. 4.

Fig. 9 is a view of a modified arrangement which also embodies my invention but is arranged to increase the speed of operation of the device, by moving the glass at a more rapid rate when it is being adjusted from one position to another between cuts.

Figs. 10, 11 and 12 are elevations of cut glass tumblers which are intended to illustrate the possibilities of the machine in the previous figures.

Like characters of reference designate corresponding parts in all the figures.

Referring to Figs. 1 to 8 inclusive of the drawings, the machine here shown comprises, in general, a base 15, a grinding wheel 25, a facing tool 30, a head stock 40 a carrier 110, and suitable driving and interconnecting mechanisms.

Base.

The base 15 comprises a hollow plate or casting having a recess 16 through which extends longitudinally an adjusting screw 17. This screw is rotatively supported at its respective ends by the base plate and at one end extends through the base flange and has a knurled head 18 by which it may readily be turned. At the same end of the screw is mounted a micrometer scale 19, which coöperates with a stationary index 37 on the base, so that the screw may be set with great accuracy. Near its respective ends it is provided with two sections having oppositely cut screw threads, one being a left hand thread and the other a right hand thread.

Provided on the base are three sets of guideways 20—21—22, the head stock 40 being mounted in the guideways 20 and the

facing tool 30 being mounted in the guideways 22. A block 23 is mounted in the guideways 21 and carries a bell crank lever 24, the purpose of which will be set forth hereinafter.

Grinding wheel.

The grinding wheel 25 is rotatively mounted in a pair of spaced bearing blocks 26—27 which are bolted or otherwise secured to the base. The wheel is secured to a shaft or arbor 28 which is provided with a driving pulley 29. The wheel may be driven by a belt (not shown) or by any other suitable means, and is intended to operate continuously while the machine is in use.

Facing tool.

The facing tool comprises a post 31 which is adjustably mounted in the guideways 22 and has secured to it at its upper end an arm 32, a tool carrier 33 pivotally supported near the outer end of the arm 32 and the facing tool proper, which is marked 34 and is adjustably secured to the support 33. A finger 35 extends laterally from the arm 32 and is tapped to receive an adjusting screw 36 which is pivotally connected to the outer end of the support 33, the arrangement of parts being such that by turning the adjusting screw 36 the facing tool 34 may be swung about the pivotal mounting of the support 33 as a center.

Head stock.

The head stock 40, as already pointed out, is adjustably mounted in the guideways 20 which are parallel to the plane of the grinding wheel as are also the guideways 21 and 22. The head stock comprises a horizontal base 41 which coöperates with the guideways, a web 42 and a pair of bosses 43—44 which constitute bearings for the spindle 45. The spindle has an enlargement 46 at one end adjacent to the grinding wheel to which the carrier 110 is secured, as more fully pointed out hereinafter.

Secured to the outer end of the spindle is a disk 47 having peripheral notches 48 and laterally projecting pins 49. Secured to the outer edge of the web is a guide block 50 in which a latch plate 51 is arranged to slide vertically and is adapted to engage one of the notches 48 of the disk 47 and hold the spindle 45 to which the disk is secured against turning until the latch plate is released. The guide block 50 is provided with a slot 52 through which a pin 53 extends. This pin is affixed to the latch plate and is embraced beyond the guide block by the bifurcated end 54 of the bell crank lever 55. This lever is pivotally supported on one side of the web 42 by means of a stud 56. Near the outer end of the opposite arm of the same bell crank lever is a roller 57 which engages the periphery of a cam 58.

The web 42 has a pair of laterally extending bosses 59—60 which rotatively support a main driving shaft 61 of the machine. This shaft may be driven in any suitable manner and at its outer end is provided with a driving pulley 62. Secured to the shaft 61 between the bosses 59 and 60 is a worm gear 63 which meshes with a worm wheel 64.

The cam 58 is secured to and may form a part of the worm gear wheel 64, and is secured to a shaft 65 which extends through the web and is rotatively supported thereby. Adjacent to the cam 58 and secured to the same shaft 65 is a pawl 66 which, under predetermined conditions, is engaged by a stopping arm 67 rotatively mounted on a shaft 68. Secured to the shaft 68 adjacent to the arm 67 is a disk 69 having a pin projection 70. The arm 67 normally rests against a stationary pin 71 but may be raised into locking position when the disk 69 has rotated and the pin 70 advanced to such position as to lift the arm.

The shaft 68 extends through the web and has secured to it near its opposite end, a ratchet wheel 72 which is prevented from turning except in one direction by means of a spring-pressed pawl 73. The ratchet is advanced by an arm 74 which is mounted on the shaft 68 adjacent to the ratchet wheel and carries a pawl 75. Secured to the web 42 near its inner end is a guide block 76 in which a rod 77 is arranged to slide. The movement of the rod in one direction is limited by a stop pin 78, and the outer end of the rod is engaged by one end of the arm 74 which is held against the rod by a spring 79. As more fully pointed out hereinafter, the rod 77 is actuated to advance the ratchet wheel once for each revolution of the carrier 110.

On the opposite side of the web from the gear wheel 64 and secured to the shaft 65 is a cam 80, the peripheral surface of which is engaged by a roller 81 forming a part of a pawl 82. This pawl is pivotally mounted on a stud or bolt 83 which is secured to the web, and has an arm 84 provided with tooth projections 85. The spindle 45 has an enlargement 86 which is provided with annular grooves 87 to coöperate with the tooth projections 85 of the pawl 82, the arrangement being such that the pawl moves the spindle axially without interfering with its rotation.

The bell crank lever 24 has a substantially vertical arm to which a pair of stop fingers 90 are secured. These fingers are substantially parallel and extend one on each side of the grinding wheel 25, being bent at 91 to engage the glass on the respective sides of the cut. As hereinafter pointed out they

are for the purpose of insuring uniform cutting by stopping further advancement of the spindle when the wheel has cut into the glass to a predetermined depth. In addition to the vertical arm, the bell crank lever has a substantially horizontal arm 92 which is bifurcated at its outer end to receive a pin 93, projecting from a hub or enlargement 94 near the lower end of a vertical rod 95. This rod extends through a substantially vertical hole in the guide block 50 and is normally pressed downwardly by a spring 96 until a collar 97 on the rod engages the top of the guide block.

When the spindle and glass are advanced the bell crank lever is tilted slightly by the action of the glass upon the fingers 90 and then the rod 95 is moved upwardly in opposition to the spring 96 and stops the machine. Connected to the rod at its upper end by a pair of curved links 98 is a wedge or cam block 99 which is adapted to slide vertically in a stationary guide block 100. The links 98 are bent to avoid interfering with the spindle 45 which extends between them and when the wedge block or cam 99 is raised it will engage one of the pins 49 of the disk 47 and thereby prevent further advancement of the spindle.

Still another stud 101 is rotatively mounted on and extends laterally from the web 42. It is located below the bifurcated bearing 43 and a worm gear 102 which is secured to the spindle and is interposed between the parts of the bearing. A worm gear 103 is secured to the stud 101 and meshes with the gear 102.

There is also secured to the stud adjacent to the gear a ratchet wheel 104. A pawl carrier 105, having the form of a bell crank lever, is rotatively mounted on the stud 101 and supports a pawl 106 which is adapted to coöperate with the ratchet wheel 104 and is held in engagement with the ratchet teeth by a spring 107. The carrier itself is actuated by a projection 108 from the cam 80 with which it is held in engagement by a spring 109. The arrangement of parts is such that, as the shaft 65 and the cam 80 are rotated, the pawl carrier 105 will be actuated once in each revolution and will advance the ratchet wheel 104 and the gear 103 step by step. These movements of the gear wheel 103 produce corresponding movements of the gear wheel 102 and the spindle 45. The rotation of the spindle is thereby produced.

The cam 80 furthermore, and as already explained, actuates the pawl 82 to move the spindle axially forward and backward.

The carrier.

The carrier 110 comprises an L-shaped support 111, which is clamped to the outer end of the spindle 46, a vertical shaft 112, which is rotatively mounted in the horizontal arm of the support, a clutch mechanism for gripping the interior walls of a tumbler, and a guide 113.

Affixed to the vertical shaft 112 and below the bearing, provided by the support, is a ratchet wheel 114 (see Fig. 7) which is adapted to be engaged by a spring-pressed pawl 115. A pawl carrier 116 is rotatively mounted on the shaft 112 adjacent to the ratchet wheel and has an offset projection 117 in which the pawl is supported. The carrier 116 has a laterally projecting arm 118 which is advanced between a pair of limiting stops 119 during each rotative movement of the support about the spindle as an axis, the head stock being provided with a stationary projection 120 having a cam surface 121.

Directly above the bearing of the vertical shaft 112 is a notched disk or wheel 122 which is engaged by a pawl 123 to determine each of the cutting positions of the glass. The pawl is pressed into engagement with the notched periphery of the disk by a spring 124 and is released from the disk in opposition to the force of the spring by the cam surface 125 of a projection 126. The pawl is also tripped once for each rotation of the support about the spindle as an axis. Above the disk 122 which is removable and may be replaced by disks having different arrangements of notches, is the clamping mechanism which is capable of being expanded to firmly grip the interior walls of the tumbler or other glass article to be cut.

This clamping mechanism comprises a hub 127 which has a frusto-conical outer surface and comprises two sections marked 127 and 127ª. These sections are connected by a plurality of axial screws 128 which extend loosely through the body of the hub 127 and have springs 129 interposed between the hub and their heads which tend to force the hub sections together. The section 127ª has a hollow boss 130 through which a resilient key 131 extends so as to engage one of a series of recesses or depressions 132 in the vertical shaft 112. By this means the section 127ª is removably secured to the shaft and the hub section 127 is mounted to slide thereon.

The shaft 112 is hollow and a rod 133 extends through it. The rod near its upper end is provided with a transverse pin 134 which extends through a slot 135 in the shaft and is affixed to the hub 127. The slot is of sufficient length to permit a limited axial movement of the hub on the shaft.

Secured to the shaft 112 near its upper end is a circular clamping plate 136 which is preferably provided with a gasket or washer 137 of rubber or other yielding material. A helical spring 138 surrounds the upper end of the shaft 112, being interposed

between the clamping plate 136 and the body of the hub 127. It therefore tends to press the hub sections 127—127ª together. The hub section 127ª is provided with a flange 139 to which are loosely attached a plurality of sectors 140 which have conically curved inner surfaces to coöperate with the frusto-conical outer surface of the body of the hub 127. The arrangement of parts is such that the sectors 140 are pressed outwardly by the action of the springs 129 and the spring 138. Their outer surfaces are curved to conform to the interior surface of a tumbler or other article to be cut.

The springs 129 are relatively light and consequently it is only necessary to press upwardly on the rod 133 in order to separate the hub sections 127—127ª and release the sectors or wedge blocks 140.

In order to still further insure that a tumbler cannot accidentally be removed from the carrier, a block 141 which is pivotally secured to the guide arm 113 is pressed against the bottom of the tumbler by means of a spring 142, the arm being pivotally mounted at 143 near the upper end of the L-shaped support 111.

Before describing the modified structure shown in Fig. 8 or discussing the designs illustrated in Figs. 9, 10 and 11, I will set forth the operation of the machine. Assuming that the carrier occupies the position substantially as shown in Fig. 4 of the drawings, except that no tumbler or glass article is in place, a rod 144 which may be connected with a foot press or other suitable device, is forced upwardly to engage the lower end of the rod 133. As already explained, when this rod is forced upwardly relative to the shaft 112, the clamping mechanism is released by the separation of the hub sections 127—127ª. If, now, the guide arm 113 is swung out of the way on its pivot 143, the tumbler may be forced downwardly onto the carrier until the disk 136 is pressed closely into it. The rod 133 will then be released and thereupon the springs 138 and 129 draw the hub sections together and force the sectors 140 in position to clamp the interior surface of the tumbler. The guide arm 113 is then placed in position as shown in Fig. 2 so that the spring 142 draws the pressure block 141 against the bottom of the tumbler.

The grinding process may now be commenced by starting the rotation of the driving shaft 61. This rotative movement is transmitted through the gears 63 and 64 to the cam 58 and the cam 78. The rotation of the cam 80 so acts upon the roller 81 of the pawl 82 as to permit a spring 145 to force the spindle 45, together with the carrier and tumbler toward the grinding wheel 25, which of course is rotating at a high rate of speed. The glass is forced against the wheel, a single cut, such as one of those shown in Fig. 9, being produced in the glass. The progress of the spindle is halted when the cut reaches a predetermined depth by the engagement of the glass with the fingers 90 of the bell crank lever 24 and the consequent rocking of the bell crank lever. A slight movement of the fingers produces a material upward movement of the rod 95. This upward movement, as already explained, moves the wedge block 99 outwardly in the guideways 100 and into the path of the projections 49 of the disk 47. The wedge block coöperating with these projections forces the spindle backwardly in opposition to the spring 145. The spindle is free to move in this direction and to carry the pawl 82 with it since only the spring 145 is depended upon for moving the spindle forward and the roller 81 is not positively held in engagement with the surface of the cam 80. The tension of the spring 145 is such as to give the proper cutting speed.

The further rotation of the cam 80 brings the projection 108 into contact with one arm of the bell crank lever 105 and produces the rocking movement of this lever in opposition to the spring 109. By this means the pawl 106 advances the ratchet wheel 104 through one notch, the gear wheel 103 and the gear wheel 102 being turned a corresponding amount. In consequence of this movement of the gear wheel 102 the spindle 45 and the carrier 110 are rotated through a predetermined arc, swinging the tumbler into a position such as that shown in Fig. 6, for example. Of course the inclination of the tumbler at each position may be varied and determined by the number of teeth on the ratchet wheel 104. The continuing rotation of the cam 80 produces alternately a cut and a revolutionary movement of the tumbler about the center of the spindle 45 as an axis. When one revolution of the tumbler and carrier is thus completed, a series of cuts will have been formed radiating from a single center as, for example, the four cuts 146 shown in Fig. 11. Just at the end of a complete revolution of the spindle 45 the pawl 123 is released by reason of its engagement with the cam surface 125 and immediately thereafter the pawl carrier 116 is advanced by the engagement of its projection 118 with the cam surface 121. This advancement of the carrier 116 produces a rotative movement of the shaft 112 and of the tumbler about the shaft as an axis. This moves the tumbler to the next position and depends upon the notches of the disk 122.

For each complete revolution of the support 111, in addition to the foregoing, the ratchet 77 is forced outwardly producing a movement of the carrier 74 and advancement of the ratchet wheel 72. By this means

the shaft 65 is turned through a slight angle and carries with it the disk 69 on which the pin 70 is mounted. Therefore the pin 70 advances step by step for the several revolutionary movements of the carrier about the spindle 45 as an axis until finally, when the tumbler is completely rotated on its axis, having been revolved at each step, the pin 70 raises the arm 67 into position as shown in broken lines in Fig. 1, to engage the pawl 66 and stop further rotation of the shaft 65 and further action of the machine.

The completed tumbler may now be removed and replaced by another and the machine started and operated as before.

The surface of the grinding wheel must of course be maintained in proper form and condition and for this purpose I have provided the facing tool 30. This tool may be advanced to face the tool by turning the knurled handle 18 and the shaft 17. When this shaftt is turned the tool 30 as a whole, is advanced by reason of the fact that the post 31 has a downwardly extending projection 31^a which is tapped to receive one of the screw-threaded portions of the shaft. The turning of the shaft also serves to advance, by an equal amount in an opposite direction, both the head stock 40 and the block 23, the head stock being provided with a projection 40^a and the block being provided with a projection 23^a which projections are tapped and engage the oppositely screw-threaded portion of the shaft as clearly shown in Fig. 2.

As already pointed out, the parts 30, 23 and 40 are mounted in guideways and the base plate 15 is provided with suitable slots through which the projections 31^a, 23^a and 40^a extend.

The pitch of the threads in each of the two screw-threaded sections of the shaft 17 correspond, although one has right hand and the other left hand threads. It is therefore evident that when the surfacing tool is advanced to some extent to reduce the size of the grinding wheel, by facing its surface, the stop bell crank 24 and the head stock, together wtih the tumbler and carrier, are advanced by a like amount toward the center of the wheel,—in other words, the relative positions of the wheel surface and of the head stock and stop finger are always maintained.

It is evident that the plate 122 may be uniformly notched so as to make a uniform border design completely around the tumbler, or may be notched in uniform groups,—for example it may be provided with four uniformly spaced groups of two notches in which case the design shown in Fig. 11 will be produced at four different places and spaced around the surface of the tumbler. In the design illustrated there are four different cuts made at each of the rotative positions of the tumbler, a revolutionary movement of the tumbler being effected for each group. This is not essential to my invention and the number of cuts radiating from a single center may be varied as desired, as already pointed out.

A group of four sets of cuts is shown in Fig. 10 while in Fig. 9 there are two different superposed groups of sets, each group corresponding to those of Figs. 10 and 11 except that adjacent sets in the same group are spaced so that they do not overlap.

In case it is found desirable to operate the machine at its highest speed, this may be accomplished by providing a slightly modified cam 150 as shown in Fig. 8, in order that the cutting stroke of the machine may be maintained at the same speed while the driving speed may be increased. The cutting speed is, of course, limited by the character of the grinding wheel and the safe operation of the device.

Attention is particularly directed to the fact that the depth of the cut is automatically determined by, and furthermore is regulated relative to, the surface of the glass adjacent to the cut. The several cuts may therefore have a very uniform appearance and also compensation is made for the variations and irregularities in the thickness and contour of the glass.

It is evident that various structural modifications may be effected within the spirit and scope of my invention, and I intend that only such limitations be imposed as are indicated in the appended claims.

What I claim is:

1. A glass grinding machine comprising a grinding wheel, a support, a spindle slidably and rotatively mounted therein, a driving shaft and interposed gearing for turning the spindle and moving it forward and back.

2. A glass grinding machine comprising a grinding wheel, a support, a spindle rotatively and slidably mounted on the support, a carrier secured to the spindle, a shaft rotatively mounted on the carrier at an angle to the axis of the spindle, a clamping mechanism associated with the shaft, and means for automatically producing movement of the clamping mechanism to adjust the position of the work, dependent upon a predetermined rotative movement of the spindle.

3. A glass grinding machine comprising a grinding wheel, a carrier rotatable about an axis at right angles to the axis of the grinding wheel, and revoluble on an axis at right angles to the axis of rotation, means for relatively moving the carrier and the wheel to bring them together, and means dependent upon the surface of the glass for determining the depth of the cut.

4. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, and a clamping mechanism mounted on the shaft, and means for automatically moving the spindle to and from the wheel and for producing rotative adjustments of the spindle between the longitudinal movements thereof.

5. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, a clamping mechanism mounted on the shaft, and means for automatically producing a rotative movement of the clamping mechanism at each revolution of the spindle.

6. A glass grinding machine comprising a grinding wheel, a head stock, a horizontal spindle slidably and rotatably mounted therein, a driving shaft, and interposed gearing for alternately turning the spindle and moving it forward and back.

7. A glass grinding machine comprising a grinding wheel, a head stock, a horizontal spindle slidably and rotatably mounted therein, a driving shaft, a cam shaft geared to the driving shaft, a plurality of cams on said shaft, means for locking the spindle, means dependent upon one of the cams for releasing the spindle, and means for alternately turning the spindle and moving it forward and back.

8. A glass grinding machine comprising a grinding wheel, a head stock, a horizontal spindle slidably and rotatably mounted therein, a driving shaft, a cam shaft geared to the driving shaft, a plurality of cams on said shaft, means for locking the spindle, means dependent upon one of the cams for releasing the spindle, a pawl coöperating with a second cam adapted to move the spindle backwardly, a spring tending to press the spindle forwardly, and means influenced by the cam for intermittently producing rotative movements of the spindle when the lock is released.

9. A glass grinding machine comprising a head stock, a horizontal spindle slidably and rotatably mounted therein, a driving shaft, and interposed gearing for alternately moving the spindle forward and back and rotatively, a carrier secured to the spindle, a shaft rotatively mounted on the carrier at right angles to the spindle, a clamping mechanism mounted on the shaft, and means dependent upon the revolutionary movement of the carrier about the spindle as an axis for producing step by step rotative movements of the shaft on its axis, and for slowly advancing a stop into position to bring the machine automatically to rest.

10. A glass grinding machine comprising a grinding wheel, a carrier, means for moving the carrier toward and from the wheel, and means dependent upon its engagement with the surface of the glass for automatically preventing further advance of the carrier to determine the depth of the grind.

11. A glass grinding machine comprising a grinding wheel, a carrier rotatable about an axis at right angles to the axis of the grinding wheel, means for automatically moving the carrier radially toward and from the center of the wheel between rotative movements thereof, and means dependent upon its engagement with the surface of the glass for automatically determining the depth of the grind relative to said surface.

12. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, and a clamping mechanism mounted on the shaft, and means for automatically moving the spindle to and from the wheel for producing rotative adjustments of the spindle between the longitudinal movements thereof, and means for automatically arresting the forward movement of the spindle to determine the depth of the cut.

13. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, a clamping mechanism mounted on the shaft, means for automatically producing a rotative movement of the clamping mechanism at each revolution of the spindle, and means for automatically arresting the forward movement of the spindle to determine the depth of the cut.

14. A glass grinding machine comprising a grinding wheel, a carrier, means for moving the carrier toward and from the wheel, a finger adjacent to the cutting edge of the wheel and adapted to be engaged by the surface of the glass being cut, and means responsive to said finger for stopping the advancement of the carrier.

15. A bell crank lever, a yielding finger on one arm of the lever extending adjacent to the cutting surface of the wheel and adapted to be engaged by the surface of the glass close to the cut, and a stop automatically actuated by the bell crank lever

for preventing advancement of the carrier toward the wheel.

16. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, and a clamping mechanism mounted on the shaft, and means for automatically moving the spindle to and from the wheel and for producing rotative adjustments of the spindle between the longitudinal movements thereof, removable means attached to the spindle for determining the number and position of the cuts produced by each rotation of the carrier about the axis of the spindle.

17. A glass grinding machine comprising a base, a grinding wheel mounted thereon, a head stock mounted on the same base, a spindle rotatably and slidably supported by the head stock, a support secured to the spindle, a shaft rotatably mounted on the support at right angles to the axis of the spindle, and a clamping mechanism mounted on the shaft, and means for automatically moving the spindle to and from the wheel and for producing rotative adjustments of the spindle between the longitudinal movements thereof, a notched disk removably attached to the spindle, a latch adapted to engage the notched disk to hold the spindle against rotation, and means dependent upon a forward and back movement of the spindle for releasing the latch to permit a rotative adjustment of the spindle and carrier.

18. A glass grinding machine comprising a grinding wheel, a head stock, a horizontal spindle slidably and rotatably mounted therein, a driving shaft, a cam shaft geared to the driving shaft, a plurality of cams on said shaft, means for locking the spindle, means dependent upon one of the cams for releasing the spindle, a pawl coöperating with a second cam adapted to move the spindle backwardly, a spring tending to press the spindle forwardly, means influenced by the cam for intermittently producing rotative movements of the spindle when the lock is released, removable means attached to the spindle for determining the rotative movements thereof.

19. A glass grinding machine comprising a grinding wheel, a head stock, a horizontal spindle slidably and rotatable mounted therein, a driving shaft, a cam shaft geared to the driving shaft, a plurality of cams on said shaft, a notched disk removably attached to the spindle, a latch coöperating therewith to lock the spindle, means dependent upon one of the cams for releasing the spindle, a pawl coöperating with a second cam adapted to move the spindle backwardly, a spring tending to press the spindle forwardly, and means influenced by the cam for intermittently producing rotative movements of the spindle when the lock is released.

20. A glass grinding machine comprising a grinder, a holder for the glass, means for bringing the glass into contact with the grinder, and means dependent upon making contact with the surface of the glass for stopping the advance of the glass holder at a predetermined depth of grind relative to the adjacent surface of the glass.

21. A glass decorating machine comprising a tool, a spindle, a carrier associated therewith, and a work holder associated with the carrier and adapted to be rotatively adjusted on an axis at an angle to the axis of the spindle, said carrier being movable to carry the work holder toward and from the tool.

In testimony whereof I have hereunto set my hand this 29th day of August, 1914, in the presence of two subscribing witnesses.

EDWARD A. RYON.

Witnesses:
R. J. DEARBORN,
ANNA T. RYON.