No. 704,348. Patented July 8, 1902.

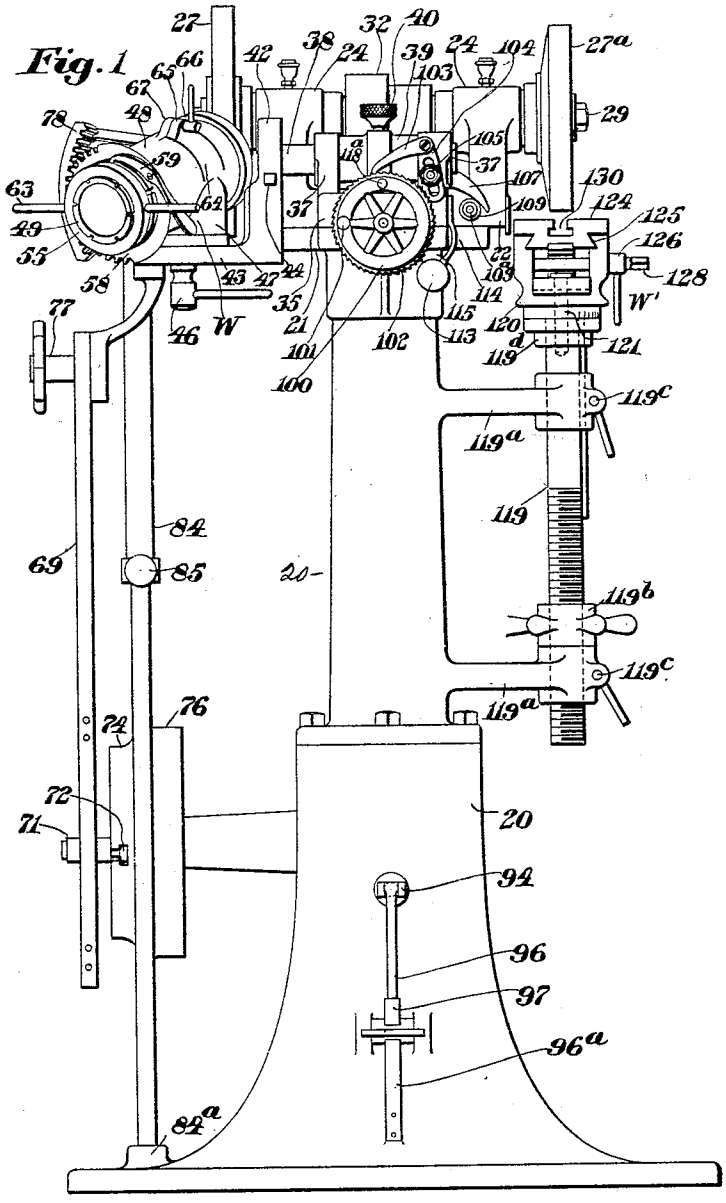
J. N. LAPOINTE.

GRINDING MACHINE.

(Application filed Jan. 3, 1902.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1



Witnesses:

Nathan C. Lombard 2nd.

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Inventor:

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by Lombard & Cobb.

Attys.

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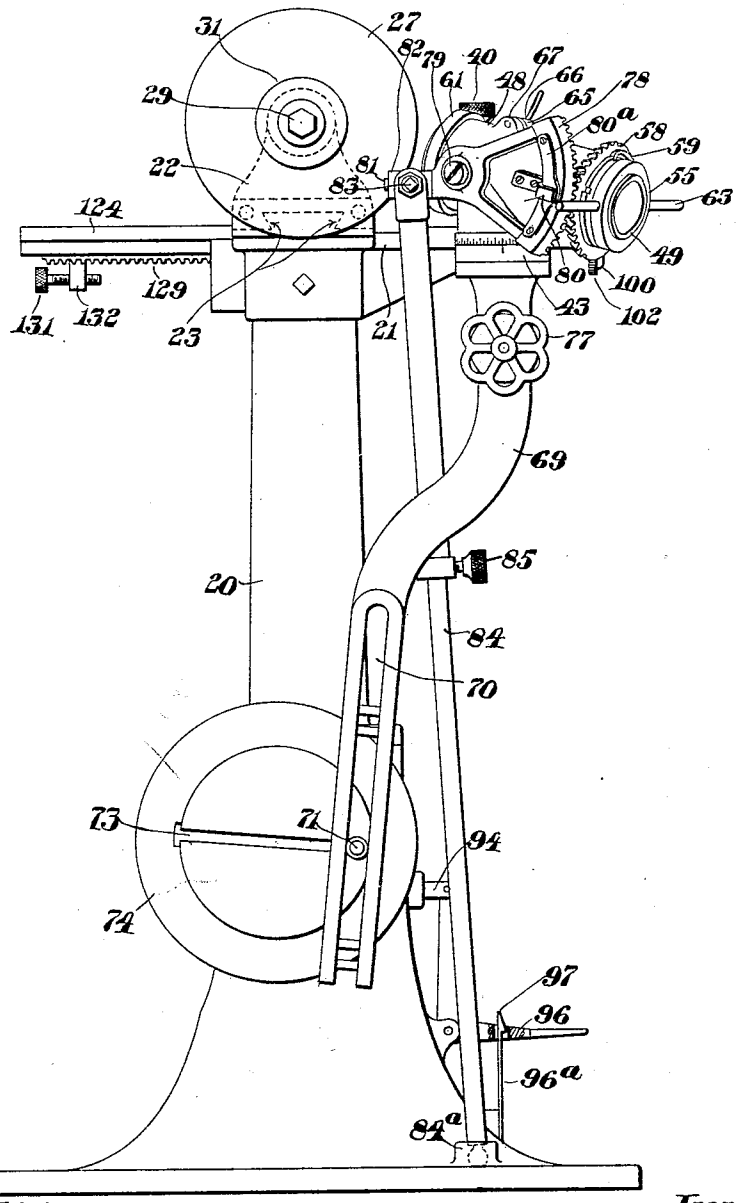
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GRINDING MACHINE.

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(No Model.) 7 Sheets—Sheet 2.

Fig. 2



Witnesses:

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(No Model.) 7 Sheets—Sheet 3.

Fig. 3.

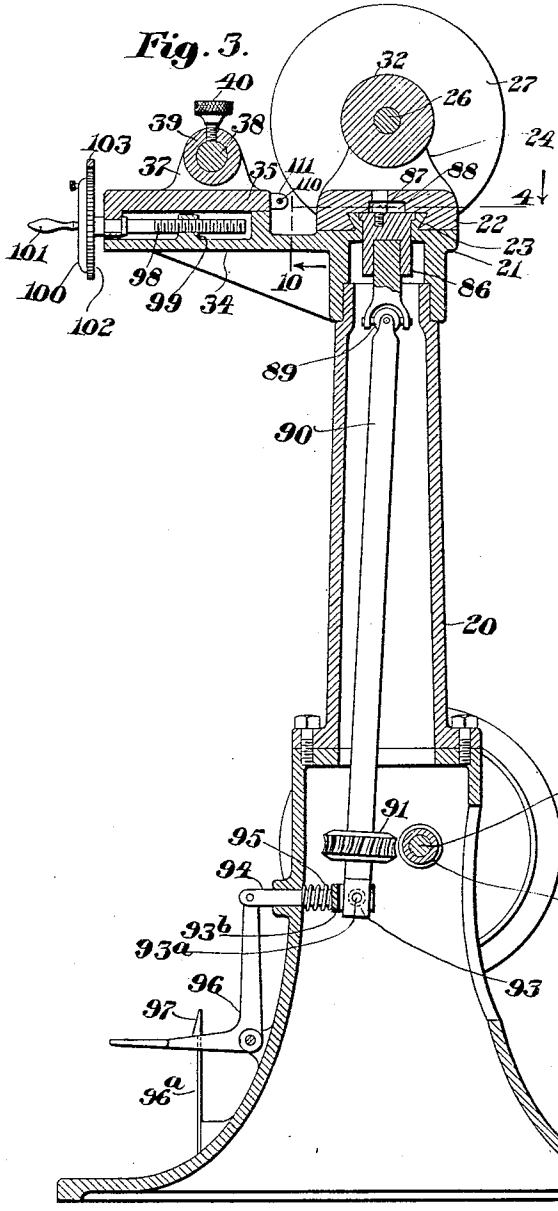
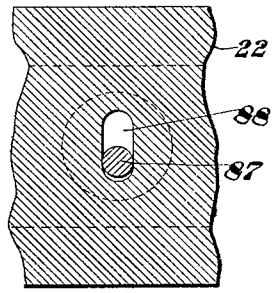


Fig. 4.



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Fig. 6

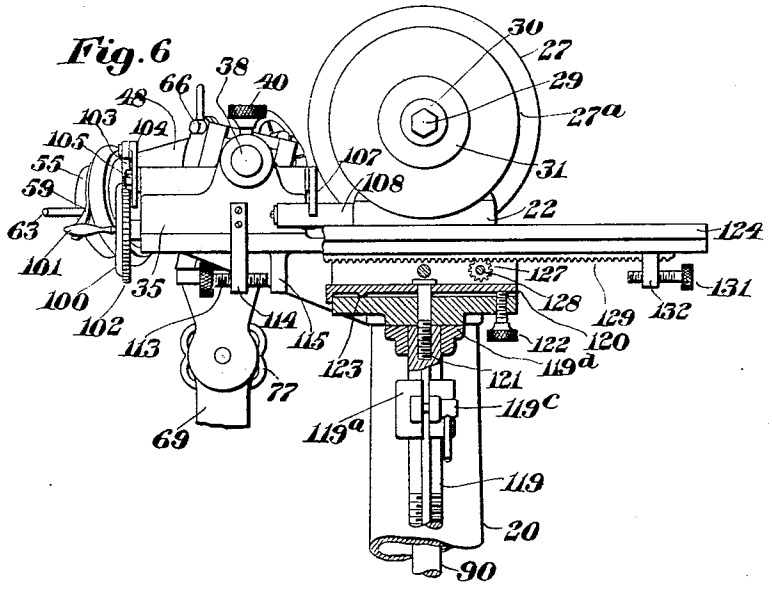
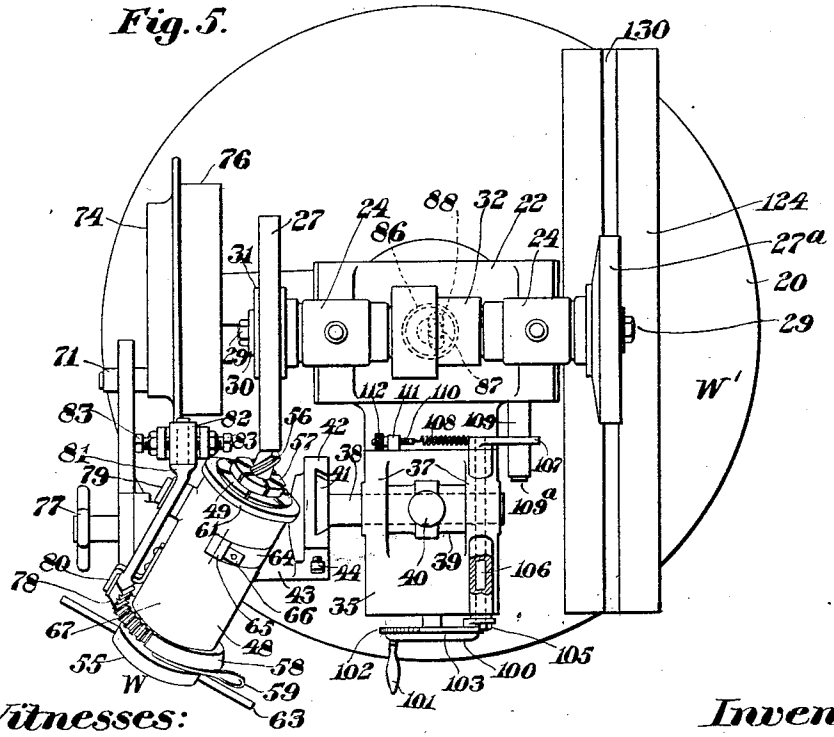


Fig. 5.



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Fig. 7.

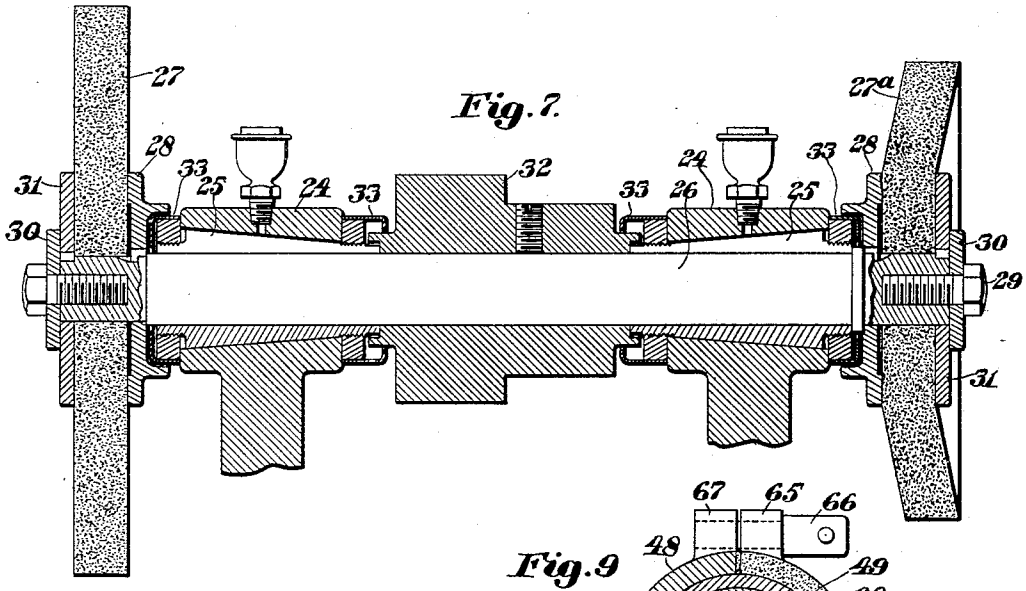


Fig. 9

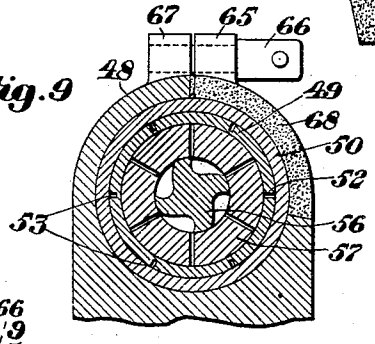


Fig. 8.

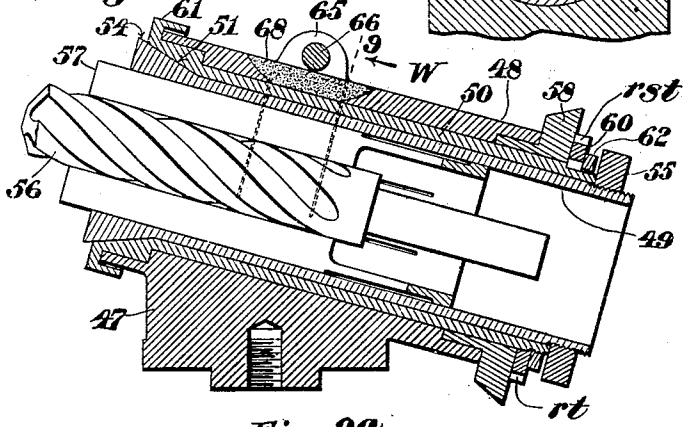
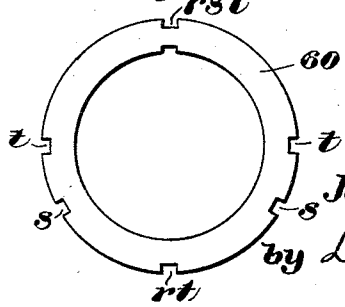


Fig. 9a



Witnesses:

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No. 704,348 Patented July 8, 1902.

J. N. LAPOINTE.

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Fig. 10.

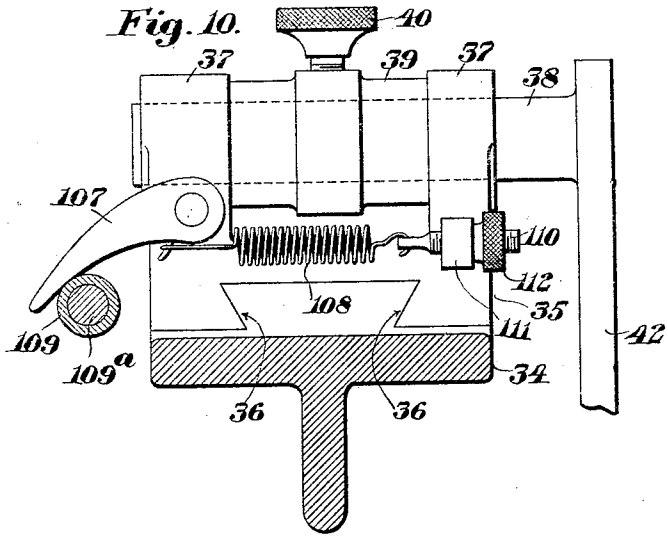


Fig. 11.

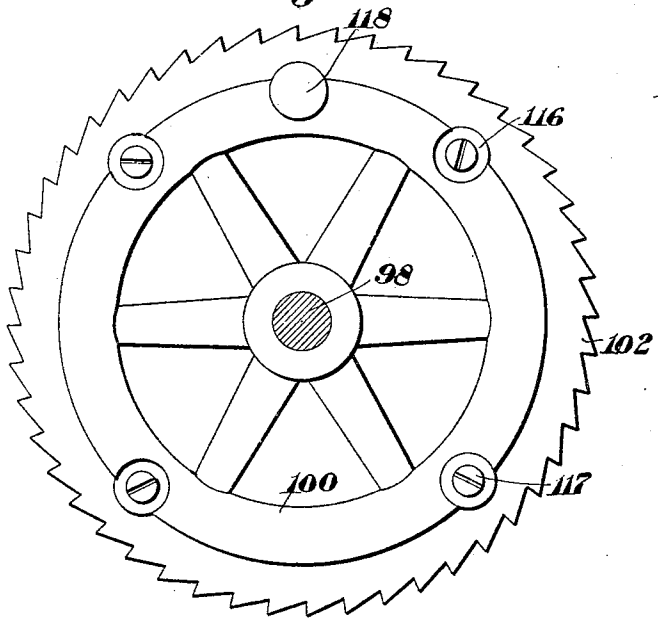
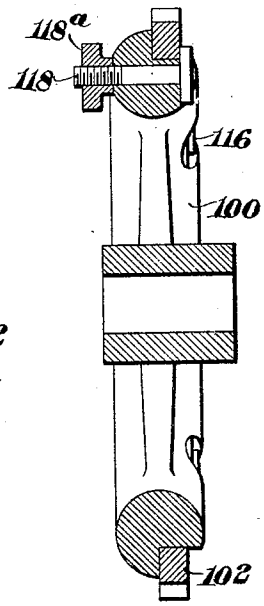


Fig. 12.



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GRINDING MACHINE.

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(No Model.) 7 Sheets—Sheet 7.

Fig. 13.

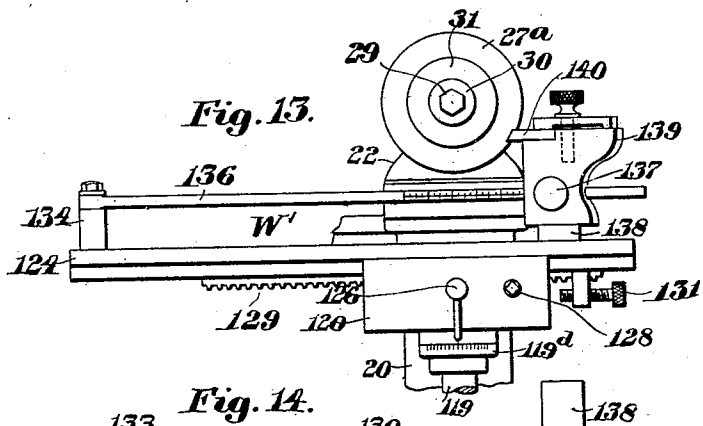


Fig. 14.

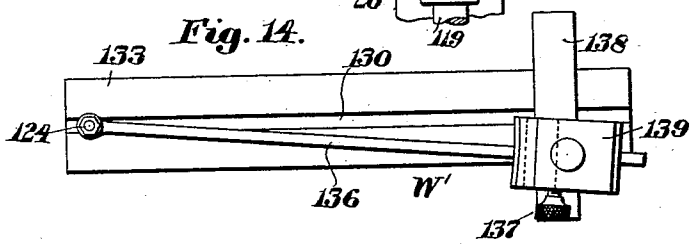


Fig. 16

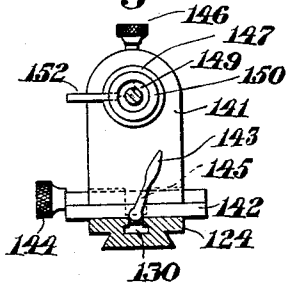


Fig. 15.

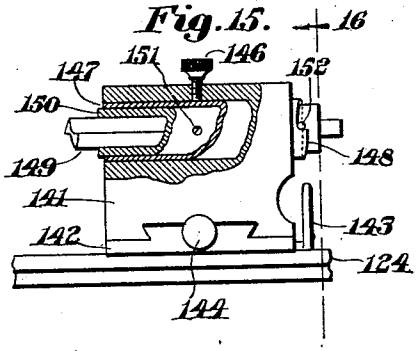
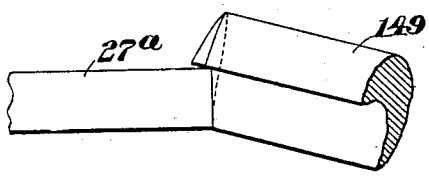


Fig. 17.



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UNITED STATES PATENT OFFICE.

JOSEPH N. LAPOINTE, OF HYDEPARK, MASSACHUSETTS.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 704,348, dated July 8, 1902.

Application filed January 3, 1902. Serial No. 88,312. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH N. LAPOINTE, a citizen of the United States of America, and a resident of Hydepark, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

My invention relates to grinding-machines, and more particularly to those adapted for the grinding of drills and other cutting-tools, having for its objects the various features hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a front elevation of one embodiment of my invention. Fig. 2 is a side elevation thereof looking from the left in Fig. 1. Fig. 3 is a substantially central vertical transverse section thereof. Fig. 4 is a broken sectional detail on the line 4 of Fig. 3. Fig. 5 is a top plan view of the machine. Fig. 6 is a side elevation of the upper portion looking from the right in Fig. 1, parts being broken away and in section. Fig. 7 is a central vertical longitudinal section through the upper portion of the grinding-head. Fig. 8 is a central vertical longitudinal section through the work-holder. Fig. 9 is a transverse section thereof on the line 9 of Fig. 8. Fig. 9ª is an enlarged detail in elevation of the index-collar. Fig. 10 is sectional detail in elevation on the line 10 of Fig. 3. Fig. 11 is a rear elevation of the ratchet-wheel. Fig. 12 is a central vertical transverse section thereof. Fig. 13 is a side elevation of a form of supplementary work-holder. Fig. 14 is a top plan view thereof. Fig. 15 is a side elevation, parts being broken away, of still another form of work-holder. Fig. 16 is a transverse vertical section thereof on the line 16 of Fig. 15, and Fig. 17 is a diagrammatic view of a single-lip drill in coaction with a grinding-wheel. All sections are taken in the direction indicated by the arrows.

Similar characters indicate like parts throughout the several figures of the drawings.

The numeral 20 designates a suitable standard or column, at the upper end of which is mounted a table 21, carrying the grinding members, a work-holder, and the elements more directly associated therewith.

A head 22, preferably movable upon ways 23 for a purpose to be later described, is formed with bearings 24 24, in which may be journaled the cones 25 of a shaft 26. This shaft carries grinding members or wheels 27 27ª, of emery or any suitable abrasive material, here shown as two in number, one being located at each end of the shaft. They may be secured to the shaft by being forced against plates 28, fast thereon by bolts 29, taking into the end of the shaft, the heads of which or washers 30 beneath said heads may in turn force plates 31, splined upon the shaft, to prevent rotation against the wheels. This arrangement permits the grinding members to be rotated in either direction without danger of loosening them by the unscrewing of the securing-bolts. The shaft 26 is driven at the desired speed by a stepped pulley 32, conveniently situated between the bearings. Dust-guards 33 are preferably provided at all points where grit may be liable to enter the bearings.

Upon a forward projection 34 from the table is supported a carriage 35, preferably sliding upon ways 36, which carriage has journaled upon it in bearings 37 37 a shaft 38, retained against longitudinal movement by a sleeve 39, occupying the space between the bearings, made fast upon the shaft to permit the adjustment of the latter by a set-screw 40. At the end adjacent to the wheel 27 this shaft is provided with a squared and beveled plate or head 41, shown as fitting within the dovetail ways of a support comprising an arm 42 and a table 43, extending in a plane substantially parallel to the shaft 38. The support may be retained in place upon the shaft-head by a set-screw 44, threaded through the former and engaging the latter.

Upon the upper side of the table is supported a work-holder W, which may be turned thereon and adjustably held in position by a clamping-screw 46, passing through the table and threaded into the work-holder, its angular position being indicated by a scale and index upon the work-holder and support. The outer element of the work-holder may consist of a standard 47, resting upon the table, and a substantially cylindrical casing 48, inclined to said standard. Within the casing is situated a clamping device or chuck

consisting in the present instance of an inner and outer sleeve 49 and 50, respectively, the latter of which is journaled within the casing and provided with a beveled inner wall at 51, while the inner sleeve may be made yielding by being longitudinally divided at 52 and slotted along various lines 53 and have a beveled wall 54, coacting with the outer wall 51. The sleeve 49 is preferably threaded at the opposite end from the bevel and carries a threaded collar 55, bearing against the end of the sleeve 50. By tightening this collar the chuck may be clamped upon the work or tool to be ground, which is here shown as a twist-drill 56, held within a suitable split bushing 57. The chuck is provided with teeth by having about it, conveniently bearing upon its sleeve 50, a bevel-gear 58, here shown as mutilated, which may carry a pivoted detent 59. Beside the gear splined upon the sleeve 50 is an index-collar 60, provided with a plurality of sets of notches adapted to be engaged by the detent and here shown as three in number, separated, respectively, by one hundred and eighty and one hundred and twenty and ninety degrees and indicated by *r s t*, there preferably being one notch, (shown as that at the top,) which is common to all the sets. An angular flange 61 upon the inner end of the sleeve 50 prevents downward movement of the chuck and excludes dust, while a threaded collar 62 at the other end retains the gear and index-collar in place and secures the chuck against movement in the opposite direction. The collar 55 may be provided with arms 63, which may be grasped by the operator to allow him to exert sufficient force to properly draw the parts of the chuck together and clamp the work within it and to hold said chuck against rotation in the casing and prevent undue strain upon its gearing while this is being done. The casing is slit to form a movable section 64, having an ear 65, through which passes a screw 66, threaded into an opposite ear 67 on the casing. The drawing of these ears together by the screw forces the section against the sleeve 50 and prevents the rotation of the chuck. Packing 68 is interposed between the adjacent edges of the movable section and casing to prevent the entrance of dust.

To secure a movement of the work-holder which will give the proper backing off to the face of the drill or tool which is being acted upon by the grinding-wheel to obtain the necessary clearance, means are provided for automatically oscillating the holder toward and from the wheel. This is effected by swinging the supporting-shaft 38 in its bearings conveniently by a connector or arm 69, secured at its upper end to the under side of the table and slotted at 70, this slot being engaged by a projection or pin 71, adjustably mounted upon a bolt 72, having its head within a T-slot 73 across the face of a driver or wheel 74. The wheel is carried by a driving-shaft 75, journaled in the column, and may be provided with a belt-surface at 76, by which it may be continuously rotated from any suitable source of power. The arm 69 is preferably made in two parts pivoted together by a clamping-screw 77, which secures them at any desired angle relatively to one another.

To enable the grinding-wheel to act over an entire face of a drill, a portion of the work-holder is given an oscillatory movement of rotation, in this instance the chuck being turned in its casing. For this purpose a toothed member or segmental bevel-gear 78, meshing with the gear 58 upon the chuck, is pivoted to the casing upon a stud 79 and may be held against springing away from the gear by a guard-arm 80, secured to the casing, extending over the segment and contacting with a wearing-plate 80^a, fastened thereto. From the segment to the rear of the stud extends an arm 81, upon which is shown mounted a sliding sleeve 82, pivotally connected by screws 83 with the divided upper end of a connector or rod 84, thus forming a universal joint therewith. The lower end of the rod is connected by a second universal joint 84^a, here shown as of the ball-and-socket type, to a fixed point, as the foot of the column. This connector controls or restricts the movement of the segment, and it is evident that as the work-holder oscillates under the influence of the driver there must be relative movement between the intermeshing gear and segment, the former moving past the latter, thus compelling the rotation of the chuck, to which the gear is connected by the detent. The point of initial engagement of the gear and segment is controlled by making the rod 84 in two parts, one of which may be telescoped within the other and be adjustably secured together by a set-screw 85.

It will be noted that the holder may be so positioned, and is so illustrated in the drawings, that the tool to be ground is held with its axis at an acute angle both to vertical and horizontal planes passing through a point of contact of the tool and grinding-surface. With such a relation of parts it is evident that, if desired, in certain classes of tools—as twist-drills, for example—upon properly moving the holder toward and from the grinding-surface, preferably in a curved path, as shown, an entire face may be traversed over said surface by the bodily movement of the holder at the same time the backing off is secured without imparting independent rotation.

To cause the entire edge of the grinding-wheel to act upon the work, and thus prevent grooving and the necessity of redressing the grinding-surface, the wheel and work-holder are moved laterally relatively to one another. As shown, the grinding-head is reciprocated upon the ways 23 by means of an operating or crank member 86, journaled between the ways and provided with an eccentric projection or crank-pin 87, entering a

slot 88 in the under side of the head extending transversely of the ways. The crank member is conveniently connected by a universal or double-trunnion joint 89 with a connector or shaft 90, upon which is fixed a worm-wheel 91, capable of meshing with a worm 92 upon the driving-shaft 75. This mechanism causes a comparatively slow automatic reciprocation of the grinding-wheel across the tool being operated upon. At times, as when the wheel 27^a is in use, this reciprocatory movement of the wheels may not be desired, and means is therefore provided for throwing this mechanism into or out of operation. The lower end of the shaft 90 may be journaled in a collar 93, pivotally supported upon the points of screws 93^a in a yoke 93^b upon the end of a shifting rod 94, sliding in a bearing in the column and encircled by a spiral spring 95, which serves to normally force the worm-wheel into engagement with the worm. To throw these parts out of engagement, and thus check the rotation of the crank member, an angle-lever 96 is pivoted to the outside of the column near its foot, which is in turn articulated at its upper end to the shifting rod and conveniently provided at its outer lower end with a treadle. When the foot of the operator is applied to this treadle, the lever will draw out the shifting rod, carrying the worm-wheel out of engagement with the worm. To retain the angle-lever in this position, a spring lock or latch 96^a may be provided, the enlarged head 97 of which passes through a recess or opening in the lever and coacts with its upper side. It may be readily released by an inward pressure of the operator's foot.

In addition to the above movements it is necessary to secure the gradual feed or advance of the work-holder toward the grinding member to obtain the proper reduction of the surface which is to be ground. For this purpose a feed-screw 98, turning in the front of the carriage 35, is threaded through a lug 99, extending from the projection 34 of the table and situated between the ways 36. The end of the screw toward the operator is preferably provided with a wheel 100 and handle 101 by which a manual advance or withdrawal of the carriage may be secured. To effect a gradual automatic feed, the wheel is provided at its edge with a rim 102, formed with the ratchet-teeth which are engaged by a ratchet 103, pivoted to an arm 104. The arm has a slot through which it is secured by a bolt 105 to the end of a shaft 106, journaled in the carriage. To the opposite end of this shaft is fixed an actuating member or finger 107, forced by a spring 108 against an extended contact member or roll 109, turning upon a stud 109^a, projecting from the grinding-head in a direction substantially parallel to the side of the carriage. The spring is conveniently secured to the end of a screw 110, which passes freely through a hole in a lug 111, projecting from the carriage and adjustably retained in position by a nut 112 to allow variation in the tension of the spring. The relation of the contact-roll, actuating-finger, and ratchet mechanism is such that while the grinding-head is moving toward the finger the contact-roll raises it and through the connecting-shaft moves the ratchet rearwardly over the ratchet-teeth. Then as the head travels in the opposite direction the roll retreats from the finger and the spring exerts its tension to force the ratchet against the teeth, and thus turn the wheel and feed-screw, which advances the carriage and work-holder toward the grinding-wheel. This feed continues until the end of an adjustable stop-screw 113, carried by a bracket 114, projecting from the side of the carriage, contacts with some relatively fixed member, as a lug 115, depending from the under side of the table 22, immediately arresting the motion of the carriage, the spring holding the ratchet against a tooth and the finger remaining out of operative contact with the roll. A safety device may also be provided to prevent undue strain upon any part by mounting the rim 102 on the ratchet-wheel to turn in an annular recess thereon, it being retained in place by washers 116 beneath the heads of screws 117, which take into the wheel. To readily adjust the degree of frictional engagement between the parts, a bolt 118, with a thumb-nut 118^a, may be provided, which may be drawn against the ratchet-rim. Obviously if the pull upon the ratchet becomes heavy enough the rim will be caused to slip upon the wheel.

In using the machine to grind a drill or like tool having a plurality of cutting-lips the operator places it in a bushing of suitable size and clamps it in the chuck of the work-holder with the faces to be ground extending into proximity with the grinding-wheel 27. The detent being in engagement with the notch designated by *r s t* upon the index-collar the end of the drill may be adjusted to any desired position, laterally of the wheel by the set-screw 40, vertically by the set-screw 44, angularly by the clamping-screw 46, while the initial point of grinding upon the face may be controlled by the screws 77 and 85 of the connector arm and rod. The position of the projection 71 is so adjusted as to give such a movement of the work-holder toward the grinding-wheel as to secure the necessary clearance of the face, the ratchet upon the bolt 105 to effect its desired throw and consequent feed of the carriage for each traverse of the grinding-head, and the stop-screw positioned to permit the requisite depth of grinding. The worm-gearing is placed in engagement by the treadle and there locked by its latch. The grinding-wheel and driver are now started and the whole grinding of a face is completed without any attention from the operator being necessary, the compound movement of oscillation of the work-holder, the components of which are its movement of

translation in the arc of a circle about the shaft 38 as an axis and the oscillatory movement of rotation of the chuck within its casing, repeatedly moving the tool automatically in exactly the proper path to grind over the surface of an entire face with the correct clearance. At the same time the grinding-wheel is automatically moved laterally of the work, which is fed slowly toward it by the automatic travel of the carriage and stopped when a sufficient amount of material has been ground off. This having been accomplished it is only necessary for the operator to throw out the ratchet 103, run the carriage back by turning the handle 101, and set the work-holder detent in the proper notch in the index-ring according to the number of faces upon the tool to be ground, when upon the ratchet again being put into coaction with the ratchet-wheel the operation will be automatically repeated.

To extend the field of usefulness of the machine and permit the grinding of objects which could not be conveniently handled by the work-holder W, a second work-holder W' is shown in proximity to the grinding-wheel 27^a. This consists of a vertical rod 119 conveniently sliding in a split bearing in brackets 119^a, extending from the column and splined therein to prevent rotation. A portion of the rod is threaded and may be raised or lowered by turning a nut 119^b, contacting with one of the brackets and clamped in position by screws 119^c, serving to draw the portions of the bracket-bearings together. The upper end of the rod may have a cylindrical enlargement or head 119^d, provided with an index-mark, and upon this turns a bed 120, having a scale moving over the index and retained in place by a central retaining-screw 121, and as the head of the screw 121 is located in a somewhat inaccessible position between the bed and a table, to be later described, it is shown as locked in position by a set-screw 122 at one side of the head 119^d. This set-screw acts to force the bed against the head of the screw 121, moving it about a projection or fulcrum-boss 123, resting upon the upper face of the head 119. Upon the head is supported a table 124, sliding in ways 125, a clamping-screw 126 being provided to draw the ways against the table and secure it in place. Below the table between the ways is a pinion 127, fast upon a shaft 128, journaled in the bed, which pinion meshes with a rack 129, extending longitudinally of the table, and upon turning the shaft by a crank or wrench applied to the squared head the table may be moved under the grinding-wheel in either direction. Work upon which surface-grinding is to be done may be bolted to a T-slot 130 in the table and may be adjusted to any desired angle horizontally by turning the bed upon the supporting-rod. A stop-screw 131 is threaded through a lug 132, depending from the table, and contacts with the end of the bed to adjustably limit the movement of the work.

For convenience in grinding such tools as crowning cutters having a cutting edge curved on the arc of a circle a table is shown in Figs. 13 and 14 having a post 134, clamped in the T-slot. Upon this post is pivoted a bar 136, suitably graduated and in the present instance adjustably secured to the bar by a set-screw 137, and sliding upon a transverse supporting-bar 138 is a work-holder 139, in which a cutter 140 is shown as clamped. By adjusting the table upon the bed and the holder upon the table any desired arc of movement of the cutter to be operated upon may be secured within proper limits, the holder-bar being swung by the operator upon its pivotal point back and forth across the grinding-wheel and being fed theretoward by the rack and pinion.

To permit the grinding of single-lip drills, another form of supplementary work-holder is illustrated in Figs. 15 and 16, consisting of a stock 141, mounted upon a plate 142, clamped in the slot of the table by a screw, only the operating-lever 143 of which is shown. The stock may be adjusted transversely of the table by a screw 144 turning therein and threaded through a depending lug 145. In a bore through the stock, secured in place by a set-screw 146, is a sleeve 147, bearing upon the end farthest from the grinding-wheel, a cam-face 148 corresponding to the curve of the face of a drill, such as 149, shown, diagramatically, in Fig. 17 in contact with the wheel. Within the sleeve is journaled a bushing 150, in which the drill may be clamped by a set-screw 151 and having a rod 152, projecting substantially at right angles, adapted to coact with the cam-face. This arrangement permits the operator by turning the rod over the cam to move the entire face of the drill over the grinding-wheel, said drill being at the proper time advanced by the table-feed previously described. For the sleeve 147 others may be substituted, if desired, having cam-faces of different contour to obtain any desired clearance curve of the drill-face.

It will be seen that my improved grinding-machine, while exceedingly compact, taking up but slight floor-space, is capable of a wide range of use, being applicable not only to the grinding of drills of all types with an absolute mechanical exactness not obtainable in a manually-operated machine, but also to the grinding of various other cutting-tools and to surface work.

Having thus described my invention, I claim—

1. In a grinding-machine, the combination with a grinding member, of a work-holder, and automatic means for imparting a compound movement to the work-holder consisting of a bodily oscillation and an oscillatory rotation.

2. In a grinding-machine, the combination

with a grinding member, of a work-holder, and automatic means for simultaneously imparting a movement of translation and an oscillatory movement of rotation to the work-holder.

3. In a grinding-machine, the combination with a grinding member, of a work-holder, and automatic means for simultaneously imparting a movement of translation in a curved path and a movement of rotation to the work-holder.

4. In a grinding-machine, the combination with a grinding member and a work-holder, of means for laterally moving the grinding member and work-holder relatively to one another, and automatic means for imparting a compound movement to the work-holder.

5. In a grinding-machine, the combination with a grinding member and a work-holder, of means for moving the grinding member laterally of the work-holder, and automatic means for imparting a compound movement to the work-holder.

6. In a grinding-machine, the combination with a grinding member and a work-holder, of automatic means for moving the grinding member laterally of the work-holder, and automatic means for imparting a compound movement to the work-holder.

7. In a grinding-machine, the combination with a grinding member and a work-holder, of means for securing a feeding movement of the grinding member and work-holder toward and from one another, and automatic means for imparting a compound movement to the work-holder.

8. In a grinding-machine, the combination with a grinding member and a work-holder, of automatic means for feeding the work-holder toward the grinding member, and automatic means for imparting a compound movement to the work-holder.

9. In a grinding-machine, the combination with a grinding member and a work-holder, of automatic means for moving the grinding member laterally of the work-holder, and means for simultaneously imparting a compound movement to the work-holder and a feeding movement toward the grinding member.

10. In a grinding-machine, the combination with a grinding member, of a work-holder, automatic means for imparting a compound movement to the work-holder, and adjusting means whereby any component of the compound movement may be varied.

11. In a grinding-machine, the combination with a rotary grinding member, an oscillatory work-holder and a continuously-operative driver, of means connected with the driver for moving the grinding member laterally of the work-holder, and a throw-out device between the moving means and driver.

12. The combination with a grinding member, of a work-holder mounted for a bodily movement of oscillation, a continuously-operative driver, and a connector between the driver and work-holder.

13. The combination with a grinding member, of a work-holder mounted for a bodily movement of oscillation, a continuously-operative driver, and an adjustable connector between the driver and work-holder.

14. The combination with a grinding member, of a work-holder mounted for a bodily movement of oscillation, a continuously-operative driver, a connector between the driver and work-holder, and means for varying the point of connection between the driver and connector.

15. The combination with a grinding member, of a work-holder mounted for a bodily movement of oscillation, a continuously-operative driver, a two-part connector between the driver and work-holder, and means for varying the angle between the parts of the connector.

16. The combination with a grinding member, of an oscillatory work-holder, and means mounted upon the work-holder for imparting to an oscillatory portion thereof a movement of rotation.

17. The combination with a grinding member, of an oscillatory work-holder, and means pivoted upon the work-holder and connected to a fixed point for imparting to a portion of said work-holder a movement of rotation.

18. The combination with a grinding member, of a casing, a clamping member provided with teeth and rotatably mounted in the casing, a gear turning upon the casing and meshing with the teeth of the clamping member, and means for controlling the movement of the gear.

19. The combination with a grinding member, of a casing, a clamping member provided with teeth and rotatably mounted in the casing, a gear turning upon the casing and meshing with the teeth of the clamping member, and a connector between the gear and a fixed point.

20. The combination with a grinding member, of a casing, a clamping member provided with teeth and rotatably mounted in the casing, a gear turning upon the casing and meshing with the teeth of the clamping member, and an adjustable connector between the gear and a fixed point.

21. The combination with a grinding member, of a casing, a clamping member provided with teeth and rotatably mounted in the casing, a gear turning upon the casing and meshing with the teeth of the clamping member, a two-part connector between the gear and a fixed point, and means for varying the length of the connector.

22. The combination with a grinding member, of a casing, a clamping member provided with teeth and rotatably mounted in the casing, a gear turning upon the casing and meshing with the teeth of the clamping member, a guard-arm fixed to the casing and extending

over the gear, a wearing-plate interposed between the guard-arm and gear, and means for controlling the movement of the gear.

23. The combination with a grinding member, of an oscillatory support, a work-holder mounted thereon, means for adjusting the angle of the work-holder with the grinding member, and means for rotating a portion of the work-holder.

24. The combination with a grinding member, of an oscillatory support, a work-holder mounted thereon, the work-holder and support being provided with a suitable scale and index, means for clamping the work-holder in the desired position, a continuously-operative driver, and a connector between the driver and work-holder.

25. The combination with a grinding member, of a casing, a rotatable clamping member mounted in the casing, and a gear for rotating the clamping member, said gear and clamping member being provided with detent mechanism for determining their relative position.

26. The combination with a grinding member, of a casing, a rotatable clamping member mounted in the casing and provided with notches, a gear for rotating the clamping member, and a detent upon the gear for engaging the notches.

27. The combination with a grinding member, of a casing, a rotatable clamping member mounted in the casing and provided with a plurality of sets of notches one notch of which is common to all the sets, a gear for rotating the clamping member, and a detent upon the gear for engaging the notches.

28. The combination with a grinding member, of a work-holder, means for continuously oscillating the work-holder toward and from the grinding member, and means for intermittently moving the work-holder toward the grinding member.

29. The combination with a movable grinding member, of a carriage, a work-holder mounted upon the carriage, and means whereby the movement of the grinding member causes an advance of the carriage.

30. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, an actuating member moving with the carriage, and ratchet mechanism connecting the feed-screw and actuating member.

31. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a spring-pressed actuating member moving with the carriage, a contact member with which the actuating member coöperates, and ratchet mechanism connecting the feed-screw and actuating member.

32. The combination with a movable grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a spring-pressed actuating member moving with the carriage, an elongated contact member moving with the grinding member with which the actuating member coöperates, and ratchet mechanism connecting the feed-screw and actuating member.

33. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a spring-pressed actuating member moving with the carriage, a contact member with which the actuating member coöperates, and ratchet mechanism connecting the feed-screw and actuating member and operating under the action of the spring to turn the feed-screw.

34. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, an actuating member moving with the carriage, and adjustable ratchet mechanism connecting the feed-screw and actuating member.

35. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, an actuating member moving with the carriage, ratchet mechanism connecting the feed-screw and actuating member in which slip is permitted, and a stop with which the carriage may coact.

36. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, an actuating member moving with the carriage, ratchet mechanism connecting the feed-screw and actuating member in which slip is permitted, a stop with which the carriage may coact, and means for adjusting the position of the stop.

37. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a shaft journaled in the carriage, a finger fixed to the shaft, a movable roll with which the finger contacts, a ratchet mounted upon the shaft, and a ratchet-wheel upon the feed-screw which is engaged by the ratchet.

38. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a shaft journaled in the carriage, a finger fixed to the shaft, a contact member with which the finger coacts, a ratchet mounted upon the shaft, and a two-part ratchet-wheel upon the feed-screw which is engaged by the ratchet, said ratchet-wheel having a connection between the parts permitting them to slip relatively to one another.

39. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a shaft journaled in the carriage, a finger fixed to the shaft, an elongated contact-roll with which the finger

coacts, a spring serving to hold the finger against the roll, a ratchet mounted upon the shaft, and a ratchet-wheel upon the feed-screw which is engaged by the ratchet.

40. The combination with a grinding member, of a movable carriage, a work-holder mounted upon the carriage, a feed-screw for advancing the carriage, a shaft journaled in the carriage, a finger fixed to the shaft, an elongated contact-roll with which the finger coacts, a spring serving to hold the finger against the roll, means for adjusting the tension of the spring, a ratchet mounted upon the shaft, and a ratchet-wheel upon the feed-screw which is engaged by the ratchet.

41. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, a casing mounted upon the support, a clamping device carried by the casing, and means connected with the support for rotating the shaft.

42. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, and means for adjusting the point of attachment of the support to the shaft.

43. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, and means for varying the position of the shaft whereby the support may be adjusted laterally of the grinding member.

44. The combination with a grinding member, of a rotatable shaft, an arm fixed to the shaft, a table extending from the arm substantially parallel to the shaft, a casing mounted upon the table, a clamping device carried by the casing, and means connected with the support for rotating the shaft.

45. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, a casing mounted upon the support, a clamping device carried by the casing, a driving-wheel, and a rod connecting the support and driving-wheel.

46. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, a casing mounted upon the support, a clamping device carried by the casing, a driving-wheel provided with a projection, and a rod connected with the support and provided with a slot adapted to receive the projection.

47. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, a casing mounted upon the support, a clamping device carried by the casing, a driving-wheel provided with an adjustable projection, and a rod connected with the support and provided with a slot adapted to receive the projection.

48. The combination with a grinding member, of a rotatable shaft, a support fixed to the shaft, a casing mounted upon the support, a clamping device carried by the casing, a driving-wheel, a rod connecting the support and driving-wheel formed in two parts pivotally joined together, and means for clamping the parts together.

49. The combination with a grinding member, of a work-holder comprising a casing, a clamping device rotatably mounted in the casing, gearing for rotating the clamping device, and means carried by the casing for securing the clamping device against rotation when desired.

50. The combination with a grinding member, of a work-holder comprising a casing provided with a movable section, a clamping device rotatably mounted in the casing, gearing for rotating the clamping device, and a screw for forcing the movable section against the clamping device.

51. The combination with a grinding member, of a work-holder comprising a casing provided with a movable section, a clamping device rotatably mounted in the casing, gearing for rotating the clamping device, a screw for forcing the movable section against the clamping device, and packing interposed between the adjacent edges of the movable section and the casing.

52. The combination with a work-holder, of a grinding-head movably mounted in proximity thereto and provided at its under side with a slot, an operating member journaled beneath the head and provided with an eccentric projection extending into the slot, and means for rotating the operating member.

53. The combination with a work-holder, of a grinding-head movably mounted in proximity thereto and provided at its under side with a slot, an operating member journaled beneath the head and provided with an eccentric projection extending into the slot, a continuously-operative driver, and a connector between the operating member and driver movable into and out of coaction with said driver.

54. The combination with a work-holder, of a grinding-head movably mounted in proximity thereto and provided at its under side with a slot, an operating member journaled beneath the head and provided with an eccentric projection extending into the slot, a continuously-operative driver, a connector between the operating member and driver movable into and out of coaction with said driver, a lever for moving the connector from coaction with the driver, a spring for holding the connector normally in engagement with the driver, and a lock for the lever.

55. The combination with a work-holder, of a grinding-head mounted to slide upon ways and provided with a transverse slot between the ways, a crank member journaled between the ways and provided with a crank-pin extending into the slot, a shaft connected to the crank member through a universal joint, a driving-shaft, a worm fixed thereto, a worm-wheel upon the shaft meshing with the worm, and a treadle connected with the shaft.

56. In a grinding-machine, the combination with a shaft, of a plate fixed thereto, a grinding-wheel abutting against the plate, and being free to turn in contact therewith, a second

plate on the opposite side of the grinding-wheel movable along the shaft but held against rotation thereon, and means for forcing the last-named plate against the wheel and a wheel against the first-named plate to secure said wheel against rotation upon the shaft.

57. In a grinding-machine, the combination with a shaft, of a plate fixed thereto, a grinding-wheel abutting against the plate, a second plate on the opposite side of the grinding-wheel splined to the shaft, and a screw taking into the end of the shaft and serving to force the last-named plate against the wheel.

58. In a drill-grinding machine, the combination with a grinding member, of a holder adapted to support the drill to be ground with its axis at an acute angle both to vertical and horizontal planes passing through the point of contact of the tool and grinding-surface, and means for moving the holder toward and from the grinding member.

59. In a drill-grinding machine, the combination with a grinding member, of a holder adapted to support the drill to be ground with its axis at an acute angle both to vertical and horizontal planes passing through the point of contact of the tool and grinding-surface, and means for moving the holder toward and from the grinding member in a curved path.

60. In a drill-grinding machine, the combination with a grinding member, of a holder adapted to support the drill to be ground with its axis at an acute angle both to vertical and horizontal planes passing through the point of contact of the tool and grinding-surface, and automatic means for moving the holder toward and from the grinding member in a curved path.

61. In a drill-grinding machine, the combination with a grinding member, of a holder adapted to support the drill to be ground with its axis at an acute angle both to vertical and horizontal planes passing through the point of contact of the tool and grinding-surface, means for securing a feeding movement of the grinding member and holder toward and from one another, and means for moving the holder toward and from the grinding member in a curved path.

62. In a drill-grinding machine, the combination with a grinding member, of a holder adapted to support the drill to be ground with its axis at an acute angle both to vertical and horizontal planes passing through the point of contact of the tool and grinding-surface, means for moving the grinding member and holder relatively to one another, and means for moving the holder toward and from the grinding member in a curved path.

Signed by me at Hydepark, Massachusetts, this 26th day of December, 1901.

JOSEPH N. LAPOINTE.

Witnesses:
RALPH R. LAPOINTE,
SYLVANUS H. COBB.