(No Model.) 4 Sheets—Sheet 1.

A. JOHNSTON.

GRINDING MACHINE.

No. 465,478. Patented Dec. 22, 1891.

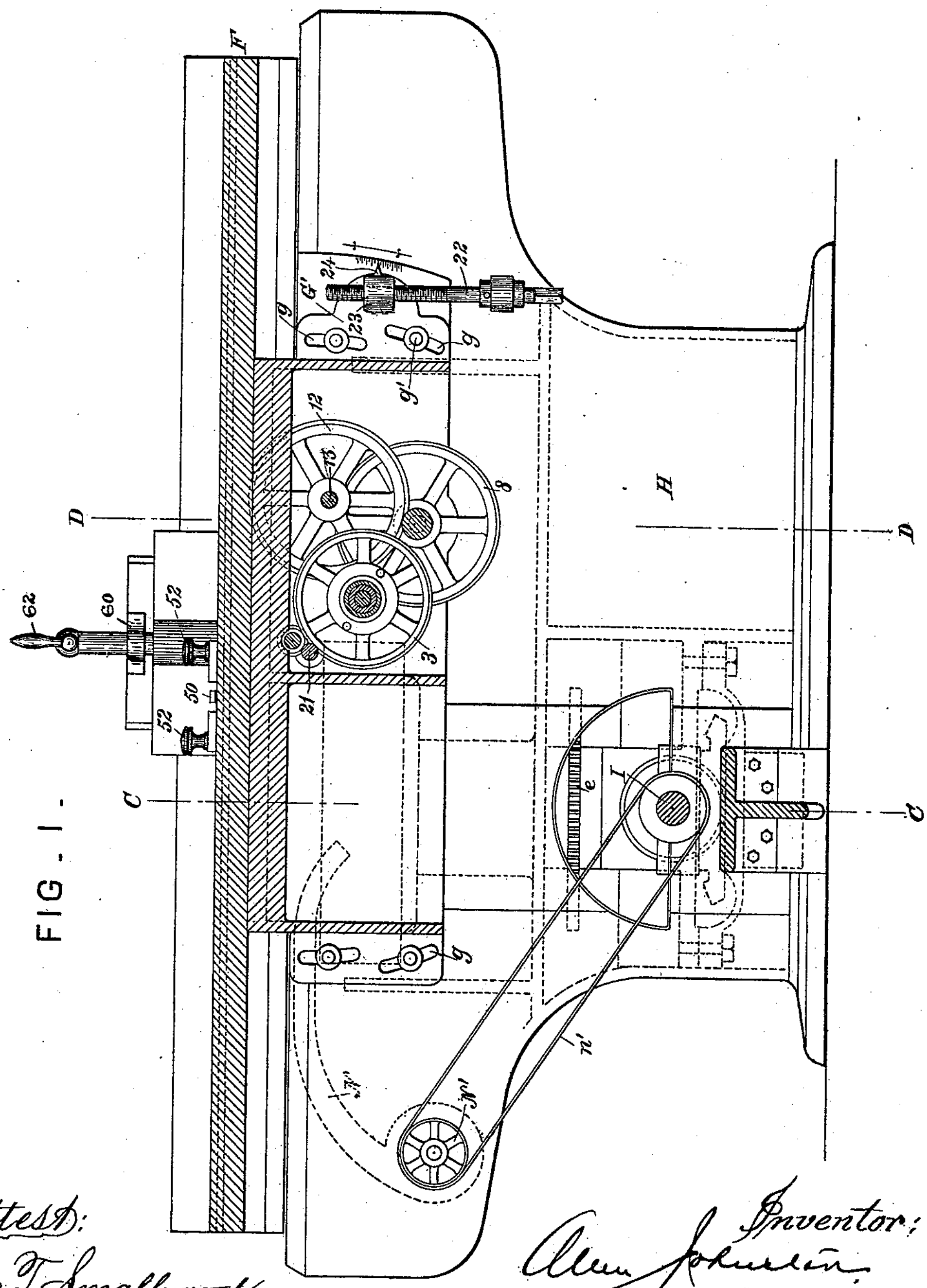

FIG. 1.

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Jno. D. Cullen

Inventor:
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by Pollok & Mauro,
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

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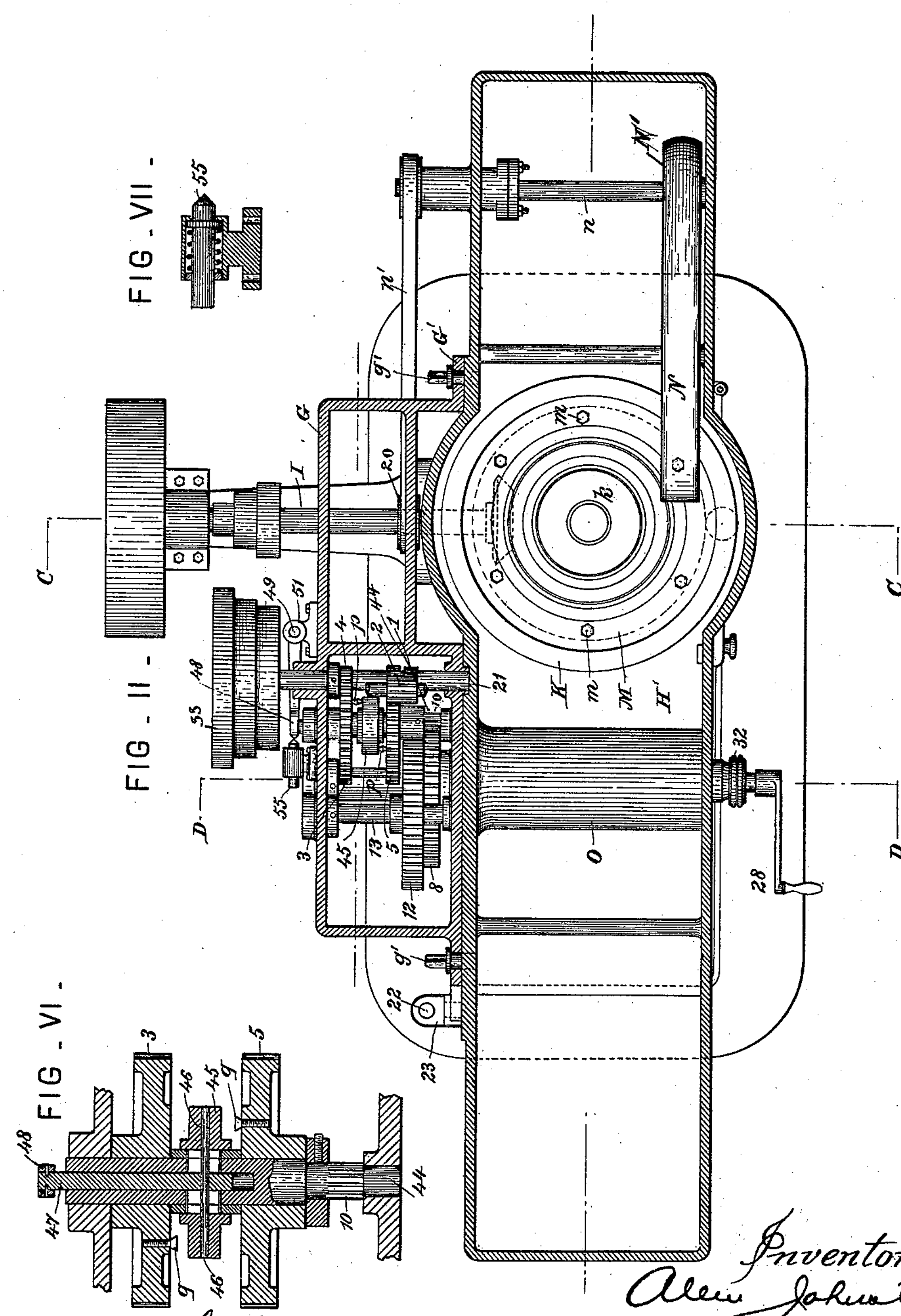

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(No Model.) 4 Sheets—Sheet 3.

A. JOHNSTON.

GRINDING MACHINE.

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FIG - IV -

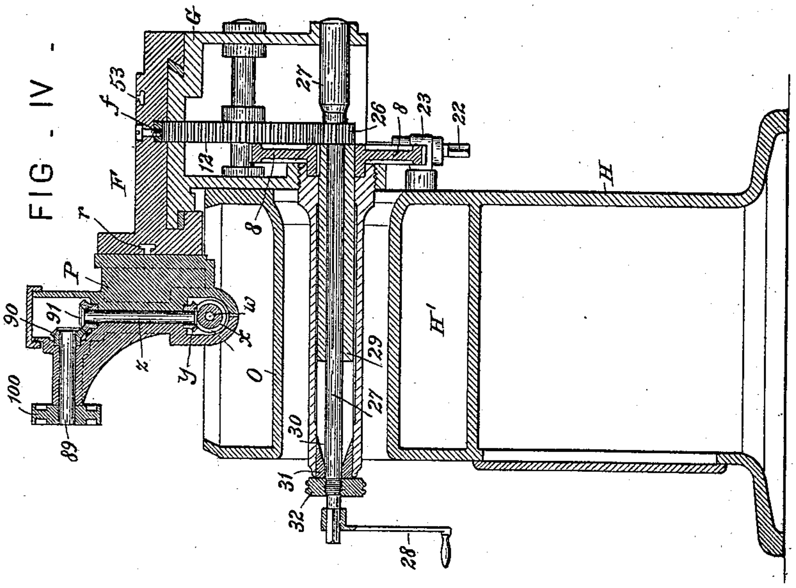
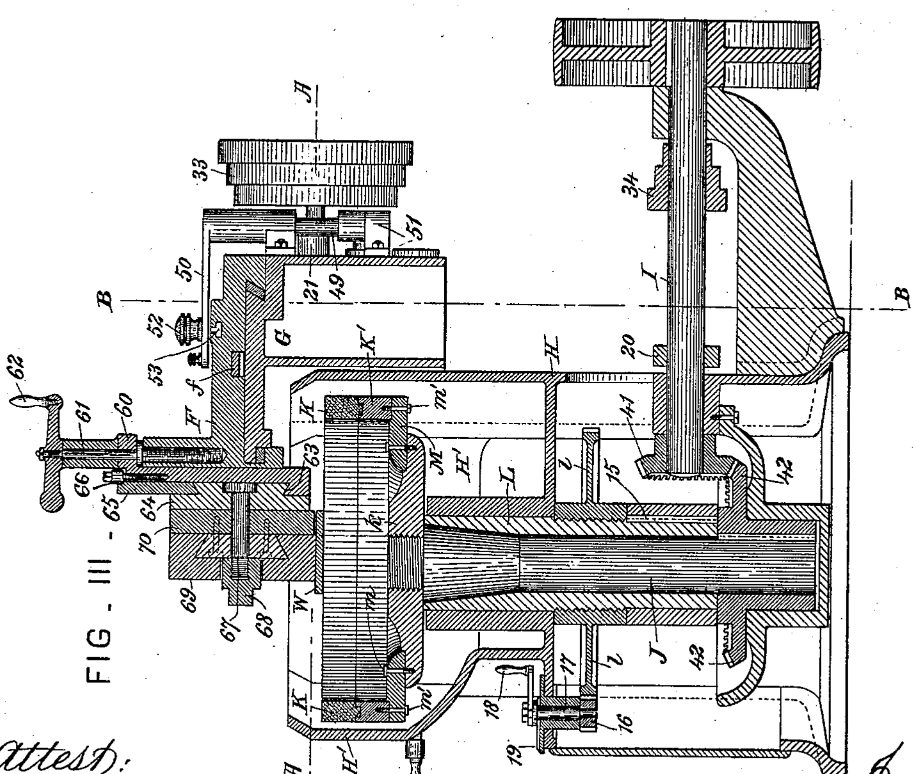


FIG - III -



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(No Model.)

4 Sheets—Sheet 4.

A. JOHNSTON.

GRINDING MACHINE.

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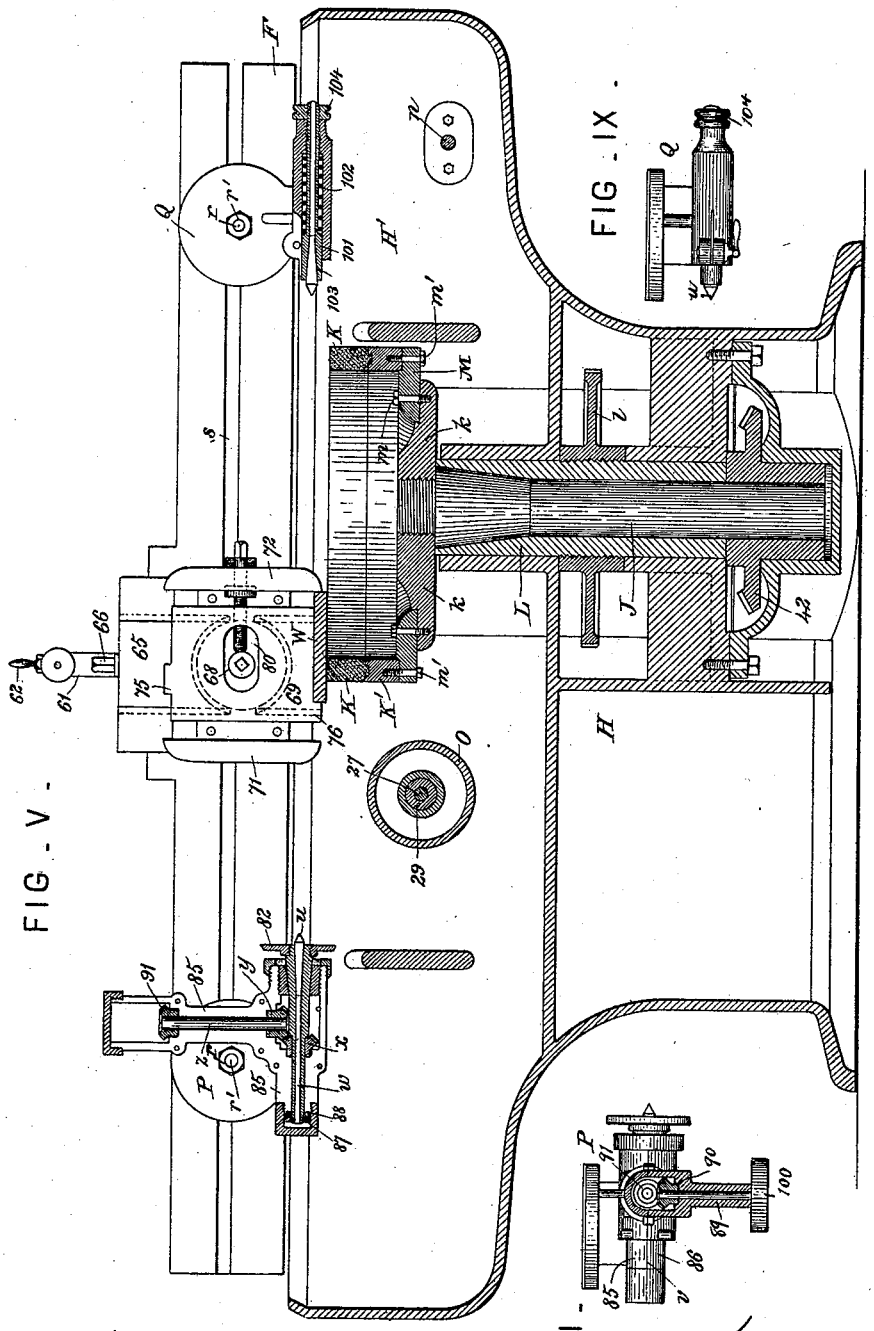

FIG. V.

FIG. IX.

FIG. VIII.

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UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 465,478, dated December 22, 1891.

Application filed January 6, 1891. Serial No. 376,901. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, a citizen of the United States, and a resident of Ottumwa, county of Wapello, State of Iowa, have invented a new and useful Improvement in Grinding-Machines, which improvement is fully set forth in the following specification.

The present invention has reference to the construction of machines for grinding various articles, such as dies, lathe-spindles, mandrels, arbors, and the like. As in a former machine, described in Letters Patent No. 377,201, dated January 31, 1888, and designed particularly for grinding cutlery, I make use of a hollow or cup-shaped grinder adapted to receive a certain quantity of water and to spread it by centrifugal action over the grinding-edge of the wheel. According to the present invention, however, the grinding-wheel is mounted on a vertical arbor, and the grinding-edge rotates in a horizontal plane. This arrangement has great advantage in maintaining the supply of water and distributing it equally over the grinding-surface in such quantity as to conduct away the heat generated by friction. The arbor of the grinding-wheel is made adjustable and provided with a gage to regulate and determine the adjustment with nicety.

The invention also includes improvements in the automatic feed, which consists of a slide and work-holders, such as a chuck carried thereby. The slide reciprocates horizontally above the trough containing the grinder, and is provided with reversing mechanism for changing its direction and with means for fixing the limits of its travel at any desired length. It also includes the particular construction of the work-holders, as hereinafter set forth. The said slide is provided with driving mechanism for actuating the same either by hand or by power, and with means for connecting the slide with and disconnecting it from a driven shaft of the machine. The bed upon which the slide reciprocates is adjustably connected with the main frame and adapted to be tilted upon a center, so as to present the work at different angles to the edge of the grinding-wheel to produce flat, convex, or concave surfaces, as desired.

The invention also includes certain details of construction and certain arrangements and combinations of parts, as hereinafter more fully set forth.

In the accompanying drawings, which form part of this specification, Figure I is a sectional elevation, looking from the rear of a machine constructed in accordance with the invention, the section being taken on line B B, Fig. III. Fig. II is a plan view, partly in horizontal section on line A A, Fig. III. Figs. III and IV are vertical cross-sections on lines C C and D D, Figs. I and II, respectively. Fig. V is a longitudinal section, partly in front elevation. Figs. VI and VII are details of the feed-reversing mechanism, and Figs. VIII and IX details of the work-holder for mandrels and other cylindrical articles.

I represents the main shaft of the machine. It is supported in bearings in the lower part of the main frame H and communicates motion through bevel-gears 41 and 42 to the upright arbor J, which carries the grinding-wheel K. The latter rotates in a trough H′, which constitutes the upper part of the machine-frame, its upper edge extending some little distance above the top of wheel K and being slightly turned in to catch and direct downward the water thrown from the edge of the wheel. Gear 42 is connected to arbor J by a spline and groove, Fig. III, so that said arbor can be adjusted longitudinally with reference thereto. The arbor is incased for the greater part of its length in a sleeve L, whose upper end constitutes a bearing for the supporting-plate *k* of the grinding-wheel. A portion of the outer periphery of sleeve L is threaded and is engaged by a spur-gear *l*, whose hub is threaded interiorly. Sleeve L is provided at 15 with a feather, which takes into a groove in the frame, preventing the rotation of the sleeve. Wheel *l* is engaged by a pinion 16, carried by a stud 17, provided at its upper end with a crank-handle 18 and with an index or pointer 19. By turning the handle 18 sleeve L, and with it arbor J and wheel K, can be adjusted to a nicety. The index-finger 19 indicates on a graduated scale the extent of the adjustment in thousandths of an inch. The supporting-plate *k* of the grinder carries at its edge a ring M, fastened thereto by screws *m*, and to this ring the cylindrical grinding-wheel is fastened by screws *m′*. This arrangement of the movable ring

M is adapted to facilitate removal of the wheel by removing screws m, the screws m' being inaccessible.

The tubular part of the grinding-wheel is composed of an upper part K of abrading material—such as emery and a suitable binding agent—and a supporting part or base K′, to which the grinder proper is molded.

The grinding-wheel is preferably made of emery and a fusible binding material, such as shellac, as described in my application filed June 13, 1888, Serial No. 276,947.

N, Figs. I and II, indicates a spout for conveying water from trough H′ to the interior of the wheel K. The water may be applied by any convenient means, such as the cylindrical pump N′, carried by shaft n and driven by belt n' from pulley 20 on the main shaft.

I will now describe the work holding and feeding devices and their actuating mechanism.

F represents a long slide extending horizontally lengthwise of the machine above the trough H′. On its front side, Fig. I, it carries the work-holding devices, as presently described, and at the rear, Figs. I, III, and IV, it rests upon a bed or support G, upon which it can reciprocate longitudinally. The adjustable attachment of this bed to the main frame is shown in Fig. I. The vertical flange G′ of the bed is provided with curved slots g, all struck from the center of shaft 21, through which power is transmitted to the slide. The bed is attached to the frame by screws g'. The bed can by this arrangement be tilted to bring the work perfectly square with the edge of the grinding-wheel or to present it thereto at an angle, as may be desired. To adjust the bed a threaded bolt 22, Fig. I, is provided. It engages a threaded boss 23 on the bed, and the latter is provided with a pointer 24, opposite a graduated scale, to indicate the position of the bed.

The slide F has on its under side a rack f, Figs. III and IV, with which engages a toothed wheel 12, mounted on shaft 13, which rotates in bearings of bed G. For the purpose of moving the slide by hand a pinion 26 engages wheel 12, said pinion being carried by a spindle 27, having on its front end a crank-handle 28. Said spindle is inclosed by a long sleeve 29, in which it can ordinarily turn loosely. Sleeve 29 is split at the end and terminates in a taper at 30. The tapering end is surrounded by a ring 31, and when the latter is forced to the left, Fig. IV, by means of the nut 32 sleeve 29 will be clutched to spindle 27, and the two will turn together. This is the position of the parts when the slide is to run by power. The motion is derived from shaft 21, provided with pulleys 33, adapted to be driven by a band from pulleys 34 on main shaft 1, Fig. III. Shaft 21 drives two wheels 3 and 5, Fig. II, the former directly from pinion 4, the latter through an idler 2 from pinion 1. Consequently wheels 3 and 5 rotate at the same speed, but in opposite directions, and as these wheels alternately communicate motion to the slide, as presently explained, the direction of the slide's movement will depend on whether it is driven for the time being from wheel 3 or wheel 5. These wheels are mounted loosely on their spindle 44, Fig. VI, and the latter has a pinion 10, which engages and turns gear 8 in one direction or the other, and the latter, which is keyed to the sleeve 29, transmits its motion through said sleeve, spindle 27, pinion 26, and gear 12 to the rack, as already described. It requires now to be shown how the direction of rotation of spindle 44 is reversed when the slide F reaches the predetermined limit of the movement in either direction. Around spindle 44 and between the wheels 3 and 5 is a ring 45, Figs. II and VI. To this ring is connected by means of a pin 46 a rod 47. Pin 46 passes through a slot in spindle 44, so that the rod 47 is free to reciprocate lengthwise of the spindle, carrying with it the ring 45. The latter has on each face a pin p, and wheels 3 and 5 have on their adjacent faces similar pins q. Consequently when the pins of ring 45 engage the pin of wheel 3 spindle 44 will turn with the latter and will move the slide through the gearing described in one direction. When in like manner the ring is connected with wheel 5, the slide will move in the opposite direction.

Rod 47 is reciprocated by means of an arm 48 of rock-shaft 49, journaled at 51 on the bed G, Fig. II. This shaft has an arm 50, Figs. I and III, which projects over slide F, and the latter is provided with stops 52 in the path of this arm, which on striking one of them will cause rock-shaft 49 to turn, disengage ring 45 from the wheel (3 or 5) which at the time is moving the slide, and cause it to engage the other wheel, thus reversing the movement of the slide. In order to throw the pins p on the ring quickly and certainly into engagement with the corresponding pins q, I employ a conical-pointed spring-actuated pin 55. (Shown in Fig. VII in detail.) As shown in Fig. II, the end of this pin is in contact with the wedge-shaped end of arm 48 of rock-shaft 49. As the arm 48 moves in either direction it forces pin 55 back against the pressure of its spring until it passes the point of said pin, when the latter springs out and throws the ring 45 into engagement with the wheel 3 or 5, as the case may be. It will be understood that this reversing mechanism is not broadly new, and is not claimed as an essential part of the apparatus. Any other suitable reversing mechanism could be employed without departing from the spirit of the invention.

The two stops 52 are set in an undercut groove 53, Fig. IV, in the slide, and are adjustable lengthwise thereof, so as to fix to the desired points the limit of motion of the slide, which for some work—mandrels, for example—would be much longer than for other kinds, such as dies.

By reference to Fig. IV it will be observed

that the spindle 27 and the sleeves surrounding it pass through a tube O, which crosses the trough H′ and is sufficiently large to permit to the shaft 27 and its sleeve all the play necessary in adjusting the bed G. This tube O also serves to stiffen the frame. The trough is entirely tight and all the gearing and other working parts are protected from access of water.

The work-holding devices will now be described. For grinding dies and short pieces of work a chuck is detachably secured to slide F near the middle thereof, Figs. III and V. The detachable connection is made by means of plate 60, secured to slide F by a threaded bolt 61, provided at its upper end with a handle 62, so that the chuck can be adjusted toward and away from the wheel K. Plate 60 has at its lower end a curved undercut flange 63, which receives the base 64 of the chuck. The latter has a circular hub of dovetail shape in cross-section, as shown in Fig. III, which fits under the flange 63 and is held in place by a holding-plate 65. Plate 65 can slide in a recess in plate 60 and is retained by the head of screw 66. Through the center of the base 64 passes a bolt 67, upon the end of which is screwed a nut 68. The latter secures to the circular base 64 those parts of the chuck which are ordinarily detached in changing from one chuck to another, or in grinding work which is rotated against the grinding-wheel. The circular base 64 is not ordinarily removed. Its function is to permit the chuck to be readily turned on its axis in a plane transverse to the grinding-surface. This function is useful for several purposes. In this particular machine, inasmuch as the work is introduced underneath the chuck, there would be difficulty in placing it accurately. By this arrangement the chuck can be inverted, the work properly placed in position, and the chuck then turned back to bring the work to the wheel. Moreover, this axial adjustment of the chuck permits dies and other articles having two inclined faces to be ground by inclining the chuck one way and grinding, say, on the inner edge of the wheel, and then tilting it the other way and grinding against the outer edge.

The plate 70, which rests against the circular base, carries the movable jaw 69 and the two stationary jaws 71 72. The movable jaw, which is between the two stationary jaws, slides upon a dovetailed projection or rib on plate 70. Jaw 69 has on its upper edge a projection 75, placed a little to one side of the center shaft, and on its lower edge a similar projection 76. These projections form, with the stationary jaws 71 72, four work-holding spaces of different sizes. In Fig. V a die W is shown as being held in the longest of the spaces. The size of these spaces can be regulated by screw 80, by means of which the movable plate or jaw 69 can be moved in either direction.

When cylindrical work is to be ground, the chuck is removed by unscrewing nut 68 and taking off the plate 70 and the jaws, and the mandrel, spindle, or other object is held between centers, as in a turning-lathe. Fig. V shows the puppets P Q in place, P being the head-stock, (shown separately in Fig. VIII,) and Q the tail-stock. (Shown in Fig. IX.) Each of these devices is secured to the slide by a T-headed stud r, which is held in a groove in the slide, Fig. IV, and secured by a nut r'. These holders are provided with the usual centering-pins u.

The head-stock P has several adjustments. It can be moved lengthwise of the slide, and it can be adjusted axially to any desired position, as for grinding objects to a cone or taper. It can be removed from the position in which it is shown and placed on the circular base of the chuck for grinding wheels, disks, or other objects that have to be rotated against the work. It can then be turned a quarter-turn from the position shown in the drawings, and so present the face of a wheel properly chucked to the face-plate 82 of the live-spindle to the edge of the grinding-wheel. It may also be turned to an oblique position to grind either convex or concave surfaces, as desired. The frame of the head-stock is formed of two castings 85 86, which meet at the line v, Fig. VIII, so that by separating them access is given to the gearing, driving-spindles, &c., inclosed therein. In Fig. V (the front casting or half of the frame being removed) the spindles and miter-pinions are shown, their bearings being formed by recesses of proper shape in these castings. The center u of the head-stock is carried by the live-spindle w, which is enlarged near the outer end. It can be adjusted to take up wear by means of nuts 87 88. To this spindle is keyed a miter-pinion x, which engages a similar pinion y on an upright spindle z. The latter is driven from a horizontal spindle 89 through pinions 90 91, Fig. IV. Spindle 89 has on its outer end a small band-pulley 100, adapted to be driven from a counter-shaft. It will be observed that the adjustment of the holder, whether axially to incline the object being ground or lengthwise of the slide, is always in the plane of the pulley 100, so that the latter will not be thrown out of line with the driving-pulley of the counter-shaft.

It will of course be understood that an ordinary compensating-pulley on the counter-shaft must be used to provide for the lengthening and shortening of the driving-belt as the pulley 100 reciprocates with the slide. The dead-spindle 101 of the tail-stock is pressed out by a helical spring 102, and an adjusting-nut 104 is provided to regulate the compression of said spring against the shoul-

dered end of sleeve 103, which surrounds said spindle.

The head and tail stocks can be adjusted on slide F toward and away from each other to hold work of different lengths, the studs *r* being loosened and slid along in groove *s*, as already described.

The foregoing description and drawings referred to therein set forth and illustrate what is believed to be the best embodiment of the principle of the invention; but it will be understood by persons skilled in the art that modifications may be made in details of construction and arrangements of parts and that some one or more of the new improvements described may be used separately and apart from the others without departing from the spirit of the invention.

Having now fully described my said invention, what I claim, and desire to secure by Letters Patent, is—

1. In a grinding-machine, the combination, with a cup-shaped grinding-wheel arranged to rotate in a horizontal plane adapted to contain water, of a work-holder and means, such as specified, for reciprocating the same horizontally, substantially as described.

2. The combination of the hollow or cylindrical grinding-wheel, a ring detachably secured to one end thereof and a base-plate detachably secured to said ring, substantially as described.

3. The combination of the trough, the vertical arbor passing through the bottom thereof, and the cup-shaped wheel on said arbor, said wheel being composed of a horizontal base-plate fixed to said arbor, a horizontal ring secured to said plate by screws accessible from above, and a tubular part constituting the grinder secured to said ring, substantially as described.

4. The combination, with the grinding-wheel, its arbor, and gearing for rotating the latter, of a sleeve loosely surrounding said arbor and held from rotation therewith, said sleeve and arbor being connected so that the latter follows the longitudinal movements of the former, means, as specified, for adjusting said sleeve longitudinally, and an adjustment-indicator, substantially as described.

5. The combination of the grinding-wheel, its arbor, gearing for rotating the latter, a sleeve loosely surrounding said arbor and forming at its upper end a support or bearing for the base of said wheel, said sleeve being connected with the frame by a spline and groove, a wheel engaging a thread on said sleeve, and a handle connected with and actuating said wheel, substantially as and for the purposes set forth.

6. A grinding-wheel comprising a base-plate, a ring detachably secured to said plate, and a tubular part composed of a metallic tube secured to said ring, and an upper portion of abrading material molded to said metallic part, substantially as described.

7. The combination, with the frame and grinding-wheel, of a bed adjustable on a center with reference to said frame, and a slide supported and movable in ways of said bed and carrying work-holding devices, substantially as described.

8. The combination of the hollow grinder rotatable in a horizontal plane, a slide movable horizontally and carrying work-holding devices, and an adjustable bed supporting said slide, substantially as described.

9. The combination of the machine-frame, a trough in the upper part thereof, a hollow grinder supported in said trough and rotatable in a horizontal plane, a slide supported above said wheel and movable horizontally, and work-holding devices carried by said slide, substantially as described.

10. The combination, with the hollow grinding-wheel on a vertical arbor, of a slide carrying work-holding devices, and a bed having ways in which said slide can reciprocate, said bed being adjustable on a center so as to incline the slide more or less from a horizontal plane, substantially as described.

11. The combination, with the grinding-wheel, of a work-holding slide, a bed carrying said slide, a shaft and gearing for transmitting motion to said slide, said shaft being journaled in bearings on said bed and the latter being adjustable on an axis concentric with said shaft, substantially as described.

12. The combination of the main frame, the grinding-wheel adapted to contain water, the reciprocatory slide, the bed supporting said slide, a shaft having bearings in said bed, and gearing inclosed in the bed for communicating motion from said shaft to said slide, substantially as described.

13. The combination, with the grinding-wheel, of the slide and a chuck detachably secured thereto, said chuck being capable of axial adjustment in a plane transverse to the plane of the grinding-surface, so as to incline the work with reference to said surface in either direction, substantially as described.

14. The combination, with the cup-shaped grinding-wheel, of the slide and the chuck detachably secured thereto, said chuck being adjusted axially, so as to present the work to either the outer or inner edge of said wheel without removing the work from the chuck, substantially as described.

15. The combination, with the cup-shaped grinding-wheel, of the slide and a chuck carried thereby, said chuck being adjustable toward and from the wheel and also adjustable axially, so as to present the work to either edge of said wheel, substantially as described.

16. The combination, with the hollow grinding-wheel rotatable in a horizontal plane, of the reciprocatory slide and the chuck carried by said slide and adjustable vertically thereon, substantially as described.

17. The combination, with the wheel and reciprocating slide, of a chuck carried by said

slide and comprising a movable jaw and stationary jaws having work-holding spaces of different sizes on opposite edges, said chuck being reversible, substantially as and for the purpose set forth.

18. The combination of the grinding-wheel, the reciprocatory slide and the chuck carried thereby, said chuck comprising a movable jaw disposed between two stationary jaws and forming therewith work-holding spaces of different dimensions, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALLEN JOHNSTON.

Witnesses:
J. T. HACKWORTH,
A. G. HARROW.