Jan. 6, 1925. 1,522,465

G. C. KIMMEL

INTERNAL GRINDING MACHINE

Filed May 6, 1921 6 Sheets-Sheet 1

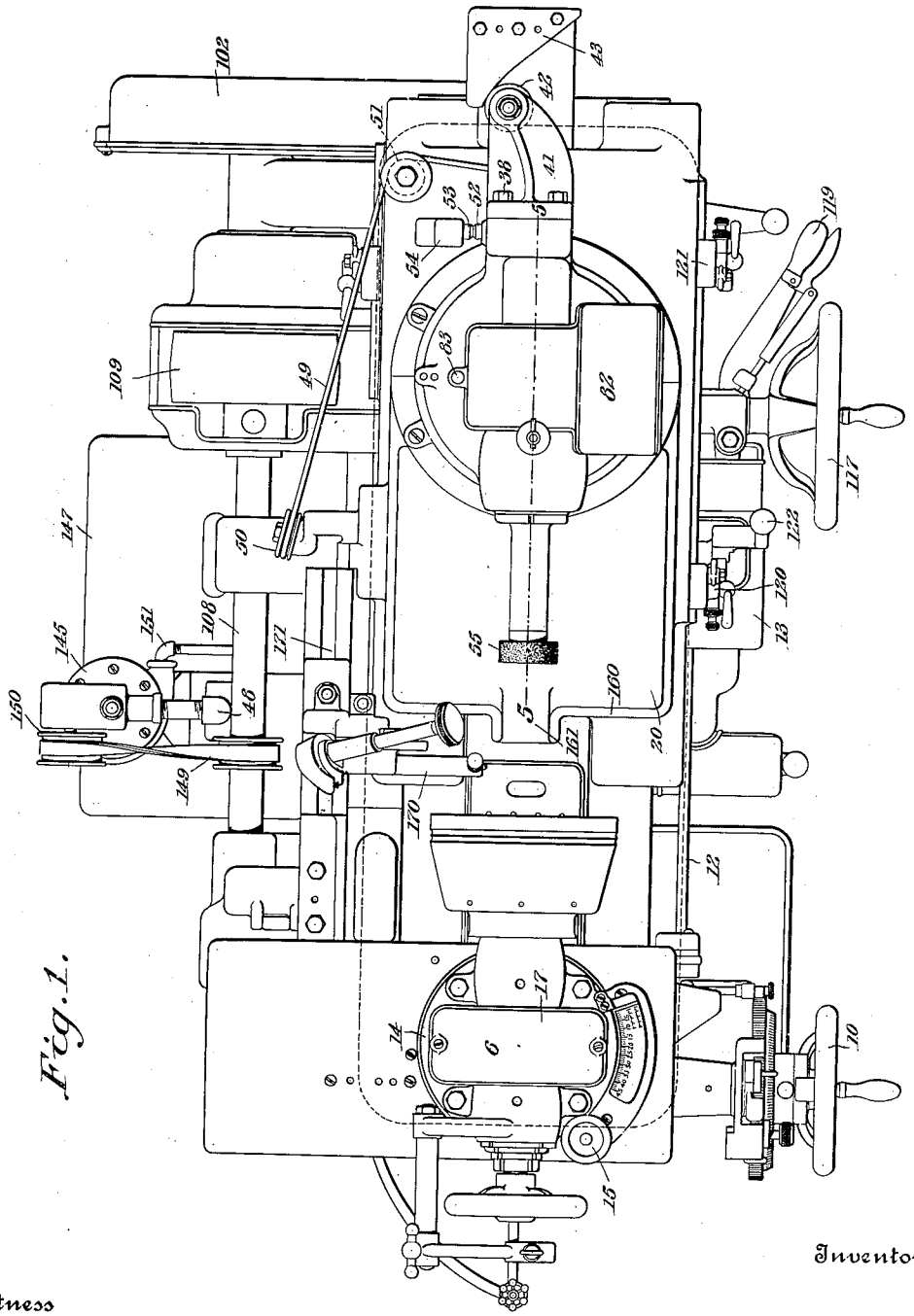


Fig. 1.

Witness
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Inventor
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By Albert F. Nathan Attorney

Jan. 6, 1925. 1,522,465

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INTERNAL GRINDING MACHINE

Filed May 6, 1921 6 Sheets-Sheet 2

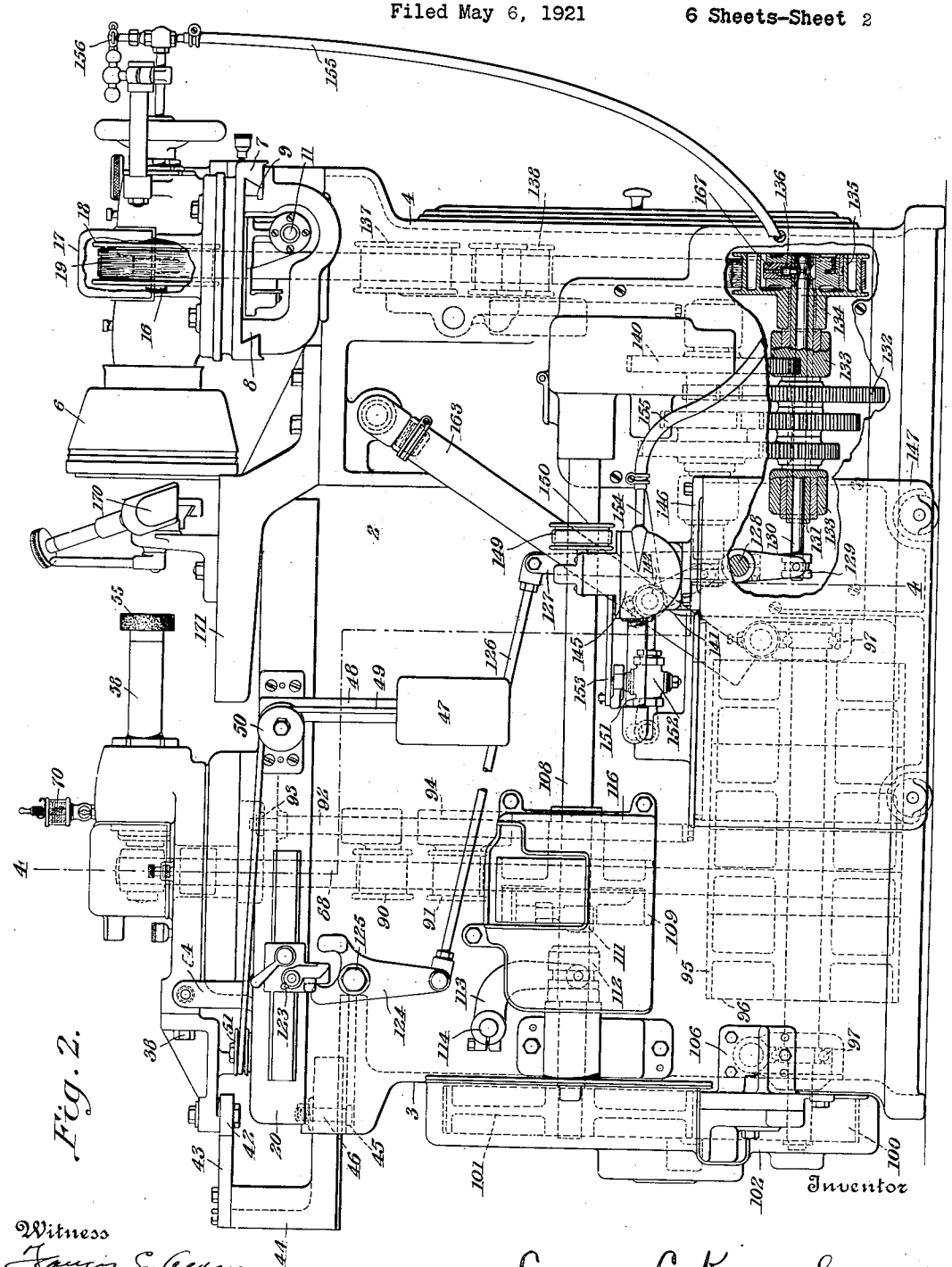


Fig. 2.

Witness
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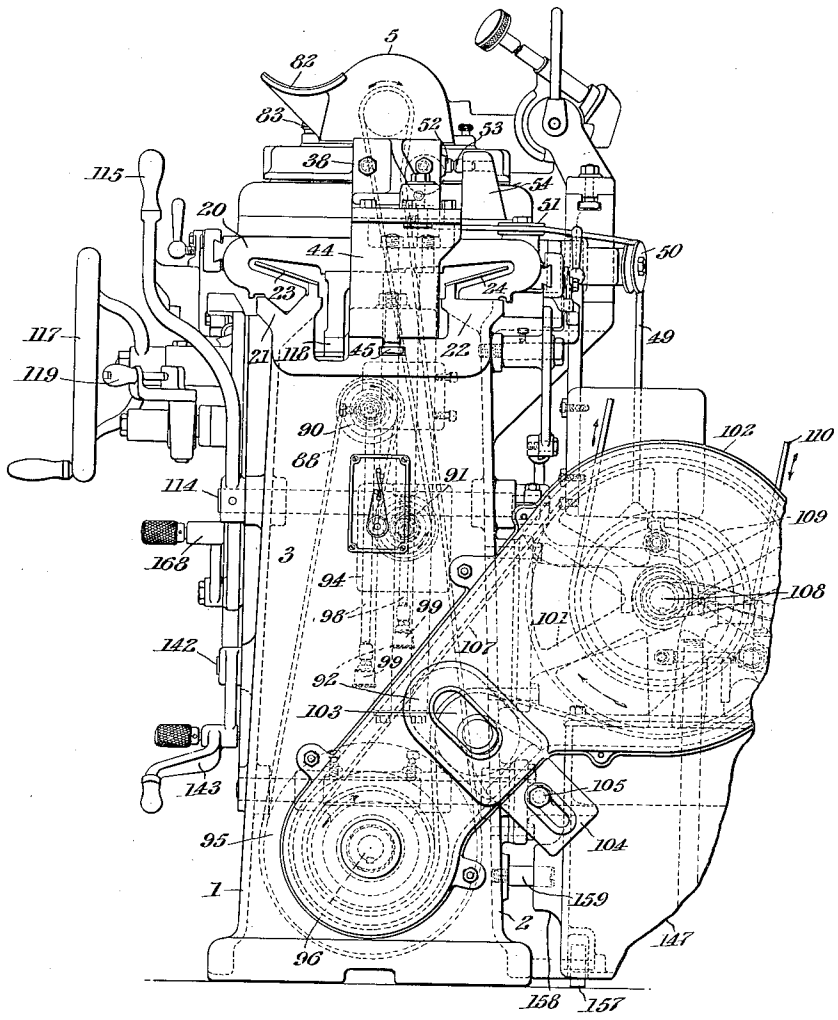
Jan. 6, 1925. **1,522,465**

G. C. KIMMEL

INTERNAL GRINDING MACHINE

Filed May 6, 1921 6 Sheets-Sheet 3

Fig. 3.



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Witness
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Jan. 6, 1925.

1,522,465

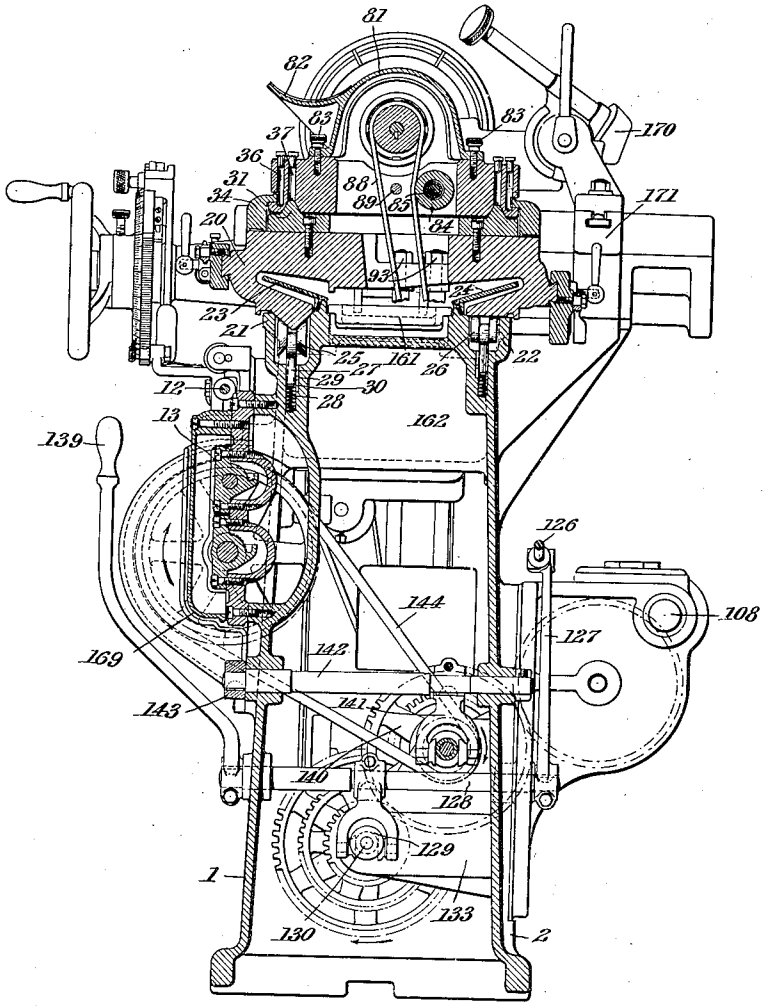
G. C. KIMMEL

INTERNAL GRINDING MACHINE

Filed May 6, 1921

6 Sheets-Sheet 4

Fig. 4.



Witness
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1,522,465

G. C. KIMMEL

INTERNAL GRINDING MACHINE

Filed May 6, 1921

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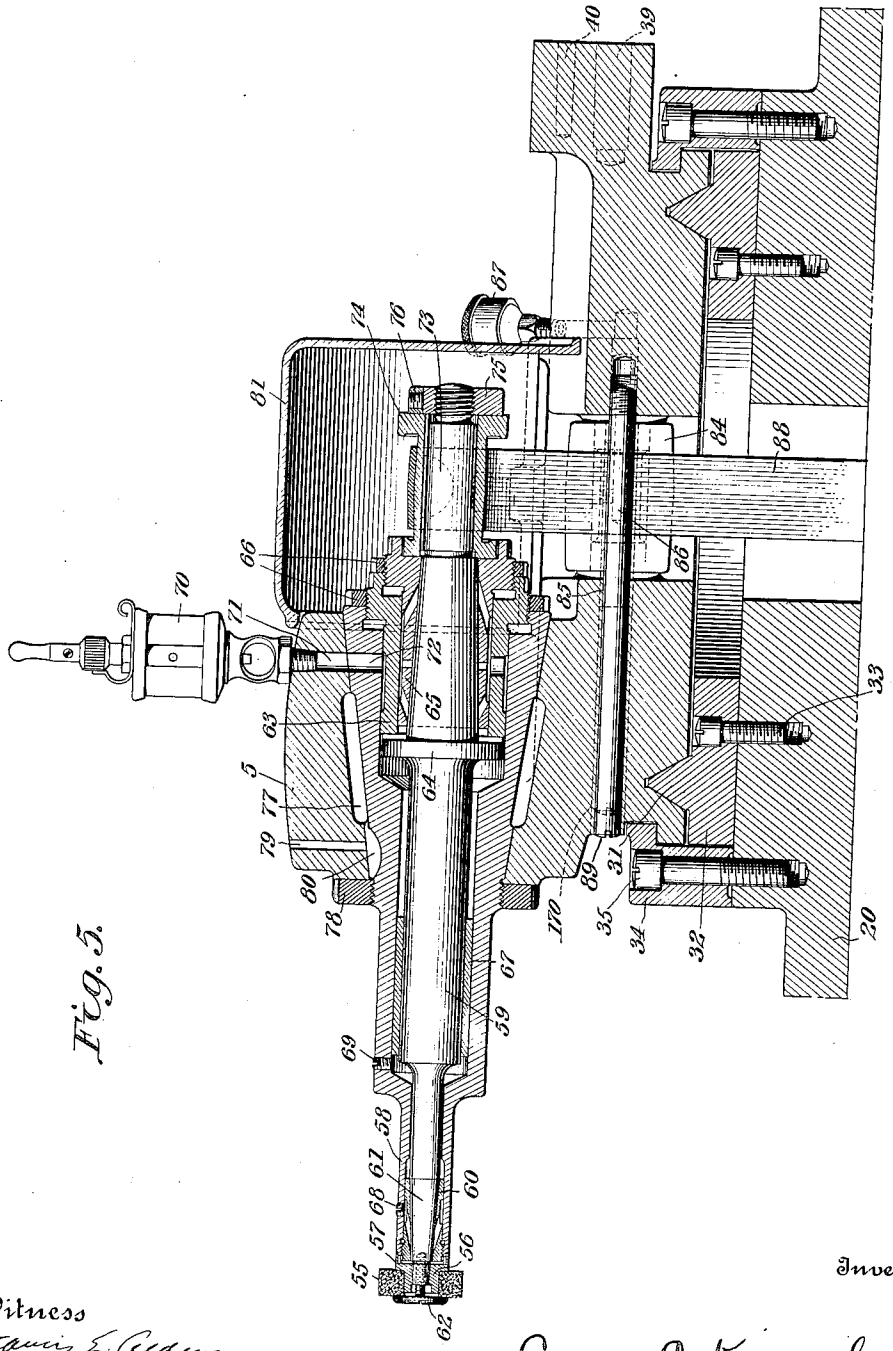


Fig. 5.

Witness
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Jan. 6, 1925.

1,522,465

G. C. KIMMEL

INTERNAL GRINDING MACHINE

Filed May 6, 1921

6 Sheets-Sheet 6

Fig. 6.

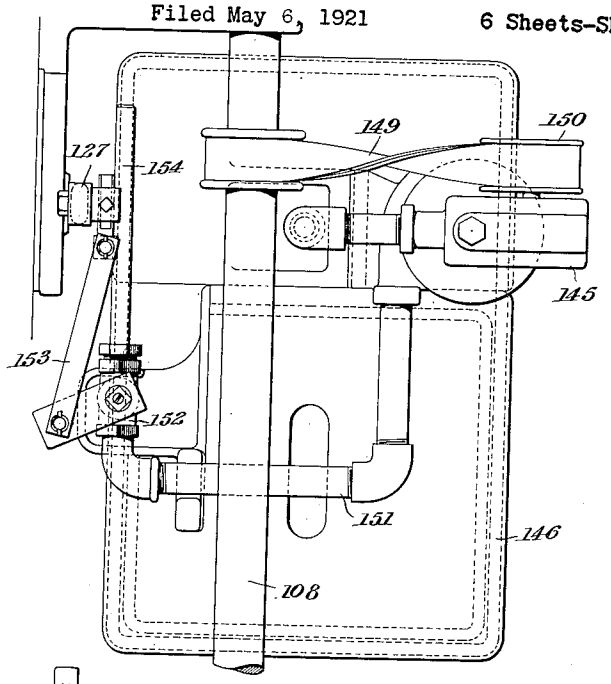
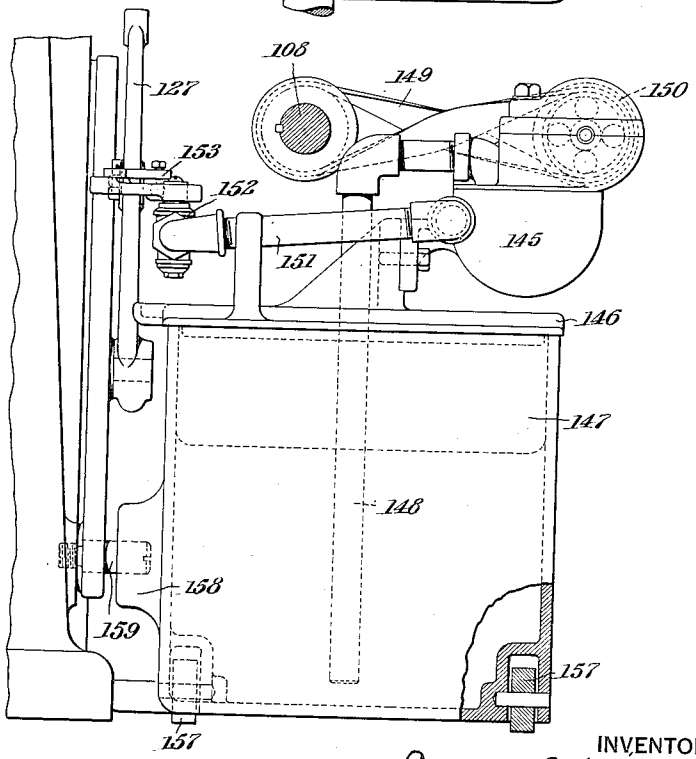


Fig. 7.



WITNESS

L. E. Fischer.

INVENTOR

George C. Kimmel

BY

Albert F. Nathan

ATTORNEY

Patented Jan. 6, 1925.

1,522,465

UNITED STATES PATENT OFFICE.

GEORGE C. KIMMEL, OF CINCINNATI, OHIO, ASSIGNOR TO THE CINCINNATI GRINDER COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

INTERNAL-GRINDING MACHINE.

Application filed May 6, 1921. Serial No. 467,297.

To all whom it may concern:

Be it known that I, GEORGE C. KIMMEL, a citizen of the United States, and residing at 2202 Highland Avenue, Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and Improved Internal-Grinding Machine, of which the following specification is a full disclosure.

This invention relates to internal grinding machines and in particular to a machine of this type which is known in the art as a "hole-grinder."

In machines of this character, grinding is generally effected by means of a grinder carried on a rapidly revolving spindle mounted in a toolhead and the work and spindle are translated relative to one another in order to effect the grinding operation, while at the same time the work in the head stock may be revolved, and in some machines as in the embodiment of my invention herein to be described it is the grinder which partakes of the translating motion.

In machines of this character wherein the article worked upon is frequently changed, and especially in precision work where it is necessary to frequently calibrate the article operated upon, it is necessary to safeguard the operative against injury from contact with the rapidly revolving grinder and other moving parts of the machine.

It is therefore an object of this invention to provide a machine of this type with a turn table tool head having a cam mechanism operating upon sufficient movement of the carriage to swing the latter away from the operative.

Another object of the invention is to provide a mechanism to automatically cause the chuck in the head stock to cease rotating coordinately with the swinging movement of the tool head.

A further object of this invention is to provide in machines of this character a mechanism to coordinately shut off the flow of coolant with the swinging of the tool head and the stoppage of the rotation of the chuck.

Still another object of this invention is to so form the tool head that the tool spindle carrying the tool and its driving pulley may be removed as a unit for a purpose to be hereinafter described.

A still further object is to provide in a machine of this character a novel form of floating idler pulley.

Another and further object is to provide a mechanism to operate the chuck in the head stock independently of the tool driving mechanism but operated from a common main drive shaft on the machine.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawings.

To enable others skilled in the art to so fully apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, drawings depicting a preferred typical construction have been annexed as a part of this disclosure, and in such drawings like characters of reference denote corresponding parts throughout all the views, of which:—

Fig. 1 is a top plan view of a grinding machine embodying my invention, Fig. 2 is a side view thereof, a portion of the side wall being broken away to disclose interior mechanism and hidden parts being shown in dotted lines, Fig. 3 is an end view of the machine, partially broken away with interior parts shown in dotted lines, Fig. 4 is a section on the line 4—4 of Fig. 2, the tank for the coolant being removed, Fig. 5 is a section through the tool-head on the line 5—5 of Fig. 1, Fig. 6 is a top plan view of the tank for storing the coolant, the pump, valve and controlling mechanisms therefor, and Fig. 7 is a similar end view.

It may be stated that although I have chosen to illustrate and describe my invention as applied to a grinding mechanism, the grinding element may be replaced by any other tool, and I do not wish to be limited to the specific embodiment of my invention except as pointed out hereafter in the appended claims.

Now referring to the several figures in which like reference characters designate like parts, there is shown a housing having end walls 1 and 2 and side walls 3 and 4 enclosing and supporting operating devices for a grinding mechanism mounted on the upper face of the housing. The grinding mechanism proper comprises a tool-head 5 and a head-stock 6. The head-stock is

mounted on a carriage 7 slidable upon transverse ways 8 and 9 on one end of the housing, and the head stock may be translated either by means of a hand wheel 10 having a shaft 11 provided with a suitable feed screw or by the conventional pawl and ratchet feed operated by a rod 12 connected with a reversing mechanism 13 for the tool carriage. The head stock is carried on a rotatable plate 14 adapted to be adjusted by means of a hand wheel 15 to align the head stock spindle 16 parallel with the longitudinal axis of the machine for straight grinding, or at an angle thereto for taper grinding. Within a housing in the headstock enclosed by a cover 17 is a pulley 18 for the spindle 16 having a drive belt 19 entrained thereover.

A tool carriage 20 slides upon ways 21 and 22 parallel to the longitudinal axis of the machine, each way being protected from dirt and grit by means of inclined guards 23 and 24. In order to relieve some of the dead weight of the tool carriage from the ways, rollers 25 and 26 are provided, and each roller is supported by a shank 27 urged upwardly by a spring 28 seated in a bore in the ways, and to prevent the rollers from being disaligned, each shank is provided with a pin 29 slidable in a keyway 30. Mounted so as to rotate on an annular ridge 31 of a ring 32 secured to the carriage as by screws 33 is the tool stock 5, the same being held against displacement on the carriage by means of a split guide-ring 34 secured to the carriage by screws 35. Suitable oil ducts 36 and 37 are provided to permit lubrication of the annular guideways formed by the ridge and the split ring. Secured to the tail end of the tool-head as by means of bolts 38 tapped into holes 39 in the tool head and by means of suitable pins dowelled into holes 40 is a projecting arm 41 carrying at its extreme end an antifriction roller 42 cooperating with a cam plate 43 carried on a cam block 44 slidably secured in a guideway 45 in the housing by means of a bolt 46 in order to adjust the rearward limit of movement of the tool head. It will now be understood that as the tool carriage is retracted a sufficient distance from work engaging position the roller 42 engages the cam-plate 43, and upon continued movement of the tool carriage the cam effects a swinging movement of the tool head to thereby swing the grinder out of the operative's way should he desire to reach over the machine to adjust the work in the chuck. Upon tool advancing movement of the carriage a weight 47 slidable on a bar 48 rigidly secured to the carriage and having a connecting cable 49 secured to the tool-head is lowered and serves to restore the tool-head to its normal operating position, a pulley 50 on the housing and another pulley 51 on the carriage being provided to properly guide the cable. The return limit of swinging movement of the toolstock is determined by a pin 52 mounted on the tool head engaging a second pin 53, which may be adjustable if desired, mounted in an abutment 54 fixed to the tool carriage.

The tool, in this instance shown as a grinding element 55 is mounted on a hub 56 having a flange 57 overlapping a portion of a sleeve 58 within which is rotatably mounted the spindle 59 so as to exclude dirt and grit from the end spindle bearing 60 screwed into the sleeve. The hub is secured to a tapered end 61 of the spindle by means of a screw 62. Within the sleeve are two additional bearings; a main bearing and an auxiliary intermediate bearing 67. The main bearing has an insert 63 against which a shouldered portion 64 of the spindle bears and a tapered inner bronze bearing portion 65 for a tapered portion of the spindle to take up spindle and bearing wear both insert and inner portion being suitably retained in place by screw threads and lock nuts 66. The end and intermediate bearings may be oiled by removing the screws 68 and 69 and the main bearing is oiled by means of an oil cup 70 screwed into the tool head having a channel 71 communicating with a channel 72 in the sleeve 58. Keyed to the spindle as by a Woodruff key 73 is a pulley 74 locked against longitudinal movement on the spindle by means of a nut 75 having a set screw 76. The main bearing end of the sleeve is tapered as is shown at 77 and the spindle with its pulley and sleeve may be inserted into the tool head and removed therefrom as a unit, the whole being retained in place by a nut 78 which when drawn up tight will cause the sleeve to wedge itself in place in the tool head. In order to facilitate assembly of the parts, the tool head is provided with a bore 79 and the spindle with a slot 80 so that a pin may be dropped in the bore to engage the slot and maintain the channel 72 in vertical position as the sleeve is drawn into place. Since there is a great variation in holes ground, various sizes of spindle and grinder wheels are used, and naturally with these various sizes of spindles and grinding wheels, various speeds for the wheel spindle should be obtained to make the machine work most efficiently. With the above construction, when a spindle and grinding wheel are replaced by another, the operator also replaces the pulley with one having the proper speed for the new spindle. A guard cover 81 having a tool rest 82 retained in place by means of thumb screws 83 serves to shield the operative against accidental contact with the pulley and also prevents the entrance of dust and dirt into the adjacent bearing.

In the base of the tool head is mounted

an idler 84 supported on a drilled out hardened steel rod 85 having a bore 86 communicating with a grease cup 87 to furnish lubricant to the idler, the rod being retained in place by means of a follow up screw 170 shown in dotted outline in Figure 5. Over the pulley 74 and the idler 84 is trained a belt 88 and a screw 89 is tapped into the tool head and lies between the runs of the belt to prevent the belt from dropping down into the housing when the same is removed from the pulley 74. The belt 88 is also trained over a stationary idler 90 and a floating idler 91, the first being carried by a bracket rigidly secured to the base of the tool carriage as by nuts 93 and the other being mounted on a weight 94 slidably mounted on the same rods, the belt being also trained over a drum 95 mounted in the base of the housing on a jack shaft 96 having ball bearings 97. Each of the idlers 90 and 91 is provided with a long tube 98 terminating in a grease cup 99 so that by opening a door (not shown) in the front wall 1 of the housing, the grease cups can be manipulated to properly lubricate the idler bearings. The drum 95 is rather long, and may be made in sections if so desired, to permit the belt 88 to travel therealong and be driven thereby as the tool carriage is moved back and forth. The idler 91 is of the floating type to maintain a proper tension on the belt and to permit it to lengthen out as the tool head is swung thru an arc of a circle in retractile movement thereof and to permit the belt to accommodate itself to different belt center distances when using different sizes of wheel spindle pulleys. The shaft 96 is driven by a pulley 100 in turn driven by a driving pulley 101, both enclosed by a gear case 102 in which is adjustably mounted an idler 103 carried on a plate 104 slotted to receive a bolt 105 tapped into a bracket 106 mounted on the wall 2 of the housing, and a belt 107 is trained over the pulleys 100 and 101 and the idler 103. The pulley is driven from a main drive shaft 108 provided with a suitable main driving pulley 109 connected to a suitable source of power as by a belt 110, altho it is to be understood that if desired, an electric motor may be coupled directly with the shaft 108, as will be readily understood. To permit the main drive shaft to be disengaged from the main driving pulley, a clutch mechanism 111 is provided operated by a clutch collar 112 controlled by a lever 113 mounted on a shaft 114 which extends from the rear of the housing to the front thereof, said shaft being provided at its front end with a machine controlling lever 115. It will now be apparent that by manipulating the lever 115 the main drive shaft can be disconnected from the main driving pulley thereby rendering the entire machine inoperative. The pulley and the clutch mechanism is enclosed in a case 116 suitably bolted to the rear wall 3 of the housing.

The tool carriage may be shifted back and forth by means of a hand wheel 117 which has a shaft provided with a pinion engaging a rack 118 on the tool carriage as is fully disclosed in Patent 1,337,139 granted to me April 13, 1920. Means are provided for automatically moving the carriage back and forth which means may be thrown in and out by the clutch lever 119, the reversing of the carriage being accomplished by means of two dogs 120 and 121 adjustably mounted on the tool carriage engaging a reversing lever 122, and the speed of movement of the carriage may be varied independent of the speed of rotation of the tool spindle or the chuck by shifting the lever 168 which shifts change speed gears in the box 169. It should be understood that in ordinary operation of the tool carriage it does not move back sufficiently to cause a turning movement of the tool-head. When however it is desired to inspect or remove the work, the reversing lever is pulled out of the path of movement of the dog 120 and the driving mechanism will then move the tool carriage to cause the tool head to be swung on its carriage, the automatic drive for the carriage including a frictional means to slip when the tool head has been swung to its complete limit of movement against the cam block. It is also to be understood that the clutch lever may be so set as to disengage the automatic carriage shifting mechanism, and the hand wheel 117 may be operated so as to fully retract the carriage. As the tool carriage driving and reversing mechanism forms no part of my present invention, a detailed description thereof is not given herein.

While the carriage is being fully retracted, and just prior to the turning movement of the tool head, an adjustable dog 123 on the rear of the carriage engages one arm of a forked drag link lever 124 pivotally mounted on a stud 125 said lever being connected with a drag link 126 connected with a clutch operating lever 127 rigidly secured to a shaft 128, the opposite end of the lever 127 engaging a collar 129 mounted on a shaft 130 slidable in a sleeve 131 to which are rigidly secured change speed gears 132, the sleeve being supported in bracket bearings 133. Rotating freely on the sleeve 131 is a pulley 134 having a clutch drum 135 adapted to be clutched in sleeve driven engagement thru the instrumentality of a pin 136 operating a clutch ring and operable by sliding movement of the shaft 130. In Fig. 2 for the sake of clearness I have shown the clutch drum in released position while the tool carriage is just about to shift the shaft

130 for effecting this release the drag link 126, being shown as parted. Over the pulley 134 is trained the belt 19 which like the belt 88 is trained over a stationary idler 137 and a floating idler 138 in order to permit lengthening of the belt as the head stock carriage is moved back and forth. It can now be seen that coordinate with the full rearward movement of the tool carriage the dog 123 actuates the drag link lever to so move the shaft 130 as to release the pulley 134 from driving engagement with the gears 132. Upon a forward movement of the tool carriage the dog 123 engages the other arm of the forked lever 124 and starts the rotation of the head stock. This release may also be effected by means of a head stock lever 139 secured to the shaft 128. Meshing with the change speed gears is the gear shift 140 which thru an intermediate gear, the outline of which is shown dotted in Fig. 2, is caused to mesh with the main drive shaft 108, and the gears are shifted by means of a link 141 rigidly secured to a shaft 142 extending thru the housing and provided at its outer end with a gear shift lever 143. A suitable drive belt 144 connects the tool carriage driving mechanism and the gear shift. A door 167 in the end wall 4 of the housing is provided to enable easy access to the gears adjacent the end wall 4 of the housing for inspection and lubrication thereof.

Means are provided to furnish a coolant to the work, this means comprising a pump 145 mounted on the cover plate 146 of a tank 147 into which there projects a sump hose 148 to conduct the coolant to the pump. The pump is driven from the main drive shaft 108 by means of a belt 149 trained over a pulley on the shaft 108 and over a pulley 150 on the pump shaft. The outlet pipe 151 of the pump is provided with a valve 152 connected by means of a link 153 with the lever 127, and into the opposite side of the valve is threaded a pipe 154 to which may be attached a rubber hose 155 leading thru a regulating cock 156 to the hollow spindle within the chuck as will be readily understood by referring to my Patent 1,137,140 granted to me April 13, 1920. With this construction, coordinately with the turning movement of the tool head and the shutting off of the power from the head stock, the valve 152 is shut off to thereby automatically cause the coolant to cease flowing. The tank is mounted on rollers 157 so as to enable ready removal of the same from the machine and the tank is provided with a central boss 158 provided with a hole to embrace a locating stop 159 screwed into the housing in order to properly position the tank with reference to the housing. The forward-end of the tool carriage is provided with a marginal wall 160 terminating in a drain spout 161, and the upper surface slopes toward said drain spout to drain the coolant flowing thereon into a compartment 162 within the housing from which an overflow pipe 163 empties into the settling compartment 164 of the tank 147. The inclined guards 33 and 34 on the ways also assist in draining the coolant back to the tank.

A grinding wheel truing device 170 is adjustably mounted on a bracket 171 secured to the housing.

By the above construction, I have provided a machine having several driven portions all deriving their power from a common drive shaft under control of the operator. By my construction, I am also able to change the work spindle in a minimum amount of time, and automatically furnish the correct speed of driving with each spindle diameter. Furthermore the floating idlers enable me to have wide latitude of movement of either the tool carriage or the head stock and enable me to easily accommodate pulleys of different sizes. By shutting off the power from the head stock and cutting off the coolant simultaneously with a retracting and swinging movement of the tool head, I enable the operator to manipulate the work with comfort and with freedom from bodily injury.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations without omitting certain features that, from the standpoint of the prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention, and therefore such adaptations should be and are intended to be comprehended within the meaning and range of equivalency of the following claims.

Having thus revealed this invention, I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:—

1. In a machine of the class described a housing, a head stock mounted thereon, a tool carriage supporting a swingable tool head axially movable to and from said head stock and means including a cam for swinging said tool head laterally upon sufficient movement thereof axially away from the head stock.

2. In a machine of the class described a housing, a head stock mounted thereon, a tool carriage supporting a swingable tool head movable to and from said head stock, a cam mechanism for swinging said tool head upon sufficient movement thereof away from the head stock and a weight for restoring the tool head upon forward movement of the tool carriage.

3. In a machine of the class described a

housing head stock mounted thereon, a tool carriage supporting a swingable tool head movable to and from said head stock, a roller attached to the tool head, a cam plate adjustably mounted on the housing in position to engage the roller, said cam and roller effecting a swinging movement of the tool head upon sufficient movement of the tool carriage away from the head stock, a weight secured to said tool head and operative to restore said tool head upon forward movement of the tool carriage, an abutment on the tool carriage and a stop pin on the tool head to limit the return swinging movement of said tool head.

4. In a machine of the class described, in combination; a housing; a head-stock mounted thereon; a rotatable spindle in said head-stock and driving means therefor; a tool carriage movable to and from said head stock; a swingable tool head thereon; automatic means for limiting the movement of said tool carriage including a lever and two dogs normally cooperating therewith at each reciprocation of said carriage; manual means for rendering ineffective one of said dogs to permit an abnormal movement of the tool carriage; and means actuated by said abnormal movement to simultaneously effect a disconnection of the head stock spindle driving means and swing said tool head out of its normal working position.

5. In a machine of the class described a housing, a head stock mounted thereon, a rotatable spindle in said head stock and driving means therefor, a tool carriage movable to and from said head stock, a swingable tool head thereon, and means operative upon sufficient retractile movement of the tool carriage to simultaneously effect a disconnection of the head stock spindle driving means and a swinging movement of said tool head.

6. In a machine of the class described, a housing, a head stock and a reciprocable tool carriage mounted thereon, a shaft in the head stock, a driving pulley therefor, a clutch mechanism for said driving pulley, a dog adjustably mounted on the tool carriage, a lever having forked ends in the path of said dog, the arms of said lever being alternately engaged by the dog in oppositely directed movements of the tool carriage, and mechanism linked to said lever and operative to throw the clutch mechanism for said driving pulley into and out of driving engagement with the pulley upon reciprocal movements of said carriage.

7. In a machine of the class described, a housing, a head stock, and a tool carriage and a tool head mounted thereon, a shaft in said head stock and a spindle in said tool head, a main drive shaft, driving mechanism for said shaft connected thereto, an independent driving connection for the spindle means on the machine for simultaneously disconnecting both said driving mechanisms from said main drive shaft and auxiliary means for disconnecting the shaft.

8. In a machine of the character described, a reciprocable tool carriage, ways upon which said carriage reciprocates anti-friction rollers in said ways and resilient means urging said rollers against the carriage to relieve a portion of the weight of said carriage from the ways.

9. In a machine of the class described, a reciprocable tool carriage, ways upon which said carriage reciprocates, anti-friction rollers provided with shanks seated in said ways, keyways in said ways and guide pins on said stems to prevent the rollers from being disaligned, and resilient means urging the rollers upwardly against the carriage to relieve the portion of the weight of said carriage from the ways.

In witness whereof, I hereunto subscribe my name, as attested by the two subscribing witnesses.

GEORGE C. KIMMEL.

Witnesses:
SOL EINSTEIN,
FREDERICK V. GEIER.