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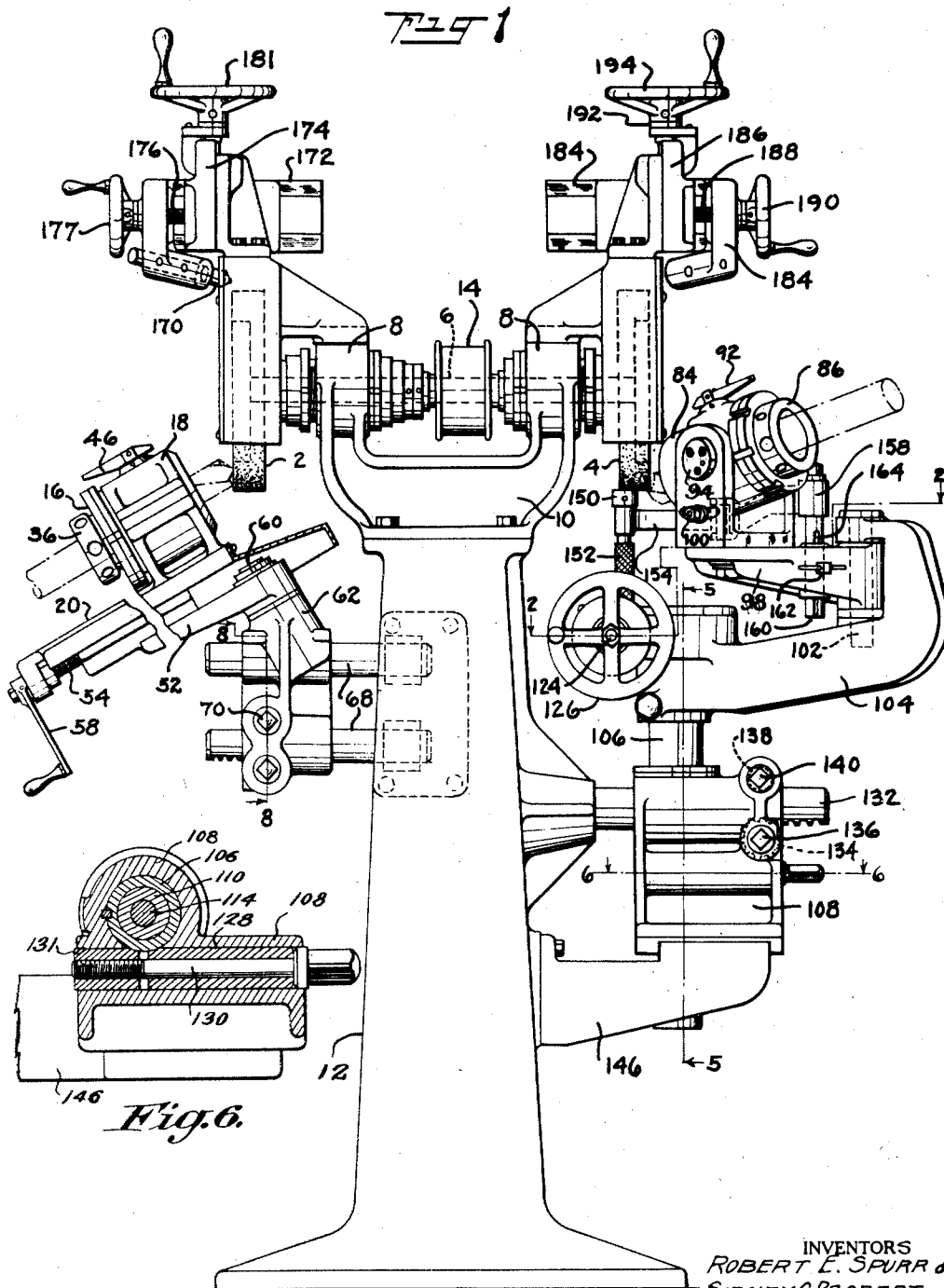
S. C. PROBERT ET AL

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MACHINE FOR GRINDING TWIST DRILLS

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4 Sheets-Sheet 1



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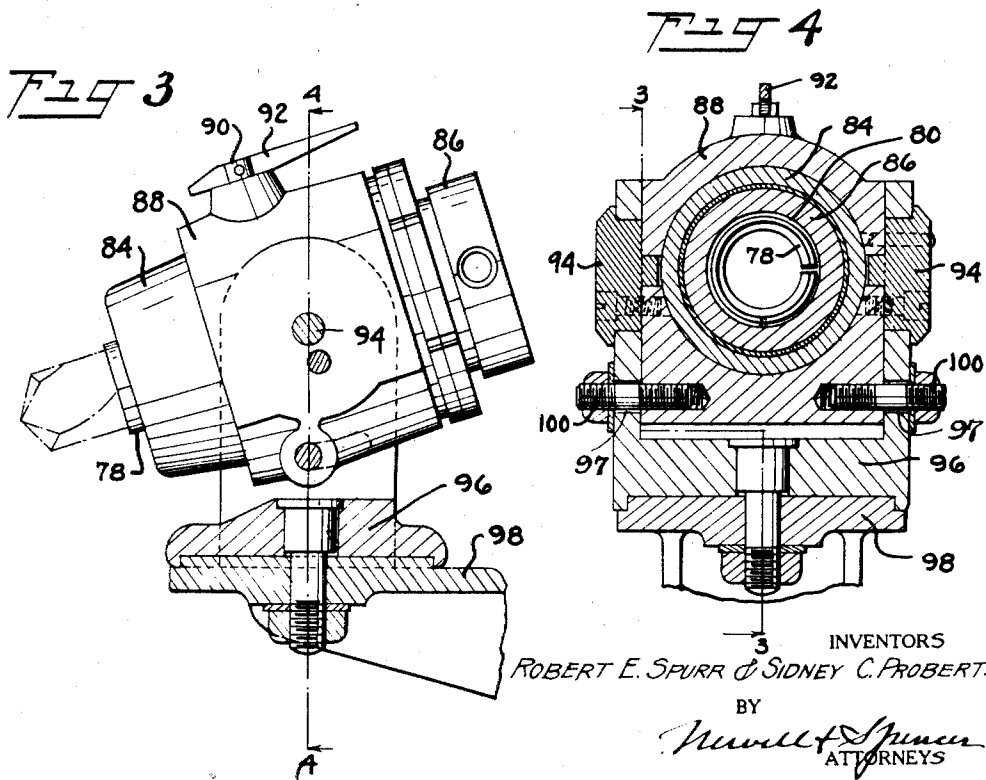
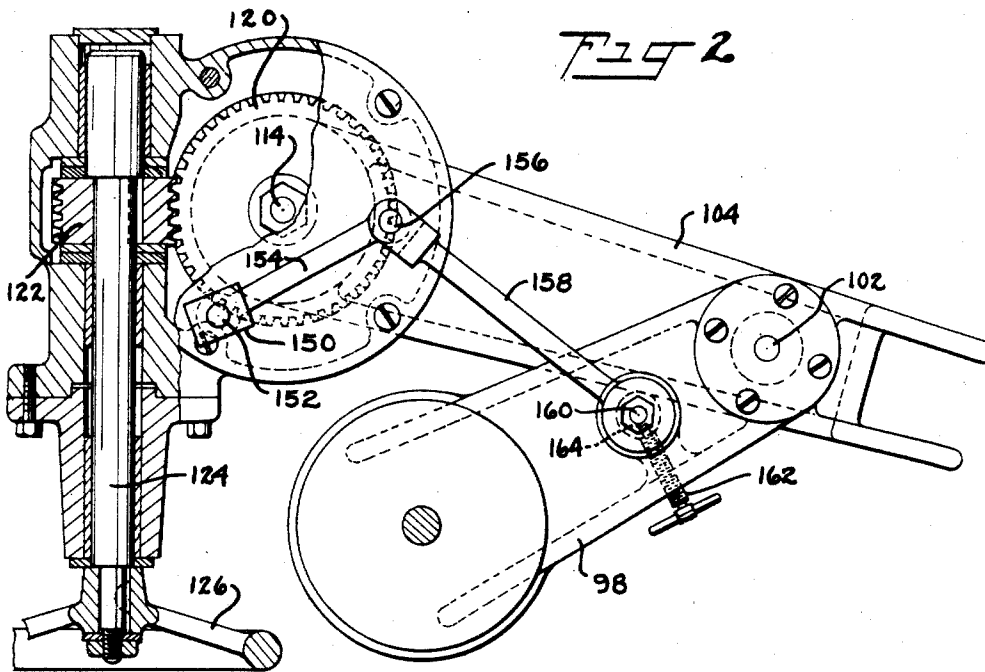
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MACHINE FOR GRINDING TWIST DRILLS

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4 Sheets-Sheet 2



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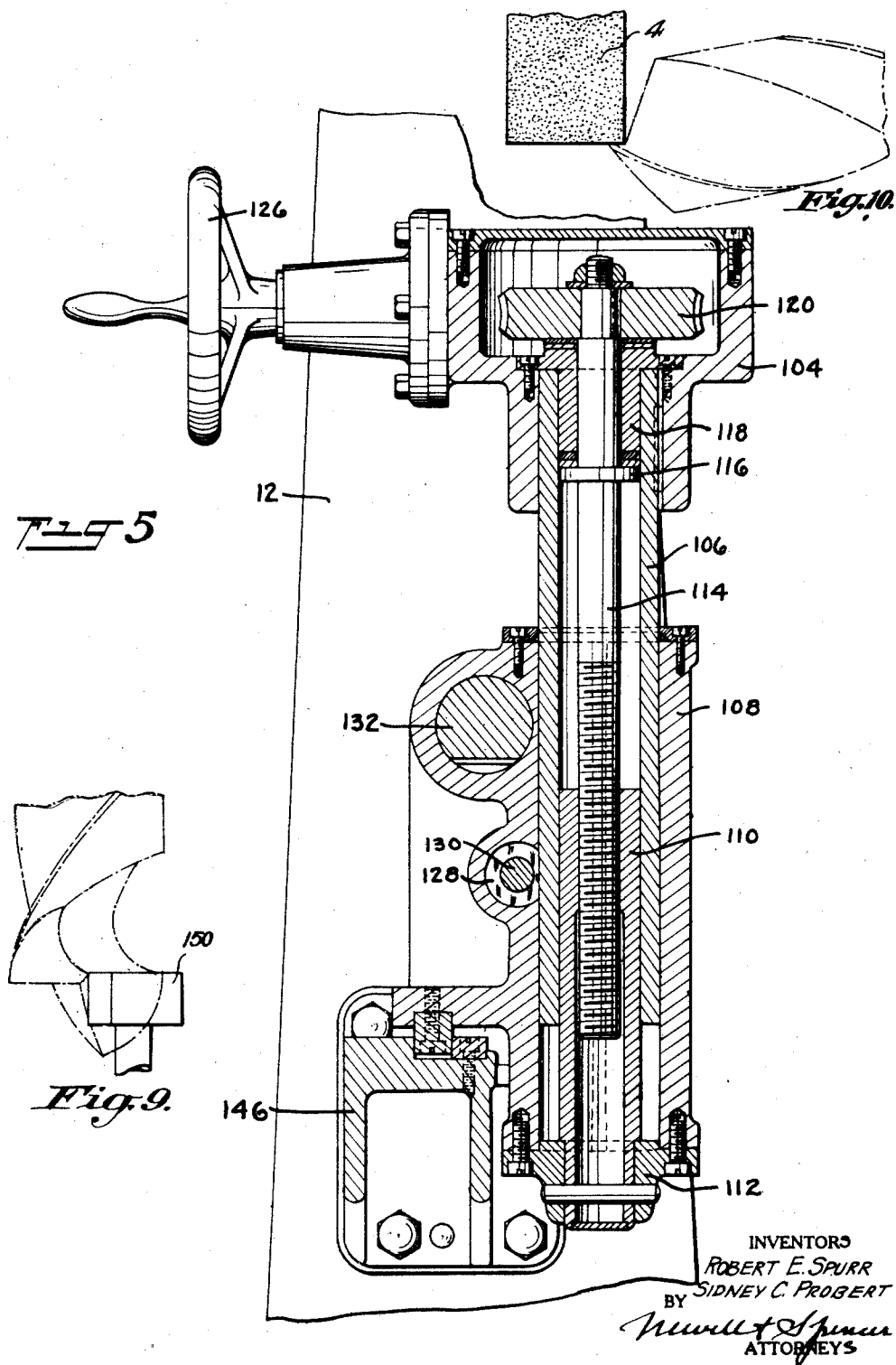
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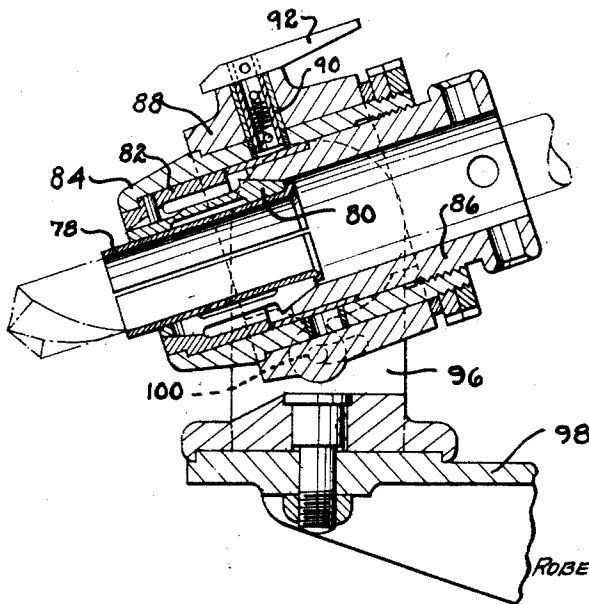
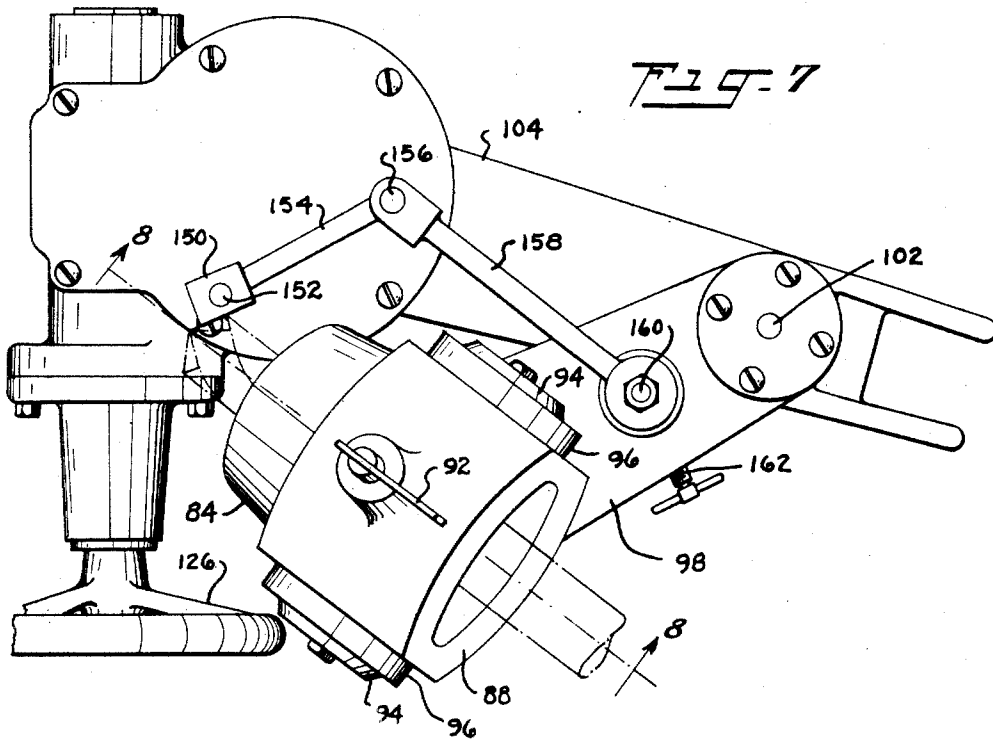
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MACHINE FOR GRINDING TWIST DRILLS

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UNITED STATES PATENT OFFICE.

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MACHINE FOR GRINDING TWIST DRILLS.

Application filed October 10, 1924. Serial No. 742,770.

The present invention relates to machines for grinding twist drills.

It is highly important in grinding twist drills that the drill should be accurately ground according to certain specifications, in order that the drill may cut with the proper speed and accuracy. In the ordinary method of grinding a twist drill, the end faces only of the lips are ground to produce the cutting edges. Each cutting edge of a drill should be perfectly straight and parallel with the other cutting edge and the cutting edges should be accurately spaced 180° apart about the axis of the drill. These cutting edges also should be accurately located at the same distance from the axis of the drill. In order to produce these results, it is desirable not only to grind the end faces of the lips, but also to grind the inner faces of the lips.

The proper grinding of a twist drill by hand takes some time and requires considerable skill and care, so that the operation must be performed by a skilled operator.

The principal object of the present invention is to produce a new and improved machine for grinding twist drills upon which the inner faces of the lips of such drills may be quickly and accurately ground, to locate the cutting edges of the drill in the proper relation to each other and to the axis of the drill.

With the above object in view, the present invention relates particularly to mechanism for holding a twist drill and for controlling and guiding the same so as to present the inner faces of the lips of the drill to a rotary grinding wheel to grind accurately these faces of the lips. This mechanism is constructed and arranged so that the grinding operation may be quickly and accurately performed and so that the operation of the machine does not require any particular skill.

In the present application, certain parts of the mechanism for holding a drill to present the end faces of the lips of the drill to the grinding wheel and certain parts of the truing mechanism with which the machine is provided for truing up the grinding face of the grinding disc, are illustrated. These mechanisms are not, however, herein described nor claimed, but form the subject

matter of applicants' co-pending applications, Serial Nos. 224,122 and 224,121, filed October 5, 1927.

The various features of the invention will be clearly understood from the accompanying drawings illustrating the invention in its preferred form and the following detail description of the constructions therein shown. In the drawings—

Figure 1 is a view in front elevation of a grinding machine embodying the invention;

Figure 2 is a view partly in plan and partly in section taken substantially on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 4 and illustrating one of the sets of drill-holding devices;

Figure 4 is a sectional view taken substantially on the line 4—4 of Figure 3;

Figure 5 is a view in vertical section taken substantially on the line 5—5 of Figure 1;

Figure 6 is a detail view in horizontal section taken substantially on the line 6—6 of Figure 1;

Figure 7 is a plan view of the mechanism for holding a drill in grinding the inner faces of the lips;

Figure 8 is a view in vertical section of the drill-holding devices illustrated in Figures 3 and 4, taken substantially on the line 8—8 of Figure 7; and

Figures 9 and 10 are diagrammatic views illustrating the manner in which the drills are positioned in the holding devices before grinding.

The machine embodying the present invention in the form illustrated in the drawings of this application is a double machine and comprises two rotary grinding discs indicated respectively at 2 and 4, secured to the opposite ends of a shaft 6 mounted in bearings 8, formed on a bracket 10, secured to the upper end of a standard 12. Upon the shaft 6 is mounted a belt pulley 14 about which passes a suitable driving belt (not shown). Each of the grinding discs is provided with a central recess extending inwardly from the outer face as indicated in dotted lines.

A grinding disc 2 is provided for grinding the end faces of the lips of drills, mecha-

nism being associated with this disc for holding a drill to present the end faces of the lips to the peripheral portion of the grinding disc. A grinding disc 4 is provided for grinding the inner faces of the lips of drills.

In grinding the inner faces of the lips of a drill, the drill is presented to the grinding wheel 4 preferably in position to bring the inner face of a lip into tangential contact with the peripheral surface of the grinding wheel. During the grinding operation, the drill is moved relatively to the grinding wheel so that the grinding wheel will make a grinding cut across the inner face of the lip in a plane substantially parallel with this face. The drills are presented to the under portion of the periphery of the grinding disc 4, and are swung about an axis preferably substantially parallel with the plane of the disc to cause the grinding wheel to grind across the inner face of the lip. The drill is preferably located with its axis at an oblique angle to the axis of the grinding wheel to give a certain amount of rake to the face of the lip, this rake being variable through suitable adjustments. The drill is clamped in an indexing chuck similar to the chuck by which the drill is clamped for presentation to the grinding wheel 2, and this chuck also is mounted to rotate about the axis of the drill. Also mechanism is provided for locating the chuck in either of two predetermined positions substantially 180° apart to locate either of the lips in position for grinding.

The chuck in which the drill is clamped comprises a drill sleeve 78, a collet 80 surrounding the drill sleeve, a bushing 82 engaging one end of the collet, a barrel 84 in which the bushing is secured, and a sleeve 86 threaded into the barrel and engaging the opposite end of the collet. The barrel 84 is rotatably mounted in a supporting ring 88, and is provided with bushings located 180° apart to receive a locking pin 90 upon which is pivoted an operating lever 92. The parts of the chuck just described have substantially the same construction, arrangement and mode of operation as the parts of the chuck for holding a drill in position for grinding the end faces of the lips, shown and described in applicants' co-pending application, Serial No. 224,122.

When a drill is inserted in a chuck, the barrel 84 is locked in position by the engagement of the locking pin 90 in one of the bushings in said barrel. In grinding the inner faces of the lips of a drill, the drill is inserted in the drill sleeve 78 which has been allowed to expand by turning the sleeve 86 to receive the drill and the drill is positioned longitudinally so that the chuck will grip the drill at the desired distance from the point. When the drill has been located in

the proper longitudinal and rotary position in the drill sleeve, the sleeve 86 is rotated to clamp the drill in position in the chuck. When the grinding of the inner face of one lip is completed, the locking pin 90 is disengaged from the bushing in the barrel 84 and the barrel is turned through 180° until the locking pin snaps into the other bushing. This will locate the other lip of the drill in position to be ground.

To enable the rake at which the inner face of the lip of the drill is ground to be varied, the supporting ring 88 is pivoted upon trunnions 94 between the arms of a yoke 96 secured to a supporting arm 98. This construction enables the drill to be tilted at different angles with relation to the plane of the grinding wheel. The ring 88 is held in adjusted position with relation to the yoke 96 by means of bolts 100 threaded into the ring and engaging in slots 97 in the arms of the yoke.

The supporting arm 98 is pivoted by a stud 102 to an arm 104 to swing preferably upon an axis substantially parallel with the plane of the grinding disc to carry a drill past said disc.

To enable a drill in the chuck to be adjusted vertically into proper position for contact with the lower margin of the grinding wheel the arm 104 is mounted for vertical adjustment. To this end the arm 104 is secured to the upper end of a guide stud 106 (see Fig. 5) mounted to slide vertically in a correspondingly shaped guideway in a bracket 108 secured to the frame of the machine and the stud is held from turning in the bracket by a suitable key. The guide stud 106 is hollow and within the same is engaged a hollow stud 110, the lower end of which is seated in a collar 112 secured to the bracket 108. Within the studs 106 and 110 is rotatably mounted a shaft 114, the lower end of which is threaded and engages corresponding screw threads formed on the interior of the stud 110. The shaft 114 is provided with an outwardly extending flange 116 which supports a bushing 118 secured to the arm 104. Thus the rotation of the shaft 114 in opposite directions will raise and lower the arm 104. The shaft is arranged to be rotated by mechanism comprising a spiral gear 120 secured to the upper end of the shaft and a spiral gear 122 (Fig. 2) secured to a shaft 124 mounted in bearings in a casing secured to the arm 104. A hand wheel 126 is secured to the forward end of the shaft 124 to enable the shaft to be manually rotated. The stud 106 and the arm 104 are held in adjusted position by means comprising a clamping sleeve 128 mounted to slide longitudinally in a bore in the bracket 108 and arranged to engage the stud at its inner end. The clamping sleeve is actuated to clamp the stud by means of a

bolt 130 passing through the sleeve and threaded into a nut 131 secured to the bracket. (See Fig. 6.)

In order to locate the end of the drill in the proper position transversely of the grinding disc the bracket 108 is mounted to slide on a horizontal stud 132 and is adjusted longitudinally of the stud by means of a rotatable pinion 134 mounted in the bracket and meshing with teeth on the stud. The pinion is secured to a shaft 136, the outer end of which is shaped to receive a crank handle for turning the same. The bracket 108 is clamped in position on the stud 132 by mechanism which comprises the clamping sleeve 138 mounted to slide in the bracket 108 and arranged to engage the stud 132 and a shaft 140 passing through the sleeve and threaded into a nut mounted in the bracket for actuating the sleeve. The outer end of the shaft 140 is also shaped to receive a crank handle or other suitable tool.

In order to prevent the bracket 108 from turning on the stud 132 the bracket is provided at its lower end with a projecting rib engaging in a guideway formed in an arm 146 projecting from the frame of the machine.

Before placing a drill in the drill-holding chuck the arm 98 is swung forwardly from the position shown in Figure 7, so that the drill will not contact with the grinding disc when inserted in the chuck, and the barrel 84 is located in position with the locking pin 90 engaging in one of the bushings in the barrel. The drill is inserted in the drill sleeve 78 and turned until the inner face of the lip occupying the lower position is substantially tangential to the periphery of the grinding disc. The drill is then clamped in the chuck by turning the clamping sleeve 86 after which the arm 104 is adjusted vertically to bring the inner face of the lip of the drill into position for grinding contact with the periphery of the grinding wheel. The arm 98 is then swung rearwardly about the stud 102 to carry the inner face of the lower lip of the drill across the periphery of the grinding wheel. To enable the inner face of the lip to be ground to be located accurately in the proper angular position the machine is provided with a lip-locating gage block 150 secured to the upper end of a spindle 152 mounted to rotate in a supporting arm 154. The arm 154 is pivoted at 156 on an arm 158 which is secured to a shaft 160 mounted to slide longitudinally in a bearing in the arm 98. The shaft 160 is secured from longitudinal movement and also from turning in its bearing in the arm 98 by means of a screw threaded pin 162 threaded into the arm 98, the inner end of which engages in a longitudinal groove 164 in the shaft 160 and is arranged to be forced against the bottom of the groove.

The arm 154 is mounted to swing around the pivot 156 to carry the gage block into and out of operating position. The gage block may be adjusted vertically by unscrewing the pin 162 and adjusting the shaft 160 longitudinally. The gage block 150 preferably is in the form of a rectangular prism, the upper surface of which is substantially tangential to the periphery of the grinding wheel. In positioning a drill by means of the gage block, with the arm 98 swung back out of grinding position, a drill is inserted in the drill sleeve and is located longitudinally in the sleeve by the operator so that the gage block will engage the point of the drill. The gage block is then swung back into engagement with the point of the drill, as shown in Figure 7, and the drill is rotated about its axis until the inner face of the lip occupying the lower position is in alignment with the upper face of the gage block. This is determined by the eye. The drill is then clamped in position in the chuck and the gage block is swung back out of the way. The drill carrier may, of course, be adjusted vertically or transversely of the grinding disc to locate the inner face of the lip properly with relation to the grinding wheel before starting the grinding operation. After the drill is properly located the grinding operation is performed by swinging the arm 98 to carry the point of the drill past the grinding wheel. After one grinding cut has been taken the drill carrier may be adjusted vertically to a slight degree to take a slightly deeper cut if desired.

When the face of one lip is ground the barrel 84 is unlocked by releasing the locking pin 90 and is turned through 180° until the locking pin engages the opening in the opposite bushing. This will locate the other lip of the drill in position for grinding and the grinding operation is performed in the same manner as before.

The machine is provided with mechanism for supporting two truing tools, one for each grinding disc, for truing up the grinding surfaces of the discs.

Figures 9 and 10 illustrate the manner in which the drill is positioned in grinding the inner faces of the lips. Figure 9 shows the drill positioned with the inner face of a lip flush with the upper surface of the gage block 150.

To enable different sizes of drills readily to be ground upon the present machine, drill sleeves 78 of different sizes are provided and also collets 80 having different interior diameters are provided to correspond with the different sizes of drill sleeves. The collet and drill sleeve of the chuck may be readily withdrawn from the chuck upon unscrewing and removing the actuating sleeve 86. Thus the collet and drill sleeve for one

size of drill may be removed from the chuck and another collet and drill sleeve for another size of drill substituted therefor very quickly and easily.

5 Upon the present machine drills of various sizes may be ground with a high degree of accuracy and no particular skill is required in operating the machine. Upon the present machine the drill grinding operation may be performed by an unskilled operator and the time ordinarily required in the grinding of twist drills is greatly reduced. Thus a large part of the cost of maintaining such drills in sharpened condition in manufacturing plants will be saved by the use of this machine.

10 In the present machine the drill is held by its finished outside surface in each grinding operation and is indexed about the true center or axis of this surface. Thus the lips of the drill are ground accurately in predetermined relation to the outside surface of the drill.

20 It is to be understood that the invention is not limited to the particular construction and arrangement of parts of the illustrated embodiment of the invention but that the invention may be embodied in other forms within the scope of the claims.

25 Having thus described our invention, we claim as new—

30 1. A grinding machine having in combination a rotary grinding wheel, means for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, and mechanism for supporting said holding means for movement to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the lip.

2. A grinding machine having in combination a rotary grinding wheel, means for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the wheel in tangential relation to the peripheral surface of the wheel with the cutting edge of the lip extending in the general direction of the plane of the wheel, and mechanism for supporting said holding means for movement to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the lip.

3. A grinding machine having in combination a rotary grinding wheel, means for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, mechanism for supporting said holding means for movement to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the

lip, and mechanism for locating said holding means angularly about the axis of the drill in positions 180° apart to position the inner face of each lip with relation to the grinding wheel.

4. A grinding machine having in combination a rotary grinding wheel, a drill-carrying arm, means on said arm for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, and means for pivotally supporting said arm to swing on an axis offset from the axis of the drill and transverse thereto to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the lip by the movement of said arm.

5. A drill grinding machine having in combination a grinding wheel, a swinging arm for supporting the drill in position to present the same to the grinding wheel, a pivotal arm for supporting the pivot of said first arm, and means for adjusting the latter arm to adjust laterally the axis of the first arm.

6. A drill grinding machine having in combination a grinding wheel, a swinging arm pivoted on an axis substantially parallel with the grinding wheel, means on said arm for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, an arm for supporting the pivot of said first arm adjustably pivoted on an axis substantially parallel with the axis of the first arm, and means for adjusting the latter arm to adjust the pivot of the first arm laterally.

7. A drill grinding machine having in combination a grinding wheel, a drill-carrying arm arranged to swing to carry the inner face of a lip of a twist drill across the periphery of the grinding wheel in a general direction parallel with the plane of the grinding wheel and also in the general direction of the cutting edge of the lip of the drill, and means for pivotally supporting said arm.

8. A drill grinding machine having in combination a grinding wheel, a drill-carrying arm arranged to swing to carry the inner face of a lip of a twist drill across the periphery of the grinding wheel in a general direction parallel with the plane of the grinding wheel and also in the general direction of the cutting edge of the lip of the drill, and means for pivotally supporting said arm, arranged for adjustment to adjust the pivot of the arm in a direction substantially parallel with the plane of the wheel.

9. A drill grinding machine having in combination a grinding wheel, a drill-car-

rying arm arranged to swing to carry the inner face of a lip of a twist drill across the periphery of the grinding wheel in a general direction parallel with the plane of the grinding wheel and also in the general direction of the cutting edge of the lip of the drill, and means for pivotally supporting the arm arranged for adjustment to adjust the pivot of the arm in a direction transverse to the plane of the wheel.

10. A drill grinding machine having in combination a grinding wheel, a drill-carrying arm arranged to swing to carry the inner face of a lip of a twist drill across the periphery of the grinding wheel in a general direction parallel with the plane of the grinding wheel and also in the general direction of the cutting edge of the lip of the drill, and means for pivotally supporting the arm arranged for adjustment to adjust the pivot of the arm in directions transverse to and substantially parallel with the plane of the wheel.

11. A grinding machine having in combination a rotary grinding wheel, means for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, mechanism for supporting said holding means for movement to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the lip, and means for adjusting the drill holding means to adjust said face of the lip toward and from the axis of the grinding wheel.

12. A grinding machine having in combination a rotary grinding wheel, means for holding a twist drill with its axis oblique to the plane of the grinding wheel in position to present the inner face of a lip to the grinding wheel at an angle to give the desired rake, mechanism for supporting said holding means for movement to carry the inner face of the lip past the grinding wheel in the general direction of the edge of the lip, and mechanism by which the relation of the axis of the drill to the grinding wheel may be adjusted to adjust the rake at which the inner face of the lip is ground.

13. A grinding machine for grinding the inner face of the cutting lip of a twist drill,

having in combination a rotary grinding wheel, means for holding a twist drill with its axis inclined to the wheel in one plane to locate the cutting edge of the lip in a position substantially parallel with the plane of the wheel and tangent to the periphery of the wheel, and in another plane to give the desired rake to said face of the drill when ground, the grinding wheel and holder being relatively movable to carry the inner face of the lip across the adjacent face of the grinding wheel in contact therewith in a direction substantially parallel to the plane of rotation of the grinding wheel and lengthwise of said cutting edge.

14. A grinding machine for grinding the inner face of the cutting lip of a twist drill, having in combination a rotary grinding wheel, means for holding a twist drill with its axis inclined to the wheel in one plane to locate the cutting edge of the lip in a position substantially parallel with the plane of the wheel and tangent to the periphery of the wheel, and in another plane to give the desired rake to said face of the drill when ground, the drill holding means being pivoted to carry the inner face of the lip past the grinding wheel in contact therewith in the direction of a line tangent to the periphery of the wheel and lengthwise of said cutting edge.

15. A drill grinding machine, having in combination a grinding disc, means for holding a drill in position for grinding the inner face of a lip of the drill and a gage for locating the inner face of a lip in a position substantially tangential to the peripheral surface of the grinding wheel when presented thereto.

16. A drill grinding machine, having in combination a grinding disc, means for holding a twist drill in position to be ground on the wheel, and a gage having a face occupying a predetermined position with relation to the disc and arranged so that the drill will be properly located angularly with relation to the disc by locating the inner face of a lip of the drill flush with said face of the gage.

Signed at Detroit, Michigan, this 7 day of October, 1924.

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