(No Model.) 2 Sheets—Sheet 1.

A. MILL.

RADIAL DRILL.

No. 557,004. Patented Mar. 24, 1896.

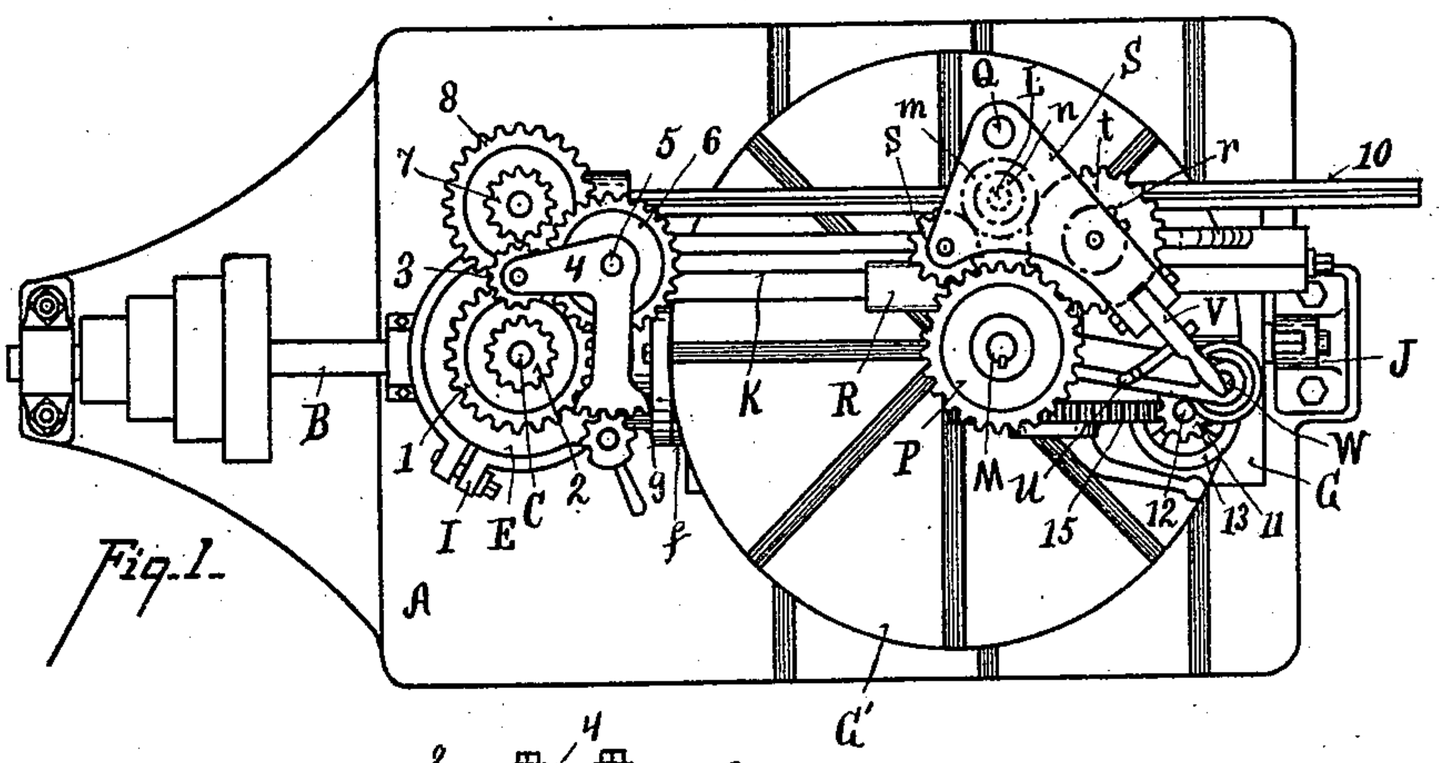

Fig. 1.

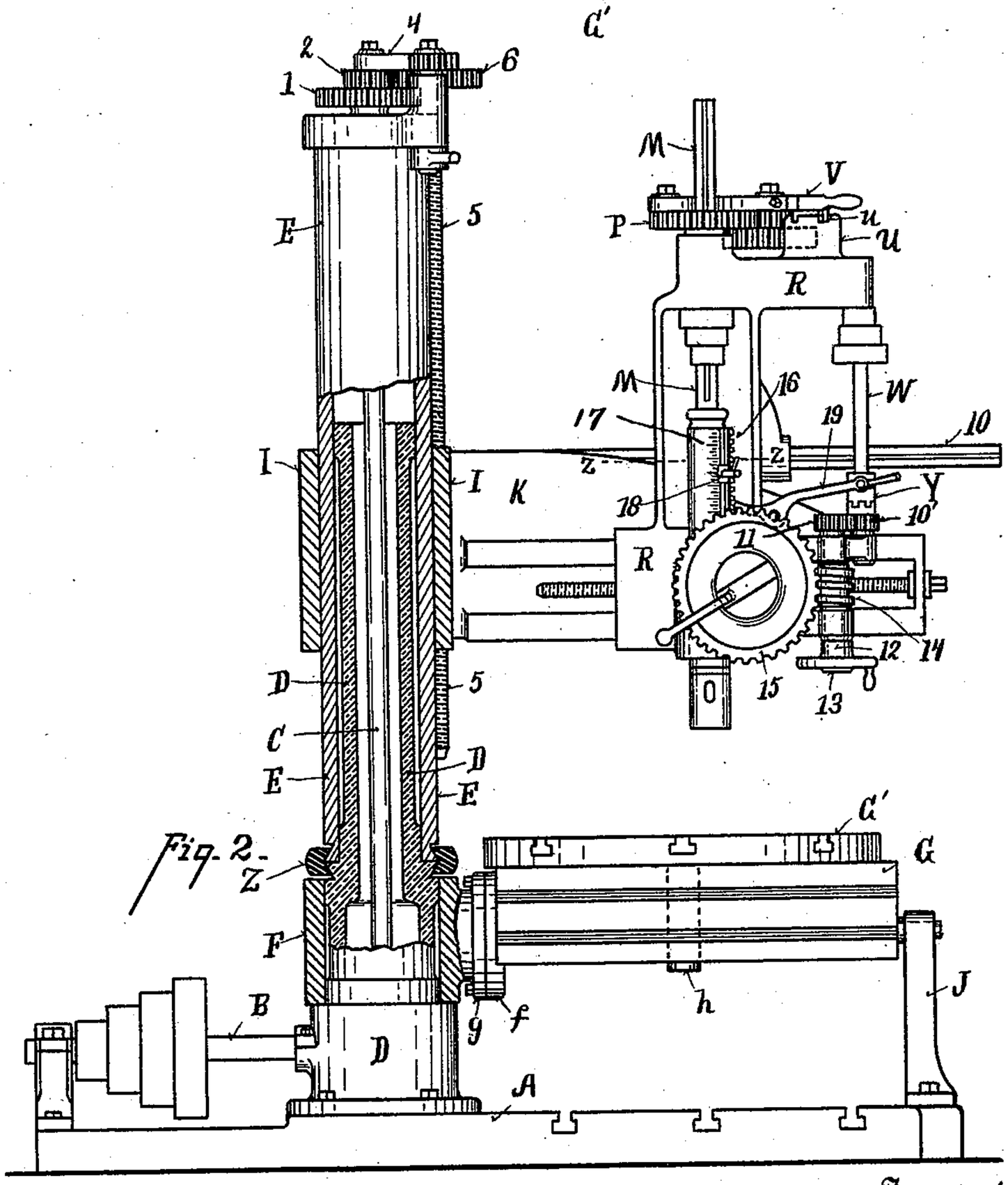

Fig. 2.

Witnesses
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(No Model.) 2 Sheets—Sheet 2.

A. MILL.

RADIAL DRILL.

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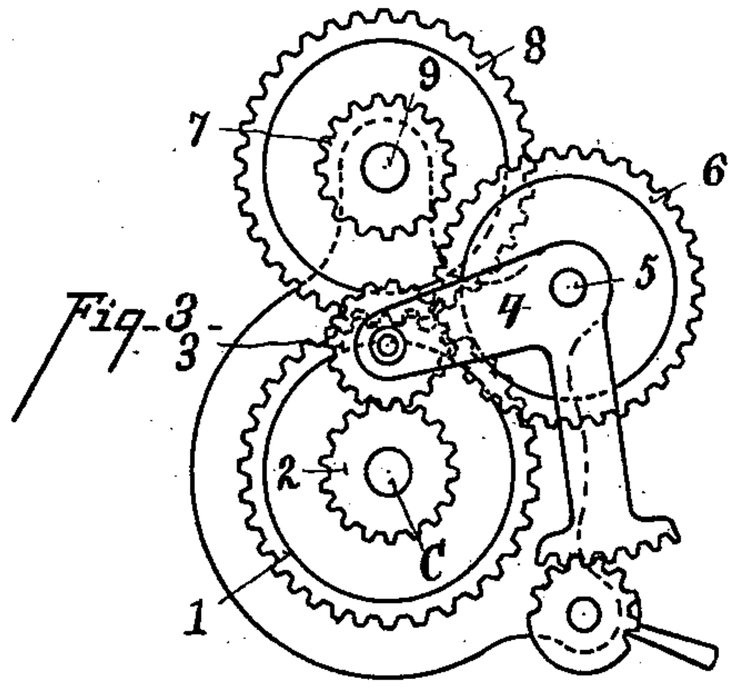

Fig. 3.

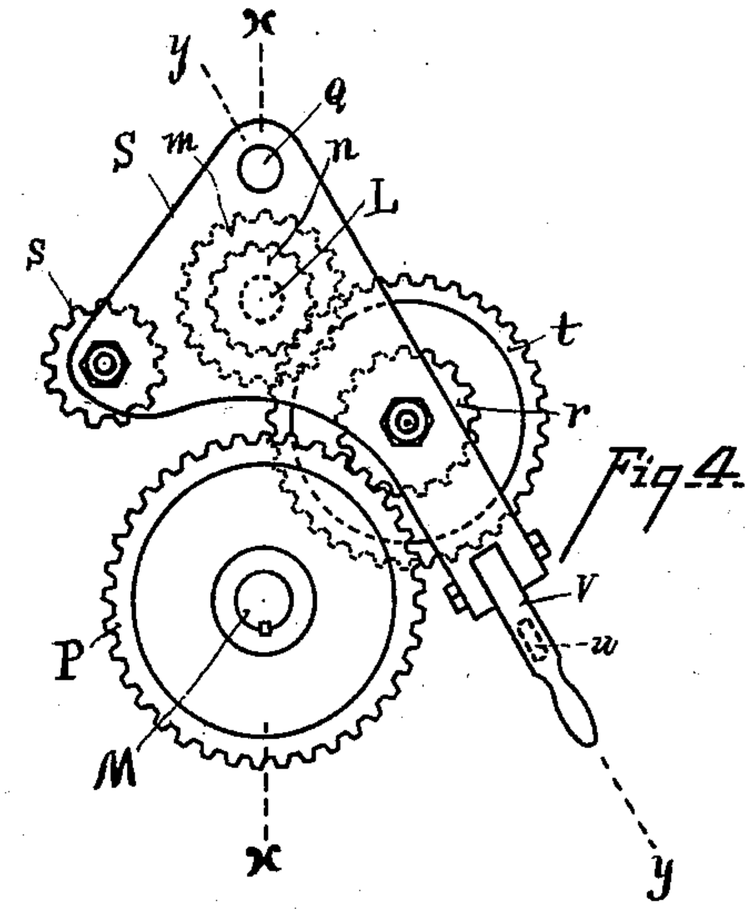

Fig. 4.

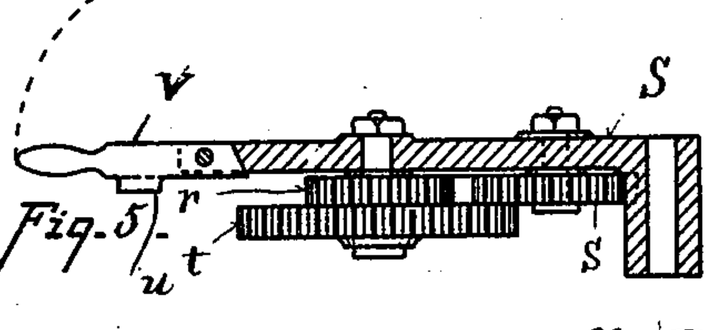

Fig. 5.

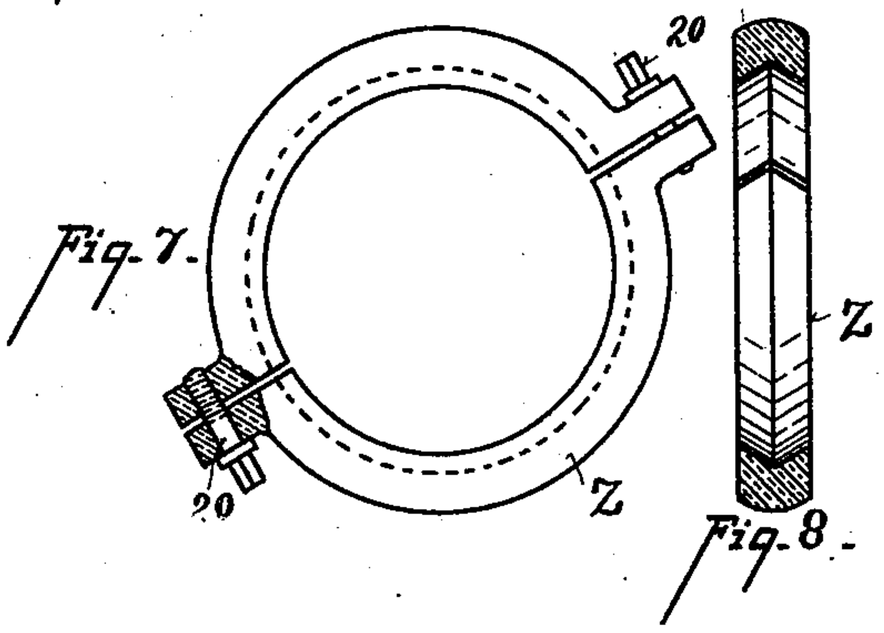

Fig. 7.

Fig. 8.

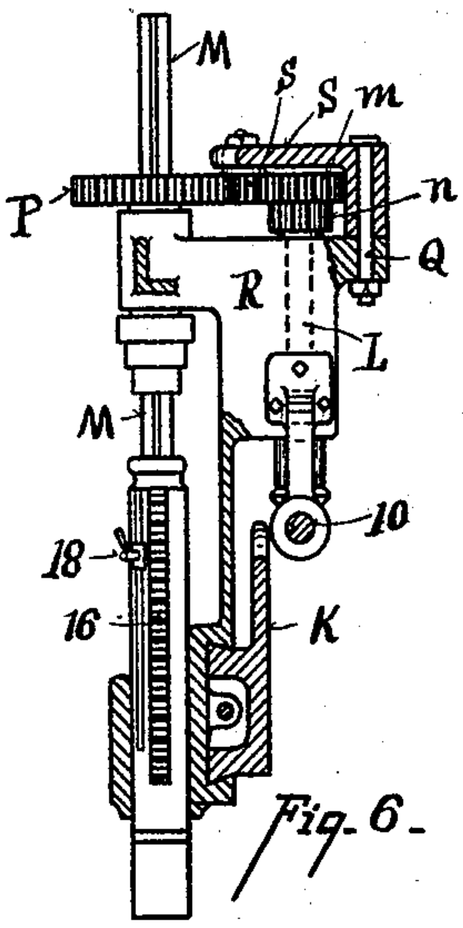

Fig. 6.

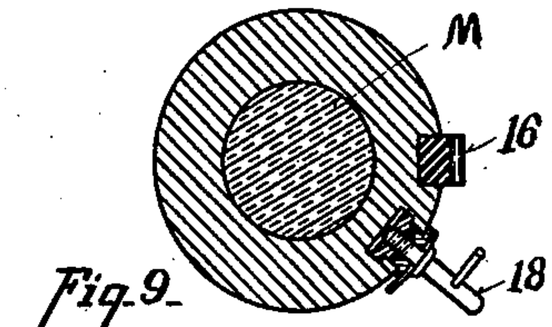

Fig. 9.

Witnesses
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UNITED STATES PATENT OFFICE.

ANTON MILL, OF CINCINNATI, OHIO.

RADIAL DRILL.

SPECIFICATION forming part of Letters Patent No. 557,004, dated March 24, 1896.

Application filed May 2, 1895. Serial No. 547,906. (No model.)

To all whom it may concern:

Be it known that I, ANTON MILL, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Radial Drills, of which the following is a specification.

The object of my invention is, first, to provide, in a radial drill, the combination of a stationary bed and a revolving column, a rotary and radially-adjustable table which may be brought into use and set at any desired angle or thrown out of use, and a stationary table employed as desired.

Another object of my invention is to provide improved means for vertically adjusting the radial-drill arm.

Another object of my invention is to provide improved means for feeding the radial-drill spindle and throwing the same out of gear.

Another object of my invention is to provide improved means for changing the speed of the drill.

The features of my invention will be more fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is a plan view of my improvement. Fig. 2 is a side elevation partly in section. Fig. 3 is an enlarged plan view of the mechanism for driving the drill-spindle and adjusting the drill-arm. Fig. 4 is a top plan view of the changeable gear for driving the spindle. Fig. 5 is a section on line *y y*, Fig. 4. Fig. 6 is a section on line *x x*, Fig. 4. Fig. 7 is a plan view of the clamping-ring. Fig. 8 is a central vertical section of Fig. 7. Fig. 9 is a section on line *z z*, Fig. 2.

A represents the bed-plate of the machine, the base of which forms a fixed table upon which the work may be supported.

B represents the main driving-shaft, which is provided with the usual bevel-gear meshing with the bevel-gear on shaft C and driving the same.

D represents a stationary column, upon which is supported the rotary column E and the sleeve-journal F for the adjustable table G. Said table G has an axial support upon the flange *g* of the sleeve F by means of the vertical flange *f*, so that the table G may be adjusted radially upon its center.

G′ represents a supplemental table supported upon the shaft *h*, which journals in a bearing formed in the table G.

The table G and its sustaining-sleeve F are radially adjustable upon the upright stationary column D, which forms a journal-support for the rotary sleeve E.

J represents an adjustable bracket for supporting the outer end of the table G. This is made readily movable, so as to allow the ready adjustment of said table.

K represents a vertically and radially adjusting drill-arm. It is secured to the sleeve I, which is clamped upon the rotary column E, sleeve I being vertically adjustable upon the rotary column E and revoluble therewith.

The mechanism for driving the drill-spindle and for adjusting the arm K vertically is mounted upon the top of said column-sleeve E and is constructed as follows: 1 represents the main gear upon the shaft C. 2 represents a transmitting-gear mounted upon the same shaft. 3 represents a shifting-gear mounted upon the arm of bell-crank lever 4, which centers upon the vertically-adjusting screw-rod 5 that engages with the thread of collar I′. 6 represents a transmitting-gear which meshes with and is driven by the transmitting-gear 3, so that when the transmitting-gear 3 is in contact with the gear 2 the screw-rod 5 is turned and it adjusts the collar I′ and its arm K vertically in one direction.

In order to reverse the direction of the screw-rod 5, I provide the following mechanisms: 7 represents a change-gear with which gear 3 is connected when the motion is to be shifted. Upon the shaft of this gear is mounted gear 8, which is in mesh with and constantly driven by gear 1. When gear 3 is in contact with gear 7, it being in mesh at all times with gear 6, it transmits motion in the opposite direction to screw-rod 5. Shaft 9, on which gear 8 is mounted, likewise drives and transmits motion to the transverse shaft 10 by the usual form of miter-gear, and this in turn drives the shaft L which drives the drill-spindle M by means of the changeable transmitting-gears *m n r s t*, which are brought into mesh

alternately with the gear P of the drill-spindle M in the following manner:

Q represents a stud-shaft supported on the top of the head-stock R. To this shaft is pivoted the tumbler-plate S, upon one arm of which is mounted transmitting-gear *s* and upon the other arm the transmitting-gears *t r*. When the parts are in the position shown in Fig. 4, the drill-spindle is driven by gears *m t r* P. When it is desired to increase the speed, the tumbler-plate is moved so as to bring the gears *s* in contact with the gears *n* P, when the drill-spindle M is driven by the gears *n s* P. When in the position shown in Fig. 4, gear *s* is disengaged from gears *n* P, and when gear *s* is in contact with gears *n* P the gears *r t* are disengaged from gears *m* P. In order to hold the said tumbler-plate S in any adjusted position, I provide the following instrumentalities: U represents a segment which is provided with a series of notches with which the lug *u* of the adjusting-lever V is adjustably connected. A material advantage is obtained by the use of this changeable gear, as the speed of the drill may be changed without stopping the same. It has hitherto been customary to make the change through the main driving-gear; but by the construction of the head-stock herein shown and by mounting the change-gear thereon the speed of the drill may be easily changed without stopping the operation of the machine.

If it is desired to stop the operation of the drill-spindle temporarily, the tumbler-plate S is moved so as to bring both gears *r s* out of mesh with the gear P, and the lock-lever holds it in that position, instantly stopping the operation of the drill.

In order to furnish an automatic feed for the drill-spindle and means for throwing it out of gear automatically, I provide the following devices: Upon the base of the head-stock I mount a feeding-shaft W, which is driven by a belt from the spindle M. Y represents a clutch which forms a connection between the shaft W and loosely-journaled gear 10 upon the lower end thereof. Gear 10 meshes with and drives gear 11 on shaft 12, which also carries a hand-wheel 13, so that the said shaft may be turned by hand when the clutch is unshipped. 14 represents a worm on said shaft 12, meshing with the worm-wheel 15, which carries a pinion that meshes with the rack 16 attached to the sleeve 17, in which the drill-spindle M journals. 18 represents a trip-pin placed on one side of the rack 16 and vertically adjustable thereon so as to regulate the time of tripping. To throw out the automatic feed, this trip is adapted to come into engagement with the tripping-lever 19, which is in engagement with the clutch-head, so that when said lever is depressed by the contact of the tripping-pin with its front end the clutch is unshipped from engagement with its coacting member and the feed thrown out of gear. When in this position the drill may be fed vertically by hand-wheel 13.

It is very desirable to have the rotary column E rigidly held in position after the radial adjustment of the drill-arm is made. To accomplish this I provide the following instrumentalities: Z represents a split ring which is grooved to fit upon dovetailed bevels formed upon the foot of the rotary column E and upon the base of the column H, so that when said split ring is drawn together by the clamping-nuts 20 the rotary column is securely locked to the stationary column. The dovetail form of this connection is made for the purpose of more securely drawing the parts together, as it takes less strain upon the clamping-screws to hold the parts in this position than if the faces of the parts were plain; but either form is within the scope of my invention.

I claim—

1. In a radial drill, the combination with the column D, of the table G provided with the rotary column E journaled on the base of the column D, the split ring Z forming a journal-support for the revoluble column E, the driving-shaft C journaled within said columns, the adjustable drill-arm K journaling on the sleeve F, the threaded rod 5 engaging with said sleeve, and driving-gear mounted upon the top of said shaft D and rod 5, substantially as and for the purpose specified.

2. In combination with the drill-arm K the head-stock R laterally adjustable thereon, the changeable driving-gear for driving the drill-spindle journaled therein, consisting of the gears *m*, *n*, P, mounted upon the shafts L and M journaled in said head-stock, a tumbler-plate S pivoted on said head-stock and carrying shipping-gears *r*, *s*, *t*, the feed-shaft W, the clutch Y operating feed-gears 10, worm 14, worm-wheel 15 operating the rack 16 of shaft M, and the tripping-pin 18 and tripping-lever 10 engaging the clutch Y of shaft W, substantially as described.

3. In combination with the head-stock R of a radial drill, the changeable driving-gear for driving the drill-spindle journaled therein, consisting of the gears *m*, *n*, P, mounted upon shafts journaled in said head-stock, a tumbler-plate S pivoted on said head and carrying shipping-gears *r*, *s*, *t*, a lever V pivoted to said tumbler-plate and carrying a lug *u* and a segment U arranged on the head-stock and adapted for engagement by said lug to lock the tumbler-plate in its adjusted position, substantially as described.

In testimony whereof I have hereunto set my hand.

ANTON MILL.

Witnesses:
W. R. WOOD,
C. W. MILES.