No. 646,750. Patented Apr. 3, 1900.

A. MILL.

RADIAL DRILL.

(Application filed June 23, 1899.)

(No Model.) 3 Sheets—Sheet 1.

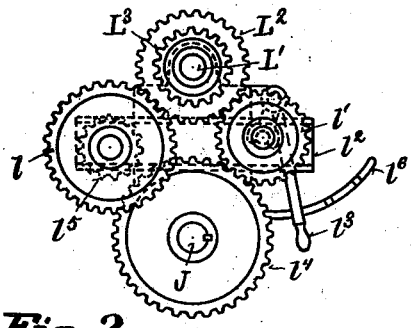

Fig. 2.

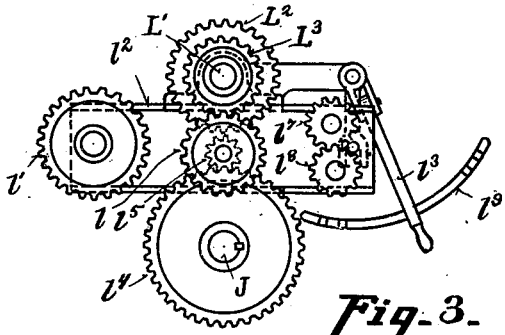

Fig. 3.

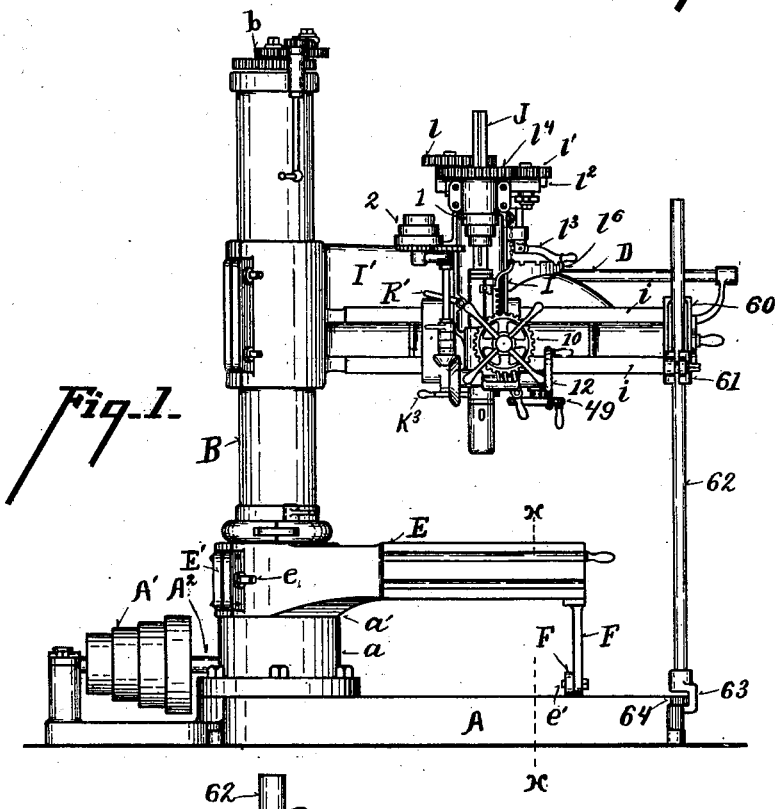

Fig. 1.

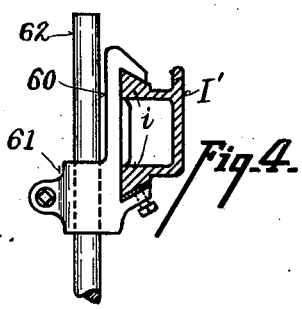

Fig. 4.

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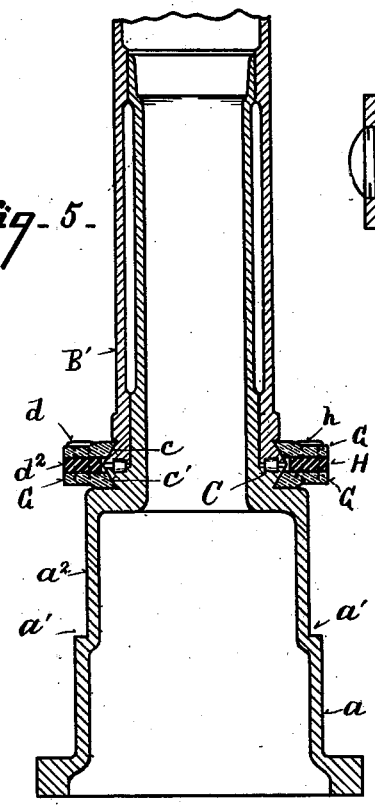
(No Model.) 3 Sheets—Sheet 2.

Fig. 5.



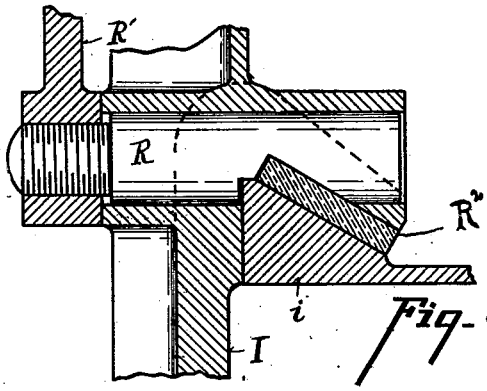


Fig. 6.

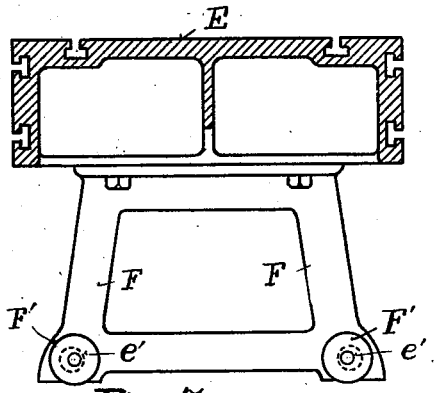


Fig. 7.

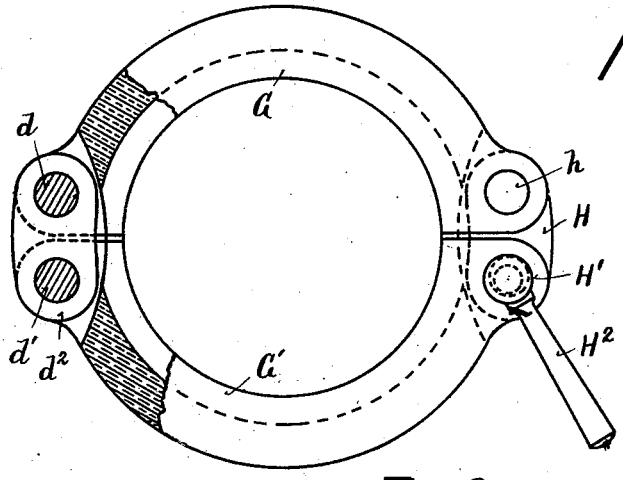


Fig. 9.

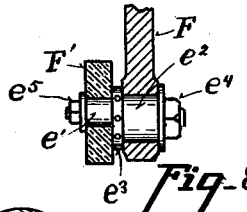


Fig. 8.

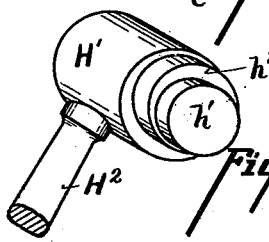


Fig. 10.

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RADIAL DRILL.

(Application filed June 23, 1899.)

(No Model.) 3 Sheets—Sheet 3.

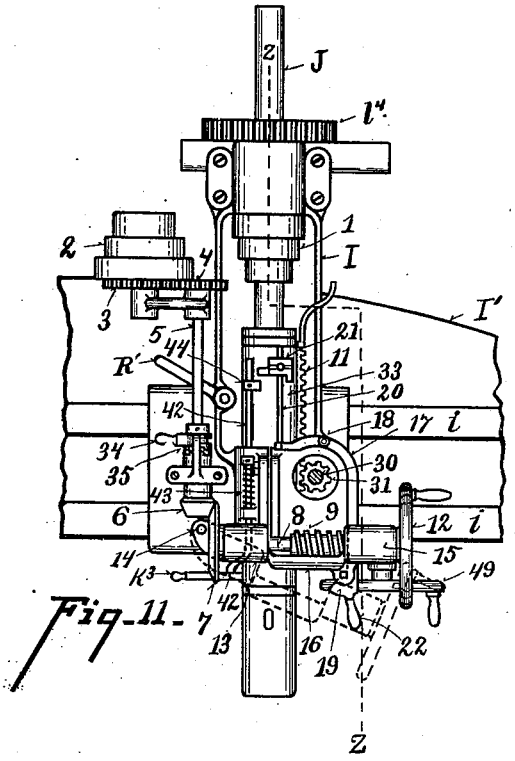

Fig. 11.

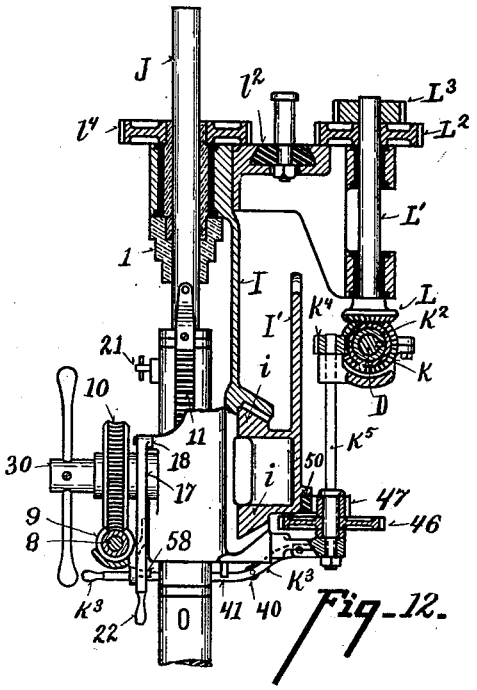

Fig. 12.

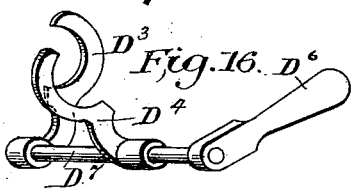

Fig. 16.

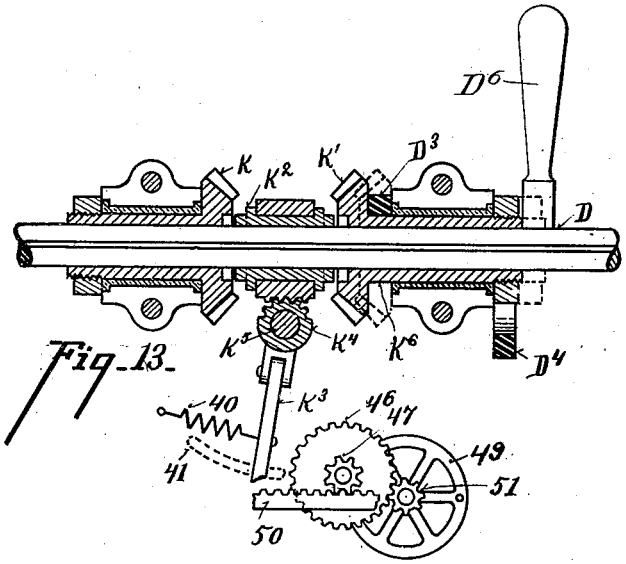

Fig. 13.

Fig. 15.

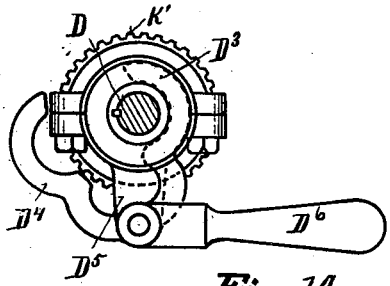

Fig. 14.

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UNITED STATES PATENT OFFICE.

ANTON MILL, OF CINCINNATI, OHIO.

RADIAL DRILL.

SPECIFICATION forming part of Letters Patent No. 646,750, dated April 3, 1900.

Application filed June 23, 1899. Serial No. 721,538. (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.

My invention relates to an improvement in radial drills the features of which are more fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is a front elevation of my improvement. Fig. 2 is a top plan view of the change-gear on top of the drill-stock. Fig. 3 is a modification of Fig. 2. Fig. 4 is a detail view of the supporting-bracket for the radial arm. Fig. 5 is a central section through the column. Fig. 6 is a detail view of the clamp for holding the drill-stock in place. Fig. 7 is a section through the table on line *x x*, Fig. 2. Fig. 8 is a detail view of the eccentric-stud on which the rollers, Fig. 7, are mounted. Fig. 9 is a plan view, partly in section, of the column-clamping segments. Fig. 10 is a detailed perspective view of the clamping eccentric-pin. Fig. 11 is an enlarged detail view of the drill-stock. Fig. 12 is a section of the same on line *z z*, Fig. 11. Fig. 13 is a detail sectional view of the reversing-clutch and gear. Fig. 14 is an end view of Fig. 13. Fig. 15 is a detail view of the mechanism for feeding the drill-stock laterally. Fig. 16 is a perspective view of the gear-locking arms shown in Figs. 13 and 14 detached from their journal.

A represents the base of the machine.

A′ represents the cone driving-pulley on shaft A^2, which carries a bevel-gear on the inner end meshing with a bevel-gear on an upright shaft within the hollow column B. On the top of this shaft is mounted a spur-gear *b*. This gear meshes with a gear mounted on the top of the column and drives a splined shaft mounted on the outside of the column for driving the horizontal shaft D. These gears and upright shafts are not shown in detail in the drawings, as they are of the ordinary construction.

It is essential in a drill to have a rigid support for all the parts, and I have provided the following means for this purpose:

a represents the base of the column, which is bolted to the bed-plate. *a′* represents a shoulder formed in said column, and a^2 represents the journal portion of the collar on which the swiveling table E is journaled. This table is slipped on over the top end of the column. The journal-eye of the table E is split.

E′ represents flanges projecting out on each side of the split.

e represents a clamping screw-bolt for drawing the split ends together to clamp the table rigidly to the column after it has been adjusted to the desired radial position. This clamp-screw can be readily loosened for any readjustment.

B′ represents a revoluble sleeve or cylinder journaled upon the stationary part of the column. It is essential to have a close and firm bearing-support at the base thereof. This I accomplish as follows:

c represents a V-shaped or inclined flange on the base of the revoluble cylinder B′. *c′* represents a corresponding incline on the stationary column, the two forming a V-shaped annular projection.

G G′ represent semicircular clamps, each one of which is provided with a hinge-pin *d d′*. d^2 represents a link pierced with orifices engaging over said pins *d d′*, thus hinging the two segments together. The inner peripheries of these clamps are V-shaped, as shown in Fig. 4, and engage upon the inclines *c c′*. In order to draw these two segments together, so as to clamp them with the desired tautness and rigidity, I provide the following mechanism:

H represents a link hinging at one end on the pin *h*, and upon the opposite end I provide a clamping-eccentric H′, provided with a handle H^2 for turning the same.

h′ represents a center which journals in the segment G′.

h^2 represents an eccentric above the center *h′*, which fits in the eye of the link, while the portion H′ is concentric with *h′* and journals in the top portion of G′ above the link. As this eccentric is turned it draws the link H in one direction or the other and clamps or unclamps the segments G G′. I thus obtain a concentric clamping of the two segments G G′ upon their bearing upon the collar and revoluble sleeve and form a reliable journal-

support for said sleeve or cylinder and affording means for clamping said revoluble sleeve rigidly upon the collar, which is very desirable in doing close work. C represents friction-rollers supporting the sleeve B'.

It is desirable to adjust its table E horizontally and also to adjust the outer end vertically to keep the table-top in a horizontal plane and to clamp the parts in the adjusted position. To accomplish this, I provide legs F, which are rigidly secured to the base of the table, as shown in Fig. 7. To the feet of these legs are attached rollers F', journaled on an eccentric-pin e', attached to the stud-bolt e^2, which journals in the legs of the table, as shown in Fig. 8. e^3 represents a flange rigidly secured to said stud-bolt e^2 and provided with peripheral holes, by which it may be turned to adjust the height of the eccentric-pin upon which the rollers journal. When the desired adjustment has been obtained, the nut e^4 is turned up, clamping the stud-bolt in the adjusted position. The nut e^5 holds the roller F' on its center.

I represents a drill-stock which is journaled so as to slide longitudinally on V-shaped ways i, as shown in Figs. 1 and 4. Upon this drill-stock is mounted the mechanism for operating the drill-spindle J and for moving the drill-stock laterally on its ways. The drill-spindle J takes its motion from bevel-gears K K' on shaft D, as shown in Fig. 12. Gear K is for driving the spindle and K' for reversing. This reversing is accomplished by means of a clutch K^2, which is shown splined to shaft D. This clutch is operated by a clutch-lever K^3, carrying the segmental gear K^4, which engages with teeth in the clutch-sleeve K^2. The gears K K' being loosely journaled on the shaft are alternately clutched as the lever K^3 is thrown to its extreme right or left position; but when the clutch is in position shown in Fig. 13 both gears are disengaged. These gears engage with gear L on the upright shaft L', as shown in Fig. 12.

L^2 L^3 represent spur-gears which engage with gears l or l', which are mounted on a sliding bar l^2. l^3 represents a lever secured to said bar for shifting it longitudinally. As shown in full line, Fig. 2, gear l' is in mesh with the gear L^2 and gear l^4 on the drill-spindle J, which is fast-speeded, gear l being out of engagement. When the bar l^2 is shifted to the right, gear l is brought into engagement with gear L^3 and gear l^5 is brought into engagement with the gear l^4 on the drill-spindle. Thus either slow or fast speed may be obtained by moving the shifting lever l^3.

l^6 represents a segment with notches for fastening the sliding lever in either position or securing the sliding bar in central position, in which position neither set of gears will be in engagement with the gears on shaft L'.

In Fig. 3 I have shown a modification for also reversing the motion of the drill-spindle. Gear l' is mounted upon the opposite end of the sliding bar l^2, and gears l and l^5 are mounted centrally on said slide. This slide is extended and provided with gears l^7 l^8, which are in mesh with each other. When the slide l^2 is thrown to its extreme left position, gear l^7 is thrown into mesh with gear L^3 and gear l^8 into mesh with gear l^4, thus reversing the motion of the drill-spindle. The segmental locking-bar l^9 is provided with appropriate notches for locking the lever l^3 into its several positions.

It is sometimes desirable when not using the drill for tapping to lock the bevel-pinion K out of engagement with the clutch K^2. To accomplish this, I mount said gear on a sleeve K^6, which sleeve journals on shaft D. To the ears or bracket D^5, attached to the journal-box, is pivoted a rock-shaft D^7, carrying two arms D^3 D^4, set staggered. These arms are operated by the handle D^6. When the gear K' is in its forward position, as shown in full lines, Fig. 13, the arm D^3 is thrown in between the journal-box and the gear K', thus locking it in its forward position. When this arm is thrown out of this space, the gear and its sleeve may be slid back, leaving a space between the nut and journal-box, into which space the arm D^4 is then moved into locking-gear K' in its rearward position, so that moving the clutch K^4 cannot cause an engagement with this gear.

It is desired to feed the drill by power at times. For this purpose I have provided a cone-gear 1 on the drill-spindle J, which drives the cone-pulley 2, which in turn drives the gears 3 4, shaft 5, and the bevel-gear 6, which drives bevel-gear 7, mounted upon the worm-shaft 8. Shaft 8 carries a worm 9. (See Fig. 11.) This worm drives a worm-wheel 10 on a shaft 30, carrying a gear 31, meshing with a rack 11 on the sleeve 33 of the drill-spindle, so as to feed the same vertically.

12 represents a hand-wheel for turning the worm-shaft 8 for feeding the drill by hand.

34 represents a hand-lever operating a friction-clutch 35 on the shaft 5 to stop and start the power-feed.

In order to trip the power-feed automatically, the worm-shaft 8 is journaled in a swiveling box 13, which is secured to the head-stock by pin 14. The rear end of said worm-shaft 8 is supported in the journal-box 15, which is rigidly connected by yoke 16 to the front or swivel journal 13. The rear journal is held in its working position, with the worm 9 engaging with the gear 10, by means of a trip-lever 17, the upper end of which is pivoted to the drill-stock by the center 18. The lower end of said lever 17 is provided with a hook 19, which engages with a catch 58 on the under side of the worm-box.

20 represents a groove in which a tripping-dog 21 is adjustably connected at any desired height on the drill-sleeve 33, so as to determine the depth to be drilled. The forward end of the lever 17 projects out vertically across the path of this tripping-dog 21, which strikes the forward end of said lever, disen-

gaging the catch 19 on the bottom end of said lever, which allows the worm-box to drop down into position shown in dotted lines, Fig. 10, disengaging the worm 8 with the worm-wheel 9, then stopping the feed. 22 shows a hand-lever also for operating this catch to engage and disengage it by hand.

It is desired at times to automatically reverse the spindle, as in tapping threads. For this purpose the worm 8 is disengaged, as before explained. It is also frequently desirable to automatically reverse the direction of the drill-spindle at a particular point. This is accomplished in the following manner:

The lever K^3 on reversing-shaft K^5 is provided with a spring 40, which normally draws the lever (see Fig. 11) to the left to bring clutch K^2 into engagement with reversing-gear K'.

41 represents a segment similar to the segment l^6, having a notch to receive and hold lever K^3 in such position as to engage clutch K^2 with gear K.

42 represents a tripping-rod journaled in boxes on the drill-stock and held up by means of a spring 43 and provided with a collar 44 to engage the trip 21. The lower end of the rod is vertically above the outer end of lever K^3 and when struck by the trip 21 throws the lever K^3 out of the notch in segment 41, when the spring 40 pulls the lever over and shifts the clutch into engagement with the gear K' and reverses the spindle. I have shown a toothed clutch K^2; but a beveled friction-clutch may be employed in its place, if desired.

46 47 represent gears mounted on stud-shaft and driven by means of a gear 51 on the shaft of hand-wheel 49, which in turn meshes with rack 50 to feed the drill along the ways *i i* on the radial arm I'.

R represents a clamping-bar for clamping the drill-stock to its adjusted position on the ways *i i*.

R' represents a hand-lever formed with a nut engaging the screw-threaded end of the clamping-bar to effect the clamping operation.

R^2 represents a fid lying upon the inclination of the upper way *i* and engaging the clamping-bolt R. The object of this fid is to prevent the way from being marred by the strain of the clamping-bolt R, the strain being transmitted through said fid.

Detachably secured to the outer end of the radial arm is a bracket 60, provided with an eye 61, in which is clamped the rod 62. The lower end of the rod is provided with a finger 63, engaging under the overhanging flange 64 on the base-plate A in order to support the outer end of the radial arm against heavy strains. The overhanging flange 64 may be formed integral with the base A or separately and bolted on, as desired.

In radial drills the radial arm slides longitudinally on a revoluble cylinder. This movement is accomplished by means of a screw-rod, (not shown in the drawings,) as it is a very common expedient in this class of drill. This radial arm is adjusted circumferentially by the rotation of the revoluble cylinder B, which must be secured to hold the radial arm in its adjusted position. It is an important feature to have a clamping device applied to the base of a cylinder as nearly concentric with the cylinder as possible, first, so as to avoid wear, and thereby maintain the horizontal plane of adjustment, and, second, to easily and readily hold the cylinder in its adjusted position. The clamping mechanism I have here shown and described is peculiarly applicable to radial drills, as it performs a function of holding the radial arm in position, and its under surface engages with the drill-table, and all parts are held firmly in their positions for the various adjustments desired. In drills of this class it is essential that the radial arm be maintained in a horizontal plane and the table also, so that the axis of the tool will be at exact right angles to the horizontal axis of the table, so as to secure the drilling of exact vertical holes. The eccentric roller-adjusting mechanism attached to the drill-table herein enables this adjustment to be readily and accurately obtained.

Having described my invention, I claim—

1. In combination with a stationary column, a revoluble cylinder journaled thereon and supporting a radial drill-arm of the clamping-segments G, G', pivoted to a common link d^2 at one end, the segment G being pivoted to link H and the segment G' pivoted to link H through the eccentric H', substantially as specified.

2. In combination with a stationary column, a revoluble cylinder journaled thereon, a radial drill-arm supported upon said cylinder of the revoluble table E journaled upon the stationary column and supported at its out end by the leg F, one or more rollers journaled upon an eccentric-pin whereby the horizontal adjustment of the table is maintained parallel with the horizontal plane of the radial drill-arm, substantially as herein specified.

3. In a radial drill employing a swinging arm, hinged to a revoluble sleeve, the combination with a drill-stock adjustably mounted upon said arm of the drill-spindle journaled in said stock, the reversing driving-gears K, K', mounted upon said shaft D, the clutch 2 mounted on said shaft, the segment-gear K^4 engaging with teeth on the clutch, the shipping-lever K^3 controlled by a spring and mounted in the path of the drill-spindle with mechanism for automatically tripping and reversing the motion of the drill-spindle, substantially as herein specified.

4. In a radial drill, a power feeding mechanism consisting of a vertical transmitting-shaft mounted on the traveling head-stock and transmitting motion to a worm-shaft journaled in a box pivoted at one end to the head-stock vertically under driving-shaft, a catch adapted to engage and hold said journal and its worm-shaft in engagement with

the worm-wheel 10 and transmitting motion to a feed-rack and means connected to and adjustably mounted on the drill-stock for tripping said catch and disengaging the worm from mesh with the worm-wheel automatically by the operation of the drill-spindle, substantially as specified.

5. In a radial drill employing a vertical drill-spindle, feeding mechanism consisting of a vertical shaft journaled to the head-stock driving a worm-shaft and worm-wheel, the pivotal journal-box 15 hinged at one end to the drill-stock, a catch for supporting said journal-box in a horizontal position, means for automatically disengaging said catch and lowering the worm-shaft in combination with a reversing-shaft and its gears, the spring-controlled lever K^3 operating a clutch K^2 for automatically reversing the motions of the spindle, substantially as specified.

6. In combination with the traveling head-stock of a radial drill, a vertical drill-spindle and a driving-gear, a transmitting-shaft L parallel with said spindle, a plurality of gears mounted thereon, a sliding bar l^2 mounted on ways in the head-stock and carrying differential gears mounted upon one end thereof, a single gear mounted upon the opposite end sliding longitudinally between the parallel shafts L′ and J, substantially as specified.

7. In combination with the traveling head-stock of a radial drill, a vertical drill-spindle and a driving-gear, a transmitting-shaft L parallel with said spindle, a plurality of gears mounted thereon, a sliding bar l^2 mounted on ways in the head-stock and carrying differential gears and reversing-gears mounted upon one end thereof, a single gear mounted upon the opposite end sliding longitudinally between the parallel shafts L′ and J, substantially as specified.

8. In combination with the transmitting-shaft D, journaled upon the swiveling arm of a radial drill, the gear K′ attached to a sleeve journaled on the shaft and within a journal-box and adapted to slide thereon, a two-armed locking device adapted to be engaged in front and in rear of said journal-box to hold the said transmitting-gear to either of its adjusted positions, substantially as specified.

9. In combination with the base and the swinging arm of a radial drill the slotted bracket 60 secured thereto, the vertically-clamping rod 63 engaging said base and detachably connected with a slotted bracket and clamping mechanism connected to said bracket for clamping said rod in position, whereby the radial overhanging arm of the drill is rigidly supported against vertical and lateral strains, substantially as specified.

10. In a radial drill employing a drill-stock supported and moving upon horizontal ways fixed to the radial arm, the notched clamping-bolt R engaging with said ways and passing through the drill-stock and the clamping-lever R′ connected to said clamping-bolt both of which are provided with means for moving the clamping-bolt longitudinally by the rotation of said lever, whereby the drill-stock is rigidly clamped to one of said ways, substantially as specified.

In testimony whereof I have hereunto set my hand.

ANTON MILL.

Witnesses:
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E. E. WOOD.