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RADIAL DRILL.

No. 513,128. Patented Jan. 23, 1894.

Fig. 1.

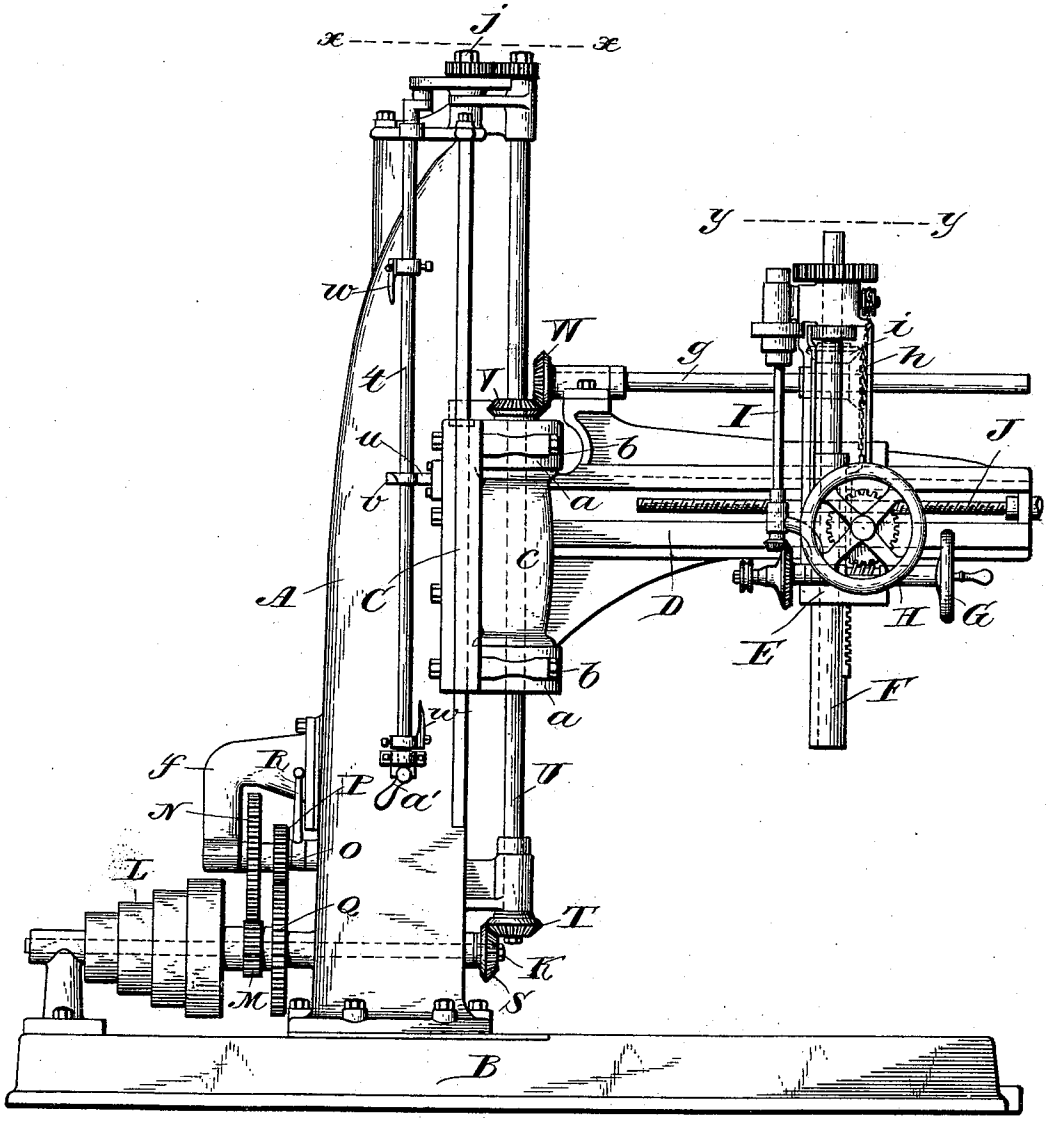

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Fig. 2.

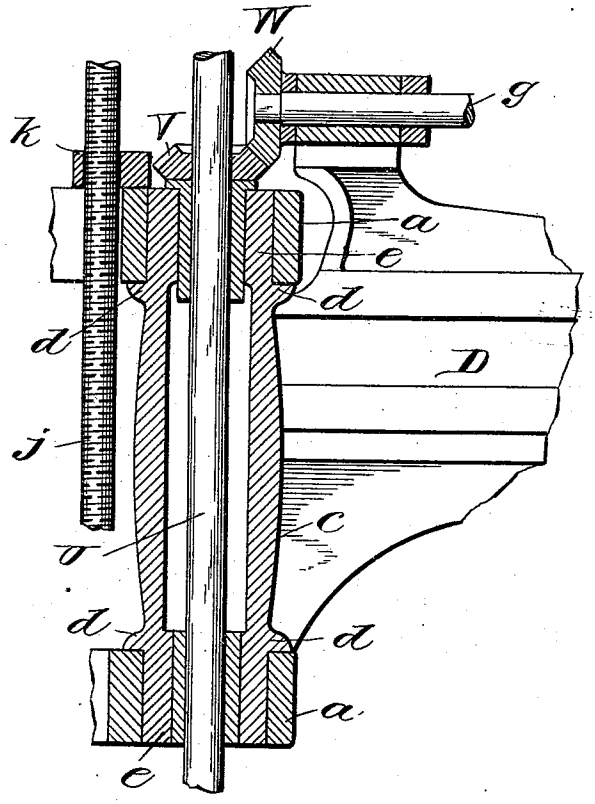
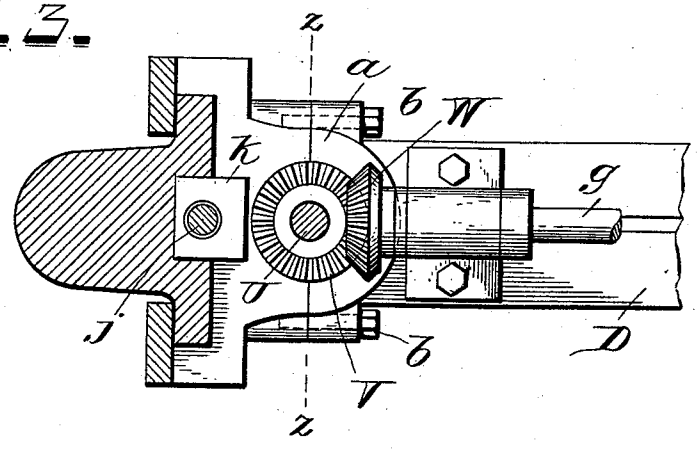


Fig. 3.



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No. 513,128. Patented Jan. 23, 1894.

Fig. 4.

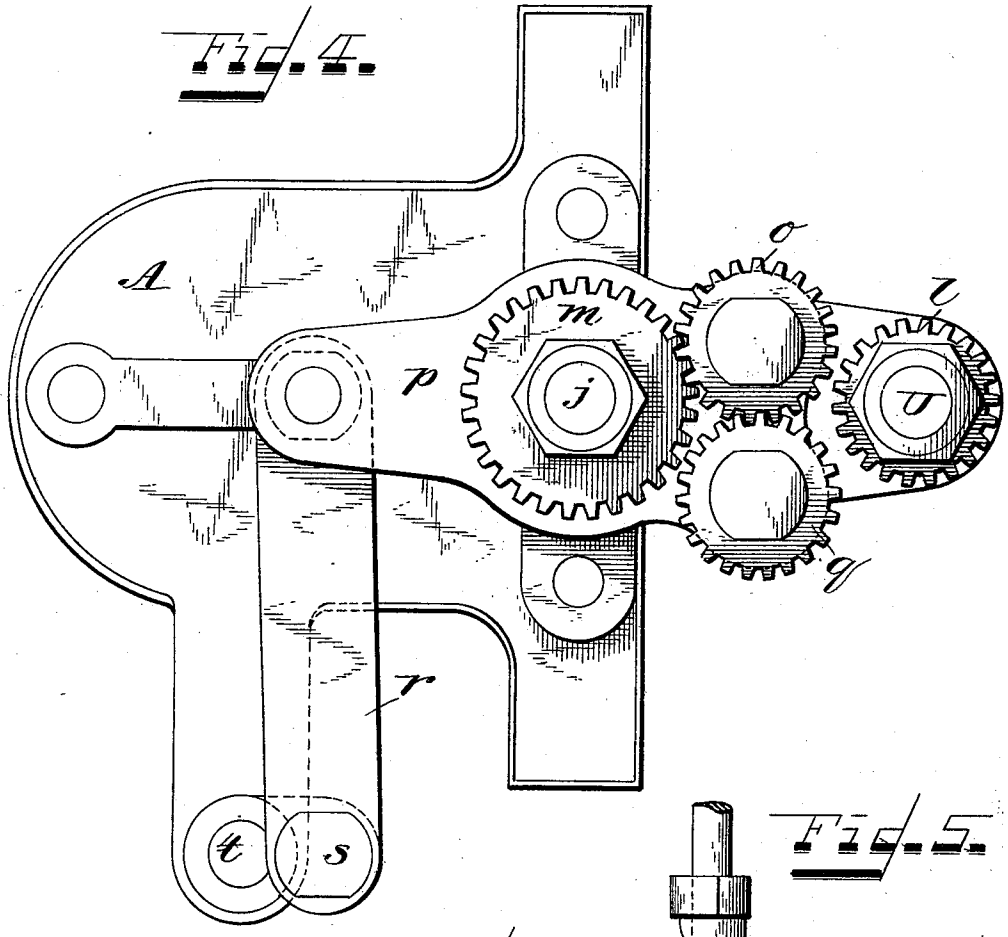

Fig. 5.

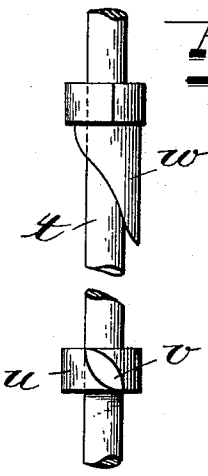

Fig. 6.

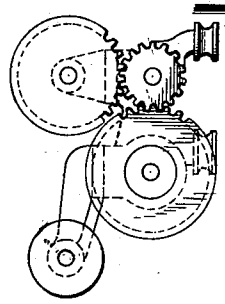

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Fig. 7.

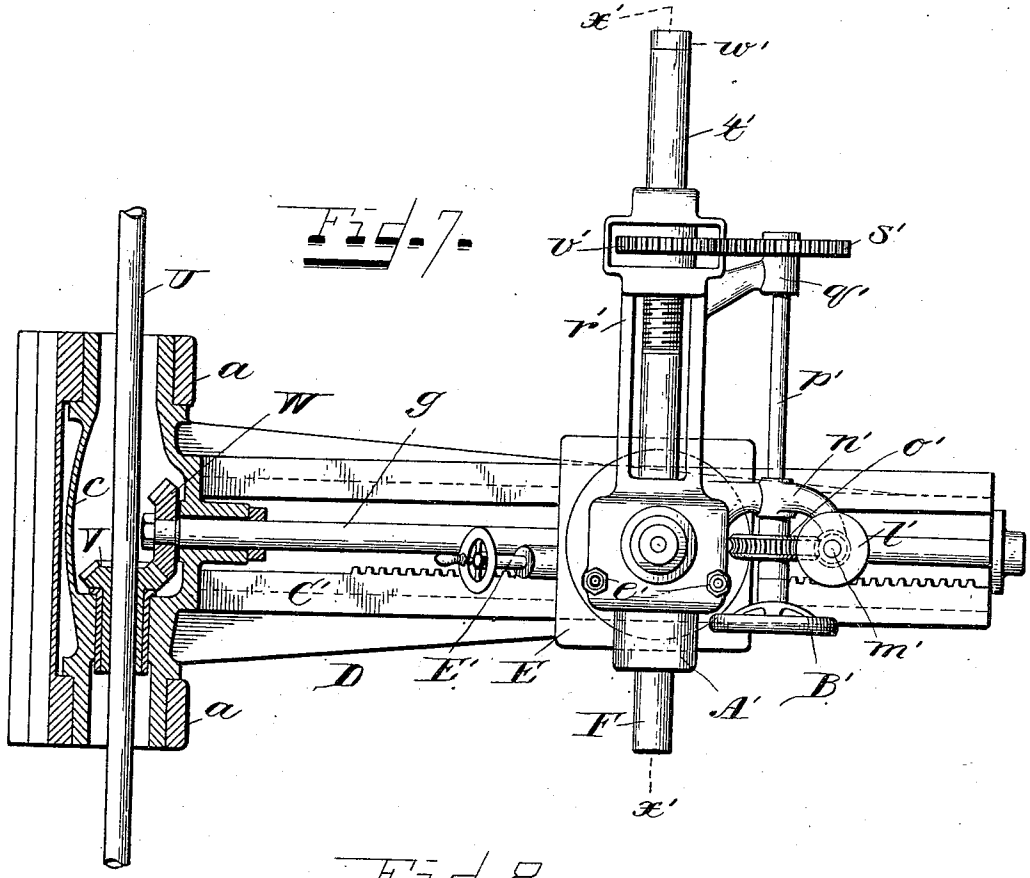
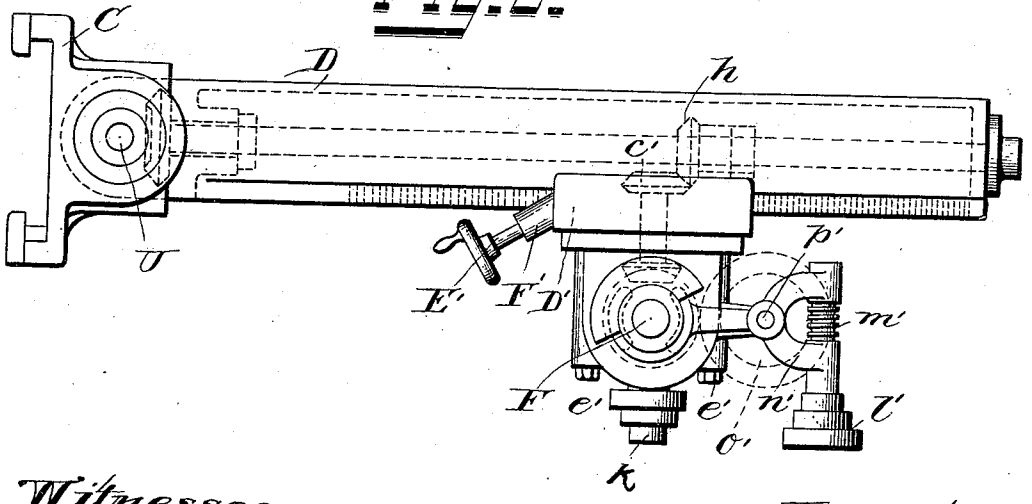


Fig. 8.



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RADIAL DRILL.

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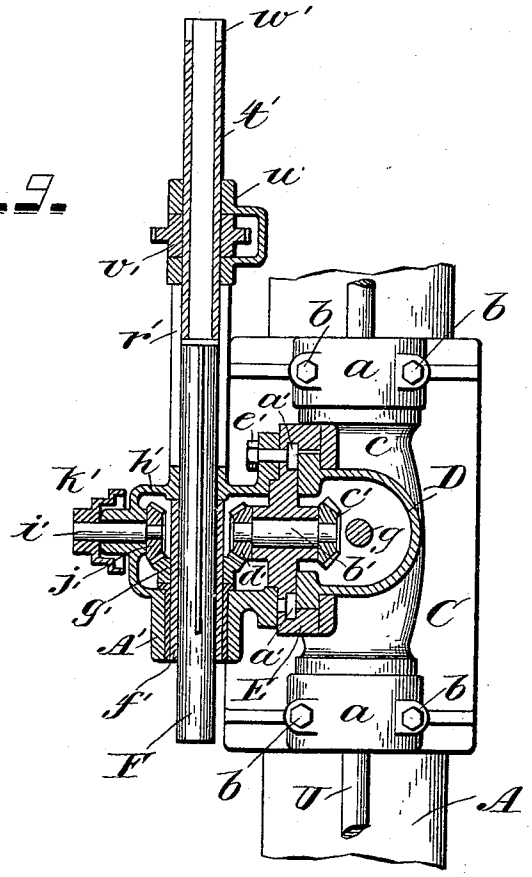
Fig. 9.



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UNITED STATES PATENT OFFICE.

ARTHUR JOHANN FRIEDRICH MILL, OF AURORA, INDIANA.

RADIAL DRILL.

SPECIFICATION forming part of Letters Patent No. 513,128, dated January 23, 1894.

Application filed October 5, 1893. Serial No. 487,290. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR JOHANN FRIEDRICH MILL, a citizen of the United States, residing at Aurora, in the county of Dearborn and State of Indiana, have invented certain new and useful Improvements in Radial Drills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to that class of metal drilling machines, in which the drill carrying arm in addition to vertical adjustment has also a horizontal adjustment through an arc of one hundred and eighty degrees, and it has for its object the improved construction of such machines whereby their rigidity and efficiency of action are increased.

The novelty of my invention will be hereinafter set forth and specifically pointed out in the claims.

In the accompanying drawings:—Figure 1, Sheet 1, is a side elevation of a radial drill embodying my invention. Fig. 2, Sheet 2, is an enlarged sectional side elevation in detail of the radial arm joint and connected parts. Fig. 3, Sheet 2, is a plan view of Fig. 2. Fig. 4, Sheet 3, is an enlarged plan view at the line x—x of Fig. 1. Fig. 5, Sheet 3, is an enlarged broken elevation in detail of the automatic stop mechanism. Fig. 6, Sheet 3, is a plan view on the line y—y of Fig. 1. Fig. 7, Sheet 4, is a side elevation partly in section of my improved radial arm and drilling mechanism. Fig. 8, Sheet 4, is a plan of Fig. 7. Fig. 9, Sheet 5, is a sectional end elevation through the dotted line x'—x' of Fig. 7, looking at the left.

The same letters of reference are used to indicate identical parts in all the figures.

In Fig. 1, A is the standard or column of box girder form bolted to the horizontal base B on which is secured a universal work carrying table not shown but which may be of the usual or any suitable construction. A knee C is gibbed to the front face of the column and has two projecting bored ears *a* Figs. 2 and 3 divided or split on an axial line z—z, Fig. 3, and clamped together by set screws *b*. D is the horizontal radial arm having at its inner end a hollow spool shaped portion *c*, Figs. 1 and 2, which fits snugly on shoulders *d* between the ears *a* and has hollow bosses *e* confined in the bores of and clamped by the ears *a* thus forming a joint with a vertical axis on which the radial arm is swung and adjusted. By loosening the set screws *b* the arm D can be swung to the position desired and then by tightening the set screws, the bosses *e* are so clamped as to hold the arm rigid in its adjusted position.

The drilling mechanism carried by the radial arm with automatic stops for drill spindle, which is shown in Fig. 1, forms no part of my present invention and is substantially of the construction of my prior patent, No. 503,153, of August 15, 1893, and in describing it here it is only necessary to say that E is the saddle gibbed on the radial arm and carrying the drill spindle F receiving rotation from the machine as presently explained and fed down by hand from the hand wheel G on the worm shaft and up for quick return when the worm is out of gear by the hand wheel H on the feed shaft, or else fed automatically by the shaft I driving, through intermeshing beveled gears, the worm shaft and driven by the machine through counter shaft, and intermeshing gears and cone pulleys carried on the saddle, in the usual or any suitable manner. The saddle is adjusted on the radial arm by the fixed screw J engaging a nut on the saddle and turned by a crank or hand wheel, not shown, on its projecting end.

Returning now to other features of my present invention, K is the primary driving shaft journaled horizontally through the base of the column and having on it, at the rear of the column, a cone pulley L, which can be made fast or loose at pleasure, driven from a pulley on a counter shaft overhead. Fast on the hub of the pulley L is a gear M meshing with a larger gear N journaled on an eccentrically hung counter shaft O supported by the column and a bracket *f* Fig. 1. Fast on the hub of the gear N is a smaller gear P meshing with a larger gear Q fast on the shaft K. The shaft O has a handle R for oscillating it to throw the gear N, M and P, Q into and out of mesh, for when the gears are out of mesh the pulley L is made fast to the shaft, and when they are in mesh the pulley L is made loose on the shaft and in this way the drill spindle is given slow or fast motion as desired. Fast on the

end of the shaft K at the front of the column is a bevel gear S meshing with a similar gear T fast on the lower end of a vertical shaft U which passes freely up through the hollow joint of the radial arm and is journaled at its upper and lower ends in brackets projecting from the column. Journaled in the upper boss *e*, Figs. 1 and 2, and feathered on the shaft U, is a bevel gear V meshing with a similar gear W fast on a horizontal shaft *g* journaled on and extending the length of the radial arm. The outer journal of this shaft is a bevel gear *h* feathered thereon and journaled in and carried by a bracket on the saddle E and this gear *h* meshes with a similar gear *i* on a vertical counter shaft carried by the saddle that, through the intermeshing gears and pulleys before referred to, drives and feeds the drill spindle.

In a recess in the face of the column is journaled a vertical screw shaft *j* Figs. 2, 3 and 4 which engages a nut *k* fast on or integral with the knee C so that the rotation of this shaft in one direction or the other, raises or lowers the knee and with it the radial arm and parts carried thereby, and this shaft is driven by the machine when desired in the following manner, particular reference being had to Figs. 1 and 4. Fast on the upper end of the shaft U, which is constantly driven by the machine, is a gear *l*, and fast on the upper end of the screw shaft *j* is a gear *m* in line with gear *l*. Pivoted concentrically with the shaft *j* is a tumbler plate *p* having journaled on a stud thereon a gear *o* constantly meshing with the gear *m*, and pivoted on a similar stud on the plate *p* is a gear *q* constantly meshing with gear *o*. When the plate *p* stands in the position shown in Fig. 4, neither of the gears *o* or *q* is in mesh with the gear *l* and no motion is communicated to the screw shaft, but upon turning said plate in one direction the gear *q* is made to mesh with gear *l* to drive the screw shaft in one direction, and upon turning said plate to the same extent in the opposite direction, gear *o* is thrown into mesh with gear *l* to drive the screw shaft in the opposite direction. Pivoted to the rear end of the plate *p* is a link *r* whose outer end is pivoted upon a crank or eccentric pin *s* upon the upper end of a vertical shaft or rod *t* journaled vertically in brackets at the side of the column. This rod passes freely through a bore in a lug *u* fast to the knee C and upon this lug is a wiper *v*, in this instance cam shaped. Adjustable, by set screws, on the rod *t* are two oppositely set and inclined cams *w* in the path of the wiper *v*, the one above and the other below the same. The lower end of the rod is provided with any suitable handle *a'*, Fig. 1, for rocking the rod by hand to throw either of the gears *o* or *q* into mesh with gear *l*. The pin *s* and link *r* are so disposed that when either of the gears *o* or *q* is in mesh with gear *l* the pivotal points are on a dead center or in a straight line to effect a lock to prevent the accidental disengagement of the gears, as will be readily understood. It results from this last described mechanism that when it is desired to feed the radial arm and parts carried thereby upward, the operator turns the rod *t* in the proper direction to engage the gear *o* with gear *l* thereby putting the screw shaft *j* in motion which, through the medium of nut *k* feeds the knee and radial arm upward. The upper cam *w* has been previously adjusted at the height desired and the turning of rod *t* brings the cam in the path of the wiper *v*. When the wiper comes in contact with the cam it, by its upward movement, turns the rod *t* back again and disengages the gear *o* from the gear *l* thereby stopping the automatic feed of the radial arm. When it is desired to feed the radial arm downward again, the rod *t* is again turned by hand in an opposite direction to engage gear *q* with gear *l* and to bring the lower cam *w*, previously adjusted, in the path of the wiper *v* whereupon, when the radial arm has been sufficiently lowered, the wiper acts on said cam and turns back the rod *t* to disconnect gear *q* from gear *l* thereby again stopping the feed as will be readily understood.

I will now describe my improved drilling mechanism carried on the radial arm and by which I am not only enabled to adjust the drill spindle toward and from the column and to swing it with the radial arm through the arc of horizontal circles but also to adjust it at varying angles in arcs of vertical circles. This mechanism is shown in Figs. 7, 8 and 9 where the shaft *g* instead of being above the radial arm is journaled in the hollow center of the same and the bevel gear V is contained and journaled within the hollow trunnion portion *c* of the radial arm and feathered on the shaft U as before. The bevel gear W is likewise contained within the hollow portion of the trunnion and is fast on the shaft *g*. The saddle E is gibbed on the radial arm and has on its face next to the radial arm, a circular slot *a'* concentric with a short shaft *b'* journaled through the saddle and having fast on its ends two bevel gears *c' d'*. The former of these gears meshes with the gear *h* feathered on the shaft *g* and journaled in and carried by the saddle. Fitted to the front face of the saddle is the drill head A' provided with clamping bolts *e'*, of which there are, in this instance, three, whose heads are confined in the circular slot *a'* of the saddle and which pass through perforations in the drill head and have nuts upon their outer threaded ends. The drill spindle F is feathered through a sleeve *f'*, Fig. 9, journaled in the drill head, and fast on this sleeve is a bevel gear *g'* with which the gear *d'* meshes. Upon the front side of the drill head there is a housing *h'* in which is journaled a short shaft *i* having fast upon its end within the housing, a bevel gear *j'* meshing with the gear *g'*. The shaft *i'* is concentric with the shaft *b'*, as seen in Fig. 9,

and it has upon its outer end a cone pulley k'. This pulley, by a belt, communicates motion to a cone pulley l' on a short worm shaft m' journaled horizontally in a bracket n' projecting from the drill head, and the worm of said shaft engages a worm wheel o' held by any suitable friction clamp on a vertical shaft p' journaled in the bracket n', and an upper bracket q' projecting from an upper extension r' of the drill head. Upon the lower end of shaft p' is a hand wheel B', and upon its upper end is a gear s'. Journaled upon the upper diminished end of the saddle spindle F, is a sleeve t', Figs. 7 and 9, exteriorly threaded and feathered in a housing u' upon the extension r' of the drill head, and engaging this sleeve is a nut gear v' meshing with the gear s'. The sleeve t' is free to turn on the drill spindle but is locked to it from endwise movement by a collar w'. To shift the saddle and mechanism carried thereby on the radial arm, I provide a rack C', Figs. 7 and 8, on the lower rib of the radial arm with which an angularly set spiral gear D' engages, and this gear is fast on a short shaft E' journaled in a projection F' of the saddle and has a hand wheel or crank G' upon it to rotate the gear to shift the saddle to any point desired.

It will be observed from the above described construction, that the drill head, by loosening the clamping nuts e', is swiveled on the saddle concentric with the shaft b' which drives the drill spindle, and that it can be swung around in either direction and be reclamped to angle the drill spindle to the radial arm to suit the requirements of the work without disturbing the relations of the gears d' g' or the other parts carried by the drill head. Again, it will be observed, that through the medium of the gears g' j', shaft i' and cone pulley k', motion is communicated to the nut gear v', to automatically feed down the drill spindle, through the medium of the cone pulley l', worm m', worm wheel o', shaft p' and gear s'. By loosening the nut which clamps the worm wheel on the shaft p', the automatic feed is stopped and then the drill spindle can be raised and lowered by hand from the hand wheel B'.

Having thus fully described my invention, I claim—

1. In a radial drill, the combination of the column, the knee gibbed thereon, the radial arm and drilling mechanism carried thereby and hinged thereto, the vertical driving shaft U for the drilling mechanism passed through the hinge of the radial arm, and the primary driving shaft K journaled through the base of the column and geared to the shaft U, substantially as described.

2. In a radial drill, the combination of the column, the knee gibbed thereon, the radial arm and drilling mechanism carried thereby and hinged thereto, a vertical screw shaft engaging and supporting said knee and radial arm, and operating mechanism driven by the machine for turning said screw shaft to raise or lower the radial arm, substantially as described.

3. In a radial drill, the combination of the column, the knee gibbed thereon, the radial arm and drilling mechanism carried thereby and hinged thereto, a vertical screw shaft engaging and supporting said knee and radial arm, operating mechanism driven by the machine for turning said screw shaft to raise or lower the radial arm, and adjustable stops for disengaging said operating mechanism to stop the feed of the screw shaft, substantially as described.

4. In a radial drill, the combination of the column, the knee gibbed thereon, the radial arm and drilling mechanism carried thereby and hinged thereto, the constantly driven vertical shaft U having gear l fast thereon, a vertical screw shaft engaging and supporting said knee and radial arm and having a gear m fast thereon, a tumbler plate p pivoted concentric with gear m and having journaled thereon intermeshing gears o q, the former of which constantly meshes with gear m, the rock shaft t provided with an eccentric pin s, and a link r connecting said pin and plate p for shifting the latter to cause the engagement of either of the gears o or q with the gear l or the disengagement of both therefrom, substantially as described.

5. In a radial drill, the combination of the column, the knee gibbed thereon, the radial arm and drilling mechanism carried thereby and hinged thereto, the constantly driven vertical shaft engaging and supporting said knee and radial arm, driving mechanism between said screw shaft and shaft U, a vertical rock shaft for connecting and disconnecting said driving mechanism, adjustable cams on said rock shaft, and a wiper movable with the knee for operating said cams to turn the rock shaft to disconnect said driving mechanism, substantially as described.

6. In a radial drill, the combination of the constantly driven vertical shaft U with gear l fast thereon, the vertical screw shaft j engaging and supporting the knee and radial arm and having gear m fast thereon, the plate p pivoted concentrically with gear m and having journaled thereon the intermeshing gears o p, the former of which constantly meshes with gear m the vertical rock shaft t having thereon the adjustable cams w, the wiper v for said cams carried by the knee and the link r connecting an eccentric pin on the shaft t and the plate p, substantially as described.

7. In the spindle carrying mechanism of a radial drill, the combination of a radial arm, the saddle gibbed and adjustable thereon and provided with a circular slot a' concentric with the shaft b', the drill head secured and adjustable on said saddle by the bolts e', the sleeve f' journaled in the drill head and feathered on the drill spindle, the

gear g' fast on said sleeve, the gear d' fast on a shaft b' journaled in the saddle concentric with the slot a' and meshing with gear g' and means operated by the machine for driving the shaft b', substantially as described.

8. In the spindle carrying mechanism of a radial drill, the combination of the drill head, its spindle, the threaded sleeve t' journaled on the spindle and held thereon from independent endwise play, a nut gear v' engaging the sleeve t' and feathered thereon said gear being confined in a housing u', the shaft p' parallel with the drill spindle and journaled in brackets projecting from the drill head, the gear s' fast on said shaft and meshing with gear v', the worm wheel o' made fast by friction when desired on shaft p', the worm m' engaging said worm wheel, the cone pulley l' on the worm shaft, the cone pulley k' on shaft i' journaled in the drill head and driven from the drill spindle, substantially as described.

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