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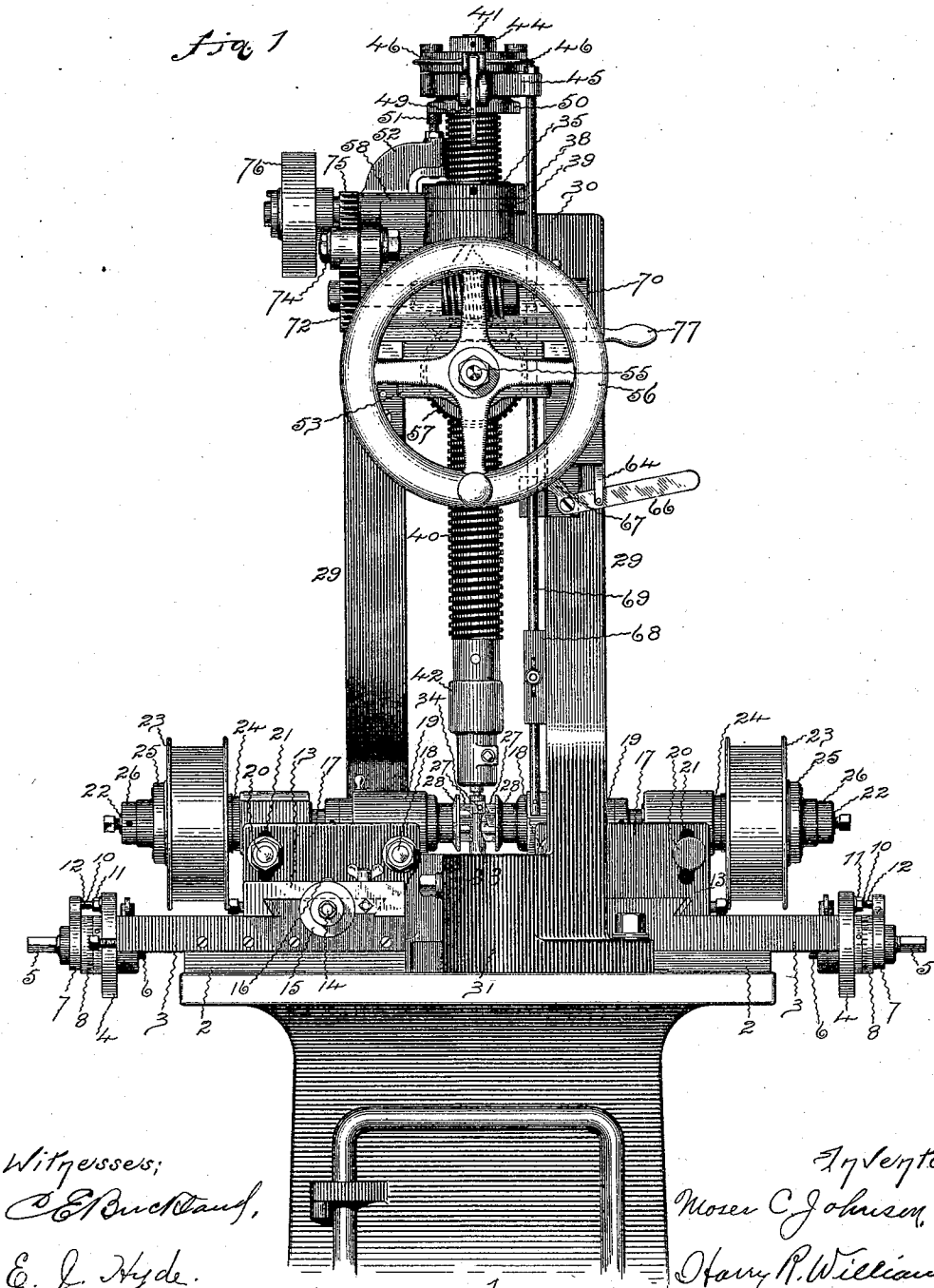
M. C. JOHNSON.

TWIST DRILL BODY CLEARING MACHINE.

No. 543,486. Patented July 30, 1895.

Fig. 1



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atty

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Fig 2

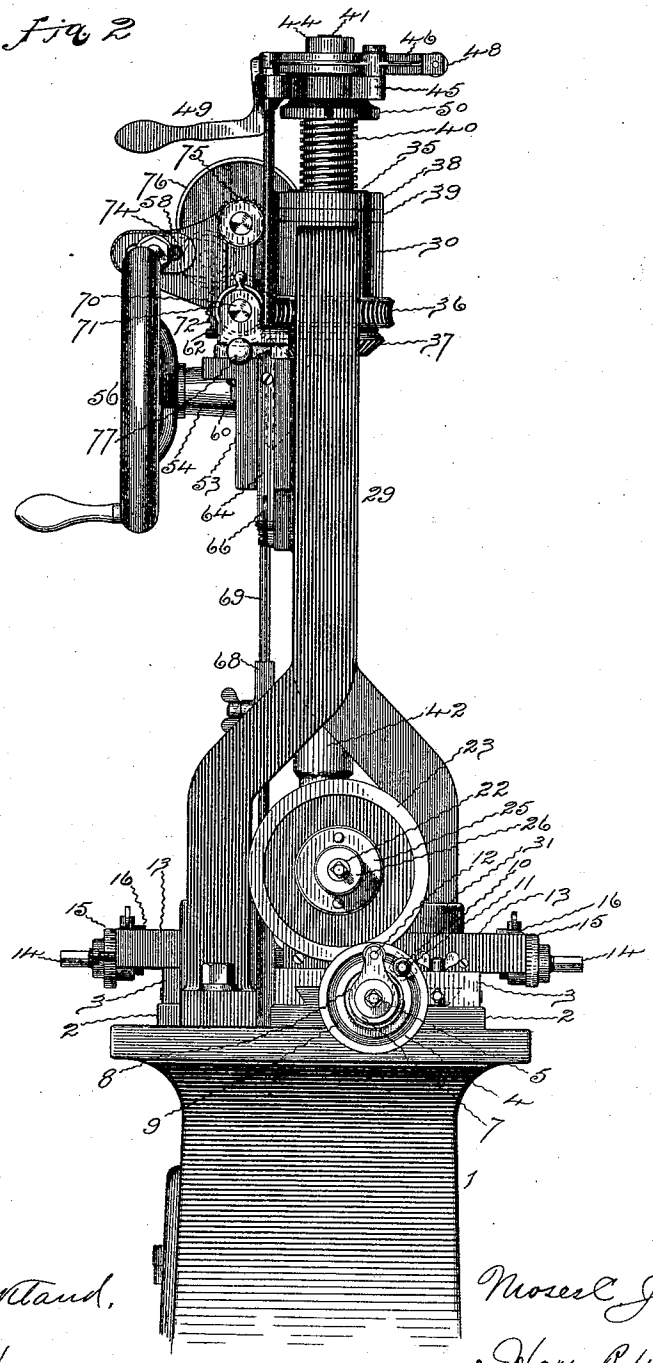

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Fig 3

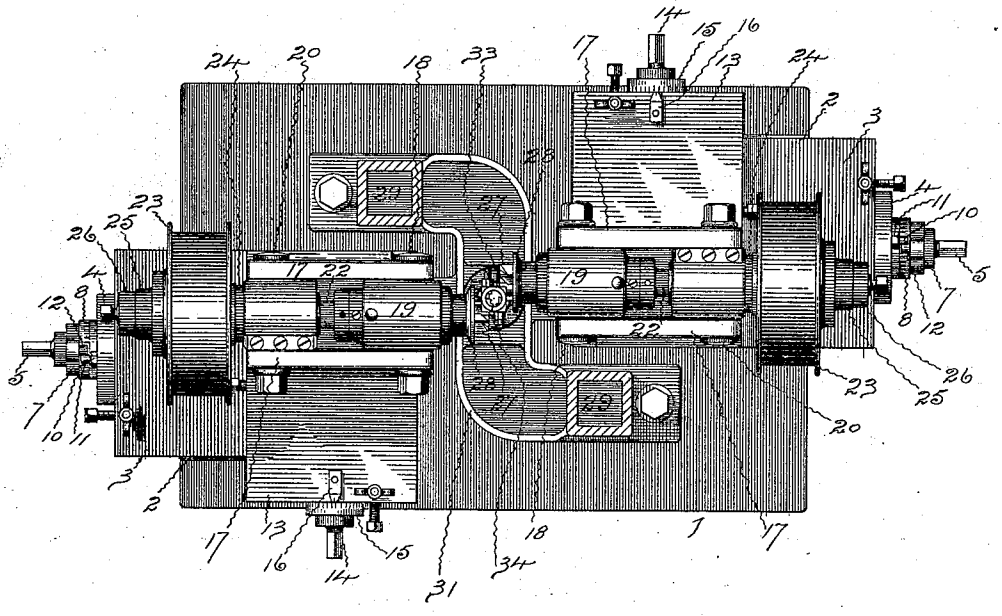


Fig 8

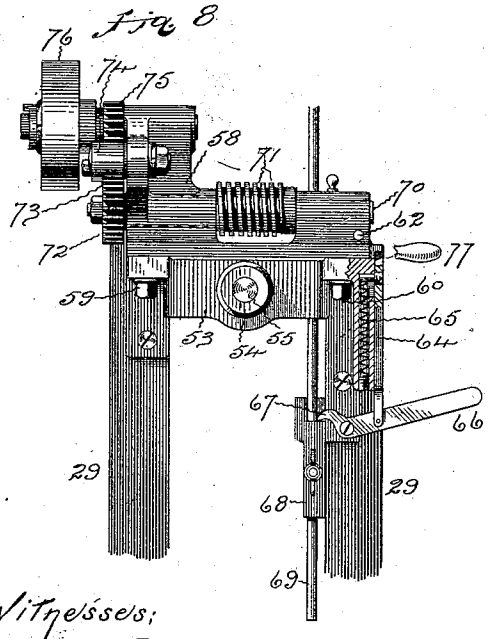
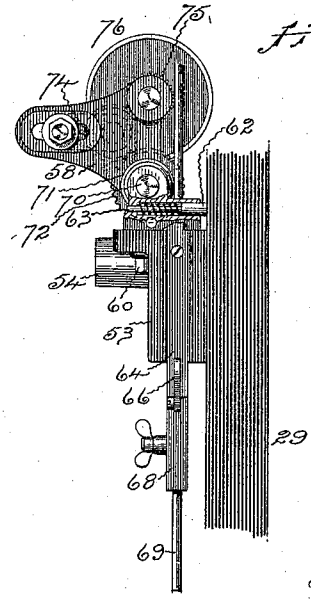


Fig 9



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(No Model.)

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M. C. JOHNSON.

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Fig 5

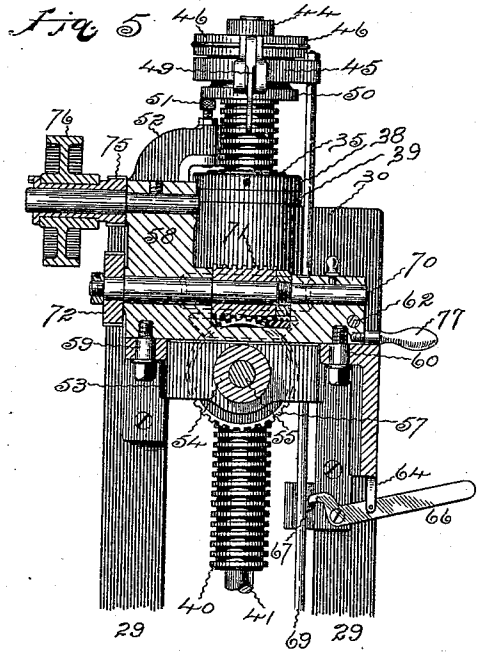

Fig 6

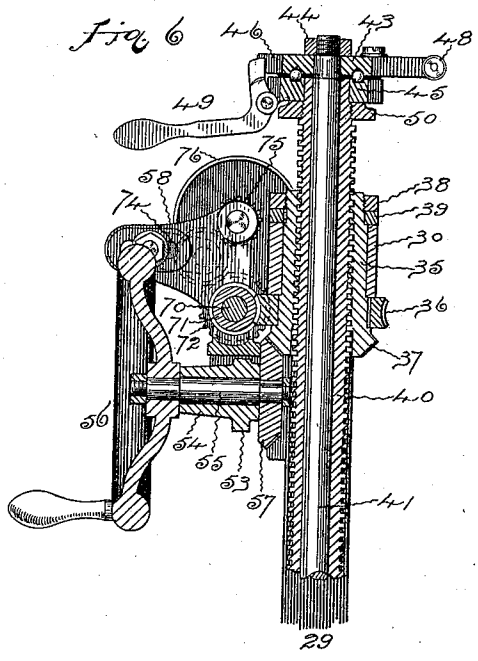

Fig 4

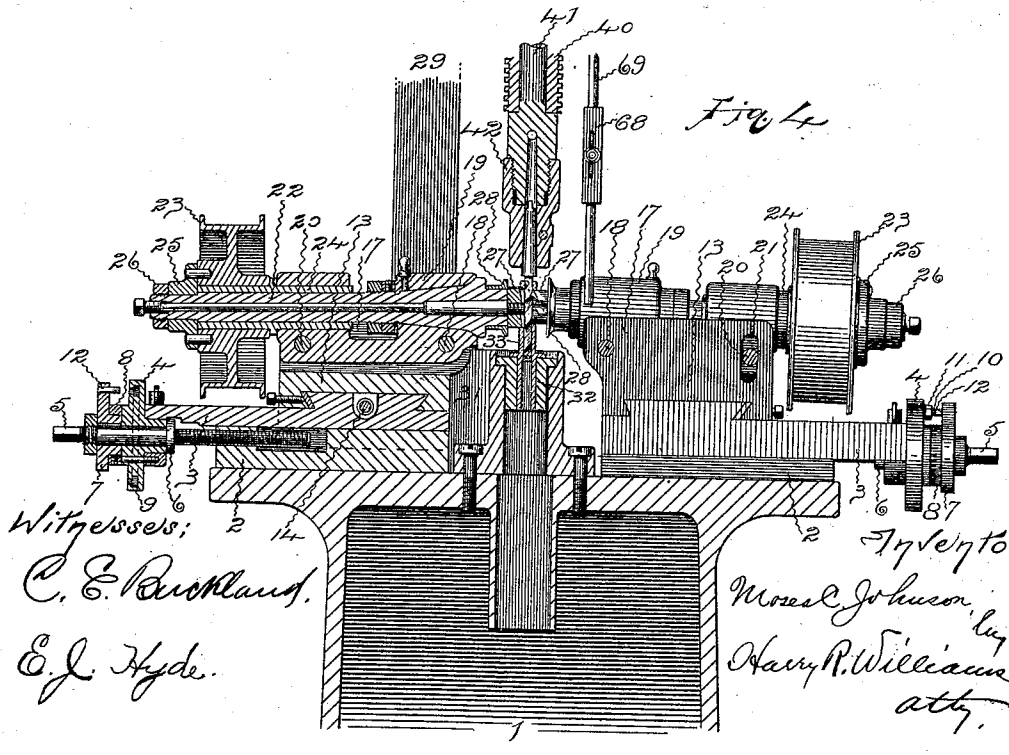

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Fig 10

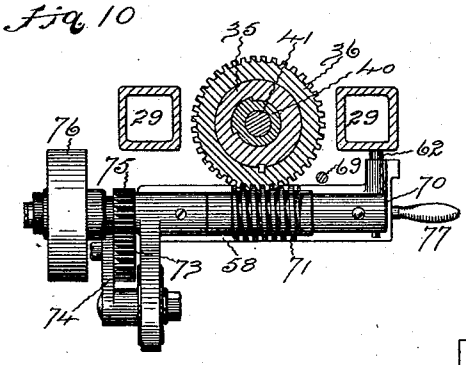

Fig 11

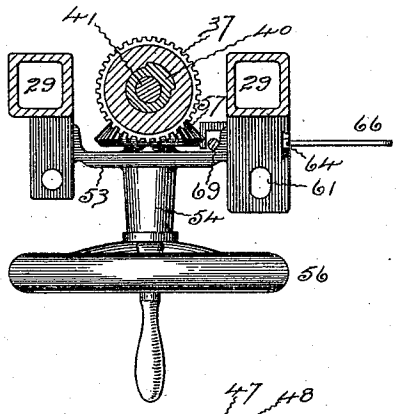

Fig 14

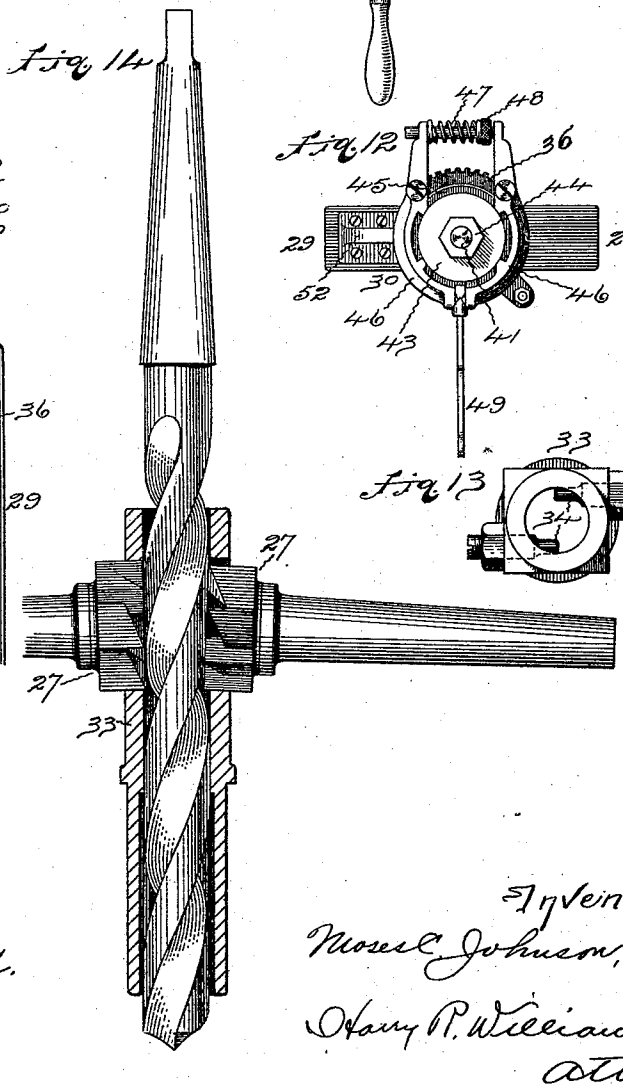

Fig 7

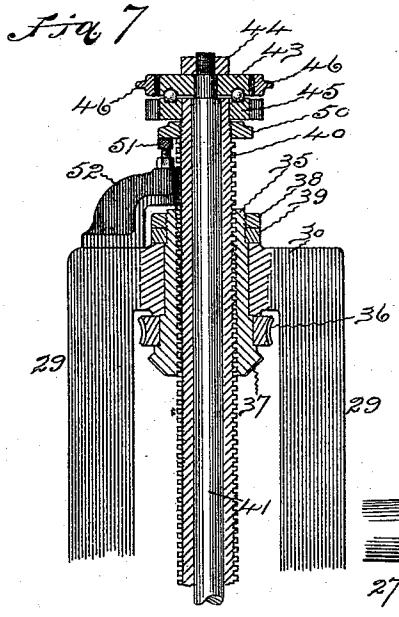

Fig 12

Fig 13

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UNITED STATES PATENT OFFICE.

MOSES C. JOHNSON, OF DANBURY, CONNECTICUT, ASSIGNOR TO THE T & B TOOL COMPANY, OF SAME PLACE AND PORTLAND, MAINE.

TWIST-DRILL BODY-CLEARING MACHINE.

SPECIFICATION forming part of Letters Patent No. 543,486, dated July 30, 1895.

Application filed May 7, 1894. Serial No. 510,331. (No model.)

To all whom it may concern:

Be it known that I, MOSES C. JOHNSON, a citizen of the United States, residing at Danbury, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Twist-Drill Body-Clearing Machines, of which the following is a specification.

The invention relates to the class of machines used in the manufacture of twist-drills to mill or cut away a portion of the land back of the cutting-edge of the blank for relieving or clearing the body of the drill, and the object is to provide a simple automatic machine into which drill-blanks of any diameter and having any common regular or increased pitch can be readily placed and quickly and uniformly cleared on any desired angle.

To this end the invention resides in a machine having a base with horizontally-adjustable slides bearing vertically-adjustable rotary spindles with milling-cutters and a frame supporting a feed for drawing the drill between the mills, and power and hand mechanism for operating the drill-feed, as more particularly hereinafter described, and pointed out in the claims.

Referring to the accompanying drawings, Figure 1 is a front elevation of the machine. Fig. 2 is a side elevation. Fig. 3 is a plan with the upper part of the frame removed. Fig. 4 is an elevation of the part shown in Fig. 3 with portions cut in section to show the construction. Fig. 5 is a front elevation of the upper part of the machine with portions cut in section. Fig. 6 is a side elevation of the upper part of the machine with portions cut in central section. Fig. 7 is a front elevation of the upper part of the frame with portions cut in central section. Fig. 8 is a front elevation of the swivel-box and the feed-driving mechanism with portions broken away to show the construction. Fig. 9 is a side elevation of the parts shown in Fig. 8 with portions broken away. Fig. 10 is a plan of the swivel-box and the feed-driving mechanism. Fig. 11 is a plan of the swivel-box bracket and the hand-feed mechanism. Fig. 12 is a plan of the upper part of the frame and the feed-friction mechanism. Fig. 13 is an enlarged plan of the drill-guide; and Fig. 14 is an enlarged section of the drill-guide, showing the drill and milling cutters in side elevation.

In the views, 1 indicates a column or base of any common material and construction. Secured to the top of the base on opposite sides of the center are slide-bases 2, that have dovetail ways on their upper surfaces. Movable on these dovetails on the slide-bases toward and from the sides of the machine are slides 3, which have dovetailed mortises that fit the dovetails on the bases. It is desirable to adjust these slides on the bases sidewise toward and from the center of the machine very finely, and to accomplish this it is preferred to secure to the edges of each slide 3 a stop-disk 4, bearing a spindle 5, that has a threaded part turning in a threaded socket formed in the slide-base. Each of these spindles bears a collar 6 on the inside of the hub of the stop-disk and a stop 7 on the outside, the stop being keyed to the spindle and having a nut screwed against the outside to hold the stop on the spindle in place, Fig. 4. On the hub of the stop is fastened a graduated ring 8, that is adapted to register with an index-mark on the hub of the stop-disk for accurately determining the position of the parts. In the stop-disk is formed a circular T-shaped mortise 9, in which moves a stop-pin 10, which can be clamped in any desired position by a clamp-nut 11 and set to engage the pin 12, that projects from the stop 7, so that the stop may be quickly and securely arrested at the proper position by the contact of the pins when the slides are moved sidewise to the proper position by the rotating of the adjusting screw, Figs. 2, 3, and 4.

The slides 3 have dovetails on their upper faces at right angles to the mortises in their under faces, and movably supported on these dovetails of the slides are the upper slides or carriages 13, which, of course, have dovetailed mortises that fit the slide dovetails. These carriages bear rotary spindles 14, that have threaded parts turning in threaded sockets in the lower slides for adjusting the carriages toward and from the front and back of the machine on the dovetails of the lower slides, and these spindles bear graduated collars 15, that register with an index-mark on

the pointers 16, secured to the carriages to determine the exact adjustment of the carriages when moved, Figs. 1, 3, and 4.

On the top face of each of the upper slides or carriages 13 is a pair of flanges 17, pivotally supported between which by a bolt 18 is a swinging head 19. The pivotal bolt 18 is preferably passed from one flange to the other through the swinging head near one end and held in place by a nut, while a bolt 20 is passed through the swinging head near the other end and through slots 21 formed in the walls of the flanges, so that when the nut which is provided for the bolt 20 is loosened the swinging head may be oscillated vertically on the pivotal bolt 18. This hanging of these swinging heads allows an inclination of the axes of the cutter-spindles which they bear, so that the faces of the cutters may be inclined at the proper angle to the axis of the drill-blank it is to relieve, Figs. 3 and 4. Supported in bearings in these swinging heads are the cutter-spindles 22, to which are fastened in any desirable manner the driving-pulleys 23. It is preferred to fit the pulleys on sleeves 24, that are borne by the spindles and connect the pulleys with the spindles by means of pulley-drivers 25, that are keyed to the spindles and held in place by set-nuts 26. To the inner ends of these cutter-spindles are secured the shanks of the ordinary milling-cutters 27, which are used to clear the body of the drill-blank. Oil-guards 28 may be placed on the ends of the spindles adjacent to the cutters if it is desired to direct into the oil catch-well 31 the lubricating material applied to the face of the cutters, Fig. 4. By means of this arrangement the cutter-spindles can be oscillated and then set so that the faces of the cutters will have any proper angle of inclination with relation to the axis of the drill to cut away the land of the drill back of the groove in the most desirable manner, and these cutters can be instantly adjusted toward or from the front or back of the machine by the movement of the upper slides or carriages, or they may be moved toward and from the sides of the machine to or from the drill-blank by the movement of the lower slides, so that they may be located to properly operate on drill-blanks of any diameter, or may be moved away while a blank is being placed in the drill-guide and connected with the feed before being operated upon.

Supported on the top of the base between the slide-bases is a frame consisting of a pair of standards 29, joined at the top by a cross-head 30 and at the bottom by a curved hollow part 31, that provides an oil-catch well and also a support for the drill-guide, Figs. 3 and 4. Held by this curved connecting part of the frame is a bushing 32, which bushing supports the drill-guide 33. This drill-guide, which may be changed for varying sizes of drills, is a tube with an opening approximating the diameter of the drill to be cleared and projecting inward from this tube near the upper ends are pins 34, that are adapted to extend into and by contact with the edges of the groove of the drill to be cleared cause the drill to rotate according to the pitch of the groove, so that its land will be correctly presented to the cutters when it is being fed through the machine, Figs. 3, 4, 13, and 14.

Rotarily held in an opening in the cross-head 30 at the top of the frame is an interiorly-threaded feed-nut 35, on which is a worm-gear 36 and a bevel-gear 37. The feed-nut is preferably held in place in the opening by means of the clamping and set nuts 38 and 39 that bear against the top, and one face of the worm-gear 36 that bears against the bottom of the cross-head, Figs. 6 and 7. Turning in the interior thread of the feed-nut 35 is a threaded drill-spindle sleeve 40, in which is located the drill-spindle 41. The lower end of this drill-spindle, which turns loosely in the sleeve, is provided with a chuck 42 for grasping the shanks of the drills to be cleared, while on the upper end is a friction-ring 43, that is keyed to the spindle and held in place by a nut 44. The under side of this ring is grooved and rests on antifriction-balls that run in a groove in a friction-arm base 45 that is keyed to the upper end of the spindle-sleeve 40, Figs. 6 and 7. To this friction arm base 45 are pivoted friction-arms 46, that are forced apart at the rear by a spring 47, the tension of which is adjusted by a nut 48, so that the arms bear with a yielding pressure against the edge of the friction-ring 43 on the end of the spindle. Pivoted to the friction-arm base 45 is a relieving-lever 49, that engages the forward ends of the friction-arms and opens them or allows them to close against the friction-ring, according to the position of the lever, Figs. 6 and 12.

The spindle that holds the drill is held loosely by the drill-spindle sleeve, for the drill is rotated as it is fed down by the guide-pins projecting into its grooves, and the rotation of the drill turns the drill-spindle which supports it. With very small drills, which this machine will clear, the drill-spindle must turn very easily and must not bind or the little drill would be twisted and broken, so the anti-friction-balls are provided to reduce the friction as much as possible. When large drills are being cleared on the same machine the friction on the end of the drill-spindle must be greatly increased, or at a certain time the larger cutters which would have to be used would so bite the metal of the drill they were clearing as to turn it around against the friction and cut into the drill as it was being fed along where it should not, and thus ruin the drill. To provide for this the friction-arms are made by the movement of the hand-lever to grasp the friction-ring on the end of the drill-spindle and hold it with a sufficiently-firm grasp.

Screwed on the spindle-sleeve beneath the friction-arm base is a stop-collar 50, that can be adjusted so as to make contact with the

end of a set-screw 51, that is screwed into the spline-bracket 52. This spline-bracket is secured to the top of the frame and has an edge that projects into a groove that is formed along one side of the threaded spindle-sleeve, so that this sleeve will not rotate when it is being fed up or down, Figs. 5 and 7. With this mechanism, when the bevel-gear or the worm-gear is rotated, the threaded spindle-sleeve is fed up or down without rotating by the rotation of the feed-nut, to which the worm-gear and bevel-gear are secured. This movement of the spindle-sleeve carries with it the drill-spindle with any drill that is held in the clutch on the end of the spindle. As the drill is fed by the movement of the spindle, it is rotated by means of the pins that project into the grooves of the blank from the sides of the drill-guide, and as the drill-spindle is mounted on the balls at the top this rotation is such that the drill will present the proper part of the land back of the cutting-edge at the desired time for the milling-cutters to cut away the correct amount to properly clear the body of the drill-blank. The drill-spindle is hung loosely and the drill rotated by the contact of the pins with the edges of the grooves, so it makes no difference what is the pitch, or whether it is regular or increasing, the drill is rotated according to the pitch of its grooves in engagement with the pins, and thus the right portion of the land back of the cutting-edge is always presented to the cutters, which are inclined to the axis of the drill-blank for milling the relief.

Secured to the frame near the top is a bracket 53, having a hub 54, that supports a shaft 55, on one end of which is a hand-wheel 56, while on the other end the shaft has a bevel-gear 57, that meshes with the bevel-gear 37 on the feed-nut 35, Figs. 6 and 11. When the hand-wheel is rotated, the meshing-gears rotate the feed-nut and cause it to feed the spindle up or down, according to the direction or rotation of the hand-wheel. Loosely supported by this bracket 53 is a swivel-box 58, the box being pivotally held at one side of the bracket by a stud 59, that passes through a perforation the size of the stud, and at the other side by a stud 60, that passes through a slot 61, Figs. 5 and 11. In a socket in one end of this swivel-box is a plunger 62, that is forced by a spring 63 against one of the standards 29 of the frame to normally thrust the box so that it will swing on its pivot out away from the frame, Figs. 9 and 10; and on one side of the bracket 53 is secured a reciprocating slide 64, that is normally forced upward by a spring 65, so that its end will engage a portion of the swivel-box and hold it up to the frame against the thrust of the spring-plunger, Figs. 8 and 9. This catch-slide 64 is connected with a lever 66, having a handle, so that the slide may be disengaged by hand from the swivel-box to allow the latter to swing out, and this lever 66 also has a hooked end 67 in the path of a trip-block 68, that is adjustably held by a set-screw to a rod 69, connected to and vertically movable with the friction-arm base 45 on the upper end of the threaded spindle-sleeve 40. When the spindle-sleeve with a drill-blank has been fed upward the desired distance, the block 68 engages the end of the lever 66 and its farther upward movement oscillates the lever so as to pull the slide and release the catch and allow the swivel-box to be thrust out away from the frame by its swinging plunger, Figs. 5, 8, and 9.

The swivel-box bears a shaft 70, on which is a worm 71, that is adapted to mesh with the worm-gear 36 on the feed-nut 35 when the swivel-box is swung up to the frame, but does not mesh with the worm-gear when the swivel-box is swung away from the frame, Figs. 2 and 10. The shaft 70 bears on its end a gear 72, Fig. 5, that can be readily changed, if desired, to vary the speed of the feed, according to the shape of the drill that is to be cleared. This gear 72 meshes with an intermediate gear 73, that is borne by an arm 74 adjustably held by a bolt passing through a slot in a part of the swivel-box, and this intermediate gear meshes with a gear 75 on a sleeve, to which is secured the feed driving-pulley 76. A handle 77 is provided for pushing the swivel-box back against the thrust of its spring-plunger, so that the catch-slide will hold it with the worm and worm-gear in mesh.

In operating the machine the cutters are first moved away from the center toward the sides by moving the slides on the slide-bases. Then after the drill-blank has been placed in the drill-guide and grasped by the chuck on the end of the drill-spindle the cutters are correctly adjusted by moving up the different slides to the proper position, and power is applied to the cutter-spindle pulleys, the angle of clearance to be given to the drill-blank body being previously determined, and the swinging heads with the cutter-spindles having been set so that the faces of the cutters will lie in a plane at the proper angle for making the desired cut on the drill-blank. When a blank and the cutters are in position, power is applied to the driving-pulley held by the swivel-box, and this, through the medium of the gears, rotates the worm and worm-gear so as to cause the spindle-sleeve on the spindle to be fed upward and draw the drill-blank between the cutters. As before stated, the drill-spindle being loosely held in the sleeve, the drill is rotated as it is drawn upward by the pins of the drill-guide according to the pitch of the groove, so that the proper portion of the land is presented to the cutters. When the drill-spindle and drill have been drawn up as far as desired the trip-block strikes and moves the trip-lever so that the slide is disengaged from and releases the swivel-box, which then under the impulse of the spring-plunger is thrust away from the frame. This of course unmeshes the worm and worm-gear and stops the feeding of the spindle and drill. The drill-

spindle may be fed down by the hand-wheel when the worm and worm-gear are disengaged and it is desired to commence again on another blank. When the fresh blank is in readiness and the cutters are moved up the swivel-box may be pushed up to the frame by means of the handle, so the rotating worm will mesh with and again rotate the worm-gear for feeding up between the cutters the blank that has just been placed in position.

Drill-blanks of any common diameter and of any regular or increased pitch can be quickly placed in position in this machine and milled on any desired angle to have the most effective clearance back of the cutting-edge, for the slides can be readily adjusted horizontally toward and from the front or back and toward or from the sides of the machine, according to the size of the drill-blank to be cleared, and the cutter-spindles are readily oscillated and adjusted so that the faces of the cutters will incline at any desired angle with relation to the axis of the blanks, which are rotated as they are fed through the machine by their own pitch.

The cutters used in this machine are simple and cheap. They have straight cutting-edges and do not have to be ground on an angle, and when the machine is once set any number of drill-blanks of a size can be subjected to the body-clearing operation of this machine and come through exactly alike, the adjusting mechanism for the slides permitting a very fine and quick setting of the parts in the desired position.

I claim as my invention—

1. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, face cutters with their axes extending in planes substantially at right angles to the plane of the axis of the drill feed, and mechanism for rotating the cutters, substantially as specified.

2. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, cutters with their cutting faces revolving in planes substantially parallel with the plane of the axis of the drill feed, and mechanism for rotating the cutters, substantially as specified.

3. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters with their cutting faces revolving in planes substantially parallel with the axis of the drill feed and supported in bearings that can be oscillated, and mechanism for rotating the cutters, substantially as specified.

4. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters with their axes out of line with the center of the drill or axis of the drill feed supported in bearings that can be oscillated and are held by slides movable at right angles to the axes of the cutters, and mechanism for rotating the cutters, substantially as specified.

5. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters with their axes out of line with the center of the drill or axis of the drill feed supported in bearings that can be oscillated and are held by slides movable parallel with the plane of the axes of the cutters, and mechanism for rotating the cutters, substantially as specified.

6. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters supported in bearings that can be oscillated and are held by slides adjustable at right angles to and also parallel with the plane of the axes of the cutters, and mechanism for rotating the cutters substantially as specified.

7. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters with their cutting faces revolving in planes substantially parallel with the axis of the drill feed and with their axes inclined at an angle with the line of movement of the axis of the drill feed, said cutters being movable at right angles to their axes, and mechanism for rotating the cutters, substantially as specified.

8. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, face cutters with their cutting faces revolving in planes substantially parallel with the axis of the drill feed and with their axes at an angle with the line of movement of the axis of the drill feed, said cutters being movable parallel with the plane of their axes, and mechanism for rotating the cutters, substantially as specified.

9. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, rotary face cutters with their axes at an angle with the line of movement of the axis of the drill feed, said cutters being adjustable at right angles to and parallel with the plane of their axes, and mechanism for rotating the cutters, substantially as specified.

10. In a twist drill body clearing machine, in combination, a drill feed, mechanism for operating the drill feed, slides movable toward and from the front and back of the machine, oscillating heads borne by the slides, rotary spindles borne by the oscillating heads, and cutters with their cutting faces revolving in planes substantially parallel with the axis of the drill feed mounted on the spindles, substantially as specified.

11. In combination with the drill feed of a twist drill body clearing machine, a rotary spindle bearing a face cutter with its axis extending in a plane substantially at right angles to the plane of the line of movement of the axis of the drill feed, but said axis of the cutter being out of line with the axis of the drill feed, substantially as specified.

12. In a twist drill body clearing machine in combination, a drill feed, mechanism for operating the drill feed, face cutters with their

axes out of line with the line of movement of the axis of the drill feed, and mechanism for rotating the cutters, substantially as specified.

13. In combination with the drill feed of a twist drill body clearing machine, a rotary spindle bearing a face cutter with teeth on one face which rotate in a plane substantially parallel with the plane of the line of movement of the axis of the drill feed, the axis of the cutter being out of line with the axis of the drill feed, substantially as specified.

14. In a twist drill body clearing machine in combination, a drill feed, mechanism for operating the drill feed, rotary cutters adjustable toward and from the line of movement of the drill feed, and a tubular guide supported by the machine in line with the drill feed, said drill guide having cutter openings through its side walls and drill supporting walls above and below the cutter openings with pins projecting through the walls into the interior of the guide, substantially as specified.

15. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, and mechanism for feeding the sleeve, substantially as specified.

16. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, a friction device connecting the sleeve and the spindle, and mechanism for feeding the sleeve, substantially as specified.

17. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a rotary feed nut, mechanism for rotating the nut, a sleeve longitudinally fed by the nut, and a drill spindle loosely carried by the sleeve, substantially as specified.

18. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, power mechanism for feeding the sleeve, and hand mechanism for feeding the sleeve, substantially as specified.

19. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, and mechanism borne by a movable support for feeding the sleeve, substantially as specified.

20. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, and mechanism borne by a pivoted support for feeding the sleeve, substantially as specified.

21. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, hand mechanism secured to the frame for feeding the sleeve, and power mechanism borne by a support movably secured to the frame for feeding the sleeve, substantially as specified.

22. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, mechanism borne by a movable support for feeding the sleeve, a catch for engaging or disengaging the movable support, and a spring for throwing the support when it is disengaged from the catch, substantially as specified.

23. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a longitudinally feeding sleeve loosely carrying a drill spindle, mechanism borne by a movable support for feeding the sleeve, a catch for engaging or disengaging the support, a spring for moving the support when it is disengaged from the catch, and a tripping device connected with the feeding sleeve and adapted to engage a part of the catch for tripping the same, substantially as specified.

24. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a rotary nut bearing two gears, power mechanism for driving the nut through one gear and hand mechanism for driving the nut through the other gear, and a sleeve bearing a loose drill spindle reciprocated by the movement of the nut, substantially as specified.

25. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a rotary feed nut bearing bevel and worm gears, a bevel gear connected with a hand wheel meshing with the bevel gear carried by the feed nut, and a power rotated worm meshing with the worm gear for rotating the feed nut by power, and a sleeve bearing a loose drill spindle reciprocated by the movement of the nut, substantially as specified.

26. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a rotary feed nut bearing a sleeve with a loose drill spindle and having a bevel gear engaging a bevel gear connected with the hand wheel, and bearing a worm gear engaging a worm borne by a movable head, mechanism for rotating the worm, and a movable head attached to the frame, substantially as specified.

27. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a rotary feed nut bearing a sleeve with a loose drill spindle and having a bevel gear that engages a bevel gear connected with a hand wheel, and bearing a worm gear that engages a worm borne by a movable head, adjustable mechanism for rotating the worm, and a movable head attached to the frame, substantially as specified.

28. In a twist drill body clearing machine, in combination, rotary cutters, mechanism

for rotating the cutters, a feed nut loosely supported by the frame, said nut bearing a worm gear and a bevel gear, a bevel gear supported by the frame meshing with the bevel gear on the nut and connected with a hand wheel for rotating the same, a worm borne by a movable head and engaging the worm wheel on the nut, a gear connected with the worm shaft and meshing with a gear borne by an adjustable arm, said latter gear meshing with a gear connected with the driving pulley, a longitudinally threaded sleeve borne by the feed nut, and a drill spindle loosely carried by the sleeve, substantially as specified.

29. In a twist drill body clearing machine, in combination, rotary cutters, mechanism for rotating the cutters, a feed nut loosely supported by the frame, said nut bearing a worm gear and a bevel gear, a bevel gear supported by the frame meshing with a bevel gear on the nut and connected with a hand wheel for rotating the same, a worm borne by a movable head and engaging the worm wheel on the nut, a gear connected with the worm shaft and meshing with a gear borne by an adjustable arm, said latter gear meshing with a gear connected with the driving pulley, a longitudinally threaded sleeve borne by the feed nut, a drill spindle loosely carried by the sleeve, and a friction device connecting the spindle with the sleeve, substantially as specified.

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Witnesses:
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