

July 4, 1944.

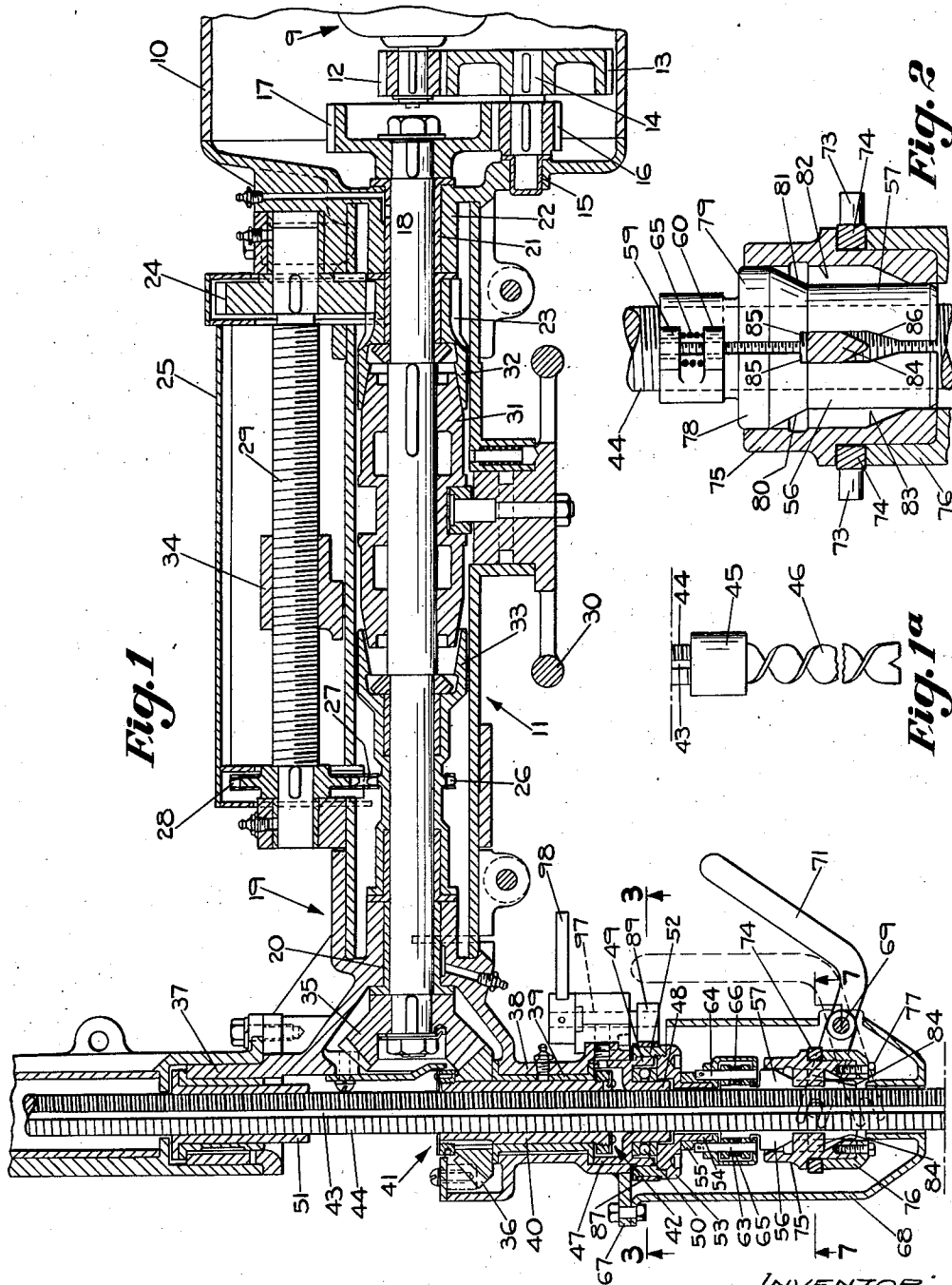
J. S. BELTZ

2,353,006

DRILLING MACHINE

Filed Aug. 1, 1942

2 Sheets-Sheet 1



INVENTOR:

JOHN S. BELTZ,

By Chas. M. Nissen,

ATT'Y.

July 4, 1944.

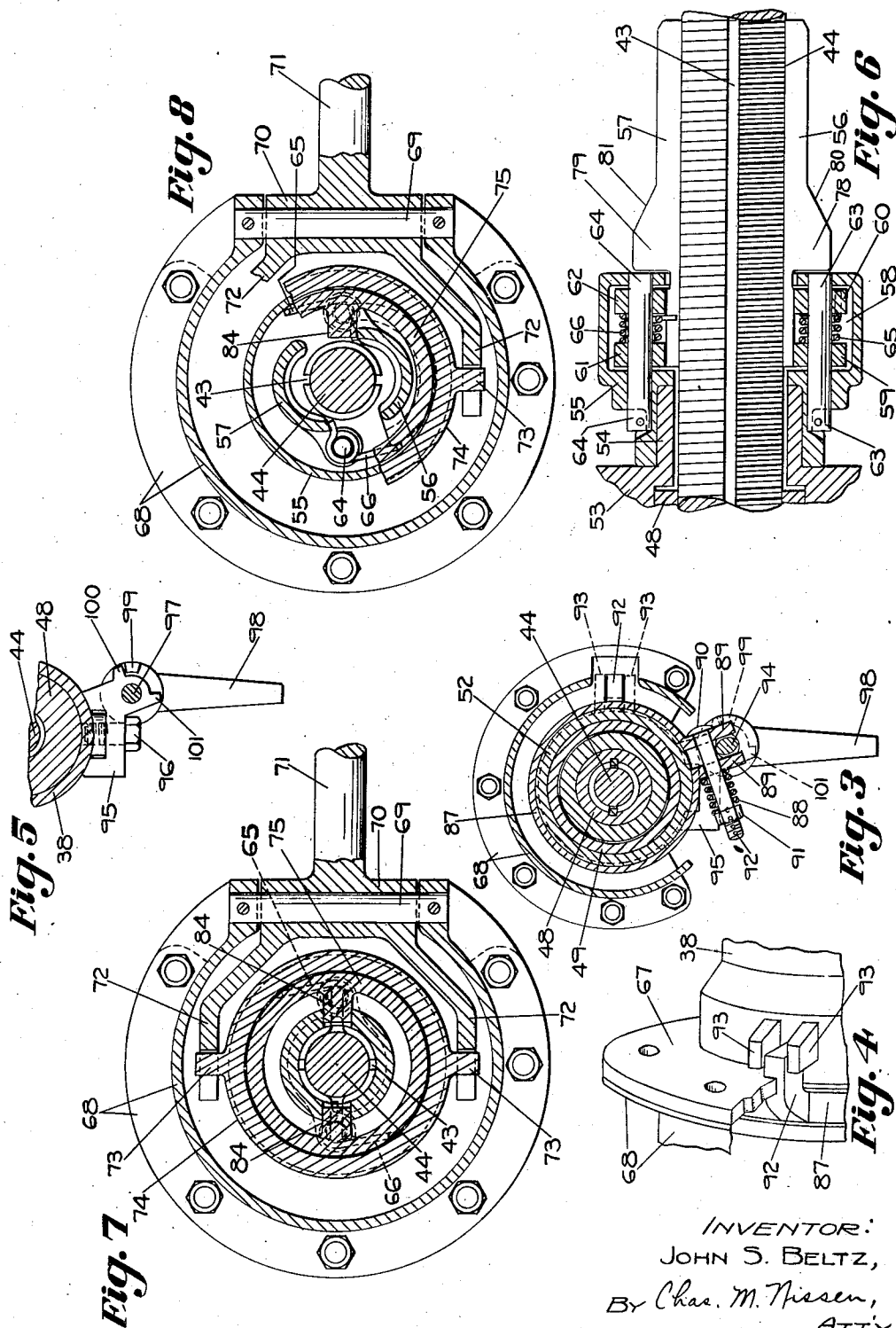
J. S. BELTZ

2,353,006

DRILLING MACHINE

Filed Aug. 1, 1942

2 Sheets-Sheet 2



INVENTOR:
JOHN S. BELTZ,
By Chas. M. Nissen,
ATT'Y.

UNITED STATES PATENT OFFICE

2,353,006

DRILLING MACHINE

John S. Beltz, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Application August 1, 1942, Serial No. 453,201

3 Claims. (Cl. 255—45)

My invention relates to drilling machines particularly adapted to drill holes in coal veins preparatory to receiving blasting charges for dislodging the coal for removal from a coal mine.

One of the objects of the invention is the provision of improved and efficient mechanism for disconnecting power transmission mechanism between a driving motor and the drill feeding means without stopping the motor, so as to effect discontinuance of the feed of the drill independently of the motor.

Another object of the invention is the provision of improved and efficient mechanism for disconnecting the feed nut from a feed screw in a motor-operated drilling machine.

A further object of the invention is the provision of brake mechanism in association with feed nut releasing means in a motor-operated drilling machine.

More particularly it is the object of the present invention to provide near the drill itself manually operated mechanism for releasing two half sections of the feed nut from the feed screw in order to stop the feed of the drill independently of the stopping of the motor by cutting off the power therefrom, in a motor-operated drilling machine.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings,

Fig. 1 is a sectional elevational view of a motor operated drilling machine embodying my improvements;

Fig. 1^a illustrates a drill adapted to be connected to the feed screw shown at the left in Fig. 1;

Fig. 2 is an enlarged sectional elevational view of the feed nut releasing mechanism, taken vertically at right angles to the feed screw at the lower left-hand corner of Fig. 1;

Fig. 3 is a bottom sectional plan view taken on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged perspective of retaining mechanism for the brake;

Fig. 5 is a fragmentary sectional plan view of a portion of the brake-releasing mechanism;

Fig. 6 is an enlarged sectional elevation of the lower left-hand portion of Fig. 1;

Fig. 7 is an enlarged sectional bottom plan view taken on the line 7—7 of Fig. 1, showing the feed nut sections applied to the feed screw; and

Fig. 8 is an enlarged sectional bottom plan view on the line 7—7 of Fig. 1, showing the feed nut sections released from the feed screw.

Referring to the accompanying drawings, the reference number 9 on Fig. 1 designates an electric motor supported in a casing 10 to which is rigidly connected a tubular frame 11. To the armature of the electric motor 9 is connected a pinion 12 which meshes with a gear 13 keyed to a shaft 14 journaled at one end in the bearing 15 supported by the casing 10. Also keyed to the shaft 14 is a small spur gear 16 in position to mesh with the large spur gear 17 mounted on one end of the shaft 18.

An auxiliary frame 19 telescopes over one end of the frame 11 and carries a bearing 20 in which one end of the shaft 18 is journaled, the other end of the shaft 18 being journaled in the bearing 21 mounted in an extension from the center of the casing 10.

Mounted loosely on the shaft 18 is a pinion 23 meshing with the gear 24 enclosed in a casing 25 mounted on the frame 11. Also mounted loosely on the shaft 18 is a sprocket 26 connected by an endless sprocket chain 27 to a sprocket 28. The spur gear 24 and the sprocket 28 are keyed to the screw-threaded shaft 29 to rotate therewith.

While the electric motor 9 may be continuously driven in the same direction, the screw-threaded shaft 29 may be rotated in opposite directions under control of the wheel 30. The pinion 23 and the sprocket 26 being mounted loosely on the shaft 18, clutches are provided under the control of the wheel 30; either the pinion 23 or the sprocket 26 may be connected to the shaft 18 to be driven thereby. The double clutch element 31 is splined to the shaft 18 and may be moved into engagement with either the clutch element 32 or the clutch element 33. When the clutch element 32 is engaged as shown in Fig. 1 the pinion 23 will rotate the gear 24 to rotate the shaft 29 so as to move the traveling crosshead 34 in one direction and when the clutch element 33 is engaged by the clutch element 31, the sprocket chain gearing 26, 27, 28 will rotate the shaft 29 to effect movement of the crosshead 34 in the opposite direction. The crosshead 34 may be connected to mechanism for effecting tilting of the casing 10 and all parts supported thereby, on a pivot having an axis extending transversely of the axis of the shaft of the motor 9, as fully illustrated in the Levin Patent No. 1,978,368, granted October 23, 1934, for an improvement in a drilling machine.

Keyed to that end of the shaft 18 remote from the electric motor 9 is a bevel pinion 35 which meshes with a bevel gear 36 as shown in Fig. 1.

The auxiliary frame 19 is provided with tubular extensions 37 and 38. Journaled in the bushing 39 secured to the extension 38 is a sleeve 40 the ends of which are provided with lubricant sealing devices 41, 42. The sleeve 40 carries longitudinal keys which fit in longitudinally extending keyways 43 on diametrically opposite sides of the screw shaft 44. Since the bevel gear 36 is keyed to one end of the sleeve 40, as shown in Fig. 1, rotation of the shaft 18 will effect rotation of the screw shaft 44 through the keys in the keyways 43. The forward or outer end of the screw shaft 44 is provided with a socket 45 for receiving the relatively long coal drill 46.

As viewed in Fig. 1, the lower end of the auxiliary frame extension 38 is provided with a cylindrical enlargement into which extends a cylinder 47 for supporting the journal bearing 48 and the ball bearing retaining ring 49. In fact the journal bearing 48 and the ring 49 are concentric, providing an annular seat between them for the ball bearing 50. It should be understood that the journal bearing 48 fits the exterior surface of the feed screw 44 and co-operates with the journal bearing 51 in the extension 37, to assist in steadying the drill feed and minimize wobbling thereof during operation, particularly when the drilling operation is in its initial stages.

Resting on an annular ledge on the outer surface of the retaining ring 49 is a brake ring 52 which in reality is journaled on the outer cylindrical surface of the ring 49 since it has a rotary movement relatively thereto.

The lower inner annular portion of the ring 52 is screw-threaded to receive the circular plate 53. The upper annular surface of the plate 53 serves to carry the ball bearing 50 in the position shown in Fig. 1. Depending from the central portion of the plate 53 is a cylindrical extension 54 to which is secured the cylindrical support 55 as shown in Fig. 6.

A feed nut comprising two sections 56 and 57 is adapted to mesh with the feed screw 44. The support 55 is provided with an annular compartment 58 into which project the hinge members 59, 60 of the nut section 56, as shown in Fig. 6. On the diametrically opposite side of the feed screw the hinge elements 61, 62 of the nut section 57 project into the annular compartment 58. Hinge pins 63, 64 are pinned to the support 55 and project downwardly through the annular compartment 58 and through the hinge members 59, 60 and 61, 62. Coil springs 65, 66 surround the hinge pins 63, 64 and the ends of these springs engage the nut sections 56, 57 and the inner cylindrical wall of the compartment 58 so as to tend to move these nut sections out of mesh with the feed screw 44.

Secured to the lower end of the auxiliary frame extension 38 is a plate 67 to which is bolted the protective casing 68 for enclosing various parts including the nut sections, as shown in Fig. 1. In an opening in the casing 68 is mounted the shaft bearing 69 for pivotally supporting the shipper 70 having an operating lever 71 as shown in Figs. 1 and 8. The two arms 72, 72 are adapted to engage trunnions 73, 73 which project diametrically from the ring 74 as shown in Figs. 1, 2 and 7.

The ring 74 surrounds the central portion of the cylindrical nut actuator 75 and is retained in place by the annular retainer 76 which is secured to the bottom of the actuator 75 by means of the cap screws 77, as shown in Fig. 1. When the lever 71 is moved to its dotted line position

the nut actuator will be lowered and when the lever 71 is moved to its full line position the nut actuator 75 will be lifted.

It should be particularly noted that the upper ends of the nut sections 56, 57 are enlarged into semi-cylindrical portions 78, 79 connected by beveled portions 80, 81 to the lower semi-cylindrical portions of less diameter, as shown in Fig. 2. The upper inner wall 82 of the nut actuator 75 is of larger diameter than the inner wall at the lower end of the actuator 75. The cylindrical walls on the interior of the actuator 75 are connected by the beveled portion 83.

The beveled portion 80, 81 and the beveled portion 83 are preferably in parallelism with each other so that when the actuation of the lever 71 moves the actuator 75 upwardly the beveled portion 83 will engage the lower ends of the nut sections 56, 57 to move them gradually toward the feed screw 44. At the same time the upper end of the actuator 75 engages the bevels 80, 81 to assist in moving the nut sections toward each other against the action of the springs 65, 66. It will thus be seen that when the cylindrical actuator is moved upwardly as viewed in Fig. 1, the springs 65, 66 will be put under greater tension ready to release the nut sections from the feed screw 44 as soon as the cylindrical actuator is moved down again by actuating the lever 71 to its dotted line position.

Secured to the interior walls of the actuator 75 diametrically opposite each other are inwardly extending wedges 84, 84. As shown in Fig. 2, the wedges 84 have flat, horizontal top surfaces in position to engage the right angle notches 85 in the adjacent edges of the nut sections 56, 57. When the actuator 75 is moved upwardly the upper cylindrical portion thereof engages the bevels 80, 81 to force the nut sections toward each other, but the vertical spaced-apart flat faces of the wedges 84 limit the movements of the edges of the nut sections toward each other as may be readily understood by referring to Fig. 2. Furthermore, since the wedges 84, 84 are integral with the actuator 75 the upward movement of the latter is limited by the upper edges of the wedges engaging the notches 85.

Now, when the actuator 75 is moved downwardly by moving the lever 71 to the dotted line position shown in Fig. 1, the lower inclined surfaces of the wedges 84 will engage the converging inclined surfaces 86, 86 at the edges of the nut sections 56, 57 as shown in Fig. 2. Therefore, at the time the parts 78, 79 are released from the upper end of the actuator 75 and the lower ends of the nut sections 56, 57 are released from the lower end of the actuator 75, the springs 65, 66 will tend to release the nut sections 56, 57 from the feed screw 44. However, the threads of the nut sections 56, 57 may stick to the threads of the feed screw to such an extent as to prevent the springs from effecting such release. I therefore prefer to provide the positive action afforded by the wedges 84 engaging the inclined surfaces 86, so that the manual force applied to the lever 71 may be added to the spring action to forcibly move the nut sections away from the feed nut 44 and out of mesh therewith. It should also be noted that when the nut sections have been moved into mesh with the feed screw 44 the friction between the ends of the actuator 75 and the ends of the nut sections may be relied on to hold the nut sections in feeding positions.

Associated with the brake ring 52 is a brake band 87. The brake ring 52 may be provided

with an annular groove for receiving the brake band 87, as shown in Fig. 1. This brake band 87 is held yieldingly applied to the brake ring 52 by means of the spring 88, as shown in Fig. 3.

The ends of the brake band 87 are provided with radial wings 89, 89 through which extends the bolt 90. The head of the bolt engages one of the wings 89 and the spring 88 surrounds the bolt and engages the other wing 89. By means of a nut 91 the tension of the spring 88 may be adjusted and the nut then locked in adjusted position by means of a cotter pin in one of the transverse holes 92' in the screw-threaded portion of the bolt 90.

In order to prevent the brake band from moving circumferentially relatively to the frame 38, an arm 92 is secured to the exterior surface of the brake band and extended upwardly through the plate 67 to have its upper end located between the lugs 93, 93 mounted on the frame 38, as shown in Fig. 4.

The brake may be released by means of the oval shaped cam 94 which is located between the brake band wings 89, 89 as shown in Fig. 2. A bracket support 95 is secured to the lower end of the frame 38 by means of a cap screw 96 as shown in Figs. 1 and 5. A vertical shaft 97 is journaled in the bracket support 95 and carries at its lower end the cam 94. A lever 98 is secured to the vertical shaft 97 and is provided with a lug 99 co-operating with the stationary abutments 100 and 101. When the lug 99 is at the abutment 100 the spring 88 is free to apply the brake band 87 to the brake ring 52. When the lug 99 is at the abutment 101 the wings 89, 89 are spread apart and the spring presses the wings 89, 89 against the ends of the cam 94 to frictionally hold the brake band 87 in released position.

When the cam 94 is in the position shown in Fig. 3, the tension of the spring 88 may be adjusted by means of the nut 91 to hold the brake band applied to the brake ring 52 with sufficient force to hold the nut sections 56, 57 stationary relative to the frame 38 during rotation of the feed nut 44. By referring to the drawings it will be seen that the nut sections 56, 57 are supported on a cylindrical frame 55 which in turn is secured to the cylindrical extension 54 from the circular plate 53. In other words, by applying the brake with maximum force, the nut sections 56, 57 together with the cylindrical actuator 75 may be held stationary relative to the frame 38 so that while the feed screw 44 rotates, maximum axial feed of the drill may be secured.

In order to regulate the feed in accordance with the hardness of the material being drilled, the brake may be partially released by adjusting the tension in the spring 88. That is to say, adjustment of the nut 91 will vary the tension in the spring 88 and the point at which the brake ring 52 will slip in the brake band when the drill meets with harder material in the coal vein. Furthermore, after setting the nut 91 to effect such slipping when a predetermined load comes on the drill, the feed of the drill may be varied by the hand lever 93 without readjusting the nut 91. Such manual control enables the operator to effect slipping frequently or quickly whenever necessary or desirable. For instance, if hard bone coal is encountered and it is desired to slow down the rate of feed while keeping up the rate of rotation of the drill, the operator can quickly and to any extent desired, release the brake to secure the desired slipping and consequently obtain exactly the amount of feed that

will enable the drill to cut through the hard material.

At the initial stages of the drilling the overhanging weight of the feed screw when in horizontal position sometimes tends to wobble and such wobbling may be reduced to a minimum by manual control of the brake mechanism.

Whenever desired the feed of the drill may be stopped altogether by actuating the lever 71 from its full line position in Fig. 1 to its dotted line position. It is highly desirable that the operator may do this quickly and positively because if the drill is fed too fast it may meet with hard material unexpectedly and slow down the rotation of the feed screw to such an extent as to stall the motor and cause it to burn out or cause the blowing of a fuse. As a safeguard against endangering the motor, the operator, if he sees that the motor is about to become stalled because the drill is about to get stuck in the drill hole, may very quickly actuate the lever 71 and manually force the nut sections out of meshing contact with the feed screw 44. This will immediately take considerable load off the motor and prevent with certainty its being stalled. Such tendency to stall the motor also sometimes occurs when the drill hole becomes choked with cuttings. By reversing the motor the feed screw may be reversed and then upon applying the nut sections the drill may be withdrawn to effect removal of the cuttings. Or by leaving the nut sections in their released positions, the drill may be pulled out of the drill hole manually, carrying the cuttings along with the drill.

Upon reapplying the drill to the bottom of the partially finished drill hole, the brake may be set by the lever 98 in released position and then the nut sections reapplied to the feed screw in readiness for renewed feed of the drill as controlled by the operator gradually applying the brake mechanism to gradually decrease the slipping and therefore gradually increasing the rate of feed until the maximum is reached in accordance with the set tension of the spring 88.

It should be particularly noted that the brake mechanism and the controlling means therefor are directly dependent upon the sectional nut mechanism and the means for operating the same. Only when the nut sections are applied to the feed screw can the brake controlling means affect the rate of the feed of the drill and during such control of the feed, the mechanism shown in Fig. 2 comes into play to hold the nut sections in mesh with the feed screw 44. While manual release of the brake mechanism may effect maximum slipping and minimum feed of the drill, all feed of the drill will be discontinued when the nut sections are released from the feed screw. In certain emergencies, the release of the nut sections should be quick and positive and I have therefore provided means for forcibly moving the nut sections out of mesh with the feed screw and when this has been accomplished, the feed screw may be moved axially and freely of the operator. It will thus be seen that the brake mechanism co-operates with the feed nut sections by controlling the rate of axial feed of the drill and that when the feed nut sections are out of mesh with the feed screw both the brake mechanism and the feed nut sections are out of operation. The positive holding of the feeding nut sections in mesh with the feed screw assures the desired operation of the means for controlling the brake mechanism and the positive release of the feed nut sections assures the throwing out of operation

both the feed of the drill and the control of the rate of such feed.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In a drilling machine, the combination with supporting framework, of a feed screw for a drill, means for rotating said feed screw, a sectional feed nut, an actuator associated with said feed nut to move the sections thereof into mesh with the feed screw, and wedges mounted on said actuator to extend inwardly therefrom to the spaces between the adjacent edges of the feed nut sections, and means for moving the actuator in such direction as to cause said wedges to spread said nut sections away from the feed screw and out of mesh therewith.

2. A drill feed nut and actuator including a feed nut formed of two similar parts each having internal threads, said feed nut having longitudinally spaced external cylindrical surfaces of different diameters, an actuator mounted on said

feed nut and slidable longitudinally thereof, said actuator having longitudinally spaced internal cylindrical bearing surfaces of different diameters, and operating means for sliding said actuator to feed nut operating or non-operating positions in the former of which the spaced bearing surfaces of said feed nut and said actuator are in engagement and in the latter of which said bearing surfaces are out of engagement.

3. A drill feed nut and actuator including a feed nut formed of two similar parts each having internal threads, said feed nut having longitudinally spaced external cylindrical surfaces of different diameters, an actuator mounted on said feed nut and slidable longitudinally thereof, said actuator having longitudinally spaced internal cylindrical bearing surfaces of different diameters, operating means for sliding said actuator to feed nut operating or non-operating positions in the former of which the spaced bearing surfaces of said feed nut and said actuator are in engagement and in the latter of which said bearing surfaces are out of engagement, and means extending between said two feed nut parts to separate them by positive action when said operating means is actuated to non-operating position.

JOHN S. BELTZ.