J. G. HEY.

FEED MECHANISM FOR DRILLING MACHINES.

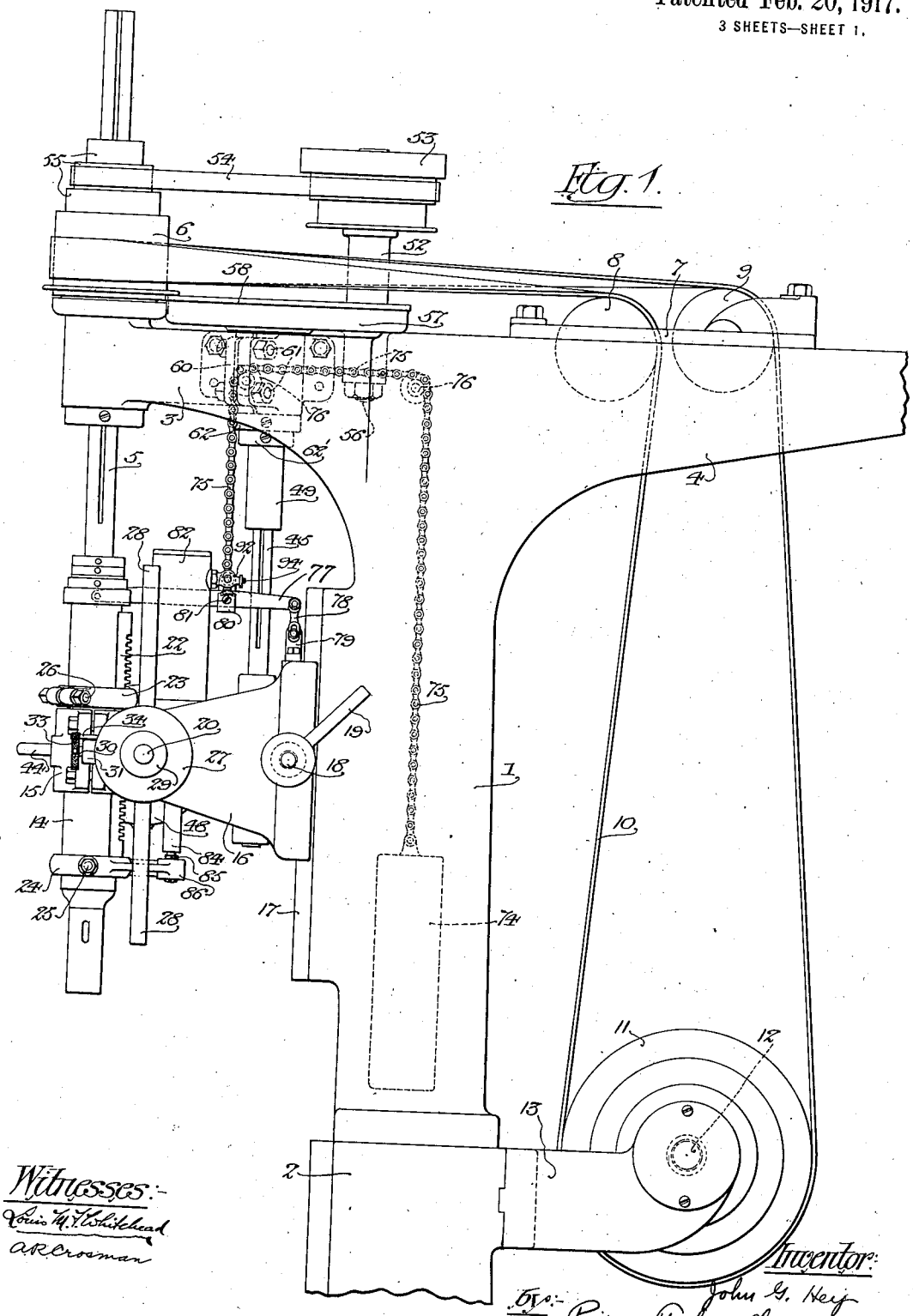
APPLICATION FILED JULY 13, 1914.

1,216,689.

Patented Feb. 20, 1917.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:-
Louis W. Whitehead
A. R. Crosman

Inventor:
John G. Hey
By:- Peirce, Pickett & Clapp Attys:-

J. G. HEY.

FEED MECHANISM FOR DRILLING MACHINES.

APPLICATION FILED JULY 13, 1914.

1,216,689.

Patented Feb. 20, 1917.

3 SHEETS—SHEET 2.

Fig. 2.

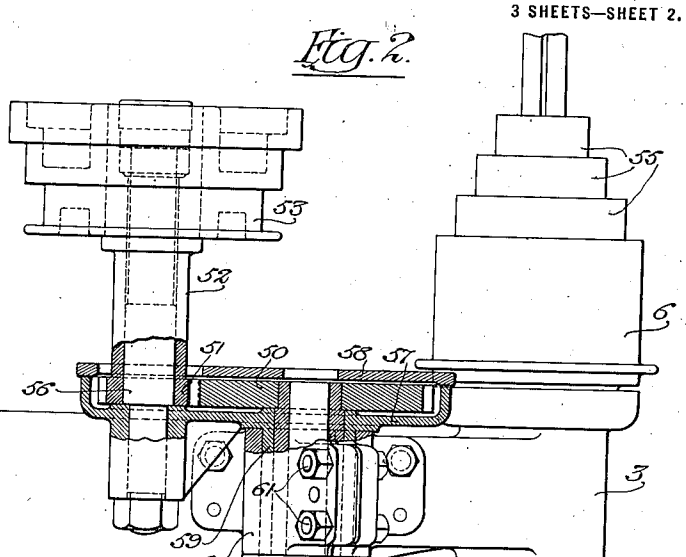
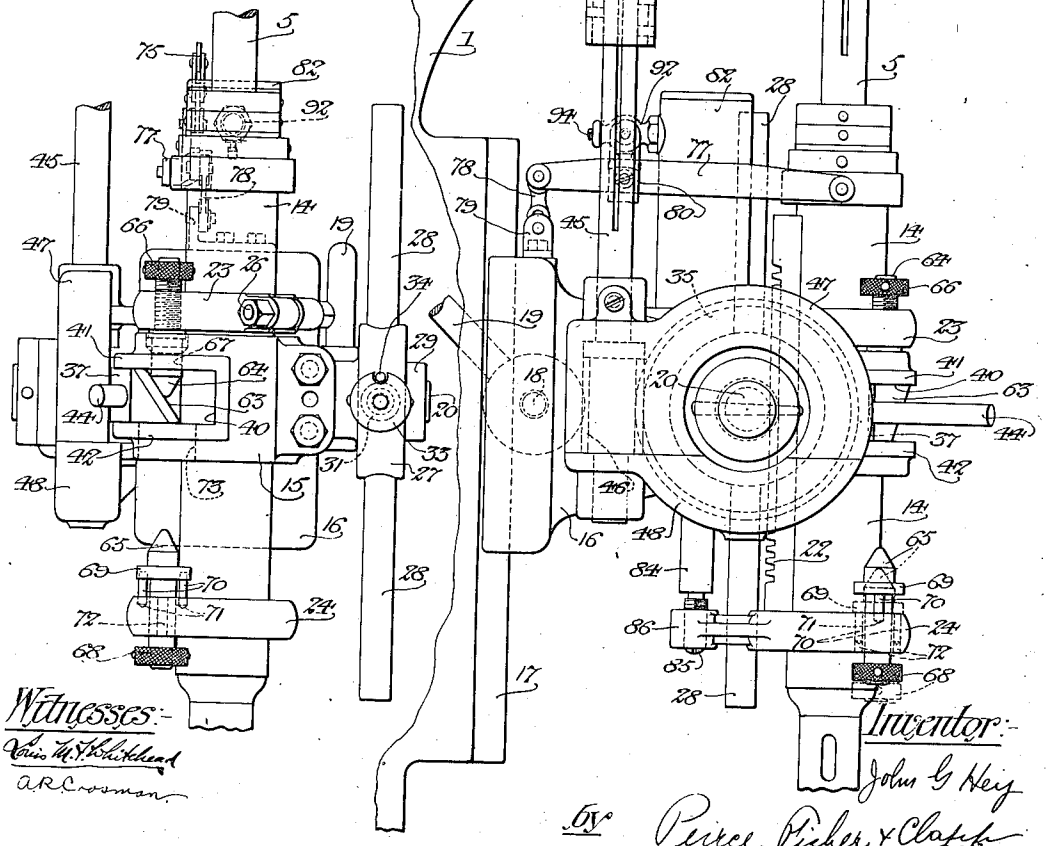


Fig. 3.



Witnesses:-

Louis M. Whitehead

A. R. Crosman

Inventor:-

John G Hey

By Pierce, Richer & Clapp

Attys.

J. G. HEY.

FEED MECHANISM FOR DRILLING MACHINES.

APPLICATION FILED JULY 13, 1914.

1,216,689.

Patented Feb. 20, 1917.

3 SHEETS—SHEET 3.

Fig. 4.

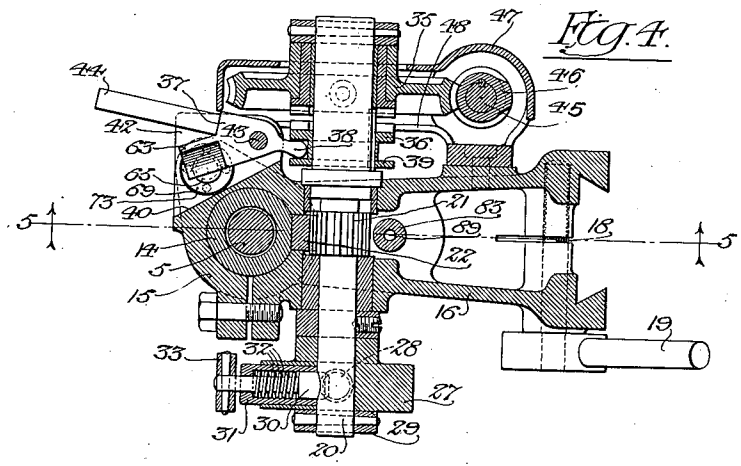
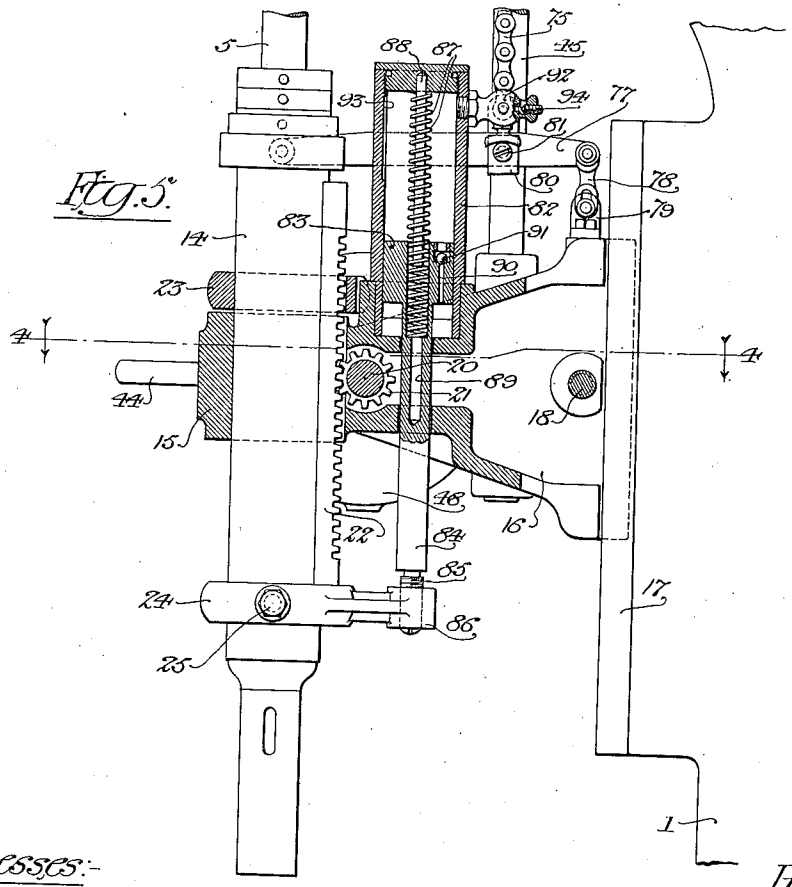


Fig. 5.



Witnesses:-

Louis W. Whitehead

A. R. Crosman

Inventor:-

John G. Hey

by:- Pierce Fischer & Clapp

attys:-

UNITED STATES PATENT OFFICE.

JOHN G. HEY, OF CINCINNATI, OHIO, ASSIGNOR TO CINCINNATI PULLEY MACHINERY COMPANY, OF CINCINNATI, OHIO, A CORPORATION.

FEED MECHANISM FOR DRILLING-MACHINES.

1,216,689. Specification of Letters Patent. Patented Feb. 20, 1917.

Application filed July 13, 1914. Serial No. 850,751.

To all whom it may concern:

Be it known that I, JOHN G. HEY, a citizen of the United States, and a resident of Cincinnati, county of Hamilton, and State of Ohio, have invented certain new and useful Improvements in Feed Mechanisms for Drilling-Machines, of which the following is a full, clear, and exact description.

The invention relates to feed mechanisms for drilling machines, and seeks to provide an improved construction by which the drill spindle may be fed either by power or by hand as desired, and also seeks to provide an improved trip mechanism for automatically arresting or reversing the movement of the drill spindle at the ends of its working and return strokes. A further object of the invention is to provide an improved feed mechanism by which the reversal of the movement of the drill spindle is automatically effected both at the end of its working stroke and the end of its return stroke, and which may be adjusted to effect the automatic reversal of the spindle at the end of the working stroke only. Further objects of the invention are to provide an improved power feed for the drill spindle, which is at all times under control of the operator, and to provide an improved feed which will afford a quick return of the drill spindle.

With this and other objects in view, as will presently appear, the invention consists in the features of improvement hereinafter set forth, illustrated in the preferred form in the accompanying drawings and more particularly pointed out in the claims.

In the drawings Figure 1 is a view in elevation of drilling machine with the present improved feed mechanism applied thereto. Fig. 2 is a partial view in elevation of the opposite side of the machine. Fig. 3 is a partial view in front elevation. Fig. 4 is a horizontal section on the line 4—4. Fig. 5 is a vertical section on the line 5—5 of Fig. 4.

The frame of the machine, in the construction shown, comprises a vertical standard or pedestal 1 mounted upon a base portion 2, and provided at its upper ends with forwardly and rearwardly projecting arms 3 and 4. The arm 3 is provided with a suitable bearing for the vertical drill spindle 5 and a pulley 6 is mounted on the spindle above the arm 3. A slide or carriage 7 is mounted on the rearwardly projecting arm 4 of the pedestal and carries two idler pulleys 8 and 9 which guide a drive belt 10. The belt 10 connects the driven pulley 6 on the drill spindle with a driving pulley 11, which is mounted upon a counter-shaft 12 at the lower rear portion of the machine. The counter-shaft 12 is mounted in a bracket 13 which projects rearwardly from the base portion 2. The driving pulley 11 in the form shown is provided with a series of steps, and is adjustable on the counter-shaft 12 so that belt 10 may engage any of the steps to thereby drive the drill spindle at different speeds. The slide 7 on which the idler pulleys 8 and 9 are mounted may be adjusted in any suitable manner to place the belt under tension. Other suitable means may be employed for driving the drill spindle at different speed ratios relatively to the driving shaft.

The drill spindle 5 is of course free to shift vertically through the bearing on the arm 3 and through the pulley 6, and as usual is provided with a supporting sleeve 14 which is connected to shift vertically with the spindle, but which, in the usual manner, is held against rotary movement within a bearing 15 at the outer end of guiding head 16. The head 16 is vertically adjustable upon a guide 17 on the front of the standard 1. The inner end of the head is split in a vertical direction and a horizontal clamp screw 18 provided with a handle 19 is adapted to secure the head in the adjusted position upon the guide 17.

A horizontal feed shaft 20 is journaled in the head 16 and is provided with a pinion 21 which meshes with a rack 22 that is fixed to the sleeve 14. The sleeve is provided with upper and lower stop collars 23 and 24 for limiting the movement of the sleeve and drill spindle relatively to the head. The lower stop collar 24 is secured to the sleeve by a set screw 25. The upper stop collar is split and a bolt 26 extending through the ends thereof serves to clamp it in adjusted position upon the sleeve. The feed

shaft 20 may be rotated either by power or by hand. For controlling it by hand, the feed shaft is provided on one end with a hub 27, having radial handle bars 28 thereon. The hub is preferably loosely mounted on the shaft, being held in place thereon by a washer 29. When it is desired to feed the drill spindle by hand, the collar 27 is locked to the feed shaft 20 by a clutch pin 30. This pin is mounted in a sleeve 31, which is secured within a radial socket in the hub 27. A spring 32 coiled about the pin extends between its enlarged inner end and the outer end of the sleeve 31 and tends to force its inner end into a suitable socket or seat formed in the shaft 20. The outer end of the locking pin 30 is provided with a small hand-wheel 33. This hand-wheel is provided with a notch in its periphery as shown in Fig. 3, and a pin 34 fixed to the hub 27 is arranged to extend through this notch. By means of the small hand-wheel or finger-piece 33, the locking pin 30 may be withdrawn from engagement with the feed shaft 20 and the handle may then be rotated so that it rests upon the outer end of the pin 34. In this way the handle bars 28 may be readily disconnected from the shaft 20 when the power feed is employed for rotating this shaft.

A worm-wheel 35 is loosely mounted upon the opposite end of the feed shaft 20 and is adapted to be connected thereto by a shiftable clutch member 36, the hub of the worm-wheel and the adjacent face of the clutch member being provided with suitable interlocking teeth. The clutch member is keyed to the shaft to slide axially thereon. A clutch shifter 37 is provided with a rounded inner end portion 38 which engages an annular groove 39 in the clutch member so that the latter may be moved axially into and out of engagement with the worm-wheel 35. The bearing portion 15 at the outer end of the head 16 is cut away on one side to form a recess 40 within which the clutch shifter is mounted. The bearing portion is also provided with laterally projecting upper and lower flanges 41 and 42 on opposite sides of the recess 40, and the clutch shifter is pivotally mounted at its inner end upon a pin 43 which extends between the flanges 41 and 42. The clutch shifter 37 is provided with a forwardly projecting handle 44 so that the power feed may be thrown out of and into operation by hand. Suitable means are also provided, as hereinafter set forth, for automatically throwing the clutch shifter.

The worm-wheel 35 is driven by a worm 46 on the lower end of a vertical counter-shaft 45. A casing formed of upper and lower sections 47 and 48 is fixed to a head 16, and incloses the worm and worm-wheel, the lower section of the casing being adapted to contain oil within which the worm-wheel runs. The inner portion of the casing is also provided with bearings for the vertical counter-shaft 45 and the worm is fixed to the shaft within the bearings so that the shaft is adjusted vertically with the head 16. The upper end of the counter-shaft telescopes within the lower end of a hollow shaft 49 which is provided on its upper end with a gear 50. The gear 50 meshes with a pinion 51 on the lower end of a sleeve 52, and the latter is provided at its upper end with a pulley 53. This pulley is preferably provided with a number of steps as shown and is adapted to be connected by a belt 54 to any one of a series of steps 55 formed upon the upper portion of the spindle pulley 6. The stepped pulley 53, sleeve 52, and pinion 51, are mounted upon a vertical stud shaft 56, which is fixed to the end of an arm or bracket 57. The arm or bracket 57 is preferably in the form of a casing for inclosing the gear 50 and pinion 51, and is provided with a suitable covered belt 58. The inner end of the arm or bracket 57 is provided with a depending sleeve 59, which surrounds the hollow shaft 49 and which is arranged within a supporting bearing 60 that is fixed to the side of the frame arm 3. The supporting bearing 60 is split and sections thereof are connected by bolts 61 to thereby clamp the sleeve 60 and arm 57 and hold the same against movement. By loosening the bolts, the arm 57 and the pulley 53 carried thereby can be swung about the upper end of the shaft 49 to place the belt 54 under proper tension. In this manner the drill spindle, and the vertical counter-shaft 45 which actuates the power feed of the drill, can be driven at a number of different speed ratios. A collar 62 in the lower end of the sleeve 59 engages the lower portion of the bearing 60, and a collar 62′ on the hollow shaft 49 engages the lower end of the sleeve 59.

The clutch shifter 37 is provided with a forwardly projecting, inclined cam lug 63, which is arranged to be engaged by the cone-shaped ends of a pair of tappets or trip pins 64 and 65, which are mounted respectively on the upper and lower stop-collars 23 and 24. The upper trip pin or tappet 64 is threaded through an opening in the stop-collar 23, and is provided with a knurled finger-piece 66, by which it may be adjusted in position upon the stop-collar. When the power feed is in operation, the worm-wheel 35 is connected to the feed shaft 20 by the clutch member 36 during the working stroke to feed the drill downwardly by power. At the end of the working stroke, pin 64 is projected through an opening 67 in the flange 41 and engages the inclined cam lug 63 so that the clutch shifter 37 is moved to thereby disengage the clutch

member 36 from the worm-wheel. The stop collar 23 is adjustable in position upon the spindle sleeve 14 and trip pin 64 may be adjusted to a nicety upon the stop collar so that the downward feed of the drill is automatically and accurately arrested when a hole has been bored of the required depth.

The trip pin 65 is free to slide vertically through an opening in the lower stop collar 24, which is fixed in position upon the spindle sleeve. It is provided on its lower end with a finger-piece 68, and upon its upper end with a flange 69 having a number of depending pins 70. These pins may be engaged either with two shallow sockets 71 in the stop collar, or with two deep sockets or holes 72 in the stop collar, the latter position being shown in dotted lines in Fig. 2. If the lower trip pin 65 is in its operative position, shown in full lines in the drawings, it will be projected through an opening 73 in the flange 42 at the end of the return stroke of the drill, and, by engagement with the cam lug 63, it will move the clutch shifter to thereby engage the clutch member 36 with the worm wheel 35.

In this way, the reversals in direction of the movement of the drill, both at the end of its working stroke and at the end of its return stroke, can be automatically effected. If desired, the lower stop pin may be shifted to the inoperative position shown in dotted lines Fig. 2, so the automatic reversal in the direction of movement of the drill is only effected at the end of its working stroke.

Whether the full automatic or the semi-automatic feed is employed, it is at all times under the control of the operator through the medium of the clutch shifter 37, which can be manually operated by means of the handle 44. By adjusting the upper stop collar 23, the upper trip pin 64 may be shifted to inoperative position so that the power feed can be entirely hand-controlled. By throwing the clutch member to inoperative position and connecting the handle bars 28 to the feed shaft 20, the working and return movements of the drill can be effected by hand.

When the power feed is employed, the return movement of the drill spindle is effected by a counterbalancing weight 74 arranged within the hollow standard 1. A chain 75 extends upwardly from the weight over a pair of guide pulleys 76, and thence downwardly to a horizontal lever 77. The forward end of the lever is pivoted to a collar on the upper end of the spindle sleeve 14, and its inner end is connected by a link 78 to a bracket 79 on the upper, inner portion of the head 16. A pin-and-slot connection is preferably provided between the bracket 79, and the link 78 as shown, and the chain 75 is connected to the lever 77 by means of a member 80, which is adjustable along the lever, being held in the adjusted position by a screw 81. By shifting the member 80 upon the lever 77, the counterbalancing effect of the weight 74 upon the drill spindle can be adjusted as desired, to thereby compensate for drills and tools of different weight, and so that the weight will not serve to return the drill spindle when the hand-feed is employed.

When the power-feed is employed, the weight 74 effects the quick return of the drill spindle, and this return movement is preferably under control of a pneumatic dash-pot or cushioning device. This cushioning device comprises a cylinder 82 mounted in vertical position upon the upper, outer portion of the head 16 and a piston 83 in the cylinder having a piston-rod which extends downwardly through openings formed in the head 16. The lower end of the piston-rod is engaged by a tappet 85, which is adjustably threaded through an arm 86 that projects rearwardly from the lower stop collar 24. The piston is pressed in downward direction by a spring 87 coiled about a rod 88 that is fixed to the upper end or head of the cylinder 82. The lower end of the spring extends within the enlarged upper portion or bore 89 formed in the piston and piston-rod. The piston is provided with a passageway or port 90 extending therethrough with an upwardly opening check valve 91 in the passage. During the downward movement of the piston, the air passes freely through the port 90, so that the downward movement of the drill spindle is not retarded. During the return or upward movement of the drill spindle and piston 83 effected by the weight 74, the flow of air through the port 90 is cut off and the air in the upper end of the cylinder is forced out slowly through a petcock 92 connected to the upper end of the cylinder. The inner wall of the cylinder adjacent its upper end is provided with a vertical by-pass or groove 93. At the end of the upward movement of the drill and piston this by-pass which is longer than the piston 83, establishes communication around the piston so that the extreme end portion of the return stroke is quickly effected, and the lower trip pin 65 will properly shift the clutch member to engaged position. If desired the outlet to the petcock 92 may be controlled by an adjustable valve 94, to thereby regulate the speed of the return movement of the spindle.

It should be noted that the power feed mechanism is shiftable with the head 16 and is properly operative in the different positions thereof, so that the power feed may be used with different kinds of work. The power feed mechanism is simple in construction, will not readily get out of order, and its adjustment and the change from power

to hand feed can be readily effected. It is obvious that numerous changes may be made in the details set forth without departure from the essentials of the invention as defined in the claims.

I claim as my invention:

1. In a drilling machine, the combination with the drill spindle, spindle-sleeve and guiding head therefor, of power-operated feed mechanism mounted on said head for effecting the working strokes of said spindle, a controlling clutch for said feed mechanism, a shifter for said clutch and trips on said sleeve for actuating said clutch shifter at the ends of working and return strokes of the spindle, one of said trips being adjustable to vary the working stroke of the spindle, and the other trip being shiftable into and out of working position, substantially as described.

2. In a drilling machine, the combination with the drill spindle, supporting sleeve therefor and the feed shaft geared to said sleeve, of drive gearing for said shaft, a clutch for throwing said gearing into and out of operation, a shifter for said clutch, an upper stop-collar adjustably mounted on said sleeve, a trip pin for said clutch shifter adjustably threaded through said stop-collar, a lower stop-collar on said sleeve, and a trip pin for said clutch shifter adjustable into and out of operative position on said lower stop-collar substantially as described.

3. In a drilling machine, the combination with a frame, of a guiding head on said frame, a drill-supporting sleeve vertically guided in said head, a drill spindle rotatably mounted in said sleeve, a horizontal feed shaft journaled in said guiding head, a rack on said supporting sleeve, a pinion on said feed shaft engaging said rack, a drive gear loosely mounted on said feed shaft, a clutch on said shaft for connecting said drive gear thereto, a clutch shifter mounted on said guiding head adjacent said sleeve and trips adjustably mounted on said sleeve for actuating said clutch shifter at the ends of the working and return strokes of said sleeve, substantially as described.

4. In a drilling machine, the combination with a frame, of a vertically movable support on said frame, a drill spindle rotatably mounted in said support, a feed shaft geared to said support, drive gearing for said shaft, a clutch for throwing said gearing into and out of operation, adjustable trips connected to said spindle support for shifting said clutch into and out of operation at the ends of the return and working strokes of said support and said spindle, a counter-balance for effecting the return stroke of said support and said spindle and a dashpot controlling the speed of the return movement of said parts, substantially as described.

5. In a drilling machine, the combination with a frame, of a vertically shiftable support on said frame, a drill spindle rotatably mounted in said support, a feed shaft journaled in said frame and geared to said support, drive gearing for said shaft, a clutch for throwing said gearing into and out of operation, adjustable trips connected to said spindle support for shifting said clutch at the ends of the working and return strokes of said support and said spindle, an operating handle loosely mounted on said feed shaft, and means for connecting and disconnecting said handle and said feed shaft, substantially as described.

6. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, feed mechanism for said spindle mounted on said head, means for actuating said feed mechanism in different adjusted positions of said head, a clutch mounted on said head and controlling said feed mechanism, an adjustable trip connected to said sleeve for automatically disengaging said clutch at the end of a working stroke of the sleeve and spindle, and a counterbalance connected to said sleeve and arranged to automatically effect the return stroke of the spindle when said clutch is disengaged by said trip, substantially as described.

7. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, feed mechanism for said spindle mounted on said head, means for actuating said feed mechanism in different adjusted positions of said head, a clutch mounted on said head and controlling said feed mechanism, an adjustable trip connected to said sleeve for automatically disengaging said clutch at the end of the working stroke of the sleeve and drill spindle, a counterbalance connected to said sleeve and arranged to automatically effect the return stroke of the sleeve and spindle, and means for adjusting the leverage of said counterbalance, substantially as described.

8. In a drilling machine, the combination with the drill spindle, supporting sleeve therefor and the feed shaft geared to said sleeve, of drive gearing for said shaft, a clutch for throwing said gearing into and out of operation, upper and lower trips mounted on said sleeve for moving said clutch into and out of operative position, a counter-balance for effecting the return stroke of the spindle, and a dash-pot for retarding the return movement of the spindle, substantially as described.

9. In a drilling machine, the combination with the drill spindle, supporting sleeve therefor, and the feed shaft geared to said sleeve, of drive gearing for said shaft, a clutch for throwing said gearing into and

out of operation, upper and lower trips mounted on said sleeve for moving said clutch into and out of operative position, a counter-balance for effecting the return stroke of said sleeve and spindle, and a dashpot for retarding the return stroke of said parts having means for accelerating the movement of said sleeve and spindle at the end of the return stroke, substantially as described.

10. In a drilling machine, the combination with the drill spindle, the supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, and lower and upper trips on said sleeve for shifting said clutch into and out of operation, said upper trip being adjustable to vary the working stroke of the spindle, and said lower trip being adjustable into and out of operative position, substantially as described.

11. In a drilling machine, the combination with the frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, lower and upper trips adjustably mounted on said sleeve for shifting said clutch into and out of operation, driving connections between said spindle and said gearing, and means for operating said feed shaft by hand, substantially as described.

12. In a drilling machine, the combination with the drill spindle, the supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, an upper stop-collar on said sleeve, a trip pin for disengaging said clutch adjustably threaded through said stop collar, a lower stop-collar, and a trip pin for engaging said clutch mounted on said lower stop-collar and shiftable into and out of operative position, substantially as described.

13. In a drilling machine, the combination with the frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, a shifter for said clutch pivoted on said head, upper and lower trips on said sleeve for moving said clutch shifter in opposite directions, a handle for manually moving said clutch shifter, a handle for manually actuating said feed shaft, and driving connections between said gearing and said spindle, substantially as described.

14. In a drilling machine, the combination with the frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, upper and lower trips on said sleeve for automatically shifting said clutch into and out of operation, means for manually shifting said clutch, and means for manually actuating said feed shaft independently of said gearing.

15. In a drilling machine, the combination with the drill spindle, the supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, means for shifting said clutch into and out of operation, a handle loosely mounted on said feed shaft, and means for connecting and disconnecting said handle and said feed shaft, substantially as described.

16. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, feed mechanism for said spindle mounted on said head, means for actuating said feed mechanism in different adjusted positions of said head, a clutch mounted on said head and controlling said feed mechanism, an adjustable trip connected to said sleeve for automatically disengaging said clutch at the end of the working stroke of said spindle, a counterbalance connected to said sleeve for automatically effecting the return stroke of said sleeve and spindle, and a dashpot for retarding the return movement of said parts, substantially as described.

17. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, feed mechanism for said spindle mounted on said head, means for actuating said feed mechanism in different adjusted positions of said head, a clutch mounted on said head and controlling said feed mechanism, upper and lower adjustable trips connected to said sleeve for automatically engaging and disengaging said clutch at the ends of the working stroke of said spindle, and a counterbalance connected to said sleeve for automatically effecting the return stroke of the sleeve and spindle when said clutch is disengaged, substantially as described.

18. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, an adjustable guiding head for said sleeve, feed mechanism for said spindle mounted on said head, means for actuating said feed mechanism in different

adjusted positions of said head, a clutch mounted on said head and controlling said feed mechanism, upper and lower adjustable trips connected to said spindle for automatically engaging and disengaging said clutch at the ends of the working stroke of said spindle, a counterbalance connected to said sleeve for automatically effecting the return stroke of the sleeve and spindle, and a dash-pot for checking the return movement of said parts, substantially as described.

19. In a drilling machine, the combination with the drill spindle, supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, lower and upper trips on said sleeve for automatically shifting said clutch into and out of operation, said upper trip being adjustable to vary the working stroke of said spindle, and said lower trip being adjustable into and out of operative position, means for manually shifting said clutch, means adjustable into and out of operative condition for manually actuating said feed shaft, and driving connections between said spindle and said gearing, substantially as described.

20. In a drilling machine, the combination with the drill spindle, the supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, means for shifting said clutch, a counter-balance for effecting the return stroke of said spindle, and a dash-pot mounted on said head for retarding such return movement, substantially as described.

21. In a drilling machine, the combination with the drill spindle, the supporting spindle sleeve, and the adjustable guiding head, of a feed shaft journaled on said head and geared to said spindle, drive gearing for said shaft mounted on said head, a clutch controlling said gearing, upper and lower trips on said sleeve for automatically shifting said clutch, a counter-balance connected to said sleeve for automatically effecting the return stroke of said spindle, a dash-pot mounted on said head for retarding the return movement of said parts, substantially as described.

22. In a drilling machine, the combination with a frame, of a drill spindle, a supporting spindle sleeve, a vertically adjustable guiding head for said sleeve, clutch controlled feed mechanism mounted on said head and geared to said sleeve, a vertical countershaft for actuating said feed mechanism extending between the upper portion of said frame and said guiding head, and variable speed driving mechanism connecting the upper ends of said countershaft and said drill spindle.

23. In a drilling machine, the combination with the drill spindle, spindle sleeve, and an adjustable guiding head, of a horizontal feed shaft journaled in said adjustable head and geared to said sleeve, a worm wheel loosely mounted on said shaft, a shiftable clutch member on said shaft for connecting said worm-wheel thereto, a vertical counter-shaft, a worm thereon engaging said worm wheel, a casing fixed to said head and inclosing said worm and worm wheel, and driving connections between said spindle and said vertical counter-shaft, substantially as described.

24. In a drilling machine, the combination with the drill spindle, spindle sleeve, and guiding head, of a horizontal feed shaft journaled in said head and geared to said sleeve, a drive gear loosely mounted on said feed shaft, actuating connections between said gear and said spindle, a shiftable clutch member on said feed shaft for connecting said drive gear thereto, a clutch shifter pivoted on said head and provided with an inclined cam lug, and upper and lower trip pins adjustably mounted on said sleeve and arranged to engage said inclined cam lug to move said clutch shifter in opposite directions, substantially as described.

25. In a drilling machine, the combination with the drill spindle, spindle sleeve, and guiding head, of a horizontal feed shaft journaled in said head and geared to said sleeve, a drive gear loosely mounted on one end of said feed shaft, operating handle bars loosely mounted on the opposite end thereof, a shiftable clutch member on said shaft for connecting said drive gear thereto, an adjustable clutch pin for connecting said handle bars to said shaft, a shifter for said clutch member pivoted on said head and provided with an inclined cam lug and a forwardly projecting handle, upper and lower stop-collars on said sleeve, and adjustable trip pins on said collars arranged to engage said cam lug to move said clutch shifter in opposite directions, substantially as described.

JOHN G. HEY.

Witnesses:
A. R. CROSMAN,
J. G. ANDERSON.