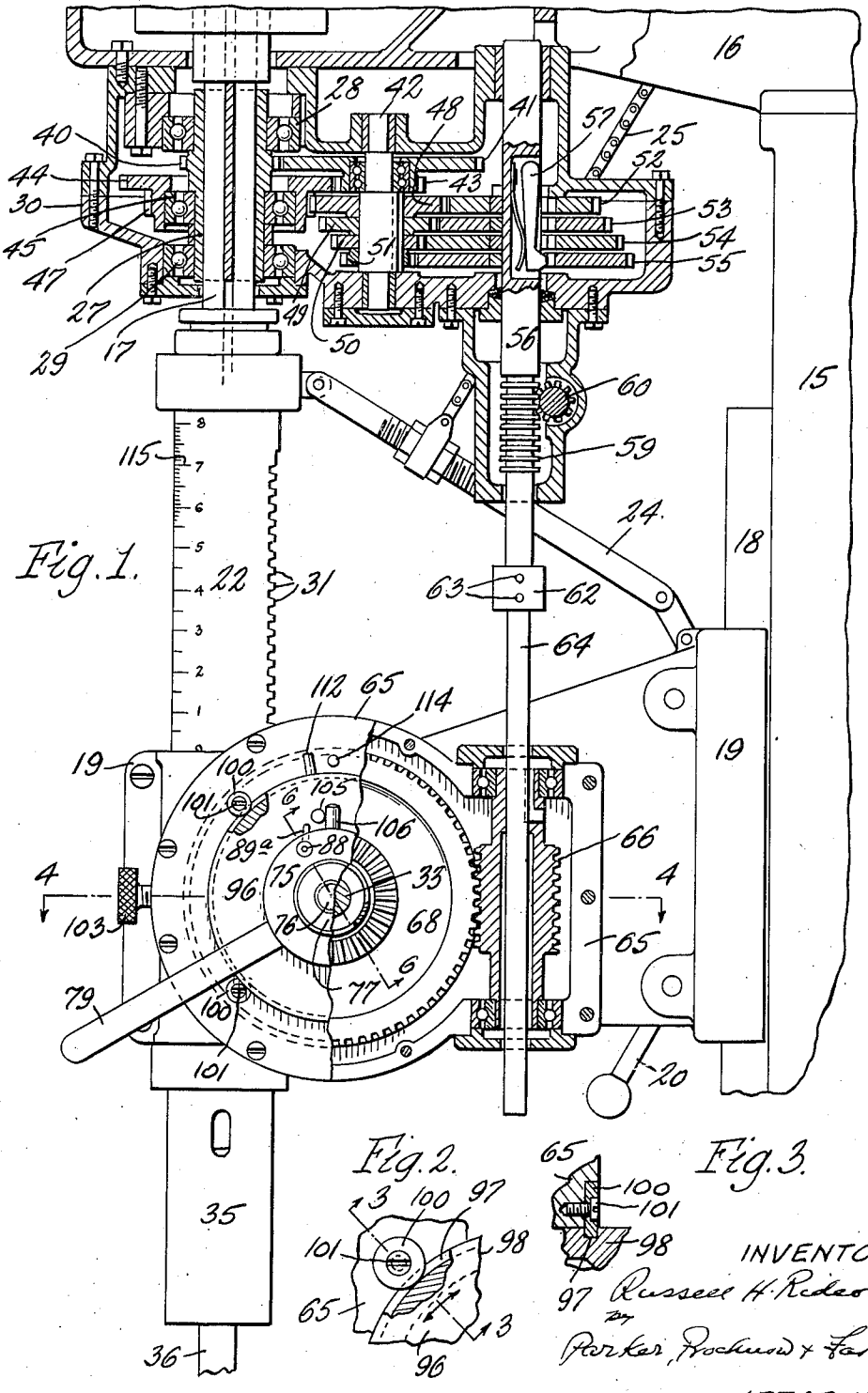
Jan. 6, 1942. R. H. RIDEOUT 2,269,064

POWER FEED MECHANISM FOR MACHINE TOOLS

Filed Feb. 24, 1940 2 Sheets-Sheet 1



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POWER FEED MECHANISM FOR MACHINE TOOLS

Filed Feb. 24, 1940 2 Sheets-Sheet 2

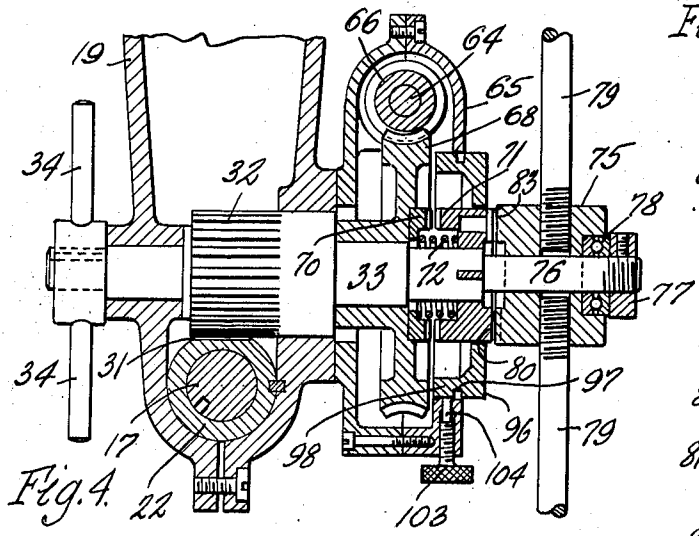


Fig. 4.

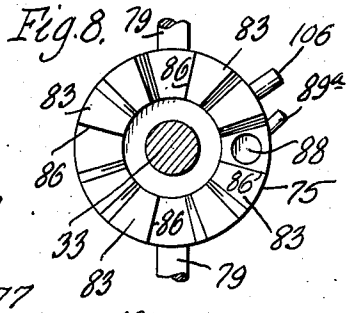


Fig. 8.

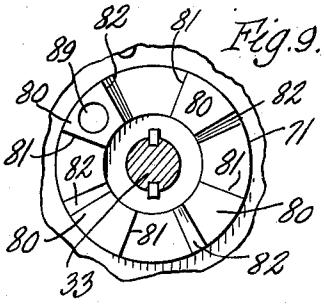


Fig. 9.

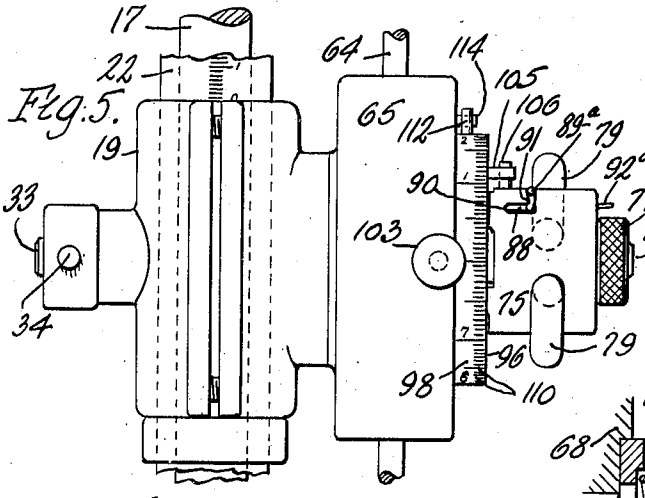


Fig. 5.

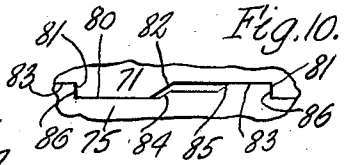


Fig. 10.

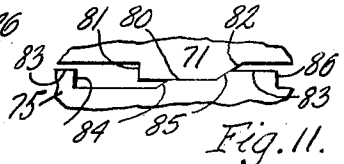


Fig. 11.

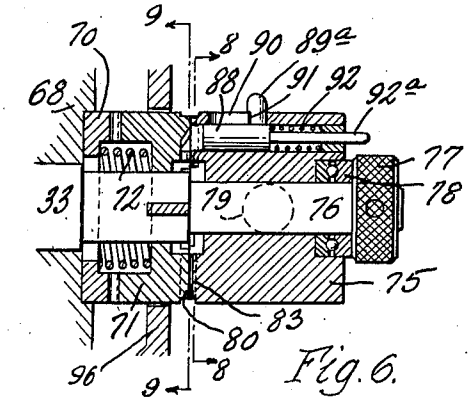


Fig. 6.

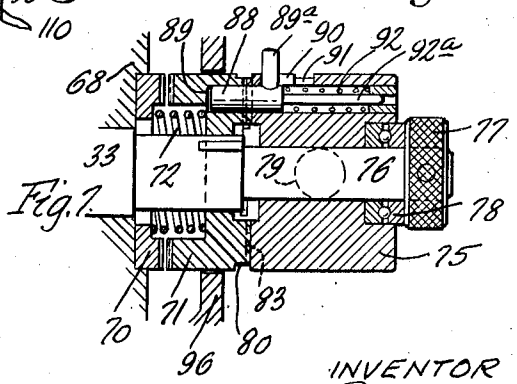


Fig. 7.

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POWER FEED MECHANISM FOR MACHINE TOOLS

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Application February 24, 1940, Serial No. 320,666

5 Claims. (Cl. 77—33)

This invention relates to power feed mechanisms for machine tools, such for example as drilling machines.

One of the objects of this invention is to provide an improved and simplified power feed mechanism for feeding a cutting tool relatively to the work to effect the desired operation on the work. Another object is to provide a feed device of this kind which can be operated either by hand or by power and which can be quickly changed to be operated either by hand or by power. It is also an object of this invention to provide a mechanism of this kind in which the power operated mechanism may become operative by merely applying an increased force to the hand feed lever. Another object is to provide means of improved construction for automatically stopping the power feed when the tool has advanced to the desired extent.

Other objects of this invention will appear from the following description and claims.

I have herein illustrated and described my improved power feed mechanism as applied, by way of example, to a drilling machine of a particular construction, but it will be understood that this invention may be applied to other types of drilling machines, and to other machine tools.

In the accompanying drawings:

Fig. 1 is a fragmentary elevation, partly in section, of a drilling machine having applied thereto a power feed mechanism embodying this invention.

Fig. 2 is a fragmentary elevation thereof, on a larger scale, showing ring retaining means employed in connection with the mechanism.

Fig. 3 is a transverse section thereof, on line 3—3, Fig. 2.

Fig. 4 is a fragmentary sectional plan view of the drilling machine and power feed mechanism, on line 4—4, Fig. 1.

Fig. 5 is a fragmentary front elevation of the part of the mechanism shown in Fig. 4.

Figs. 6 and 7 are fragmentary sectional elevations thereof, on an enlarged scale, on line 6—6, Fig. 1, the parts being shown in different positions in the two figures.

Fig. 8 is a fragmentary sectional elevation thereof, on line 8—8, Fig. 6.

Fig. 9 is a similar fragmentary elevation thereof, on line 9—9, Fig. 6.

Figs. 10 and 11 are fragmentary side elevations or developments of the cooperating cams shown in Figs. 8 and 9 and showing these cams in different relations to each other, and on an enlarged scale.

Referring to Fig. 1, 15 represents an upright standard of a drilling machine having an upper casing or housing part 16 secured thereto. 17 represents the spindle of the drilling machine which is suitably journalled on the upper housing part 16. The standard 15 may be provided with the usual guideway 18 on which a bracket 19 is arranged for vertical adjustment. This bracket carries the usual means for feeding or adjusting the drill toward and from the work and may be secured at different elevations on the guide 18 by any suitable clamping means, which may, for example, include a clamping rod 20. The drill spindle 17 is also adjustable vertically, being rotatable within a spindle sleeve 22. The weight of the spindle and spindle sleeve as well as the weight of the adjustable bracket 19 may be suitably counter-balanced to facilitate adjustment of the same, and in the construction shown for this purpose, a yoke or rod 24 is pivotally connected with the spindle sleeve 22 and the bracket 19 and one end of a chain 25 is connected to the rod 24. The chain may pass over a pulley or sprocket wheel (not shown) and extend downwardly into the standard 15 and the usual counterweight may be secured to the other end of the chain.

The particular means for imparting rotation to the spindle 17 are not shown, since they do not form a part of this invention. The upper portion of the spindle 17 is splined to a bearing sleeve 27 which is suitably journalled by means of ball bearings 28 and 29, the outer races of which are secured to a gear frame or housing 30 secured to the housing part 16. Any other bearing means for the spindle may, of course, be provided, if desired. The spindle 17 is adjusted vertically relatively to its bearing sleeve 27 by means of the spindle sleeve 22, in which the spindle is free to rotate but held against endwise movement. The spindle sleeve is arranged to slide vertically in the outer end of the bracket 19, and in the construction shown is provided with rock teeth 31 which mesh with a pinion 32, Fig. 4, secured on a driven shaft 33. The shaft 33 is suitably journalled in the forwardly extending portion of the bracket 19 and may be rotated by means of arms 34 suitably secured to one end of the driven shaft 33. Below the spindle sleeve, the spindle 17 is provided with any suitable or usual tool holder 35, and 36 indicates in part a drill or other tool held by the tool holder 35.

If it is desired to take off power from the spindle 17 and to transmit it to the driven shaft 33 for the purpose of providing an automatic or power feed for the spindle sleeve 22, this may be done in any suitable or desired manner, and in the construction illustrated, I have provided the sleeve 27 with gear teeth 40, which may be formed integral therewith or on a ring secured to the sleeve 27. The teeth 40 of the sleeve 27 mesh with a gear 41 which is journalled to rotate about a shaft 42 suitably journalled in the gear frame or housing 30. The gear 41 preferably has a pinion 43 formed thereon or secured thereto, and

this pinion meshes with a larger gear 44 which is journalled to rotate freely about the axis of the spindle 17 and the sleeve 27. In the particular construction shown, this gear 44 is shown mounted on a ball bearing 45, the inner race of which is secured to the sleeve 27. The large gear 44 has a smaller gear 47 secured thereto or formed on the hub thereof, which in turn meshes with a gear 48 secured on the shaft 42. This gear 48 is the largest of a cluster of gears which also includes the gears 49, 50 and 51, all of which are keyed or otherwise rigidly secured to the shaft 42. The gears 48, 49, 50, and 51 respectively mesh with gears, 52, 53, 54 and 55, which are mounted to rotate about an upright shaft 56. This shaft has a longitudinal recess or slot formed therein containing a dive key 57, which is yieldingly urged by means of a spring into engagement with one or another of the driven gears 52, 53, 54 or 55. The shaft 56 may be raised or lowered to place the dive key 57 into engagement with any of the four driven gears, the dive key being shown in operative relation to the lowest gear 55 in Fig. 1.

The raising and lowering of the shaft 56 and the holding of the same in adjusted position may be effected in any suitable or desired manner, for example, by means of annular rack teeth 59 formed on the shaft 56 and engaging with a rotatable adjusting pinion 60 which may be locked in any suitable position. Since the mechanism for connecting the desired driven gear to the shaft 56 by means of a dive key is well known and does not of itself constitute a part of this invention, no further description of the same is herein given.

By means of the arrangement of the gears 44 and 47 coaxial with the spindle 17 and rotatable about the spindle, and by arranging the gears 41 and 43 coaxial with the shaft 42 and rotatable about the same, a very compact speed reducing gear train results and the provision of special shafts or bearing pins for these gears is eliminated. Any other means for transmitting power at a greatly reduced speed of rotation from the spindle 17 to the shaft 56 may be employed, if desired.

The shaft 56 is adapted to be connected with and disconnected from the driven shaft 33. Any desired driving connection may be employed for this purpose, and in the construction shown by way of example, the shaft 56 is connected by means of a collar 62 and safety shear pins 63 to a shaft 64, which extends downwardly into a housing 65 mounted on the bracket 19. Within this housing 65 a worm 66 is journalled and this worm is suitably splined to the shaft 64, thus permitting the vertical adjustment of the shaft 64 to position the dive key as may be desired. The worm 66 engages a worm gear 68 which is mounted upon the driven shaft 33 to rotate about the same. The worm gear 68 constitutes the driving member of the power feed device, and it will be obvious that any other means for imparting rotary motion to the driving member 68 may be provided in place of those described.

In accordance with my invention, I provide means operable at will for connecting the driving member 68 to the driven member or shaft 33 whenever it is desired to have the drill or other tool fed by power toward the work, and means are preferably also provided for automatically releasing or disconnecting the power mechanism from the driven shaft 33 when the tool has moved through or relatively to the work to the extent desired, whereupon the spindle and tool carried thereby may be manually moved in the reverse direction away from the work.

The connecting of the driving member 68 to the driven shaft 33 may be effected in any suitable or desired manner, for example by means of a clutch, one element or part of which is secured to or connected with the driving member 68, and the other of which has a driving connection with the driven member or shaft 33. In the construction illustrated by way of example, I have provided a toothed clutch member 70, which is rigidly secured to or formed as a part of the driving member or worm gear 68, and 71 represents a corresponding toothed clutch member facing the clutch member 70 and splined on the driven shaft 33. The two clutch members are normally held out of engagement with each other by means of a coil spring 72. Since the clutch member 71 is splined to the driven shaft 33, it will be obvious that if this clutch member is moved against the action of the spring 72, into clutching engagement with the clutch member 70 mounted on the driving member 68, then the driven shaft 33 and its pinion 32 will be driven by power derived from the spindle, and this pinion in turn will advance the spindle sleeve, the spindle and the tool mounted thereon toward the work.

In order to move the driven clutch member 71 into engagement with the driving clutch member 70, I preferably provide a hub or sleeve 75 which is freely rotatable on a part 76 of the shaft 33. This hub may be held against lengthwise movement on the shaft in one direction by means of a nut 77 secured to the end of the driven shaft 33. Preferably a thrust bearing 78 is interposed between the hub 75 and the nut 77, and radial arms or rods 79 may be secured to the hub 75 for rotating this hub.

The hub 75, in the construction shown, is arranged adjacent to the outer face of the driven clutch member 71 and the outer face of this clutch member and the inner face of the hub 75 are provided with cooperating cam faces which are so formed that when the hub 75 is rotated in a direction to feed the tool toward the work, these cam faces will enable the hub 75 to transmit to the clutch member 71 a rotary motion. Since this clutch member 71 is splined to the driven shaft 33, this rotary motion of the hub 75 will, of course, be transmitted to the pinion 32 and to the spindle sleeve 22. If greater force is applied to the hub 75 through the arms 39 thereof, the cams may ride upon each other in such a manner as to throw the two clutch members into engagement with each other against the action of the spring 72 and thus connect the power feed to the tool advancing mechanism.

Cams of any suitable or desired type may be provided for this purpose, on the opposing faces of the driven clutch member 71 and the hub 75, and in the construction shown, the clutch member 71 has a series of radial cams or raised faces 80 formed thereon, each having an abrupt rear shoulder 71 and an inclined or beveled shoulder 82 on the front face thereof. Each cooperating cam on the hub 75 has a two-step cam or raised part 83 formed thereon having inclined faces 84 and 85, arranged to engage successively with the inclined cam face 82 of the other cam. Each cam 83 also has an abrupt face 86 adapted to engage with the abrupt faces 81 of the other cams for moving the tool away from the work.

The operation of these cams will be easily un-

derstood by reference to Figs. 10 and 11. If the hub member 75 is turned in a direction to advance the work, the cam face 84 thereof will move into engagement with the correspondingly inclined cam face 82 of the driven clutch member 71 which is splined to the driven shaft 33. The engagement of these two inclined faces 84 and 82 with a light or moderate pressure will result in a turning of the driven shaft 33 and the feeding of the spindle 17 toward the work. When the drill or other tool engages the work, if it is desired to apply the power feed, a slightly increased turning effect may be applied to the hub 75, whereupon the cam face 84 will ride over the cam face 82, until the parts occupy the positions shown in Figs. 6 and 11. During this movement of the clutch member 71 by means of the inclined cam faces 82 and 84, the spring 72 will be compressed and the driven clutch member splined to the shaft 33 will be moved into engagement with the driving clutch member 71, whereupon rotation of the driving member 71 will be transmitted to the driven shaft 33. The movement of the inclined cam face 84 over the inclined cam face 82 may also be effected by having the operator grasp the arms 34 and move them in the opposite direction to the arms 79. In this way, the cam 83 may be caused to move the cam 80 axially of the shaft 33 without exerting pressure against the tool, or if desired, after the tool has been advanced to the work by turning the hub member 75 by hand, the operator may hold the arms 34 stationary while exerting slightly greater pressure against the arms 79 in a direction to advance the tool, so that the same result is accomplished without exerting any increased pressure against the tool. The inclined face 85 serves as a stop to limit the extent to which one cam face may be turned relatively to the other. It will also be obvious that when the arms 79 are turned in the opposite direction, the cams will be moved back into the relative positions shown in Fig. 10, whereupon the abrupt faces or shoulders 81 and 86 will engage to move the spindle away from the work.

It may be desirable at times to operate the feeding of the drill or other tool toward the work entirely by hand, and for this purpose, means may be provided for releasably or temporarily connecting the hub 75 with the driven clutch member 71. Any suitable means may be provided for this purpose, and in the construction shown, I have illustrated by way of example a coupling bolt 88 which is arranged in a hole in the hub 75, and which may enter into a hole 89 in the clutch member 71 which is splined to the shaft 33. In order to readily move the coupling bolt 88 into operative or inoperative positions, this bolt is preferably provided with an outwardly extending handle or pin 89*a*, which extends through a slot 90 in the peripheral portion of the hub 75. The slot may have a radially extending part 91. A spring 92 is also preferably provided for yieldingly urging the coupling bolt 88 into its coupling position as shown in Fig. 7. If it is desired to uncouple the hub 75 from the clutch member 71, the coupling bolt may be moved out of its operative position against the action of the spring 92, by means of the pin 89*a* which may be withdrawn lengthwise of the slot 90 and moved laterally into the lateral extension 91 of this slot, as shown in Fig. 6. When this is done, the hub 75 will be disconnected from the clutch member 71. If desired, the coupling bolt 88 may be provided with a pin or extension 92*a* which extends through a hole in a spring retaining sleeve 93 and serves to hold the coupling bolt in correct alinement with the hole in the hub 75 and with the hole 89.

It is also desirable to provide means for automatically disengaging the power feed when the drill or other tool has made the desired cut in the work. For this purpose, I have provided an adjustable ring 96 which is suitably mounted in the housing 65 to rotate about the axis of the driven shaft 33. The ring may, of course, be rotatably mounted in the housing 65 in any suitable or desired manner, and in the construction shown, I have provided an improved rotatable mounting, which includes an annular slot 97 formed in a flange 98 of the ring. The housing 65 is provided at a number of intervals about the ring 96 with disks 100 which may be held in place by means of screws 101, or in any other suitable manner. The peripheral portions of these disks enter into the groove 97 of the ring, so that the ring is retained in place on the housing 65 and may readily be turned relatively to the same. The ring may also be locked in an adjusted position in any suitable or desired manner, for example, by means of a locking screw 103 which extends into a radial threaded hole in the housing 65. A pin 104 may be arranged in the inner portion of this hole so as to be pressed by the screw into engagement with a portion of the flange 98 of the ring, to hold the ring in adjusted position.

The ring 96 is provided with a post 105 extending outwardly from the flat face thereof and this post is adapted to engage another post 106 extending radially outwardly from the hub 75. When the post 106 of the hub moves into engagement with the relatively stationary post 105 of the ring, the hub 75 will be held against further turning, so that the cam portion 80 of the clutch member 71 will be moved out of engagement with the projection or cam 83 of the hub 75, thus returning the cams into the relative positions shown in Fig. 10. This in turn causes the clutch members to be moved out of engagement with each other by means of the spring 72, thus interrupting the power feed of the spindle 17.

In order to enable the post 105 on the ring 96 to be readily positioned in correct relation to the movable pin 106 on the hub 75, the flange 98 of the ring may be provided with graduations 110, which may cooperate with a zero mark on the housing 65. By releasing the locking screw 103, the ring 96 may be turned into any desired position, and the number appearing on the dial 110 opposite the zero mark on the housing 65 will indicate the depth to which the drill spindle 17 will be moved toward the work before the pins 105 and 106 engage to cause the disengagement of the clutch members 70 and 71.

The ring 96 is preferably also provided with means for preventing the turning of the same through more than a single revolution, and for this purpose, a pin 112 may be provided in the flange 98 of the ring, which may engage with a fixed pin 114 secured in the housing 65.

In the use of the power feed mechanism herein described, assuming that one or more holes of a certain depth are to be drilled, the mechanism is adjusted for the depth at which the automatic mechanism is to cease feeding the drill by first releasing the holding screw 103 and turning the ring 96 into a position corresponding to that at which the power feed of the drill is to be stopped. This may, for example, be done by first lowering

the drill into contact with the work, reading the position of the spindle sleeve 22 with relation to the usual scale 115 thereon, adding the desired depth to this reading, and setting the ring 96 in accordance with the result of this calculation. The speed of the power feed is then controlled by adjusting the shaft 56 vertically by means of the pinion 60 so that the dive key engages with the desired one of the gears 52, 53, 54 or 55. The hub 75 is turned to a slight extent in the direction to advance the drill spindle to the work, for example, by striking one of the arms or rods 79 with the hand. This causes the engagement of the cams as described, and moves the driving and driven clutch members into engagement, thus coupling the driven shaft 33 and the feed pinion 32 thereon with the power feed mechanism. The drill is then automatically fed to the work by the power mechanism, and as soon as the hole has been drilled almost to the desired depth, the post 106 on the hub 75 will engage the post 105, thus stopping further rotation of the hub 75. A slight further movement of the drill until it reaches the desired depth takes place while the cam 82 of the clutch member 71 is moving out of engagement with the cam 83 on the hub 75, and as soon as these two cams are out of engagement, the clutch members 70 and 71 are also moved out of engagement, thus interrupting the power feed.

I claim as my invention:

1. A power feed mechanism for advancing the tool to the work, including a driven shaft connected with said tool for moving the same toward and from the work, a clutch member splined on said shaft, a driving clutch member rotatable about said shaft and adapted to engage said first mentioned clutch member to transmit power to said shaft, means for yieldingly urging said clutch members out of engagement with each other, a hand operated feed member mounted to rotate on said shaft, cooperating faces on said hand feed member and said splined clutch member for urging said splined clutch member into engagement with said other clutch member to cause said power feed mechanism to advance the tool to the work, and means for locking said hand feed member and said splined clutch member against relative rotation while the latter is out of engagement with said other clutch member, for enabling said tool to be advanced toward and from the work only by means of said hand feed member.

2. A power feed mechanism for advancing a tool to the work, including a rotary driving member for supplying power to said mechanism and having a clutch face, a rotary driven member connected with the tool to move the same toward and from the work, a clutch member having a driving connection with said driven member and movable toward and from said clutch face, a hand operated feed member having a cam connection with said clutch member for imparting a torque to said driven member through said clutch member and for moving said clutch member into engagement with said clutch face, and a bolt movable at will for locking said hand member and said clutch member against relative rotation while the clutch member is out of engagement with said clutch face to cause the tool to be moved toward and from the work only by said hand member only.

3. A power feed mechanism for advancing a tool to the work, including a rotary driving member for supplying power to said mechanism, a rotary driven member connected with the tool to move the same toward and from the work, a pair of clutch members one of which is connected with said driving member, and the other of which is connected with said driven member, means for normally holding said clutch members apart, a hand feed member rotatably mounted on said driven member, cooperating cam faces on said hand feed member and said other clutch member, said cam faces being formed to engage and transmit power through said second clutch member to rotate said driven member from said hand feed member upon application of a force to said hand feed member sufficient only to move the tool to the work, and to move one cam member relatively to the other upon application of a greater force to said hand feed member to move said clutch members into clutching engagement with each other, and adjustable means adapted to engage said hand feed member to hold the same against turning for disengaging said clutch members when said tool has been moved to the work to the desired extent.

4. A power feed mechanism for advancing a tool to the work, including a rotary driving member for supplying power to said mechanism, a rotary driven member connected with the tool to move the same toward and from the work, a part splined on said driven member and movable into and out of driving relation to the driving member, a hand operated feed member having a cam connection with said splined member, said cam connection including an inclined face through which rotary motion may be transmitted from said hand feed member to said splined member upon application to said hand feed member of a force only sufficient to feed the tool to the work and which inclined face, upon application of a greater force to said hand feed member, moves said splined member lengthwise into driving engagement with said driving member, a stop on said feed member, and a relatively stationary stop adjustable to different positions in the path of movement of said first stop, said stops when engaging moving said cam connection into a position to interrupt said driving engagement between said driving and driven members.

5. A power feed mechanism for advancing a tool to the work, including a rotary driving member for supplying power to said mechanism, a rotary driven member connected with the tool to move the same toward and from the work, a pair of clutch members one of which is connected with said driving member, and the other of which is connected with said driven member, means for normally holding said clutch members apart, a hand feed member rotatably mounted on said driven member, cooperating cam faces on said hand feed member and said other clutch member, said cam faces being formed to engage and transmit power through said second clutch member to rotate said driven member from said hand feed member, upon application of a force to said hand feed member sufficient only to move the tool to the work, and to move one cam member relatively to the other upon application of a greater force to said hand feed member to move said clutch members into clutching engagement with each other, and a member movable at will into position to form a positive driving connection between said hand feed member and said second clutch member while the same are in position for operation from said hand feed member.

RUSSELL H. RIDEOUT.