March 22, 1932. S. C. WATSON 1,850,299

AUTOMATIC DRILL HEAD

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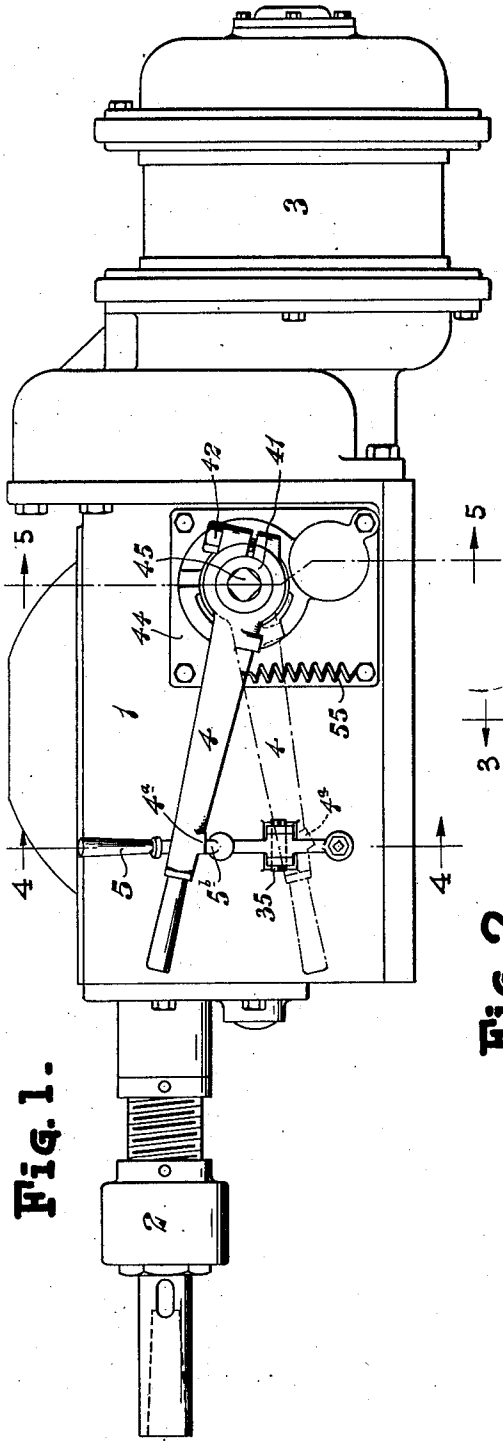


Fig. 1.

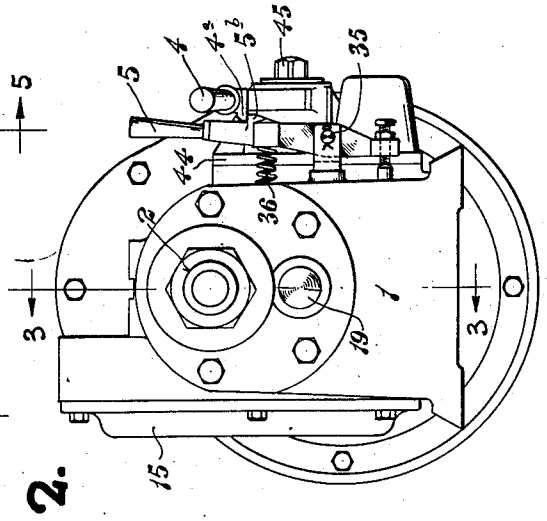


Fig. 2.

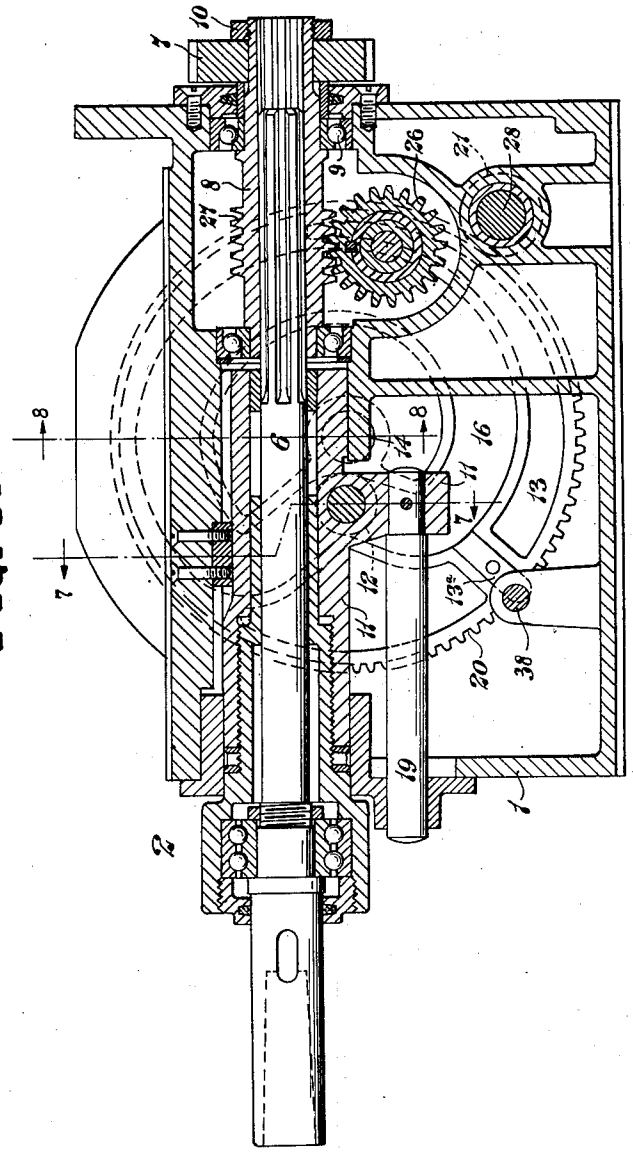
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Fig. 3.



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Fig. 5.

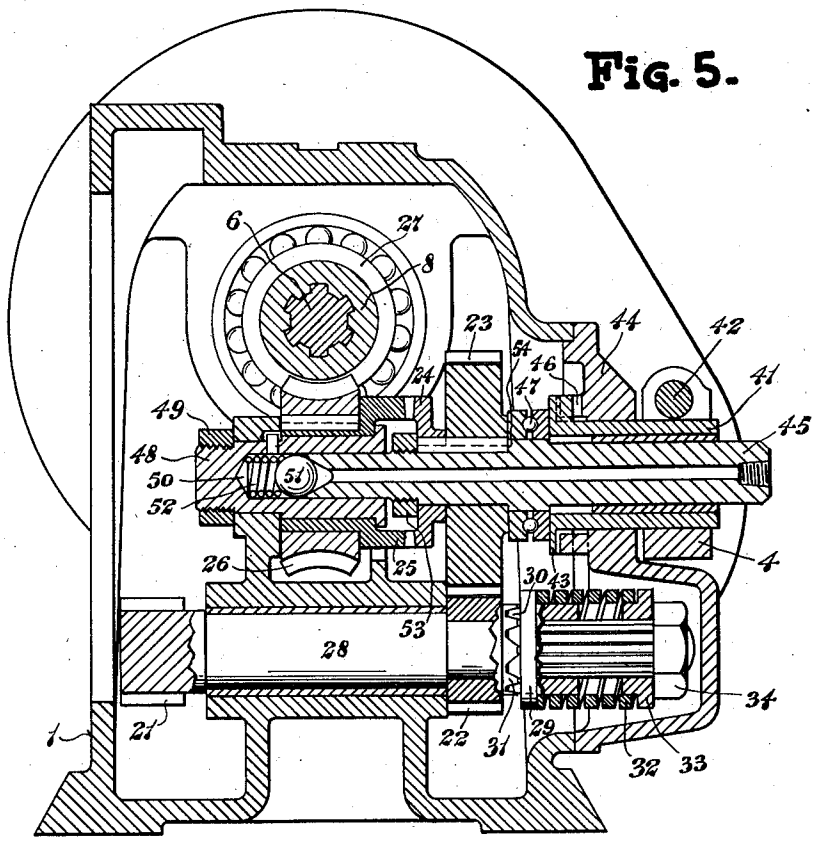


Fig. 6.

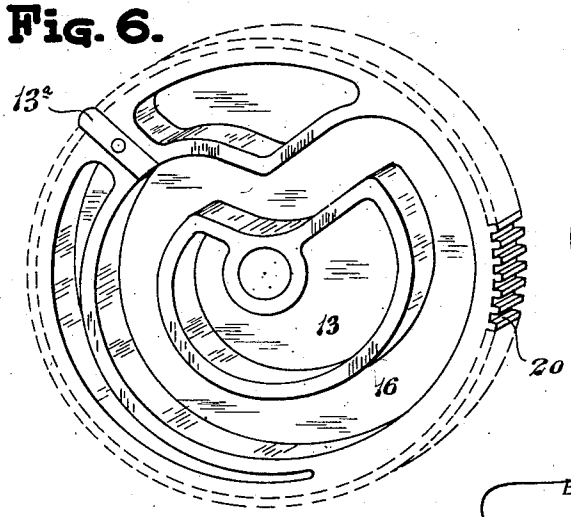
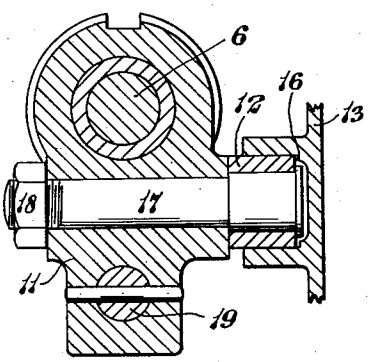


Fig. 7.



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Fig. 4.

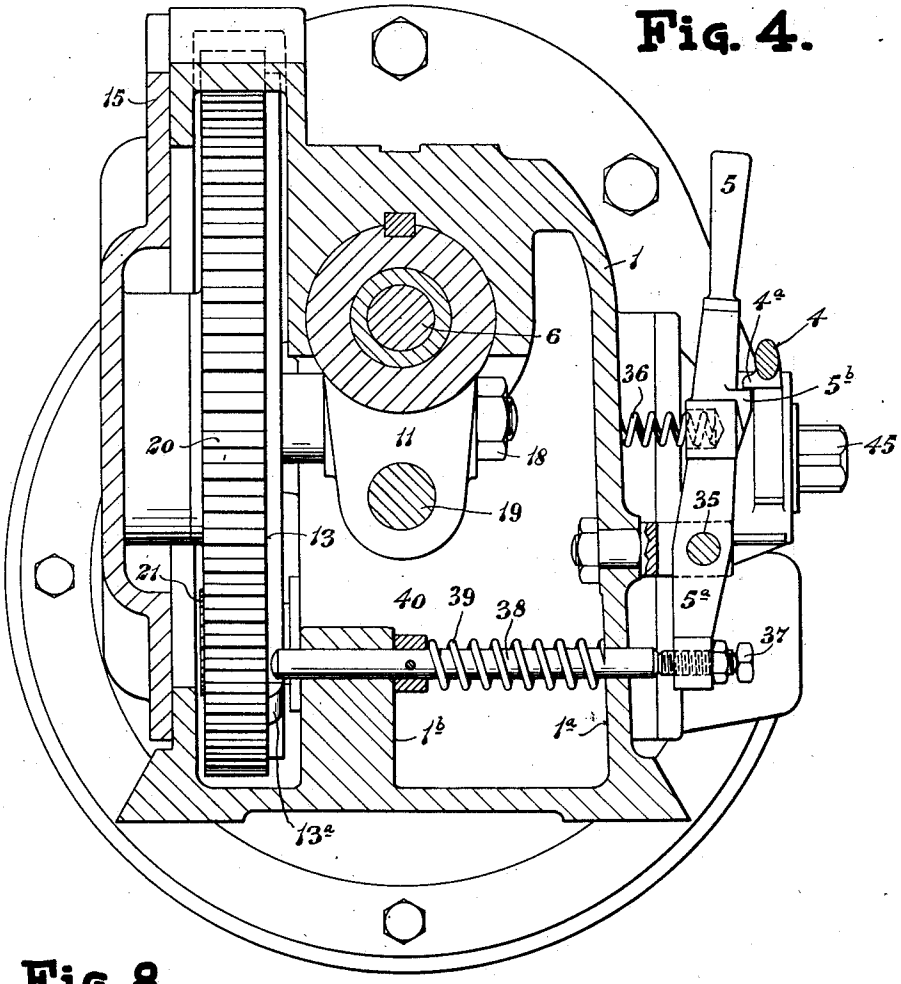
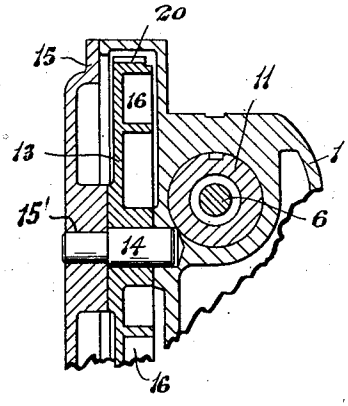


Fig. 8.



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UNITED STATES PATENT OFFICE

SYDNEY C. WATSON, OF DETROIT, MICHIGAN, ASSIGNOR TO THE BRADFORD MACHINE TOOL COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO

AUTOMATIC DRILL HEAD

Application filed October 10, 1928. Serial No. 311,698.

My invention relates to automatic drill heads and more particularly to the feed clutch mechanism, including the means for tripping same; the positive cam control with the cam roller mounted directly in the quill; and the means for driving the cam from the periphery instead of the center.

The objects of my invention are to provide a drill head which is simple, efficient, economical to manufacture, automatic in its operation and having a rapid approach and return of the spindle.

My invention consists in the construction, combination, location and arrangement of parts, as herein set forth and claimed.

In the drawings:

Fig. 1 is a side elevation of a drill head embodying the invention;

Fig. 2 is an end elevation thereof looking towards the spindle;

Fig. 3 is a vertical longitudinal section taken on a plane corresponding to line 3—3 of Fig. 2, with parts of the spindle and clamping rod appearing in elevation;

Fig. 4 is a vertical cross section on the line 4—4 of Fig. 1, parts appearing in elevation;

Fig. 5 is a vertical cross section on the line 5—5 of Fig. 1, parts appearing in elevation;

Fig. 6 is an elevational detail of the feed cam;

Fig. 7 is a fragmental vertical cross section through the roller, quill and part of the feed cam, on the line 7—7 of Fig. 3, with parts appearing in elevation; and

Fig. 8 is a vertical section taken on the line 8—8 of Fig. 3, the cam shaft shown in elevation.

Referring to the drawings, the particular machine chosen for disclosure of an embodiment of the invention comprises frame or bed 1, spindle 2, motor 3, starting lever 4 and emergency lever 5, as clearly shown in Fig. 1.

Spindle drive.—Referring to Fig. 3, the spindle shaft 6 is driven directly from motor 3 through gear 7 and sleeve 8. Said sleeve 8 is rotatably mounted within bearings 9, which bearings are supported within bed 1. The inner end of spindle shaft 6 is splined within the sleeve 8 and is adapted to have a longitudinal reciprocating motion therein during the forward and return strokes of the spindle 2. The gear 7 is keyed to the outer end of sleeve 8 and held against disengagement therefrom by nut 10.

Positive cam control.—The forward and return strokes of spindle 2 are controlled by a positive cam action. This mechanism comprises quill 11, slidably mounted within bed 1, cam roller 12 and feed cam 13. The feed cam 13 is rotatably mounted upon stud 14 (Fig. 8) the outer end of which stud is reduced and received by hole 15′ in cover plate 15 and the inner enlarged end of which is received and supported by bed 1. Cam track 16, formed within feed cam 13, receives cam roller 12 and is so designed that a rapid approach and return of the spindle 2 is effected during each complete revolution of said feed cam 13 and the track may be arranged to produce any variation of the spindle travel that may be desired. The cam roller 12 is rotatably mounted upon stud 17 (Fig. 7) which stud is carried directly by the quill 11 and held therein by nut 18. A clamping rod 19 is also rigidly fixed and carried by quill 11, as clearly illustrated in Figs. 3 and 7, respectively, and the purpose of this clamping rod is to operate any auxiliary clamping attachment or other mechanism that may require the use of a reciprocating motion in conjunction with the travel of the spindle.

Feed cam drive.—The feed cam 13 has teeth cut on its outer periphery forming gear 20, which gear is driven from motor 3, through pinion 21 (Fig. 5) gear 22, gear 23, clutch members 24—25, worm gear 26 and worm 27, the latter being integrally formed with sleeve 8, as shown in Fig. 3.

Pinion 21 is integrally formed on one end of shaft 28, the latter being rotatably mounted in bed 1 (Fig. 5) and gear 22 is mounted upon said shaft and in permanent mesh with gear 23.

Overload or safety clutch.—Ordinarily, the gear 22 is pinned to shaft 28 by a shear pin (not shown) but I prefer to have a collar 29 splined to shaft 28 and provided with clutch teeth 30, which teeth are adapted to be forced into clutching engagement with clutch teeth 31, formed integral with gear 22,

by heavy coil spring 32. Collar 33 is adapted to be forced against spring 32 by nut 34 to increase the tension of said spring against collar 29. Should the spindle ever become overloaded, all moving parts of the drill head and the motor 3 will be protected from any damage, due to the fact that the clutch teeth 30—31 will slip past each other, thus stopping the drive to the feed cam. Should the teeth 30—31 slip during normal operation of the drill head, simply take up on nut 34, thereby increasing the tension of coil spring 32 against collar 29.

Emergency lever.—As clearly shown in Figs. 1, 2 and 4, respectively, the emergency lever 5 is pivotally mounted upon pin 35 and is vertically arranged upon the outside of bed 1 and between said bed and starting lever 4. That portion of the lever 5, above pin 35, is forced in an outward direction or away from bed 1 by coil spring 36, thus the lower end 5*a* of lever 5 is forced inwardly towards bed 1, and the screw 37, carried by said lower end 5*a* of lever 5, is forced against the outer end or rod 38. As clearly shown in Fig. 4, rod 38 is horizontally disposed and slidably mounted within bed 1, and coil spring 39 encircles said rod and fits between the outer wall 1*a* of bed 1 and collar 40, said collar being pinned to said rod 38, thus exerting inward pressure on said rod 38 through said collar 40, so that said collar normally rests against the face of wall 1*b*. The emergency lever 5 is also provided with an extended portion or shelf 5*b*, which is adapted to receive and support lug 4*a*, formed integral with starting lever 4.

The starting lever.—The starting lever 4 is fixed to the outer end of sleeve 41 by stud bolt 42, as clearly shown in Figs. 1 and 5, respectively, and the inner end of said sleeve is provided with a plurality of inclined projections or teeth 43.

The sleeve 41 is slidably mounted within cover plate 44 and one end of shaft 45 is rotatably mounted within said sleeve (Fig. 5). The inner surface of cover plate 44 is provided with a plurality of inclined teeth 46, arranged for wedging engagement with the inclined teeth 43. Gear 23 and clutch member 24, respectively, are keyed to shaft 45 and are locked against the shoulder 54 by nut 53. A bearing 47 is inserted between said gear 23 and the inner end of sleeve 41, as shown in Fig. 5. Clutch member 25 is keyed to worm gear 26 and said clutch member is rotatably mounted upon bearing stud 48, as clearly shown in Fig. 5, said stud being anchored within bed 1 by nut 49. The inner end of shaft 45 is journaled within socket 50 of bearing stud 48 and is countersunk to receive the ball 51. Coil spring 52, received by socket 50 (in bearing stud 48) rests against the bottom of said socket and forces outward on said ball 51, which ball, in turn, forces outward on shaft 45. This outward thrust on shaft 45 by spring 52 and ball 51 holds the clutches 24—25 out of engagement with each other when the starting lever 4 is in the dropped or inoperative position shown by dotted lines in Fig. 1. Whenever the starting lever 4 is drawn upwardly, as shown by full lines in Fig. 1, the wedging engagement of inclined teeth 43—46 overcomes the tension of spring 52, thereby engaging the clutch members 24—25, as heretofore described.

Operation.—Referring now to the operation of my improved drill head, let us assume that the motor 3 is running at a selected speed. As the motor 3 is suitably connected to gear 7 it will, therefore, be apparent that said gear will also be in motion, or, in other words, revolved in a clockwise direction. As sleeve 8 is fixed to gear 7, said sleeve will revolve in unison with said gear. As before stated, spindle shaft 6 is slidably splined within sleeve 8; therefore, said shaft will revolve in unison with said sleeve and thus the drive from motor 3 to spindle 2 is accomplished. Whenever the motor 3 is running, the spindle shaft 6 and spindle 2 are revolved in a clockwise or anti-clockwise direction depending upon the direction of rotation of said motor. Referring to Fig. 1, the normal position of starting lever 4 is shown by broken lines and is held in this lowered position by spring 55. To start the feed cam 13, thereby imparting a reciprocating movement to spindle 2, simply proceed as follows:

Raise the starting lever 4 until the lug 4*a* thereof engages the shelf 5*b* of emergency lever 5, thereby holding said starting lever in a raised position, as shown by full lines in Fig. 1. This upward movement of starting lever 4 causes the sleeve 41, carrying the teeth 43, and rotatably mounted on shaft 45 to have a partial rotation and to be moved inwardly, due to the inclined teeth 43 engaging the inclined teeth 46 on cover plate 44, which, in turn, forces bearing 47, gear 23 and clutch member 24 inwardly with shaft 45, overcoming the tension of spring 52, and thus engaging the clutch member 24 with clutch member 25, thereby connecting gear 23 with worm gear 26. Therefore, when the starting lever 4 is raised upwardly the clutches 24—25 will be engaged with each other and the feed cam 13, driven from motor 3, through gear 7, sleeve 8, worm 27, worm gear 26, clutches 25—24, gear 23, gear 22, clutch collar 29, shaft 28, pinion 21 and gear 20, respectively, as clearly shown in Figs. 3 and 5. Each complete revolution of the feed cam 13 moves the spindle 2 from its extreme inner position within bed 1 to its extreme outer position and back to the extreme inner position. This outward and inward movement of the spindle 2 is caused by the movement of cam roller 12

within cam track 16, said roller being rotatably mounted upon the quill 11.

The feed cam 13 is provided with an obstruction 13*a*, which obstruction is adapted to engage the inner end of rod 38 and is adapted to force it outwardly, whereupon the outer end of said shaft is adapted to push against screw 37 and thereby move the emergency lever 5, so that shelf 5*b* will be disengaged from lug 4*a* of starting lever 4, thus allowing coil spring 55 to draw the lever downwardly to the dotted position shown in Fig. 1, which, in turn, disengages the clutch member 24—25, thereby discontinuing the drive to the feed cam 13. If it is desired to impart continuous motion to the feed cam 13, simply unscrew screw 37 a sufficient distance so that the outer end of rod 38 will not strike said screw, thus preventing the release of emergency lever 5.

An advantage of this invention is that the feed cam 13 can be continuously driven by motor 3, or, if desired, it may be stopped after each revolution by the trip mechanism, as heretofore explained.

Another advantage of this invention is the manner in which the feed cam is driven from its periphery instead of its center, as has been the general practice heretofore, thus creating a larger volume of available power for the operation of the feeding mechanism with a reduced input of power from the motor than has heretofore been made possible.

Still another advantage is the positive cam action and roller mounted directly in the quill. This is not only a strong and durable construction but gives a positive movement to the spindle 2 without the use of springs.

It will be understood that certain changes and modifications of the invention can be made without departing from the scope or spirit thereof as defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. An automatic drill head comprising, in combination, a bed, a quill movable endwise therein, a spindle shaft rotatably mounted in said quill, a sleeve splined to said shaft and rotatably mounted within said bed, driving means for said sleeve, a worm formed on the outer periphery of said sleeve, a worm gear rotatably mounted within said bed and in permanent mesh with said worm, a clutch member fixed to said worm gear, a second clutch member adapted to slidably engage said first-mentioned clutch member, a clutch gear adapted to be rotatably mounted within said bed and held in permanent mesh with said last-mentioned gear, a clutch collar, means for holding said clutch collar in engagement with said clutch gear, a shaft rotatably mounted within said bed and splined to said clutch gear, a pinion fixed to one end of said shaft, a feed cam rotatably mounted within said bed, teeth on the outer periphery of said feed cam adapted to permanently mesh with said last-mentioned pinion, an irregular track formed within said feed cam, a roller rotatably mounted upon said quill and adapted to be inserted within said track, a starting lever adapted to engage or disengage said first and second-mentioned clutches whereby the drive from said worm to said feed cam is completed or severed, depending upon the position of said starting lever, and means carried by said feed cam and bed whereby said starting lever may be released, thereby releasing or disengaging said first and second-named clutch members after each complete revolution of said feed cam.

2. An automatic drill head, as specified in claim 1, wherein the drive from the worm to the feed cam includes a safety clutch adapted to engage clutch teeth integrally formed on said second-mentioned gear, substantially as set forth and for the purposes specified.

3. An automatic drill head, as specified in claim 1, wherein means is supplied for severing the drive from the worm to the feed cam after one complete revolution of the cam, comprising a pin horizontally mounted within said bed, a trip dog carried by said cam and adapted to engage one end of said pin, a spring adapted to normally hold said pin inwardly so as to be in the path of said dog, the other end of said pin adapted to engage the lower end of said emergency lever when said dog moves said pin outwardly from within said bed to thereby cause said emergency lever to release said starting lever thus severing the drive from said worm to said feed cam by the disengagement of said first and second mentioned clutch members.

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