L. S. ADAMS.

HOLE DIGGER.

APPLICATION FILED DEC. 4, 1917.

1,319,259.

Patented Oct. 21, 1919.

3 SHEETS—SHEET 1.

Fig. 2.

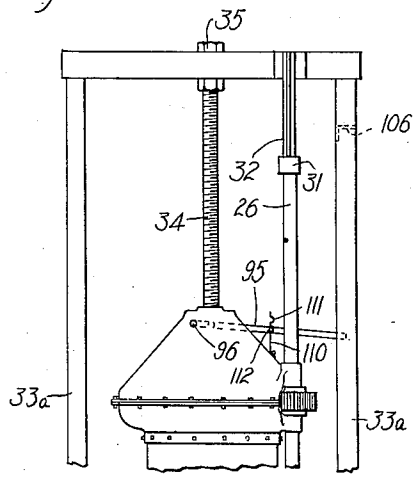


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 3.

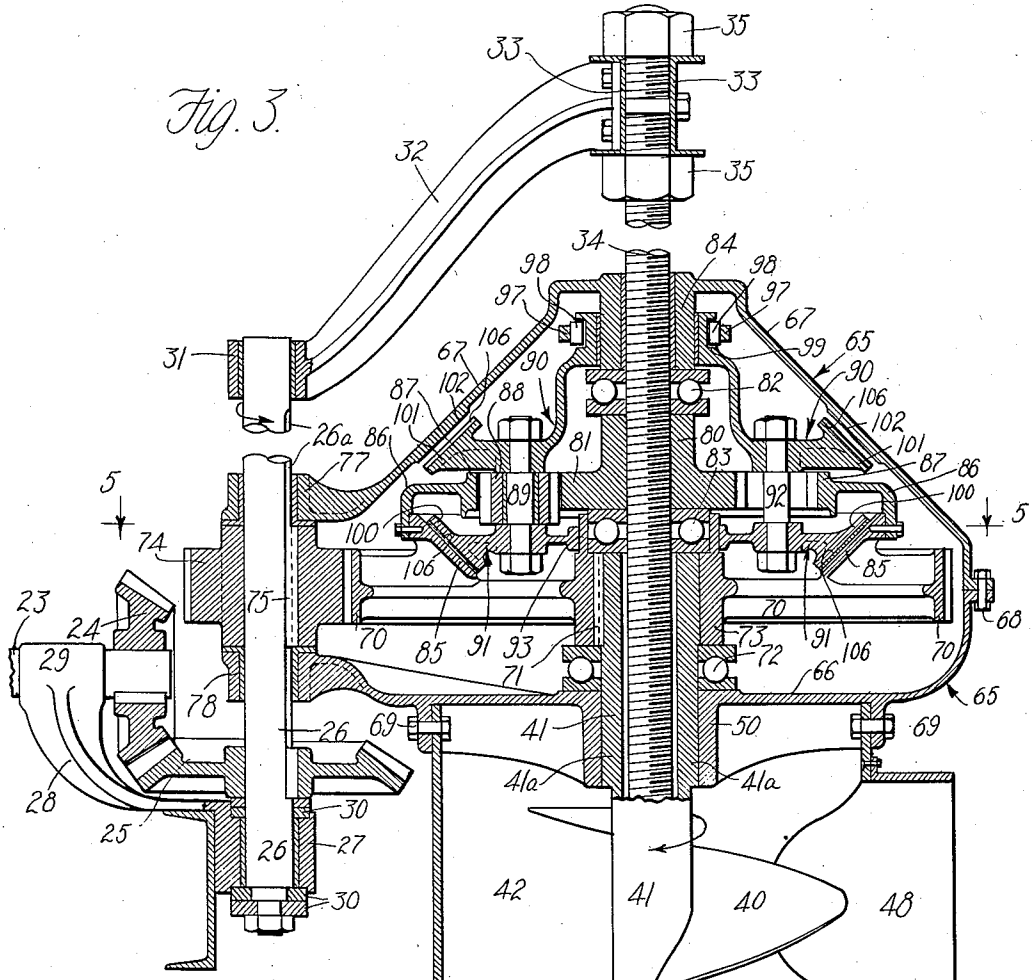
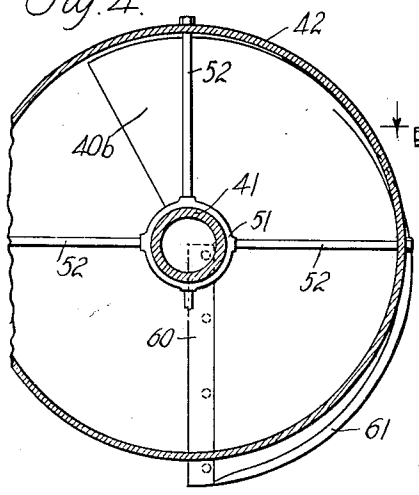


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

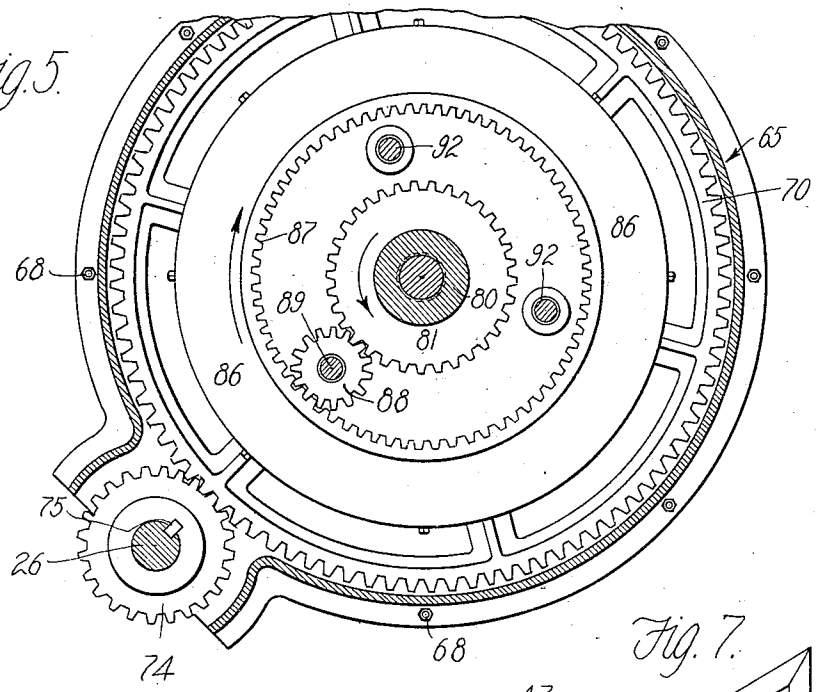


Fig. 7.

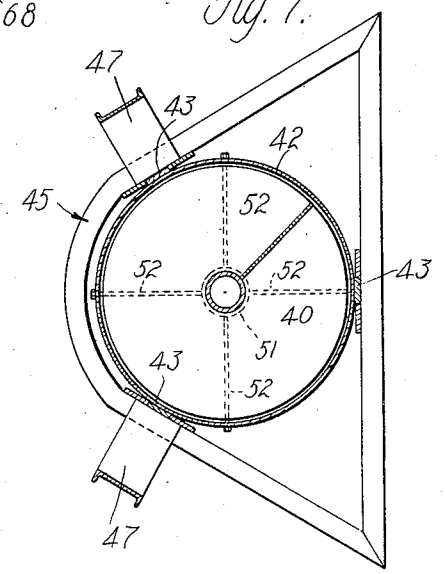
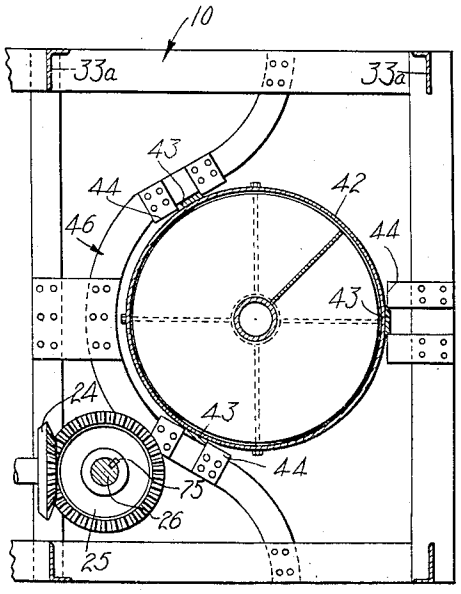


Fig. 6.



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UNITED STATES PATENT OFFICE.

LYTLE S. ADAMS, OF VENICE, CALIFORNIA.

HOLE-DIGGER.

1,319,259. Specification of Letters Patent. Patented Oct. 21, 1919.

Application filed December 4, 1917. Serial No. 205,294.

To all whom it may concern:

Be it known that I, LYTLE S. ADAMS, a citizen of the United States, residing at Venice, in the county of Los Angeles, State of California, have invented new and useful Improvements in Hole-Diggers, of which the following is a specification.

This invention relates to excavation machinery and has particularly to do with devices for digging holes, such as post holes and the like; and it is an object of this invention to provide a mechanical device adapted to efficiently, economically and quickly excavate such holes.

The invention herein set forth and particularly claimed is, in some parts, set forth in my application on excavator, Serial No. 183,966, filed August 1, 1917. In said application I set forth and claim my broad invention as applied jointly to excavators; and this present application is, in part, a divisional continuation of said prior application.

A feature of my excavator, and of the hole digger herein explained, is the use of a spiral digging element. In the hole digger I use a spiral digging element which forms a spiral conveyer for the dug earth. This spiral has, at its lower end, a digging edge; and the rotation of the spiral, and its simultaneous movement into the soil, causes at once the digging of the earth and its conveyance upwardly to the surface. I preferably surround the spiral with a cylindrical casing; and the dug earth is discharged through a suitable opening at the upper end of this casing. The spiral is journaled in the casing, and the casing is mounted in vertical ways; and I employ means for rotating the spiral and for feeding the casing and spiral down into the earth and for withdrawing it therefrom. My preferred means of causing vertical movement is through the medium of a mechanism which acts upon a stationary screw supported at its upper end and projecting down within the hollow central shaft of the spiral. By this means I economize vertical space and make the mechanism as low as possible. The up and down movement of the mechanism may be under manual control or automatic control; or, preferably, under a semi-automatic control. The whole device is preferably designed to be mounted upon a motor truck and to be operated from the power mechanism thereof.

My invention will be better and more fully understood by reference to the following detailed specification of a specific preferred form of device embodying the invention; reference being had to the accompanying drawings in which—

Figure 1 is a side elevation of my improved device mounted upon the rear end of a motor truck; Fig. 2 is a partial elevation taken as indicated by line 2—2 on Fig. 1; Fig. 3 is an enlarged vertical central section of the digger itself; Fig. 4 is a horizontal section taken as indicated by line 4—4 on Fig. 3; Fig. 5 is a horizontal section taken as indicated by line 5—5 on Fig. 3; Fig. 6 is an enlarged section taken as indicated by line 6—6 on Fig. 1; and Fig. 7 is an enlarged section taken as indicated by line 7—7 on Fig. 1.

In the drawings the numeral 10 designates the frame of a typical motor truck and 11 designates the transmission casing thereof. In some motor trucks there is a shaft 12 projecting from the transmission case 11; and I utilize this shaft to obtain power for my digger mechanism; or where there is no such shaft I may provide one or I may obtain power from some other shaft of the power mechanism of the truck.

In the particular case herein illustrated I continue this shaft 12 on forward, as shown at 12^a, and give it a forward bearing 13; and on this shaft I then mount a sprocket wheel 14 and a clutch 15. The clutch may be moved and controlled in any suitable manner (not illustrated). A chain 16 runs from the sprocket 14 to a sprocket 17 on a shaft 18 mounted in bearings 19. This shaft 18 connects with a propeller shaft 20 through the medium of a universal joint, indicated at 21; and the propeller shaft connects at its rear end, through the medium of another universal joint 22, with a shaft 23 upon which the bevel gear 24 is mounted. Gear 24 meshes with another bevel gear 25 mounted upon a long upright shaft 26. The lower end of shaft 26 is mounted in a bearing 27 carried by a bracket 28 which also carries the bearing 29 for shaft 23. Shaft 26 is also provided with end thrust collars or plates 30 above and below bearing 27 to take care of any vertical movement of shaft 26. The upper end of shaft 26 is journaled in a bearing 31 supported by a bracket 32 mounted upon cross beams 33. Cross beams 33 form the upper parts of a supporting structure which includes supporting col-

umns or legs 33ª mounted upon the opposite side beams of truck frame 10. This supporting frame, and beams 33, form the means for supporting the whole of the vertically movable digger mechanism, a vertical screw 34 forming the supporting member and being a means of causing the up and down feed of the mechanism, all as hereinafter described. This vertical screw may be secured to the beams 33 by passing vertically between them and having nuts 35 above and below the beams.

I now describe the preferred construction of the digging mechanism itself. A spiral conveyer screw 40 is mounted upon a vertical hollow shaft 41 and is inclosed in the cylindrical casing 42. This cylindrical casing is provided to form a tube through which the dug earth is moved upwardly; but in some instances it may be unnecessary and may be dispensed with. Casing 42 is provided on its exterior with longitudinal guide strips 43 which slide vertically between vertical guides 44. Guides 44 are mounted upon two frames 45 and 46. Frame 45 is mounted approximately in the horizontal plane of the truck frame 10; while the frame 45 is mounted below the truck frame and supported by suitable supporting elements 47 as close to the ground as proper clearance will permit.

Conveyer 40 extends preferably through the whole length of casing 42; and the casing may have a suitable dirt outlet at 48 near its upper end. Shaft 41 is mounted in an upper bearing 50 and a lower bearing 51. Lower bearing 51 may be supported in casing 42 by radial bolts 52; and spiral conveyer 40 extends down to a point where its lower edge 40ª just clears these bolts, the inner edge of the conveyer being formed, as shown at 40ᶜ, so as to hang over lower bearing 51. Below bearing 51 I mount upon shaft 41 a digger head 55. This digger head may have a hub 56 and may be screw-threaded upon the lower end of the shaft, as indicated at 57, screwing up against a shoulder at 58 upon the shaft; and may be pinned at 59. Hub 56 carries a spiral flange 40ᵇ which forms in effect a continuation of spiral conveyer 40. It is the desirability of placing a bearing at 51 that causes a gap between the parts 40 and 40ᵇ; but at the same time the bolts 52 have an action tending to keep the loose earth from rotating with the conveyer 40 and the bolt structure duplicated at such gaps. At its lower edge spiral flange 40ᵇ carries a digging edge which may preferably be provided in the form of a movable digging knife 60 extending preferably radially and horizontally. Digger head 55 projects beyond the casing 42 and, below the casing, is expanded to a radial dimension larger than the radial dimension of casing 42; so that the digger makes a hole of sufficient diameter for casing 42 to enter freely. The spiral flange 40ᵇ has a peripheral flange 61 extending upwardly at its outer edge, for the purpose of throwing the dirt inwardly, and also for strengthening the digger head.

The upper end of casing 42 carries a head frame or head casing 65 preferably made in lower and upper parts 66 and 67 secured together by bolts 68. The lower part 66 is secured to the upper end of casing 42 by bolts 69; and bearing 50 for the hollow shaft 41 is formed in this lower part 66. Shaft 41 is enlarged at 41ª; and a large driving gear 70 is keyed at 71 to the enlarged portion of the shaft 41 above the bearing 50; an end-thrust ball bearing 72 being interposed between the hub 73 of the gear and casing part 66, to transmit the down thrust, as hereinafter explained. A driving pinion 74 is mounted upon vertical shaft 26. Shaft 26 has a longitudinal key-way 26ª, and pinion 74 is slidably keyed at 75. The pinion 74 is confined between bearings 77 and 78 on shaft 26 and is thereby caused to move vertically on shaft 26 with the head casing 65.

Stationary screw 34 projects down through head casing 65 and projects into hollow shaft 41; and a nut 80 screw-threadedly engages screw 34. This nut 80 carries a gear 81; and the combined nut and gear element is confined between end thrust bearings 82 and 83. The lower ball bearing 83 rests upon the upper end of hub 73 of driving gear 70 and upon the upper end of shaft 41; and the upper ball bearing 82 is between nut 80 and an upper bearing 84, through which bearing the screw 34 slides longitudinally. It is through the medium of this nut 80 that the whole vertically movable mechanism is moved up and down. The upward thrust of the nut is transmitted through upper bearing 82 and through the bearing sleeve 84 to the upper part 67 of head casing 65; while the downward thrust of the nut is transmitted through bearing 83 to shaft 41 and also through hub 73 of gear 70 and through lower bearing 72 to the lower part 66 of head casing 65.

Gear 70 carries a circular flange 85, cone-shaped, to perform a function hereinafter set forth; and an internal gear ring 86 is mounted upon this flange 85, carrying the internal gear 87 in a position opposite gear 81, and concentric therewith. Between gears 87 and 81 there is a small planetary gear 88 freely revoluble upon a stud 89 which is carried between, and forms a connection between, the two circular clutch members 90 and 91. These two members 90 and 91 may be further connected together by other studs 92, which, in my present design of mechanism, are so placed that, if so desired, other planetary gears may be mounted upon them. Being thus connected together by

studs 89 and 92, the two parts 90 and 91 form a rigid element which is rotatable about the central axis of the various gears. The lower member 91 is rotatably mounted upon an upward extension 93 of gear hub 73; and the upper member 90 is rotatably mounted upon the outside of upper bearing 84; and both of these mountings provide not only for rotation but for vertical sliding movement. All of these parts just described can be moved vertically by the operation of lever 95 pivoted at 96 (see Fig. 2) and having arms 97 carrying rollers 98 which engage in a suitable annular groove 99 around the upper part of member 90. When the members 90 and 91 are in their lowermost positions, then a conical clutch flange 100 on member 91 engages conical flange 85 on gear 70; and the members 90 and 91, and the planetary gear 88, are thus all locked to gear 70 to revolve therewith; causing gear 81 and nut 80 to revolve directly with gear 70. Gear 70 revolves in the direction indicated by the arrow in Fig. 5; and, in the position of the parts just described, nut 80 thus revolves in the same direction (a right handed direction when viewed from above) and, the screw 34 being a right handed screw, it will be seen that the described rotation of the nut will feed the whole mechanism downwardly at a rate depending upon the rotation of the gear 70 and the pitch of screw 34. When lever 95 is moved upwardly, moving parts 90 and 91 upwardly, then a conical clutch flange 101 on member 90 moves upwardly into engagement with conical clutch surface 102 on the upper part 67 of head casing 65; and in this position of the parts the members 90 and 91 are locked still. The stud 89 of planetary gear 88 is thus kept from movement; and planetary gear 88 then performs the office of a transmission gear between the internal gear 87 and nut gear 81, causing the nut gear and nut 80 to rotate in a direction opposite to the rotation of main driving gear 70, and also causing the nut to rotate at a speed greater than that of the rotation of gear 70. The opposite rotation at a higher speed causes the whole vertically movable mechanism to be moved upwardly on screw 34 at a speed greater than the speed of downward feed. Lever 95 may be operated entirely manually; but I prefer to provide stops 105 and 106 in the framing 33a for the purpose of automatically stopping the vertical movement of the digging mechanism when they reach the limit of movement in either direction. For instance, when lever 95 is in its lower position, as shown in Fig. 2, and the mechanism is being fed downwardly, then lever 95 will strike lower stop 105 before the mechanism reaches the lowest possible limit of movement, and further downward movement of the mechanism will cause relative upward movement of lever 95, lifting the parts 90 and 91 until they reach a middle inoperative position, when the downward movement of the whole mechanism will stop. When it is desired to start the upward movement of the mechanism, then lever 95 is pulled upwardly to its uppermost position; and, when the uppermost limit of movement is about to be reached, then lever 95 will strike upper stop 106 and will again be thrown into an intermediate position, when further upward movement of the mechanism will stop. Any suitable means may be used for yieldingly holding lever 95 in either one of its positions; or the clutch flanges 100 and 101 may be provided with suitable facings 106 to cause the clutches to more or less "grab" when closed. The cone angle of the clutches also has a bearing upon this action. But in actual practice I may use some such mechanism as a spring, illustrated at 110 in Figs. 1 and 2, with notches or bends 111 therein, adapted to yieldingly engage a pin 112 set in the lever 95.

Although I have described this typical form of mechanism in some detail, I do not thereby mean to say that my invention is limited to this specific preferred form of mechanism. Rather have I described this particular form of mechanism as indicative of various mechanisms which may be included within my invention.

Having described a preferred form of my invention, I claim:

1. In digging machinery, the combination of a vertical cylindrical casing, a vertical spiral conveyer journaled therein and having a digging edge on its lower end, means to rotate the spiral, a vertical stationary screw and a support therefor and mechanism mounted upon the upper end of the casing coöperating with the rotating means and acting upon the vertical screw to feed the casing down and up.

2. In digging machinery, the combination of a casing, a vertical spiral conveyer journaled therein and having a digging edge on its lower end, means to rotate the spiral, a vertical stationary screw and a support therefor and mechanism mounted upon the upper end of the casing coöperating with the rotating means and acting upon the vertical screw to feed the casing down and up; said mechanism embodying a nut on the screw and means to cause the nut to revolve either in the same direction as the spiral or in the opposite direction.

3. In digging machinery, the combination of a vertical cylindrical casing mounted in vertical ways, a vertical spiral conveyer journaled therein and having a digging edge on its lower end, a vertical central hollow shaft for the spiral, a vertical screw extending down into the hollow shaft, a support for the screw at its upper end, a head frame on

the upper end of the casing, a driving gear in the frame on the hollow shaft, a gear nut on the screw and vertically confined between the driving gear and the frame, and means to cause the gear nut to rotate in the same direction as the driving gear or in the opposite direction.

4. In digging machinery, the combination of a vertical cylindrical casing mounted in vertical ways, a vertical spiral conveyer journaled therein and having a digging edge on its lower end, a vertical central hollow shaft for the spiral, a vertical screw extending down into the hollow shaft, a support for the screw at its upper end, a head frame on the upper end of the casing, a driving gear in the frame on the hollow shaft, a gear nut on the screw and vertically confined between the driving gear and the frame, and means to cause the gear nut to rotate with the driving gear or to rotate at a higher speed in the opposite direction.

5. In digging machinery, the combination of a vertical cylindrical casing mounted in vertical ways, a vertical spiral conveyer journaled therein and having a digging edge on its lower end, a vertical central hollow shaft for the spiral, a vertical screw extending down into the hollow shaft, a support for the screw at its upper end, a head frame on the upper end of the casing, a driving gear in the frame on the spiral shaft, a gear nut on the screw and vertically confined between the driving gear and the frame, an internal gear carried by the driving gear, a planetary gear between the gear nut and the internal gear, a rotatable member carrying the planetary gear, and means to lock said member to the driving gear or to lock it to the frame.

6. In digging machinery, the combination of a rotatable vertical spiral conveyer with a lower digging edge, means to rotate the spiral, a vertical raising and lowering screw concentric with the spiral, means to support the screw, a nut on the screw and in vertically fixed relation to the spiral, means to cause the nut to rotate with the spiral and means to cause the nut to rotate oppositely to the spiral.

7. In digging machinery, the combination of a rotatable vertical spiral conveyer with a lower digging edge, means to rotate the spiral, a vertical raising and lowering screw concentric with the spiral, means to support the screw, a nut on the screw and in vertically fixed relation to the spiral, means to cause the nut to rotate with the spiral and means to cause the nut to rotate oppositely to the spiral, said two last mentioned means being in coöperation with the spiral rotating means.

8. In digging machinery, the combination of a rotatable vertical spiral conveyer with a lower digging edge, means to rotate the spiral, a vertical screw concentric with the spiral, means to support the screw, a head frame in vertically fixed relation to the spiral, vertical guides for the frame allowing it to move vertically and preventing its rotation, a screw engaging nut in vertically fixed relation to the frame, and means to either lock the nut to the rotation spiral or to cause it to rotate in a direction opposite to the spiral rotation.

9. In digging machinery, the combination of a rotatable vertical spiral conveyer with a lower digging edge, means to rotate the spiral, a vertical screw concentric with the spiral, means to support the screw, a head frame in vertically fixed relation to the spiral, vertical guides for the frame allowing it to move vertically and preventing its rotation, a screw engaging nut in vertically fixed relation to the frame, and means to either lock the nut to the rotating spiral or to cause it to rotate in a direction opposite to the spiral rotation; said last mentioned means embodying a planetary gear train of which one annular gear is fixed to the spiral and the other annular gear is fixed to the nut, and means whereby the axis of the planetary gear of said train may be either caused to rotate with the spiral or held stationary with reference to the head frame.

In witness that I claim the foregoing I have hereunto subscribed my name this 28th day of November 1917.

LYTLE S. ADAMS.

Witness:
V. BERINGER.