No. 710,438. Patented Oct. 7, 1902.

F. H. DAVIS & C. A. TERRY.

ROTARY DRILLING MACHINE.

(Application filed June 6, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1,

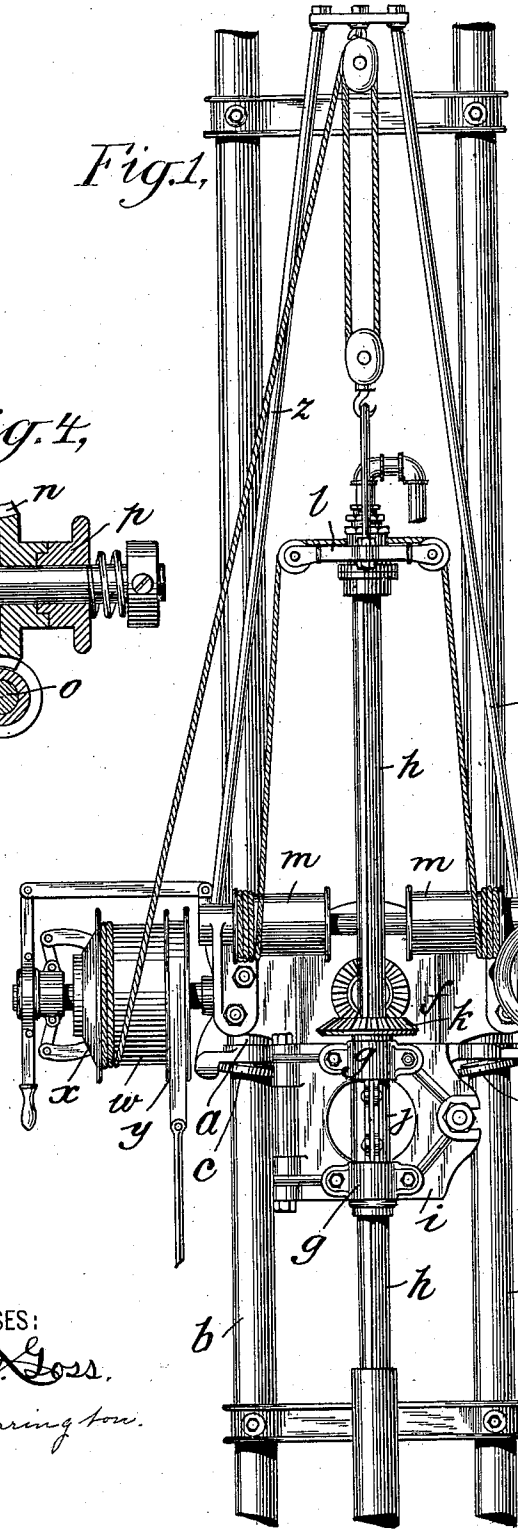



Fig. 5,

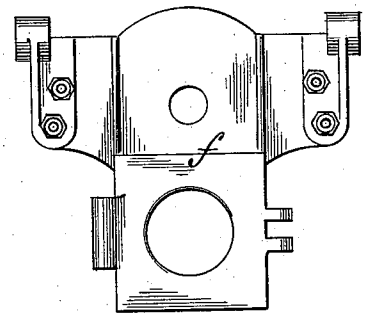
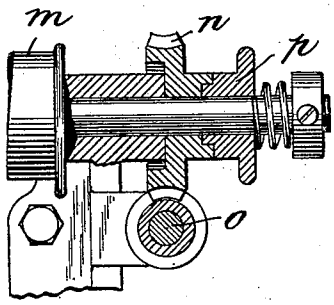



Fig. 4,




WITNESSES:

Harry F. Goss.

C. F. Carrington.

INVENTORS

Francis H. Davis &

Coleman A. Terry

BY

Chapin & Baynard

Their ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 2,

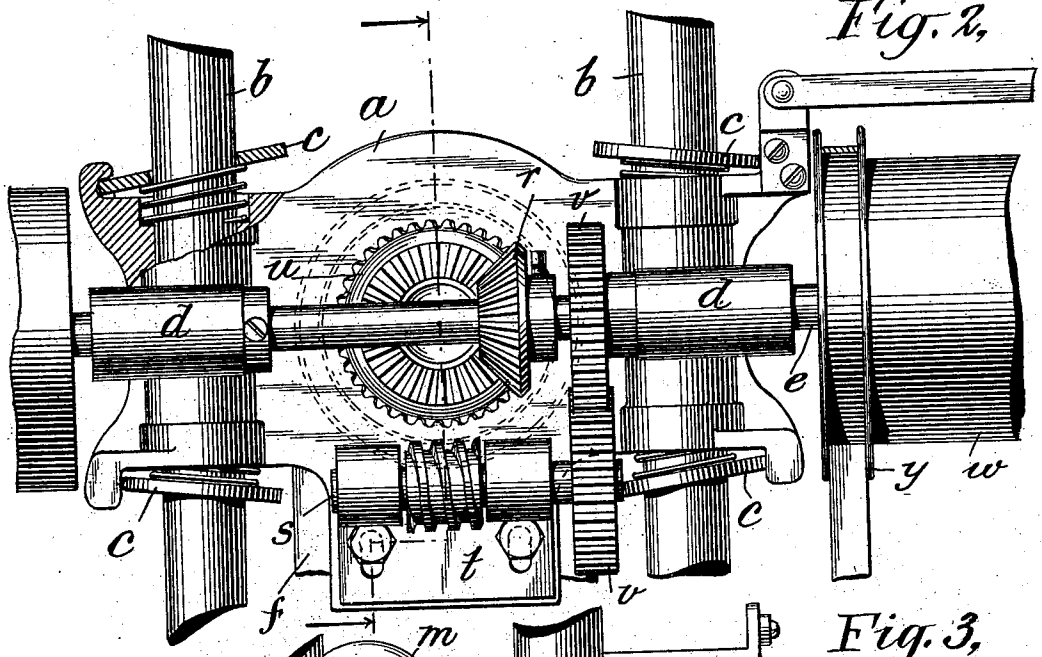
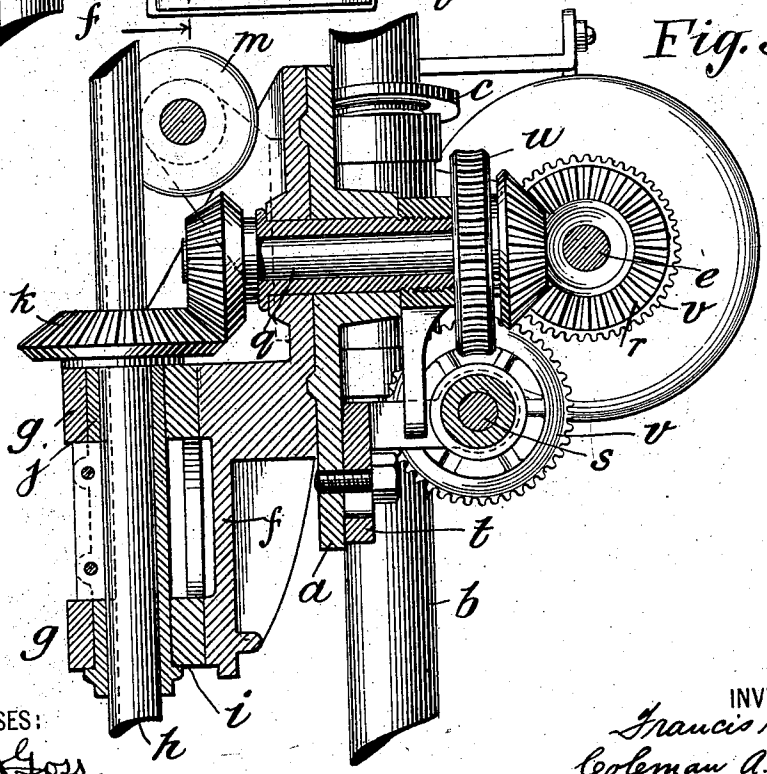



Fig. 3,




WITNESSES:

~~Harry A. Goss.~~

C. F. Carrington.

INVENTORS

Francis H. Davis

Coleman A. Terry

BY

Chapin & Hayward

Their ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

FRANCIS HARLEY DAVIS AND COLEMAN A. TERRY, OF NEW YORK, N. Y., ASSIGNORS TO DAVIS CALYX DRILL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF WEST VIRGINIA.

## ROTARY DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 710,438, dated October 7, 1902.

Application filed June 6, 1901. Serial No. 63,375. (No model.)

*To all whom it may concern:*

Be it known that we, FRANCIS HARLEY DAVIS, a subject of the King of Great Britain, and COLEMAN ARTHUR TERRY, a citizen of the United States of America, both residents of the city, county, and State of New York, have invented certain new and useful Improvements in Rotary Drilling-Machines, of which the following is a specification.

Our invention relates to improvements in rotary drilling-machines, and particularly to machines adapted to core-drilling.

Our invention consists in an improved form of feeding mechanism for the drill-rod, in an improved means for actuating the feeding mechanism, in the provision of a stationary supporting member and a member swiveled thereon and carrying the drill-rod, the said swiveled member carrying a hoisting means for the drill-rod, in the provision of means for varying the speed of the drill-rod relatively to the speed of the drive-shaft, in the provision of a winding-drum, clutch and friction-brake on the drive-shaft, and in the provision of friction-clutch washers between the stationary supporting member and certain supporting-columns employed.

The objects of our invention are generally to improve the construction and operation of drilling-machines of this type.

Our invention further consists in certain details of construction and combination of parts, as will hereinafter be fully set forth.

We will now proceed to describe our invention with reference to the accompanying drawings and will then point out the novel features in claims.

In the drawings, Figure 1 represents a front elevation of a drilling-machine embodying our invention. Fig. 2 represents a rear elevation of certain parts of the machine and illustrating our improved driving mechanism and certain friction-clutch washers employed. Fig. 3 is a view in central vertical sectional elevation of the parts illustrated in Fig. 2. Fig. 4 is a detail view in section of certain parts employed for actuating the feeding mechanism. Fig. 5 is a detail view of one of the frame members.

The drilling-machine herein illustrated comprises two frame members—one a stationary supporting member and the other a relatively movable member swivelly supported thereon. The stationary member supports bearings in which the drive-shaft is mounted, while the relatively movable member carries bearings in which the drill-rod is mounted.

The stationary supporting member (herein designated by the reference character *a*) may be secured to or mounted upon any suitable fixed support or may itself form the fixed support. It is preferably mounted upon cylindrical columns *b*, which columns may be carried upon a frame or may be used in the ordinary and well-known manner as mining-columns. The stationary member will preferably be adjustably secured to the said columns, and we have shown a convenient form of adjustable connection in friction-clutch washers *c*, which surround the said columns and engage on one side each with projecting ears, suitably provided therefor upon the said frames. Springs may be provided, if desired, to prevent accidental movement of the washers. By the employment of these friction-clutch washers the member *a* may readily be adjusted upwardly or downwardly upon the said columns without the employment of tools for such purpose, it being merely necessary to straighten the said washers relatively to the frame in order to freely move the said member. The stationary member *a* has suitable bearings *d* thereon, in which is mounted the drive-shaft *e*.

The movable member is designated in the drawings by the reference character *f* and is swivelly mounted upon the stationary member. A cylindrical guide-rib upon one of the said members fitted to a cylindrical groove in the other maintains correct axial alinement between the two said members. The movable member is provided with bearings *g*, in which is mounted a drill-rod *h*. Said drill-rod is shown in the drawings with its lower end carrying the drill-bit as broken away in order to permit of the illustration of the other parts of the machine on a larger scale than would otherwise be possible. The said drill-

rod bearings *g* are preferably mounted upon a swinging plate *i*, hinged to the movable member *f*, as shown, and adapted when in operative position to be securely locked to the said movable member and to become, in effect, an integral part therewith. The said plate is arranged to swing outwardly in order that the upper end of the drill-rod (which as a whole is comprised of a number of separable sections in a manner well known) may be swung clear of the line of drilling when desired. The drill-rod has a spline connection at about its upper end with a bushing *j*, to which is secured a bevel gear-wheel *k*. The bushing *j* and bevel gear-wheel *k* may of course be constructed of one piece, if desired. The spline connection preferably consists of a key carried by the bushing and which may be inserted into a milled portion thereof and has a sliding engagement with a longitudinal groove in the said drill-rod. The drill-rod is further provided with the usual swivel-head and water connection common to this type of drilling-machine, and is further provided with a pressure-yoke *l*, secured to the said swivel-head. The said movable frame member has mounted thereon a winding-drum *m*, said drum divided in this instance into two sections. A cord constituting a flexible connection is secured at its opposite ends to the said winding-drum and intermediate its two ends passes over antifriction-rollers on the said pressure-yoke *l*. The winding-drum shaft is journaled in suitable brackets bolted or otherwise secured to the said movable frame member. Upon a rotation of the said winding-drum shaft in one direction the drill-rod may be forced downwardly, and hence the foregoing mechanism constitutes a feeding mechanism for the said drill-rod. A preferable form of actuating mechanism therefor comprises a worm-wheel *n*, mounted upon the winding-drum shaft and engaged by a suitable worm-wheel secured upon a feed-shaft *o*, upon which is also secured a hand-wheel. Rotation of the feed-shaft *o* by manipulation of the hand-wheel thereon will cause a relatively slow rotation of the winding-drum to cause the downward feed of the drill-rod or to slacken up the said cord or other flexible connection to permit of the lifting of the drill-rod. The worm and worm-wheel transmission between the feed-shaft and the winding-drum shaft will form a lock for the winding-drum shaft to prevent accidental movement thereof. The worm-wheel *n* is preferably loosely mounted upon the worm-wheel shaft and caused to rigidly engage therewith through a spring-jaw clutch *p*, which may be thrown out, if desired, and the winding-drum shaft released from its actuating mechanism. In this way it is possible to obtain a quick movement of the winding-drum shaft in order to give or take up slack in the said flexible connection when desired. The drill-rod is rotated by the drive-shaft *e* through an intermediate shaft *g*, mounted in a suitable bearing supported in the stationary frame member *a*. The shaft *q* is provided at one end with a bevel gear-wheel in mesh with the bevel gear-wheel *k* and at the other end with a bevel gear-wheel adapted to engage with a similar bevel gear-wheel *r*, mounted upon the drive-shaft *e*. The drive-shaft *e* derives its motion through a belt-wheel suitably connected with a source of power and transmits its motion to the drill-rod through the said bevel-gears when in engagement with each other. The bevel-gear *r*, however, is adapted to be thrown into and out of engagement with its corresponding bevel-gear on the intermediate shaft in order that a change-speed gearing may be interposed when desired.

A drilling-machine of this type is adapted for various classes of work, and the drill-rod must be rotated at largely-varying speeds, according to the class of work being done. For drilling through granite the well-known shot system of drilling may be employed, and the drill-rod should be rotated at a speed of from one hundred and fifty to two hundred revolutions per minute. For drilling through less hard materials a steel-toothed cutter-bit may be employed, and in such cases the drill-rod should not be rotated at a greater speed than from about six to ten revolutions per minute. We have found the correct ratio between the two systems to be about as thirty-five is to one. To accomplish this variation of speed of the drill-rod while maintaining the same speed of the drive-shaft, we have provided a secondary shaft *s*, mounted in suitable bearings on a bracket *t*, the said secondary shaft having secured thereon a worm, and we have provided a worm-wheel *u* upon the said intermediate shaft, with which the said worm is adapted to engage. A pair of toothed wheels *v v* are also provided, the one upon the secondary shaft and the other upon the drive-shaft. The said toothed wheels *v v* are adapted to intermesh when the said worm and wheel are engaged. The bevel gear-wheel *r* is slidably mounted upon the drive-shaft and is fixed in the desired position by any suitable means, such as by a set-screw passing through the hub thereof and engaging with the shaft. When it is desired to introduce the change-speed gearing, the bevel gear-wheel *r* may be slipped out of engagement with its corresponding bevel gear-wheel on the intermediate shaft, and the bracket carrying the secondary shaft may be raised until the gear-wheels *v v* are engaged and the worm on the said secondary shaft is engaged with the said worm-wheel *u*. Transmission from the drive-shaft will then be through the gear-wheels *v v*, the said worm and worm-wheel, and the bevel-gear on the opposite end of the intermediate shaft to the bevel gear-wheel *k* upon the drill-rod. The speed of the drill-rod relatively to the drive-shaft will be very largely reduced. The bracket *t* will be secured upon the frame by bolts, as shown,

which bolts pass through slots in the said bracket and permit the desired movement thereof when necessary. The drive-shaft is further provided with a winding-drum *w*, a clutch *x*, by which said winding-drum may be placed out of and into operative connection with said drive-shaft, and a friction-brake *y*.

The movable frame member is provided with a derrick *z*, which is rigidly secured thereto and partakes of its movement. The derrick supports a tackle, which may be connected with the pressure-yoke and the purchase-rope of which may pass around the said winding-drum *w*. The tackle may be employed to support a part of the weight of the drill-rod and parts carried thereby when the weight thereof is excessive owing to the hole drilled being of great depth, and the tackle and winding-drum may be employed to lift the sections of drill-rod out of the hole and the friction-brake to lower them down into the hole again, as may be desired. The derrick being carried by the movable frame member will always maintain the tackle in line with the axis of the drill-rod regardless of the relative position of the movable frame member with the stationary frame member.

It will of course be understood that the foregoing is but one embodiment of our invention and that the same is capable of modification within wide limits without departing from the spirit and scope of our invention. We do not, hence, desire to be limited to the precise structure shown.

In describing the two frame members as being vertically swiveled one upon the other and in the use of such terms in the claims we intend to be understood as defining a frame member which swings upon another in a vertical plane, or, in other words, which has a substantially horizontal axis of rotation.

What we claim as our invention is—

1. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, and a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod.

2. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a pressure-yoke carried by said drill-rod, a winding-drum carried by said swiveled member, and a flexible connection passing over said pressure-yoke, and connected with said winding-drum.

3. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a pressure-yoke carried by said drill-rod, a winding drum carried by said swiveled member, and a cord or chain, secured at both its ends to the said winding-drum, and, intermediate of its ends, passing over the said pressure-yoke.

4. In a core-drilling machine, the combination with a stationary supporting member and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, gearing connecting said drill-rod with said drive-shaft, a winding-drum carried by said swiveled member, and a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod.

5. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, a flexible connection between said winding-drum and said drill-rod, driving means for said winding-drum, and a clutch for connecting and disconnecting said driving means.

6. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod, driving means for said winding-drum, and a spring-actuated jaw-clutch for connecting and disconnecting said driving means.

7. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon

said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod, a worm-wheel secured to rotate with said winding-drum, and a worm in engagement with said worm-wheel, and adapted to operate same.

8. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod, a worm-wheel, a clutch for connecting and disconnecting said worm-wheel with said winding-drum, and a worm in engagement with said worm-wheel, and adapted to operate same.

9. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a winding-drum carried by said swiveled member, a flexible connection between said winding-drum and said drill-rod, said winding-drum and flexible connection constituting a feeding means for the drill-rod, a worm-wheel, a spring-jaw clutch for connecting and disconnecting said worm-wheel with said winding-drum, and a worm in engagement with said worm-wheel, and adapted to operate same.

10. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, and a derrick secured to said swiveled member, and adapted to partake of its movement.

11. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a drill-rod mounted in bearings upon said swiveled member, means for applying continuous rotary movement to said drill-rod from said drive-shaft, a derrick secured to said swiveled member, a head swiveled to said drill-rod, and tackle supported by said derrick and adapted to engage the swiveled drill-rod head.

12. In a core-drilling machine, the combination with supporting-columns, of a rotatable drill-rod and a supporting-frame therefor, together with spring-actuated friction-clutch washers surrounding the said columns, and in engagement on one side each with the said frame.

13. In a core-drilling machine, the combination with supporting-columns, of a rotatable drill-rod and a supporting-frame therefor, said supporting-frame having projecting ears in proximity to said columns, together with friction-clutch washers surrounding the said columns, and in engagement with the said projecting ears.

14. In an earth-boring machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a hollow sectional drill-rod revolubly mounted in bearings upon said swiveled member, a swivel-head and water connection for said drill-rod, beveled gearing between said drive-shaft and said drill-rod, a secondary shaft, worm-gearing actuated by said secondary shaft, and means whereby said worm-gearing may be introduced into the train of gearing between said drive-shaft and said drill-rod.

15. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod, mounted in bearings upon said swiveled member, an intermediate shaft, gearing between said intermediate shaft and said drill-rod, and between said intermediate shaft and said drive-shaft and through which gearing the drill-shaft is adapted to be rotated, a secondary shaft, a worm-wheel on said intermediate shaft, a worm on said secondary shaft, and gears adapted to intermesh between said drive-shaft and said secondary shaft, together with means whereby the said intermediate shaft may be actuated by the drive-shaft to rotate the drill-rod, either directly through the aforesaid gearing between it and the said drive-shaft, or through the said worm-gearing, and gearing between it and the drive-shaft.

16. In a core-drilling machine, the combination with a stationary supporting member, and a drive-shaft whose bearings are stationary with said member, of a member vertically swiveled upon said stationary member, a revoluble drill-rod, mounted in bearings upon said swiveled member, and intermediate shaft, beveled gearing between said intermediate shaft and said drill-rod, beveled gearing between said intermediate shaft and said drive-shaft, said gearing forming a train through which said drill-shaft may be rotated, said beveled gearing adapted to be placed

into, and out of, operative engagement, a secondary shaft, a worm-wheel on said intermediate shaft, a worm on said secondary shaft, and gears, adapted to intermesh, between said drive-shaft and said secondary shaft, said worm and worm-wheel adapted to be placed into, and out of, operative engagement with each other, whereby the said worm-gearing may be included in the train of gearing for rotating the drill-shaft.

FRANCIS HARLEY DAVIS.
COLEMAN A. TERRY.

Witnesses:
E. L. MILLS,
D. HOWARD HAYWOOD.