No. 747,869. PATENTED DEC. 22, 1903.

C. T. DRAKE.

EXCAVATING MACHINE.

APPLICATION FILED APR. 17, 1903.

NO MODEL. 2 SHEETS—SHEET 1

Fig. 3.

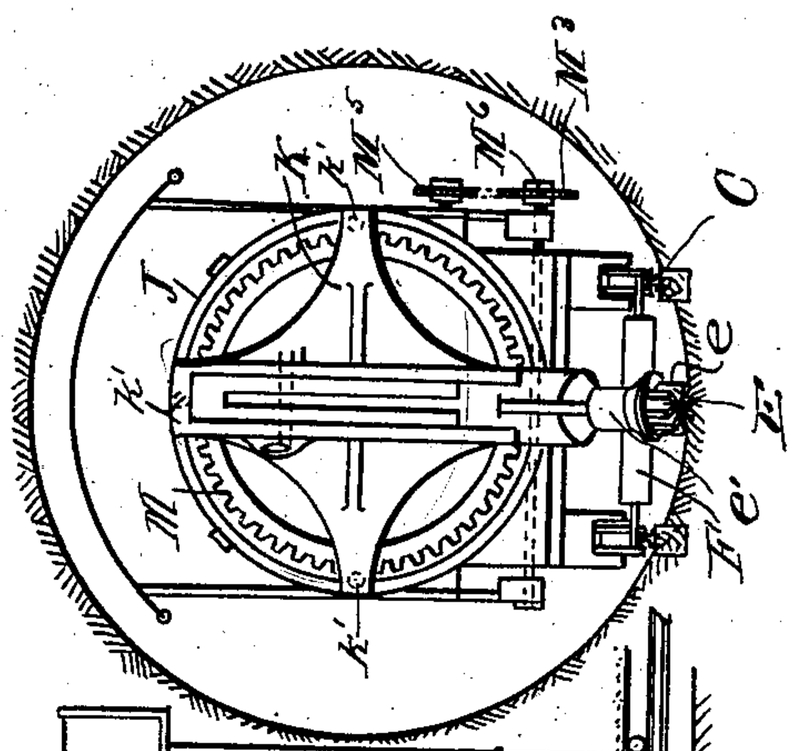


Fig. 1.

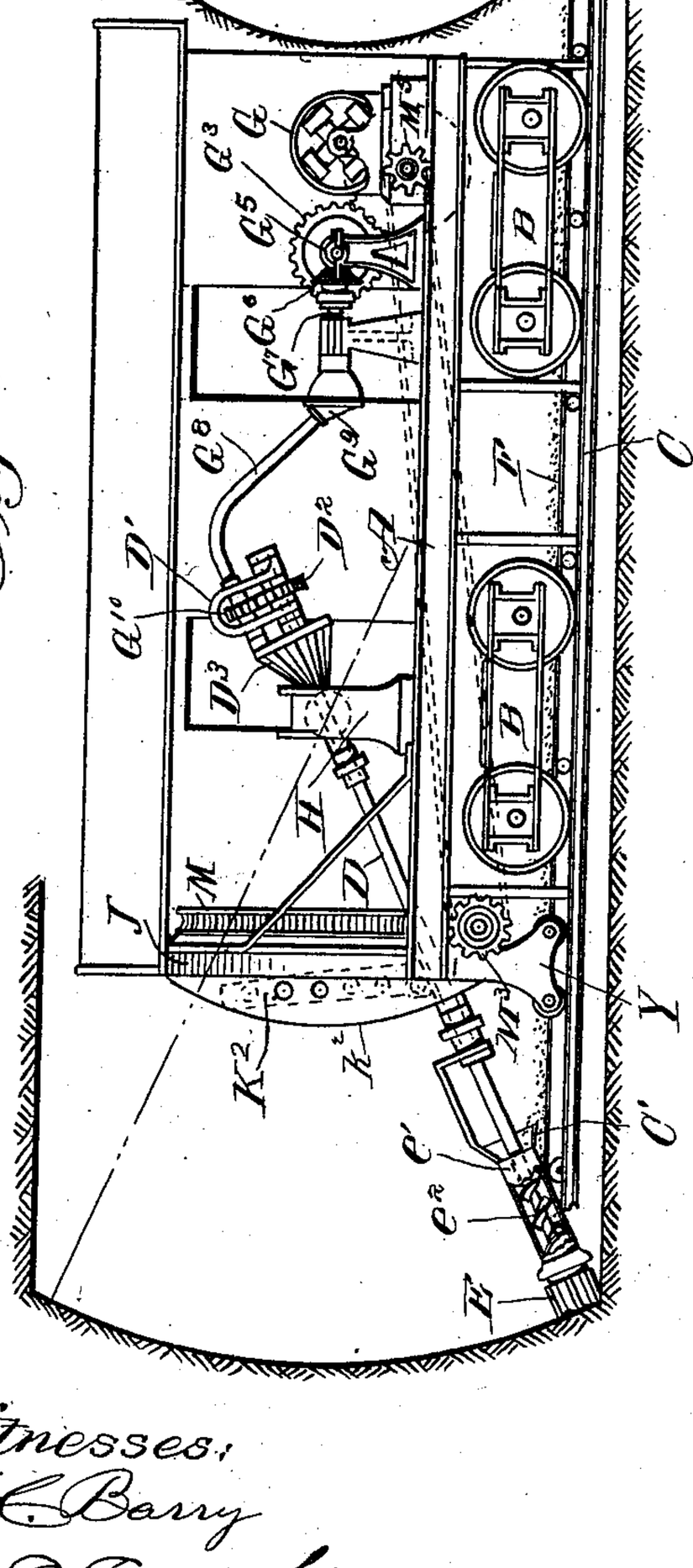
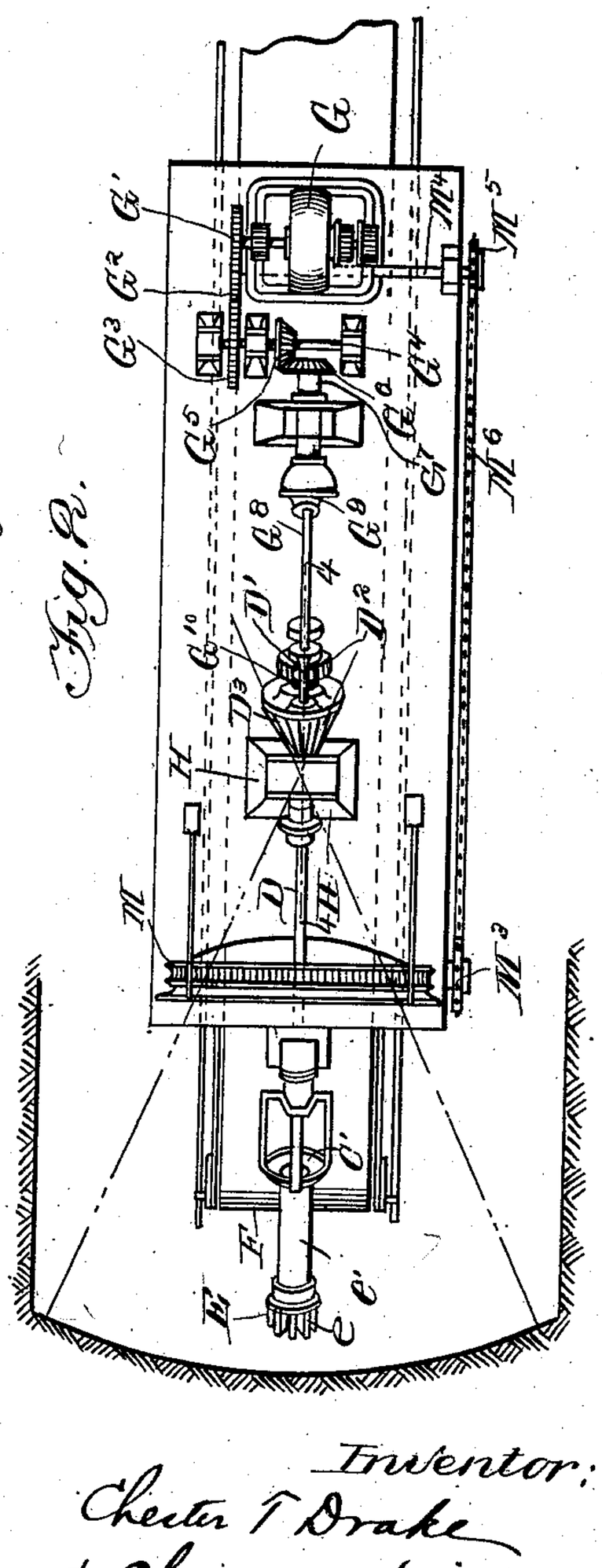


Fig. 2.



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NO MODEL. 2 SHEETS—SHEET 2.

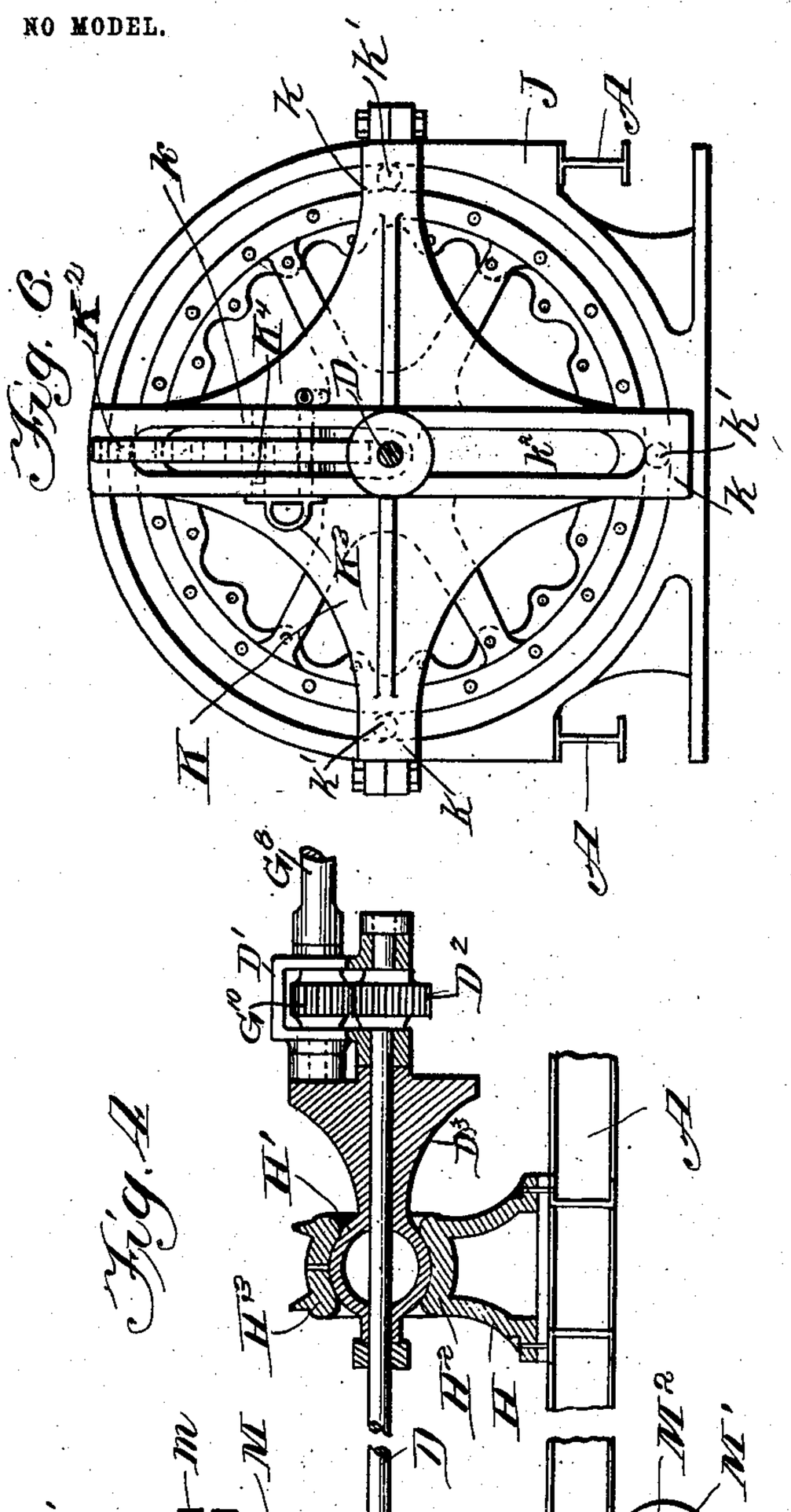

Fig. 4.

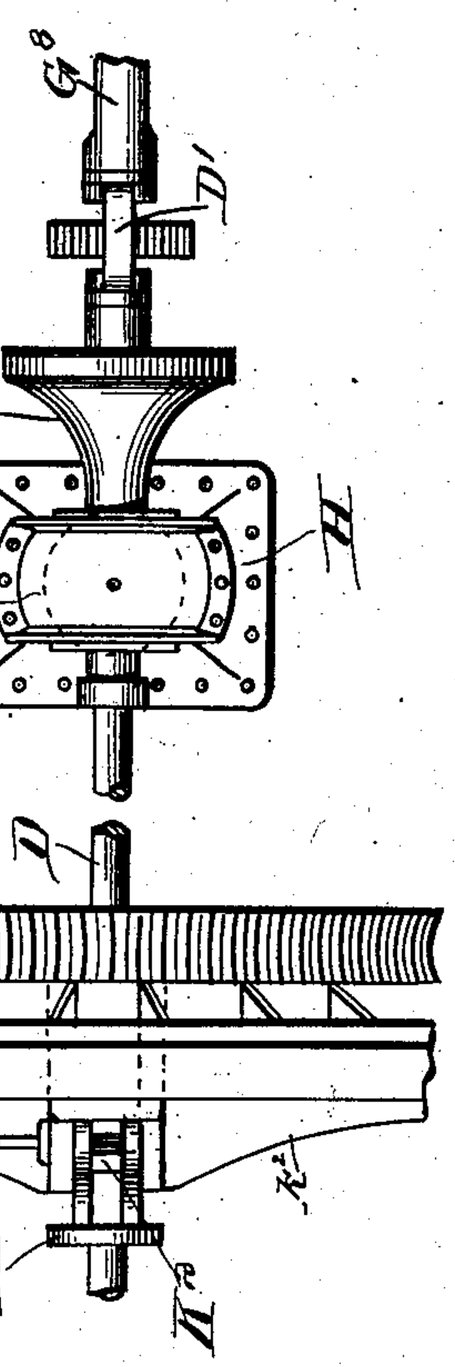

Fig. 5.

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No. 747,869. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

CHESTER T. DRAKE, OF CHICAGO, ILLINOIS.

EXCAVATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 747,869, dated December 22, 1903.

Application filed April 17, 1903. Serial No. 153,083. (No model.)

To all whom it may concern:

Be it known that I, CHESTER T. DRAKE, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Excavating-Machines; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object the production of an excavating-machine wherein a cutter is mounted upon a shaft and provided with mechanism whereby the cutter may be given a rotary motion and at the same time caused to travel in a circular direction and, in addition to this, be capable of adjustment vertically, so that when in operation the cutter operates with a rotary motion to cut the earth, &c., in advance of it, and at the same time it travels in a circle, and being capable of adjustment toward or from the center of the circle may be employed to successively cut circles of a larger diameter until the desired diameter of excavation is reached.

The construction and operation of the apparatus will be more fully hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of an apparatus embodying my invention; Fig. 2, a plan view of the same; Fig. 3, an end elevation; Fig. 4, a sectional view on the line 4 4 of Fig. 2; Fig. 5, a plan view of the apparatus shown in Fig. 4; Fig. 6, an end elevation of the apparatus shown in Fig. 4.

In carrying out the invention A represents any suitable framework of any desirable construction mounted on the trucks B, the latter adapted to travel on rails C. The particular construction of framework and trucks is of course immaterial, as they may be of any of the well-known forms known in the art.

D is a shaft upon which the cutter E is mounted, the cutter being of any desired form—such, for instance, as the well-known construction having radial cutting-blades *e*. Back of the cutting-blade is a cylinder *e'*, provided with a spiral conveyer e^2 for carrying the earth back out of the way of the cutter. At the rear end of the cylinder *e'* is provided an endless-belt carrier F, on which the earth drops and by means of which it is carried back to any desired point. This belt may be operated in any convenient way—as, for instance, by power supplied at its rear end. I will now describe the mechanism for operating the shaft D.

G is a suitable motor of any desired construction, preferably, perhaps, in most work an electrical motor. By the train of gears G' G^2 G^3 the shaft G^4 is revolved. This shaft is provided with a beveled gear G^5, which meshes with a beveled gear G^6 on the end of the shaft G^7.

G^8 is a flexible shaft connected with the shaft G^7 by the hinged joint G^9. The other end of the flexible shaft is carried in the bearings D' on the end of the shaft D and is provided with a pinion G^{10}, which meshes with the pinion D^2 on the end of the shaft D. On this end of the shaft D is also provided the counterweight D^3. It will thus be seen that a revolution of the shaft of the motor G will, through the mechanism just described, revolve the shaft D, and because of the flexibility of the shaft G^8 on the inner end of the shaft D, to which the flexible shaft is connected, can be moved about in any direction without interfering with its revolution.

H is a suitable standard carried by the frame A. (Shown in detail in Fig. 4.) The upper end of this standard forms a bearing for the shaft, the latter being provided at this point with a ball H', which rests in and is carried by the circular bearing H^2 H^3 on the standard H. Thus through this ball-joint between the bearing and the shaft D the two ends of the shaft may be moved around in any direction, while at the same time the shaft is revolving.

J is a suitable ring supported upon and carried by the frame A, and, if desired, the frame A at this point may be supported by an additional truck Y. This ring forms the support for the mechanism adapted to support the outer end of the shaft D.

K is a framework having four arms *k*, each provided at its end with a roller *k'*, adapted to bear against the frame J. On the front of the frame K are two parallel braces or

frames k^2, either attached to or integral with the frame K, between which passes the shaft D, the latter being journaled in the sleeve K'. Pivoted to the sleeve is an arm K^2, perforated at regular intervals, as at k^3. The braces or frames k^2 are perforated at a point above the shaft, and a pin K^3 is passed through the perforation in the frames k^2 and through the arm or link K^2. This pin has a projection K^4, adapted to enter an adjacent orifice and prevent the pin from turning. Thus by virtue of the series of perforations in the link K^2 the shaft can be fixed at any desired elevation by means of the pin K^3. Engaged to the frame K by bolts *m*, as shown in Fig. 4, is a gear M.

M' is a shaft supported by suitable bearings on the frame A and provided with a worm M^2. On the end of the shaft M' (shown in Fig. 2) is a sprocket-wheel M^3. Adjacent to the motor is a counter-shaft M^4, having on its end the gear G^2, which is in the train which communicates the motion from the motor to the shaft D. On the opposite end of the counter-shaft M^4 is a sprocket-wheel M^5, which is connected with the sprocket-wheel M^3 by the sprocket-chain M^6.

The operation of the mechanism is as follows: As before explained, a revolution of the motor acts, through the train of gears G' G^2 G^3 and the beveled gears G^5 G^6 and the flexible shaft G^8, to revolve the shaft D. Prior to the commencement of its revolution the shaft has been fixed at the desired point of elevation by means of the link K^2, as before explained. Through the counter-shaft M^4 and sprocket-chain M^6 the worm-gear M^2 is revolved, and this revolves the gear M, and the latter of course revolves the frame K, and consequently while the cutter is being given a rotary motion on its own axis it is given a rotary motion around the axis of the gear M, or, in other words, an orbital revolution, while the radius of the circle described by the cutter—that is, the orbit of its revolution—of course depends upon its point of elevation by the link K^2.

One manner of using the apparatus is to start with the shaft in the position shown in Fig. 4—that is, in a horizontal position—and after boring a hole the depth of the cutter to depress the shaft by means of the link K^2 the distance of the diameter of the cutter, then by operating the mechanism the cutter while revolving on its own axis revolves around the periphery of the orifice already formed until a complete circle has been described, when it is again depressed the thickness of the diameter of the cutter and revolved again, and so on until the desired diameter of hole is cut, when the entire apparatus is moved forward and the operation repeated. In order that when the cutter is elevated the earth which has been removed may be with certainty dropped on the endless-belt carrier F, I provide the apron C' at the end of the cylinder *e'*.

While I have herein described an excavating-machine adapted more particularly as a tunneling-machine, yet it is obvious that the same mechanism is applicable for use as a ditching-machine or any other form of excavating, and I would have it understood that I contemplate such use by my invention. It is also obvious that many different forms of driving-gear may be employed for revolving the shaft D, and also many other details of the construction might be altered or dispensed with without departing from the spirit of my invention, which consists, essentially, in the provision of a rotary cutter upon a shaft so mounted that while revolving the cutter may be caused to describe a circle of any desired diameter.

I wish it understood that in the present application I have shown and described several features which are not broadly claimed in this invention, but which are also shown, described, and claimed more particularly in my concurrently-pending application filed April 17, 1903, Serial No. 153,082.

What I claim is—

1. In an excavating-machine, the combination of a shaft provided on its end with a cutter, mechanism for revolving the shaft, mechanism for giving the shaft and cutter an orbital revolution and adjustable mechanism for varying the orbit described.

2. In an excavating-machine, the combination of a shaft provided on its end with a rotary cutter, mechanism for revolving the shaft, mechanism for setting the cutter end of the shaft at any desired elevation and mechanism for causing the cutter to revolve in a circular direction while revolving on its own axis.

3. In an excavating-machine, the combination of the rotary cutter, a shaft on the end of which the cutter is mounted, means for revolving the shaft, a revolving frame through which the shaft passes and in which it may be fixed at any desired elevation, and means for revolving said frame and thus causing the cutter to travel in a circular direction while revolving.

4. In an excavating-machine, the combination of a rotary cutter, a shaft on the end of which the cutter is mounted, means for revolving the shaft, a revolving frame through which the shaft passes, a link connected with the shaft and adapted to hold the shaft at the desired point within the revolving frame, and means for revolving the frame.

5. In a machine of the class described, the combination with the shaft provided with a cutter on its end, a ball-joint forming the bearing between the shaft and a supporting-standard, a revolving frame to which the shaft is engaged and means for varying the elevation at which the shaft is engaged to the frame.

6. In a machine of the class described, the combination of the shaft provided with a cutter on its end, a ball-joint forming the bear-

ing between the shaft and a supporting-standard, a revolving frame to which the shaft is engaged, means for varying the elevation at which the shaft is engaged to the frame, and means for revolving the shaft on its own axis.

7. In a machine of the class described, the combination of a shaft provided on its end with a cutter, a flexible shaft connected with said cutter-shaft, means for revolving the flexible shaft, and means for causing the cutter to travel in a circular direction in addition to the revolution on its own axis.

8. In a machine of the class described, the combination of a shaft provided on its end with a rotary cutter, a universal-joint bearing supporting said shaft, a flexible shaft engaged to said cutter-shaft, means for revolving the flexible shaft and a revolving frame to which the cutter-shaft is engaged and by means of which the cutter is caused to travel in a circular direction.

9. In a machine of the class described, the combination with the supporting-frame and the circular stationary frame thereon of a revolving frame supported by and bearing upon the stationary circular frame, a gear engaged to said revolving frame, a worm meshing with said gear, means for revolving the worm and means for engaging the cutter-shaft adjustably to said revolving frame.

10. In a machine of the class described, the combination with the supporting-frame and the circular stationary frame thereon, of a revolving frame supported by and bearing upon the stationary circular frame, a gear engaged to said revolving frame of substantially the same diameter as the revolving frame, a worm meshing with said gear, means for revolving the worm and means for adjustably engaging the cutter-shaft to said revolving frame.

11. In a machine of the class described, the combination with the main frame of a motor mounted thereon, a rotary cutter whose shaft is supported thereon, a flexible shaft connected by intermediate gearing with the cutter-shaft, and a train of gears between the motor and the end of the flexible shaft.

12. In a machine of the class described, the combination of a main frame, a rotary cutter, mechanism for revolving the cutter, mechanism for moving it simultaneously in a circular direction, a spiral conveyer back of the cutter, and an endless-belt carrier below the spiral conveyer on which the latter dumps the earth.

13. In a machine of the class described, the combination of a main frame, a rotary cutter, mechanism for revolving the cutter, mechanism for moving it simultaneously in a circular direction, a spiral conveyer back of the cutter, and an endless-belt carrier carried by the main frame and located below the spiral conveyer on which the latter dumps the earth.

14. The combination of an operating-shaft, mechanism for revolving the shaft, mechanism for giving the shaft an orbital revolution, and adjustable mechanism for varying the orbit described.

15. The combination of an operating-shaft, mechanism for revolving the same, a ball-joint forming the joint between the shaft and its supporting-standard and mechanism located between the ball-joint and the operating end of the shaft for giving the latter an orbital revolution.

In testimony whereof I sign this specification in the presence of two witnesses.

CHESTER T. DRAKE.

Witnesses:
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CLARA C. CUNNINGHAM.