No. 839,837. PATENTED JAN. 1, 1907.

C. W. GUTTZEIT.

DRILL BIT FOR WELLS.

APPLICATION FILED APR. 2, 1906.

5 SHEETS—SHEET 1.

Fig. 1.

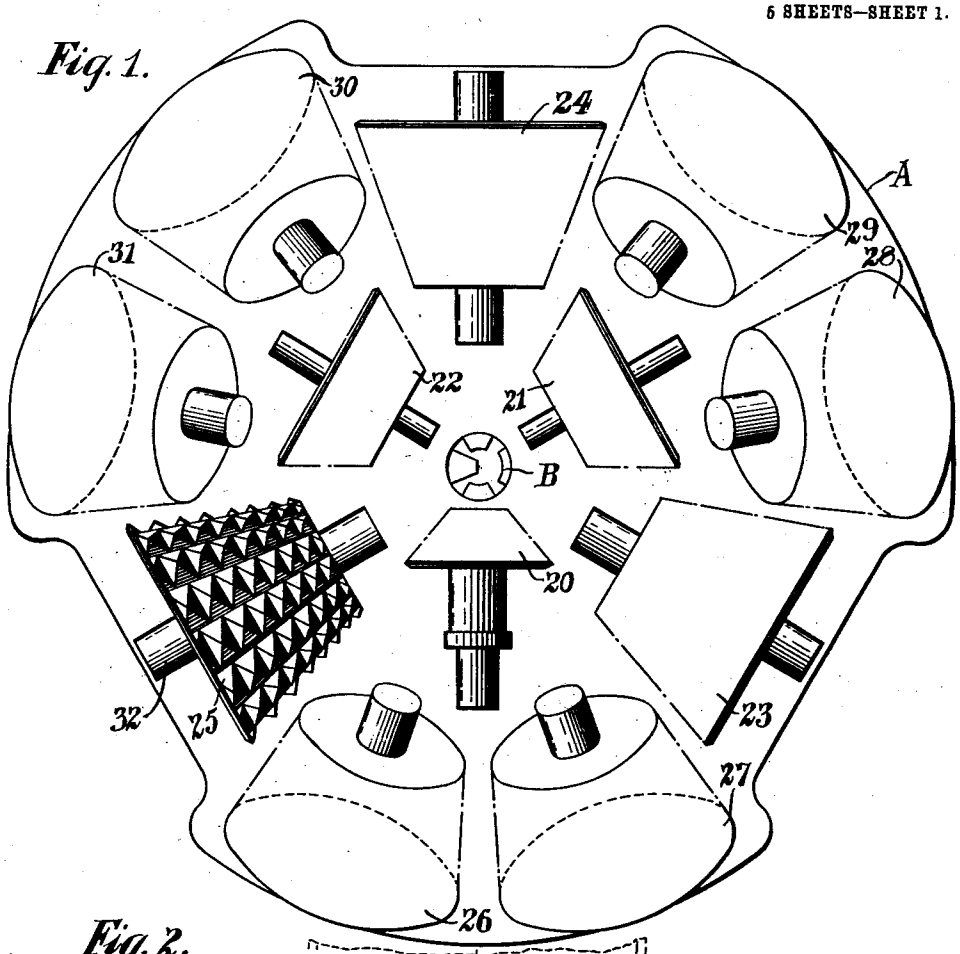
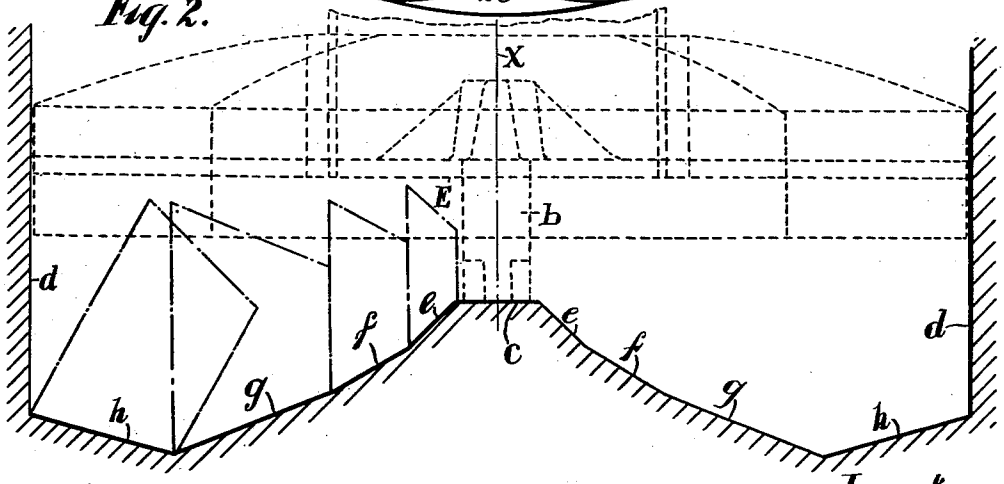


Fig. 2.



Witnesses:
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Robert Adt.

By his Attorney,

Inventor:
C. W. Guttzeit,
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5 SHEETS—SHEET 2.

Fig. 3.

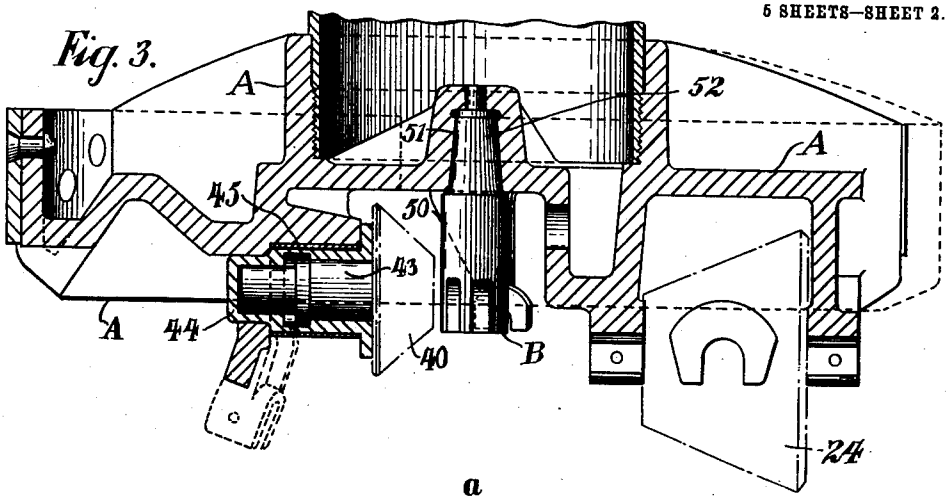
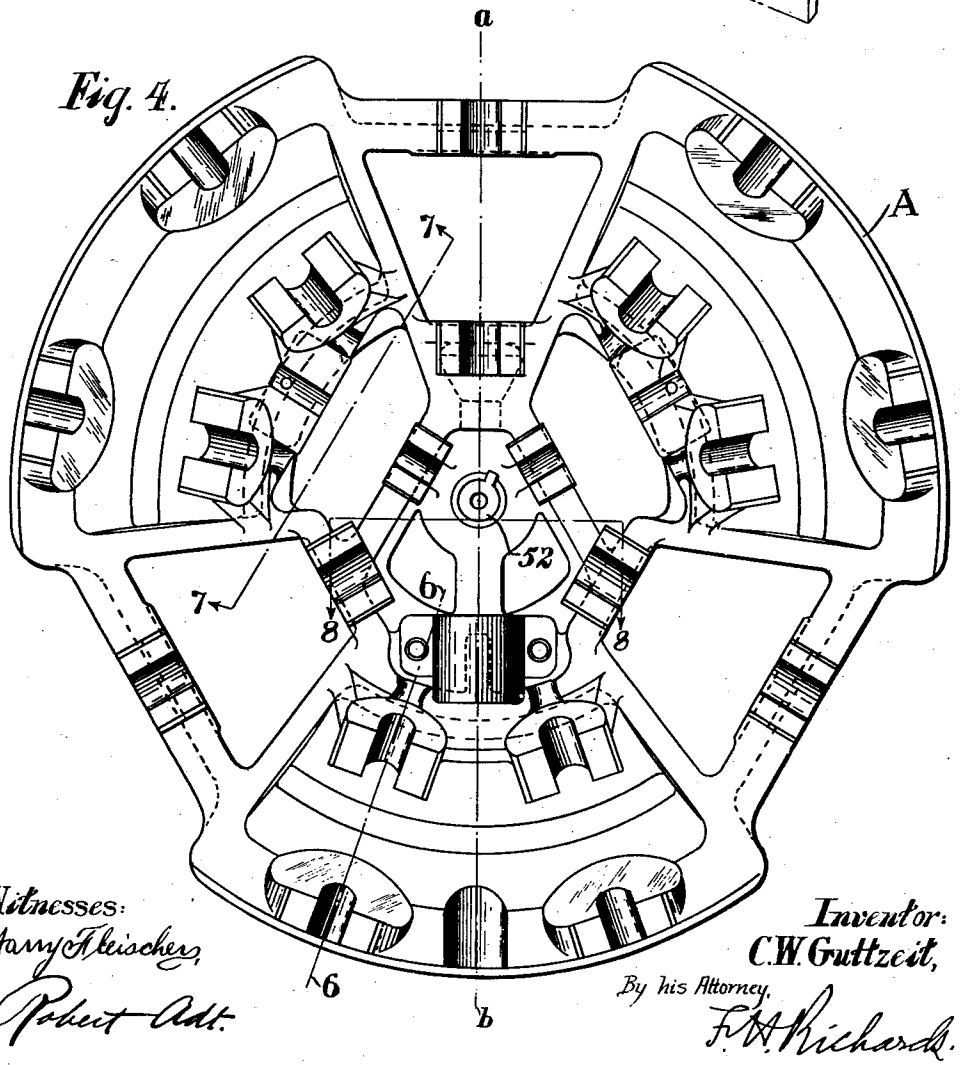


Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 5.

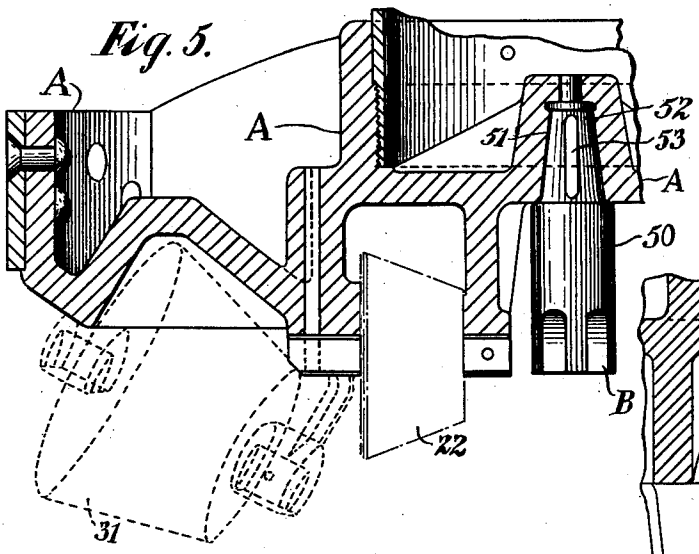


Fig. 6.

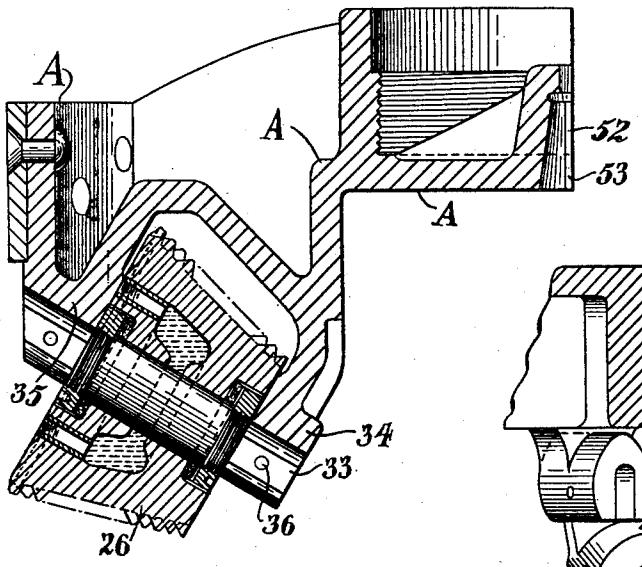


Fig. 7.

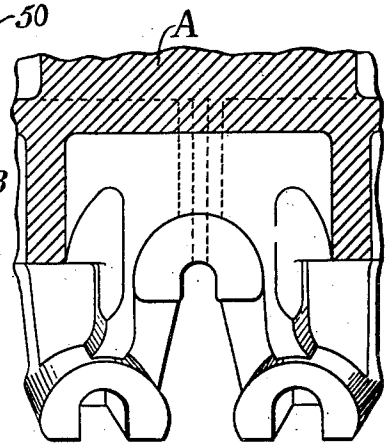
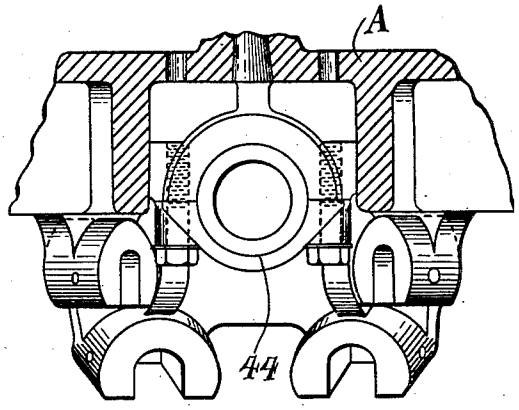


Fig. 8.



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5 SHEETS—SHEET 4.

Fig. 10.

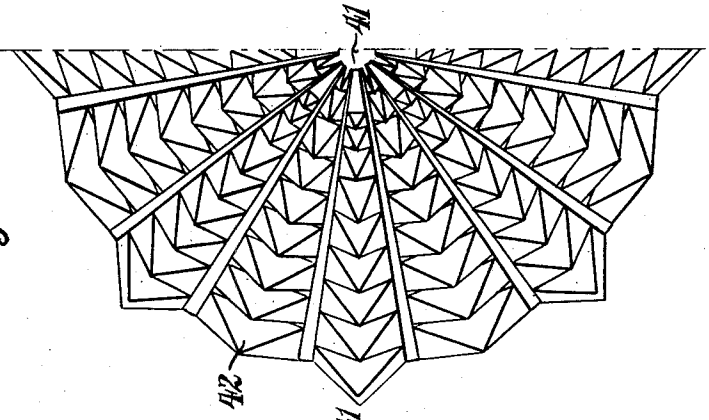
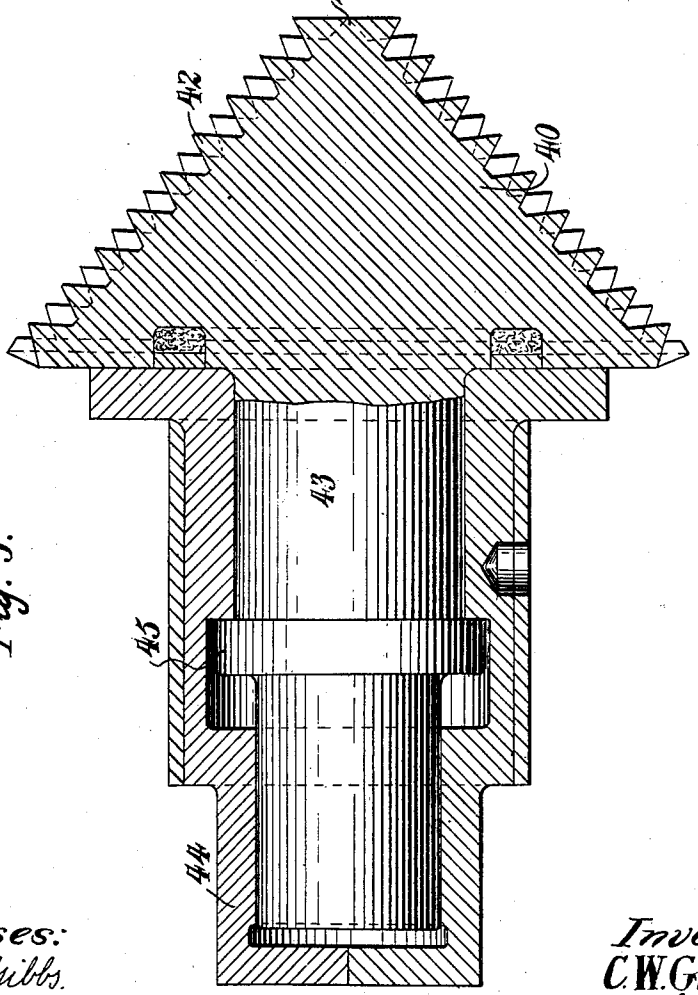


Fig. 9.



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No. 839,837. PATENTED JAN. 1, 1907.

C. W. GUTTZEIT.

DRILL BIT FOR WELLS.

APPLICATION FILED APR. 2, 1906.

5 SHEETS—SHEET 5.

Fig. 12.

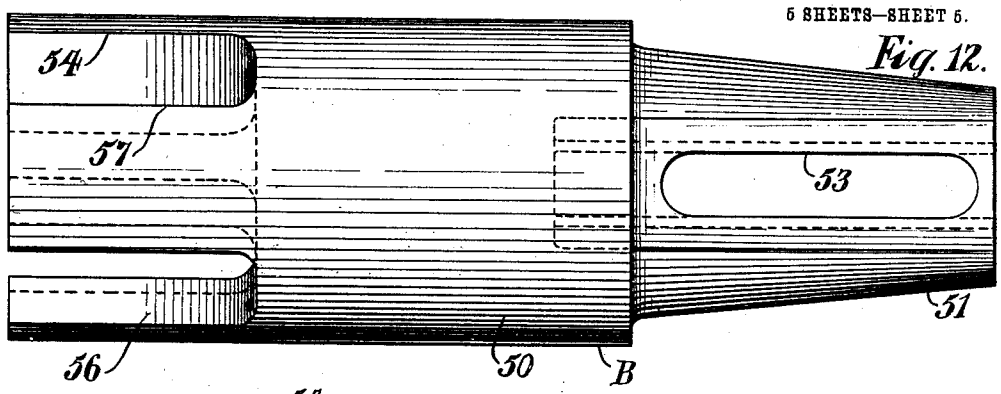


Fig. 13.

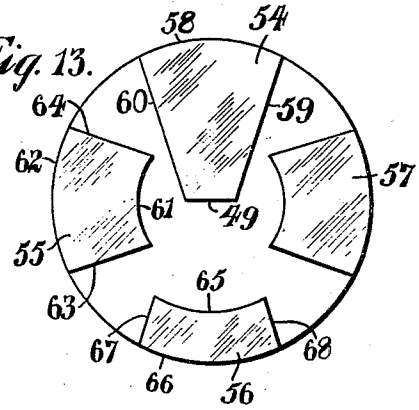


Fig. 14.

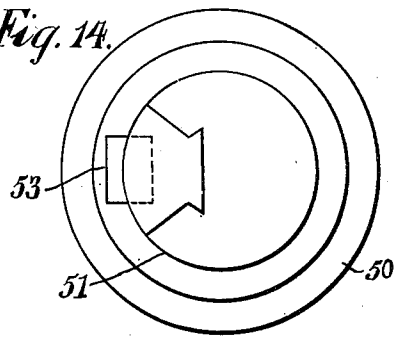
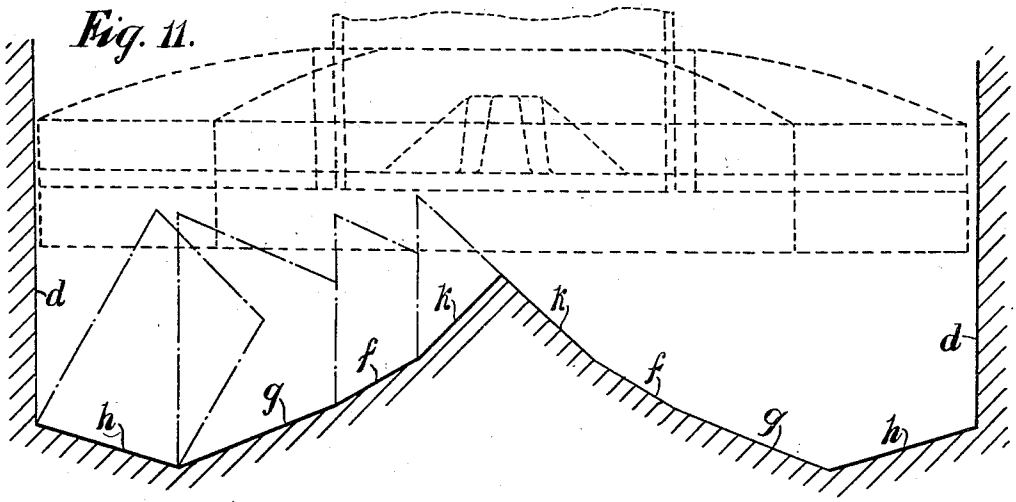


Fig. 11.



Witnesses:
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Robert Adt

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UNITED STATES PATENT OFFICE.

CHARLES W. GUTTZEIT, OF HIGH BRIDGE, NEW JERSEY, ASSIGNOR TO TAYLOR IRON & STEEL COMPANY, OF HIGH BRIDGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

DRILL-BIT FOR WELLS.

No. 839,837. Specification of Letters Patent. Patented Jan. 1, 1907.

Application filed April 2, 1906. Serial No. 309,244.

To all whom it may concern:

Be it known that I, CHARLES W. GUTTZEIT, a citizen of the United States, residing at High Bridge, in the county of Hunterdon and State of New Jersey, have invented certain new and useful Improvements in Drill-Bits for Wells, of which the following is a specification.

This invention relates to bits or boring-tools for drilling purposes, and is especially designed for use in drilling wells either through earth or solid rock, or both.

One of the objects of the invention is to produce a drill that will operate by the rolling action of a number of cutters in the form of conical rollers, which as the drill revolves serve to loosen or grind up the soil and rock, with the assistance of water, that is customary in well-drilling operations.

A further object of the invention is to provide a form of drill in which the cutters will have a true rolling engagement with the ground at the bottom of the hole, and thereby prevent slipping between any part of the engaging surface of the roller and the ground that would have the effect of unequal or undue wear on the roller and impair its usefulness and length of use.

A further object of the invention is to provide in such an organization of rolling cutters an axially-extending bit at the center of the head that will operate to drill out a small hole in advance of the rollers.

A further object of the invention is to provide a form of bit with roller-cutters having a true rolling engagement with the ground and in which one of the roller members extends to the axis of the drill and serves to engage the earth at the central part of the hole.

Embodiments of my invention are illustrated in the accompanying drawings, whereon—

Figure 1 is a view showing the relative position of the several cutting-rollers. Fig. 2 is a transverse section through a hole being drilled, showing the zones traversed by the different cutting-rollers and the portion engaged by the center drill or bit. Fig. 3 is a transverse section of the head with the rollers removed. Fig. 4 is a bottom plan view of the head with the rollers removed. Fig. 5 is a partially transverse section through the head. Fig. 6 is a fragmentary sectional view on the line 6 6 of Fig. 4. Fig. 7 is a fragmentary sectional view on the line 7 7 of Fig. 4. Fig. 8 is a fragmentary sectional view on the line 8 8 of Fig. 4. Fig. 9 is a longitudinal section through one of the cutting-rollers. Fig. 10 is an end view of one half of the cutter shown in Fig. 9. Fig. 11 is a diagrammatic view similar to Fig. 2, showing the use of an inner roller extending to the axis in place of a center-drill bit. Fig. 12 is a side elevation of a drill-bit that may be used at the center of the drill-head. Fig. 13 is an end view of the cutting end of the center drill, and Fig. 14 is a view of the opposite end of the center drill.

The device comprises a head member or frame (denoted generally by A) in which are rotatably supported a number of conical rollers or cutters. These rollers are grouped or located around the head, so that the zones of the material operated upon by the series of cutters will meet, as indicated in Fig. 2. In the construction shown in Fig. 1 and elsewhere there is a center cutting-bit B, which may be of the form indicated in Fig. 12 or otherwise. This bit is shown as a regular cutting-bit whose bottom edge cuts and removes the earth as the drill rotates. This drill B will occupy the position indicated at *b* in Fig. 2, and therefore the ground will there have a substantially horizontal surface or one transverse to the axis of the cutter, as shown at *c* in this figure. The bottom of the hole drilled from the circle *c* to the side wall *d* of the hole will with the construction shown consist of a number of contiguous zones that are denoted in Fig. 2 as *e*, *f*, *g*, and *h*. Each of these zones may be engaged by one or more of the cutters. In the construction of Fig. 1 the innermost cutting-roller 20 will operate on the ground at the zone *e*. This cutter is arranged with its axis perpendicular to the main axis of the drill—that is, its axis is horizontal; but the cone or angle of the engaging surface of the roller converges to the drill-axis, the vertex of the cone-frustum lying in the axial line X.

The cutting-roller 21, it will be seen from Fig. 1, is spaced from the axis X a greater distance than is the roller 20, its inner edge being about the same distance from the axis as the outer edge of the roller 20. By this arrangement the zone traversed by the roller

21 will be the zone *f*, (indicated in Fig. 2,) and hence the zones *e* and *f* are contiguous. The roller 21 has its axis also perpendicular to the axis X of the driller, and the vertex of its conical surface lies in the line X.

Another cutting-roller 22, identical with the roller 21, is shown as supported to rotate equidistant from the axis and in a position symmetrical with that of the roller 21. By this arrangement the two rollers 21 and 22 will follow each other around the zone *f*. The roller 22 also has the vertex of its conical surface lying in the axis X, and being symmetrically arranged with respect to the roller 21 their two vertices will be a common point. The zone *g* is traversed in the present construction by three rollers 23, 24, and 25, that are supported to rotate in the head at an equal distance therefrom and are circularly arranged with their axes perpendicular to the axis X. These rollers have their conical cutting-faces converging in the axis X, and the vertices of the three will be a common point in such axis.

The zone indicated by *h* is in the present construction traversed by six rollers 26, 27, 28, 29, 30, and 31. These rollers have their axes inclined to the axis X and downward; but the vertex of each roller lies in the axis X and in a common point. From this construction it will be seen that the engaging portion of every one of the rollers has a true rolling engagement with the ground at the bottom of the hole and that therefore every point engaging the ground of all the rollers will have the same angular velocity as the drill rotates. By this means there will be no slipping between the roller and the earth, tending to unduly wear the engaging face of the drill. These rollers preferably are provided with projections on their conical engaging surfaces that will operate to disintegrate or grind up the earth and rock, thereby forming a sort of slime or mud, which by the usual hydraulic means is removed from the hole. In Fig. 1 the roller 25 is shown as provided with projections 32. These projections are shown as elevated above what would be the conical face of the roller whose vertex lies in the main axis X of the head. In this figure only one roller is shown as provided with these projections; but they are preferably formed on all of the rollers.

Various means may be employed for rotatably supporting these several rollers in the head A. In the present construction the rollers, with the exception of the innermost roller 20, are each rotatably mounted on a spindle. This mounting is best shown in Fig. 6, in which the roller 26 is rotatably mounted on a spindle 33, that is secured in blocks 34 and 35, extending from the head A by pins 36. The other rollers except the roller 20 are similarly mounted, and need not be further described.

If preferred, the center bit B may be omitted and the innermost roller extended to the axis of the head, as indicated in the diagram in Fig. 11. A rolling cutter for this purpose is shown in Figs. 9 and 10, which comprises a conical member 40, whose conical surface would converge at a point 41, which would be located in the axis of the head; but this drill is shown as provided with projections 42, extending from what would be its conical surface. This inner rolling cutter will traverse the zone *k* of Fig. 11, and the other rollers will traverse the remaining zones *f*, *g*, and *h* in the same manner as indicated in Fig. 2.

The innermost roller, whether a true cone, as indicated in Figs. 9 and 11, or a frusto-conical roller, such as the roller 20 of Fig. 1, may be supported by having a spindle fast thereto or integral therewith, as shown in Fig. 9. In such instance the spindle 43 of the roller 40 rotates in a bearing-box 44, made in two sections and suitably secured together. The spindle 43 is provided with a flange 45 to prevent longitudinal movement of the spindle in the bearing. This form of bearing is provided for the roller 20 also.

The several rollers or sets of rollers being symmetrically disposed, or approximately so, each roll or set of rolls in each zone will tend to counteract the effect of the other rollers in the same zone to produce any side motion of the drill, thereby making the drill self-centering. Furthermore, the number of the rolls or sets of rolls can be increased or decreased as long as a substantially symmetrical arrangement is provided to make the drill self-centering.

Another advantageous feature of the construction shown is that the bottom of the hole being drilled is conical, which will keep the drill working in a straight line and prevent its moving sidewise.

The center drill or bit, as shown separately in Figs. 12, 13, and 14, comprises a shank 50, having a tapered end 51, whereby it is secured in a socket 52 in the head A by any suitable means, such as a key (not shown) passing through a slot 53 in the bit. At its working end it is provided with a series of prongs or cutters, in the form shown having four cutters 54, 55, 56, and 57. These cutters are shown as of the same length; but their cross-section is different. The outer wall or side of the cutters alines with the cylindrical portion of the shank 50; but the other three walls of the cutters are free from the shank and from each other. The cutter 54 is shown as having its inner wall 49 extending to the axis of the drill and is connected with the outer cylindrical wall 58 by two walls 59 and 60, that are converging, making the cutter somewhat in the form of a keystone. The cutters 55 and 57 are of substantially the same shape and are diamet-

rically opposite in position. The cutter 55 has its inner wall 61 substantially concentric with its outer peripheral wall 62. These two walls are joined by side walls 63 and 64, that are made converging and one of which acts as a cutter, according to the direction of rotation. The fourth cutter, 56, has an inner wall 65 concentric with its outer peripheral wall 66, which walls are connected by converging side walls 67 and 68.

It will be observed that the inner walls of the cutters 55 and 57 are spaced from the axis about half of the radius and also that the inner wall 65 is spaced from the axis a greater distance than the inner walls of the two similar cutters. By this construction there will be three different zones acted on by these cutters. The cutter 56 will take an outer zone about one-third of the radius of the drill. The two cutters 55 and 57 will operate on the outer zone about half of the radius of the drill, while the larger cutter 54 will operate throughout the radius of the drill. The free space between each of the cutters permits the material cut to pass outward and keep the cutters clear and insure rapid and efficient operation. The ends of the four cutters are shown as lying in a plane perpendicular to the axis of the drill.

Having thus described my invention, I claim—

1. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical working surfaces whose vertices lie in the axis of the head.

2. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and disposed to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head.

3. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the head being provided with an axially-extending boring-bit at the central portion.

4. In a well-drill, the combination of a head, a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the head being provided with an axially-extending boring-bit at the central portion.

5. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the rollers being provided with projections on their engaging faces, and the head being provided with an axially-extending boring-bit at the central portion.

6. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the rollers being provided with projections on their engaging surfaces.

7. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes inclined to the drill-axis.

8. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes inclined to the drill-axis and converging forward.

9. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axes of the head, and the other rollers having their axis inclined to the drill-axis.

10. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and rollers having their axis inclined to the drill-axis and converging forward.

11. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and some of the rollers having their axis inclined to the drill-axis, and an axial boring-bit at the center of the head.

12. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized

to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and some of the rollers having their axis inclined to the drill-axis.

13. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose elements converge at the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and some of the rollers having their axis inclined to the drill-axis and converging forward.

14. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose elements converge at the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and some of the rollers having their axis inclined to the drill-axis and converging forward, and an axial boring-bit at the center of the drill.

15. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the outer rollers having their axes inclined forward.

16. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the outer rollers having their axes inclined forward, and some of the other rollers having their axes extending perpendicular to the axis of the head.

17. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the outer rollers having their axes inclined, and other rollers having their axes extending perpendicular to the axis of the head.

18. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the outer rollers having their axes inclined, and other rollers having their axes extending perpendicular to the axis of the head, and an axial boring-bit at the center of the head.

19. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical working surfaces whose vertices lie in the axis of the head, one of the rolling members extending to the axis of the drill.

20. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and disposed to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, one of the rolling members extending to the axis of the drill.

21. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the rollers being provided with projections on their engaging surfaces, one of the rollers extending to the axis of the drill.

22. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, the outer rollers having their axis inclined forward, and the inner roller extending to the axis of the drill.

23. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground as the drill is advanced, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and other rollers having their axes inclined to the drill-axis and converging forward, one of the rollers extending to the axis of the drill.

24. In a well-drill, the combination of a head, and a plurality of rolling members rotatably supported in the head, and organized to engage the ground in adjacent zones, the rolling members having conical engaging surfaces whose vertices lie in the axis of the head, some of the rollers having their axes extending perpendicular to the axis of the head, and other rolls having their axis inclined to the drill-axis and converging forward, one of the rollers extending to the axis of the drill.

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