Oct. 4, 1932. R. P. SIMMONS 1,880,214

WELL DRILLING APPARATUS

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Fig. 1.

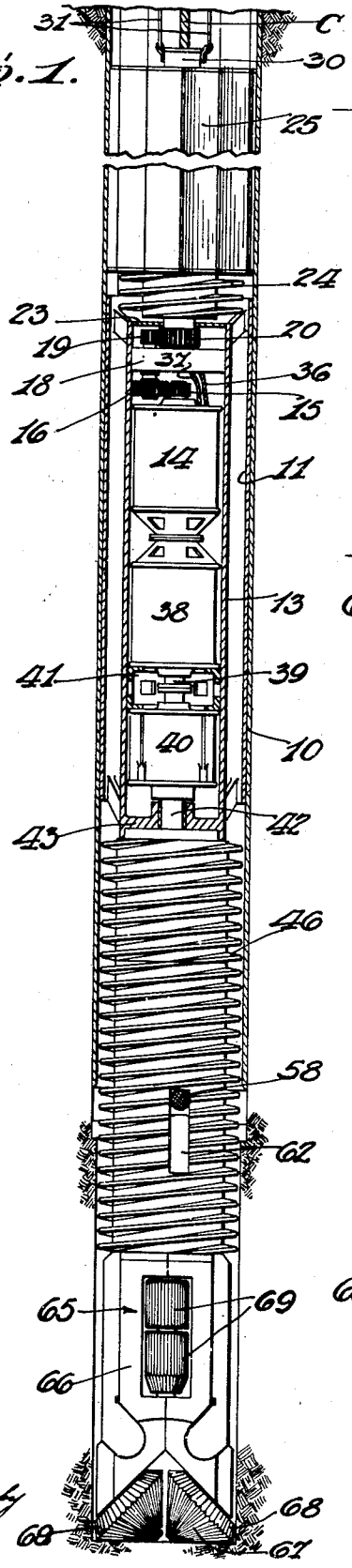
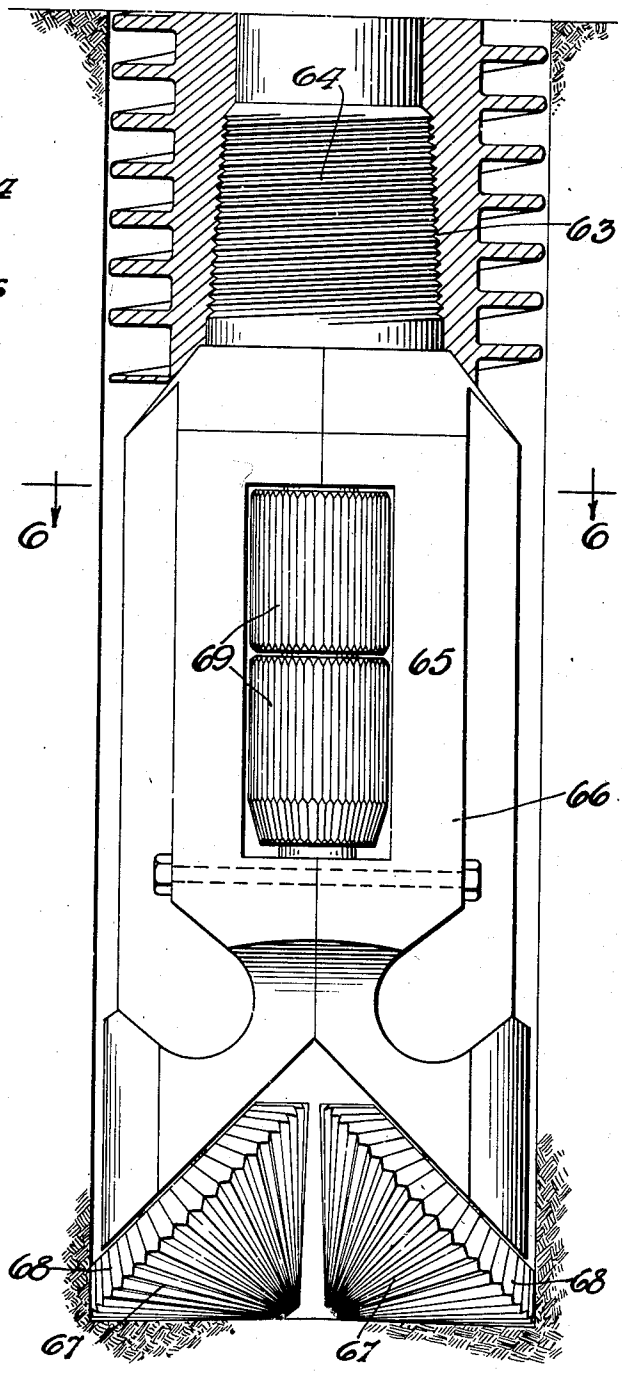


Fig. 2.



WITNESS:

RICHARD P. SIMMONS
INVENTOR

BY Victor J. Evans

ATTORNEY

Oct. 4, 1932. R. P. SIMMONS 1,880,214

WELL DRILLING APPARATUS

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Fig. 3.

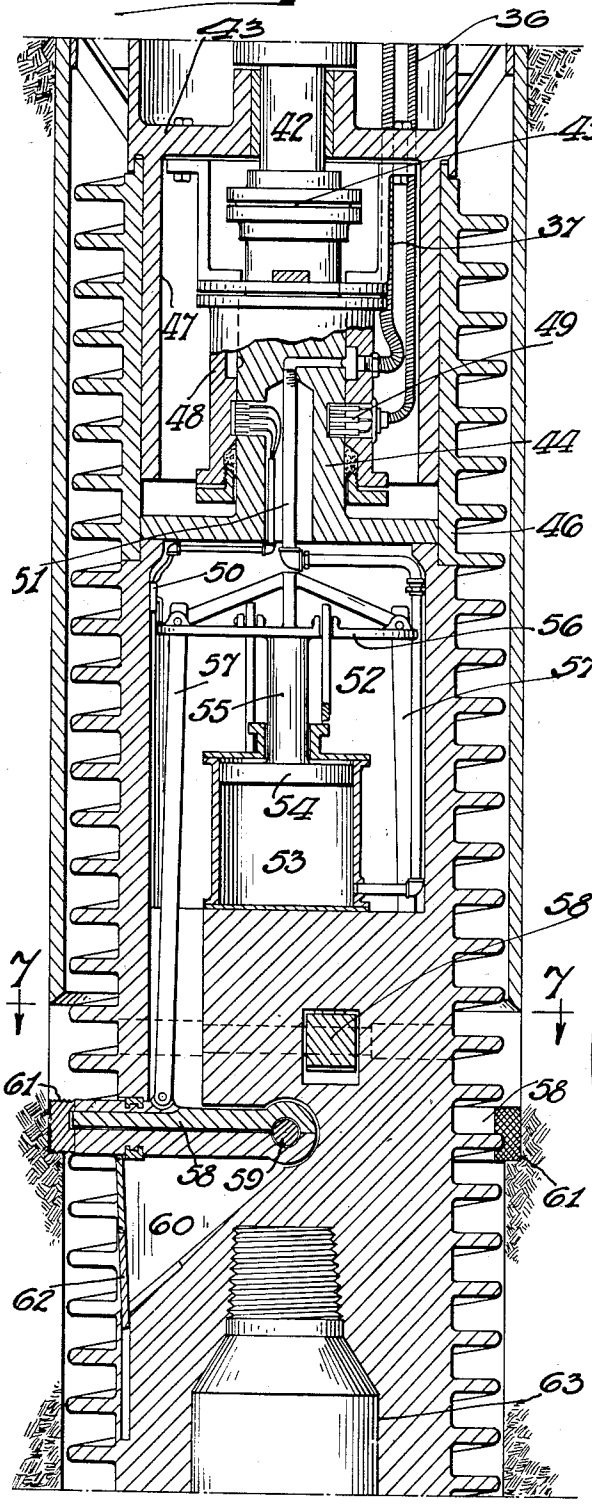


Fig. 6.

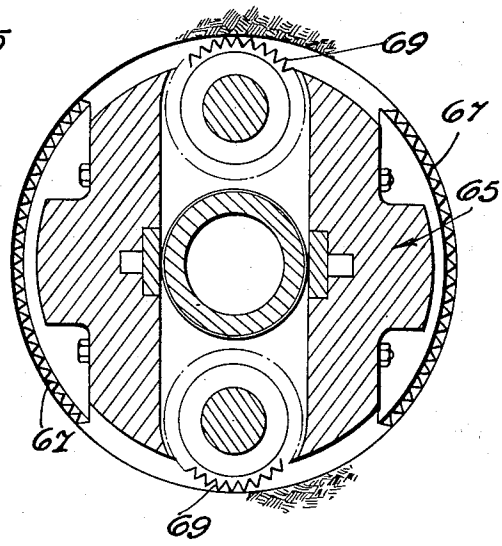
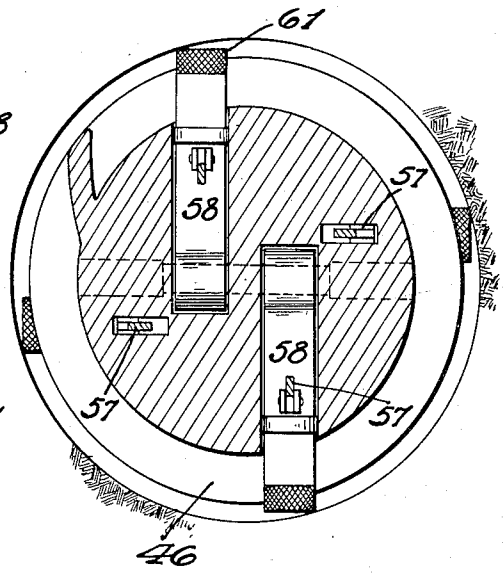


Fig. 7.



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Oct. 4, 1932. R. P. SIMMONS 1,880,214

WELL DRILLING APPARATUS

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Fig. 4.

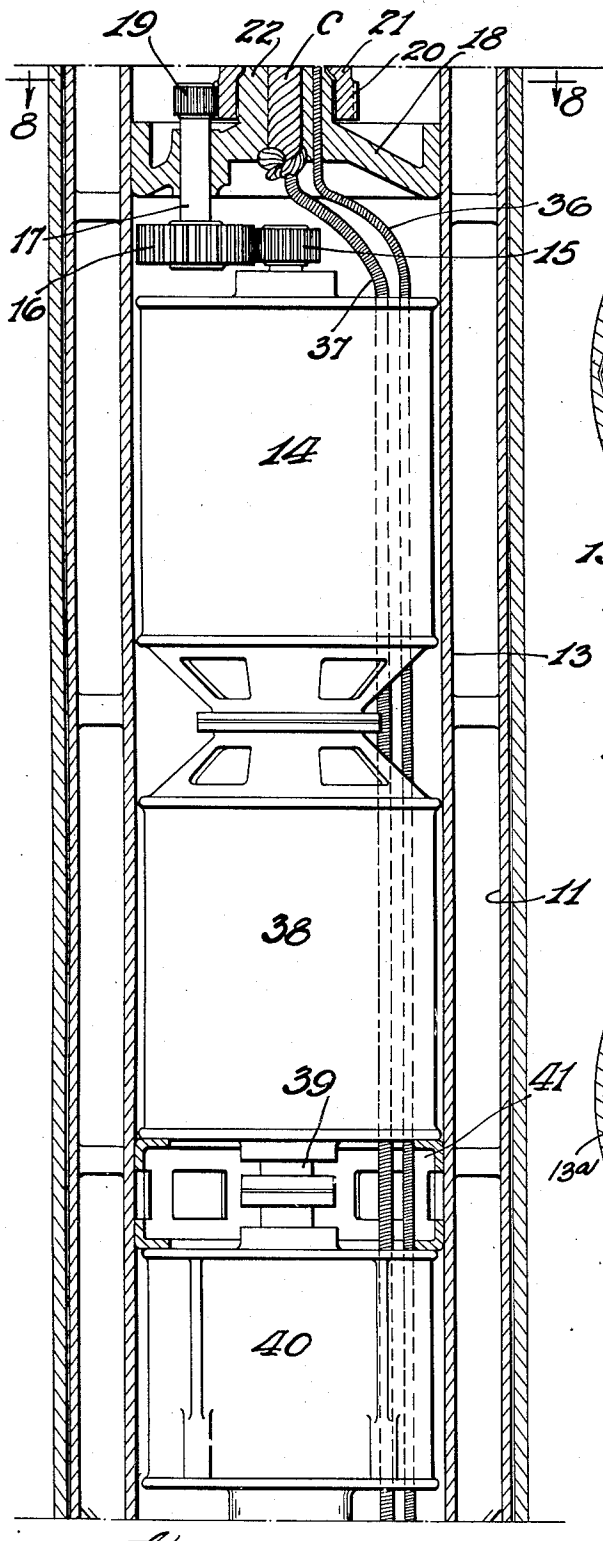


Fig. 8.

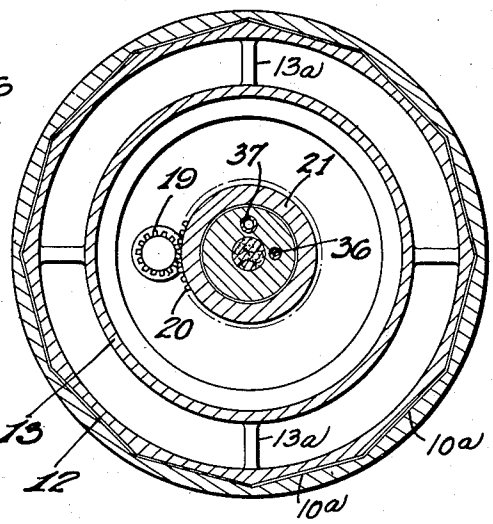
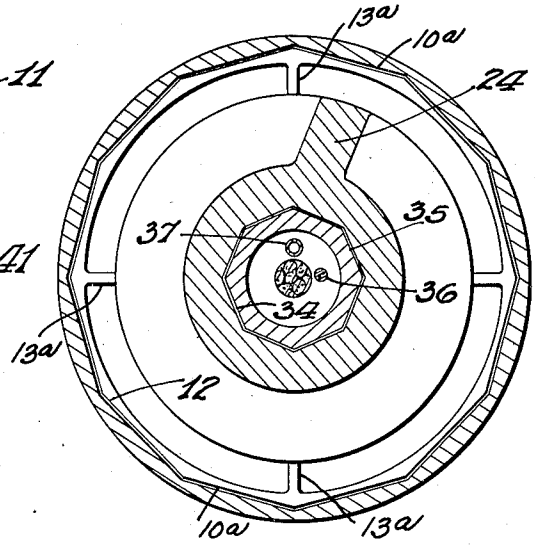


Fig. 9.



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Oct. 4, 1932. R. P. SIMMONS 1,880,214

WELL DRILLING APPARATUS

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Fig. 5.

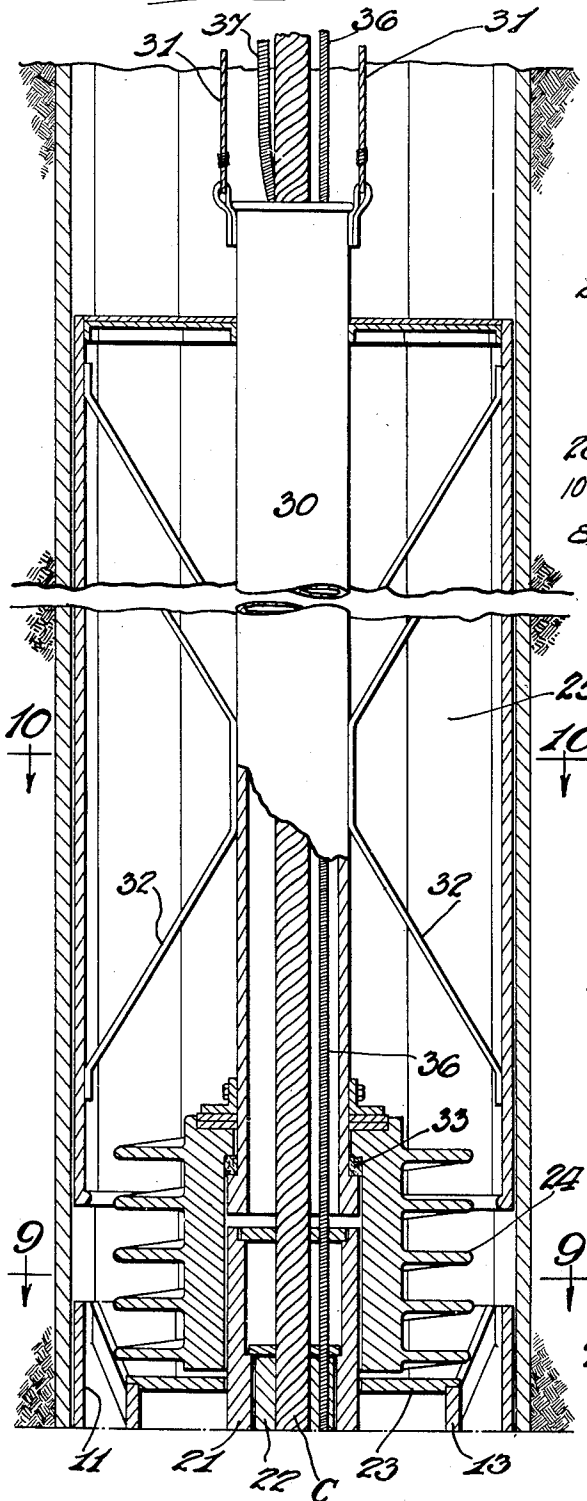


Fig. 10.

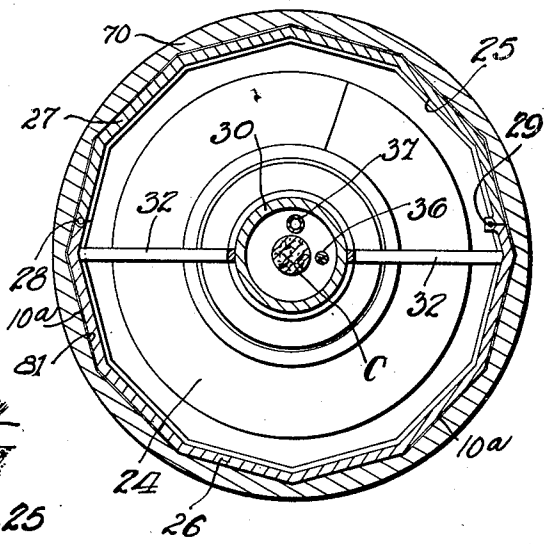
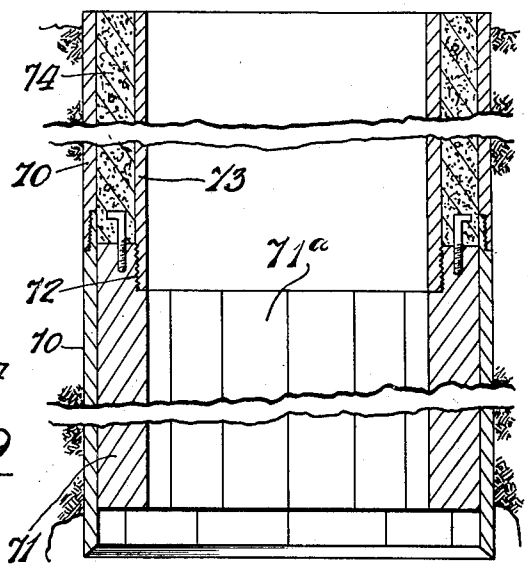


Fig. 11



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WITNESS: G. Clayton Tinsley

Patented Oct. 4, 1932

1,880,214

UNITED STATES PATENT OFFICE

RICHARD P. SIMMONS, OF NEW YORK, N. Y.

WELL DRILLING APPARATUS

Application filed November 11, 1927. Serial No. 232,663.

This invention relates to well drilling apparatus and is an improvement over my invention shown and described in my co-pending application, Serial Number 192,449, filed May 18th, 1927, and Patent Number 1,687,399, issued Oct. 9, 1928.

The primary object of this invention is to simplify the construction of a well drilling apparatus from that shown in the above mentioned applications although the result obtained by this apparatus is quite similar to the result derived by the use of the others, namely to drill deep wells in which the apparatus is lowered thereinto and the drilled material is lifted to the surface through a system of conveyors while a tubular casing is gradually lowered into the well as the drilling progresses for protecting the walls of the well preparatory to forming a plastic wall therefor.

Another object of this invention resides in a well drilling apparatus which gradually moves downward through a well casing and which is extensible through the lower end of the same to ream a hole of a size to permit of the casing to be lowered downward, the casing serving as a guide for the drilling unit.

Another object of the invention is the provision of a well casing with means for slidably locking an inner casing element thereto to permit of relative longitudinal movement, and to prevent relative rotative movement, and to provide drilling means on said inner casing, whereby the outer casing may be rotated so that the inner casing and its drilling means or equipment will be worked by rotary action against the earth or rock, or reciprocated independently of this rotative movement of the outer casing or at the same time, and whereby, perhaps most importantly, the inner casing may be remotely controlled, as from the surface of the well, and hence locked to the outer casing when desired, and raised to the ground surface when desired to permit said inner casing to be inspected and/or cleaned out and/or replaced by another and different casing and/or equipped with a different tool or device;—all to provide a well drilling method characterized by avoidance of the necessity, as heretofore, of "slipping" the casing.

Another object of the invention resides in the construction of a deep well drilling apparatus for the drilling of a large hole of about twenty-four inches in diameter, that can be reduced to a hole of any desired diameter to accommodate the "flush" or natural flow of oil, caused by natural pressure. Another advantage derived from a hole of large diameter, will enable the insertion of a series of practical pumps, such as shown and described in the above last mentioned application, to pump the oil after the decline of the "flush" or natural pressure. The present holes of a six to eight inches in diameter are too small to receive practical pumps whereby a large hole will allow more oil to seep into the same than a small hole.

Another object of the invention resides in the construction of a deep well drilling apparatus that will eliminate the constant pulling of the entire casing to change bits, as the drilling bit in the "rotary" method of drilling is threaded on to the last joint of the casing, which not only retards progress, but leaves the drilled portion of the well totally unprotected from the earth caving in, or the drilling with open hole, as now pursued by the standard method of drilling.

Another object of the invention resides in the construction of a deep well drilling apparatus that will eliminate the costly steel casing, as I show a practical method of recovering the casing after a cement wall has been formed.

A still further object of the invention is the construction of a deep well drilling apparatus desired to eliminate the present method of pumping the residue from the well as the drilling progresses.

A still further object of the invention resides in the construction of a deep well drilling apparatus designed to convey an unadulterated and a positive geological knowledge of every foot of substance encountered from the start to the finish, thereby positively eliminating any chance of passing through an oil or gas sand.

Another object of the invention resides in

the construction of a deep well drilling apparatus that makes it almost impossible for the drilling tools to become lost in the hole.

Another object of the invention resides in the construction of a deep well drilling apparatus that will eliminate the rotation of the casing as a means of power for the drilling bits as there is danger of seriously twisting the casing after a great depth has been reached.

With these and other objects in view, the invention resides in certain novel construction and combination and arrangement of parts, the essential features of which are hereinafter fully described, are particularly pointed out in the appended claims, and are illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical sectional view through the well casing showing my improved drilling apparatus in elevation.

Figure 2 is an enlarged detail vertical sectional view through the lower reaming of the apparatus.

Figure 3 is a similar view through the lower spiral conveyor.

Figure 4 is a similar view through the driving mechanism.

Figure 5 is a similar view through the hoisting bucket.

Figure 6 is a horizontal sectional view on the line 6—6 of Figure 2.

Figure 7 is a similar view on the line 7—7 of Figure 3.

Figure 8 is a similar view on the line 8—8 of Figure 4.

Figure 9 is a similar view on the line 9—9 of Figure 5.

Figure 10 is a similar view on the line 10—10 of Figure 5.

Figure 11 is a detail view of the lower portion of a finished well.

Referring to the drawings in detail 10 designates an outer casing, which is provided with a series of polygonal faces 10*a* located on its inner wall face, and extending longitudinally thereof. Within this outer casing an inner casing 12 is slidably interlocked, said inner casing 12 being formed with a series of longitudinally extending polygonal faces 12, which slidably engage the polygonal faces 10*a* of the outer casing to permit of relative longitudinal movement of the inner casing in the outer casing, and to prevent relative rotative movement of the inner casing in the outer casing. This construction permits of the manual rotation of the drilling equipment carried by the inner casing, by the turning of the outer casing from the head of the driven well. A second tubular inner casing 13 is concentrically spaced from the inner casing 12 and is connected thereto by means of the radial arms 13*a*. This second inner casing 13 extends beyond the lower end of the casing wall 11, and slightly above the top of the outer casing wall 10, as will be later explained.

Housed within the inner wall adjacent the upper end thereof is an electric motor 14, the armature shaft of which carries a pinion gear 15 for constant meshing engagement with a gear 16 fixed to the lower end of a vertically disposed stub shaft 17 having its bearing in a head 18 held by the inner wall 13 of the housing head. The upper end of the shaft 17 carries a pinion gear 19 for constant meshing engagement with gear teeth 20 provided on the lower end of a sleeve 21 which has its bearing on a hub 22 extending upward from the head 18 and in a cover plate 23 which closes the upper end of the inner compartment of the housing head to exclude any drilled material which is adapted to pass upward between the inner and outer walls from coming in contact with the motor and gears. Telescoping the top of the sleeve 21 is a spiral conveyor 24 of a diameter slightly larger than the diameter of the inner wall of the housing head to overlap the same in a vertical plane. Correlated with the conveyor 24 is what I shall term a bucket 25, the outer walls of which are shaped similar to the outer surfaces 12 of the outer wall of the housing head and which aligns vertically therewith. The bucket 25 includes a pair of sections 26 and 27 which are hingedly connected together as at 28, and which may be held closed by a suitable latch 29. A central tube 30 extends axially of the walls of the bucket beyond the closed end thereof and has cables 31 attached thereto and which lead to the surface of the well by which the bucket may be hoisted up to empty a load of drilled material which is lifted thereto in a manner hereinafter explained. The tube is held integral with the bucket section 26 by brace rods 32 so as to form an integral part thereof. The lower end of the tube is connected to the conveyor 24 by a suitable joint 33 by which the conveyor rotates independently of the bucket but which is captively connected therewith for vertical movement with the bucket during the lifting and lowering of the same. The upper end of the sleeve 21 is octagonal in cross section as at 34 to be received by the similar shaped interior walls 35 of the sleeve as clearly shown in Figure 9 of the drawings.

Extending downwardly through the tube 30, sleeve 21, and bearing 22 from the surface of the well are electric cables 36 for supplying current to the motor 14 and other electrically operated parts, and a compressed air hose 37 which controls the movement of certain drilling bits hereinafter described. A main cable C passes downward from the surface and is connected to the head 18 and from which the entire main drilling unit is suspended within the well and which is gradually paid out from the surface as the drilling progresses.

Mounted within the inner walls of the housing head 10 below the motor 14 is a second electric motor 38 which has its driven shaft 39 extending into the housing of a speed reducer 40 which is held in spaced relation to the motor by a spacing collar 41. The motor driven shaft 42 of the speed reducer is journalled in the bottom wall 43 of the housing head and extends downward beyond the same for connection with a stub shaft 44 by a coupling joint 45 which shaft is integral with a spiral conveyor 46. The conveyor is constructed of a plurality of sections to facilitate the assembly of the parts but are securely connected together for rotation as a single unit by the power from the motor 38. A collar or skirt 47 depends from the bottom 43 and acts as a bearing for the top of the conveyor which abuts said bottom. A bearing 48 for the stub shaft 44 is suspended into the skirt while an electric wiping switch 49 is provided between the bearing and the shaft for conducting electric current from one of the electric cables 36 to a switch 50. The bearing 48 also has an annular recess therein to which the lower end of the air hose 37 is connected for establishing connection between the hose and a length of pipe 51 extending into a compartment 52 in the conveyor 46. The pipe 51 leads to the lower end of an air cylinder 53 contained within the compartment within which a piston head 54 is reciprocably mounted. A piston rod 55 extends through the top of the cylinder and carries a cross head 56 to which links 57 are pivotally connected. The lower end of the links are pivotally connected to extensible bits 58 pivotally mounted as at 59 for swinging into and out of recess 60 in the sides of the conveyor 46. The cutting ends 61 of the bits extend beyond the plane of the sides of the conveyor for cutting the walls of the well of a diameter greater than the diameter of the convolutions of the conveyor. Doors 62 are carried by the bits for closing the recesses 60 when the bits are in a horizontal or cutting position for preventing drilled material from collecting in the recess which might interfere with the movement of the bits to an inoperative position. In operation, the compressed air from the surface of the well will pass through the hose 37 into the cylinder 53 which forces the piston against the top wall of the same, thus holding the cross head in a raised position with the bits 58 extended. The switch 50 is in the path of movement with the cross head and is engaged by the same to close an electric circuit in which a light may be arranged for indicating at the surface of a well that the bits are in an extended position.

The lower end of the conveyor 46 has a threaded socket 63 therein for detachably receiving the threaded shank 64 of a reamer 65 which is rotatable with the conveyor. The reamer shown in the drawings includes an elongated body 66 having its lower end inverted V-shape to snugly receive rotary grinders or bits 67 which are substantially cone-shape and have their cutting faces 68 extending beyond the sides of the body for reaming a hole of a diameter to accommodate the conveyor 46 as it moves downward. The body 66 of the reamer is spaced from the sides of the well as it is formed and has rotary finishing bits 69 projecting beyond the body to a vertical plane in alignment with the cutting face 68 of the bits 67. The finishing bits engage the wall of the well and cut any part not cut by the bits 67. The type of reamer being old in the art, it is not thought necessary to go into the detail construction other than to make clear that the same is capable of drilling through all kinds of material which might be expected when drilling for oil, and that it is intended to rotate with the conveyor 46 and ream a hole of a diameter to receive the said conveyor.

In operation, a hole of a sufficient depth is dug to receive a well casing section 70 which has its interior surface provided with flat surfaces 81 of a configuration to slidably receive the bucket 25 and housing head and prevent rotation of these parts with respect to the casing. The exterior of the casing is annular to fit the inner wall of the drilled well. The drilling unit is then lowered through the casing section until the reamer strikes the bottom of the well which we shall assume is slightly below the end of the casing section. The current to the motors 14 and 38 is turned on as is the compressed air to the cylinder 53. The motors impart rotation to the conveyors 24 and 46 and in turn to the reamer 65 and bits 58, the bits having been extended by the admission of compressed air to the cylinder 53. The reamer will of course drill downward as the weight of the drilling apparatus is supported thereby which bores a hole of a diameter equal to the diameter of the conveyor 46. The material drilled thereby backs up into the well and is picked up by the conveyor 46 and lifted through the space between the inner and outer walls of the housing head 10. As the drilled material reaches the top of the housing head, it is picked up by the conveyor 24 and forced into the bucket 25 where it accumulates until it has fully packed the bucket. The motors are now shut off and the bucket hoisted to the surface by pulling upward upon the cables 31. The conveyor 24 moves upward with the bucket and serves to prevent the accidental dropping of any material through the lower open end of the bucket during the hoisting operation. Upon reaching the surface, the latch 29 is unfastened, and the sections of the bucket swung open upon their hinge joint 28 whereupon the contents of the bucket is released. The sections are locked together and the bucket low-

ered back into the well and by reason of the snug fit between the bucket and the casing 70, the conveyor 29 will telescope the square end of the sleeve 21 whereupon the conveyor is again in position for operation.

Following behind the reamer 65 are the bits 58 which enlarge the diameter of the well hole over the diameter cut by the reamer end and which facilitates the gradual sinking of the well casing sections. These casing sections are supported upon the surface of the well and are released to drop down after the housing head nears the end of the casing whereupon the casing section is dropped down over the housing head and conveyor 46 and held until the drilling unit has progressed with respect thereto. The material cut by the bits 58 is carried up with the column of material from the reaming operation and forms a part thereof.

When the well has been completely drilled the sections 70 of the outer casing 10 remain in place, while the interior drilling equipment is removed. The inner faces of the sections 70 of said outer casing 10 are formed with polygonal faces 10*a* extending longitudinally thereof. After the withdrawal of the drilling equipment the inner well casing 73, consisting of tubular sections coupled to each other, is lowered into position. The lowermost section of this inner casing 73 carries a head 71, which is detachably connected thereto by the screw threaded joint 72, and the external face of this head is formed with polygonal faces to interlock with the polygonal faces 10*a* of the sections 70, and with polygonal faces 71*a* formed on the inner surface thereof, to interlock with any equipment lowered into the well during dueling and after completion of the same, for any purpose. This head 71 concentrically spaces the inner casing 73 from the outer casing, thus providing a casting chamber in which concrete or other plastic material 74 may be poured, to form an enclosing wall around the inner casing 73. After this has been done the outer casing consisting of the sections 70 may be withdrawn.

While I have described what I deem to be the most desirable embodiment of my invention, it is obvious that many of the details may be varied without in any way departing from the spirit of my invention, and I therefore do not limit myself to the exact details of construction herein set forth nor to anything less than the whole of my invention limited only by the appended claims.

What is claimed as new is:—

1. In an apparatus of the class described, a tubular housing head having a duct extending longitudinally therethrough, drilling elements rotatably suspended from said housing head to bore a hole of a diameter to allow a well casing to be lowered into a well hole as the same is formed, a rotatable conveyor for lifting the drilled material cut by said drilling elements and forcing the same upward through said duct, driving means for rotating said drilling elements and said conveyor in unison, and a bucket separable from said housing head for receiving the drilled material as it passes out through the top of said duct and which may be raised and lowered in a well hole independent of said housing head.

2. In a well drilling apparatus, a tubular housing, drilling means extending below the bottom of said housing for boring a hole of a diameter to receive the same, a bucket separable from said housing and disposed above the same, conveyor means for lifting the drilled material upward through said housing into said bucket, and cables attached to said bucket by which the same may be lifted from and lowered into position with respect to said housing, and driving means for said conveyor and drill.

3. A well drilling apparatus comprising an outer tubular casing, an inner tubular casing in spaced relation to said outer tubular casing to provide a passage between the same, a spiral conveyor journalled in said inner casing and depending therefrom, drilling elements carried by the lower end of said spiral conveyor, a second spiral conveyor journalled above the top of said inner casing, motor driven means contained within said inner casing and operatively connected to said spiral conveyors to rotate them and having connection with the drill, and a bucket having an open bottom suspended above said second spiral conveyor whereby the residue drilled by said drilling elements is lifted by the first spiral conveyor and forced upward through the passage to the second upper spiral conveyor which causes the same to enter said bucket.

4. A well drilling apparatus comprising a housing head having a longitudinal passage extending therethrough, a rotary spiral conveyor journalled in the lower end of said housing head and depending therefrom, drilling elements carried by the lower end of said conveyor, a rotatable shaft journalled in the top end of said housing head, driving means contained within said housing head and operatively connected to said rotary spiral conveyor and said rotatable shaft, a bucket suspended above said housing head, a spiral conveyor turnably carried by said bucket and removably connected to said rotatable shaft to turn therewith, and hoisting cables attached to said bucket by which the same may be withdrawn from a well hole independent of said housing head.

5. A well drilling apparatus comprising a hollow housing head having a passage therethrough, a chambered structure adapted to be supported above said passage, means near the lower end of said housing head for drilling

a well hole and a spiral conveyor above said means acting to transport the drilled substance through said passage and into the chamber of said structure, said structure being movable independently of said housing head longitudinally of the well hole.

6. A well casing, a débris-receiving receptacle movable vertically in said casing and means for preventing relative rotative movement between said casing and said receptacle.

7. A well casing, a débris-receiving receptacle movable vertically in said casing and means for preventing relative rotative movement between said casing and said receptacle and elevating means for filling said receptacle.

8. A well casing, a débris-receiving receptacle movable vertically in said casing and means for preventing relative rotative movement between said casing and said receptacle, said means comprising coacting polygonal faces on said casing and said receptacle.

9. A well casing, a débris-receiving receptacle movable vertically in said casing and means for preventing relative rotative movement between said casing and said receptacle and elevating means for filling said receptacle, said means comprising coacting polygonal faces on said casing and said receptacle.

10. A well casing, a débris-receiving receptacle movable vertically in said casing and means for preventing relative rotative movement between said casing and said receptacle and elevating means for filling said receptacle, a rotary drill, spiral elevating means above said drill for lifting débris into said receptacle.

In testimony whereof I have affixed my signature.

RICHARD P. SIMMONS.