983,050.

A. G. HEGGEM.

HYDRAULIC ROTARY DRILLING MACHINE.

APPLICATION FILED OCT. 6, 1909.

Patented Jan. 31, 1911.

4 SHEETS—SHEET 1.

Fig. 1.

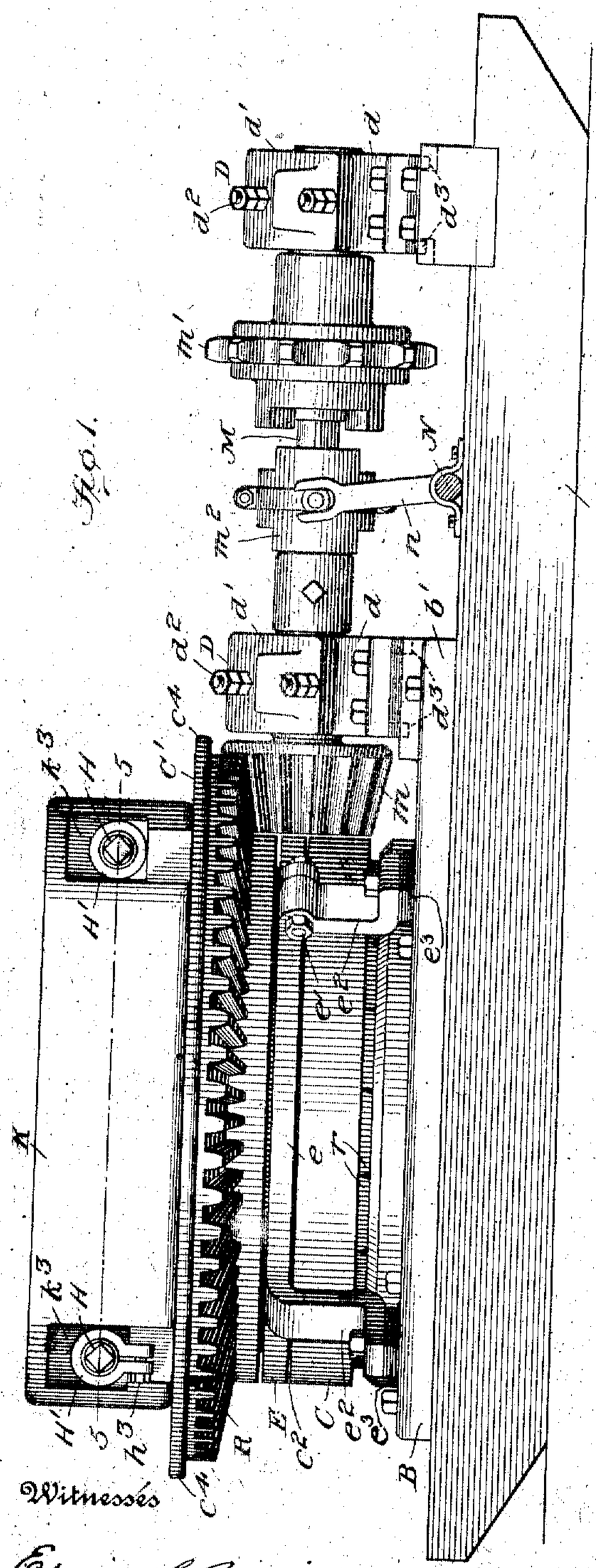

Fig. 9.

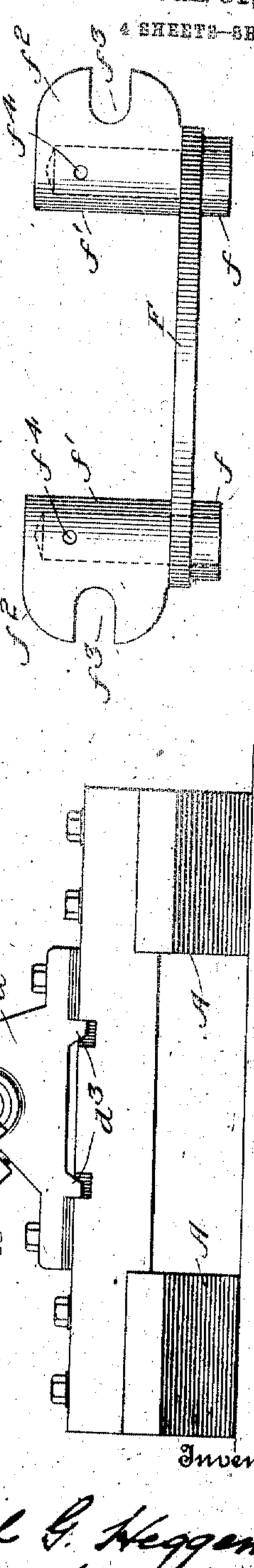

Fig. 8.

Witnesses

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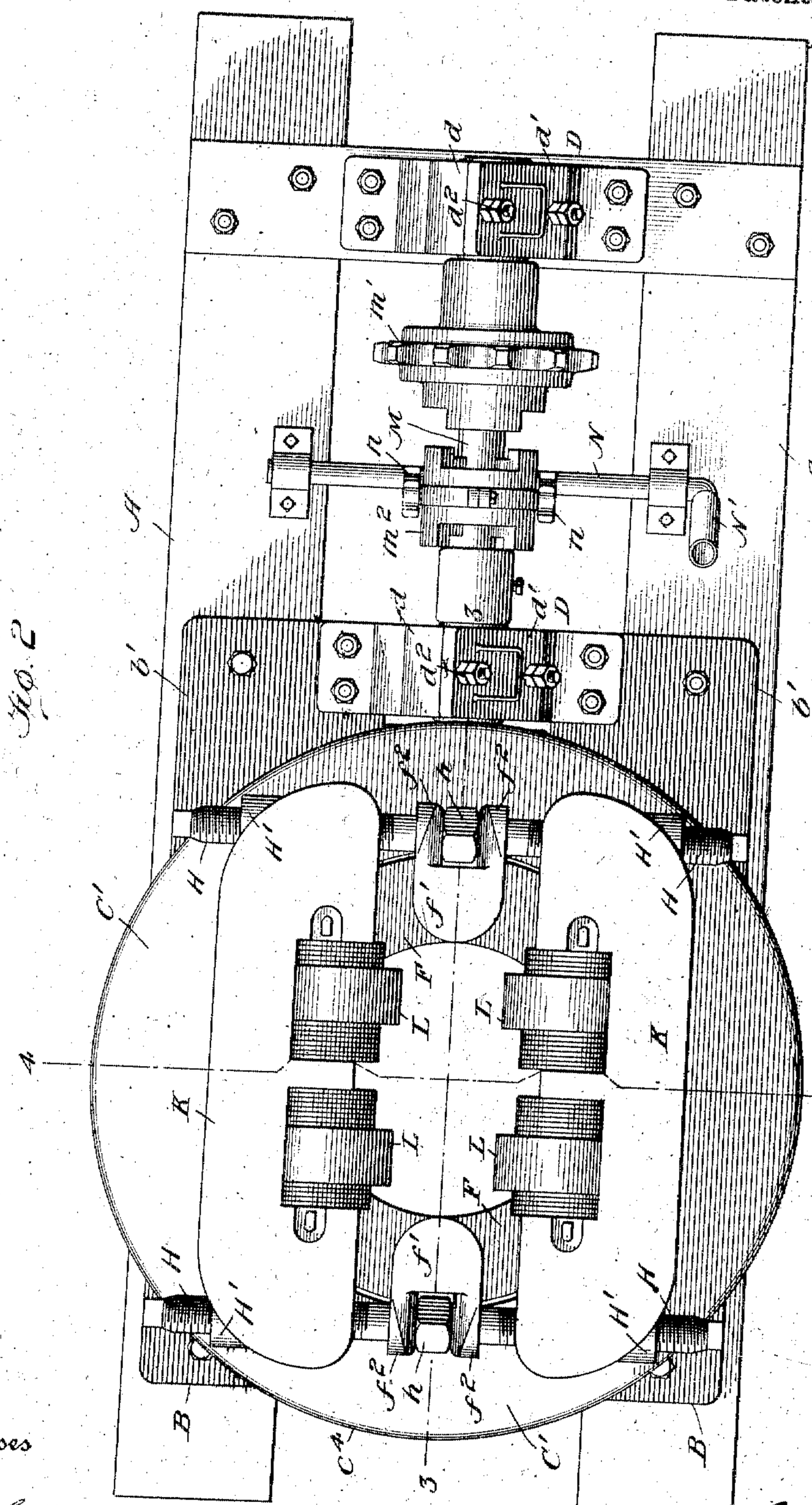
4 SHEETS—SHEET 2.

Fig. 2



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4 SHEETS—SHEET 3.

Fig. 3.

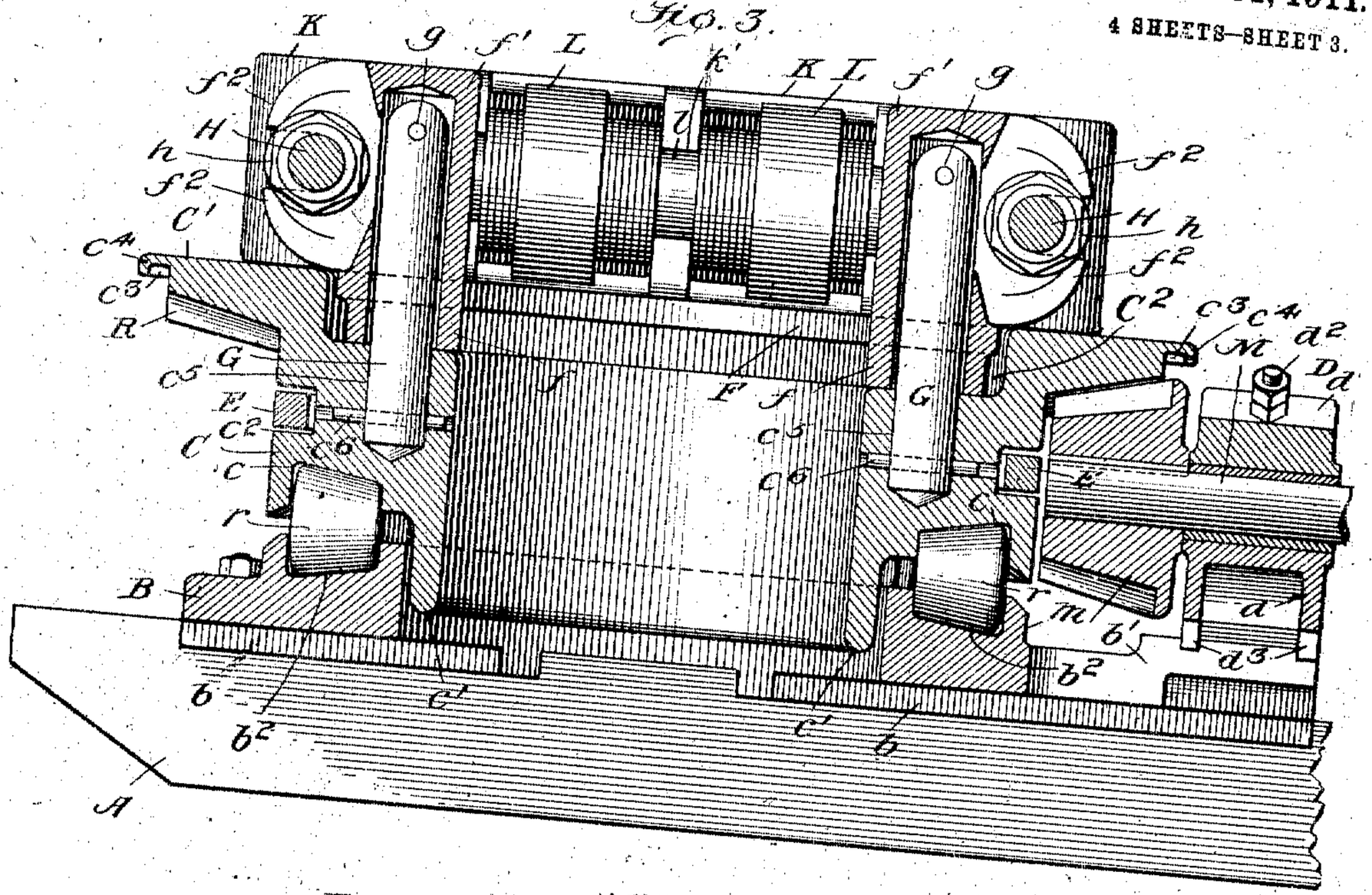
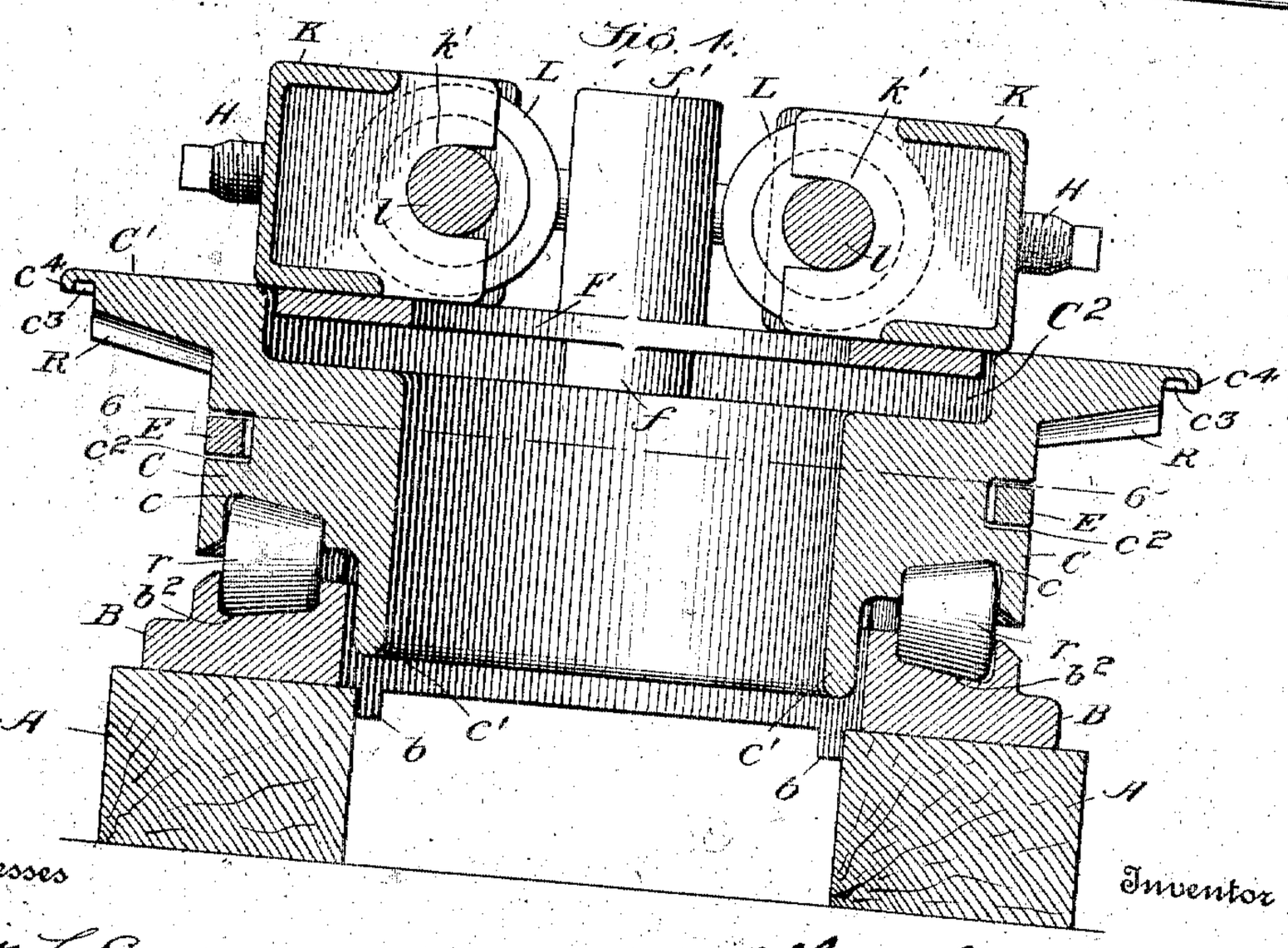


Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 6.

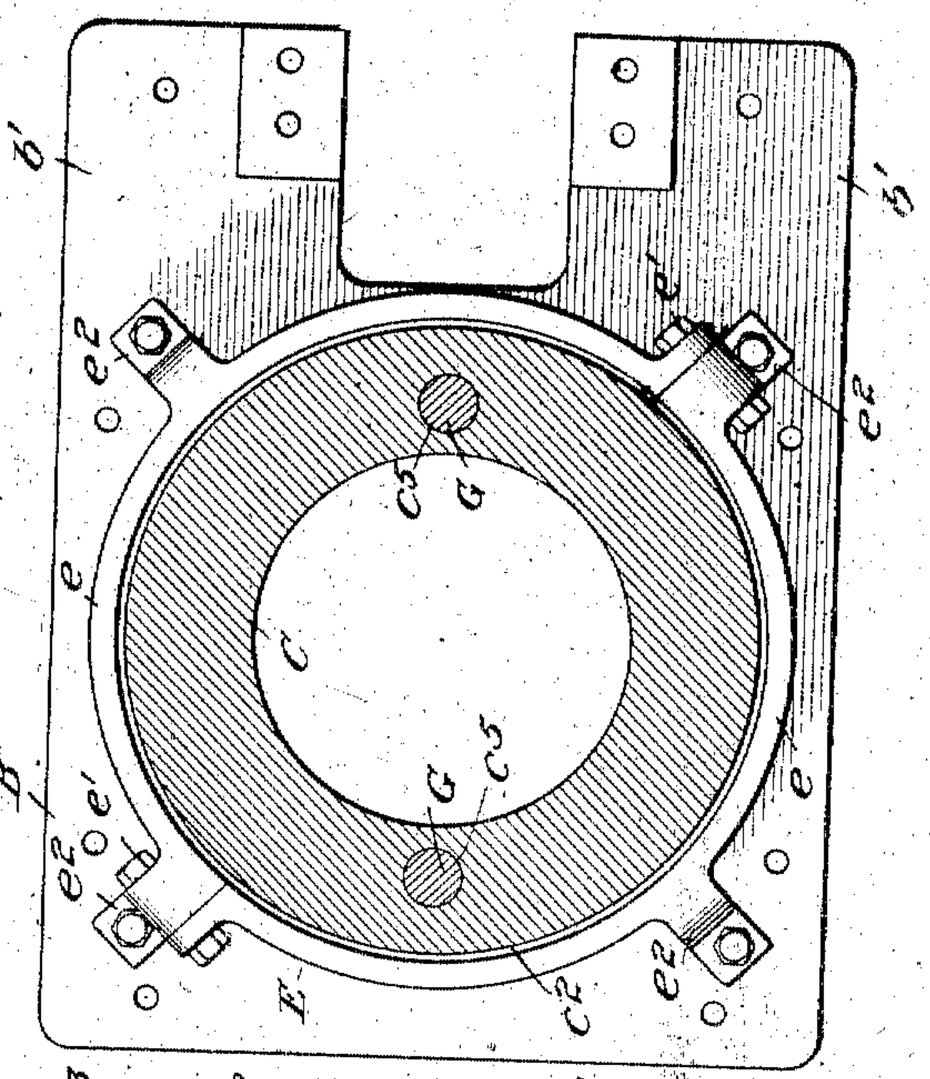


Fig. 7.

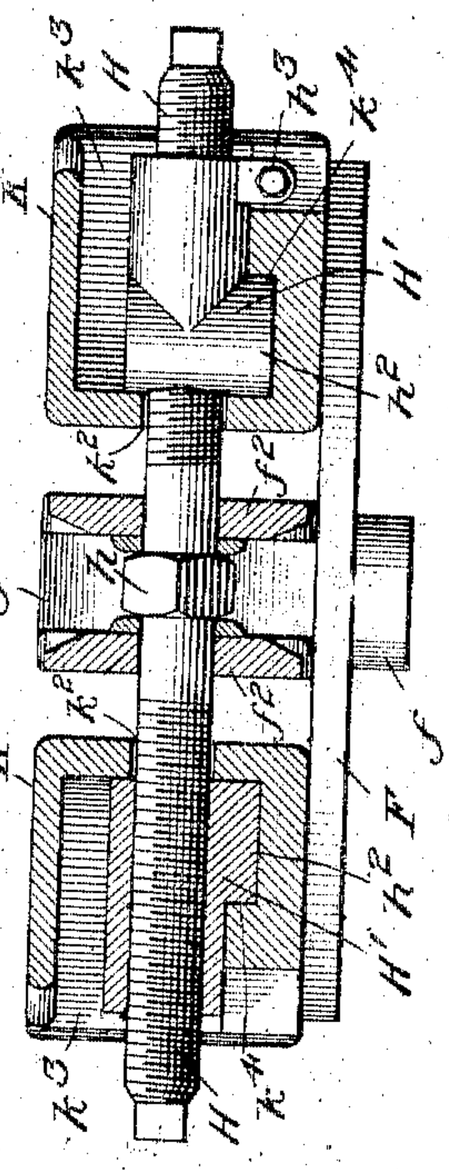
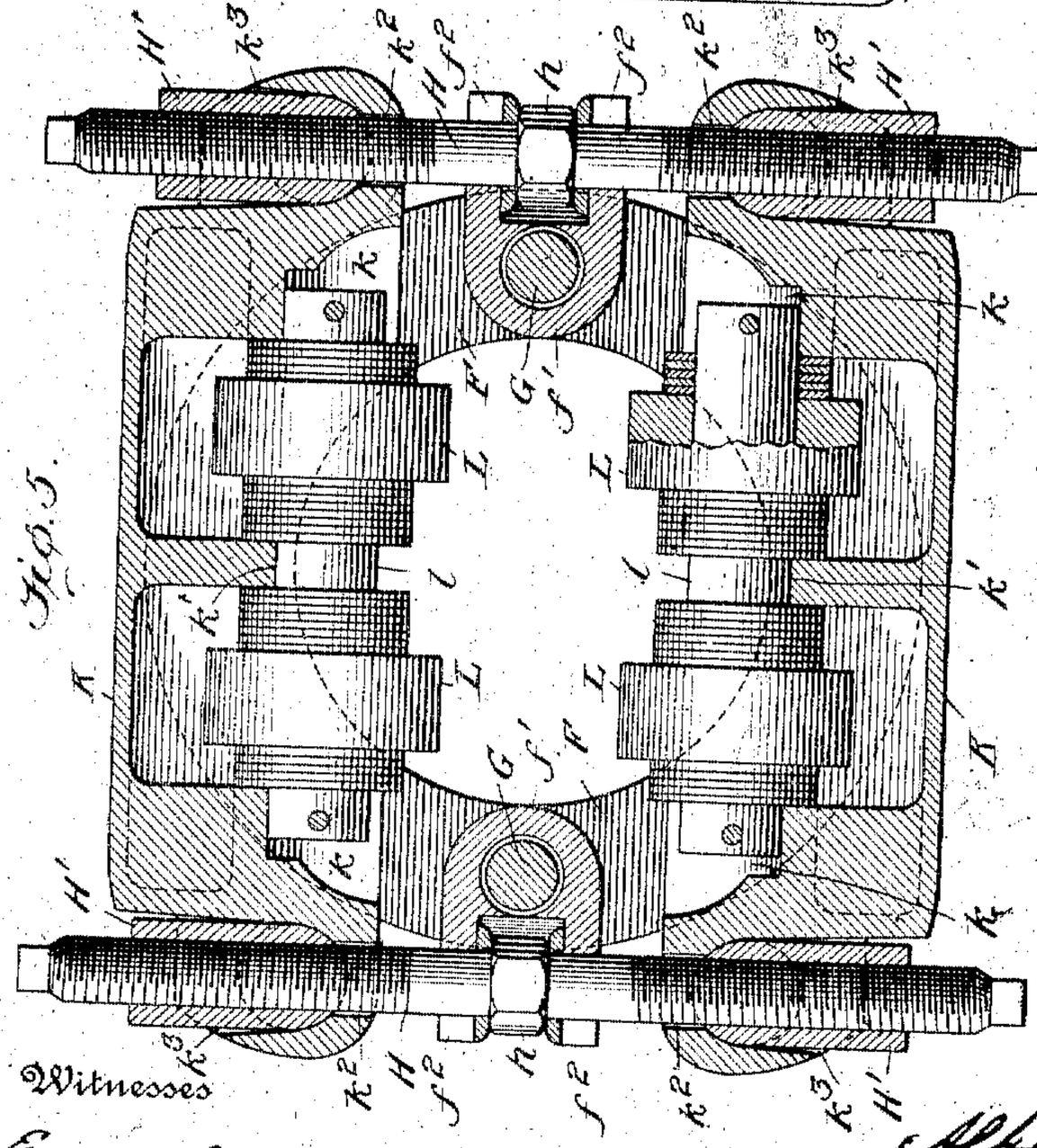


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

ALFRED G. HEGGEM, OF CORAOPOLIS, PENNSYLVANIA, ASSIGNOR TO OIL WELL SUPPLY COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

HYDRAULIC ROTARY DRILLING-MACHINE.

983,050. Specification of Letters Patent. Patented Jan. 31, 1911.

Application filed October 6, 1909. Serial No. 521,363.

To all whom it may concern:

Be it known that I, ALFRED G. HEGGEM, a citizen of the United States, residing at Coraopolis, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Hydraulic Rotary Drilling-Machines; and I do hereby 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 appertains to make and use the same.

My invention relates to rotary drilling mechanism for sinking wells and especially to that class wherein are combined a suitable bed or base, an annular rotary plate or turn table, and a clamp frame and gripping rolls mounted on the turn-table, said clamp frame movable with the turn-table and said gripping rolls adapted to hold and cause the rotation of the drill rod or drill tube with the table without restraining the endwise movement of said drill tube or drill rod, through the gripping rolls.

The elemental construction, as well as the combinations thereof, in this class of drilling machines, as heretofore existing, have been of a more or less objectionable character, for several reasons, as for instance, the height of the turn-table which interferes materially with the operator's use of the various tongs on the pipe or drill tube; the clogging and wear of the operative parts of the machine which occur by reason of the seepage of the muddy water containing sand or grit, which at all times floods the machine; the inability of the operator to readily change the grip of the gripping rolls on the drill tube should a blister open on the tube at any point under the grip of the rolls; the liability of the weakening of the grip or hold of the gripping rolls on the drill tube or drill rod, arising not only from the spring of the rolls but also from the recession of the clamp frames induced by the vibration of the machine; the lack of security between the base and turn-table and the excessive wear incident thereto, due to the character of the devices used to restrain the turn-table under the thrust of the driving mechanism; and the liability of injury to the operator, by reason of the position and arrangement of the clutch lever for actuating the clutch whereby the machine is started and stopped; as well as many others, recognized by the operators of such machines.

The object of the present invention is the elimination of the recited defects, and others involved in the existing constructions of rotary drilling machines.

In order to effectively reduce the height of the machine so as to facilitate the application of the various tongs or tools to the drill tube by the operator, when required, I provide the base-plate of a rotary drilling machine with pendant ribs, whereby the base-plate may be placed directly on the sills, thus insuring the proper alinement of the sills, dispensing with the cross pieces heretofore used, and securing a better support for the machine, and one which materially increases its rigidity and diminishes its vibration.

In order to obtain such a connection between the rotary table and the drive ring which carries the clamp frames and gripping rolls as will enable the operator to change the location of the grip of the gripping rolls in case of the opening of a blister on the drill tube or drill rod, I provide means on the drive-ring for engaging the drive-pins on the turn-table and supporting the drive ring above the table, and such a construction embodies one feature of my invention.

In order to insure the grip or holder of the gripping rolls on the drill tube I provide the clamp frames which carry the shafts of the gripping rolls with an intermediate bearing as well as end bearings for the roll shafts, whereby the clamp frame acts as a beam transferring the load of the clamp screw to the drill tube through the gripping rolls, and such a construction embodies a second feature of my invention.

In order to maintain the hold of the clamp screws under the vibrations of the machine, and permit a swiveling action of the gripping devices which will allow them to accommodate themselves to any irregularities of the drill stem, I combine with the clamp-frames and clamp-screws nuts having cylindrical offsets or bosses whose axes intersect the center lines of the nuts, which bosses engage in corresponding recesses in the clamp-frames, and such a construction embodies a third feature of my invention.

In order to restrain the thrust of the annular plate or turn-table incident to the op-

eration of the driving mechanism, I provide the turn-table with a peripheral groove, and combine with the turn-table and base or bed plate a sectional ring having a continuous engagement in the groove of the turn-table and provided with a plurality of pendant straps or foot extensions secured to the base or bed plate of the machine, and such a construction embodies a fourth feature of my invention.

In order to prevent the seepage of muddy water, sand and grit into the operative parts of the machine, I form the clamp frames with covered bearings for the shafts of the gripping rolls, and covered seats or nut pockets for the nuts of the clamp screws. I also form the drive pin openings in the drive ring closed at their upper ends, and such details embody additional features of my invention.

There are other, minor, features of invention, embracing particular combinations and features of elemental construction, all as will hereinafter more fully appear.

In the drawings chosen for the purpose of illustrating my invention, the scope whereof is pointed out in the claims, Figure 1 is a side elevation of a rotary drilling machine embodying my invention, Fig. 2 is a plan view of the rotary drilling machine shown in Fig. 1. Fig. 3 is a vertical central section of the machine, taken in the plane of the line 3—3, Fig. 2. Fig. 4 is a vertical central section of the machine, at right angles to Fig. 3, taken in the plane of the line 4—4, Fig. 2. Fig. 5 is a horizontal section through the clamp frame and its adjuncts, taken in the plane of the line 5—5, Fig. 1. Fig. 6 is a horizontal section of the machine, taken in the plane of the line 6—6, Fig. 4, showing the continuous engagement of the sectional thrust-ring in the peripheral groove of the turn-table, and the connection of said thrust ring with the base-plate. Fig. 7 is a detail sectional view of the clamp-frames and forked yoke of the clamp screw, showing the connection of the screw with the forked yoke on the drive ring and with the clamp frames. Fig. 8 is a detail view in side elevation of one of the bearings for the shaft of the pinion which drives the turn-table, and Fig. 9 is a view in side elevation of the drive-ring, the drive pin bosses thereon, and the forked yoke for the clamp screws.

Like symbols refer to like parts wherever they occur.

I will now proceed to describe my invention more fully so that others skilled in the art to which it appertains may apply the same.

In the drawings, A, A indicate the usual longitudinal skids or sills for the support of the machine, and B the bed-plate, which in my construction I locate directly on the skids so as to eliminate the commonly employed cross timbers and thus lower the machine to a position which will enable the operator to use with ease the requisite tools in manipulating the tubing. This bed plate B which supports the annular rotary plate or turn-table C, is provided on its under surface with parallel pendant ribs *b b* sufficiently spaced to accommodate the longitudinal skids A, A, and said ribs terminate or are interrupted at the central opening of the bed-plate B provided for the passage of the drill pipe. These ribs serve not only to strengthen the structure, but maintain the parallelism of the skids A, A, and insure the rigidity of the machine. Extensions b', b' of the bed plate provide a suitable support and points of attachment for the bearing D of the driving shaft which actuates the turn-table. The upper surface of the bed-plate B is provided with an annular groove or race-way b^2 for the rolls r which support the annular rotary plate or turn-table C, and said base-plate is bolted or otherwise secured to the skids A, A in any approved manner.

C indicates the annular rotary plate or turn-table provided on its under surface with an annular groove or race-way c corresponding to the race-way b^2 of the base-plate B, for the reception of the rolls r which support the turn-table and on which it travels. To the inside of race-way c the turn-table is provided with a pendant annular flange c' which extends down into the pipe opening of the base-plate, and in its periphery above the race-way the turn-table is provided with an annular groove or recess c^2 for the reception of a thrust-ring E which anchors the turn-table to the base-plate. The upper portion of the table is provided with an overhang or flange C′ on the under surface of which is formed an annular rack R with which the pinion on the driving shaft M engages. Exterior to the annular rack R in the under side of the overhang C′ is an annular groove or channel c^3 forming a counter c^4 which deflects the muddy water of the table and prevents it from entering and abrading the gear. The upper surface of turn-table C is depressed as at C^2 to accommodate the drive-ring F and is provided with holes c^5 for the drive-pins G. The drive-pins are secured to the turn-table by cross pins c^6 inserted through holes in the table in the plane of the groove for the thrust ring E.

F indicates the drive-ring which carries the clamp-screws, clamp-frames and gripping rolls, and which is carried by the rotary turn-table C. It is caused to rotate with the turn-table by means of the drive-pins G secured in the upper surface of the turn-table. The drive-ring is provided at diametrically opposite points on both its upper and under surfaces with bosses *f*, *f'*,

which are bored or otherwise hollowed out to form pockets for the reception of the drive-pins G, G which project from the upper surface of the turn-table. The bosses f', f' located on the upper surface of the drive-ring F are U-shaped in cross section (see Fig. 5) or forked for the reception of the enlarged middle portion h of the clamp-screw and the forks are notched laterally as at f^3 for the passage of the clamp-screws H.

It will be noted that the drive-pin holes in the drive-ring are in the form of pockets or closed above so that no muddy water, sand or grit from the table or ring can enter the drive-pin holes to interfere with the free movement of the drive-ring on the drive-pins. It will also be noted that the bosses f' are provided with pin holes f^4 and the drive pins G are likewise provided with pin holes g, so that the drive-pins G can be secured to the drive-ring as well as to the turn-table, if the same is desired. There is, however, another and more important function for the pin holes f^4, viz., the reception of pins to decrease the operative depth of the drive-pin pocket and thus hold the drive-ring a predetermined distance above the turn-table when it is desired to change the plane of the engagement of the gripping rolls with the drill-tube. The counterboring of the turn-table and the bosses of the drive-ring for the reception of the drive-pins enables drive-pins of maximum length to be employed as well as the securing of the same to the turn-table below the surface of the table or table top.

H, H indicate the clamp-screws by which the clamp-frames carrying the gripping rolls are connected with the drive-ring F and caused to approach each other for gripping and turning the drill-tube or drill rod. These clamp-screws H, H have at their midlengths enlarged prismatic portions h, and on the opposite sides of said enlargement are right and left hand threads which carry corresponding nuts H′ fitted in nut seats or nut pockets in the clamp frames K. These enlarged portions h of the clamp-screws H, H are inserted in the forks f^2 on the bosses f' of the drive-ring, and thus while the rotation of the clamp-screws is permitted by said forks f^2 the clamp-screws are connected to the drive-ring and their endwise movement is restrained.

The nuts H′, H′ by means of which the clamp screws are connected with the clamp-frames are of general L shape, that is to say, have each an offset or cylindrical boss h^2 the axis of which intersects the center line of the nut H′, and this permits a swiveling action of the gripping devices whereby they may accommodate themselves to any irregularities of the drill stem. One at least of the nuts H′ on each clamp-screw H is split longitudinally for a portion of its length and provided with lugs and a clamp screw as at h^3, whereby when required the nut may be caused to clamp the clamp-screw H and perform the function of a nut lock.

K, K indicate the clamp-frames which carry the gripping rolls. These frames are of a general box form, that is to say, are each covered or closed above, beneath and on the outer side so as to exclude muddy water, sand and grit as far as practicable, but are open on the inner side for the reception of the gripping rolls and the projecting of the operative portions thereof. On the interior of each of said frames adjacent to the ends thereof are bearings k for the shaft of the gripping rolls, and projecting inwardly at midlength is an intermediate bearing or support k' for the shaft of the gripping rolls, so that the clamp-frames have the characteristics of beams for transmitting the load of the clamp-screws directly to the rolls and drill-tube, and the shafts of the rolls are prevented from springing so as to weaken the grip of the rolls on the drill-tube or drill-rod. At the ends of the clamp frame are holes k^2 for the passage of the clamp-screws H, H and back thereof are nut pockets k^3 of the general form of nuts H′ for the reception of said nuts. The least diameter of said nut pockets k^3 slightly exceeds the greatest diameter of the nuts H′ (see Fig. 7) so as to permit the easy introduction of the nuts into the pockets k^3, but within the mouth of the pocket the pocket is expanded to form a cylindrical recess or sub-pocket k^4 for the reception of the cylindrical boss or offset h^2 of the nut H′. The excess of the diameter of the nut-pocket k^3 over that of the nut H′, which permits the nut with its cylindrical boss to be easily introduced into the nut pocket, also permits a limited vertical play of the nut, so that the nut while sustained by the clamp-screw may be said to constitute a floating connection between the clamp-screw and clamp-frame.

L, L indicate the gripping rolls, the shafts l, l of which have their bearings at k and k' in the clamp-frames K, K. These rolls may be comprised of a series of annular disks of different diameters through which the shafts are passed, the relative number and arrangement of disks on the shafts l, l being such as to so space the disks of greater diameter by the interposition of disks of less diameter as to obtain the desired edge grip of the larger disks on a drill-tube of any required diameter.

M indicates the driving-shaft provided with a pinion m which engages the annular rack R of the turn-table. This shaft M and its bearings D, D, are in alinement, and the shaft extends radially toward the axis of rotation of the rotary table C. This driving shaft may be driven from any suitable motor by means of a chain-belt to a sprocket-

wheel m' loose on the shaft M and operatively connected thereto by a clutch member m^2 splined on and rotating with the shaft. In order to shift the clutch-member m^2 into and out of engagement with the sprocket-wheel m' a clutch-lever n connected with a rock-shaft N journaled on the sills A, A, said rock shaft extending at right angles to the shaft M, is employed, and on the stub end of the rock-shaft N which actuates the clutch lever n is loosely fitted a short piece of pipe N' as a protection under the severe handling incident to the use of the machine.

It will be noted that the arrangement and construction of the clutch lever is such as to locate the handle away from the shaft and on the side toward the operator which enables the clutch to be more readily operated and without exposing the operator to danger.

As hereinbefore pointed out, the pinion-shaft M is journaled in suitable bearings D secured to the bed-plate B. I construct the bearing D for the shaft M with a pillow-block d and cap d' divided on a plane inclined to the horizontal (see Fig. 8) which brings the pressure of the shaft against the solid or bottom portion of the box d leaving the cap free from pressure, so that the cap d' which is connected with the pillow-block d by the bolts d^2 always remains securely in place. As a result of this construction of the shaft bearing, taken in connection with the relation of the shaft to the sprocket wheel and driving chain and the turn table driven by the shaft, the pull of the chain is counteracted by the reaction of the driving gear, so that the wear on the bearing and shaft and the injury to the machinery frequently occurring where a horizontally divided bearing is used in such a combination, are obviated. The under surface of the pillow-block d is provided with pendant lugs d^3 which engage the bed and oppose the pull of the sprocket wheel m' and the resultant pressure from the gearing, thus relieving the bolts from all shearing stresses.

The thrust of the turn-table is taken up and transmitted to the bed-plate by the thrust ring E, as hereinbefore noted. This thrust-ring E which has its seat in the peripheral groove c^2 and thus maintains a continuous bearing on the periphery of the turn-table, is composed of a plurality of sections e, e, preferably two, which, after application to the turn-table, are bolted together as at e', and said sections are provided with a plurality of pendant straps or foot extensions e^2 by means of which the thrust-ring is secured to, or anchored to, the bed plate B. This construction not only insures uniform support of the rotary table at all points on its periphery but it causes the co-action of the several straps e^2 in support of the individual strap under the thrust of the rotary table when that thrust is in the line of an individual strap. Furthermore, such a construction permits of the use of shims e^3 between the straps e^2 and bed plate B to provide for taking up wear and lost motion.

The construction of the several elements of the machine being substantially such as hereinbefore pointed out, they may be assembled as follows: The drive pins G will be inserted in the holes c^5 of the turn-table C, and secured by the cross-pins c^6. The disks constituting the gripping rolls L, L will be properly assembled on their shafts l, and the rolls inserted in the clamp-frames K, K. The skids A, A, or longitudinal sills which are to support the machine, are properly placed and spaced, the bed-plate B deposited directly thereon with the pendant ribs b between and in contact with the inner sides of the sills to maintain the alinement of the sills, and the bed-plate is secured to the sills in the usual manner so that great rigidity of the bed-plate is obtained. The driving gear is then alined with the bed-plate and secured thereto and to the sills, the rollers r are placed in the race-way b^2 in the upper surface of the bed-plate, the turn-table is placed in position on rolls r and the bed-plate, the thrust-ring sections e, e are applied in the peripheral groove c^2 of the turn-table and are bolted together, after which the pendant straps or foot extensions e^2 of thrust-ring E are bolted or otherwise secured to bed-plate B. The drive-ring F will then be placed on the turn-table with the drive-pins G projecting into the tubular bosses f, f' of the drive-ring, after which cross pins may be passed through the openings f^4 of the bosses and through the drive pins G. The clamp-screws H, H will then be connected with the drive-ring F by inserting the enlarged prismatic portions h thereof in the yoke or fork f^2 of the bosses f, the nuts H', H', will be inserted in the nut pockets k^3 of the clamp-frames K, K, after which the clamp-frames K, K will be placed in proper relation with each other and with the clamp-screws H, H, the ends of the clamp-screws inserted into the nuts H', H' through the holes k^2 at the ends of the clamp frame, and the clamp-screws rotated until they have engaged the nuts H', H', and drawn the clamp-frames toward each other the desired distance. When thus assembled the machine is ready for service.

In operating the machine, the clamp-frames are drawn toward each other by the clamp-screws until the gripping rolls have obtained the required hold on the drill-pipe or drill-rod, after which power having been applied to rotate the turn-table, the drive-pins G will cause the drive-ring F to rotate with the table, and this will carry with it the clamp-screw, clamp-frame and gripping rolls, and thus rotate the drill-tube or drill-rod. If at any time a blister should open on the drill-tube from the grip of the gripping

rolls, and it should become desirable to change the location of the grip of the rolls on the drill-pipe, the rotation of the table will be stopped, the cross-pins will be withdrawn from the holes f^4 of bosses f' and the holes g of drive-pins G, and power applied to raise the drill-tube. The drill-tube when lifted will carry up with it the gripping rolls L, L, clamp-frames K, K, clamp-screws H, H, and the drive-ring F. When this has taken place the cross-pins may be replaced in the holes f^4 of the bosses f' of the drive ring, and the drill-tube lowered so that the cross-pins rest upon the tops of drive-pins G which will hold the drive-ring elevated above the table while the weight of the drill-tube will cause it to sink through the gripping rolls until a new grip higher up on the drive-tube will be secured. The power can be again applied to rotate the turn-table and the drilling operation proceeded with as before.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a rotary drilling machine, the combination of a turn-table having drive-pins, and a drive-ring having drive-pin holes for the reception of the drive pins, said holes in the drive-ring being closed above to prevent the introduction of table water.

2. In a rotary drilling machine, the combination of a turn-table having drive-pins, and a drive-ring having tubular bosses for the reception of the drive-pins, said bosses closed at their upper ends to constitute pockets.

3. In a rotary drilling machine the combination of a turn-table having drive-pins, and a drive-ring having tubular bosses for the reception of the drive-pins, said bosses having transverse pin-holes for the reception of a cross-pin.

4. In a rotary drilling machine, the combination of a turn-table having drive-pins, a drive-ring having tubular bosses for the reception of the drive-pins of the turn-table, said bosses being forked for the reception of clamp screws, clamp-screws each having an enlargement which fits in the fork of a drive-pin boss, and clamp frames actuated by the clamp-screws.

5. In a rotary drilling machine, the combination of gripping rolls, clamp-frames therefor having covered bearings for the gripping roll shafts and covered pockets for clamp-screw nuts, clamp-screws, and clamp-screw nuts located in the nut-pockets of the clamp-frames.

6. In a rotary drilling machine the combination of gripping rolls, clamp-frames having end bearings and an intermediate bearing for the gripping rolls, and clamp-screws for actuating the clamp-frames.

7. A clamp frame for the gripping rolls of a rotary drilling machine, said frame being of box form with a series of partitions constituting bearings for the gripping rolls.

8. In a rotary drilling machine the combination of clamp-screws, nuts therefor, said nuts having cylindrical bosses or lateral offsets, and clamp-frames for the gripping rolls, said frames having nut pockets and cylindrical recesses corresponding to the configuration of the bosses on the nuts.

9. In a rotary drilling machine, the combination of clamp-frames having nut pockets provided with cylindrical recesses, clamp-screws, and split clamp nuts for the clamp-screws, said nuts having cylindrical bosses adapted to enter the cylindrical recesses in the nut-pockets of the clamp-frame.

10. In a rotary drilling machine, the combination of a bed or base-plate having a hollow center, a turn table having a pendant annular extension which enters the hollow center of the bed or base-plate and provided with a peripheral groove for the reception of a thrust ring, and a thrust ring provided with a plurality of pendant straps or foot extensions whereby a rigid connection with said bed or base plate is effected.

11. In a rotary drilling machine, the combination of a bed or base-plate having a hollow center, a turn table having an annular rack and a peripheral thrust-ring groove and provided with a pendant annular extension which enters the hollow center of the bed-plate, a thrust ring provided with a plurality of pendant straps or foot extensions whereby connection is made with the base-plate, a driving shaft having a pinion for engaging the annular rack of the turn table, said shaft extending radially toward the axis of rotation of the turn-table, and bearings for said shaft said bearings being divided in a plane inclined to the horizontal.

12. In a rotary drilling machine, the combination of a bed or base-plate having a hollow center, a turn table having an annular rack and a peripheral thrust ring groove and provided with an annular pendant portion which enters the hollow center of the base plate, a thrust ring having pendant straps for connection with the base plate, a driving shaft having a pinion for engaging the annular rack of the turn-table and a sprocket-wheel for a drive chain, said shaft extending radially toward the axis of rotation of the turn table, and bearings for said shaft said bearings divided in a plane inclined to the horizontal.

In testimony whereof I affix my signature, in presence of two subscribing witnesses.

ALFRED G. HEGGEM.

Witnesses:
D. J. Brown,
H. A. Boschert.