

P. A. SCHMUCK.
 ROTARY WELL DRILLING APPARATUS.
 APPLICATION FILED FEB. 12, 1916.

1,196,033.

Patented Aug. 29, 1916.

3 SHEETS—SHEET 1.

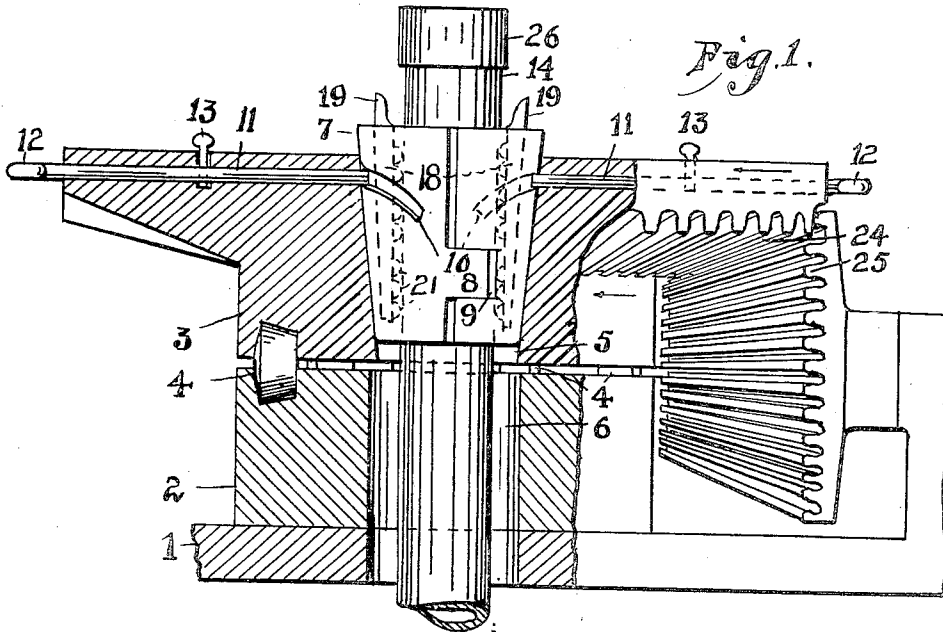


Fig. 1.

Fig. 2.

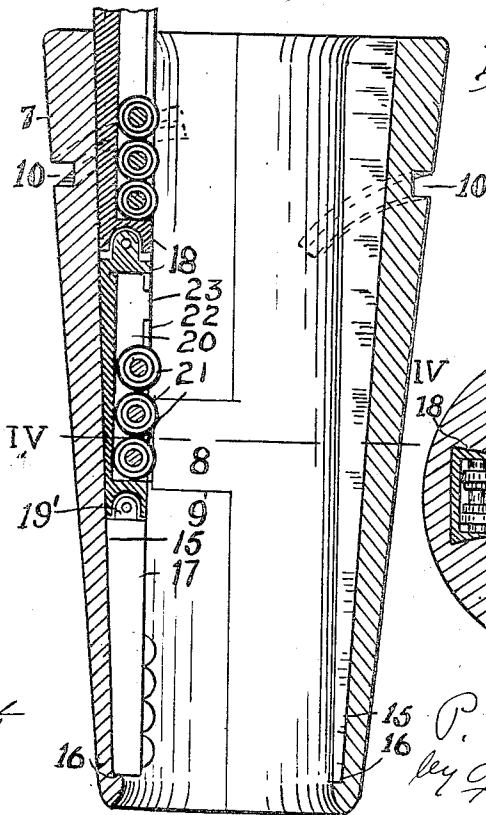
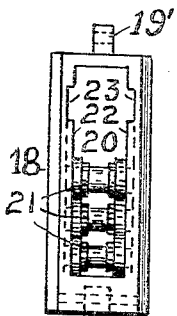
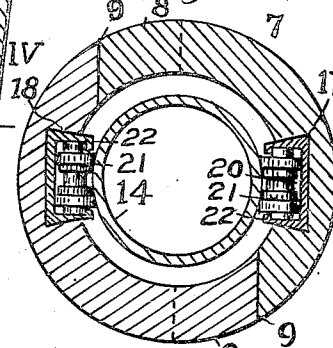


Fig. 3.

Fig. 4.



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3 SHEETS—SHEET 2.

Fig. 5.

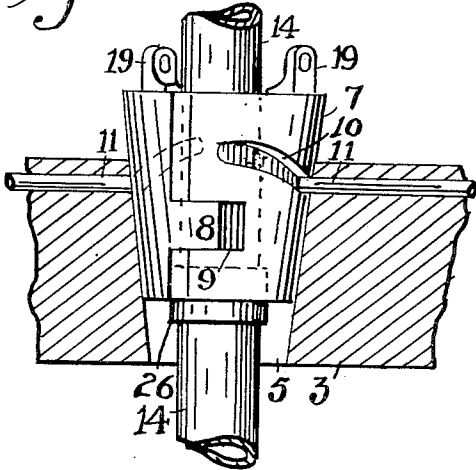


Fig. 6.

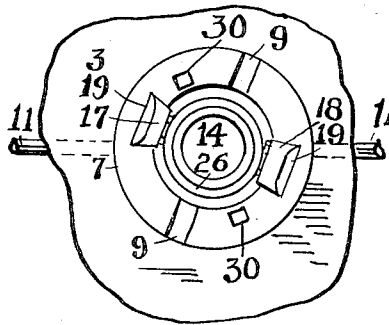


Fig. 7.

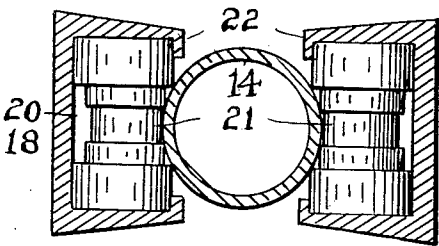


Fig. 8.

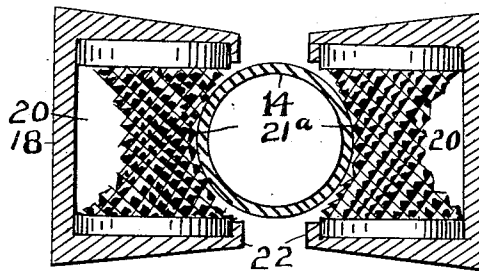


Fig. 11.

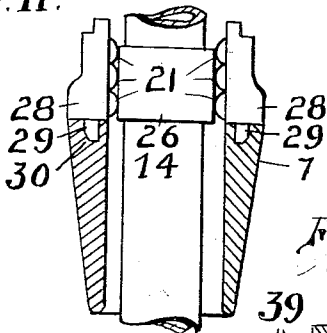


Fig. 17.

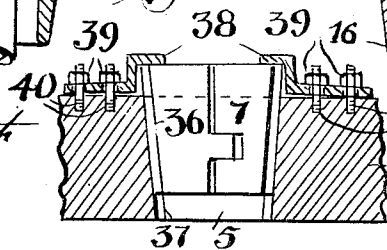
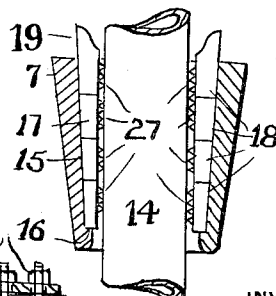


Fig. 14.



WITNESS

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3 SHEETS—SHEET 3.

Fig. 9.

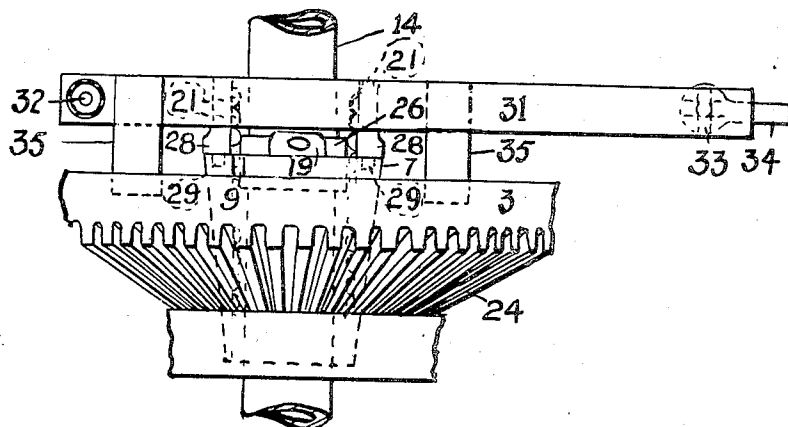


Fig. 10.

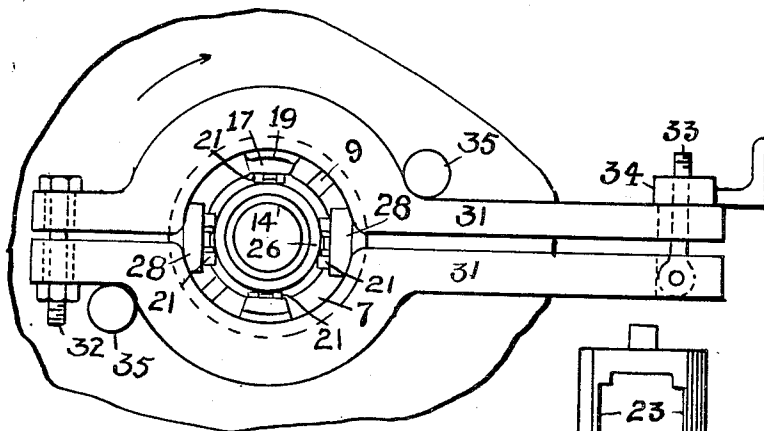


Fig. 13.

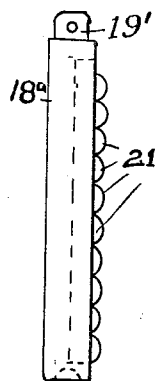


Fig. 12.

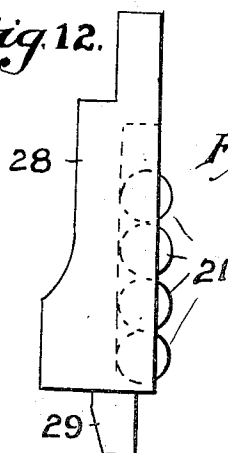


Fig. 16.

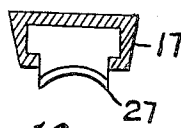
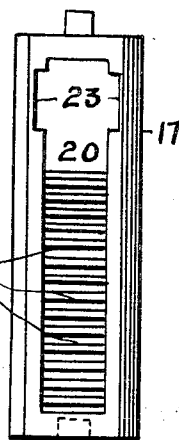


Fig. 15.



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UNITED STATES PATENT OFFICE.

PHILIP A. SCHMUCK, OF PITTSBURGH, PENNSYLVANIA.

ROTARY WELL-DRILLING APPARATUS.

1,196,033.

Specification of Letters Patent.

Patented Aug. 29, 1916.

Application filed February 12, 1916. Serial No. 77,884.

To all whom it may concern:

Be it known that I, PHILIP A. SCHMUCK, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Rotary Well-Drilling Apparatus, of which the following is a specification.

My invention relates to rotary drilling apparatus for gas, oil, and other wells.

It is the principal object of this invention to provide readily exchangeable means whereby round drill-pipe or drill-stems may be either moved rotarily or prevented from moving longitudinally.

My invention relates more particularly to apparatus whereby the means for rotating the drill may be restricted to small units which may be quickly and easily substituted for other units for supporting the weight of the string of pipe in the well. I prefer that these units comprise separate magazines holding roller grips for rotating the pipe and slips for supporting the pipe.

My invention preferably contemplates automatic devices for causing the rotation of the rotary table to make the roller grips seize the pipe firmly or to increase the firmness of their seizure of the pipe.

Other objects will appear hereinafter.

Referring to the accompanying drawings, Figure 1 is a central vertical section of a rotary drilling machine equipped with my invention; Fig. 2, a face view of one of the pivoted sections of a magazine for roller grips for seizing and rotating the pipe; Fig. 3, a vertical section of the table-bushing containing one roller-grip magazine, the opposite magazine being omitted; Fig. 4, a section on the line IV—IV, Fig. 3; Fig. 5, a central vertical section of the rotary table with the table-bushing in side elevation, the pipe being drawn upwardly with the collar partly within the bushing; Fig. 6, a top plan view of Fig. 5; Fig. 7, a horizontal section showing two magazines containing roller-grips engaging a pipe or drill-stem between them; Fig. 8, a view similar to Fig. 7, but showing a different form of roller-grips; Fig. 9, a side elevation of a rotary table equipped with my attachments for engaging the pipe collar and rotating it while entering the top of the bushing; Fig. 10, a top view of Fig. 9; Fig. 11, a section of the bushing with the said attachments in en-

gagement with a pipe collar; Fig. 12, an enlarged view showing in side elevation one of the said attachments; Fig. 13, a side view of a roller-grip magazine without vertical taper; Fig. 14, a vertical section of the table-bushing provided with magazines holding slips in engagement with a pipe, the magazines being tapered vertically; Fig. 15, a face view of one section of a slip magazine containing slips; and Fig. 16, a cross-section of a slip magazine with a slip shown in plan view. Fig. 17 shows partly in side elevation and partly in vertical section a still further modification of my invention.

On the drawings, 1 represents the horizontal bed-plate of a rotary drilling apparatus, and 2 a bearing block resting thereon.

3 is the rotary table supported by the rollers 4 on the block 2, so as to maintain the downwardly-tapering opening 5 in the table 3 directly over the vertical opening 6 in the block and bed-plate, the opening 6 being at least as large as the lower end of the opening 5. The opening 5 forms a seat for the bushing 7 having its exterior wall tapered to fit the opening 5. The bushing is formed in vertical sections, preferably halves, having horizontal interlocking tongues 8 and recesses 9, which prevent one section slipping past the other to any degree. The tongues are made long enough and the recesses deep enough so that the edges of the sections of the bushing may be in contact or separated somewhat when the grips or slips engage a pipe, and separated more widely when a collar is passing through the bushing, without the tongues being withdrawn wholly from the recesses. Each section is provided externally with a cam-slot 10 into which a rod 11 at each side of the table extends. These rods 11 may be supported in various ways by the table 3, but I have shown them reciprocable in horizontal holes in the table by means of handles 12 at the outer ends of the rods. The rods may be prevented by the cross-pins 13 from moving longitudinally while their inner ends are in the cam-slots 10. The inclination of the slots 10 is such that, when the table is rotated in the direction shown by the arrow on Fig. 10, the rods 11 will tend to move the bushing downwardly in the opening 5, thereby increasing the frictional grip between the table and the bushing, and also

forcing the sections of the bushing toward the pipe 14 in the bushing for a purpose to be explained presently.

I provide the interior walls of the sections 5 of the bushing with vertical grooves 15 which are undercut at their sides and are tapered downwardly in case the magazines to be described are to be tapered. Preferably these grooves are provided with stop-shoulders 16 at their lower ends to limit the downward movement of the magazines.

The magazines marked 17 are constructed alike wherefore a description of only one will be given. A magazine 17 is preferably composed of a number of vertically arranged sections 18, which I prefer to make separable. I prefer to provide the adjacent ends of the sections with pivotal connections 19' so that the sections may adjust themselves automatically to irregularities on the pipe and so that by withdrawing the pivot pins the sections may be separated. Each magazine has its sides fitting the sides of its groove 15 to hold it 25 firmly in place, and its outer wall fitting against the outer wall of the groove to give it an immovable support against the lateral thrust of the drill-pipe. The upper end of each magazine has above the bushing 7 the handle or projection 19 by which it can be seized by the hand or a tool and lifted out of the bushing, or inserted therein. Each section 18 of a magazine 17 has a receptacle or pocket 20 to receive a group of superimposed stepped roller grips 21. The lower roller grip of each group may rest on the bottom of the pocket or be otherwise supported. The roller grips are all exposed toward the center of the bushing except the end portions thereof which are back of the flanges 22 which lie along the sides of the pockets and at the forward face thereof. The flanges 22 are cut away at their upper ends as shown at 23 in order to admit the ends of the roller grips to the pockets. The lower face of the table 3 is provided with the usual bevel gear teeth 24 meshing with the drive-pinion 25. 26 represents a collar or coupling on the pipe 14.

The apparatus so far described operates as follows: A pipe, as 14, being suspended in the openings 5 and 6, the sections of the bushing 7 are assembled around it with the tongues 8 in the recesses 9. The bushing is then lowered into the opening 5 and so arranged that the rods 11 may be pushed into the cam-slots 10. When the rods 11 have been pushed into the slots 10, the rods are 60 locked by the pins 13 or other preferred devices. A magazine 17 is dropped into each groove 15 in the bushing, the pockets 20 in the sections 18 of the magazine being each supplied with a number of roller-grips 65 21. The table is then rotated in the direc-

tion indicated by the arrow on Figs. 1 and 10, whereupon the rods 11 drive the bushing 7 downwardly and hold it from rising, and the roller grips 21 are forced toward the pipe 14. As the table 3 rotates, the roller-grips 21 cause the pipe to be rotated with it. 70 The drill on the lower end of the string of pipe attached to the pipe or stem 14 cuts its way downwardly, and the roller grips allow the pipe 14 to pass downwardly in a well known manner. If it be desired to raise the pipe so as to bring the collar 26 (Fig. 5) above the bushing to the position shown on Fig. 1, the rotation of the table is reversed slightly so as to cause the rods 80 11 to loosen the bushing in the opening 5. The rods 11 are withdrawn from the slots 10, if they interfere with the upward movement of the collar. The pipe is raised in the usual manner. The upper end of the collar 26 engages the lower end of the bushing 7, the opening in which is shown on Fig. 3 to be tapered upwardly a short distance, and wedges the sections of the bushing sufficiently apart to allow the collar to 90 pass up through the bushing. When the collar passes above the bushing the sections of the bushing move toward each other and toward the pipe below the collar. In removing pipe from the well, the magazines 95 17 may be removed from the bushing unless it is desired to use the roller grips immediately for turning the string of pipe. If it be desired to hold up the string of pipe after a coupling has been brought above the 100 table, or at any other time, magazines having their pockets supplied with toothed slips 27 are substituted for the magazines provided with the roller-grips. The slips 27 may be shaped to take the place of the roller grips in the pockets of the magazines, as shown in Fig. 16, or special magazines or apparatus for holding slips like those shown or slips of any other suitable design may be used. If preferred, roller-grips 21* con- 110 caved to fit the pipe but covered with pyramidal or similar projections may be employed as shown on Fig. 8.

When a collar or coupling on a pipe or stem moves down to the bushing 7, the pipe 115 can move downwardly no farther until provision is made to let the collar or coupling pass between the sections of the bushing. To accomplish this I provide a number of attachments or auxiliary magazines 28, each 120 comprising preferably a single section constructed to contain roller-grips 21 the same as a section 18 of a magazine 17. Each magazine 28 has a tenon or projection 29 which may be seated in a mortise or hole 30 in the top of the bushing 3. As seen in Fig. 10, the magazines 28 are arranged so that the biting edges of the roller grips therein will be in the same circle as the biting edge of the roller grips in the magazine 17. The maga- 130

zines 28 are arranged around the collar 26. Then a clamp having the two members 31 pivoted together at one end by the bolt 32 is applied to the upper ends of the magazines to hold them parallel with the pipe coupling and prevent their spreading. The intermediate portions of the members are curved so that the opposing portions present a circle having a diameter approximately equal to the distance between the upper ends of the magazines 28, so that the clamp will engage all the upper ends of the magazines, no matter what parts of the circle contacts therewith. The remaining ends of the members 31 are provided with the clamping bolt 33 and nut 34, whereby the members may be brought to the required adjustment and maintained there. The table 3 may be provided with the removable posts 35 which engage the clamp and cause it to assist in rotating the pipe. As soon as the collar passes below the magazines 28, the grips 21 in the magazine 17 rotates the pipe by their engagement with the collar, and the clamp, the pins 35 and the magazines 28 may be removed. When the collar 26 reaches the lowest roller-grips in the magazines 17, the said magazines may be withdrawn and then reinserted after the bottom section 18 has been removed from each magazine. The magazines may be readily taken out after the rotation of the table has been reversed slightly, causing the bushing to be lifted and the roller-grips to be loosened on the pipe. By removing the lower sections 18, there will be no part of the magazine opposite the collar to prevent the sections of the bushing moving closer together so as to bring the roller grips above the collar into engagement with the pipe. Instead of removing the lower sections 18, magazines of greater depth or thickness may be substituted for those removed. These substituted magazines, as also the shortened magazines 17, will be thick enough to prevent the collar from engaging the bushing, and their lower ends should be above the collar. The magazines may have their inner and outer sides parallel, that is, of uniform thickness. I have shown such a magazine marked 18^a on Fig. 13. Magazines such as 18^a would, of course, require the guide-grooves in the bushing to have their outer walls parallel with the pipe. If the rods 11 be moved out of the cam-slots 10, the pipe can be pulled upwardly, the roller-grips rotating as the pipe passes. The bushing will move upwardly slightly to relieve the friction on the pipe. The rotation of the table may be reversed slightly before the rods 11 are withdrawn in order to loosen the bushing. The pipe may be lifted without removing the rods 11 from the slots 10, after the table has been turned backwardly so as to bring the rods to the right-hand end of the slots and thereby lift the bushing a short

distance. When a pipe collar or coupling engages the bottom of the bushing it spreads the sections thereof apart and passes on up above the bushing, the sections falling back automatically with the roller-grips or the slips, as the case may be, in engagement with the pipe. The magazines may be taken out previously to drawing up the pipe, and when the desired length of pipe has been pulled up through the bushing, magazines with roller grips or toothed slips, as desired, will be inserted in the bushing.

On Fig. 17, I show the bushing 7^a with the vertical wings 36 slidable in the grooves 37 in the table 3 to prevent relative rotary movement of the table and bushing. These wings and grooves are alternative to the cam-slots and the rods 11 so far as the rods serve to assist in making the bushing rotate with the table in case the friction between the table and bushing are insufficient for that purpose. The bars 38 having one of their ends on the top of the bushing may be drawn down by the nuts 39 which work in the bolts 40 on the top of the table, as an alternate to the cam-slots 10 and rods 11 so far as they serve to drive the bushing downwardly, and hold it in place. I do not limit my invention to any particular means for insuring the rotation of the bushing with the table except as the claims particularly specify.

I claim—

1. In a well-drilling apparatus, a rotary table having a central vertical opening, a vertical bushing therein, pipe-engaging devices, and magazines removably inserted in the bushing and removably containing the pipe-engaging devices.

2. In a well-drilling apparatus, a rotary table having a central vertical opening, a vertical bushing therein, rotatable pipe-engaging grips, and magazines removably inserted in the bushing, the said magazines each having a pocket open toward the inner side and containing a plurality of said grips superposed.

3. In a well-drilling apparatus, a rotary table having a central vertical opening, a vertical bushing therein, pipe-engaging devices, magazines removably inserted in the bushing and provided each with a pocket, and means for removably retaining the devices in each pocket.

4. In a well-drilling apparatus, a rotary table having a central vertical opening, a vertical bushing therein provided with longitudinal grooves in its internal surface, rotatable pipe-engaging grips, and magazines removably inserted in the grooves in the bushing, each magazine having a vertically arranged pocket open toward the inner side and containing one or more of the said grips.

5. In a well-drilling apparatus, a rotary table having a central vertical opening, a

vertical bushing therein, pipe-engaging devices, and magazines removably inserted in the bushing, one of the magazines being composed of a plurality of vertical sections with their adjacent ends detachably connected together and each section containing means for retaining one or more of the said pipe-engaging devices.

6. In a well-drilling apparatus, a rotary table having a tapered opening therein, a bushing therein having exterior cam grooves, and means carried by the table and cooperating with the grooves for causing the said means to move the bushing downwardly or upwardly as the table is rotated in one direction or the other.

7. In a well-drilling apparatus, a rotary table having a tapered opening therein, a bushing therein having exterior cam grooves, and divided into laterally movable sections, and means carried by the table and cooperating with the grooves for causing the said means to move the bushing downwardly or upwardly as the table is rotated in one direction or the other.

8. In a well-drilling apparatus, a rotary table having a central opening, an externally-tapered bushing therein divided into movable lateral sections, pipe-rotating devices carried by the inner faces of the sections, other pipe-rotating devices, and removable magazines containing the said other removable pipe-rotating devices, carried by

the bushing, and arranged when the sections are spread apart to engage a coupling or collar on a pipe so as to rotate the same as it passes down into the bushing, the pipe-rotating devices carried by the inner faces of the sections being adapted automatically to engage the pipe above the collar after the collar passes below the last named pipe-engaging devices.

9. In a well-drilling apparatus, a rotary table having a central opening, a bushing therein divided into movable lateral sections, pipe-rotating devices carried by the sections, removable magazines having free ends above the table and containing removable pipe-rotating devices which are carried by the bushing and arranged to engage a coupling or collar on a pipe so as to rotate the same as it passes down into the bushing, and means for holding the free ends of the attachments with their pipe-rotating devices in engagement with the coupling or collar.

10. In a well-drilling apparatus, a rotary table having a downwardly tapered opening, a tapered bushing therein, pipe-engaging means carried by the bushing, and means actuated by the rotation of the table for forcing the bushing downwardly.

Signed at Pittsburgh, Pa., this 10th day of February, A. D. 1916.

PHILIP A. SCHMUCK.