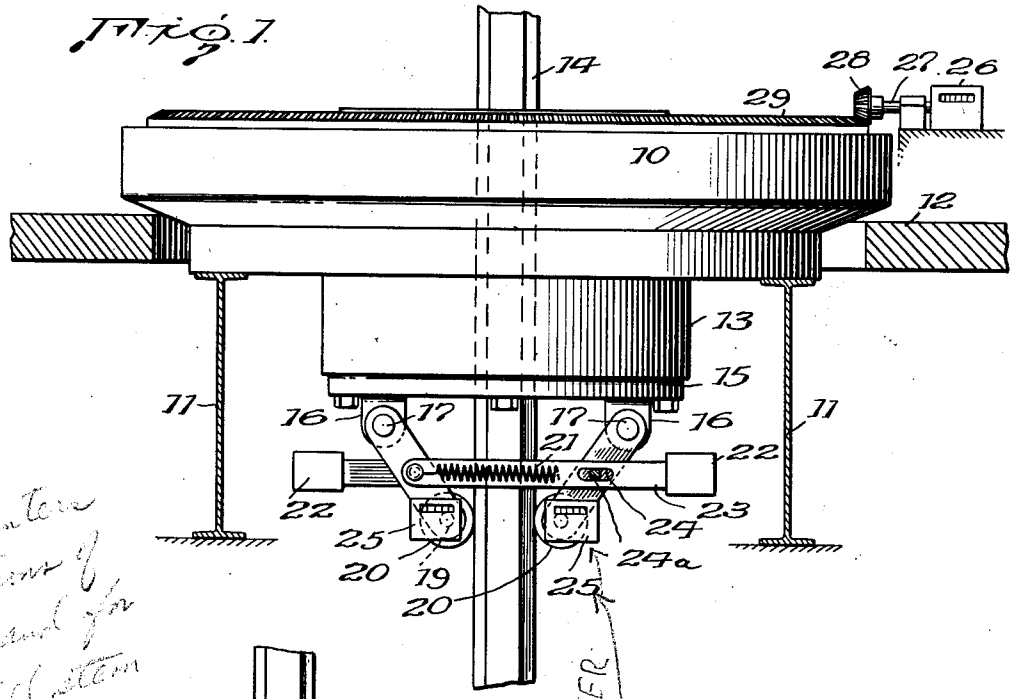
Sept. 17, 1940. S. W. MARSHALL, JR 2,215,047

ROTARY WELL-DRILLING APPARATUS

Filed Dec. 17, 1938

FIG. 1.



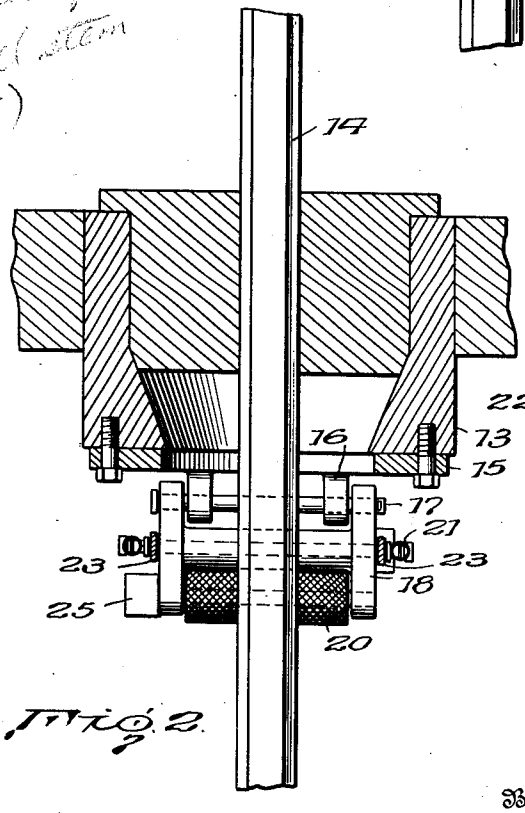


FIG. 2.

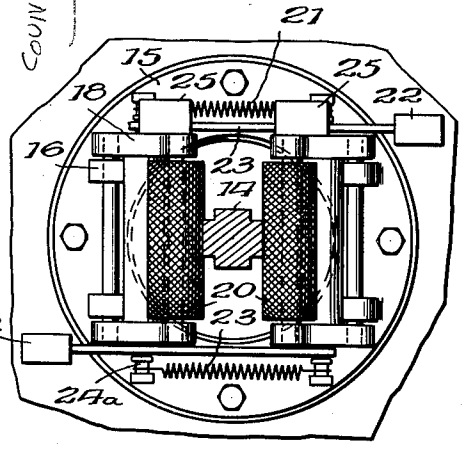


FIG. 3.

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ROTARY WELL-DRILLING APPARATUS

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Application December 17, 1938, Serial No. 246,423

5 Claims. (Cl. 255—1)

This invention relates to well-drilling apparatus and, particularly, to well-drilling apparatus of the rotary type.

The primary object of the invention is to provide rotary well-drilling apparatus with means for facilitating the determination of the nature of the geological formations penetrated in the drilling of the well hole.

A further object of the invention is to provide a rotary drilling apparatus with means for calculating the length of drill pipe or drill stem entering the well and simultaneously calculating the number of revolutions made by the rotary table, whereby the number of revolutions made by said table during the entry of a given length of drill stem into the well hole will accurately indicate the density or hardness of the formation penetrated by the drill bit.

A still further object of the invention is to provide means for calculating the length of drill pipe or drill stem entering the well hole through the usual bore in the rotary table, such means being so arranged as not to interfere with the connecting or disconnecting of successive sections of drill stem.

More specifically, the invention contemplates a rotary drilling apparatus having a counter mechanism operatively associated with the rotary table, whereby the rotations of the table will be recorded and one or more counter mechanisms operatively associated with the drill stem at a point below the rotary table for recording the length of drill pipe or drill stem entering the well hole. These latter recording mechanisms are operatively associated with the drill stem beneath the table by means of swingable brackets carrying rollers engageable with the drill stem, said brackets being pivoted in lugs provided on the under surface of the drill table.

A still further object is the provision of counterweight means for insuring sufficient frictional contact between the drill stem and the counter-actuating rollers.

With these and other objects in view, the invention consists in certain details of construction and combinations and arrangements of parts, all as will hereinafter be more fully described, and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawing—

Figure 1 is an elevational view illustrating, more or less diagrammatically, the table and drive bushing of a rotary drilling apparatus, with the present improvements installed thereon;

Fig. 2 is a similar view, taken at right angles to Fig. 1; and

Fig. 3 is a bottom plan view.

As illustrated in Fig. 1, and in accordance with usual practice, the rotary table 10, indicated more or less in outline, is supported on beams 11 in an opening in the derrick floor 12. The rotary table comprises the drive bushing 13 below the table proper, and is formed with a central bore through which the drill stem 14 is adapted to pass in entering or being lowered into the well hole. Below the table, means are provided for recording the length of drill stem lowered through the table and bushing. Preferably, a mounting plate 15 is secured to the under surface of the table or bushing and said plate is provided with a plurality of lugs 16 arranged in pairs at opposite sides of the bore in the bushing and table. Pivoted in each pair of lugs 16 is a pivot pin 17 and carried on said pivot pins 17 are roller brackets 18. Each bracket comprises side arms in which the pivot pin 17 is received at one end and in the other, or free, ends of said arms there is journaled a roller shaft 19 carrying a roller 20 between the arms of the bracket. As will be apparent, the roller bracket arms are free to swing toward and from each other but, under normal conditions, they are yieldingly urged toward one another by springs 21 connected at their opposite ends to the two brackets. The normal tendency of springs 21 is to draw the two brackets toward one another, thus bringing the rollers 20 closer together and toward the vertical plane of the bore in the table, so that they will firmly engage against a drill stem extending below the table into the well hole. However, due to centrifugal force developed by the rotary motion of the table when in operation, there is a tendency for the roller brackets and rollers to move away from one another to whatever extent the tension of springs 21 might be overcome by such force. For this reason, the counterweights are also provided to offset this tendency of centrifugal force to move the brackets and rollers away from each other. Preferably, the counterweights are arranged as best illustrated in Fig. 1, wherein each counterweight 22 is illustrated as being carried at one end of an arm 23. Each arm 23 is of sufficient length to span the space between the brackets 18, so that one end of the arm can be pivotally attached to one of the brackets 18 with its opposite end carrying the counterweight projecting laterally beyond the other bracket, and with its intermediate portion connected to the other bracket

by a lost motion connection. For instance, each counterweight arm is provided with a slot **24** in which a pin **24a** on said other bracket **18** is received. Thus, intimate contact of the rollers **20** with the drill stem is insured at all times, regardless of the speed of rotation of the table. This is due to the fact that radially outward movement of each counterweight by centrifugal force will result, first, in the bracket to which the counterweight arm is pivoted being pulled toward the drill stem and, second, in the counterweight arm being raised due to the swinging of said bracket. This upward movement of the counterweight arm causes the other bracket to which it is connected by the pin and slot connection to also be moved toward the drill stem by reason of the wall of the slot pressing against the pin, it being understood that the bracket is to one side of its dead center so that pressure on the pin swings the bracket closer to the drill stem.

For denoting the length of pipe lowered into the well, a Veeder counter mechanism is mounted on one or both of the shafts **19** of rollers **20**. One counter mechanism will suffice, but it is preferred that there be a counter on each of the shafts **19** in order that one may be checked against the other. As will be understood, these counter mechanisms **25** will record the number of revolutions imparted to the rollers **20** by the drill stem entering the well hole and, of course, with the circumference of the roller known, the number of revolutions thereof can be quickly translated into feet and inches to determine the length of pipe passing into the hole. If desired, the counters **25** may be located at a fixed point to facilitate reading thereof. For instance, registration from rollers **20** might be transmitted to a point located within convenient sight of the driller. In conjunction with these counter mechanisms **25** and for the purpose of indicating the nature of the geological formations penetrated by the drill bit (not shown), another counter mechanism **26** is operatively associated with the shaft **27** by which the rotary table **10** is rotated. A gear **28** on shaft **27** meshes with a ring gear **29** on the table, so that the number of revolutions of the table will be indicated by the counter mechanism **26**. Thus, with the number of revolutions of the table required for advancing a given length of drill stem into the hole known, a rather accurate estimate can be made of the density or penetrability of the formation penetrated by the drill bit. Stated conversely, it can be determined from the counters **25** when, say, one foot of drill stem has entered the well hole and, at the same time, it can be determined from the counter mechanism **26** how many revolutions the table has made in advancing the stem that distance and, by comparing this unit of length with succeeding, corresponding units of length of drill stem, the relative densities of successive formations encountered by the drill bit can be determined.

Preferably, the rollers **20** have knurled surfaces, so as to increase their frictional contact with the drill stem.

What I claim is:

1. In a rotary well-drilling apparatus comprising a rotary table having a central bore therein for a drill stem, the combination of a plurality of bearing lugs beneath said table arranged in pairs at opposite sides of said bore, a roller-supporting bracket pivoted in each pair of lugs and depending below said table, a roller shaft in each bracket, a roller on each roller shaft, means yieldingly urging said brackets and rollers toward each other, and counter mechanisms operatively associated with both of said roller shafts.

2. In a rotary well-drilling apparatus comprising a rotary table having a central bore therein for a drill stem, the combination of a plurality of bearing lugs beneath said table arranged in pairs at opposite sides of said bore, a roller-supporting bracket pivoted in each pair of lugs and depending below said table, a roller shaft in each bracket, a roller on each roller shaft, means yieldingly urging said brackets and rollers toward each other, said means comprising springs connecting said brackets and counterweights carried by said brackets, and counter mechanisms operatively associated with both of said roller shafts.

3. In a rotary well-drilling apparatus comprising a rotary table having a central bore therein for a drill stem, a roller mounting plate secured to the under surface of said table and formed with an opening in registry with said table bore, depending roller brackets pivoted on said plate at opposite sides of said opening, means yieldingly urging the brackets toward the bore of the table, a roller shaft journaled in each bracket, rollers fixed on said shafts, and a counter mechanism operatively associated with each of said shafts.

4. In a rotary well-drilling apparatus comprising a rotary table having a central bore therein for a drill stem, a roller mounting plate secured to the under surface of said table and formed with an opening in registry with said table bore, depending roller brackets pivoted on said plate at opposite sides of said opening, means yieldingly urging the brackets toward the bore of the table, a roller shaft journaled in each bracket, rollers fixed on said shafts, a driven shaft for rotating said table, a counter mechanism operatively associated with said driven shaft and a second counter mechanism operatively associated with one of said roller shafts.

5. In a rotary well-drilling apparatus comprising a rotary table having a central bore for a drill stem, the combination of a pair of roller-supporting brackets swingably depending from said table at opposite sides of said bore, a roller journaled in each bracket, a counter mechanism associated with at least one of said rollers to record the revolutions thereof, and means for yieldingly urging said roller brackets toward each other comprising a counterweight and a counterweight arm pivoted at one end to one of said brackets and connected intermediate its ends to the other bracket by a pin and slot connection.

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