Aug. 19, 1930. F. C. LAWRENCE ET AL 1,773,231

TRUE BORE FORMING GUIDE FOR ROTARY DRILL STEMS

Filed July 25, 1929 2 Sheets-Sheet 1

Fig. 1.

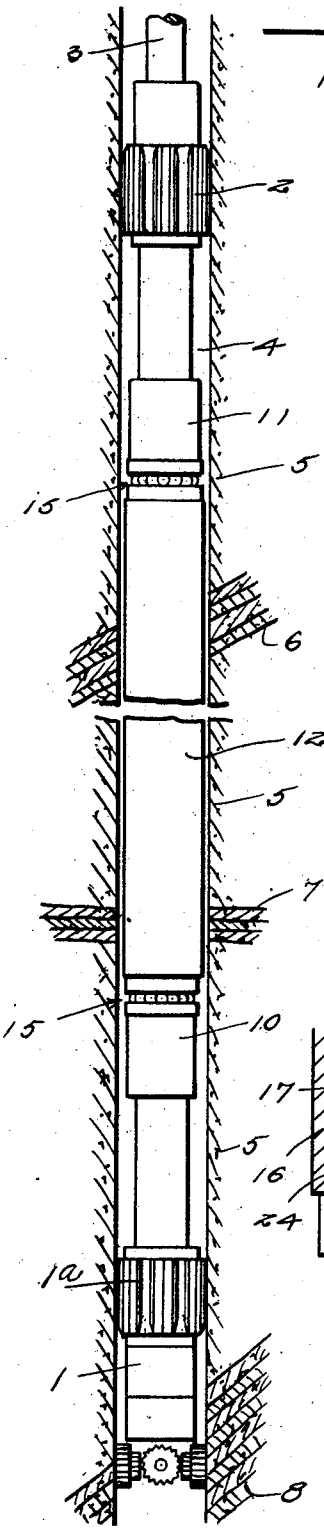


Fig. 4.

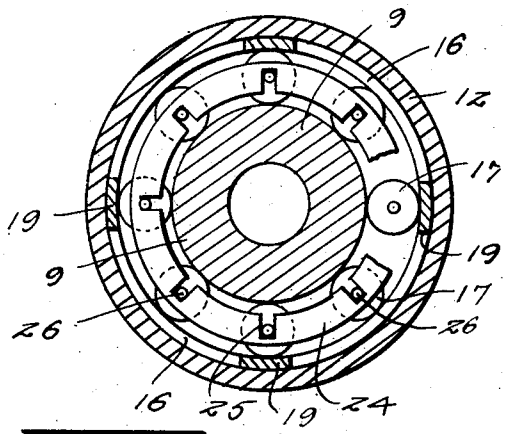
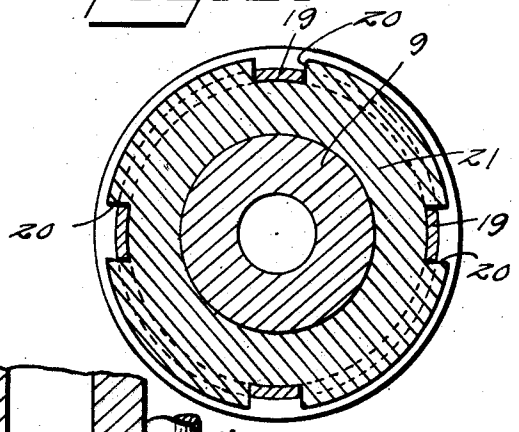


Fig. 5.



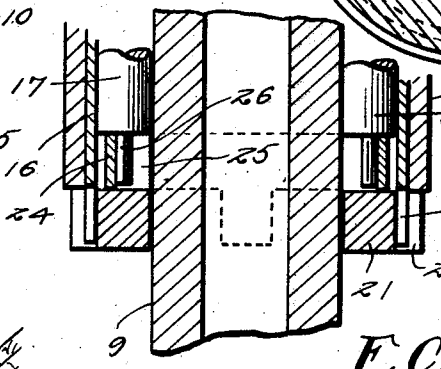


Fig. 6.

Inventor

F. C. Lawrence

J. P. Winters

By Watson E. Coleman

Attorney

Aug. 19, 1930. F. C. LAWRENCE ET AL 1,773,231

TRUE BORE FORMING GUIDE FOR ROTARY DRILL STEMS

Filed July 25, 1929 2 Sheets-Sheet 2

Fig. 2.

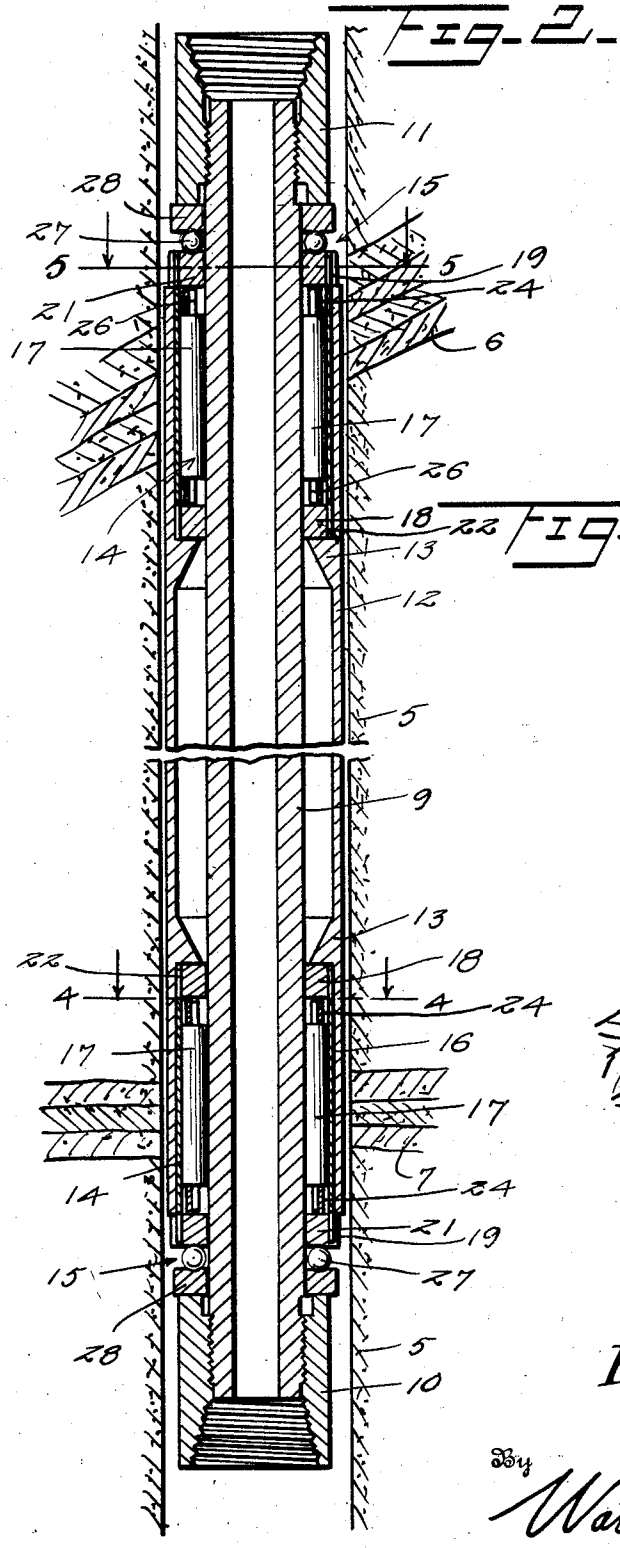
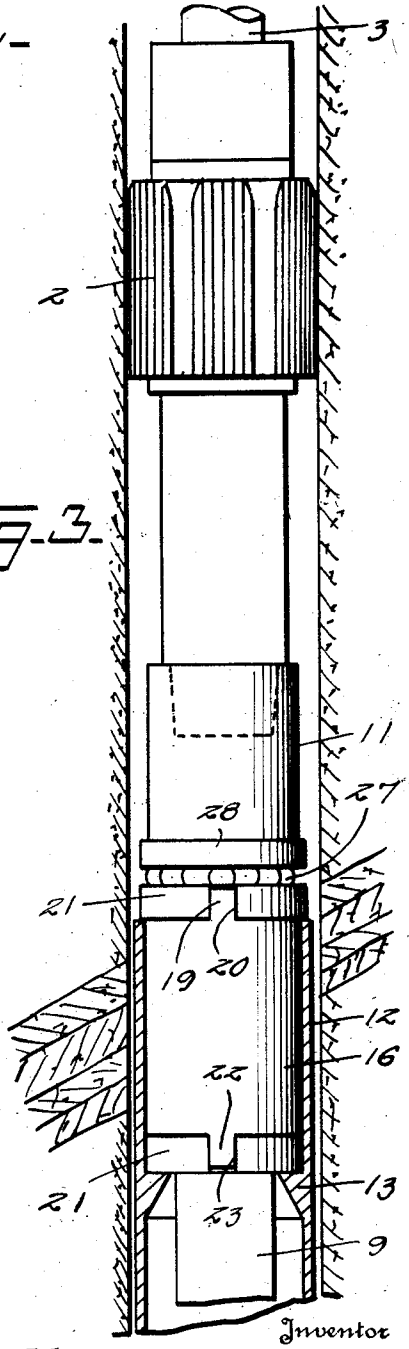


Fig. 3.



Inventor

F. C. Lawrence

J. P. Winters

By Watson E. Coleman

Attorney

Patented Aug. 19, 1930 1,773,231

UNITED STATES PATENT OFFICE

FRED C. LAWRENCE AND JOHN P. WINTERS, OF ELDORADO, KANSAS

TRUE-BORE-FORMING GUIDE FOR ROTARY DRILL STEMS

Application filed July 25, 1929. Serial No. 380,941.

This invention relates to deep well drilling apparatus of that type embodying a rotary drill stem.

The invention has for one of its objects to insure the formation of true vertical bores by apparatus of this character, and to attain this and other objects, the invention comprehends the provision of a novel guide which shall be adapted to prevent slanting strata of hard formation from deflecting the bit from its perpendicular path.

The invention further comprehends the provision of a guide of the character stated which shall be adapted to be applied to the drill stem immediately above the bit and remain out of contact with the wall of the bore during the vertical descent of the bit, which shall be adapted on the deflection of the bit to contact with the wall of the bore and cause the bit to travel vertically downward through the hard strata and which when in contact with the wall of the bore shall be adapted to offer little or no resistance to the rotation of the stem.

The invention still further comprehends the provision of a guide of the character stated which shall be simple and durable and capable of being readily applied to the drill stem between the bit reamer and the follow-up reamer thereof.

The invention consists in the construction, combination and arrangement of parts hereinafter fully described and claimed and illustrated in the accompanying drawings, wherein:—

Figure 1 is a view in side elevation of the lower portion of a drill stem equipped with a guide constructed in accordance with our invention, the stem being illustrated in the act of forming a bore;

Figure 2 is a sectional view taken on a plane extending vertically and centrally through the guide, the guide being shown in normal position in the bore;

Figure 3 is a view partly in vertical section and partly in elevation of the upper portion of the guide and the adjacent portion of the drill stem;

Figure 4 is a sectional view taken on the horizontal plane indicated by the line 4—4 of Figure 2;

Figure 5 is a sectional view taken on the horizontal plane indicated by the line 5—5 of Figure 2; and

Figure 6 is a sectional view taken on a plane extending vertically and centrally through the lower portion of the guide.

Referring in detail to the drawings, 1 designates the rock drill or bit, 1ª the lower or bit reamer, 2 the upper or follow-up reamer, and 3 the pipe of a rotary drill stem, which is illustrated as having formed a vertical bore 4 through strata of shale 5, a slanting stratum of rock 6 and a horizontal stratum of rock 7, and which is illustrated as continuing the bore vertically through a slanting stratum of solid rock 8. As the parts 1, 2 and 3 are of well known construction, they are illustrated diagrammatically and a further description of the same is deemed unnecessary.

In accordance with our invention, the drill stem is provided, between its bit reamer 1 and its follow-up reamer 2, with a guide which is adapted to cause the bit to follow a vertical or perpendicular path. This guide comprises a stem 9 of hollow formation and having its lower and upper ends externally screw threaded for the application thereto of collars 10 and 11. An upset or tube 12 surrounds the stem 9. The tube 12 is shorter than the stem 9, and is arranged upon the stem with its ends similarly spaced from the ends of the stem. The tube 12 is provided with inner annular shoulders 13 which are similarly spaced from the ends thereof. Radial thrust bearings 14 are arranged between the stem 9 and tube 12, and axial thrust bearings 15 are arranged between the collars 10 and 11 and the tube.

The bearings 14 are arranged within the

end portions of the tube 12, and are maintained against axial displacement in the direction of each other by the shoulders 13. The bearings 14 are similar, and they comprise steel sleeves 16 contacting with the inner surface of the tube 12, and steel rollers 17 arranged between and contacting with the stem 9 and the sleeves. Washers 18 are arranged between the shoulders 13 and the adjacent or inner ends of the sleeves 16, and are connected to the sleeves by fingers 19 projecting axially from the inner ends of the sleeves and engaging in slots 20 in the peripheries of the washers. Washers 21 are arranged in contact with the ends of the tube 12 and the adjacent or outer ends of the sleeves 16, and are connected to the sleeves by fingers 22 extending axially from the outer ends of the sleeves and engaging in slots 23 in the peripheries of the washers.

The rollers 17 are held in circumferentially spaced relation by spacing rings 24 which are arranged within the sleeves 16 and provided with slots 25 for the reception of pins 26 on the end of the rollers. The sleeves 16 constitute containers for the double acting rollers 17 of the bearings, and the rollers are held within the sleeves or containers by the stem 9 and washers 18 and 21. As the rollers of each of the bearings 14 in themselves constitute a unit, they have a free double action motion.

The bearings 15 are similar and comprise steel balls 27 arranged between the washers 21 and washers 28 contacting with the collars 10 and 11. The washers 21 constitute the inner races and the washers 28 the outer races of the bearings 15. The washers 21 form solid abutments for the ends of the tube 12.

The guide is arranged between the drill and reamer 1 and the follow-up reamer 2, and it is connected to these parts by the collars 10 and 11. The stem 9 is of hollow formation to establish communication between the interior of the drill and reamer 1 and the pipe 3. The tube 12 is of considerable length. It will be approximately twenty feet in length when used in connection with a drill stem embodying a six inch pipe, and it will have an external diameter slightly smaller than the diameter of the bore to be drilled. The tube 12 and the other parts of the guide may be made of any desired or required size, their size depending upon the size of the drill stem in connection with which the guide is to be used.

In practice, the tube 12 remains out of contact with the wall of the bore being drilled during such time as the bit is free to follow a vertical or penpendicular path. When the bit encounters a stratum, such for instance as a slanting stratum of rock, which tends to deflect it from its vertical path, the tube 12 will, as the result of the deflection of the bit, be carried into contact with the wall of the bore. The contact between the tube 12 and the wall of the bore resists the further deflection of the bit and tends to force the bit to continue straight downwardly through the hard strata. After the bit has been guided into its proper path, the tube 12 will again occupy its spaced relation with respect to the wall of the bore. When the tube 12 is in contact with the wall of the bore, it does not interfere with the free rotation of the drill stem due to the fact that it is mounted on the stem 9 through the medium of radial and axial thrust bearings, the bearings being of such construction and so arranged as to insure the free rotation of the drill stem while the tube is held against rotation by reason of its contact with the wall of the bore. After the tube 12 has passed the small deflection in the wall of the bore caused by the slight deflection of the bit necessary to carry the tube into contact with the wall of the bore, the follow-up reamer 2 will free the bore of this deflection, with the result that the tube and bit may be freely removed from the bore whenever desired.

There is no tension or weight on the tube 12 while the bit is following a vertical path. The tube 12 rides freely with the drill and it is never under any torsion until the bit is deflected by a stratum of rock.

The guide will also prevent the formation of bores of irregular form transversely when the bit is entering a hard formation, due to fact that the action of the tube on the wall of the bore will prevent the bit from wobbling at all times. As the bit is held from wobbling the wear and tear on its cones is reduced to the minimum. The sleeves 16 may, if desired, be provided with grease nipples in order to permit the bearings 15 to be supplied with lubricant whenever the drill stem is removed from the bore for the purpose of installing a freshly dressed bit. After the deflection of the bit has been arrested and the bit proceeds downwardly, the contact between the tube 12 and the wall of the bore will not interfere with the free rotation of the pipe 3 due to the mounting of the tube through the medium of the radial and axial thrust bearings 14 and 15.

While we have described the principle of the invention together with the structure which we now consider the preferred embodiment thereof, it is to be understood that the structure shown is merely illustrative and that such changes may be made, when desired, as fall within the scope of the invention as claimed.

We claim:—

A guide for a rotary drill stem, comprising a hollow stem, a tube surrounding the stem and provided with inner annular shoulders, washers arranged within the tube and in contact with the shoulders, washers ar-

ranged on the stem in contact with the ends of the tube, sleeves arranged within and contacting with the tube and having their ends connected to the washers, and bearing rollers arranged between and contacting with the stem and sleeves.

In testimony whereof we hereunto affix our signatures.

FRED C. LAWRENCE.
JOHN P. WINTERS.