T. H. SLAVIN.

WELL BORING APPARATUS.

APPLICATION FILED APR. 24, 1913.

1,273,099. Patented July 16, 1918.

Fig. 2.

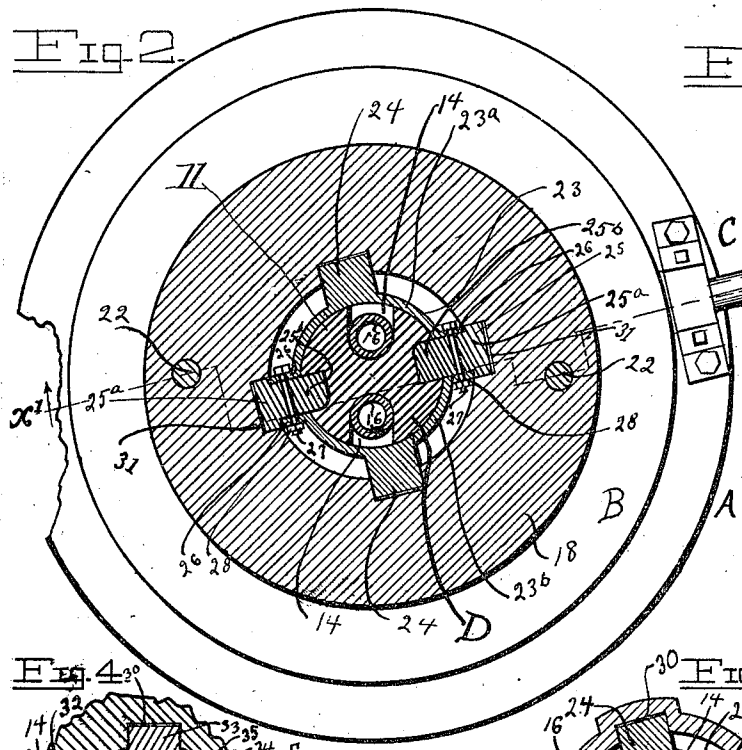


Fig. 5.

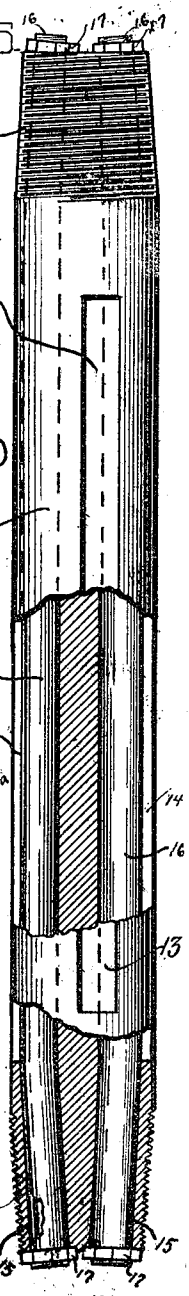


Fig. 4.

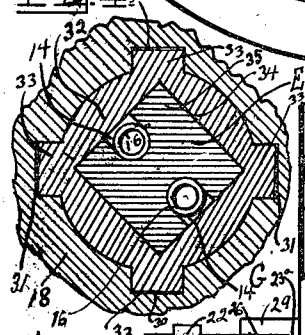


Fig. 3.

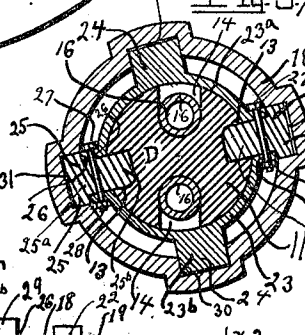


Fig. 1.

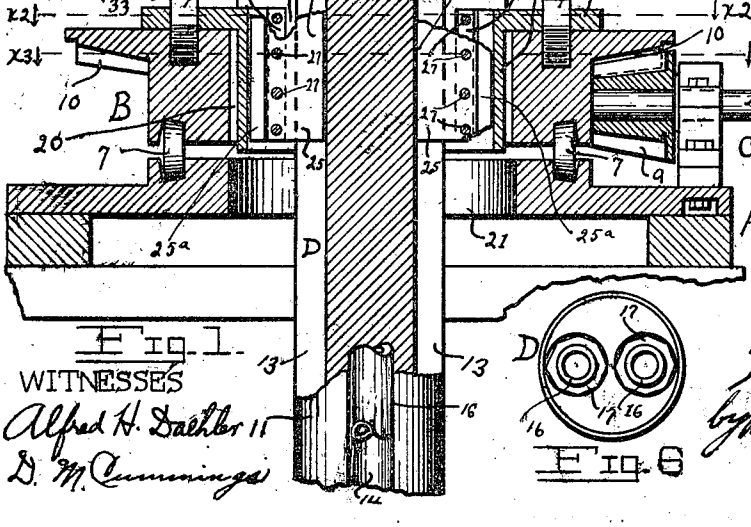


Fig. 6.

WITNESSES

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HIS ATTORNEY

UNITED STATES PATENT OFFICE.

THOMAS H. SLAVIN, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO CHARLES E. WILCOX, OF BAKERSFIELD, CALIFORNIA, AND ONE-HALF TO WILLIAM W. WILSON, OF LOS ANGELES, CALIFORNIA.

WELL-BORING APPARATUS.

1,273,099. Specification of Letters Patent. Patented July 16, 1918.

Application filed April 24, 1913. Serial No. 763,345.

To all whom it may concern:

Be it known that I, THOMAS H. SLAVIN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Well-Boring Apparatus, of which the following is a specification.

This invention relates to well boring apparatus and particularly to apparatus for drilling or boring deep wells for the extraction of oil and other fluids. In such apparatus it is customary to employ a string of pipe which is lowered in the well as the development of the same proceeds, and at the lower end of which the drilling or boring tool or device is provided. Means are provided at the surface for rotating such string of pipe to actuate the boring or drilling tool or device. What is customarily designated as a rotary top is provided, the same co-acting with the string of pipe, directly or through suitable devices or operative connections, causing the rotation of the string of pipe and the drilling or boring tool. Suitable means are provided for driving the rotary top. The present invention relates to the organization of the string of pipe, or a length or portion thereof which is used to rotate the string, and also to the means or devices which co-act with the pipe or said joint or portion thereof and further co-act with the rotary top so as to unite the string and the rotary top in a rotative couple. Many attempts have been made to perfect and simplify devices and means adapted for this service, so as to produce the proper gripping or interlocking relation permitting rotation and likewise vertical or endwise movement of the string, together with that simplicity and inexpensiveness of organization which are desiderata in such apparatus.

The invention further relates to the construction and organization of the string or that joint or portion thereof to which the rotative action is directly transmitted from the rotary top. Certain features of a circulatory system for water or the like enter into the construction and organization of this operative length or joint of the string of pipe.

The invention further has for its object to provide apparatus inclusive of the general features above stated which will be generally superior in efficiency and serviceability, durability, facility in installation and attachment or detachment and adjustment, positiveness in operation, and adaptability to varying conditions of service.

With the above and other objects in view, the invention consists in the novel and useful provision, formation, construction, combination and association of parts, members and features hereinafter described, shown in the drawing, and finally pointed out in claims.

In the drawing:

Figure 1 is a vertical transverse sectional view of well boring apparatus constructed and organized in accordance with the invention, and taken on the line x^1—x^1, Fig. 2, and looking in the direction of the appended arrows;

Fig. 2 is a transverse horizontal view of the same, taken on the line x^2—x^2, Fig. 1, and looking in the direction of the appended arrows;

Fig. 3 is a similar fragmentary view taken upon the line x^3—x^3, Fig. 1, and looking in the direction of the appended arrows;

Fig. 4 is a fragmentary view similar to Fig. 2 and showing a modified form of construction;

Fig. 5 is a side elevation, partially broken away and in section, of a feature of the improvements shown in the other figures, being in detached position; and

Fig. 6 is a top plan view of the showing in Fig. 5.

Corresponding parts in all the figures are designated by the same reference characters.

Referring with particularity to the drawing, A designates the base or frame and B the rotary top or table of the rotary well boring apparatus, anti-friction devices 7 being disposed between the base frame and the top, and operating means C being provided for rotating the top upon the base frame, and including a drive shaft 8 and a gear 9 meshing with teeth 10 upon the table top, in accordance with the usual practice. D designates a member of the boring string

which is constructed or modified in practising the invention. In Fig. 4 I show a joint or string member E which is varied in construction from the member D. F designates means of operative connection between the rotary table top and the member D in all the figures but Fig. 4; and G designates corresponding means of operative connection in the construction shown in Fig. 4. Each of these means serve to interlock the member D or E with the rotary table top so that they jointly rotate, causing the rotation of the boring tool at the lower end of the string.

Referring now to all the figures but Fig. 4, the member D is shown as comprising an elongated solid cylindrical body 11, which is slightly tapered at its ends and exteriorly screw threaded at such ends, as at 12, such body being provided with longitudinal channels or grooves 13 in opposed portions of the body, the same being placed in the body in continuous formation between terminal points somewhat within the tapered threaded end portions of the body. Other channels 14, diametrically opposed, are produced in the body 11 alternating with the channels 13 around the cylindrical body, such channels, however, being spaced each less than 90° from one of the channels 13 and consequently more than 90° from the other channel 13, producing metallic masses or walls of greater thickness at one side of each of such channels 14 for the purposes hereinafter set forth. The channels 14 are produced lengthwise of the body 11 continuously and somewhat beyond the terminations of the channels 13, as clearly shown in Fig. 5, the terminal portions of such channels 14 being, however, respectively below and above the tapered end portions of the body 11; and through each of said tapered end portions are produced divergent bores 15. The pipes or tubes 16 of a circulating system are passed into the channels 14, the ends thereof being bent to project within the respective communicating bores 15. To the ends of each of the pipes 16 are applied lock-nuts 17 retaining the pipes against longitudinal displacement.

It will be understood that I define the body or stem 11 as solid to distinguish it from the pipe of lengths or joints of which rotary strings are ordinarily made up. The invention in this respect concerns the provision of a channel or passage or duct for the supply of liquid through or past the stem or drive portion of the string, such stem or drive portion being in the form of a strong torsion-resisting, string-rotating shaft or beam or column or post so channeled or bored, rather than in the form of a pipe.

The operative connections F between the member D and the table top B comprise a bushing 18 having a top annular flange 19 resting upon the table top, the bushing 18 likewise being annular and fitting down within a central circular opening 20 in the table top B, which opening registers with the central vertical opening 21 in the base frame A and likewise with the orifice of the well hole. The bushing 18 is coupled with the table top B to rotate with the same by pins or the like 22. Between the bushing 18 and the member D is disposed a built-up bushing 23 which comprises two bowed portions 23^a and 23^b which fit the outer surface of the member D in a common curvature. Each of these bushing portions 23^a and 23^b is provided with a fixed or integral vertical tongue or head 24, and such members or portions 23^a and 23^b are joined together at their vertical edges with and by separable tongues 25. The members 23^a and 23^b have outwardly ranging vertical edge flanges 26. Between the opposed flanges 26 of each pair of such flanges, one upon each of such bushing members, the tongues 25 are clamped by bolts 27 passing transversely through such tongues or heads and the flanges and having nuts 28 detachably holding the parts together. The bushing members 23^a and 23^b are provided each with an outwardly projecting flange 29 which rests upon the upper surface of the flange 19 on the bushing 18, holding the entire built-up bushing 23 against displacement downwardly within the table opening 20. The integral heads or tongues 24 take into vertical channels 30 in the side walls of the bushing 18 to lock the bushing 23 and the bushing 18 together for joint rotation. The tongues 25 are provided with outwardly projecting T-heads 25^a taking into vertical channels 31 in the walls of the bushing 18. The channels 30 and 31 are arranged in spaced relation 90° apart in the bushing 18, the heads 24 and 25 being correspondingly spaced upon the bushing 23. The tongues 25 are provided with inwardly directed heads 25^b which take into the channels 13 upon the member D. The heads 24 and 25^a and 25^b all have a proper working fit with the walls of the channels 30 and 31 and 13; and when the heads 24 and 25^a and 25^b are in the said channels and the parts are assembled as shown, the member D is interlocked with the bushing 23 and the bushing 23 is interlocked with the bushing 18 which in turn is locked by the pins 22 to the table top B, so that upon rotation of the table top it rotates jointly therewith and the member D is moved. The elongation of the channels 13, with respect to the vertical extent of the bushing 23, permits the member D to play vertically in the operation of the boring string, at the same time that the boring string is rotated.

It will be understood that the string, of which the member D constitutes a part in operation, is continued on below the mem-

ber D, being coupled on to the lower end of the member D at the screw threaded tapered lower portion 12 thereof. Similarly, the suspension means for the string are coupled on to the upper threaded tapered end of the member D, together with the means for supplying liquid for the circulation system including the pipes or tubes 16. None of these remaining features of the string or of the circulation system or suspension means are shown in the drawing, nor will the same be described, as they do not *per se* enter into the invention in any particular manner or in any manner involved in the specific construction.

It will be understood that the members 23^a and 23^b of the bushing 23 are assembled together upon the member D, together with the heads 24 and tongues 25, the heads 25^b being introduced within the channels 13 in such process of assembling. The member D with the bushing 23 are then assembled with the bushing 18, previously installed in connection with the table top B, the heads 24 and heads 25^a being interengaged with the bushing 18 in the channels 30 and 31 therein. The parts are now in position and connection for rotating the string through the bushings 18 and 23 upon the rotation of the table top. And when it is desired to add a fresh joint of pipe the string is raised by means of the member D and the suspension means above it, the member D raising the bushing 23 clear of the bushing 18 by interengagement of the lower end walls of the channels 13 with the heads 25^b. When the fresh joint of pipe has been added to the string, it is coupled on to the lower threaded end of the member D and that member is again lowered to interengage the bushing 23 with the bushing 18 and permit the rotary operation to proceed.

In the form of construction shown in Fig. 4, the bushing 18 is utilized, being pinned to the table top in the same manner as shown in the other figures, and being of the same construction. In place of the bushing 23, however, I utilize a one-piece or integral bushing 32 which has a plurality of outwardly projecting heads 33 arranged preferably 90° apart and taking into channels 30 and 31 in the bushing 18 for similar interlocking purpose. The member E of the string shown in Fig. 4 is disclosed as square in cross-section, so that it may be passed within a cross square bore 34 in the bushing 32 and thus interlocked therewith for joint rotation. The use of exterior driving channels such as 13 is thus made unnecessary. The pipes 16 of the circulation system are set into similar side channels 14 in the body 35 of the member E, and it is to be understood that these channels at their ends communicate with divergent end bores 15 in the tapered ends of the body 35, such tapered ends and the other features last referred to not being shown but being identical in provision and arrangement and formation with the corresponding features shown in the other figures. The parts of the construction shown in Fig. 4 are assembled by passing the bushing 32 over the end of the member E, thus interlocking the two stated parts together. The bushing 32 is then interlocked with the bushing 18 by means of the heads 33 and the channels 30 and 31. The parts so interlocked are operated in the rotation of the string which is connected with the member E, in the same manner as set forth with respect to the other construction, and suitable suspension means and other parts of the circulation system are coupled on to the upper end of the member E in the same manner as described. When the member E is raised away from the remaining portions of the string to permit insertion or addition of a fresh joint of pipe, the coupling at the lower end of such member E will engage with the bushing 32 and raise it up out of the bushing 18 so that the fresh joint may be passed through such latter bushing.

The construction of the bushing 23, in its built-up form, permits of convenient assembling of the parts, and likewise permits of the substitution of fresh tongues 25 when the heads on said tongues become worn or mutilated. Should the heads 24 become mutilated fresh bushing members 23^a and 23^b with such heads may be substituted if necessary. Most of the wear will come upon the detachable tongues 25 which are made of harder material than the bowed members 23^a and 23^b with the integral heads 24; and therefore, ordinarily, any mutilation of the heads 24 may be cured by ordinary process of repair, so that under all ordinary circumstances the members 23^a and 23^b of the bushing 23 will be long lived and the only parts needing replacement, if such need arises, will be the detachable tongues 25. It will thus be seen that by providing such fresh tongues 25 the effects of ordinary wear will be remedied without substituting an entirely new inner bushing member. By spacing the channels 14 each farther away from one of the channels 13 than the other, I am enabled to provide increased thickness of metal ahead of the driving heads 25^b of the bushing 23, and between the channels 13 and the channels 14 in the direction of drive, having thus the advantage of the greater strength of such increase of metal over an arrangement of channels in which they were equi-distantly spaced throughout the series thereof.

I do not desire that my invention be considered as limited to any of the particular and specific features of construction, formation and relative arrangement and combi-

nation herein set forth, but that the invention be judged within a fairly broad spirit of its interpretation.

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

1. In a well boring apparatus, a boring string member beneath which members of the string and the boring tool are suspended, and a circulation pipe extending lengthwise of the member and exteriorly applied thereto.

2. In well boring apparatus, a boring string member, and a circulation pipe extending lengthwise of the member; said member comprising a body provided with a side channel within which the circulation pipe lies in part, and with end bores within which parts of the circulation pipe also extend.

3. In well boring apparatus, a boring string member, and a circulation pipe extending lengthwise of the member; said member comprising a body provided with a side channel within which the circulation pipe lies in part, and with end bores within which parts of the circulation pipe also extend; the ends of said body being threaded for connection with the remaining parts of the string.

4. In well boring apparatus, a boring string member, and a circulation pipe extending lengthwise of the member; said member comprising a body provided with a side channel within which the circulation pipe lies in part, and with end bores within which parts of the circulation pipe also extend; the ends of said body being tapered and threaded for connection with the remaining parts of the string, and said end bores therein extending through said tapered end portions in angular relation to said channel in said body.

5. In a well-boring apparatus, a boring string member, a circulation pipe extending lengthwise of the member; and lock nuts applied to the ends of the circulation pipe at and bearing against the ends of said member and opposing longitudinal displacement of said pipe.

6. In well boring apparatus, a boring string member having spaced channels extending lengthwise of the member and produced inwardly at the sides thereof, and circulation pipes lying in part within the channels.

7. In well boring apparatus, a boring string member having spaced channels extending lengthwise of the member and produced inwardly at the sides thereof, and circulation pipes lying in part within the channels; said member having bores extending through the ends of the member and communicating with the channels and within which other portions of the circulation pipes extend.

8. In well boring apparatus, a boring string member comprising an elongated body provided with a plurality of spaced longitudinal channels one of which is provided for engagement by a rotary table, and a circulation pipe extending in part in another of said channels.

9. In well boring apparatus, a boring string member comprising an elongated body provided with a plurality of spaced longitudinal channels one of which is provided for engagement by a rotary table, and a circulation pipe extending in part in another of said channels; said member having a bore produced lengthwise of the member at each end thereof and communicating with the channel within which lies said circulation pipe, and portions of the circulation pipe extending within said bores.

10. In well boring apparatus, a boring string member comprising an elongated body provided with two sets of longitudinal channels one of which sets is provided for engagement by a rotary table, and circulation pipes lying in the channels of the other set thereof, each of said channels within which said circulation pipes lies being unequally spaced from the channels of the other set thereof.

11. In apparatus of the character set forth, a boring string member comprising an elongated body provided with a plurality of longitudinal channels, certain of said channels terminating short of the ends of said body, and a circulation pipe lying in another of said channels, said body having an end bore communicating with one end of the pipe-receiving channel and within which bore a portion of the pipe extends.

12. In well boring apparatus, a boring string member having an outside lengthwise channel, and a circulation pipe extending lengthwise of the member in said outside channel therein.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS H. SLAVIN.

Witnesses:

ALFRED H. DAEHLER,

H. H. HARRIS.

Correction in Letters Patent No. 1,273,099.

It is hereby certified that Letters Patent No. 1,273,099, granted July 16, 1918, upon the application of Thomas H. Slavin, of Los Angeles, California, for an improvement in "Well-Boring Apparatus," were erroneously issued to Charles E. Wilcox and William W. Wilson as owners of the said invention, whereas said Letters Patent should have been issued to *Arthur G. Willard and William W. Wilson, as assignees, by direct and mesne assignments, of one-half interest each* in said invention, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of September, A. D., 1919.

[SEAL.]

M. H. COULSTON,

Acting Commissioner of Patents.

Cl. 255—28.