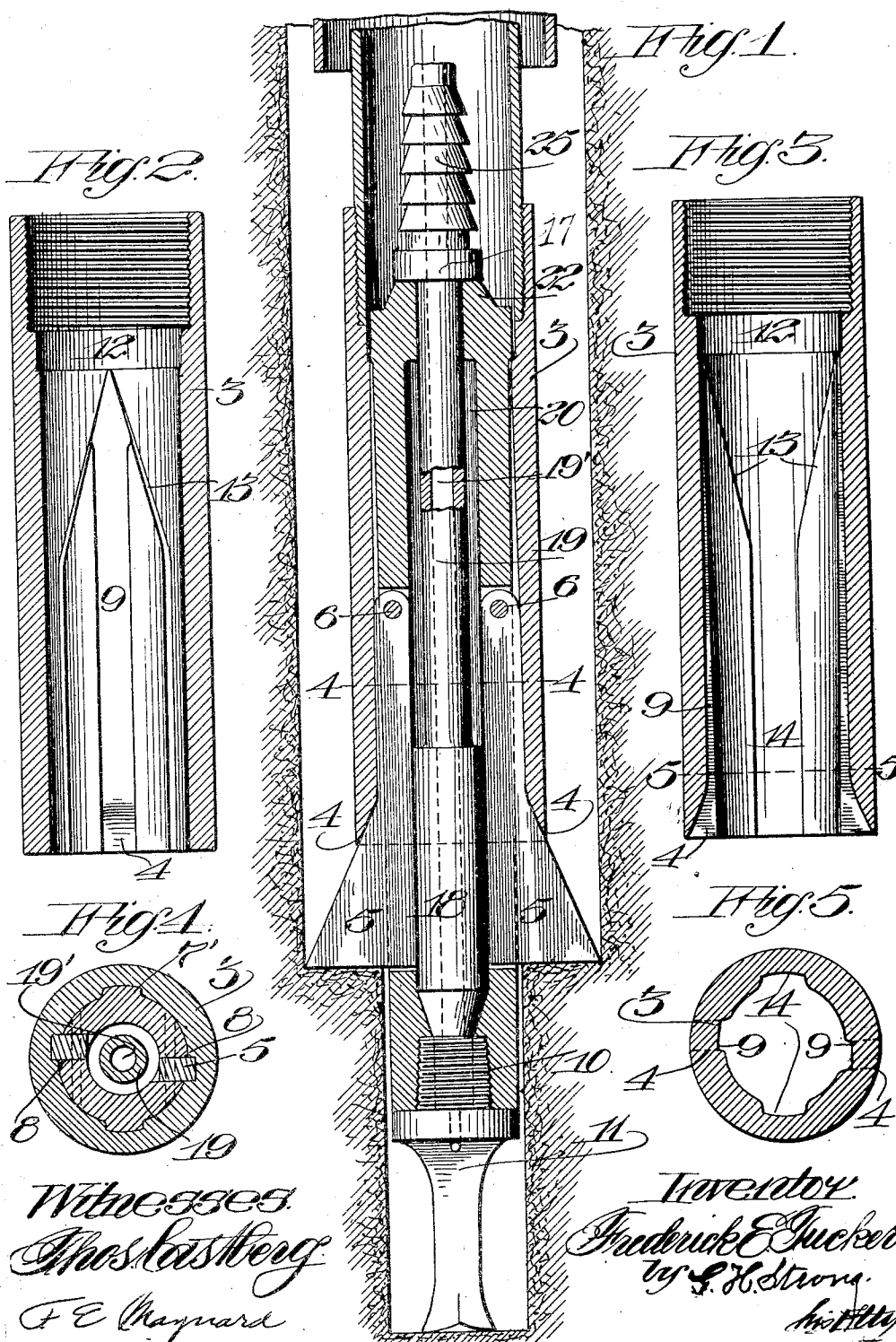


1,025,339.

F. E. TUCKER.
WELL BORING TOOL.
APPLICATION FILED DEC. 11, 1911.

Patented May 7, 1912.
2 SHEETS—SHEET 1.



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2 SHEETS-SHEET 2.

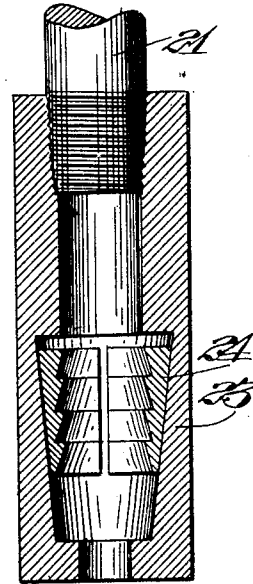
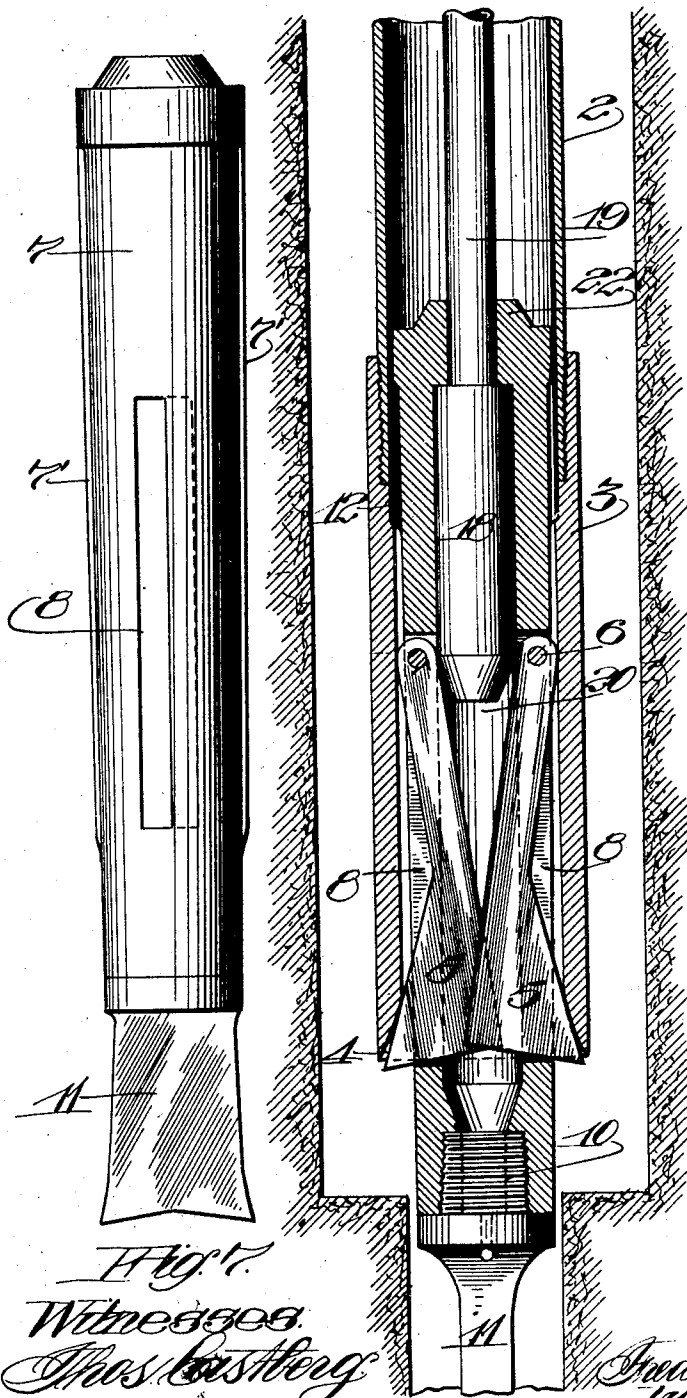


Fig. 8.

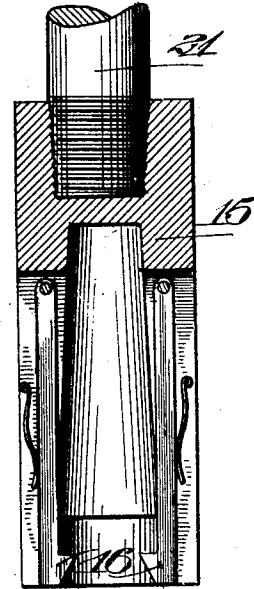


Fig. 9.

Witnesses
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Fig. 6.

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UNITED STATES PATENT OFFICE.

FREDERICK E. TUCKER, OF TAFT, CALIFORNIA.

WELL-BORING TOOL.

1,025,339.

Specification of Letters Patent.

Patented May 7, 1912.

Application filed December 11, 1911. Serial No. 665,085.

To all whom it may concern:

Be it known that I, FREDERICK E. TUCKER, a citizen of the United States, residing at Taft, in the county of Kern and State of California, have invented new and useful Improvements in Well-Boring Tools, of which the following is a specification.

This invention relates to well-boring apparatus, and particularly to an improved cutter mechanism.

The object of the present invention is to provide in rotary well-boring apparatus a structure of bits and cutters designed to be readily lowered into position adjacent the lower end of a rotatable stem; an important object of the invention being to provide such a cutter structure as will avoid the necessity of lifting and dismantling the stem, when necessary to replace, sharpen or adjust the cutter structure.

It is also an object of the invention to devise and provide a detachable cutter structure, which may be arranged and adjusted on the lower end of a revolving stem; the cutter structure being so designed that it may be released from a lowering apparatus so as to be disconnected with the superstructure of the boring machinery other than by means of the stem. Means are provided in the bit structure for the insertion and for the removal of the cutter structure at desirable intervals.

Among the varieties of apparatus employed for the sinking of deep wells, such, for instance, as oil wells, there are used in some instances rotating cutters, the bits of which are actuated rotatively by a suitable stem or connection extending upwardly to the mouth of the well. Ordinarily, whenever it is necessary to change the position of the parts of the cutters at the lower end of the revolving stem, the entire revolving stem and its cutters have to be elevated and dismantled section by section. This necessitates a great loss of time and is expensive, particularly in the sinking of very deep wells.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical sectional detail of the cutting structure in expanded cutting position at the bottom of the well. Fig. 2

is a vertical sectional detail of the shoe. Fig. 3 is a vertical sectional detail of the shoe at right angles to Fig. 2. Fig. 4 is a cross section on line 4—4, Fig. 1. Fig. 5 is a cross section on line 5—5, Fig. 3. Fig. 6 shows the cutters as collapsed in position for withdrawal or expansion relative to the shoe. Fig. 7 is a side elevation of the carrier and fishtail bit. Fig. 8 is a vertical sectional detail of the bit withdrawing clutch. Fig. 9 is a vertical sectional detail of a bit lowering clutch.

The present structure is designed for application and use with that type of well-drilling apparatus in which there is employed a driven rotary stem 2, which may be lowered as drilling proceeds through a casing, shown in Fig. 1; the stem 2 continuing to the upper end of the well and being operated by a rotating structure, not shown.

The stem 2 is of somewhat smaller diameter than the well casing, and the two are lowered together as the drilling proceeds, with the cutting bit and stem considerably in advance of the lower end of the well casing. Since the stem 2 is of less diameter than the casing, it is frequently packed therein with any suitable material to prevent the upward flow of water or other fluid between the inside of the casing and the exterior of the stem 2, thus keeping the well casing free by external circulation.

In the present illustration of my invention, there is shown as suitably connected to the lower end of the stem 2 a shoe 3 of suitable proportion and design, the lower end of which is internally and angularly slotted, as at 4, to form seats for the lateral cutters or reamers 5, which are shown in Fig. 4 as arranged in offset relation so that they may be collapsed when swung about suspending pivots 6 to the position indicated in Fig. 6; the pivots being secured in a suitable carrier or filler 7, which is slotted on its opposite sides, as at 8, Fig. 4, to receive the swinging cutters 5.

The carrier 7 is shown as externally tapering, so as to have a snug fit with a conical bore or chamber in the shoe 3; the latter being provided with channels or guideways 9, into which the pivoted cutters swing and seat themselves when expanded, as shown in Fig. 1. The lower end of the carrier 7 is threaded, as at 10, to receive a fishtail

cutter 11, the extreme width of the lower end of which is adapted to cut a hole somewhat larger than the diameter of the lower end of the carrier 7. As the carrier 7 with the fishtail 11 attached is lowered through the stem 2, the cutting faces of the cutter 11 will enter an annular portion 12 adjacent the upper end of the shoe 3, and be guided between converging channels, indicated at 13, into slots 14, Fig. 5, thus automatically guiding and turning the cutter 11 to the proper diametral position, so that the cross cutters 5 will be brought into registration with their respective channels 9.

In assembling and removing the cutter structure, which includes the carrier 7, the cutter 11 and the reamers 5, a suitable clutch 15 is indicated in Fig. 9, having inwardly pressed pawls 16 adapted to be snapped around the enlarged upper end 17 of an expander 18; the expander being provided with a head portion at its lower end and a reduced stem portion 19. The head portion is reciprocable in an internal chamber 20 in the carrier 7, and when the carrier is being lowered by means of the clutch 15 embracing the head 17 of the expander, the weight of the carrier and its superposed tools is carried on the shoulder at the upper end of the head 18; the clutch 15 being connected by a suitable connection 21, Fig. 9, which extends upwardly to the upper end of the well, from which point the cutters are lowered.

Assuming that the rotary stem 2 with its attached shoe 3 has been advanced into a well hole and that it is desired to insert the cutter structure, the clutch 15 embracing the upper end of the expander 19 is lowered with the carrier 7 resting on the shoulder of the head 18 of the expander. As the lowering proceeds to a point when the tapering carrier 7 will seat in the shoe 3, then the motion of the carrier 7 will cease, while the expander 19 may be lowered, so that its head portion 18 will pass between the collapsed reamers 5, as at Fig. 6; these being then expanded to the position shown in Fig. 1, when the carrier has been finally seated and the expander permitted to actuate the reamers.

It will be understood that during the lowering of the carrier 7 with its tools, the cutter 11 will automatically turn to its proper position in the shoe 3 by engaging the angular walls of the diverging channels 13 on the inside of the shoe 3, and keys 7' on the carrier fitting channels 13.

When the reamers 5 have been expanded to their operating position Fig. 1, and the rotation of the stem 2 proceeds, the resistance of the cutting force of the cutters will be taken up by the inclined shoulders 4 of the shoe, and it will be impossible for the reamers 5 to collapse during work, on ac-

count of the interposition of the head 18 of the expander between the inner edges of the reamers 5.

It is understood that after the carrier with its superposed cutters has once been seated in the shoe 3, the clutch 15 with its connections 21 will be withdrawn from the well; the clutch pawls 16 being automatically expanded and released from engagement with the shoulder 17 of the expander by encountering a tapering or cam wall 22 formed on the upper end of the shoe; thereafter the apparatus will freely withdraw the lowering connection 21 with its clutch 15 leaving the interior of the rotary stem 2 clear, so that water may be freely forced therethrough and into a chamber or duct 19' in the expander 19; the water from the duct 19' being discharged through the lower end of the carrier 7, which is appropriately channeled for the discharge of the fluid. The force of the water discharging through the stem 2 and drilling structure is sufficient to carry the cuttings while rising upwardly through the well being sunk.

Should it become necessary for any cause to remove the cutting structure, which includes the carrier 7 and the bits 5 and 11, a suitable or appropriate form of fishing tool or clutch 23 may be lowered by the connection 21, the clutch 23 having suitable jaws 24 adapted to embrace the notched or toothed end 25 of the expander 19. When the expander has been coupled to the connection 21 by the clutch 23, as the connection 21 is withdrawn from the well, the clutch will carry upward the expander 19 until the shoulder at the upper end of the head 18 engages the upper end of the chamber 20 in the carrier 7. Thereafter the continued upward movement of the clutch 23, the expander 19 and carrier 7 will cause the expanded reamers 5 to collapse, due to the pull on their pivots 6 by the rising carrier 7; the collapse of the reamers being permitted by the withdrawal of the expanding head 18 from between the reamers.

It is desirable to exclude to the greatest possible extent the admission of the cuttings from the lower end of the well into the interior of the shoe 3 or the lower end of the stem 2, and it will be observed that the design of the present cutting structure is such that the parts are so compact when assembled in operative cutting position that access of the cuttings is substantially impossible.

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

1. The combination in a drilling apparatus, of a rotary tubular driving member having a downwardly converging seat, a tubular, downwardly tapering carrier connected from the apparatus and adjustable 13

upon said seat, lateral reamers radially movable in and connected to the carrier, and a channeled expander movable within said carrier and effective to expand said reamers when the carrier is seated.

2. The combination in a drilling apparatus, of a rotary tubular driving member having a downwardly converging seat, longitudinally recessed throughout its length, a tubular, downwardly tapering carrier disconnected from the apparatus and adjustable upon said seat, lateral reamers radially movable in and connected to the carrier, and registrable with certain of said recesses, and a channeled expander movable within said carrier and effective to expand said reamers when the carrier is seated.

3. The combination in a drilling apparatus, of a rotary tubular driving member having a downwardly converging seat, a tubular, downwardly tapering carrier disconnected from the apparatus and adjustable upon said seat, lateral reamers radially movable in and connected to the carrier, a channeled expander movable within said carrier and effective to expand said reamers when the carrier is seated, and a fishtail cutter attached to the carrier and of less diameter than the end of the driving member.

4. The combination in a drilling apparatus, of a rotary tubular driving member having a downwardly converging seat, a tubular, downwardly tapering carrier disconnected from the apparatus and adjustable upon said seat, lateral reamers radially movable in and connected to the carrier, a channeled expander movable within said carrier and effective to expand said reamers when the carrier is seated, and a fishtail cutter attached to the carrier and of less diameter than the end of the driving member, said carrier and its associated elements being normally free of any extraneous appliance.

5. The combination in a drilling apparatus, of a rotary tubular driving member having a downwardly converging seat, longitudinally recessed throughout its length, a tubular, downwardly tapering carrier dis-

connected from the apparatus and adjustable upon said seat, lateral reamers radially movable in and connected to the carrier, and registrable with certain of said recesses, and a channeled expander movable within said carrier and effective to expand said reamers when the carrier is seated, the exterior of the carrier being provided with longitudinal keys fitting certain recesses in said member.

6. A well-boring apparatus including a tubular driving shell having a conical seat, a carrier seatable and keyed thereon, expandable cutters attached to said carrier, and means within the carrier for expanding the cutters and being adapted for automatic cooperation with clutches for lowering and removing the carrier.

7. The combination in well-boring apparatus, of a tubular stem having a tapering seat with longitudinal slots, a removable tapering carrier having keys to fit certain of said slots, a diametral cutter of greater width than the lower part of said seat and adapted to be guided into certain of said slots in the seat, expansible reamers hung in the carrier above the diametral cutter, and an expander movable in the carrier to actuate the reamers.

8. The combination in a well-boring apparatus, of a tubular stem having a tapering seat with longitudinal slots, a removable tapering carrier having keys to fit certain of said slots, a diametral cutter of greater width than the lower part of said seat and adapted to be guided into certain of said slots in the seat, expansible reamers hung in the carrier above the diametral cutter, and an expander movable in the carrier to actuate the reamers and adapted to cooperate with detachable lowering and withdrawing devices.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FREDERICK E. TUCKER.

Witnesses:

JOHN H. HERRING,

CHARLES EDELMAN.