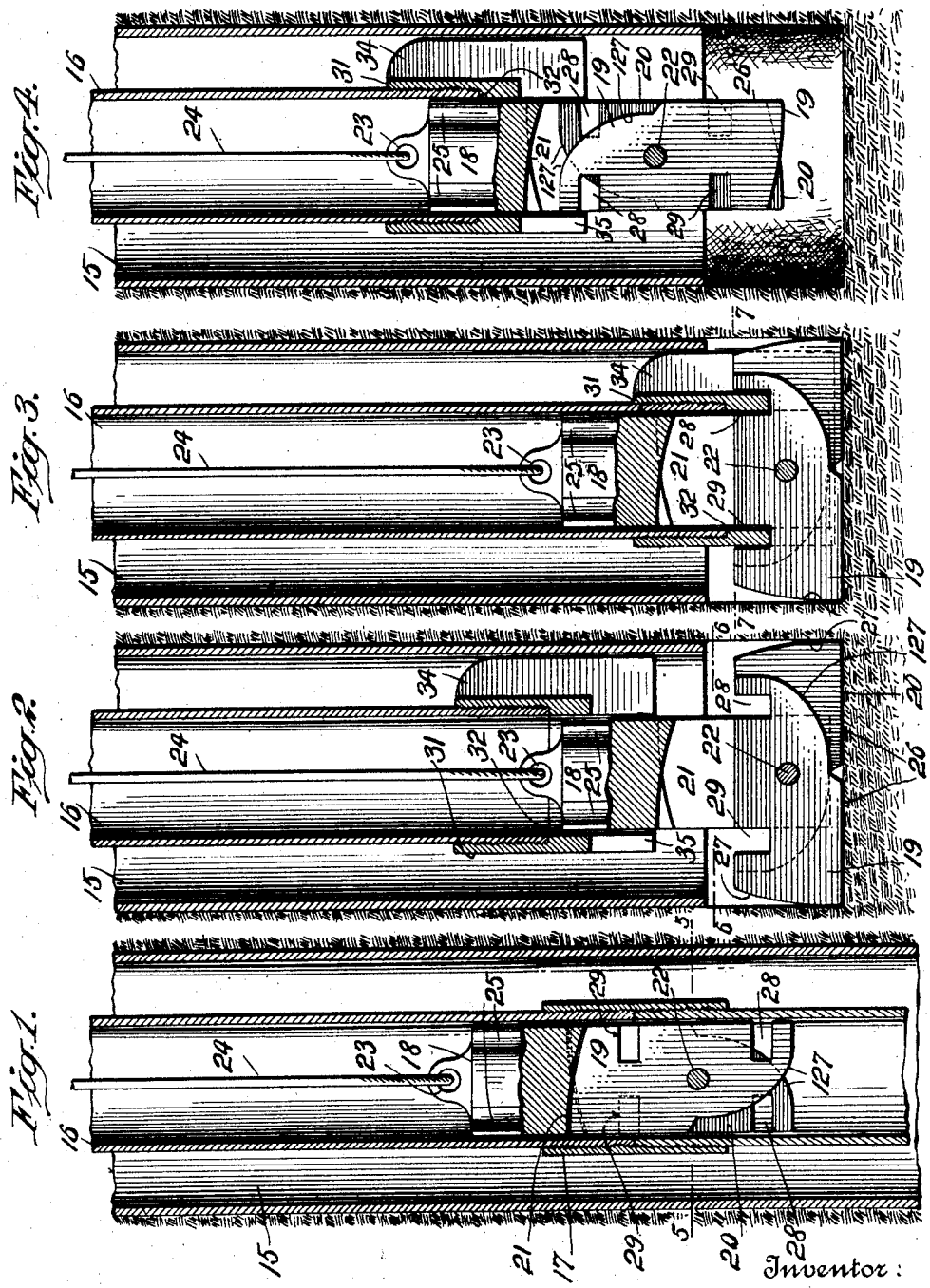
May 15, 1923. 1,454,984

V. A. STEWART

WELL DRILLING APPARATUS

Original Filed April 4, 1921 2 Sheets-Sheet 1




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May 15, 1923. 1,454,984

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WELL DRILLING APPARATUS

Original Filed April 4, 1921 2 Sheets-Sheet 2

Fig. 5.

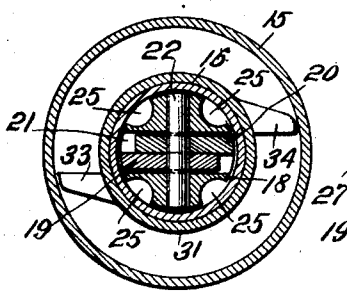



Fig. 6.

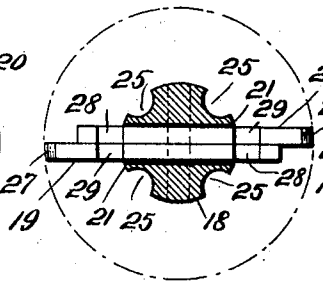



Fig. 7.

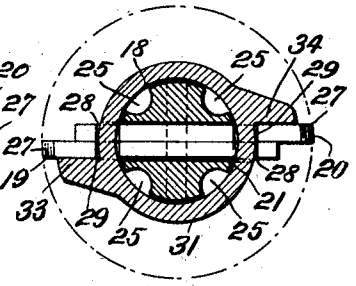



Fig. 8.

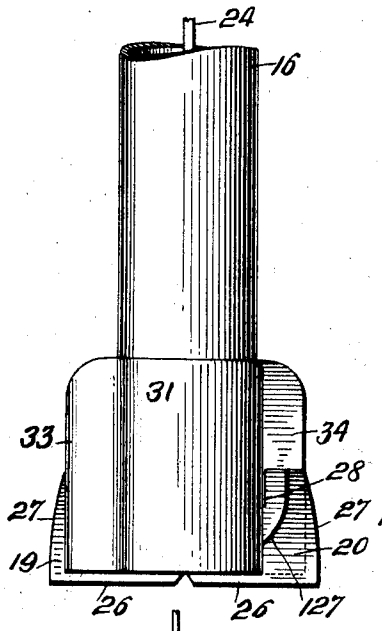



Fig. 9.

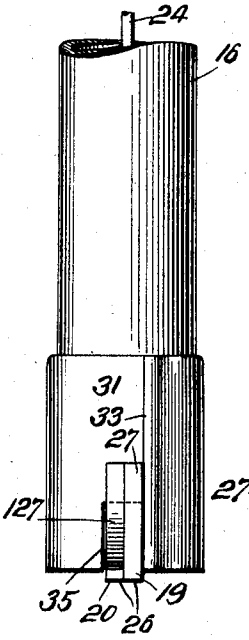



Fig. 10.

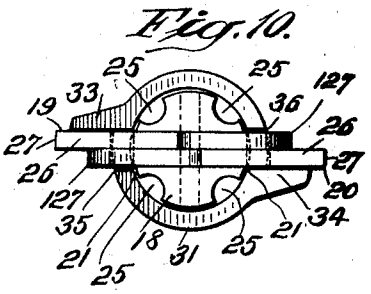



Fig. 11.

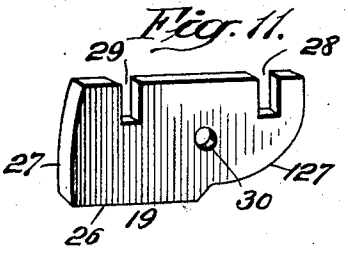
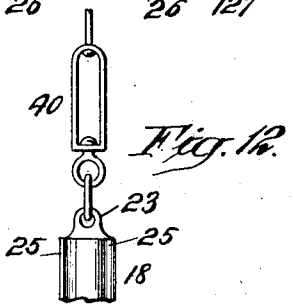



Fig. 12.




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# UNITED STATES PATENT OFFICE.

VICTOR A. STEWART, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO ROUGIER THORNE, OF GLEN COVE, NEW YORK.

## WELL-DRILLING APPARATUS.

Application filed April 4, 1921, Serial No. 458,327. Renewed October 14, 1922. Serial No. 594,656.

*To all whom it may concern:*

Be it known that I, VICTOR A. STEWART, a subject of the King of Great Britain, and resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Well-Drilling Apparatus, of which the following is a specification.

The invention relates to well-drilling apparatus and has more particular reference to improvements in means for drilling oil wells or wells of like character. I present my invention herein as embodied in apparatus for the drilling of oil wells, said invention having been more particularly designed for that purpose. The apparatus comprises the usual exterior cylindrical casing, an inner tubular rotary shaft and a bit or tool of special construction adapted to be lowered through said shaft to operative position and become interlocked with said shaft for rotation therewith and to be disengaged from said shaft and drawn upwardly through the same at any time it might be desired to withdraw the bit without removing the shaft. The bit or tool proper comprises a stock and a pair of foldable blades, and said stock is connected with a rope or cable by which the bit may be lowered through the shaft or drawn upwardly therefrom, as may be desired. The blades are pivotally secured within a slot in the lower end of the bit-stock and their outer or cutting ends are folded upwardly alongside of each other when the tool is to be lowered through the shaft so that said blades on reaching the earth below the lower end of the shaft may automatically turn outwardly in a direction from each other into operative position, and this feature of the construction is utilized on the return movement of the bit up through the shaft, since on such movement the outer ends of the blades automatically fold downwardly and inwardly alongside of each other so that the blades may not occupy more space laterally considered than the diameter of the bore of the shaft. On the lower end of the shaft is provided a head which interlocks with the blades of the bit when said blades are in their laterally extended operative position, and said head in addition to becoming interlocked with the blades by direct engagement are formed with flanges at opposite sides to engage, during the rotation of the shaft, the outer end portions of the blades so as to aid in causing said blades to efficiently perform their duties and to preserve said blades against being unduly strained or bent or otherwise damaged. My invention therefore resides more especially in the construction of the lower end of the tubular shaft and in the construction of the bit for cooperation therewith.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Fig. 1 is a central vertical section, partly broken away, of an oil well drilling apparatus embodying my invention, Fig. 1 illustrating the bit or boring tool as being allowed to descend through the tubular shaft located concentrically within the exterior casing, which is of usual construction;

Fig. 2 is a like view of the same, illustrating the bit or tool as having descended from the tubular shaft and as having had its blades automatically turned laterally in opposite directions into operative position for drilling purposes, the tubular shaft however being shown as not having been lowered through the exterior casing to interlock with said blades;

Fig. 3 is a like view of the same, but illustrating the tubular shaft as having been lowered through the exterior casing and interlocked with the blades of the bit or tool, the parts then being ready for operation;

Fig. 4 is a corresponding view of the same illustrating the tubular shaft as having been elevated, after a drilling operation, within the exterior casing and the bit or tool as being drawn upwardly through said shaft, the blades of the bit or tool when drawn upwardly reversing themselves in position from that occupied by them when descending through the shaft, as may be seen by a comparison of Figs. 1 and 4;

Fig. 5 is a horizontal section through the same, taken on the dotted line 5—5 of Fig. 1;

Fig. 6 is a horizontal section through the same, taken on the dotted line 6—6 of Fig. 2;

Fig. 7 is a horizontal section through the same, taken on the dotted line 7—7 of Fig. 3;

Fig. 8 is a side elevation of the lower por-

tion of the tubular shaft and the bit, illustrated in the relation they occupy when in their operative position shown in Fig. 3;

Fig. 9 is an edge view of the same taken from the left hand side of Fig. 8;

Fig. 10 is a bottom view of the same;

Fig. 11 is a detached perspective view of one of the blades of the bit, and

Fig. 12 is a detail showing the employment of a swivel in the connection of the rope or cable to the stock of the bit or tool.

In the drawings, 15 designates the customary tubular exterior casing employed in drilling oil-wells, and 16 a tubular shaft which, except at its lower end, is also of usual character, said shaft 16 being formed of tubing in sections connected together, as required, by couplings 17 (Fig. 1).

The bit or tool comprises a stock 18 and two pivoted blades 19, 20, respectively, carried by said stock and secured in face to face relation within a slot 21 in the lower end of said stock by means of a transverse pin or rod 22 which extends through said stock and blades. The stock 18 has a substantially cylindrical vertical body transversely slotted at its lower end, as at 21, to receive the blades 19, 20 and being provided with an eye 23 at its upper end to receive the lower end of a rope or cable 24, by means of which the bit may be allowed to descend through the shaft 16 to the point of application for operative use or drawn upwardly through said shaft, as the occasion may require. The body of the stock 18 freely but rather snugly fits the bore of the shaft 16 and on its exterior vertical sides is fluted or formed with vertical grooves 25 to serve as waterways for the water employed in the drilling operation.

The blades 19, 20 are exactly alike, but are reversely disposed, and the details of these blades, as to shape, are shown in Fig. 11. The blades 19, 20 each have a straight lower edge 26 to engage the earth, said edge 26 extending from a point about centrally below the pivot-rod 22 to the outer end or edge 27 of the blade, which edge 27 curves upwardly and inwardly, as represented in Fig. 2, so that its lower portion, in cooperation with the edge 26 of the blade, may be effective in the drilling operation. From the inner end of the edge 26 of the blade, said blade is offset upwardly to a rounded edge 127 constituting the inner end of the blade. The upper edges of the blades 19, 20 are straight and unbroken, except at the points where vertical recesses 28, 29 are cut through said edges and downwardly into the bodies of the blades. The space between the recesses or slots 28, 29 is substantially equal to the width of the stock 18, as shown in Figs. 2 and 3, and in use, those portions of the blades between the recesses or slots 28, 29 are substantially enclosed within the slot 21 of the stock 18 and afford broad surface-engagement with the said stock at the outer faces of said blades, as shown in Figs. 6 and 10. The blades also have a broad surface engagement with each other when in their operative position and this with the surface engagement of the blades with the stock 18 at the sides of the slot 21 therein, is a feature of considerable importance in rendering the drill of lasting efficiency.

It may be noted that the pivot hole 30 (Fig. 11) in the blades 19, 20 for the pivot pin or rod 22 is at one side of the center of said blades, leaving the outer end portions of said blades, at 27, heavier than the inner end portions thereof, and this feature of the construction becomes important when the tool is lowered downwardly through the shaft 16 and passes beyond the same and the blades are to automatically turn outwardly at their upper ends from each other from the position in which they are shown in Fig. 1 to that illustrated in Figs. 2 and 3. The overweighting of the outer or cutting ends of the blades 19, 20 is also of importance in permitting said blades when the shaft 16 is moved upwardly and the rope or cable 24 is thereafter drawn upwardly, to take the position in which they are illustrated in Fig. 4 and allow the bit to be drawn upwardly through the shaft 16.

Upon the lower end of the shaft 16 is a hollow head 31, said head preferably, though not necessarily, being made in a separate piece and threaded upon the lower end of said shaft and having a bore of the same diameter as the bore of said shaft and also having a shoulder 32 to abut against the lower end of the shaft 16 when said head is screwed home. The head 31 is formed at opposite sides with vertical abutment or presser flanges 33, 34 to engage the blades 19, 20 in the manner shown in Figs. 7 and 10 during the rotation of the shaft 16 in the operation of drilling.

The flanges 33, 34 are of substantial character and they are offset in opposite directions from the axial center of the shaft 16, as shown in Fig. 7, and the full width of the flange 33 is adapted to engage the outer or cutting end portion of the blade 19, while the flange 34 is likewise adapted to engage the outer or cutting end portion of the blade 20.

The head 31 is recessed on one side, as at 35, to extend downwardly upon and become interlocked with the outer end of the blade 19 and the inner end of the blade 20, and the metal of said head 31 above the recess 35 passes into the recess 29 of the blade 19 and the recess 28 of the blade 20; and on its opposite side the head 31 is formed with a slot or recess 36, corresponding with the aforesaid slot 35, and this slot 36 settles

down upon the outer end of the blade 20 and the inner end of the blade 19, the metal immediately above the recess 36 entering the recess 29 of the blade 20 and the recess 28 of the blade 19, said blades thus becoming interlocked with said head 31. The recesses 35, 36 are directly at the side of the respective flanges 33, 34, as shown in Fig. 10, and the engagement of the walls of these recesses 35, 36 with the blades 19, 20 at the recesses 28, 29 therein, serves to efficiently interlock the head 31 with said blades when the latter are in their operative position and results in the formation of a durable strain-resisting structure adapted for efficient use in drilling, there being a firm cooperative action between the bit, its stock 18, the head 31 and flanges 33, 34 rendering the tool of great durability and efficiency.

One important advantage of my invention resides in the fact that the bit consisting of the stock 18 and blades 19, 20 may be lowered down through the shaft 16, and said blades caused to automatically take their operative position, as shown in Fig. 2, and become locked in that position on the lowering of the shaft 16 to carry its head 31 into interlocking engagement with said blades, as shown in Fig. 3, and that whenever necessary the bit consisting of the stock 18 and blades 19, 20 may be withdrawn upwardly through and from the shaft 16 for such treatment as may be necessary and then returned down through said shaft for continuing the operation. The shaft 16 preparatory to the withdrawal of the bit upwardly therefrom may be elevated to the slight extent indicated in Fig. 4, so that the blades 19, 20 may properly fold together and be capable of being drawn upwardly through said shaft. The bit is detachable from the shaft while the shaft may be a long distance under ground, and since the bit is always connected with the cable 24 there is never any danger of losing the bit at the bottom of the well.

When the bit is introduced into the shaft 16 for the purpose of being lowered through the lower end thereof, the heavier outer or cutting ends of the blades 19, 20 will be folded upwardly into the slot 21 in the lower end of the stock 18, or to the position shown in Fig. 1, and thereupon by means of the cable or rope 24, the bit consisting of the stock 18 and blades 19, 20 will be allowed to descend by gravity through the shaft 16. When the blades 19 pass downwardly from the lower end of the shaft 16, the lighter rounded inner ends of the blades will strike the ground and the heavier outer ends 27 of the blades will turn outwardly in opposite directions from the slot 21 of the stock 18 and take the position in which said blades are shown in Fig. 2. The shaft 16 will then be lowered to carry the head portion 31 thereof into interlocking engagement with said blades 19, 20, the structure then having its parts disposed and related to one another in the manner shown in Fig. 3, this being the operative position and the drill when the parts are in the position shown in Fig. 3, being ready for operation.

When it is desired to withdraw the bit or tool upwardly from the shaft 16, the shaft will be raised slightly as indicated in Fig. 4 and thereupon by means of the rope or cable 24 the bit will be drawn upwardly through the shaft 16. On the first upward pull of the rope 24 on the stock 18, the heavier outer ends of the blades 19, 20 will, by gravity, turn downwardly toward and alongside of each other, as shown in Fig. 4, and this action will turn the inner and lighter ends 127 of said blades inwardly toward each other, so that the blades will stand vertically and offer no obstruction to their upward passage through the shaft 16. When the blades 19, 20 are lowered through the shaft 16, their heavier ends are, prior to the introduction of the bit to the shaft, folded upwardly alongside of each other, as shown in Fig. 1, so that the blades may take their operative position when emerging from the lower end of said shaft, and when the bit is pulled upwardly for withdrawal through the shaft 16, the heavier outer ends of the blades 19, 20 automatically fold downwardly toward each other and the blades are thereby compelled to fold into the smallest transverse dimensions possible so that they may be moved upwardly without difficulty through the shaft 16. In carrying out my invention I seek to provide a very durable and simple construction with the blades capable of automatic folding action outwardly and inwardly without the aid of such complicating features as springs, cams and the like.

It may be seen on reference to Figs. 2 and 3 that the lower outer edges of the blades 19, 20 are adapted to cut a hole of the full diameter of the exterior casing 15, thereby forming a path for said casing.

In Fig. 12 I illustrate the upper end of the stock 18 as being equipped with a swivel 40 of ordinary type to which the lower end of the rope or cable 24 may be connected, this swivel serving the purpose of preventing the twisting of the rope or cable 24 during the boring or drilling operation.

I do not limit my invention to all the details of form and structure hereinbefore described, since there would be an operative interlocking of the shaft 16 with the blades 19, 20 if the flanges 33, 34 were omitted and also if the recesses 28, 29 in the blades were omitted, since then the side walls of the recesses 35, 36 by their engagement with said blades would impart the rotation of the shaft 16 to the blades. A more efficient and durable construction is, however, produced

when the flanges 33, 34 and recesses 28, 29 are made use of.

What I claim as my invention and desire to secure by Letters-Patent, is:

1. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being adapted when the shaft is lowered to interlock with said blades for imparting movement thereto.

2. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being recessed to pass downwardly upon and interlock with both of said blades at each side of the pivot point thereof for imparting movement to said blades.

3. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being adapted to be lowered into interlocking relation with said blades and having presser flanges to engage the back faces of the cutting ends thereof.

4. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being recessed at opposite sides to pass downwardly upon and interlock with both said blades at each side of the pivot point thereof, and said blades having recesses at each side of said pivot point to intermesh with the recesses of said shaft.

5. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being recessed at opposite sides to pass downwardly upon and interlock with both said blades at each side of the pivot point thereof, and said blades having recesses at each side of said pivot point to intermesh with the recesses of said shaft, and said shaft having at its recesses outwardly projecting presser flanges to engage the back faces of the cutting ends of said blades.

6. In a well-drilling apparatus, an exterior tubular casing, a tubular shaft concentrically therein, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to

automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being adapted when the shaft is lowered to interlock with said blades for imparting movement thereto, and said blades at their cutting ends, when the blades are unfolded, extending outwardly to the full diameter of and below said casing and being adapted to clear a path for the descent of the same.

7. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their heavier ends downward, and the lower end of said shaft being adapted when the shaft is lowered to interlock with said blades for imparting movement thereto, and said blades at their inner ends being inset from the plane of the lower cutting edge of their outer ends and being shorter than said outer ends and serving on striking the bottom of the well to facilitate the turning outwardly in opposite directions of said outer ends to operative position.

8. In a well-drilling apparatus, a rotary tubular shaft, a bit and a rope or cable connected with said bit for lowering or raising the same freely through said shaft, said bit comprising a stock or body portion transversely slotted in its lower end and a pair of blades pivoted within said slot and being heavier at their outer or cutting ends and adapted to be folded upwardly with their cutting ends uppermost when the bit is to be lowered through said shaft and to automatically unfold outwardly and downwardly on leaving the lower end of said shaft, and said blades on an upward pull of said rope to withdraw the bit through said shaft, being adapted to automatically fold together with their cutting ends downward, and the lower end of said shaft being recessed to pass downwardly upon the outer faces of both of said blades at both sides of the pivot point thereof and lock said blades in face to face relation and to said shaft, and said blades at their inner ends being inset from the plane of the lower cutting edge of their outer ends and being shorter than said outer ends and serving on striking the bottom of the well to facilitate the turning outwardly in opposite directions of said outer ends to operative position.

Signed at New York city in the county of New York and State of New York, this 1st day of April, A. D. 1921.

VICTOR A. STEWART.