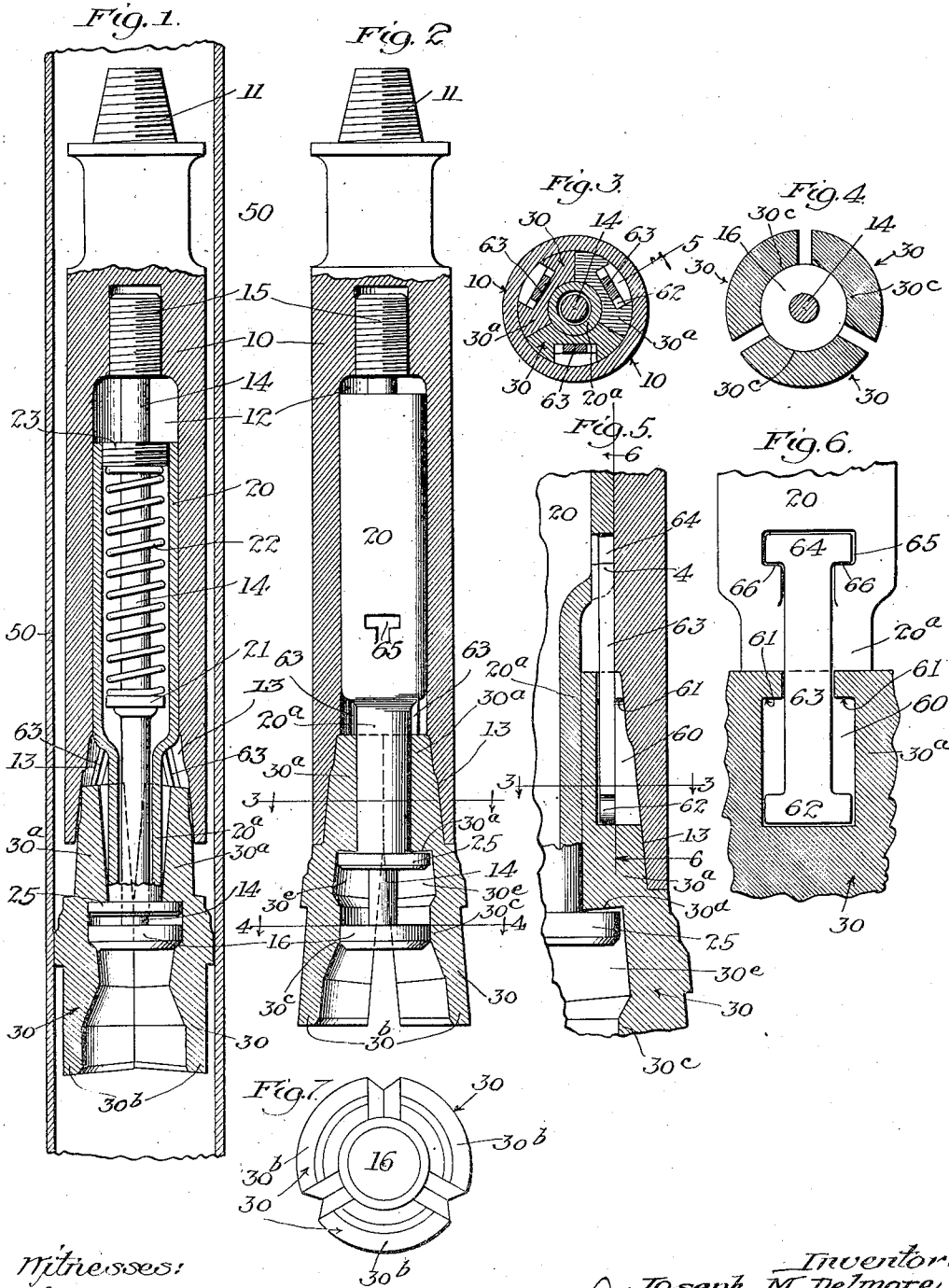


J. M. DELMORE.
 UNDERREAMER.
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1,031,628.

Patented July 2, 1912.



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UNITED STATES PATENT OFFICE.

JOSEPH M. DELMORE, OF LOS ANGELES, CALIFORNIA.

UNDERREAMER.

1,031,628.

Specification of Letters Patent.

Patented July 2, 1912.

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To all whom it may concern:

Be it known that I, JOSEPH M. DELMORE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to underreamers of the general type used in well drilling; and the principal object of the invention is the provision of an underreamer in which the cutters will expand to cut around a complete circle or a very large proportion thereof. In its preferred form I utilize three cutters; but it will be seen that any number may be used.

The gist of the invention is contained in the construction which allows the use of three or more cutters. And one of the prime advantages of my underreamer is its provision for three or more cutters; but the construction which allows of this is of such simple and practical nature that it may be used to advantage in a two cutter construction if desired.

Heretofore, so far as I am aware, most underreamers have been provided with only two cutters and have been able to cut over only about half of the circle of the well hole. With my underreamer nearly the whole circle is cut over at each stroke; thus insuring a uniformly cylindrical hole.

In the drawings I have shown a preferred form of my construction, illustrating an underreamer with three cutters.

In these drawings: Figure 1 is a longitudinal section showing my underreamer in position for insertion in a well. Fig. 2 is a longitudinal section showing the underreamer with its cutters expanded ready for drilling operations. Fig. 3 is a cross section taken on lines 3—3 of Figs. 2 and 5. Fig. 4 is a cross section taken on line 4—4 of Fig. 2. Fig. 5 is an enlarged fragmentary longitudinal section taken as indicated by line 5 of Fig. 3. Fig. 6 is a longitudinal section taken on line 6—6 of Fig. 5. Fig. 7 is a bottom view of the underreamer as shown in Fig. 2.

In the drawings 10 designates a mandrel having a suitable connecting means 11 on its upper end and having a longitudinal bore 12 therein. This longitudinal bore 12 is enlarged into a conical opening 13 of any suit-

able shape at the lower end of the mandrel. A longitudinal rod 14 is secured in the mandrel at its upper end, as at 15, and its lower end has an enlargement 16 thereon. This enlargement 16 is typically below the lower end of the mandrel and is held stationary from the stationary rod 14. Mounted around rod 14 and sliding within the bore 12 of the mandrel is a barrel 20. Rod 14 carries a collar 21 upon which a compression spring 22 is supported, the upper end of this spring pressing upwardly against a collar 23 in the upper end of the barrel 20, thus tending to raise the barrel to its uppermost position. The lower portion of the barrel 20 is reduced, as shown at 20^a, and this reduced portion carries on its lower end an enlargement 25. The movement of barrel 20 is sufficient to move the enlarged portion 25 from the position shown in Fig. 1 to the position shown in Fig. 2. Enlargement 25 provides a means for connecting the barrel 20 with the cutters of the underreamer; and is typical of other methods of connection which may be used.

Cutters 30 are preferably three in number and are each provided with upper portions 30^a which fit into the conical opening 13 in the lower end of the mandrel and which fit around the reduced portion 20^a of barrel 20. This is perhaps best shown in Figs. 2 and 3. In this position of the cutters the lower ends 30^b are expanded to the position shown in Fig. 2. The upper ends of the cutters bed solidly against the mandrel and against the portion 20^a of the barrel and the cutters are thereby held solidly in position. In this position inwardly projecting portions 30^c of the cutters bear against enlargement 16, and the lower ends of the cutters are thus solidly held in their expanded position. Shoulders 30^d of the cutters rest upon enlargement 25; and the cutters are thus supported by the spring 22 which supports barrel 20. When the barrel 20 is lowered, as when the underreamer is passing through the casing 50, the cutters are lowered to the position shown in Fig. 1, so that the recesses 30^e in each of the cutters directly above portions 30^c will then be opposite enlargement 16 and will allow the cutters to contract to the position shown in Fig. 1. When the underreamer is in this condition, both enlargements 16 and 25 will be surrounded by the recesses 30^e. The up-

per ends of the cutters do not then touch each other but hang comparatively loosely in the conical opening 13 and around the portion 20^a of barrel 20. Immediately the underreamer passes out of the casing the spring 22 raises the barrel 20 and raises the cutters, forcing their upper ends into solid engagement with the mandrel and with the portion 20^a of barrel 20 and forcing the portions 30^c of the cutters into engagement with enlargement 16. This causes, as before explained, the positioning of the cutters as shown in Fig. 2; and it will be seen that in this position the cutters are solidly supported against inward transverse thrust at their lower ends and against longitudinal upward thrust.

Although the cutters are held within the mandrel by being connected with the barrel 20, I additionally provide for retaining them within the mandrel by means of the device shown in Figs. 3, 5 and 6. This device is intended to act as a safety appliance in case spring 22 should break and allow the barrel 20 to lower; or in case the rod 14 should break and otherwise allow the barrel and the cutters to fall completely out of the mandrel. In each of the upper ends 30^a of the cutters 30 I have provided a slot 60 which is wider at its lower end than at its upper end. Shoulders 61 are thus formed against which the enlarged end portion 62 of link 63 may engage. Link 63 is placed in the position shown and has an enlarged upper end 64 which engages in a slot 65 in barrel 20, this slot being of such configuration as to afford shoulders 66 against which the enlarged portion 64 may bear. Slots 60 and enlarged portions 62 allow the cutters 30 their proper vertical movement; but should the cutters have a tendency to drop farther, the links 63 will prevent this.

From the foregoing it will be seen that my invention consists broadly in the provision of certain mechanism whereby a multiple cutter underreamer may be constructed; and specifically in the combination of the concentric vertically moving parts which support and control the action of the cutters. It is to these parts that I wish to particularly direct the following claims; desiring to cover broadly the combinations described. For this purpose the exact conformation of the several parts is of no great importance; and particularly is this true of the central rod and its surrounding barrel. The barrel may be considered broadly as a resiliently supported cutter supporting member, while the main function of the rod is to expand the cutters which engage its lower end. Although I have adopted and shown a practical form for the working combination of the rod, barrel and cutters, the exact designs described are not essential. Other arrangements may be substituted

for those specifically and preferably described without exceeding the scope of my invention.

Having described my invention, I claim:

1. In an underreamer comprising a tubular body having an attaching end, said body having a bore with a reduced upper portion and an enlarged mouth portion, a rod, a barrel mounted upon the rod, said rod being secured in the reduced portion of the bore against movement, enlarged portions formed at the lower ends of the rod and barrel, expansible means around the rod and within the barrel for holding said enlarged portions normally separated and the barrel in an upward position, and cutter members having link connections with the barrel above the enlarged portions and having inwardly projecting portions engageable with said enlarged portions.
2. An underreamer comprising a tubular mandrel having an enlarged conical opening at its lower end, a vertical rod secured to the mandrel at its upper end and passing down through its interior, an enlarged portion on the lower end of the rod near the enlarged conical opening, a vertically movable barrel on the rod and within the mandrel, an enlarged portion on the lower end of the barrel above the enlarged portion on the rod, a coiled spring around the rod within the barrel and acting to raise the barrel, and cutters supported on the barrel enlarged portion and having portions engageable with the rod enlarged portion, the upper ends of the cutters fitting into the conical opening in the lower end of the mandrel.
3. An underreamer comprising a hollow mandrel having a conical opening at its lower end, a longitudinal rod affixed at its upper end to the mandrel and extending through the mandrel to a point near its lower end, a barrel within the hollow mandrel and surrounding the rod, resilient means for supporting the barrel, cutters having upper ends adapted to fit within the conical lower opening of the mandrel and having portions engaging the lower end of the longitudinal rod, and connecting means between the cutters and the barrel.
4. An underreamer, comprising a hollow mandrel having an upwardly tapering opening at its lower end, a vertical rod secured at its upper end to the mandrel and projecting down through the tapering opening, a barrel slidable on said rod within the mandrel, resilient means to move the barrel upwardly on the rod, and a set of cutters supported by the barrel and having portions adapted to fit within the mandrel opening and portions adapted to engage the lower end of said rod.
5. An underreamer, comprising a mandrel having an upwardly tapering opening at its lower end, a vertical rod secured at its upper

end to the mandrel and projecting down
through said tapered opening, a cutter sup-
porting member slidable on the rod, resili-
ent means to support said member, and cut-
5 ters supported by the said member and hav-
ing portions engaging within said tapered
opening and portions engaging the lower
end of said rod.

In witness that I claim the foregoing I
have hereunto subscribed my name this 25 10
day of July 1911.

JOSEPH M. DELMORE.

Witnesses:

JAMES T. BARKELEW,
JAS. H. BALLAGH.