C. T. MAPES.

UNDERREAMER.

APPLICATION FILED JUNE 25, 1908.

923,677. Patented June 1, 1909

2 SHEETS—SHEET 1

Fig. 1.

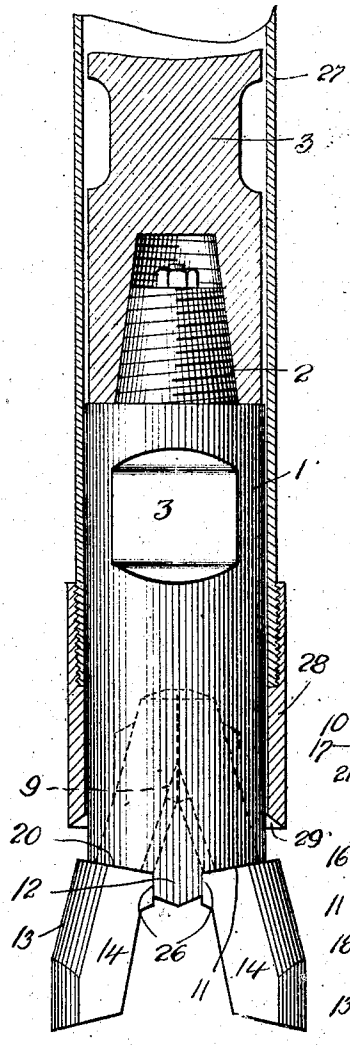


Fig. 2.

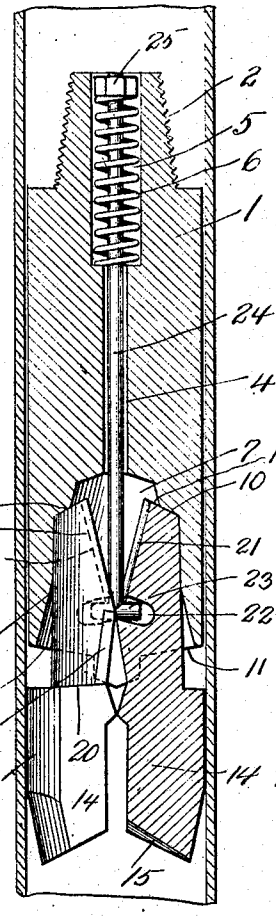


Fig. 3.

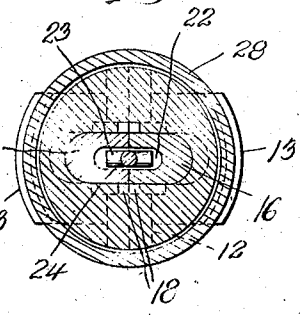


Fig. 4.

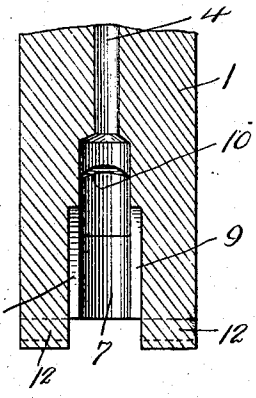


Fig. 5.

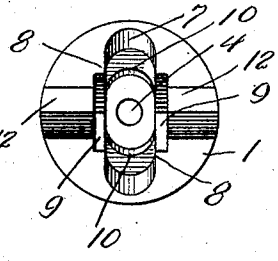
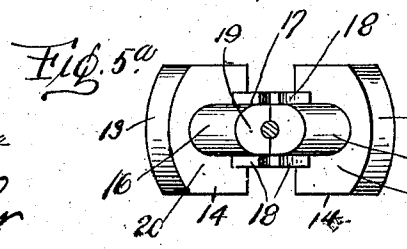


Fig. 5a.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 6.

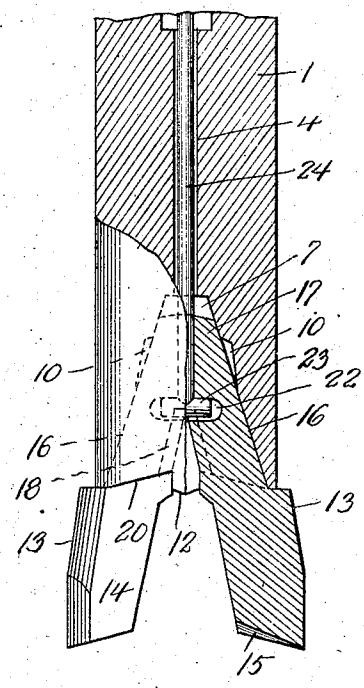


Fig. 7.

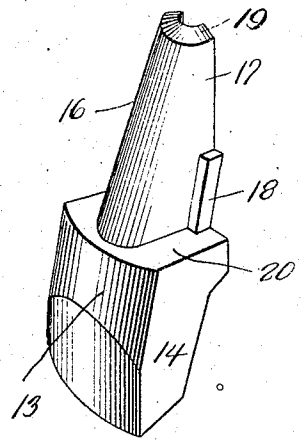


Fig. 8.

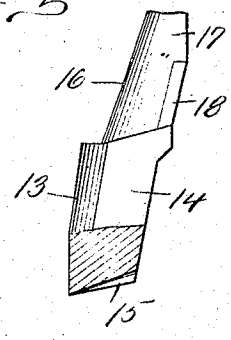
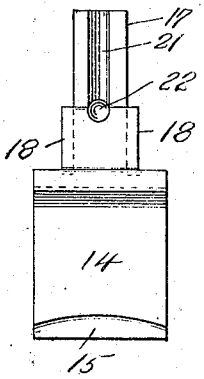


Fig. 9.



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UNITED STATES PATENT OFFICE.

CLARENCE T. MAPES, OF CRAFTON, PENNSYLVANIA.

UNDERREAMER.

No. 923,677. Specification of Letters Patent. Patented June 1, 1909.

Application filed June 25, 1908. Serial No. 440,282.

To all whom it may concern:

Be it known that I, CLARENCE T. MAPES, a citizen of the United States of America, residing at Crafton, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Underreamers, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to under reamers and the objects of my invention are, first, to provide a durable device for reaming out or enlarging well-holes drilled below a casing, in order to permit the casing to be lowered farther down in the well-hole; second, to expediate the operation of reaming out a well-hole by providing an under reamer that will be positive in its action and free from injury by ordinary use; third, to provide an inexpensive under reamer that can be successfully operated in a shale formation or in the most indurate strata of an oil field; fourth, to provide an under reamer having positive and reliable means for effecting a movement of the reamer-bits when released and bracing and firmly holding said bits while the under reamer is in operation; and fifth, to provide an under reamer comprising comparatively few parts quickly assembled, easily manipulated to enter a well-casing and easily disassembled when the bits need resharpening.

I attain the above objects by an under reaming device that will be presently described in detail and then specifically pointed out in the appended claims.

In the drawings, Figure 1 is a side elevation of the under reamer within a well-casing, illustrating the bits thereof released by the casing and in position for operation, Fig. 2 is a vertical sectional view of the under reamer within a casing, illustrating one of the bits in elevation and both of said bits held and retracted within the casing, Fig. 3 is a horizontal sectional view taken on the line x—x of Fig. 1 looking downward toward the reamer bits, Fig. 4 is a vertical longitudinally sectional view of a portion of a reamer body, Fig. 5 is a bottom plan of the same illustrating the recesses and cavity thereof, Fig. 5^a is a plan of the reamer bits, Fig. 6 is an elevation of a modified form of under reamer, partly broken away and partly in section, Fig. 7 is a perspective view of one of the reamer bits of the preferred form of construction, Fig. 8 is a side elevation of one of the reamer bits of a modified form, partly broken away and partly in section, and Fig. 9 is an elevation of the inner side of the modified form of reamer bit.

In the accompanying drawings, 1 designates a reamer-body having at the upper end thereof a screw threaded protuberance 2 of less diameter than the reamer-body, whereby said reamer bit can be connected to a sub 3 or a string of drilling tools. The reamer-body 1 is cylindrical and contiguous to the protuberance is provided with oppositely disposed flat faces 3 adapted to receive a wrench, (not shown), commonly employed to tighten and loosen the protuberance 2.

The reference numeral 4 designates a central longitudinal bore, the upper end communicating with a recess constituting a socket 5 formed longitudinally of the protuberance for a coil spring 6, the object of which will presently appear.

The lower end of the bore 4 communicates with a conoidal shaped cavity 7, having flattened oppositely disposed sides 8, the material bordering upon the sides of said cavity having oppositely disposed inverted V-shaped guide-ways 9, while the curved upper sides of the cavity 7, adjacent to the upper end of the cavity, are provided with oppositely disposed recesses 10.

The lower end of the reamer body 1 is beveled, as at 11, toward two transversely depending spreader ribs 12, said ribs extending from the lower end of the guide-ways 9 to the peripheral edges of the reamer-body 1, as best shown in Figs. 4 and 5. The lower ends of the ribs 12 are beveled for a purpose that will hereinafter appear.

Movably mounted in the cavity 7 and protruding from the lower end thereof are oppositely disposed reamer bits or dogs, each reamer bit or dog comprising a body 13 having flattened sides 14, lower beveled ends 15, and tapering shaped shanks 16, said shanks having flattened oppositely disposed faces 17 provided with guide-flanges 18. The shanks 16 when assembled, are approximately the same shape in cross section as the cavity 7, with the flanges 18 engaging in the guide-ways 9.

Each reamer bit or dog is provided with two angular bearing surfaces 19 and 20, the former engaging the upper end of the cavity 7 and the latter the beveled surfaces 11 at the lower end of the reamer-body 1, when the reamer bits or dogs are expanded or released.

The subject-matter of the above para-

graph forms one of the important features of my invention, since the angular bearing surfaces 19 are disposed at right angles to the direction of the blow received by the reamer bits. To accomplish this result it is necessary that the surfaces 20 be inclined upwardly and outwardly and the large area of these surfaces fully brace the bits as the blow is received upon the lower ends of said bits. With the bearing surfaces at right angles to the direction of the blow, it is impossible for the bits to shift during the operation, and to exert any stresses or strains other than would be received by the surfaces 20. The upper bearing surfaces 19 of the shanks 16 assist in this respect, and as will hereinafter appear these upper surfaces 19 can be dispensed with for this purpose.

The confronting faces of the shanks 16 are provided with grooves 21, said grooves being centrally disposed from the bearing surfaces 19 to oppositely disposed sockets 22 formed in said shanks, said sockets being in transverse alinement with the upper ends of the flanges 18. Adapted to engage in the sockets 22 is a cross-head 23 of a rod 24, said rod extending upwardly through the bore 4 and the spring 6 and having the upper end thereof provided with a nut 25 for retaining the spring 6 under tension.

The confronting faces of the reamer bits or dogs are provided with vertical bearing surfaces 26, the upper edges of these surfaces engaging the lower beveled edges of the spreader ribs 12, when the bits or dogs are retracted, while the surfaces 26 are maintained vertically by the sides of the ribs 12 when the bits or dogs are expanded for operation in a well.

The reference numeral 27 designates the lower end of the casing having threaded thereon a cylindrical drive-shoe 28, the inner lower edges of which are beveled, as at 29.

In operation, the reamer bits or dogs are pressed downwardly and inwardly to enter a casing 27, the reamer bits or dogs remaining in this position while the under reamer is lowered in a well. With the reamer bits or dogs retracted, the bearing surfaces 19 are adapted to engage in the recesses 10, with the lower edges of the vertical surfaces 26 contacting, and with the spring 6 under tension, as shown in Fig. 2 of the drawings.

Immediately upon the reamer bit reaching the drive-shoe 28, the reamer bits or dogs are released. The tension of the spring 26 is then sufficient to elevate the rod 24 and the reamer bits, said bits assuming the position illustrated in Fig. 1 of the drawings. To facilitate the spreading of the reamer bits or dogs, the beveled bearing surfaces 19 are provided, also the beveled bearing surfaces of the spreader ribs 12, the upper ends of the shanks 16 readily sliding out of the recesses 10, while the ribs 12 spread the reamer bits or dogs and brace said bits or dogs during the operation of the under reamer.

The beveled ends 15 of the reamer bits provide cutting edges and clearance for said bits when in operation; the beveled surfaces 11 of the lower end of a reamer body are adapted to receive vertical stresses and strains, and the ribs 12 lateral stresses and strains while the under reamer is in operation.

The flanges 18 within the guide-ways 9 are adapted to limit the outward movement of the reamer bits or dogs and at the same time retain said bits or dogs in proper relation to one another. When the bits or dogs are in operation, the shanks 16 are adapted to brace said bits or dogs by virtue of the upper ends of said shanks engaging in the upper ends of the cavity 7, this also being true when the bits or dogs are retracted with the upper ends of the shanks in the recesses 10. With the bits or dogs braced in a retracted position, irregularities on the interior of the casing can be readily overcome when a reamer bit is lowered in a well.

In Fig. 6 of the drawings I have illustrated a slight modification of my invention, wherein the upper bearing surfaces 19 of the shank 16 are only employed for engaging in the recesses 10, said shanks not being of a sufficient length to permit of these bearing surfaces 19 engaging in the upper end of the cavity 7.

Another instance, when the under reamer is to be drawn from the casing 27, the reamer bits or dogs are retracted by virtue of the drive-shoe 28, the lower beveled ends 29 of said shoe forcing the bits or dogs inwardly, as the under reamer is elevated.

While in the drawings forming a part of this application there is illustrated the preferred embodiments of my invention, I would have it understood that the elements therein can be varied or changed, as to the shape, proportion and manner of assemblage without departing from the spirit of the invention.

Having now described my invention, what I claim as new, is:—

1. An underreamer embodying a body having the lower end thereof beveled and provided with a conoidal-shaped cavity having oppositely disposed flat sides provided with inverted V-shaped guide-ways and oppositely disposed sides provided with recesses, said body having a bore formed therein terminating in a socket at the upper end of said body, a contractible and extensible spring mounted in said socket reamer bits, said bits comprising bodies, shanks carried thereby and extending into said cavity with the upper ends of said shanks adapted to bear against the upper end of said cavity when said bits are expanded and recede into said recesses when said bits retract, said shanks provided with confronting sockets oppositely disposed flanges carried by said shanks

and adapted to engage in the guide-ways of said cavity, a rod mounted in said bore and having a cross-head engaging in the said confronting sockets, said spring carried by and adapted to elevate and lower said rod, and beveled spreader ribs carried by the lower end of said reamer body and adapted to engage vertical bearing surfaces provided therefor upon the confronting sides of said bits, substantially as described.

2. An under reamer embodying a reamer body having the lower end thereof beveled and provided with a conoidal-shaped cavity, the side walls of said cavity provided with recesses each having a flat inner wall and an inclined top wall, said flat inner and said inclined top wall constituting a bracing means, reamer bits adapted to engage the beveled end of said reamer body and the upper end of said cavity, when projected and the walls of said recesses when retracted, said bits comprising bodies having cutting edges, shanks carried by said bodies and extending into said cavity and provided with confronting sockets, said side walls further provided with guide-ways flanges carried by said shanks and extending into the guideways of the side walls of said cavity, a spring-held rod movably mounted in said reamer body, a cross-head carried thereby and loosely engaging in the confronting sockets of said shanks, and beveled spreader ribs carried by the lower end of said reamer body for expanding said bits.

In testimony whereof I affix my signature in the presence of two witnesses.

CLARENCE T. MAPES.

Witnesses:
MAX H. SROLOVITZ,
K. H. BUTLER.