A. J. SNOW & A. M. KIDD.

ROTARY UNDERREAMER.

APPLICATION FILED SEPT. 28, 1912.

1,049,774.

Patented Jan. 7, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

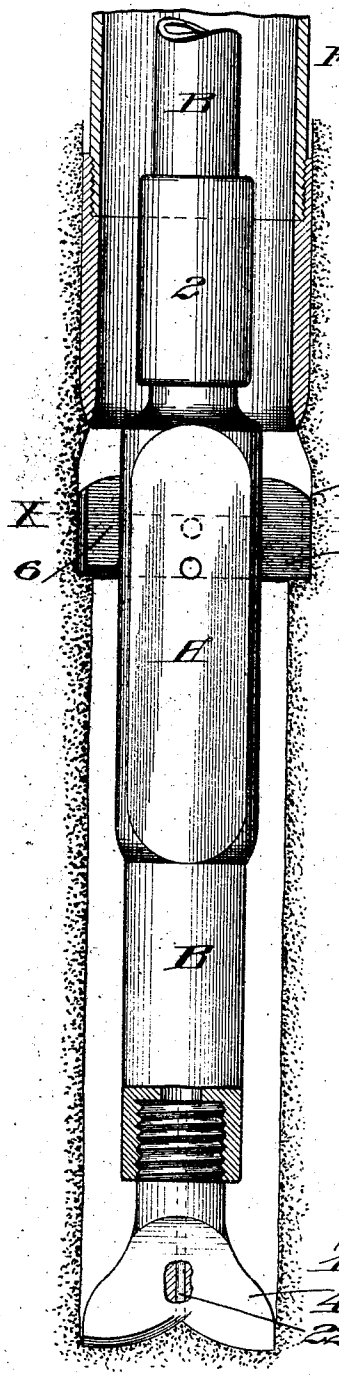


Fig. 2.

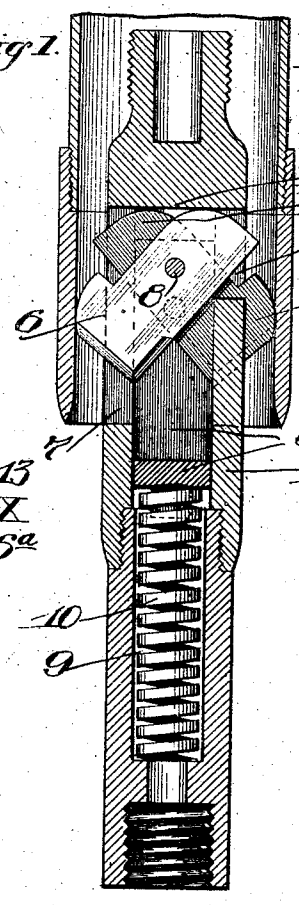


Fig. 3.

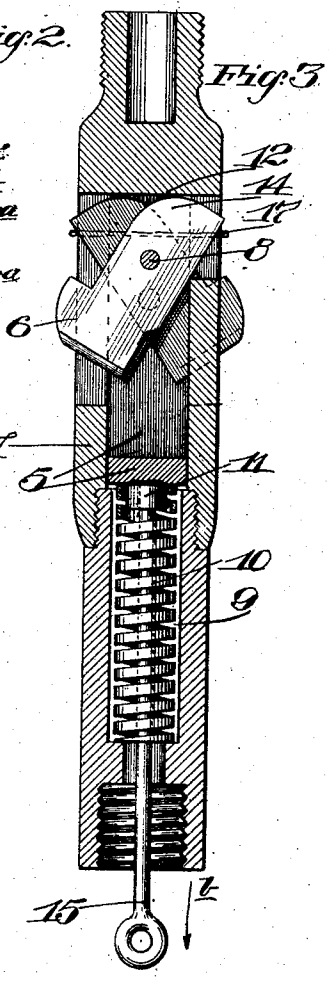
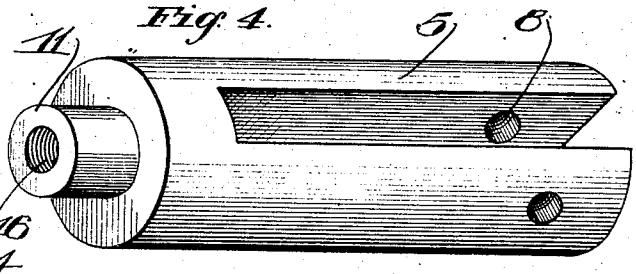


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 6.

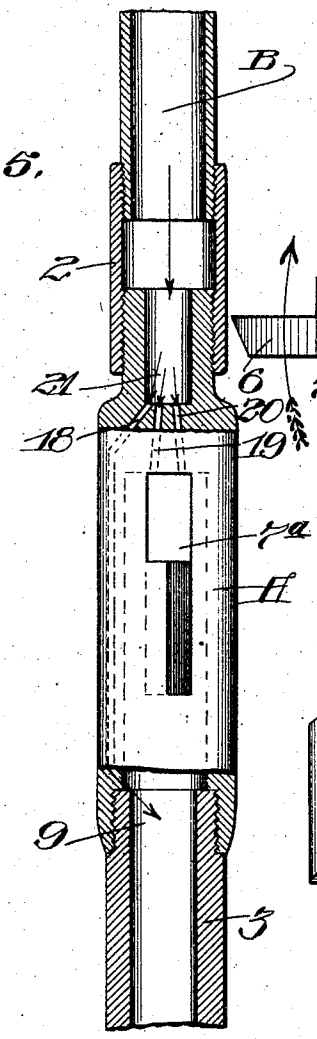


Fig. 6.

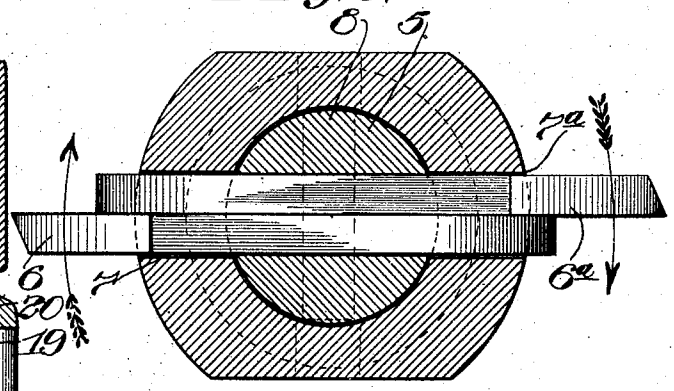
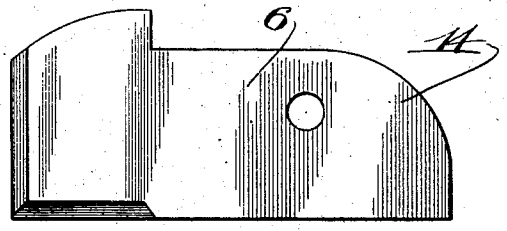


Fig. 7.



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ROTARY UNDERREAMER.

1,049,774. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed September 28, 1912. Serial No. 722,871.

To all whom it may concern:

Be it known that we, ALBERT J. SNOW and ARCHIE M. KIDD, citizens of the United States, residing at Taft, in the county of Kern and State of California, have invented new and useful Improvements in Rotary Underreamers, of which the following is a specification.

This invention relates to a rotary underreamer.

The object of the present invention is to construct a simple, substantial, and reliable rotary underreamer, provided with self-adjusting cutting tools which will automatically open into cutting position when projected beyond the end or string of old piping.

Another object of the invention is to provide a series of fluid conducting passages, so positioned as to deliver fluid at or near the cutting edges, thereby greatly increasing the cutting power of the reamer by continuously removing the cuttings and helping to remove the formation while the reamer is at work.

The invention consists of certain novel constructions, combinations and arrangement of parts, all of which will be more particularly described in the following specification and drawings, in which—

Figure 1 is a section of the pipe line showing the reamer in cutting position. Fig. 2 is a longitudinal, vertical section of the reaming tool, showing it in the position where it is being extracted from the pipe. Fig. 3 is a similar section, showing the reaming bits in position before the reamer is inserted into the pipe line. Fig. 4 is a perspective view of the forked mandrel. Fig. 5 is a side elevation partly in section of the reamer, showing the fluid conducting passages and slots through which the reaming tools project. Fig. 6 is a cross section of the reamer. Fig. 7 is a plan view of the reaming tool.

Where a string of pipe has been landed and it is necessary to have a larger hole below than the inside diameter of the pipe passed through, or where it is desired to carry a string of pipe to a greater depth, it is necessary to have a larger hole than the outside of the pipe in order to give clearance and overcome friction. With this object in view we have constructed a rotary underreamer consisting of a main body A secured to the end of a hollow drill rod B by any suitable means, as a coupling 2. The lower end of the main body portion of the reamer is provided with a drill collar 3, in which is secured a bit 4, of any suitable description, depending upon the nature of the formation through which the bit is passing. This is provided for the purpose of drilling a new hole or for the purpose of cleaning out cavings or other material below the reamer while reaming. Slidably mounted within the main reamer body A is a forked mandrel 5, in which is pivotally mounted a pair of reaming tools or bits 6—6ª which extend a suitable distance outside of the reamer body through slots 7 and 7ª formed in the reamer body. The reamer bits 6 and 6ª are held in position by a pin 8, passing through the forked mandrel and the bits.

9 indicates a hollow chamber in the drill collar, in which is housed a coil spring 10. The coil spring 10 is so positioned as to exert its pressure against the bottom portion of the forked mandrel, which is provided with a central hub or extension 11 around which the spring is seated. The pressure of the spring normally tends to force the forked mandrel against the upper end of the chamber 12 in which it is mounted for the purpose of throwing the reaming bits into cutting position, as shown at 13, Fig. 1.

The inner ends of the reaming bits are provided with rounded shoulder portions 14, which normally contact with the walls of the upper portions of the slots 7 and 7ª. These will cause the reaming tools to be thrown into cutting position when the forked mandrel is moved into its upper position. The shape of these cutters may be changed or improved from time to time as the location and conditions may demand, as the different formations may require different styles of cutting edges. They may be square edged, beveled, round, saw toothed, or they may be longer or shorter, according to the diameter of the hole required.

When it is desired to drop the reamer through the piping into the cutting position shown in Fig. 1, it is necessary to temporarily withdraw the reaming bits for the pur-

pose of giving the necessary clearance when dropping the tool through the piping. This is accomplished by screwing an eye-bolt 15 into the cylindrical extension 11, formed on the lower end of the mandrel; this being provided with a threaded hole 16 for this purpose. The eye-bolt is then pulled in the direction of arrow *b*, causing the mandrel to be drawn into the lower position shown in Fig. 3 against the pressure of the coil spring 10. A wire or any other suitable fastening 17 is then tied around the outside of the reamer, as shown in Fig. 3, for the purpose of holding the reaming cutters in the contracted position. The eye-bolt is then removed and the tool dropped into cutting position and rotated; a few revolutions of the reamer causing the wire or other material used to secure the cutters to break as the exposed portions of the cutters come in contact with the walls. The moment this temporary securing means has been removed, the spring 10, located in the drill collar, will exert its pressure on the mandrel and force the forked mandrel, in which the cutters are mounted by the pin 8, into the upper position, which will cause the cutters to be projected, as shown in Fig. 1.

In operating a reamer of the construction here shown, it is very desirable to force fluid under varied pressures, as from fifty to two hundred and fifty or more pounds to the square inch, depending upon the depth of the hole and the nature of the material being undercut, for the purpose of removing the cuttings of the reaming tools and also for the purpose of removing cavings or other material. With this object in view, we have provided a series of fluid conducting channels 18, 19 and 20. The passage 18 connects at one end 21 with the hollow portion of the drill rod, through which the fluid under pressure is conducted, and at the other end with the hollow portion 9 in the drill collar. The drill bit 4, carried by the drill collar, may be provided with a suitable passage, as 22, for the purpose of conveying the wash fluid directly to the cutting point. The passages 19 and 20 are connected at their upper ends with the hollow portion of the drill rod and at their lower ends with the slot openings 7 and 7^a for the purpose of conducting the wash fluid to the reaming tools 6 and 6^a.

In drilling a hole with a rotary drill rig, water and clay are used as a wash and are forced down through the hollow drill shaft or rod by hydraulic force, and when projected at the point of contact between the cutting tools and the surfaces being cut, the fluid will help to cut the formation and carry the cuttings to the surface. The wash holes being positioned, as shown in this reamer, are so arranged that the fluid will strike the walls of the hole or well at or near the cutting edges of the cutters. The hydraulic force of the fluid delivered at these points greatly facilitates and increases the cutting power of the reaming tools by continuously removing the cuttings and helping to remove the formation while the reamer is at work.

The tool is simple and substantial in construction and reliable in its action. The materials and finish of the several parts of the tool are such as experience and judgment of the manufacturer may dictate.

Various changes in form, proportions and minor details of construction may be resorted to within the scope of the appended claims.

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

1. A rotary underreamer comprising a hollow carrier or body portion, a forked mandrel slidably mounted within said carrier, a pair of reaming tools pivotally mounted in said mandrel, slots formed in the carrier through which the reaming tools project, and means for automatically projecting the reaming tools into cutting position.

2. A rotary underreamer comprising a hollow carrier or body portion, a drill collar and bit secured to same, a forked mandrel slidably mounted within said carrier, a pair of reaming tools pivotally mounted in said mandrel, slots formed in the carrier through which the reaming tools project, means for automatically projecting the reaming tools into cutting position, said means comprising lever portions formed on the inner ends of the tools, and means for rocking said levers.

3. A rotary underreamer comprising a hollow carrier or body portion, a drill collar and bit secured to same, a forked mandrel slidably mounted within said carrier, a pair of reaming tools pivotally mounted in said mandrel, slots formed in the carrier through which the reaming tools project, means for automatically projecting the reaming tools into cutting position, said means comprising lever portions formed on the inner ends of the tools, and means for rocking said levers, said means comprising a coil spring so positioned as to force the forked mandrel in which the tools are mounted into its upper position which will bring the levers into engagement with stops and project the tools into position.

4. A rotary underreamer comprising a hollow carrier or body portion, a hollow drill collar secured to same, a drill bit removably secured to said collar, a hollow drill rod to which the carrier or body is secured adapted to convey wash fluid, a plurality of conduits in the carrier connected with the drill rod adapted to convey fluid to the cutting points, a forked mandrel slid-

ably mounted within said carrier, a pair of reaming tools pivotally mounted in said mandrel, slots formed in the carrier through which the reaming tools project, and means for automatically projecting the reaming tools into cutting position.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ALBERT J. SNOW.
ARCHIE M. KIDD.

Witnesses:
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J. WALTER KEY.