C. P. SKINNER.

UNDERREAMER.

APPLICATION FILED APR. 19, 1920.

1,362,513. Patented Dec. 14, 1920.

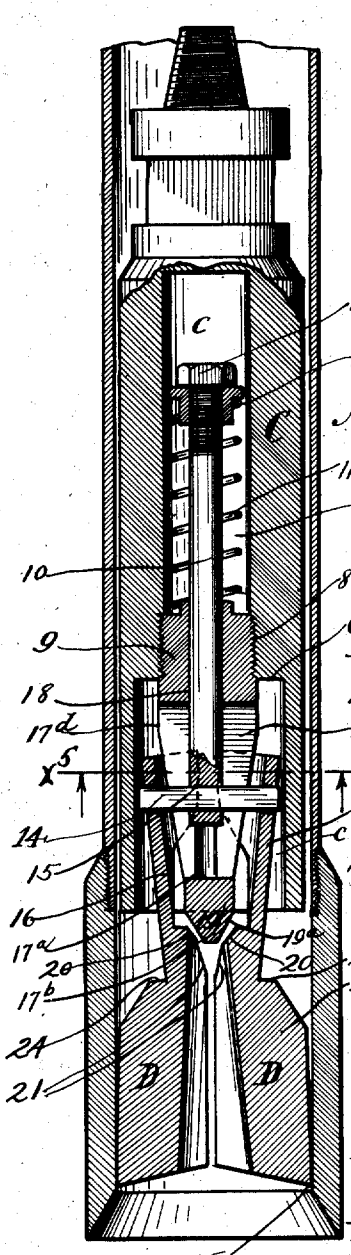

Fig. 1.

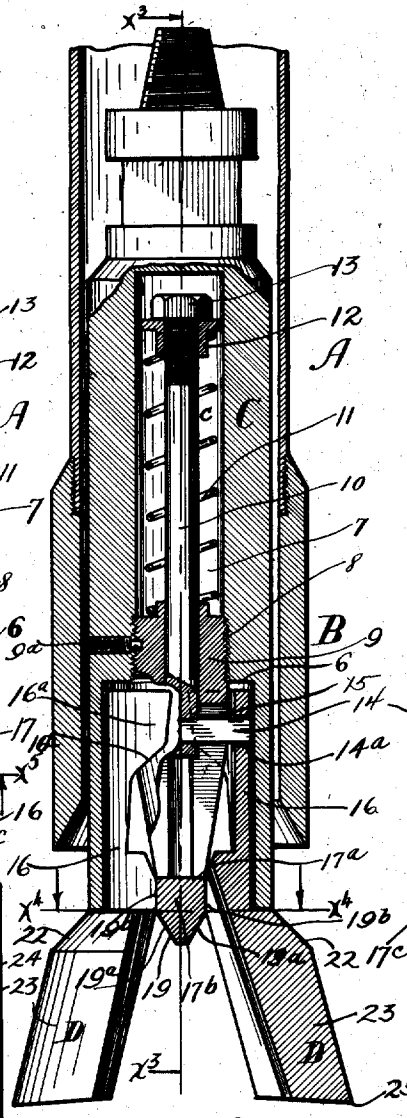

Fig. 2.

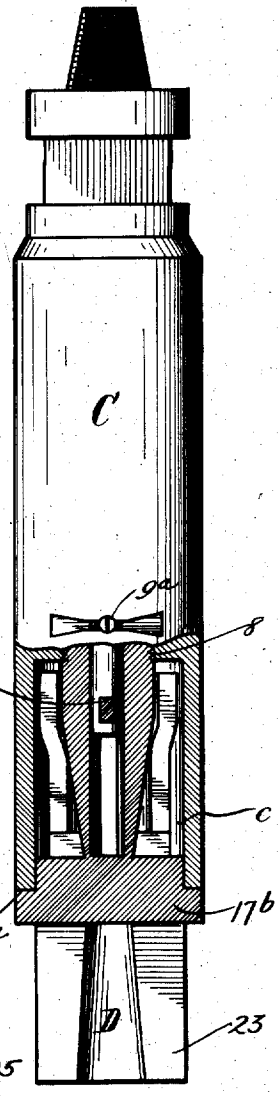

Fig. 3.

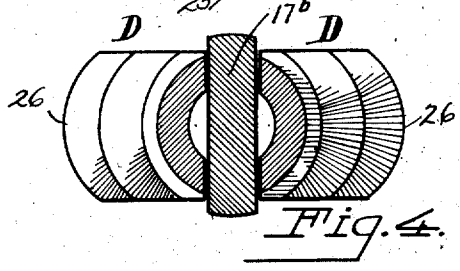

Fig. 4.

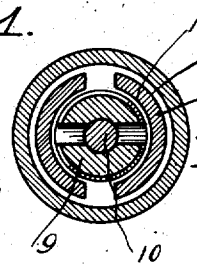

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES P. SKINNER, OF ORCUTT, CALIFORNIA.

UNDERREAMER.

1,362,513. Specification of Letters Patent. Patented Dec. 14, 1920.

Application filed April 19, 1920. Serial No. 374,935.

To all whom it may concern:

Be it known that I, CHARLES P. SKINNER, a citizen of the United States, residing at Orcutt, in the county of Santa Barbara and State of California, have invented new and useful Improvements in Underreamers, of which the following is a specification.

This invention relates to underreamers, namely devices for enlarging well holes so that the casing may be lowered in same as the development of the well hole proceeds. In the standard form of drilling a reciprocating bit is operated in the formation of the well hole and this is lowered through the casing and only cuts or drills or bores a hole having a diameter substantially that of the inside of the well casing. It therefore is necessary to ream or cut out the annular formation beneath the casing, or the casing and its shoe, in order to permit the casing to be further lowered. To do this underreamers are employed, and the same are used in substitution for the bit, and are reciprocated by the beam at the mouth of the well.

The present invention has for its object the provision of an improved underreamer which will be superior in point of relative simplicity and inexpensiveness of construction, taken in conjunction with positiveness in operation, reliability and durability, facility in adjustment, safety in use, and which will be devoid of liability of the cutters and the attendant features being lost in the hole in case of breakage therein or in the parts suspending or controlling same.

With the above and other objects in view, the invention consists in the novel and useful provision, formation, construction, combination, association and relative arrangement of parts, members and features, all as hereinafter described, shown in the drawing, and finally pointed out in claims.

In the drawing:

Figure 1 is a vertical central sectional view, partly in elevation and partly broken away, of an underreamer embodying the invention and shown in conjunction with a portion of well casing and the shoe thereof, the parts of the underreamer being shown in collapsed condition for passage through the casing and its shoe;

Fig. 2 is a view similar to Fig. 1 showing the underreamer in expanded or operative condition;

Fig. 3 is a vertical sectional view, partly in elevation and partly broken away, taken on the line x^3—x^3, Fig. 2, and looking in the direction of the appended arrows;

Fig. 4 is a transverse detail sectional view, taken upon the line x^4—x^4 Fig. 2, and looking in the direction of the appended arrows; and

Fig. 5 is a detail fragmentary transverse sectional view taken upon the line x^5—x^5, Fig. 1, and looking in the direction of the appended arrows.

Corresponding parts in all the figures are designated by the same reference characters.

Referring with particularity to the drawing, A designates a portion of a length of well casing, with its shoe B, within which is disposed the mandrel or tubular body C of an underreamer having at the lower end thereof an open bowl mouth *c* with a preferably cylindrical internal bore, leading up to an annular shoulder 6 above which is provided a chamber 7 of lesser diameter than the bowl mouth *c*, and within which is threaded, at the lower end, as at 8, a detachable hollow slotted extension 9 which may be prevented from turning by a lateral screw pin 9^a and through which plays lengthwise a spring-actuated rod 10, the coiled compression spring 11 of which surrounds the rod, bearing at its lower end upon the top of the hollow slotted extension 9, and at its upper end beneath a bushing 12 slipped onto the upper end of the rod 10 and maintained in position of adjustment to vary the compression of the spring 11 by a nut 13 threaded to the upper end of the rod 10. A transverse key 14 is inserted through a slot 15 in the lower end of the spring-actuated rod 10, and upon this key are suspended the shanks 16 of cutters D, which key operates in a slot 17 vertically formed in the extension 9, and with which communicates the hollow or bore 18 which accommodates the reciprocating rod 10. This slot 17 extends from a shoulder 17^a somewhat above the lower end of the hollow slotted extension 9 upwardly to a point somewhat below the shoulder 6. The lower end of the extension, 17^b, beneath the shoulder 17^a, is laterally extended or extended transversely of the mandrel C and its bowl *c*, and its ends are notched to fit under the lower end of the bowl mouth *c*, as at 17^c. The hollow slotted extension 9, in the slotted portion 17 thereof, above the transverse

extension or partition 17^b, tapers quite abruptly downwardly to such partition 17^b. The partition 17^b acts as an expanding member for the cutters D, and is provided at its lower portion with a wedge-shaped spreader 19, preferably integral with such partition 17^b, providing opposed downwardly expanding surfaces 19^a for the cutters, which at their upper ends merge into substantially parallel opposed inthrust surfaces 19^b.

The shanks 16 of the cutters are preferably very much enlarged at their upper end portions, to form arcuate expanding and outthrust cutter shank portions 16^a, the inner surfaces 16^b of which coöperate with the outer face of the substantially cylindrical portion 17^d of the hollow slotted extension 9 at and above the slotted portion 17 thereof, as clearly shown in Figs. 2 and 5, in the event that any outthrust upon the cutters, when the latter are in expanded position, tends to rock said cutters upon the inthrust surfaces 19^b upon the expanding partition 17^b. The cutters are expanded by means of angularly directed inner faces 20 and 21 which are provided at their inner faces, and which coöperate with the wedge faces 19^a, and finally with the parallel faces 19^b on the expanding partition 17^b, bringing the inner faces 21 ultimately into final engagement with such parallel opposed faces 19^b when the cutters are in the finally expanded positions shown in Fig. 2. Riding shoulders 22 are provided upon enlarged portions of the stock of the cutter bodies 23, beneath the shanks 16, and these coöperate with the shoe B to cause the cutters to be drawn down over the expanding partition 17^b and to collapse the same, bringing the inner faces 20 down beneath and slightly spaced from the wedge faces 19^a, as shown in Fig. 1. The inner faces 20 and 21 are formed at the lower portions of the shanks 16 where they merge into the stock of the cutter bodies 23. These riding shoulders 22 merge into upthrust shoulders 24 which engage the lower periphery of the bowl mouth *c* when the cutters are expanded, imparting upthrust in reaming to the mandrel C. The inthrust in reaming is transmitted by the faces 20 to the parallel faces 19^b, and any outthrust, as above pointed out, is taken care of by the inner faces 16^b of the enlarged cutter shank portions 16^a.

These latter enlarged portions 16^a are provided with lower terminal shoulders 16^c which are adapted to catch upon the wedge partition 17^b in case the key 14 parts or the rod 10 breaks, thus preventing the loss of the cutters in the hole and perhaps avoiding an expensive and elaborate fishing job. It will be understood that the spring 11 exerts a tendency to maintain the cutters D in expanded positions, and that as soon as the cutters pass the shoe they will automatically expand into the reaming or expanded positions shown in Fig. 2.

The cutter bodies 23 are provided at their lower ends and at their outer edges with cutting edges 25, and the cutters may be dressed out and repaired as required when the same become worn, or ready replacements may be made, the same being capable of assembling, together with the spring-actuated rod and other parts, at the lower end of the bowl mouth *c*.

The cutters, due to the particular arrangement and accommodation of features of the reamer, may be made very wide, with plenty of stock to dress out, the inthrust is well taken care of and rotatory action prevented by the wedging partition 17^b, and the cutters may execute a wide cut in each stroke, thus tending to the fast making of "hole."

It will be seen that the key 14 takes into eyes 14^a in the cutter shanks 16, which eyes are slightly enlarged to permit the cutters to tilt or teeter upon such key.

It is obvious that many changes and variations may be made in practising the invention, in departing from the showing of the accompanying drawing and the foregoing description, without departing from the true spirit of the invention.

Having thus disclosed my invention, I claim and desire to secure by Letters Patent:

1. In an underreamer, the combination with a body having an open mouth at the lower end thereof, of a slotted extension arranged within the mouth and provided with an expansion head, cutters provided with shanks which project into the open mouth, said shanks being formed with shoulder portions adapted to engage the expanding head to prevent loss of the cutters, and cutter actuating means operating in the slotted extension and engaging the cutter shanks.

2. An underreamer including a body provided with a spring receiving chamber and having an open mouth at its lower end, an extension fitted in the spring receiving chamber and projecting into the open mouth, said extension being hollow and slotted and provided with a transversely extending expansion head, cutters provided with shanks which extend into the mouth of the body and also provided with shoulders adapted to coöperate with the expansion head, said shanks having portions adapted to engage the expanding head to prevent loss of the cutters, a spring actuated rod slidable within the hollow portion of the extension, and a key carried by the rod and operable within the slot of the extension, said key engaging the cutter shanks.

3. An underreamer including a body formed with a spring receiving chamber and having a mouth at the lower end thereof, a hollow slotted extension fitted in the lower end of the spring receiving cham-

ber and projecting into the mouth, a substantially annular chamber being provided surrounding the extension and the extension having an expanding head, cutters provided with shanks projecting into the annular chamber and constructed for coöperation with the expanding head, the upper ends of the shanks being curved to fit around the extension and being provided with shoulders adapted to engage the expanding head to prevent loss of the cutters, a spring actuated rod slidable within the hollow extension, and a key carried by the said rod and operable within the slot of the extension, said key engaging the cutter shanks.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES P. SKINNER.

Witnesses:
J. H. HARTMAN,
L. J. MORRIS.