

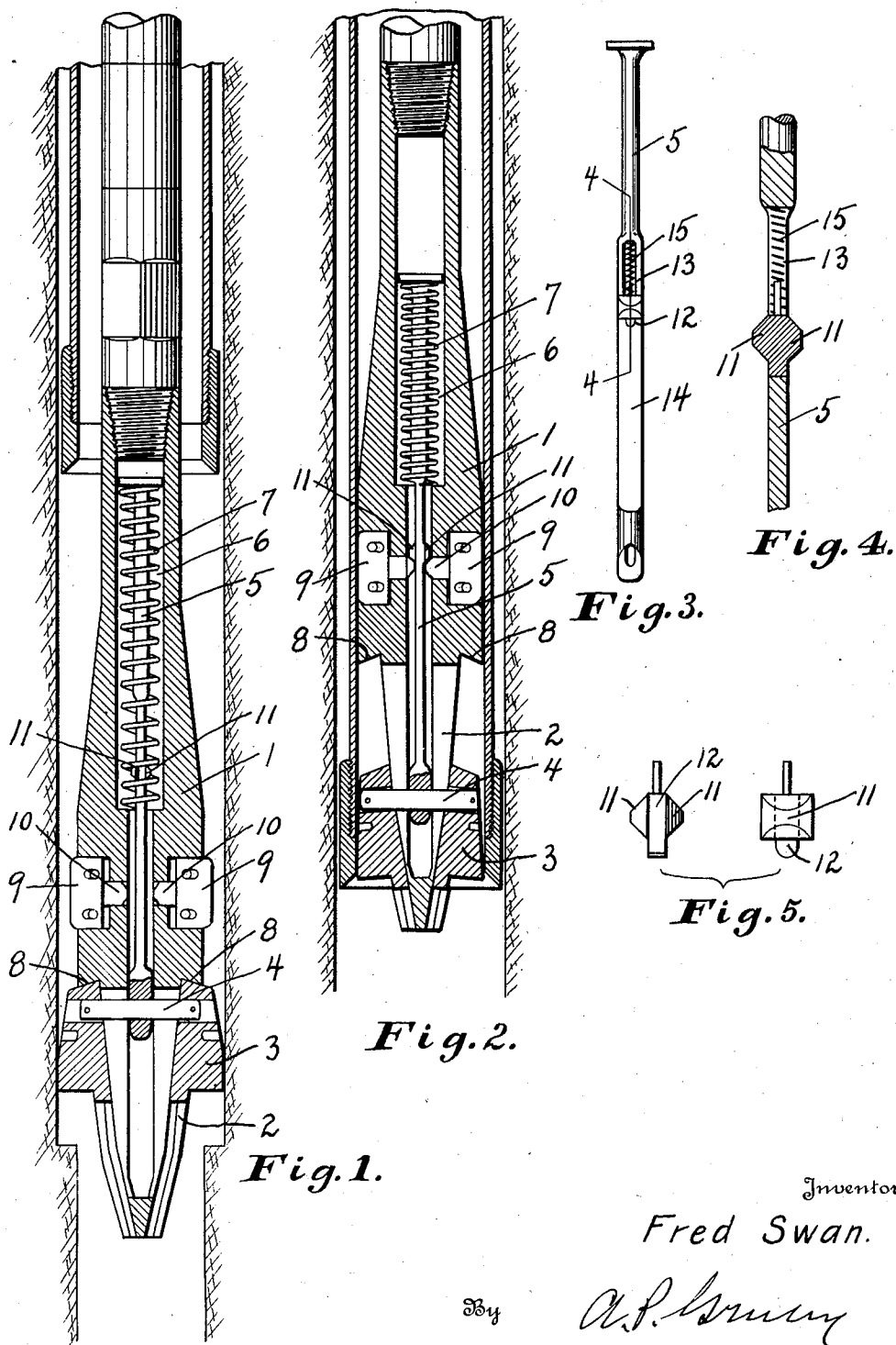
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SPRING ROD FOR UNDERREAMERS

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SPRING ROD FOR UNDERREAMERS.

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To all whom it may concern:

Be it known that I, FRED SWAN, a citizen of the United States, residing at Marietta, in the county of Washington and State of Ohio, have invented certain new and useful Improvements in Spring Rods for Underreamers, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

My invention relates to improvements in spring rods of under-reamers such as the Swan under-reamer shown in U. S. patents to John C. Swan, Nos. 683,352 dated Sept. 24, 1901, and 979,106 dated Dec. 20, 1910.

In Swan under-reamers as well as in other under-reamers and in a number of other expansible tools used in well drilling which are adapted to be introduced through casing, and to be expanded below casing to enlarge a hole drilled below casing or to drill below casing a hole of greater diameter than the interior of the casing, the cutters are slidable on inclined ways into and out of expanded position, these inclined ways, normally, as in the Swan under-reamer, being so arranged that as the cutters slide upward on the inclined ways they are forced radially outward and as they are drawn downward on the tool body they move inward so that when at their lowest position their outer edges are within a circle not greater in diameter than is the interior of the casing.

In the construction to which my present improvement is applied the cutters are connected to a spring rod which is movable longitudinally of the tool body and is acted upon by a spring carried within the tool body to draw the cutters upward into expanded position. To hold the cutters in collapsed position for introducing the tool into and lowering it through the casing the spring rod is locked against the tendency of the spring to draw it upward by trips which engage the spring rod and are held in engagement therewith by the walls of the casing.

In drawing out an expanding tool of this character the cutters as they are drawn upward into the lower end of the casing are

held until as the tool body is drawn upward the downwardly tapering ways cause the cutters to move radially inward so that they may pass into the casing. As the tool body is drawn into the lower end of the casing the trips enter the casing before the cutters and, being forced inward, will prevent the projections on the spring rod from passing downward past them, and if these projections are fixed on the spring rod, will prevent such relative movement of the tool body and cutters as is required to bring the cutters down to the lower ends of the inclined ways. While if the projections on the spring rod which are engaged by the trips in introducing the tool into casing are fixed, and being above the trips when the trips are moved inward and will thus prevent the cutters from being drawn as closely together as they are drawn for introduction into the upper end of the casing, there is usually sufficient margin of difference between the distance between the outer edges of the cutters when they are as near the lower ends of the ways as is possible while the projections on the spring rod are still above the trips, it sometimes happens that the cutters are overdressed, that is, in dressing them their outer edges are spread too much. When the cutters are thus overdressed the distance between their outer edges may be such that when they are as near the lower ends of the inclined ways as the spring rod will permit, they will not enter the casing but will hold the tool locked against withdrawal.

My present invention is intended to obviate this difficulty by so constructing the spring rod that the portions carried by it which are engaged by the trips will permit a limited downward movement of the spring rod, and with this object in view my invention consists in the construction and combination of elements hereinafter described and claimed.

Referring to the drawings:

Figure 1 is a longitudinal view of a Swan under-reamer in position to operate below casing.

Fig. 2 is a similar view showing a Swan under-reamer entering the lower end of casing.

Fig. 3 is a side view of a spring rod provided with my improvement.

Fig. 4 is a vertical sectional view on line 4-4 of Fig. 3.

Fig. 5 is a detail view of the slide shown in Figs. 3 and 4.

In the drawings 1 indicates the tool body having at its lower end downwardly tapering inclined ways 2 in which are guided the cutters 3. Cross bar 4 carried in a slot at the lower end of spring rod 5 connects these cutters with the spring rod which extends upward into a central chamber 6 in which is arranged spring 7 which acts upon the spring rod to draw it upward and, through the spring rod, to draw the cutters upward on the tapering ways to come into contact with abutment 8. In the walls of the tool body are formed radial recesses in which are received trips 9, the outer end portions of which are adapted to contact with the interior of the casing to hold the pins 10 against the spring rod and, by engaging above projections on the spring rod when it is drawn down against the face of the spring, act to hold the spring rod in this downward position and thus hold the cutters in collapsed position. The projections usually used on the spring rod are fixed.

In order to permit downward movement of the spring rod beyond the point at which it will be held by engagement of the projections above the trips, as may be necessary to permit cutters which are dressed oversize to enter the casing, I form the projections 11 with which the pins 10 of the trips 9 engage, on a slide 12 which is movable in a slot 13, extending longitudinally through a preferably slightly flattened portion 14 of the spring rod. The slide 12 is so formed that when its lower end fits against the lower end of the slot 13 its upper end is sufficiently away from the upper end of the slot to permit considerable movement. A coiled spring 15 between the upper end of the slide and the upper end of the slot tends to keep the slide with its lower end against the lower end of the slot but this spring may be omitted.

The slide 12 is preferably formed in one piece with the projections 11 and in order to place it in position the sides of the slot 13 are preferably heated and spread, the slide inserted and the sides forced back into position.

When the under-reamer is to be introduced into the top of the casing the cutters are drawn down into collapsed position and inserted into the casing. As the trips enter the casing they are forced and held inward with their pins 10 engaging the upper faces of the projections 11 holding the slide 12

against upward movement until the trips pass below the lower end of the casing, and as the lower end of the slide is against the lower end of the slot 13 the spring rod and the cutters cannot be drawn upward by spring 7.

In drawing out, the trips enter the lower end of the casing before the cutters and are forced inward. This prevents the projections 11 from passing the pins 10 of these trips and if these projections were fixed, might so hold the spring rod against downward movement as to prevent the cutters, if dressed over size, from entering the lower end of the casing. By the movement of the spring rod permitted by the slide the difficulty is overcome and the upward pull of the tool body will so draw it through the cutters that they will be so drawn inward as to permit them to enter the casing.

It will, of course, be understood that the invention is not limited to use with the Swan under-reamer or to any particular under-reamer or expanding drilling tool, but is applicable to any form of tool in which the cutters slide on inclined ways and are drawn into expanded position by a spring rod adapted to be locked against movement by trips.

Having thus described my invention what I claim is:—

1. In a well drilling tool, a body provided with tapering ways, cutters slidable in said ways into and out of expanded position, a spring for sliding the cutters upon the ways into expanded position, a spring rod connecting the cutters and the spring and means for engaging the spring rod to hold the cutters in contracted position against the force of the spring comprising trips carried by the tool body, and a slide carried by the spring rod provided with projections to be engaged by the trips, said slide being so mounted on the spring rod as to permit the spring rod to move relative to said projections against the force of the spring by which the spring rod is operated, and yielding means carried by the spring rod for resisting relative movement of the slide and spring rod.

2. In a well drilling tool, a body provided with tapering ways, cutters slidable in said ways into and out of expanded position, a spring for sliding the cutters upon the ways into expanded position, a spring rod connecting the cutters and the spring and means for engaging the spring rod to hold the cutters in contracted position against the force of the spring comprising trips carried by the tool body, and a slide carried by the spring rod provided with projections to be engaged by the trips, said spring rod being provided with a longitudinal slot and said slide extending through and being movable in said slot so as to permit the spring rod to move relative to said projections against

the force of the spring by which the spring rod is operated.

3. A spring rod for use in expansible drilling tools of the type in which the cutters are slidable on tapered ways into expanded position by a spring and are held in contracted position against the force of the spring by trips, said spring rod being adapted to serve as the connecting means
10 between the cutters and the spring and hav-

ing a longitudinal slot formed therein, a slide movable in said slot and carrying projections for engagement with the trips, and means arranged in said slot adapted to yieldingly hold the slide against one end thereof. 15

In testimony whereof, I hereunto affix my signature.

FRED SWAN.