

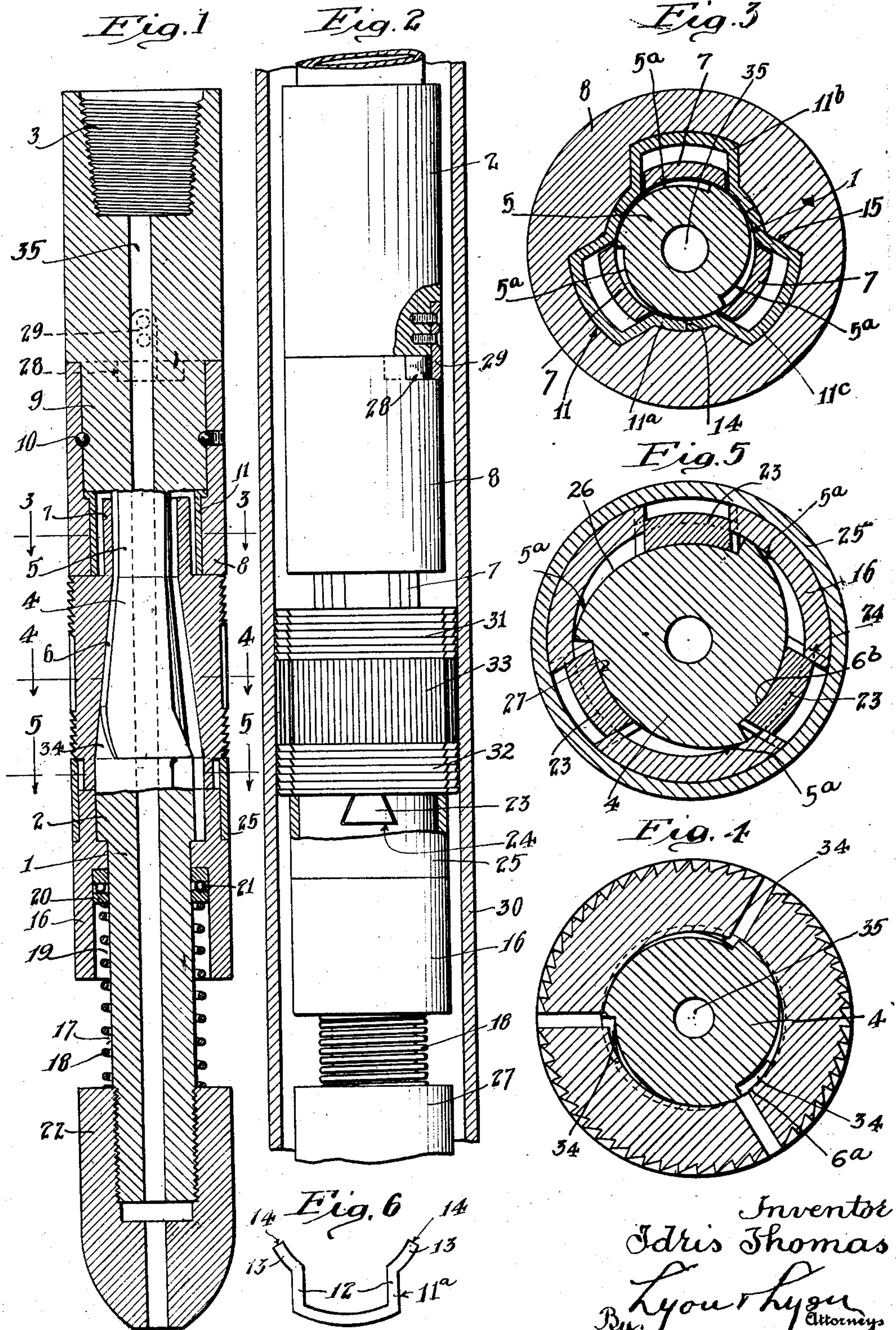
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CASING SPEAR

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UNITED STATES PATENT OFFICE

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CASING SPEAR

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This invention relates to fishing tools of the type disclosed in Patent Number 1,687,808, granted October 16, 1928, to Ernest I. Tibbet and myself. In the present invention, however, the preferred embodiment involves the use of a longitudinally tapered portion or waist on the mandrel of the tool, carrying slips for engaging with the casing to be pulled. Tools of this type have been employed in which the slips are maintained in an elevated position on the waist by frangible means which may be broken after the spear has been inserted in the casing, operating to permit the slips to move relatively downwardly on the mandrel toward the larger end of the tapered portion, thereby forcing the slips outwardly and anchoring them against the wall of the casing. The general object of this invention is to provide improved means for mounting the slips on the mandrel and for enabling a relative rotation of the mandrel and slips, to enable the slips to be released at will; also to provide a tool of this class of improved construction, including means for retaining the slips normally in a retracted position in which they are held at an elevated position on the tapered waist of the mandrel.

In the preferred embodiment of the invention, the slips include upwardly projecting tangs at their upper ends, which are retained by a ring or collar on the mandrel. The tool is constructed so that this collar can be passed up over the enlarged lower portion of the waist of the mandrel, and one of the objects of the invention is to provide a construction which will enable this to be accomplished and, at the same time, provide for effective guiding of the upper tangs of the slips.

A further object of the invention is to provide means for connecting the lower ends of the slips in such a way that, if one of the slips engages the casing when the mandrel is pulled upwardly, it will immediately communicate its relative downward movement to the other slips and insure that all of the slips will be at the same elevation on the waist at all times. In this way, I am sure that the spear in operation will maintain itself centrally in the casing and that it is not possible

for any one of the slips to become cocked or thrown out of proper alignment with the other slips.

In the preferred embodiment of the invention the tapered waist of the mandrel is provided with circumferential cam faces engaging the slips, the presence of which enables the slips to be moved outwardly or inwardly with respect to the axis of the mandrel, and one of the objects of the invention is to provide simple means in combination with the mandrel for limiting the rotary movement of the slips with respect to the mandrel.

A further object of the invention is to improve the general construction of tools of this type and to provide a tool capable of being used for pulling casings of different diameters.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient casing spear.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Figure 1 is a vertical section through a casing spear embodying my invention. This view shows a portion of the mandrel in elevation and shows slips in their extreme elevated position; the section is taken about on line 1—1 of Figure 4.

Figure 2 is a side elevation of the casing spear illustrated in Figure 1, certain parts being broken away and others shown in section and partial section. This view shows the slips in their lowered position, in which they are extended outwardly with respect to the longitudinal axis of the spear.

Figure 3 is a horizontal cross-section on the line 3—3 of Figure 1, upon an enlarged scale.

Figure 4 is a horizontal cross-section taken on the line 4—4 of Figure 1, upon an enlarged scale.

Figure 5 is a horizontal cross-section, upon an enlarged scale, taken on the line 5—5 of Figure 1.

Figure 6 is a plan showing one of the segments of a liner which I prefer to employ for assisting in guiding the upper tangs of the slips.

Referring more particularly to the parts, 1 represents the mandrel of the casing spear, which is preferably constructed with an enlarged head 2 at its upper end having means such as a tapered threaded box 3 for attaching the same to the lower end of a tool string. Below the head 2 the mandrel is provided with a tapered portion or waist 4 of general conical form, with a slight taper and having its larger end disposed downwardly toward the lower end of the spear. I prefer to provide a neck 5 of reduced diameter at the upper end of the waist, and between it and the head 2. This neck has circumferential cam faces 5^a (see Fig. 3).

The waist 4 of the spear is formed with a plurality of circumferential cam faces 6 (see Figure 4); the inner faces of the slips 6^a are curved to fit against these cam faces and against the cam faces 5^a in such a way that by a relative rotation of the mandrel with respect to the slips, the slips can be moved outwardly or permitted to move inwardly with respect to the longitudinal axis of the spear.

The upper ends of the slips are provided with upper tangs 7 of reduced width that cooperate with the cam faces 5^a (see Figure 3), and these tangs are retained in a collar 8 which seats on a cylindrical neck 9 of reduced diameter formed on the mandrel. If desired, a ball bearing 10 may be provided between the collar and the neck 9.

I prefer to construct the tool so that this collar 8 can be slipped up on the tool from its lower end. However, this necessitates a considerable inside diameter for this collar, which tends to give too much freedom of movement of the tangs 7 in the collar. In order to overcome this difficulty, I provide a liner 11 for the collar which preferably consists of three sections, 11^a, 11^b, and 11^c. These sections are just alike, and one of them is illustrated removed from the tool in Figure 6. Each section or segment comprises a U-shaped body with parallel side bars 12 which operate to engage the side edges of the tangs 7 to guide them, and these bars 12 terminate in arcuate fingers 13 which are struck on substantially the same radius as the inside diameter of the collar so that the ends 14 of the arcuate fingers meet together, as illustrated in Figure 3, thereby holding the liner 11 properly centered in the tool. The collar is also provided with outwardly extending recesses 15 to receive the bodies of the segments or sections of the liner (see Figure 3).

Below the slips the spear is provided with means for normally holding all the slips in an elevated position on the waist. For this pur-

pose I prefer to provide a sliding collar 16 mounted to slide on an elongated neck 17 of reduced diameter at the lower end of the mandrel. Any suitable means may be provided for holding this collar up but for this purpose I prefer to provide a coil spring 18 the upper end of which is received in an annular chamber 19 formed within the collar, the upper end of the spring thrusting against a bottom ring 20 of a ball-bearing 21. The lower end of the spring thrusts against the bowl 22 of the spear which may be attached to the lower end of the neck 17 by screw threads.

I prefer to provide an interlocking connection between the lower ends of the slips and the collar 16. For this purpose each slip is provided with a lower tang 23 preferably of dove-tail shape and these tangs are received in corresponding dove-tail notches 24 formed in the upper end of the collar 16. The tangs 23 are prevented from moving out of the dove-tail notches by means of an encircling retaining ring 25 (see Figure 1).

If desired, I may rely entirely upon the cam faces 6 for controlling the position of the slips by relative rotary movement of the mandrel and slips, but I prefer to provide similar circumferential cam faces 26 on the mandrel just below the tapered waist portion 4 and between it and the neck 17 (see Figure 5). These cam faces 26 fit against the curved inner faces 27 of the lower tangs 23 and assist in forcing the slips outwardly when the mandrel is rotated relatively to the slips in a clock-wise direction.

With this organization of parts it will be evident that the casing spear may be lowered down into a well with the mandrel in any relative oriented position with relation to the slips. In other words, where the casing spear is being used on a relatively large casing, the mandrel would be in an oriented position holding the slips projected out as far as possible so that the slips may touch the wall of the casing that is to be pulled. In order to anchor the spear to the casing to be pulled the mandrel would be given an upward pull or jar, which would set the slips against the casing by reason of the longitudinal taper of the waist.

When it is desired to release the casing spear, this can be done by rotating the mandrel in an anti-clockwise direction.

It will be evident that by reason of the circumferential cam faces 6 and 26, the casing spear has a wide range of usefulness, enabling it to be used for pulling casings having a considerable range in diameter. Furthermore, by reason of the interlocking connection between the slips and the collar 16, it will be evident that the slips will always be held at the same elevation on the waist 4. This maintains the mandrel at all times centrally in the casing that is to be pulled. The pres-

ence of the liner 11 insures effective guiding of the upper tangs of the slips and the arcuate portion of the body of each segment of this liner prevents the tangs from having too great outward movement.

It has been found in practice that when oil well workers employ tools of this general type which include a longitudinally tapered waist on the mandrel, they may insert the casing spear with the slips in an extreme position which renders it impossible for the slips to function properly when they are to be set against the casing wall. This tool tends to overcome this objection and insures that the slips will always be held in their uppermost position. Hence, if the tool is run down into the casing in its expanded position, the slips cannot fail to bite against the casing when an upward pull is given to the mandrel; this will insure proper releasing of the tool by relative rotation of the mandrel with respect to the slips.

While it is not essential, I prefer to provide means for limiting the relative rotary movement of the mandrel with respect to the slips. For this purpose I provide a notch 28 in the upper edge of the collar 8 and I provide a downwardly projecting tongue 29 secured to the head of the mandrel and projecting down into this notch. The ends of this notch striking against the edges of the tongue 29 evidently will limit the relative rotary movement of the mandrel and the slips.

The outer faces of the slips are provided with wickers or teeth for engaging the inner face of the wall of a casing such as the casing 30 (see Fig. 2). These wickers may be formed as illustrated with two zones 31 and 32 in which the teeth extend circumferentially, and I may provide between these zones an intermediate zone 33 in which the teeth or wickers extend in a longitudinal direction on the face of the slip.

In using a tool of this kind having a longitudinal and circumferentially tapered waist on the mandrel, I find in practice that when an upward pull has been exerted in which the slips 6^a move downwardly relatively on the tapered waist 4, there is a tendency for them to sidle or shift laterally toward the receding portions 6^b of the cam faces. This, of course, is objectionable as it tends to release the slips. I provide means on the waist of the mandrel which overcome this tendency.

For this purpose I provide the large end of the waist 4 adjacent the receding portion 6^b of the cam faces with inclined shoulders 34 (see Fig. 1). If it should happen that the slips 6^a have moved down relatively on the waist of the mandrel and they tend to sidle toward the receding portion of the cam, they will engage these inclined faces 34, which faces will exert a lateral thrust upon the slips to prevent this lateral shifting or sidling movement. In this way the slips are made

to "stand up" under the pressure and cannot shift around on the mandrel in such a way as to loosen themselves. This tendency of the slips to sidle around on the mandrel is not objectionable if the slips have not slid down considerably, because if they are being pressed by the mandrel well up on the tapered waist, then there is plenty of taper or larger portion of the mandrel below to increase the wedging or jamming action due to the pull. It is only necessary to have this means toward the large end of the waist.

The tool may be provided with a central bore 35 for passing circulating water down through it.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What I claim is:

1. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, yielding means for holding the slips in an elevated position on the waist, said waist having circumferential cam faces to move the slips in or out when the mandrel is rotated relatively to the slips.

2. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their upper ends, a collar distinct from the mandrel mounted on the mandrel and having means for retaining the tangs against outward and lateral movement in any operating position of the same, yielding means for holding the slips in an elevated position on the waist, said waist having circumferential cam faces operating to permit the slips to move in or out when the mandrel is rotated relatively to the slips while they are engaging the casing.

3. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their upper ends, means separate from the mandrel mounted on the mandrel for engaging said tangs on their outer faces and side edges to retain the slips on the mandrel, said slips having tangs at their lower ends, means mounted to slide on the mandrel below the said waist for engaging the lower tangs to retain the slips at their lower ends, and a

spring engaging said means and normally holding the same and the slips in an elevated position, said waist having circumferential cam faces operating to release the slips and permit the same to move inwardly toward the axis of the mandrel when the mandrel is rotated relatively to the slips when the slips are set on the inside of a casing.

4. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, a collar mounted to slide on the mandrel below the slips, said collar and said slips having means for enabling the slips to interlock with the collar by radial movement of the slips toward the mandrel, said collar having means for preventing outward movement of the lower ends of the slips after interlocking with the collar, and a spring normally holding the collar in an elevated position, said waist having circumferential cam faces for engaging the inner faces of the slips and operating to move the slips in or out when a relative rotation of the mandrel occurs with respect to the slips.

5. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their lower ends, a collar mounted to slide on the mandrel below the waist, said tangs being of substantially dove-tail form and said collar having slots receiving the tangs and interlocking with the same when the slips are moved radially inwardly toward the axis of the mandrel, and a spring on the mandrel for normally holding the collar and the slips elevated.

6. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their lower ends, a collar mounted to slide on the mandrel below the waist, said tangs being of substantially dove-tail form and said collar having slots receiving the tangs and interlocking with the same when the slips are moved radially inwardly toward the axis of the mandrel, and a spring on the mandrel for normally holding the collar and the slips elevated, said slips having tangs at their upper ends and a collar on the mandrel above the slips for retaining the last named tangs.

7. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said man-

drel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their upper ends, a collar on the mandrel for engaging the outer faces and side edges of the tangs for guiding the tangs longitudinally on the mandrel, and for retaining the tangs, yielding means for holding the slips in an elevated position on the waist, said waist having circumferential cam faces operating to permit the slips to move in or out when the mandrel is rotated relatively to the slips while they are engaging the casing, and means for limiting the relative rotary movement of the mandrel with respect to the slips.

8. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their upper ends, a collar capable of being passed up the mandrel from below and past the said waist to a point opposite said tangs having means for maintaining the tangs in longitudinal alignment with the mandrel and for limiting the outward movement of said tangs, a lower collar mounted to slide on the mandrel below the waist and having means for retaining the lower ends of the slips, and a spring on the mandrel for normally holding the last named collar and the slips in an elevated position.

9. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having tangs at their upper ends, a collar capable of being passed up the mandrel from below and past the said waist to a point opposite said tangs for retaining said tangs, a lower collar mounted to slide on the mandrel below the waist and having means for retaining the lower ends of the slips, and a spring on the mandrel for normally holding the last named collar and the slips in an elevated position, and a segmental liner for the first named collar capable of being put in place after the upper collar has been slid upwardly over the mandrel to a point near the location of the said tangs.

10. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having a plurality of tangs at their upper ends projecting up-

wardly, a collar capable of being slipped upwardly over the lower portion of the mandrel to a point opposite the tangs for retaining the tangs, a liner for the said collar including a plurality of segments corresponding to the tangs and guiding the tangs, and means mounted on the mandrel below the waist for retaining the lower ends of the slips.

11. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and a plurality of tangs at their upper ends projecting upwardly, a collar capable of being slipped upwardly over the lower portion of the mandrel to a point opposite the tangs for retaining the tangs, a liner for the said collar including a plurality of segments corresponding to the tangs and engaging the outer faces and side edges of the tangs for guiding the tangs, and means mounted on the mandrel below the waist for retaining the lower ends of the slips, and a spring associated with the last named means for normally holding the slips in an elevated position.

12. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, and having a plurality of tangs at their upper ends projecting upwardly, a collar capable of being slipped upwardly over the lower portion of the mandrel to a point opposite the tangs for retaining the tangs, a liner for the said collar including a plurality of segments corresponding to the tangs and guiding the tangs, and means mounted on the mandrel below the waist for retaining the lower ends of the slips, and a spring associated with the last named means for normally holding the slips in an elevated position, said mandrel having circumferential cam faces corresponding to the slips for moving the slips in or out when the mandrel has a relative rotation with respect to the slips.

13. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, and having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging the casing, said waist having circumferential cam faces to cooperate with the slips to enable the same to move in or out when the mandrel is rotated relatively to the slips, and means on the mandrel operating to engage the lower ends of the slips and exert a lateral force upon the same to prevent the slips from sidling laterally on the cam faces toward the depressed portions thereof.

14. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, and having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging the casing, said waist having circumferential cam faces to cooperate with the slips to enable the same to move in or out when the mandrel is rotated relatively to the slips, said waist having shoulders located toward the large end of the waist and adjacent the receding portions of the cam faces, and disposed in an inclined direction, said shoulders operating to engage the lower ends of the slips and exert a lateral force upon the same to prevent the slips from sidling laterally on the cam faces toward the depressed portions thereof.

15. In a casing spear, the combination of a mandrel having a head at its upper end for attaching the same to a tool string, said mandrel having a tapered waist with its larger end disposed downwardly, a plurality of slips mounted on the tapered waist for engaging a casing, yielding means for holding the slips in an elevated position on the waist, said waist having circumferential cam faces to move the slips in or out when the mandrel is rotated relatively to the slips, and having shoulders located toward the large end of the waist and adjacent the cam receding portions of the cam faces, and disposed in an inclined direction and operating to engage the lower ends of the slips and force the same laterally on the faces of the cams and toward the projecting portions of the cam faces.

Signed at Los Angeles, Calif., this 27th day of June, 1929.

IDRIS THOMAS.

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