This invention relates to new and useful improvements in overshot-grappling tools.

Hereinafter, overshots or grappling tools employing a helix or spiral grapping element have been in use, several types of which are illustrated in United States Patent Nos. 2,174,076 and 2,559,315. The latter patent was granted to the present inventor, Dean W. Osmun. Such prior constructions have included a sliding keyway connection for permitting a longitudinal non-rotative sliding of the helical grapple.

An object of the present invention is to provide a new and improved overshot-grappling tool or casing patch having a helix grapple element which is mounted for non-rotative longitudinal sliding movement while eliminating the sliding keyway connections hereinafter used.

An important object of this invention is to provide a new and improved tool which may be used as an overshot-grapple or as a casing patch, wherein a helical grapple element is mounted in a body or bowl with the lower end of the grapple element secured to the bowl, and with the grapple element constructed so as to prevent any abrupt bending at the area of attachment of the grapple element to the tool.

A particular object of this invention is to provide a new and improved overshot-grappling tool or casing patch which has a helical grapple element disposed in an internal helical groove in the tool bowl or body with the lower end of the grapple element welded or otherwise secured to the bowl and with approximately one revolution of the grapple element extending upwardly from the weld having a smooth internal bore so as to allow the casing or pipe entering the grapple element to become engaged thereby without breaking the welded connection.

The preferred embodiment of this invention will be described hereinafter, together with other features thereof, and additional objects will become evident from such description.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

FIG. 1 is a vertical sectional view of the tool of this invention in its running-in position prior to engagement with a pipe or casing;

FIG. 2 is a view similar to FIG. 1, but illustrating the tool of this invention with the pipe or casing in the engaged or gripped position; and

FIG. 3 is a partial enlarged sectional view illustrating in detail the gripping action by the grapple element of the tool.

In the drawings, the letter A designates generally the overshot-grappling tool or casing patch of this invention which is adapted to be releasably connected to a pipe or casing C. Briefly, the tool A includes a bowl or body 10 which is adapted to be connected to a pipe string (not shown) through an annular sub 12 or a similar connecting means. A spiral or helical grapple element 14 is disposed in the bowl 10 for gripping engagement with the casing or pipe C when it is moved longitudinally into the bore of the element 14 and in contact with the gripping teeth 15 thereof. As will be explained more in detail hereinafter, the tool A of this invention is constructed so that it engages a pipe, rod or other object in a well with a gripping action so that the pipe or other object so gripped may be removed from the well. In some instances, the tool A of this invention may be used as a casing patch so that it is disposed over the upper end of a portion of the pipe or casing C and left in position for subsequent use in the well in cooperation with the pipe string above the tool A.

Considering the invention more in detail, the bowl 10 has an internal spiral or helical groove 16 formed therein for receiving the spiral or helical grapple element 14. Both the groove 16 and the grapple element 14 have a left hand helical configuration. In cross-section, the groove 16 has a downwardly and inwardly tapered surface 16a and an upper laterally extending shoulder 16b. The grapple element 14 is formed of a resilient spring material, preferably steel, and is provided with an external surface 14a which is downwardly and inwardly tapered as viewed in cross-section for wedging the grapple element 14 in gripping contact with the casing C so as to gradually increase such gripping contact and securely hold the casing C within the bowl 10. In the usual case, the upper end 14b of the grapple element 14 is adapted to engage the laterally extending shoulder 16b prior to the insertion of the casing C or other object within the bore of the grapple element 14 (FIG. 1).

The teeth 15 on the grapple 14 preferably have an upward inclination as best seen in FIG. 3 of the drawings to assure an effective gripping engagement between the grapple element 14 and the casing C or other object when an upward pull is applied to the tool A, as will be more evident hereinafter.

In the present invention, the lower end 14c of the grapple element 14 is welded or otherwise connected at 22 to the bowl 10 at the lower end of the helical groove 16 (FIG. 1). Also, the lower portion of the grapple element 14 is provided with a smooth internal bore as indicated at 14d, preferably for approximately one revolution of the grapple 14. By reason of such smooth bore portion 14d of the grapple element 14, the casing C or other object which is moved upwardly within the grapple element 14 is prevented from exerting an abrupt bending force on the weld 22. Therefore, the grapple element is resilient in a longitudinal direction even though the weld 22 is a rigid connection. The internal diameter of the teeth 15 are preferably slightly less than the external diameter of the casing C or other object C which enters the bore of the grapple element 14 so that the casing C or other object is adapted to pass longitudinally upwardly through the bore of the grapple element 14 while the teeth 15 engage therewith. There is a slight radial or outward expansion of the grapple element 14 by reason of the engagement of the teeth 15 with the external surface of the casing C as can be seen by comparing FIGS. 1 and 2 of the drawings. It is to be noted that the upper end 14e of the grapple element 14 is not attached to the bowl 10.

In fact, the grapple element 14 is not attached to the bowl 10 in any place other than the weld connection 22.

In order to guide the casing C into the bore of the grapple element 14, a guide sleeve 25 is disposed within the bore of the bowl 10 below the grapple element 14. Preferably, such guide sleeve 25 is welded to the bowl 10 as indicated at 25a and the lower annular edge is tapered at 16c and 25a so as to assure the proper movement of the casing C within the bore of the bowl 10 as the tool A is lowered over the casing C in use. The sleeve 25 has an internal diameter which is about the same, or slightly greater than, the bore of the grapple element 14 as best seen in FIG. 1.

When the tool A is used as a casing patch, a resilient seal 30 formed of rubber or the like of the type disclosed in U.S. Patent 2,659,440 is preferably utilized. Such seal 30 has sealing lips 31 and 32 which sealingly engage the external surface of the casing C (FIG. 2). A retaining
sleeve 34 of steel or similar material is disposed over the seal 30 as shown in FIG. 1 and is held in such position by a shear pin 35 during the running-in of the tool A. When the upper end of the casing C engages the lower end of the sleeve 34, the shear pin 35 is severed and the sleeve 34 moves upwardly to the position shown in FIG. 2 so as to expose the full seal 30 to the external surface of the casing C.

In the use or operation of the tool A of this invention, it is lowered into a well on a pipe or tubing string connected in the usual manner to the top sub 12. Ordinarily, the casing C or the sub A which is to be engaged and gripped by the tool A is disposed a substantial distance below the surface of the well. The casing C is guided into the bore of the tool 10 by the inclined surfaces 126 and 25a and then by the guide sleeve 25.

Since the lower portion 144 of the grapple element 14 has a smooth bore, the casing C passes smoothly through such smooth bore 144 without any appreciable contact or interference. Ultimately, the casing C engages the teeth 15 on the upper portion of the grapple element 14. Since the teeth 15 project upwardly, the casing C slides upwardly across the teeth 15 even though it engages them. As the tool A is lowered downwardly with respect to the casing C, the grapple element 14 passes downwardly over the casing C. When the upper end of the casing C engages the lower edge of the sleeve 34, the pin 35 is sheared, and the sleeve 34 is moved upwardly to the position shown in FIG. 2, at which point, the relative downward movement of the tool A with respect to the casing C is stopped.

Thereafter, in order to increase the effective gripping action of the grapple element 14 with the casing C, the grapple tool A may be lifted upwardly causing the grapple element 14 to wedge by a downward movement along the taper surface 16c as illustrated in FIG. 3. If the casing C or other object is to be removed from the well, the upward lifting with the grapple tool A further increases the gripping action and facilitates the removal of the casing C or other object from the well.

If it should become desirable or necessary to remove the grapple element 14 from the casing C or other object engaged thereby, the tool A may be released by rotating it to the right and lifting upwardly on the tool A, whereby the entire tool A may be withdrawn from the well, leaving the casing C in the well.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A well tool adapted to be used as an overshot-grapple or a casing patch, comprising:
   (a) a tool bowl adapted to have its upper end connected to a pipe string,
   (b) said bowl having a longitudinal bore with an internal helical groove formed therein,
   (c) a helical grapple element disposed in said helical groove,
   (d) co-acting downwardly and inwardly tapered surfaces on said grapple element and on said helical groove for causing said grapple element to move inwardly as it moves longitudinally downwardly relative to said bowl so as to effect an increasing gripping action on a pipe engaged by the grapple element,
   (e) a weld connection attaching the lower end of said grapple element to said bowl,
   (f) a lower section of the inner surface of said grapple element extending upwardly from the attaching means being substantially smooth for about one revolution thereof to enable a pipe to pass therethrough, and
   (g) an upper section of the inner surface of said grapple element disposed upwardly from said lower section and having pipe-engaging teeth for gripping a pipe disposed within said grapple element.

2. A well tool adapted to be used as an overshot-grapple or a casing patch, comprising:
   (a) a tool bowl adapted to have its upper end connected to a pipe string,
   (b) said bowl having a longitudinal bore with an internal helical groove formed therein,
   (c) a helical grapple element disposed in said helical groove,
   (d) co-acting downwardly and inwardly tapered surfaces on said grapple element and on said helical groove for causing said grapple element to move inwardly as it moves longitudinally downwardly relative to said bowl so as to effect an increasing gripping action on a pipe engaged by the grapple element,
   (e) means attaching the lower end of said grapple element to said bowl,
   (f) said grapple element having about one revolution of its inner surface formed with a smooth bore to enable a pipe to pass therethrough, and
   (g) said grapple element having pipe-engaging teeth formed on its inner surface above the smooth portion for gripping a pipe disposed within the grapple element.

3. A well tool adapted to be used as an overshot-grapple or a casing patch, comprising:
   (a) a tool bowl adapted to have its upper end connected to a pipe string,
   (b) said bowl having a longitudinal bore with an internal helical groove formed therein,
   (c) a helical grapple element disposed in said helical groove,
   (d) co-acting downwardly and inwardly tapered surfaces on said grapple element and on said helical groove for causing said grapple element to move inwardly as it moves longitudinally downwardly relative to said bowl so as to effect an increasing gripping action on a pipe engaged by the grapple element, and
   (e) a weld connection at the lower end of the grapple element connecting the grapple element to the bowl to prevent relative rotational and longitudinal movement therebetween while the portion of the grapple element above the weld connection which is unconnected to the bowl moves longitudinally relative to the bowl.

4. A well tool adapted to be used as an overshot-grapple or a casing patch, comprising:
   (a) a tool bowl adapted to have its upper end connected to a pipe string,
   (b) said bowl having a longitudinal bore with an internal helical groove formed therein,
   (c) a helical grapple element disposed in said helical groove,
   (d) co-acting downwardly and inwardly tapered surfaces on said grapple element and on said helical groove for causing said grapple element to move inwardly as it moves longitudinally downwardly relative to said bowl so as to effect an increasing gripping action on a pipe engaged by the grapple element,
   (e) a weld connection connecting the lower end of the grapple element to the bowl,
   (f) a lower section of the inner surface of said grapple element extending upwardly from the attaching means being substantially smooth to enable a pipe to pass therethrough, and
   (g) an upper section of the inner surface of said grapple element disposed upwardly from said lower section and having pipe-engaging teeth for gripping a pipe disposed within said grapple element.
5. A well tool adapted to be used as an overshot-grapple or a casing patch, comprising:
(a) a tool bowl adapted to have its upper end connected to a pipe string,
(b) said bowl having a longitudinal bore with an internal helical groove formed therein,
(c) a helical grapple element disposed in said helical groove,
(d) co-acting downwardly and inwardly tapered surfaces on said grapple element and on said helical groove for causing said grapple element to move inwardly as it moves longitudinally downwardly relative to said bowl so as to effect an increasing gripping action on a pipe engaged by the grapple element,
(e) a weld connection attaching the lower end of said grapple element to said bowl,
(f) a lower section of the inner surface of said grapple element extending upwardly from the attaching means being substantially smooth to enable a pipe to pass therethrough,

6. (g) an upper section of the inner surface of said grapple element disposed upwardly from said lower section and having pipe-engaging teeth for gripping a pipe disposed within said grapple element, and
(h) an annular resilient seal in said bowl above said grapple element for sealing with the external surface of a pipe gripped by said grapple element.

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