Oct. 9, 1956 F. A. HESTER 2,766,010

CASING WHIPSTOCKS

Filed March 6, 1953

3 Sheets-Sheet 1

Fig. 1

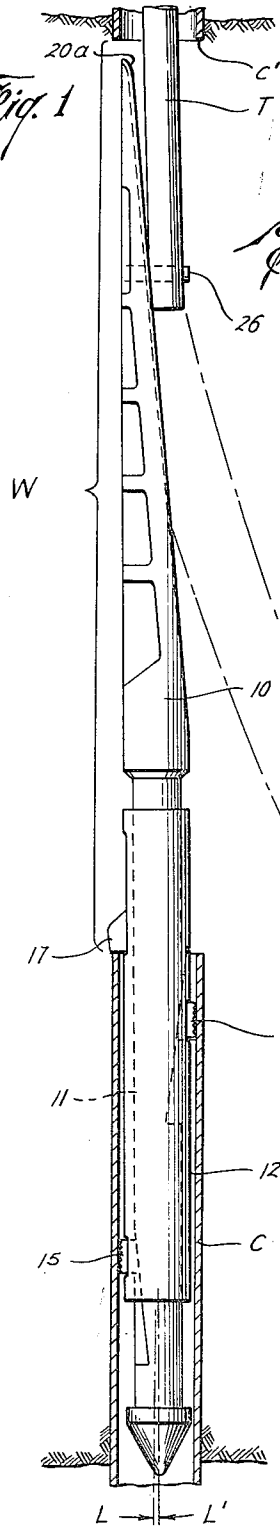



Fig. 2

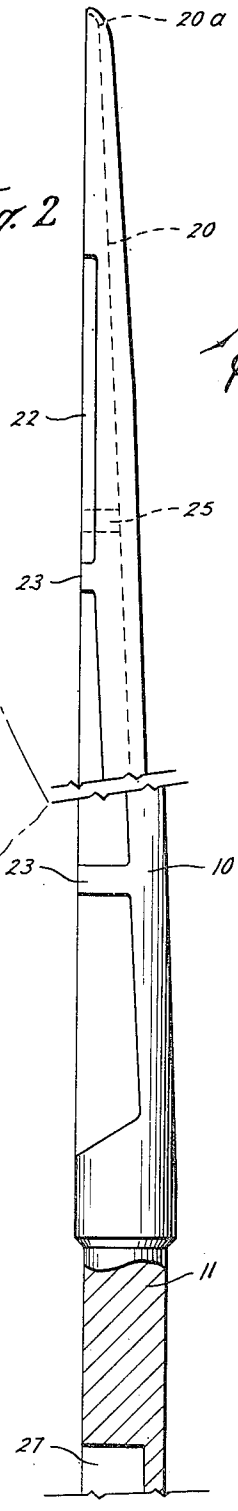
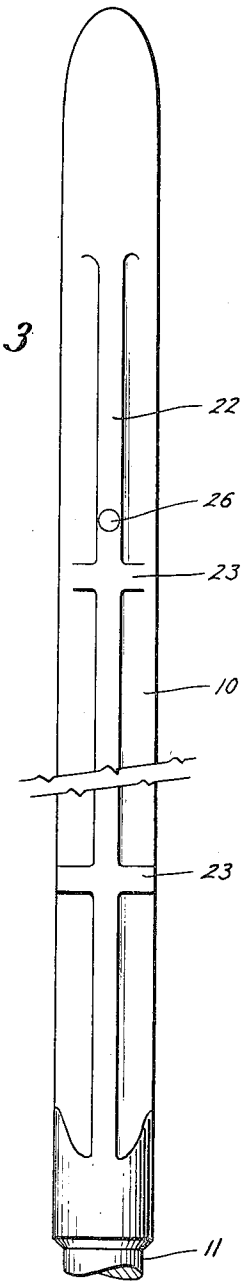



Fig. 3




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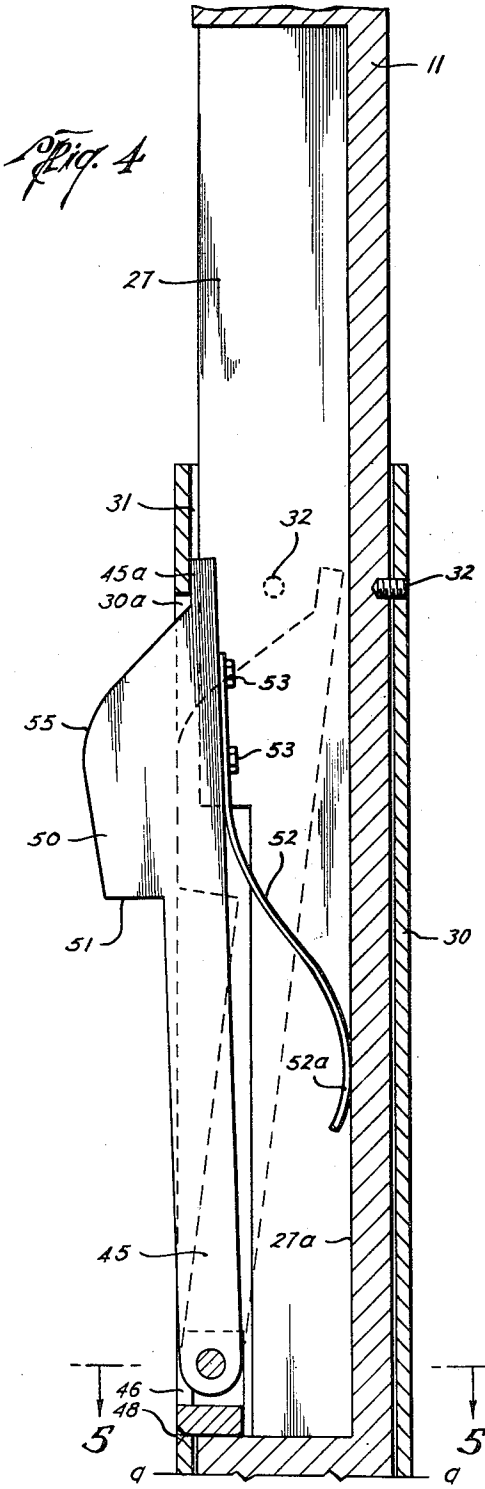
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Fig. 4



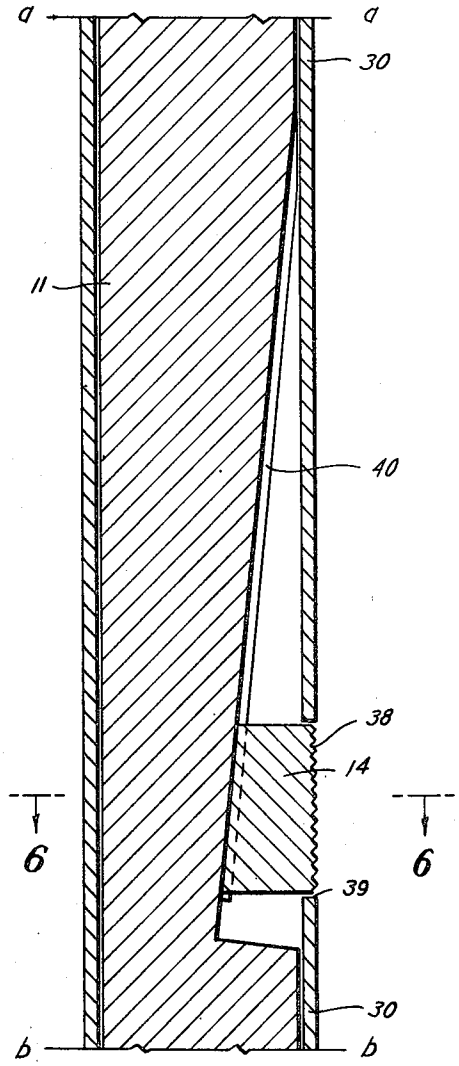




Fig. 4-A

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Fig. 4-B

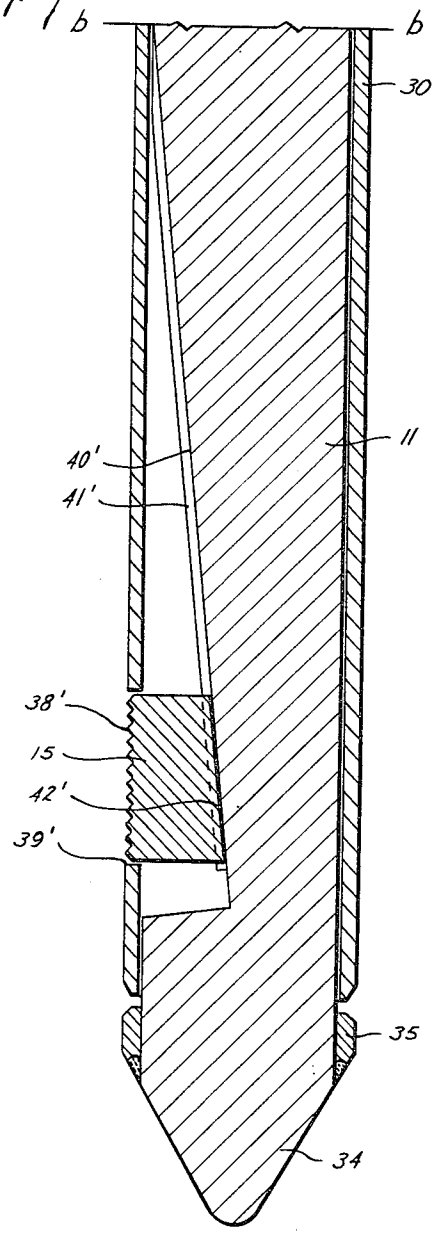
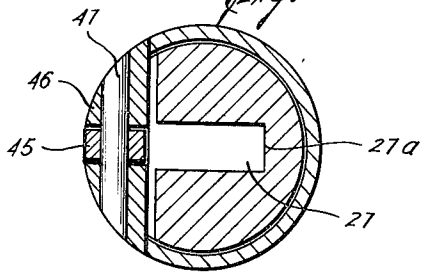



Fig. 5



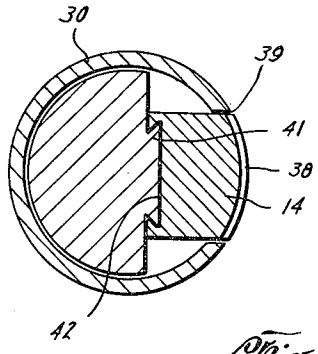




Fig. 6

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United States Patent Office 2,766,010 Patented Oct. 9, 1956



2,766,010

# CASING WHIPSTOCKS

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Application March 6, 1953, Serial No. 340,783
7 Claims. (Cl. 255—1.6)

This invention relates to new and useful improvements in casing whipstocks.

Heretofore much difficulty has been encountered in positioning casing whipstocks in a casing at the "window" or milled-out longitudinal section thereof so that a directional drilling bit can be guided through the window into the formation adjacent thereto without damaging the whipstock. In the previously known casing whipstocks, there has been no means for assuring that the upper end of the whipstock is positioned to one side of the casing with the result that many times the directional drill bit cuts up the whipstock itself instead of being guided into the formation by the inclined guide surface of the whipstock.

Also, in the previously known casing whipstocks, the surface orientation of the whipstock is often lost because the whipstock has to be rotated to prevent premature hanging of the whipstock on the upper edge of the section of casing below the window.

It is therefore one object of this invention to provide an improved casing whipstock that is adapted to automatically align the whipstock in the casing with the upper end of the whipstock disposed to one side of the well bore whereby a directional drilling bit will be guided along the inclined guide surface of the whipstock without damaging the whipstock itself.

An important object of this invention is to provide an improved casing whipstock wherein a pair of slips are utilized for tilting the whipstock to one side of the well bore to thereby assure proper guiding of a directional drill bit.

Another object of this invention is to provide an improved casing whipstock which will be guided into the lower section of casing below the window or cut-away portion thereof without the necessity for rotating the whipstock during the lowering and setting of same in the casing, whereby the surface orientation of the whipstock is maintained and the direction in which the directional drill bit is guided by the whpstock is therefore known.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

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

Figure 1 is an elevational view of the casing whipstock of this invention, with the whipstock being anchored in a sectional casing below a window or a longitudinal cut-away section of the casing.

Figure 2 is a view, partly in elevation and partly in section, illustrating the upper portion of the casing whipstock of this invention.

Figure 3 is a side view of a portion of the upper whipstock section shown in Figure 2.

Figures 4, 4A, and 4B, are views, partly in elevation and partly in section, which together illustrate the lower or anchoring section of the casing whipstock of this invention, with Figure 4 illustrating the uppermost part of the lower or anchoring section, Figure 4A illustrating the intermediate portion, and Figure 4B illustrating the lowermost portion of the lower or anchoring section.



Figure 5 is a horizontal sectional view taken on line 5—5 of Figure 4.

Figure 6 is a horizontal sectional vew taken on line 6—6 of Figure 4A.

As shown in the drawing, the guide section of the whipstock of this invention is designated by the numeral **10**. The guide section **10** has a mandrel **11** extending down below and into an anchoring section **12**, which has a pair of diametrically opposed gripping slips **14** and **15**. As will be explained, the anchoring section **12** carries a latch mechanism **17** which is adapted to engage the upper edge of a section of casing or well pipe C, to restrain the downward movement of the anchoring section **12**, whereby the slips **14** and **15** are set into gripping contact with the casing C upon a continued downward movement of the mandrel **11** with respect to the anchoring section **12**. When the gripping slips **14** and **15** are set (Figure 1), the upper or guide section **10** is disposed adjacent a window or longitudinal cut-away portion W between the lower section of casing C and the upper section of casing C' which extends to the surface of the well. When the whipstock of this invention has been set in the casing C (Figure 1), then the upper end of the guide section **10** is disposed to one side of the well bore in which the casing is located, so that subsequently a directional drilling bit (not shown) may be lowered into the casing C' and thereafter guided by the guide section **10** into the wall of the well bore adjacent the window or longitudinal opening W.

The upper or guide section **10** is illustrated in detail in Figures 2 and 3. As can be seen therein, the guide section **10** has an inclined concave guide face or surface **20**, which is adapted to receive a directional drill bit (not shown) at its upper end **20***a*, and guide such bit at an angle to the wall of the well bore adjacent the window W. The portion of the guide section **10** on the diametrically opposite surface of the section **10** from the guide face **20** includes a longitudinal rib **22** with lateral support ribs **23** at various points throughout its length. This longitudinal rib **22** forms the back or rear surface of the guide section **10** and is adapted to be positioned substantially parallel to the wall of the well bore adjacent the window W. Obviously, when the rear or back rib **22** of the guide section **10** is substantially parallel to the wall of the well bore, the inclined concave guide surface **20** will be at an angle to such well bore wall, and that angle may vary depending upon the direction the bit is to be guided, but preferably that angle is very small, on the order of three to five degrees to prevent excessive bending of the pipe which supports the drill bit as it is guided by the inclined face **20**.

The guide section **10** has a lateral opening **25** therethrough for the reception of a shear bolt **26**, which connects a tubing type setting tool T to the whipstock for the lowering and setting of the whipstock in casing C. The tubing type setting tool T is diagrammatically illustrated in Figure 1 and may be of the conventional construction. The lower end of the guide section **10** has formed integral therewith, or affixed by suitable means, a mandrel **11** which has a longitudinal recess **27** therein, a portion of which is shown in Figure 2, and the purpose of which will be explained hereinafter.

The details of the mandrel **11** are shown in connection with the anchoring section **12** in Figures 4, 4A and 4B, wherein it can be seen that the anchoring section **12** includes an outer sleeve **30** surrounding such mandrel **11**. The external diameter of the mandrel **11** is considerably less than the internal diameter of the sleeve **30**, whereby an annular space **31** is formed between the sleeve **30** and the mandrel **11**, the purpose of which will be explained later. When the whipstock is lowered into the casing,

prior to the time that the slips **14** and **15** are set in gripping contact with the casing C, shear pins or bolts **32** are provided to hold the mandrel **11** and sleeve **30** together, but after the shear bolts **32** are sheared, then the mandrel **11** may move downwardly with respect to the sleeve **30**. It will be apppreciated, of course, that any number of shear bolts **32** can be utilized.

The lower end of the mandrel **11** is formed in the shape of a cone **34** so that upon lowering the whipstock into the lower section of casing C, the whipstock will automatically be guided into the upper end of such casing C without the necessity for rotating the whipstock. This conical section **34** prevents the loss of surface orientation of the whipstock, so that the direction of the inclined guide face **20** can be maintained at all times during the lowering of the whipstock and the setting of same in the casing C. An annular ring **35** is welded or otherwise secured to the mandrel **11** above the cone **34** to limit the movement of the mandrel upwardly with respect to the sleeve **30**.

The upper gripping slip **14** is shown in Figure 4A, and therein it can be seen that the slip **14** includes a slidable jaw member having casing engaging teeth **38** on the exterior thereof, with the jaw member being radially movable through an opening **39** in the sleeve **30**. The mandrel **11** has an expander surface **40** which is keyed to the inner portion of the jaw member or slip **14** by a tongue **41** which fits within a corresponding groove **42** on the inner portion of the slip **14** (Figure 6). Thus, as the inner mandrel **11** is moved downwardly with respect to the sleeve **30**, the inclined expander surface **40** moves the gripping member **14** radially outwardly through the opening **39** into gripping contact with the interior of the casing C. Since the gripping jaw member **14** is disposed in the radial opening **39** in sleeve **30**, the tongue and groove construction **41**, **42** prevents the rotation of the mandrel **11** with respect to the sleeve **30**, as well as preventing relative rotation between the gripping slip member **14** and the inner mandrel **11**.

The gripping slip **14** is located in vertical alignment with the inclined guide face **20** of the upper guide section **10**. The lower gripping slip **15** is constructed in an identical manner with the upper gripping slip **14**. The lower gripping slip **15** has gripping teeth **38'** and a tongue and groove construction **41'**, **42'** on the inclined surface **40'**, so that the gripping slip member **15** moves radially outwardly through the operating **39'** in the sleeve **30**. The lower slip **15** is located below the upper gripping slip **14** and is disposed on the opposite side of the sleeve **30** from the upper gripping member **14**. In other words, the lower slip **15** is disposed 180 degrees from the upper slip **14**, and is therefore substantially vertically aligned with the rear rib section **22** of the upper guide section **10**. By reason of such positioning of the slips **14** and **15**, upon a setting of same, after shearing of the shear pin or pins **32**, there is a positive torque applied to the mandrel **11** which tilts the mandrel **11**, and consequently the upper guide section **10** in a direction tending to move the rear longitudinal rib **22** of the upper guide section **10** toward the wall of the well bore. Thus, considering the axis of the casing C to be along the center line L as shown in Figure 1, upon a setting of the slips **14** and **15** the mandrel **11** will be moved laterally so that the longitudinal axis of the mandrel and the guide section will assume a line along L'. Such tilting of the mandrel **11** relative to the sleeve **30** is possible by reason of the annular space **31** which provides a freedom of lateral movement between the mandrel **11** and the sleeve **30**. Thus, as the inclined expander surfaces **40** to **40'** are moved downwardly relative to the slips **14** and **15**, respectively, the slips are moved radially outwardly until they engage the interior of the casing C. Upon such engagement, continued downward movement of the inclined surfaces cannot move the slips radially outwardly any further; consequently, the mandrel **11** must move laterally: As seen in Figure 1, the upper slip **14** then moves the mandrel **11** laterally to the left until the mandrel contacts the left side of the bore wall of the sleeve **30**; substantially simultaneously, the lower slip **15** moves the mandrel **11** laterally to the right until it contacts the right side of the bore wall of the sleeve. It will be observed that the slips **14** and **15** thus actually serve as pivot points during the tilting of the mandrel **11** with respect to the sleeve **30**, and the ultimate result is that the upper guide section **10** is tilted to the left of the vertical axis of the sleeve **30** and the casing C (Figure 1). In the usual case, the mandrel **11** will not be tilted to the full extent permitted by the annular space **31** because prior to the full tilting, the rear wall or rib **22** will contact the wall of the well bore. Of course, when such contact occurs, further tilting is unnecessary since the upper end **20***a* is properly positioned to one side of the well bore.

It should also be pointed out that because the slip **14** is vertically aligned with the whipstock guide face **20** and the slip **15** is vertically aligned with the rear side **22** of the guide section **10**, with the slip **15** below the slip **14**, the guide face **20** cannot be tilted toward the right of the vertical axis. Thus, even if the mandrel **11** where not undersize to permit tilting to the left, the slips **14** and **15** would prevent tilting of the guide section to the right. Furthermore, in some instances, after the mandrel **11** is tilted to the left its full extent, if the rear side **22** has not contacted the wall of the well bore, it is possible to further tilt the guide section **10** to the left by tilting the sleeve **30**. This can be accomplished because the sleeve **30** generally has a considerably smaller outside diameter than the internal diameter of the casing C so that after the mandrel **11** has been tilted and a continued downward force is applied to the mandrel **11**, the lateral movement of the mandrel by the co-action of the inclined surface **40** with the slip **14** will move the upper end of the sleeve **30** to the left (Figure 1) since the mandrel is contacting the left side of the sleeve at its upper end. Likewise, the lower end of the sleeve **30** is moved to the right by the slip **15** so that there is a pivoting of the sleeve **30** about the slips **14** and **15** and consequently a further tilting of the upper guide section **11** to the left, tending to move the rear side **22** into contact with the wall of the well bore.

The latching mechanism **17** which serves to initially stop the downward movement of the sleeve **30** for subsequently actuating the gripping slips **14** and **15** is shown in detail in Figure 4. This latching mechanism **17** includes a latch arm **45** which is pivoted to a bracket **46** by a pivot pin **47** extending through the bracket **46**. The bracket **46** is welded at **48** or otherwise suitably affixed to the sleeve **30** so as to be integral therewith. The latch arm **45** has a projection **50** which has a lateral casing-engaging surface **51**, which is adapted to engage with the upper edge of the casing C (Figure 1).

The latch arm **45** is urged radially outwardly by a leaf spring **52** which is bolted to the latch arm by bolts **53**. The inner end of the leaf spring **52** is curved at **52***a* and the curved surface **52***a* is adapted to slide on the inner wall **27***a* of the recess or slot **27** in the mandrel **11** when the mandrel **11** moves relative to the sleeve **30**.

Radial outward movement of the latch arm **45** is limited by the engagement of its upper end **45***a* with the inner surface of the sleeve **30** above the longitudinal opening **30***a* in the wall of the sleeve **30**. As the tool is lowered into the well casing prior to the positioning in the lower section of the casing C, the latch arm will normally be confined in the dotted line position shown in Figure 4 by reason of its engagement with the wall of the casing as it is lowered therethrough. However, even though the latch arm **45** may be urged radially outwardly through the opening **30***a* prior to the time that it is to engage the upper end of the lower section of casing C, the lateral curved section **55** on the projection **50** of latch arm **45** prevents the lateral surface **51** from engag-

ing with the casing prior to the time that the lateral surface **51** contacts the upper edge of the lower section of casing C in which the whipstock is to be anchored.

In use, or operation, of the whipstock of this invention, the whipstock is lowered on a setting tool T with the shear pins **32** preventing the sleeve **30** and the mandrel **11** from prematurely separating and the shear bolt or pin **26** preventing the setting tool T in the whipstock from prematurely separating. After the whipstock has been lowered into the casing and the cone or whipstock alignment member **34** has directed the whipstock into the lower section of casing C, the latch member **17** engages with the upper edge of casing C, with the lateral surface **51** effecting the engagement. Once the latch mechanism **17** has restrained the further downward movement of the sleeve **30**, then the continued lowering of the mandrel **11** by lowering of the tubing setting tool will shear the pin or pins **32**. It will be observed that the shear pin **32** must be of a lesser strength than the shear pin **26** so that the shear pin **32** will initially shear prior to the release of the tubing setting tool T. The downward movement of the mandrel **11** relative to the sleeve **30** effects a radial expansion of the gripping members **14** and **15** simultaneously, because the inclined expanding surfaces **40** and **40'** are of the same but opposite angle. As the slips **14** and **15** are set in gripping contact with the lower section of casing C, the mandrel **11** and the upper guide section **10**, and in some instances the sleeve **30**, are pivoted or tilted so that the upper end **20***a* of the whipstock guide surface **20** is disposed to one side of the well bore. As pointed out previously, the lateral movement of the mandrel **11** is made possible by reason of the annular space **31** which provides a freedom of lateral movement of the mandrel **11** relative to the sleeve **30** during the setting of the slips **14** and **15**. Also, the annular space between the sleeve **30** and the casing C permits the lateral pivoting of the sleeve **30** relative to the casing C. Of course, once the rear side **22** of the guide section **10** contacts the wall of the well bore, the guide face **20** is properly positioned and further tilting is not possible. It will be noted that as the mandrel **11** is lowered relative to the sleeve **30** for setting the slips **14** and **15**, the curved section **52***a* of the spring **52** will ride on the inner wall **27***a* of the recess **27** in the mandrel **11**, so that it is immaterial how far down the mandrel **11** moves insofar as the spring action of spring **52** is concerned.

After the slips **14** and **15** are set and the whipstock is otherwise ready for use, a weight is applied to the tubing type setting tool T to shear the pin **26**, whereby the setting tool T may be removed and the directional drilling bit may be lowered for guiding along the inclined concave guide surface **20** of the guide section **10** into the wall of the well bore through the window W. The direction in which the directional drill bit will be guided is indicated in Figure 1 by the dash-dot lines.

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 casing whipstock adapted to be anchored in the lower section of a well casing formed by cutting out a portion of the casing thereabove to provide an upper section of casing spaced from the lower section, said upper section extending to the surface of the well, said whipstock being adapted to guide a directional drill bit through the space above said lower section into the wall of the well bore at an angle to the axis of the casing, said whipstock comprising an upper guide section releasably suspended from a lowering tool including an inclined guide surface for guiding the directional drill bit, a mandrel secured to the lower end of said guide section and extending downwardly therefrom, a tubular sleeve loosely surrounding said mandrel and releasably secured thereto, said mandrel and tubular sleeve when secured together being adapted to be lowered into the lower section of the well casing by said lowering tool, said tubular sleeve having a longitudinal slot therein, latch means mounted on said sleeve, resilient means normally projecting said latch means into said slot, a recess in said mandrel longitudinally aligned with said slot to receive said latch means when said means is in retracted position, said latch means in the extended position thereof being adapted to engage the upper marginal edge of said lower casing section, a pair of gripping slips slidably mounted on inclined guideways on said mandrel, openings in said tubular sleeve through which said slips project, the walls of said openings embracing said slips to prevent longitudinal movement thereof, but permitting lateral movement thereof, whereby downward movement of said mandrel will cause said slips to be projected through said openings to engage the inner wall of said lower section, said pair of slips being vertically spaced and diametrically positioned on said mandrel, the upper slip being in longitudinal alignment with said guide section, said mandrel beng enabled to move further downwardly with respect to said tubular sleeve when released therefrom but still suspended from said lowering tool.



2. The structure set forth in claim 1, wherein said inclined guideways on said mandrel move said slips radially outwardly simultaneously, said guideways being adapted to effect outward radial movement of said slips upon release of said mandrel and said sleeve to permit relative downward movement of said mandrel with respect to said sleeve.

3. The structure set forth in claim 1 including shear pins for releasably securing the tubular sleeve which surrounds said mandrel to said mandrel to prevent relative axial movement of said sleeve and said mandrel, to maintain said mandrel in elevated position relative to said tubular sleeve whereby the slips will be held in retracted position.

4. The structure set forth in claim 1, including means on the lower end of said whipstock for guiding said whipstock into said lower section of casing without rotation of the whipstock, whereby the surface orientation of the inclined guide surface is maintained.

5. The structure set forth in claim 1, wherein there is an annular space between the exterior of the mandrel and the interior of the sleeve to permit tilting of the mandrel and the upper guide section when the slips are set to assure that the upper end of the upper guide section is positioned at one side of the well bore, whereby upon lowering the directional drill bit, the bit will not engage said upper end but will be guided by said inclined guide to thereby avoid damage to said whipstock by the drill bit.

6. The structure set forth in claim 1, wherein the lower end of the mandrel has a conical pilot for guiding the whipstock into the open upper end of said lower section of casing without the necessity for rotating the whipstock, whereby the surface orientation of the whipstock is maintained.

7. The structure set forth in claim 1, wherein said latching means includes a latch arm pivoted to said sleeve with a resilient means on said latch arm and in contact with the wall of said recess to urge said latch arm outwardly through said longitudinal opening in said sleeve.

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