

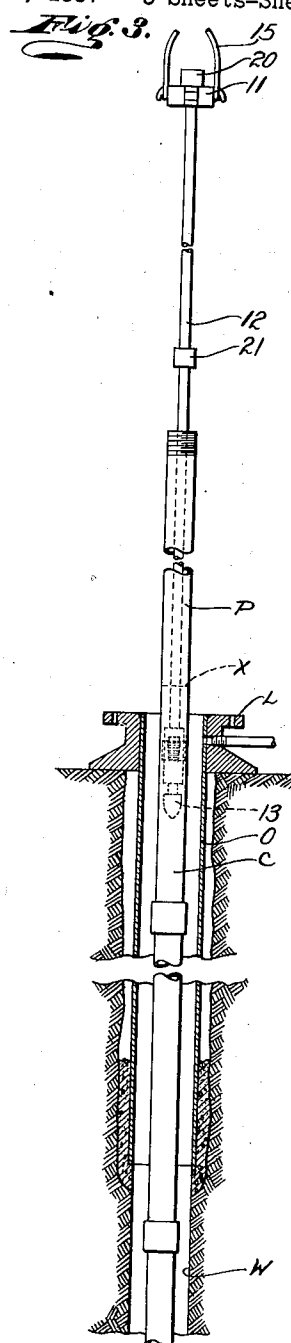
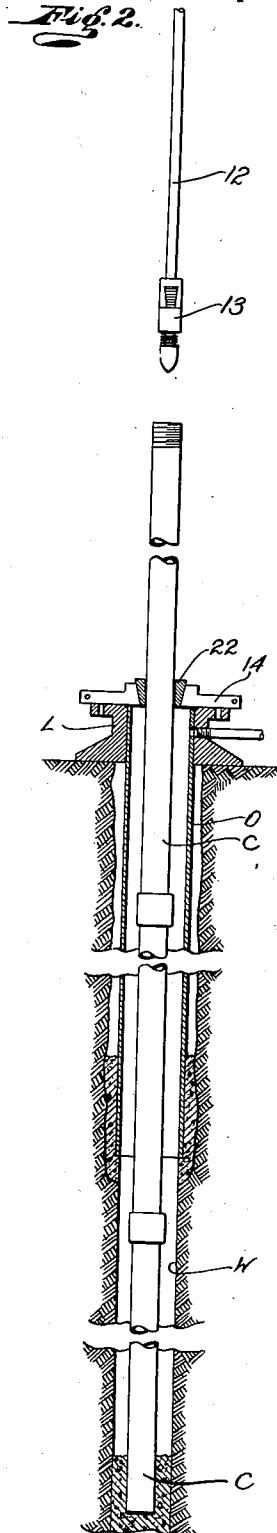
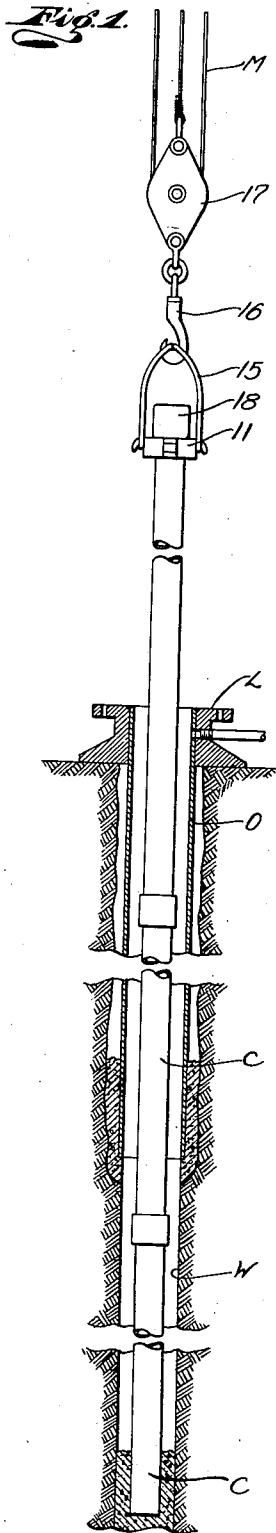
Jan. 30, 1940.

A. L. ARMENTROUT

2,188,589

METHOD FOR HANDLING WELL CASINGS

Original Filed Sept. 13, 1937 3 Sheets-Sheet 1



Inventor
ARTHUR L. ARMENTROUT
By
R. W. McFarrell
His Attorney

Jan. 30, 1940.

A. L. ARMENTROUT

2,188,589

METHOD FOR HANDLING WELL CASINGS

Original Filed Sept. 13, 1937

3 Sheets-Sheet 2

Fig. 4.

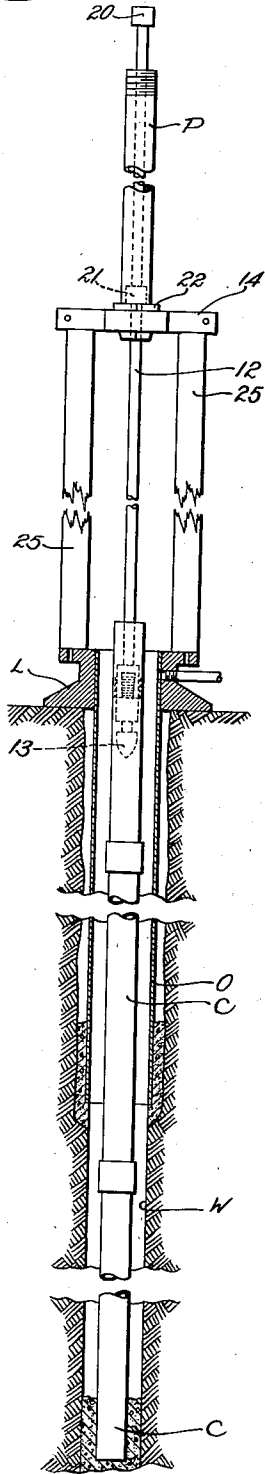


Fig. 5.

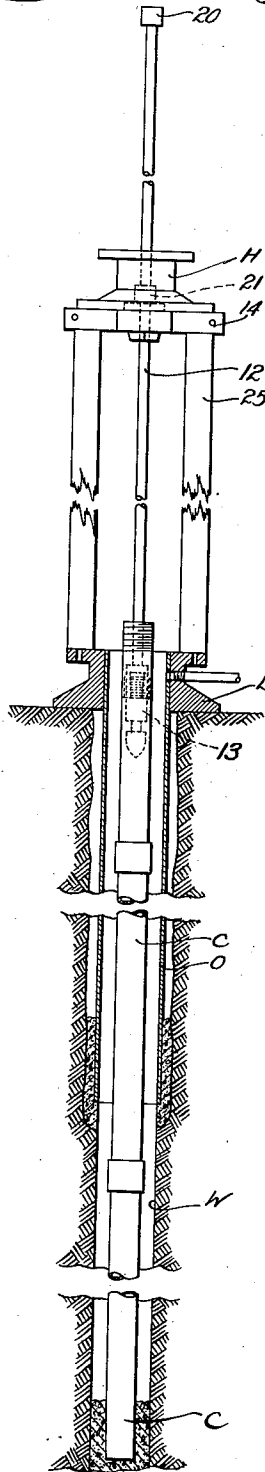
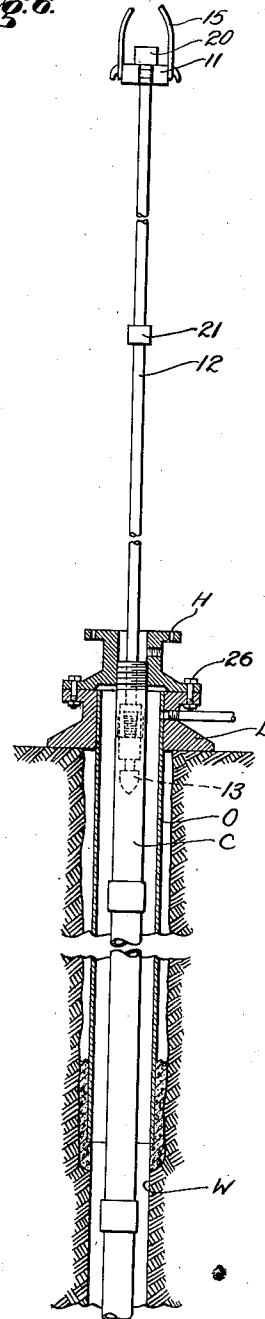


Fig. 6.



Inventor
ARTHUR L. ARMENTROUT
By
R. H. Kelley
His Attorney

Jan. 30, 1940.

A. L. ARMENTROUT

2,188,589

METHOD FOR HANDLING WELL CASINGS

Original Filed Sept. 13, 1937 3 Sheets-Sheet 3

Fig. 7.

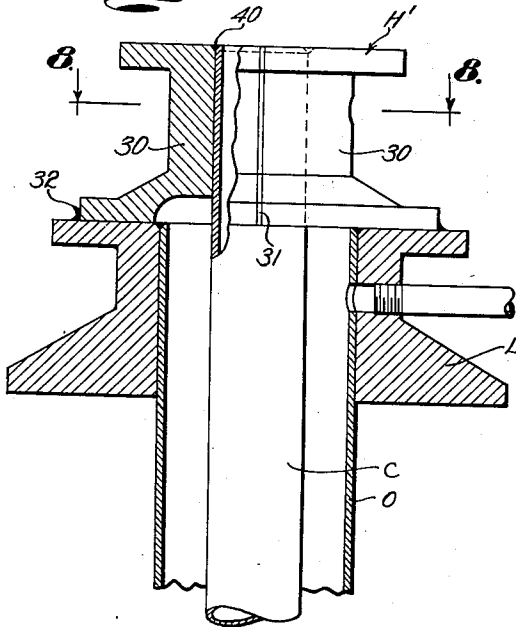


Fig. 8.

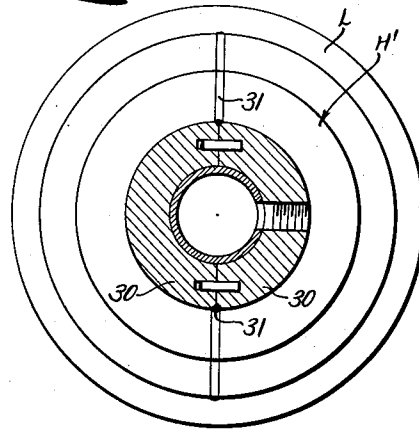


Fig. 9.

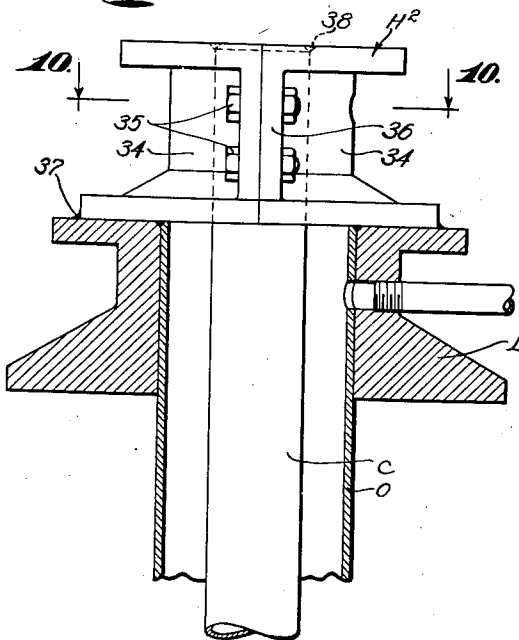
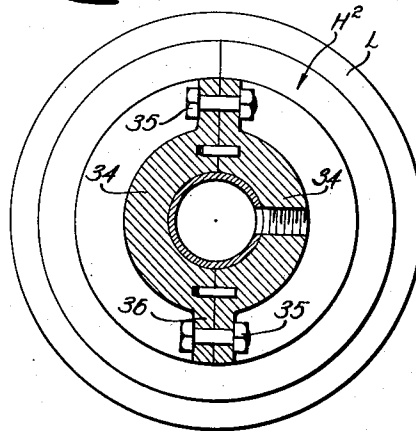


Fig. 10.



Inventor
ARTHUR L. ARMENTROUT
By *W. H. Applewell*
His Attorney

UNITED STATES PATENT OFFICE

2,188,589

METHOD FOR HANDLING WELL CASINGS

Arthur L. Armentrout, Los Angeles, Calif., assignor of one-third to Elwin B. Hall and one-third to Virgil P. Baker

Continuation of application Serial No. 163,549, September 13, 1937. This application May 22, 1939, Serial No. 275,119

11 Claims. (Cl. 166—21)

This invention relates to the well drilling art and relates more particularly to methods for installing well casings. A general object of this invention is to provide rapid, simple and effective methods for handling and installing well casings.

This application is a continuation of application Serial No. 163,549, filed September 13, 1937.

When a string of well casing is run into a well it is difficult, if not impossible, to determine the extent that the casing will project from the mouth of the well when the string is cemented in and put under a suitable tension. Accordingly, when a string of casing has been cemented in a well and put under the desired tension, it is usual to have a substantial portion of the casing project from the well head. This projecting portion must be cut off to prepare the casing for attachment to the landing head. In setting and landing a string of casing it is very undesirable to release the string as the casing may buckle and distort and the cement seal at its lower end may be fractured by the weight of the casing. For this reason it has heretofore been necessary to provide slips or other holding means in the landing head (hereinafter sometimes referred to as the head) to maintain the casing under tension when its upper part is shortened and packed off in the head.

Another object of this invention is to provide a method for landing well casing in which the casing string is maintained under tension from a point below its upper end leaving its upper portion free and unstressed to be cut off and secured to the supporting member or head.

Another object of this invention is to provide a method for landing well casing that precludes the possibility of the casing settling or buckling when it is being prepared for attachment to the head.

Another object of this invention is to provide a method of the character mentioned in which the casing may be welded to the head to be suspended therefrom and to be sealed therewith.

Another object of this invention is to provide a method of the character mentioned in which the portion of casing being welded to the head is free and under no strain so that the weld or welds are not under stress during the welding process. In prior attempts to weld casing to landing heads it has been the practice to engage the projecting upper portion of the casing with an elevator, or the like, to maintain the entire casing string under tension when the weld is to be made. With this procedure the part of the casing being welded to the head is under a heavy

tensile strain and is stretched so that severe stresses are set up in the weld or welds. The method of the present invention overcomes this difficulty as the part of the casing welded to the head is relieved of all strains at the time of the welding operations.

Another object of this invention is to provide a method of the character mentioned in which simple, inexpensive heads may be employed.

Another object of this invention is to provide a method of the character mentioned that does not require the permanent use of casing slips or spiders at the heads.

Another object of this invention is to provide a method of the character mentioned in which a plurality of strings of casing may be successively landed and suspended from simple, inexpensive heads.

Another object of this invention is to provide a method of the character mentioned that avoids the use of packing means, split rings and other more or less complicated parts liable to fail and allow leakage when the well is completed and under production.

The various objects and features of my invention will be fully understood from the following detailed description of typical preferred forms and applications of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a typical well with a string of casing extending therethrough illustrating the step of putting the casing under tension. Fig. 2 is a view similar to Fig. 1 showing the casing supported under tension on the landing head and illustrating the mandrel and casing gripping tool about to enter the casing. Fig. 3 is a view similar to Fig. 2 showing the tool in gripping engagement with the casing and the mandrel supported by the hoist mechanism of the well to maintain the casing under tension. Fig. 4 is a view similar to Fig. 3 showing the cut off upper portion of the casing being passed over the mandrel while the mandrel is supported by jacks or blocks. Fig. 5 is a view similar to Fig. 4 showing the landing head being passed down over the mandrel. Fig. 6 is a view similar to Fig. 5 showing the landing head connected with the casing to land or support the same. Fig. 7 is an enlarged fragmentary vertical sectional view of a form of head that may be employed in connection with the method, there being a portion of the upper head section broken away to appear in cross section. Fig. 8 is a horizontal detailed sectional view taken as

indicated by line 8—8 on Fig. 7. Fig. 9 is a view similar to Fig. 7 showing another form of split landing head and Fig. 10 is a horizontal detailed sectional view taken as indicated by line 10—10 on Fig. 9.

The present invention is concerned with the setting and landing of well casings of the character employed in deep wells such as oil wells and gas wells. Figs. 1 to 6, inclusive, illustrate a typical well W having an outer casing O cemented in the well W and secured at its upper end to a landing head L. The present invention is not concerned with the setting or landing of the outer casing O and it may be assumed that this casing has been previously set and landed. An inner casing C extends longitudinally through the outer casing O from the lower end of the well to the top of the well. I will first proceed with a detailed description of a preferred manner of carrying out the method of the invention utilizing a head H that is to be threaded to the casing C, to land or suspend the same, and will later describe the manner of carrying out the method when employing the "welded on" type head.

The method of the present invention, as illustrated in Figs 1 to 6, inclusive, may be said to comprise, generally, cementing the lower end of the casing C in the well W, putting the casing C under tension, maintaining the casing C under tension by supporting it on the landing head L through the medium of a supporting element or spider 14, introducing a mandrel 12 and a tool 13 into the casing C to grip the casing below the head L whereby the casing may be put under tension by a hoist mechanism M, cutting off the upper portion P of the casing C, alternately supporting the mandrel 12 by the hoist mechanism M and the head L to provide for the removal of the cut off portion P, passing the head H over the mandrel 12 to the head L while alternately supporting the mandrel 12 on the head L and the hoist mechanism M to maintain the casing C under tension and then securing the casing C to the head H.

The casing C is assembled and run into the well W in the usual manner and is then cemented. The lower end portion of the casing C is cemented in the open lower part of the well to provide a shut off or seal about the casing and to secure the lower part of the casing in the well. The cementing operation may be performed in any selected manner and this operation is well known to those skilled in the art. Figs. 1, 2, 4 and 5 show the casing C cemented in the well W.

When the cement at the lower end of the casing C has set and hardened the elevator 11 may be engaged under a collar 18 on the upper end of the casing C and the hoist mechanism M may be operated to take the desired stretch in the casing. When this has been done the split spider 14 is arranged about the upper part of the casing and is supported on the head L or any other suitable support. The slips 22 of the spider 14 may be arranged in place so that the spider serves to support the casing C on the head L for the maintenance of the tension on the casing. With the spider in active holding engagement with the casing C the elevator 11 is disengaged from the casing, and the collar 18 is unthreaded from the upper end of the casing. While the required tension is being maintained on the casing C by the elevator 11 or by the spider 14 the casing is marked as illustrated at X at the point where it is to be

cut preparatory to its connection with the head H.

Following the above operations the mandrel 12 provided with the tool 13 is connected with the hoist mechanism M through the medium of the elevator 11 or a similar device. The elevator 11 is engaged about the mandrel 12 to cooperate with an upper collar 20 so that it suspends the mandrel from its upper end. The mechanism M is then operated to lower the mandrel 12 into the casing C. The mandrel 12 is lowered to bring the tool 13 to a point below the plane of the upper end of the head L. With the tool 13 in this position the mandrel 12 is operated or manipulated to actuate the tool 13 so that it grips the interior of the casing C. The hoist mechanism M is then operated to place an upward strain on the casing C through the medium of the mandrel 12 and the tool 13. The hoist mechanism M is set or locked to maintain the desired tension on the casing C. The split spider is then removed from about the casing C to expose the portion of the casing above the head L so that the casing may be severed or cut along the line X. Any suitable cutting tool may be employed to cut the casing.

The cutting of the casing C at the line X of course frees the projecting upper portion P and this free portion P is passed upwardly from the mandrel 12. The portion P is first moved upwardly to a position on the mandrel between the spaced collars 20 and 21 and the split spider 14 is assembled or arranged about the mandrel below the collar 21. The slips 22 are arranged in the spider 14 to cooperate with the lower end of the collar 21 and the spider is jacked up or blocked up to maintain the tension on the mandrel 12 and the casing C. Figs. 4 and 5 of the drawings illustrate the spider 14 blocked up by blocks 25 resting on the head L. Hydraulic jacks or screw jacks may be employed to jack up the spider 14. With the spider 14 in holding cooperation with the collar 21, as shown in Figs. 4 and 5, the elevator 11 may be disconnected from the mandrel 12 so that the cut off portion P may be passed upwardly from the upper end of the mandrel and removed. Subsequent to the removal of the cut off casing portion P and while the spider 14 is engaged under the lower collar 21 the head H is lowered down over the upper portion of the mandrel 12 to the spider 14, as shown in Fig. 5. The elevator 11 is then engaged under the upper collar 20 and the hoist mechanism M is operated so that the elevator 11 bears upwardly against the collar 20 to maintain the necessary tension on the casing C. The spider 14 may be removed from about the mandrel 12 to allow the head H to be lowered to its final position on the head L. This puts the head H in position for connection with the casing C.

In the particular form of the method being described the head H is threaded on the upper portion of the casing C which protrudes from the head L. Where the threaded-on head H is to be used the protruding upper portion of the casing C is threaded by means of a split die or a special thread milling tool, or, if desired, may be threaded by a typical die passed downwardly over the mandrel 12 while alternately engaging the collars 20 and 21 with supporting means to maintain the tension on the casing. This threading operation is, of course, performed before the head H is brought to its final position on the head L. Following the connection

of the head H with the casing C the head H is connected with the head L by bolts 26, or the equivalent. This completes the landing operation and the hoist mechanism is operated to release the tool 13 and to withdraw the tool 13 and the mandrel 12 from the casing C.

The invention contemplates the variation of the above described method by welding the casing C to the head H instead of threading the head to the casing. After the head H has been arranged on the landing head L and secured to the landing head L the casing may be welded to the head H. At this time the casing C is maintained under the selected tension by the tool 13 engaging in the casing, as described above. In this connection it is important to note that the tool 13 engages in the casing C below the head H so that the portion of the casing C being welded to the head H is free of all tension and strain. Accordingly, the weld or welds are not made at a stretched or stressed part of the casing and the finished weld or welds are secure, dependable and devoid of stresses. The weld or welds connecting the casing C with the head H preferably form a closure or seal about the casing to prevent the escape of fluid and pressure, although if desired the head H may be provided with packing means for this purpose. It will be readily understood how the welding operation may be substituted for the threading of the head H to the casing C in the method described in detail above.

An important and time saving variation in the above described method is provided by the invention. The method of the invention provides for the use of a sectional supporting member or head for suspending or supporting the casing C. A sectional supporting member or head may be readily assembled about the protruding portion of the casing C to rest on the head L while the tension is maintained on the casing C by the tool 13, the mandrel 12, etc. and the casing may be then secured to the supporting member or head. The invention contemplates the employment of sectional supporting members or head fittings varying greatly in character and construction. In Figs. 7 to 10, inclusive, I have illustrated two forms of sectional heads H' and H² that may be employed in the method of the invention, it being understood that the invention is not to be construed as restricted to the use of these particular heads or to sectional heads of this general nature.

The forms of heads illustrated in Figs. 7 to 10 of the drawings are divided or split so that they may be readily arranged about the protruding upper portion of the casing C. The head H' illustrated in Figs. 7 and 8 is divided on a vertical diametric plane to constitute two complementary sections 30. In carrying out the method of the invention while employing the head H' the casing C is put under tension and its upper portion P is cut off at X and removed, all as described above. Following the removal of the cut off portion P and while the casing C is maintained under tension by the tool 13, the mandrel 12 and the elevator 11, as illustrated in Fig. 6, the head sections are assembled about the protruding upper portion of the casing C to rest on the head L. The head sections 30 are then connected together to form an annular or tubular assembly and the head assembly is secured to the head L. In the case illustrated in Figs. 7 and 8 the sections 30 are connected by welding 31 to constitute a continuous annular structure and the head H' is secured to the head L by welding 32.

Following the assembling and connecting of the head sections 30 the upper end part of the casing C is welded to the head H'. A continuous annular weld 40 may be made to connect the casing C to the head H' and to provide a dependable seal about the casing. As illustrated in Figs. 3-6, inclusive, of the drawings, the tool 13 engages in the casing C below the upper end part of the casing so that at the time of making the weld 40 the part of the casing C receiving the weld is in a normal unstressed condition and is not distorted or stretched and the weld joins or unites the metal of the free casing with the metal of the head H'. The weld 40 is not strained or weakened by reason of elongation, contraction or other distortion of the casing C and, therefore, constitutes a strong, dependable connection between the casing and the head H'. At the completion of the weld 40 the mandrel 12 is manipulated to release the tool 13 and the tool 13 and the mandrel 12 are withdrawn from the casing and the head H'. This completes the operation.

The head H² illustrated in Figs. 9 and 10 of the drawings is an annular or tubular supporting member divided along a vertical diametric plane to constitute two sections 34. The head sections 34 are adapted to be assembled about the protruding upper portion of the casing C following the removal of the cut off portion P and while the casing is maintained under tension by the tool 13, the mandrel 12 and the hoisting mechanism M. The head sections 34 are adapted to rest on the landing head L and are adapted to be connected to constitute an annular structure or assembly. Bolts 35 passed through flanged portions 36 of the sections 34 may connect the two sections and welding 37 may secure the head H² to the head L. When the sections 34 have been secured together and attached to the head L the casing C is secured to the head H². It is preferred to weld the casing C to the head H². A continuous annular weld 38 may secure the upper end of the casing C to the upper end part of the head H². The weld 38 is made while the casing C is maintained under tension by the engagement of the tool 13 in the casing. As the tool 13 is engaged in the casing C some distance below the upper end of the casing the portion of the casing receiving the weld 38 is unstressed and free. The weld 38 joining the normal unstressed and undistorted part of the casing C with the head H² forms a strong durable connection between the casing and the head H². The weld 38 is preferably annular and complete to constitute a closure or seal for preventing the leakage of fluid and pressure from around the casing. Following the completion of the weld 38 the mandrel 12 is manipulated to free the tool 13 and the tool and the mandrel are withdrawn from the casing C to complete the operation.

It is to be observed that the head H' and the head H² may have extensive contact with the casing C below the welds 40 and 38 to dampen or prevent vibration of the casing. This extensive contact of the head with the casing prevents vibration of the casing from effecting the weld at the upper end of the casing.

Having described only typical preferred forms and applications of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art, or fall within the scope of the following claims.

Having described my invention, I claim:

1. A method of landing a well casing comprising placing the casing under tension by engaging the interior of the casing with a tensioning means, cutting off an upper portion of the casing at a point above where the casing is engaged by the tensioning means and while the tension is maintained on the casing, passing the cut off portion of casing upwardly from the tensioning means while tension is maintained on said means, passing a head down over the tensioning means to a support, welding the casing to the head while the tension is maintained thereon, and then removing the tensioning means from the casing so that the weld suspends the tensioned casing from the head.

2. A method of landing a well casing on a landing head comprising inserting a tool into the upper end of the casing for gripping the interior of the casing at a point below the landing head and so that it projects upwardly beyond the casing, applying a pull on the tool to maintain the casing under tension, cutting off the portion of the casing above the point where it is gripped by the tool, passing the cut off portion of the casing upwardly from the tool, passing a head down over the tool, welding the upper end of the casing to the last named head while the tension is maintained on the casing, and then removing said tool from the casing so that the welding suspends the tensioned casing from said last named head.

3. A method of landing a well casing comprising placing the casing under tension by engaging the interior of the casing with a tensioning means, cutting off an upper portion of the casing at the point where the landing head is to be arranged and above where the casing is engaged by the tensioning means while the tension is maintained on the casing, passing a landing head down over the tensioning means to a support, and then securing the casing to the head.

4. A method of landing a well casing comprising placing the casing under tension by engaging the casing with a tensioning means, cutting off an upper portion of the casing at a point above where the casing is engaged by the tensioning means and while the tension is maintained on the casing, arranging a support about the tensioned casing to rest on the well head, welding the casing to the support to seal the casing and support together and to connect the casing and support together with the casing under tension, and then disengaging the tensioning means from the casing to leave the casing suspended on the well head through the medium of the welding and support.

5. The method of suspending a well casing from the landing head of a well comprising temporarily maintaining the casing under tension by engaging the casing with a tensioning tool at a point removed from the head, arranging a support around the casing to rest on the head, welding the casing and support together while the casing is maintained under tension by said tensioning means, and then disassociating the said tensioning tool from the casing to leave the casing suspended under tension from the head by said support.

6. The method of suspending a well casing from the landing head of a well comprising placing the casing under tension by engaging the casing with a tensioning means unassociated with the head and operating the tensioning means, assembling a sectional support about the casing and

on the head, welding the casing to the support while the casing is held under tension by the tensioning means, and then disengaging the tensioning means from the casing whereby the tension is maintained on the casing by the support welded to the casing and bearing on the head.

7. The method of handling a well casing comprising running the casing into the well, securing the lower portion of the casing in the well, putting the casing under tension by a hoist means, assembling a sectional support about the upper portion of the casing while the casing is maintained under tension, welding the casing to the support while the casing is under tension, and then disengaging the hoist means from the casing so that the said tension is maintained on the casing by the said support.

8. The method of handling a well casing comprising running the casing into the well, sealing the lower portion of the casing in the well, putting the casing under tension by engaging the casing at a point below its upper end with a tensioning means, arranging a sectional support about the upper portion of the casing above said point while the casing is under tension, welding the casing to the support above said point while the casing is maintained under tension by the tensioning means, and then disengaging the tensioning means from the casing so that the support maintains the tension on the casing.

9. The method of handling a well casing comprising running the casing into the well, cementing the lower portion of the casing in the well, putting the casing under tension by engaging the casing at a point below its upper end with a tensioning means operated by a lifting means and then operating the lifting means, cutting off an upper portion of the casing, assembling a sectional support about the casing, welding the casing to the support, the said cutting, assembling and welding operations being performed while the casing is maintained under tension by said means, and then releasing the tensioning means from the casing so that the tension is maintained on the casing by the support.

10. The method of handling a well casing comprising running the casing into the well, cementing the lower portion of the casing in the well, putting the casing under tension by engaging the casing at a point below its upper end with a tensioning means operated by a lifting means and then operating the lifting means, cutting off an upper portion of the casing, assembling a sectional support about the casing, connecting together the sections of said support, welding the upper end of the casing to said support, said cutting, assembling, connecting and welding operations being performed while the casing is maintained under tension by said means, and then releasing the tensioning means from the casing to allow the support to assume and maintain the tension on the casing.

11. The method of landing a well casing on a landing head comprising placing the casing under tension by engaging the casing with a tensioning means at a point removed from the head, assembling a sectional support about the casing to rest on the head, welding the sections of the support together, welding the support to the casing, welding the support to the head, and disengaging the tensioning means from the casing to leave the casing suspended under tension from the support.