

Feb. 12, 1963

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3,077,227

METHOD AND APPARATUS FOR CEMENTING WELL CASING

Filed May 9, 1960

4 Sheets-Sheet 1

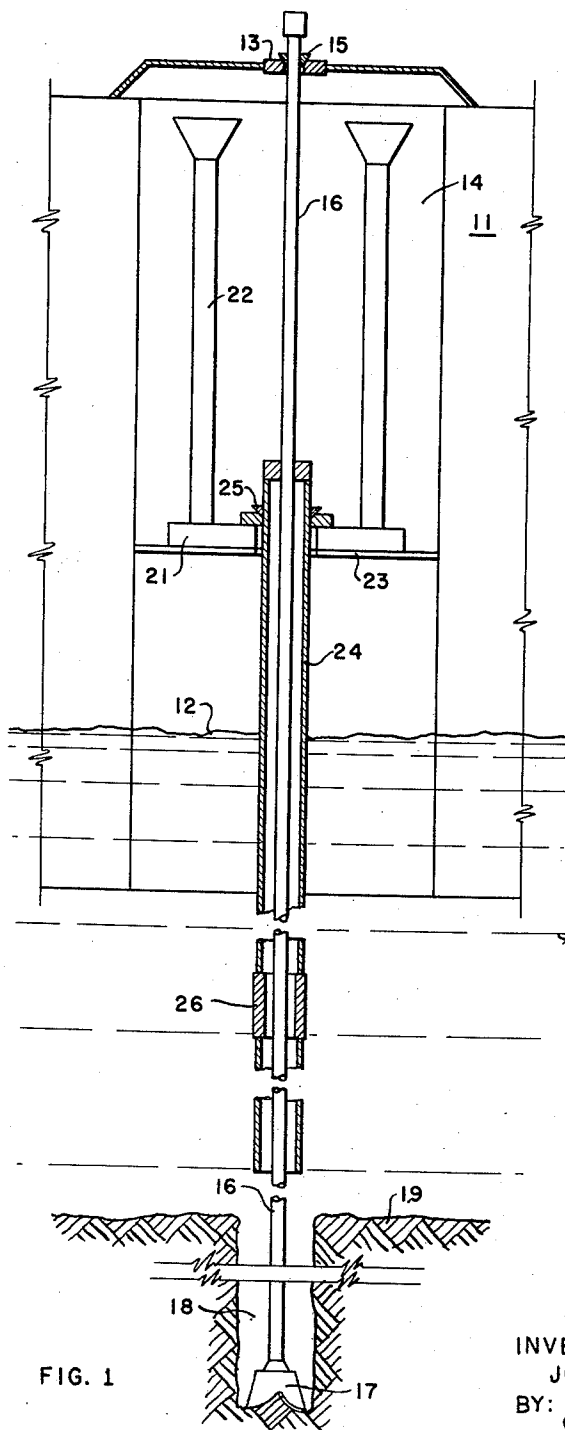


FIG. 1

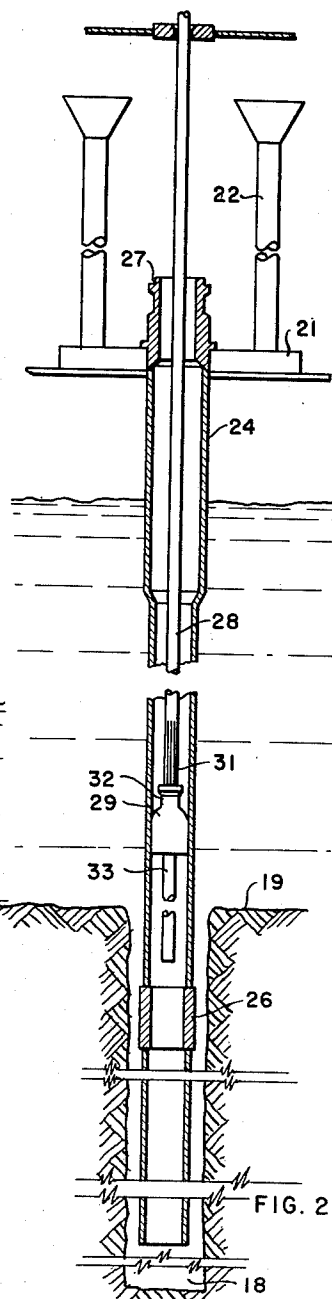


FIG. 2

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4 Sheets-Sheet 2

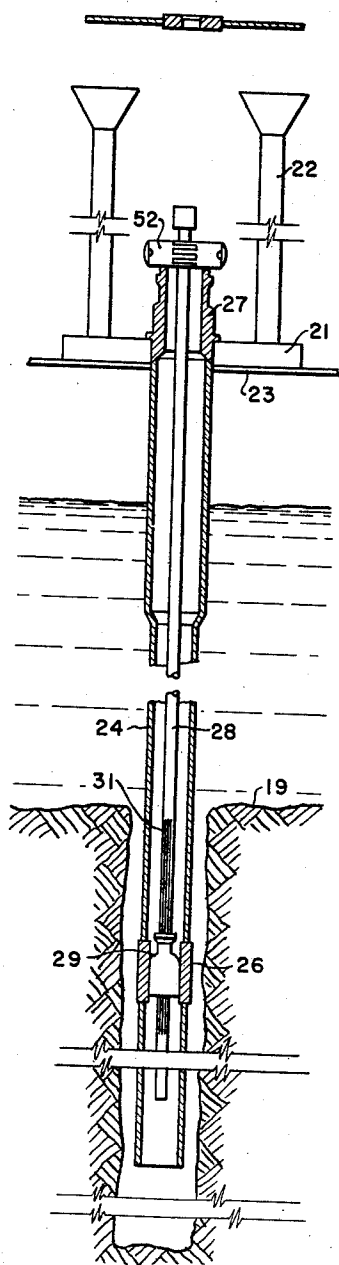


FIG. 3

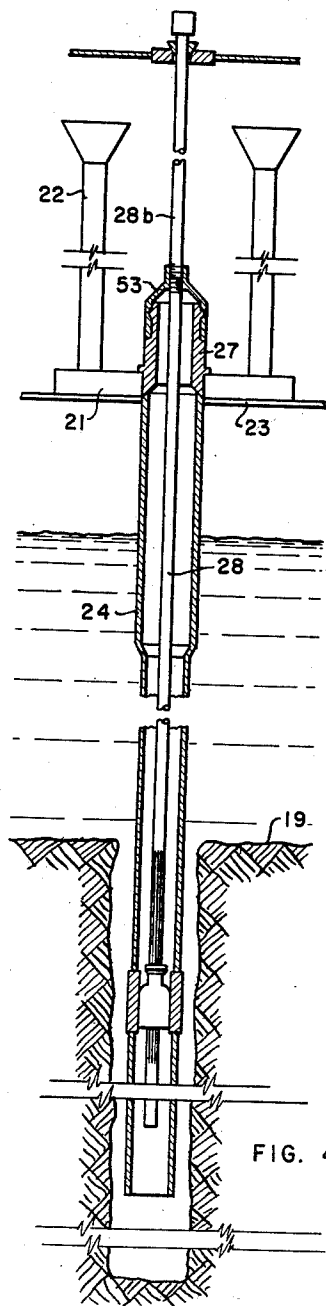


FIG. 4

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4 Sheets-Sheet 3

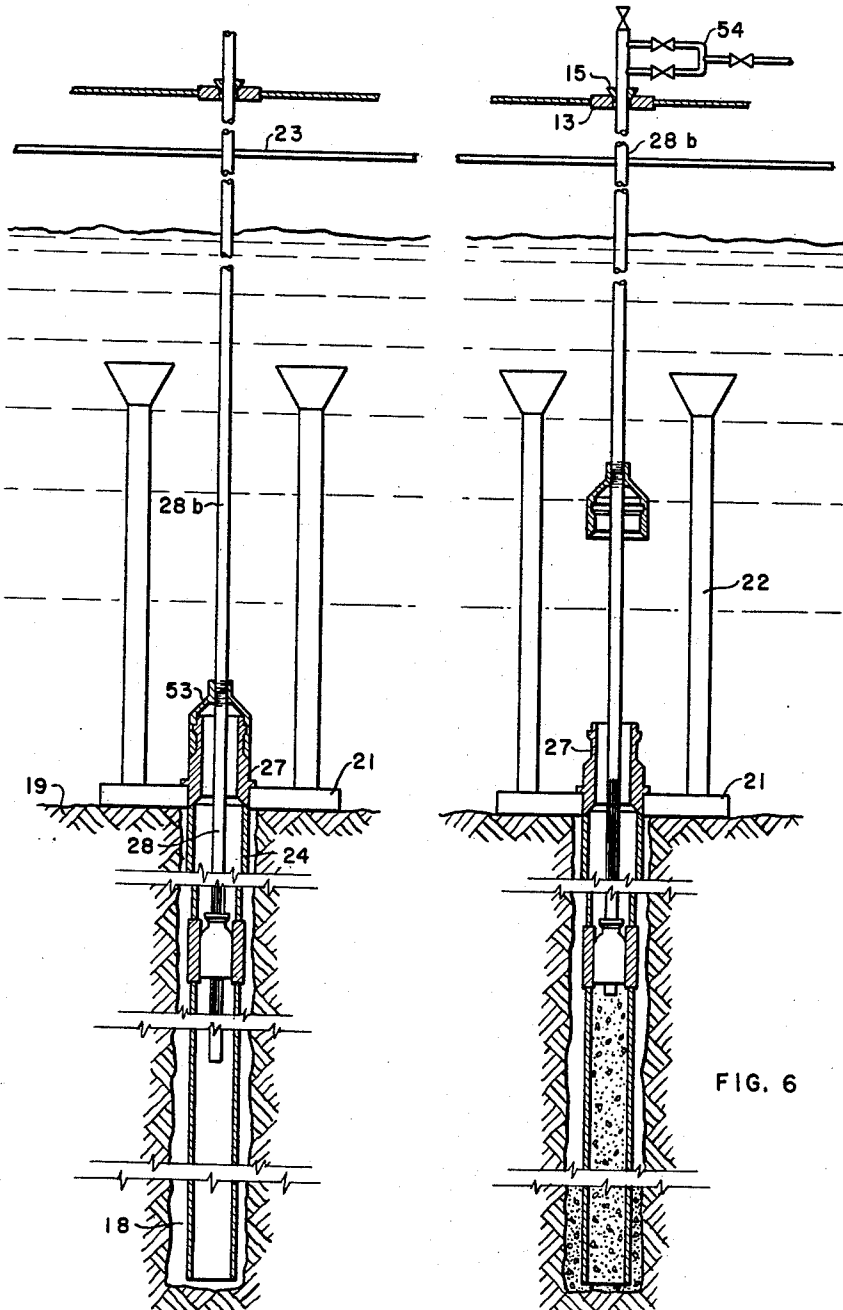


FIG. 5

FIG. 6

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METHOD AND APPARATUS FOR CEMENTING WELL CASING

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4 Sheets-Sheet 4

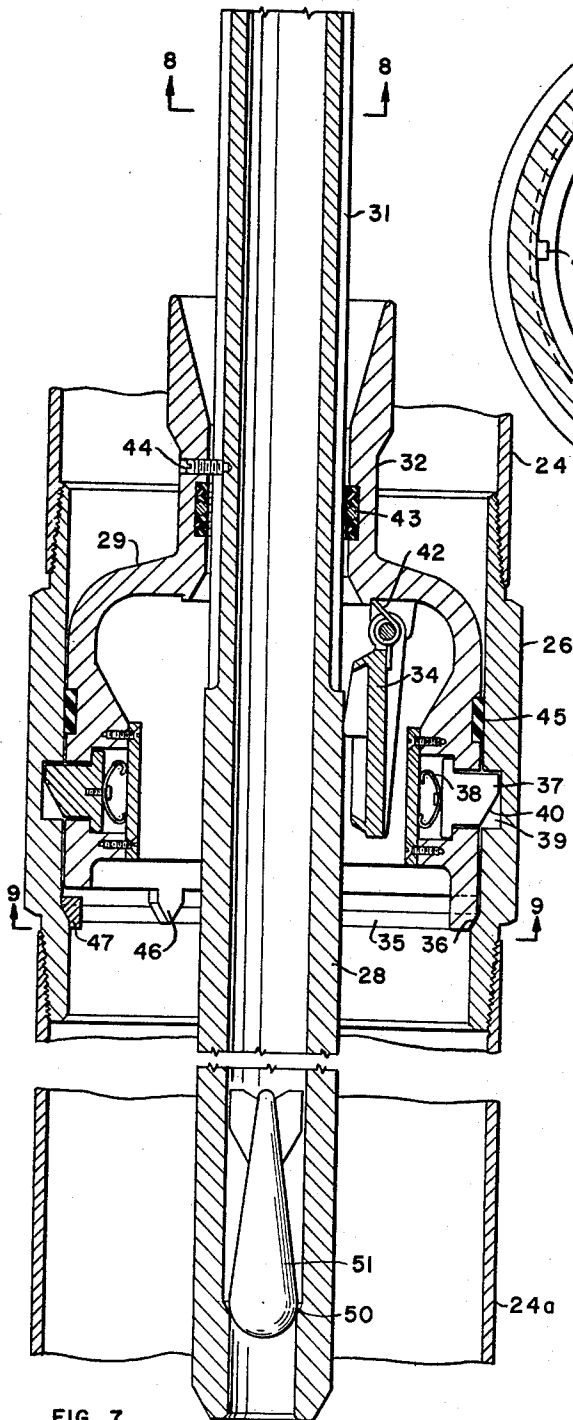


FIG. 7

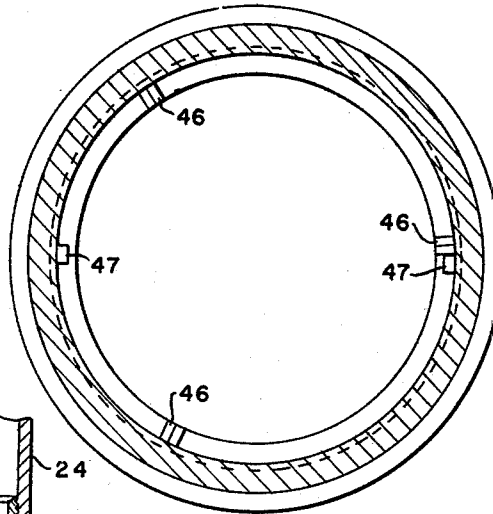


FIG. 9

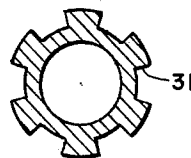


FIG. 8

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METHOD AND APPARATUS FOR CEMENTING WELL CASING

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Filed May 9, 1960, Ser. No. 27,867
8 Claims. (Cl. 166-27)

This invention relates to the cementing of casing in offshore wells and pertains more particularly to a method and apparatus for cementing the first string of casing in a well which has been drilled from a platform above the surface of the water, for example from a floating vessel, and wherein a wellhead assembly is to be positioned entirely under water, preferably on the ocean floor.

Many problems are encountered in cementing well casing in wells drilled in offshore locations, especially where the well is drilled from a floating vessel and wherein the wellhead is to be positioned under water. Since the first string of casing, often called a conductor tube, is lowered into a well drilled in the ocean floor by lowering it or stripping it downwardly over a drill pipe left in the well, normal methods of cementing the casing in place cannot be employed. For example, when lowering the first casing into a well drilled on land, a float shoe is normally secured to the bottom end of the casing, or a float collar is connected into the casing string, normally about one section of casing above the lower end thereof. Float collars or float shoes contain a check valve which prevents fluid from entering the lower end of the casing while permitting cement or other fluids to be pumped downwardly through the casing from the top thereof. If a float shoe, float collar or other type of cement retainer is not employed in a string of casing cement would fill the casing string at the end of cementing operations thus necessitating drilling all of the cement out of the casing before further drilling of the well could be resumed.

In drilling and completing wells in accordance with the method described in copending U.S. patent application, Serial No. 830,538, filed July 30, 1959, to Haebler et al., entitled "Underwater Well Completion Method," of which this application is a continuation-in-part, it is not possible to install a float shoe, float collar or other cement retainer in the casing string prior to lowering it into the well since the casing string is lowered into the well over a string of drill pipe already positioned in the well, which drill string is later withdrawn from the well and from the well casing. It is realized that well casing could be run into a well over a drill pipe from a point above the surface of water to a point in a well just below the ocean floor, after which the drill string could be withdrawn from the casing and a float shoe connected to the upper end of the casing before the rest of the casing was made up and run into the well. However, in the event that the offshore well was being drilled in 500 feet of water, the float collar that was connected into the well casing would be positioned at least 500 feet above the lower end of the casing which would allow the casing below the float collar to fill up with cement during cementing operations. This would necessitate the drilling out of 550 feet or more of cement from the casing before drilling of the well could be resumed.

It is therefore a primary object of the present invention to provide a method of cementing a string of casing in an offshore well in a manner such that the major

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portion of the casing is kept free of cement at the time the cementing operations have been completed.

A further object of the present invention is to provide a method and apparatus for positioning a cement retainer near the bottom of a string of casing after the casing string has been made up and run down through a body of water to the ocean floor.

Another object of the present invention is to provide an apparatus adapted to position a cement retainer in the lower end of a casing string while at the same time being adapted to lower the casing string into a well drilled in the ocean floor.

Another object of the present invention is to provide an apparatus adapted to position a cement retainer in the lower end of a well casing to be run into a well and to provide means for bypassing fluid upwardly past the cement retainer during the time the well casing string and cement retainer are being lowered into the well.

These and other objects of this invention will be understood from the following description taken with reference to the drawing, wherein:

FIGURES 1 to 6 are schematic elevation views taken partly in section illustrating various steps in the installation of a conductor pipe or the first string of casing in a well drilled in the ocean floor in accordance with the method of the present invention;

FIGURE 7 is a view taken in longitudinal cross-section of one form of cement retainer mounted on a pipe string in accordance with the present invention;

FIGURE 8 is a cross-sectional view taken along the line 8-8 of FIGURE 7; and,

FIGURE 9 is a cross-sectional view taken along the line 9-9 of FIGURE 7.

Referring to FIGURE 1 of the drawing, a drilling barge 11, of any suitable type is illustrated as floating on the surface of the water 12 and fixedly positioned over a preselected drilling location by being anchored to the ocean floor by suitable anchors (not shown). While the method of the present invention will be described with regard to barge 11 of the floatable type, drilling barges which are adapted to rest on the ocean floor during drilling operations may also be employed while practicing the method of the present invention. Also, drilling platforms either driven in the ocean floor or temporarily positioned thereon may be used as a base for equipment in drilling wells and cementing a well casing therein in accordance with the present invention.

The drilling barge 11 is equipped with a suitable derrick (not shown) and all the other necessary auxiliary drilling equipment of which only a rotary table 13 is shown as being positioned above a drilling slot or well 14 which extends vertically through the barge in a conventional manner. When using the equipment of the present invention the slot 14 in the barge 11 may be either centrally located or extend in from one edge. However, drilling or cementing operations may be carried out over the side of the barge without use of a slot.

A pair of slips 15 are illustrated as being wedged in the center of the rotary table 13 for supporting a string of drill pipe 16 therein, the drill pipe having a drill bit 17 at the lower end thereof. The drill bit 17 is shown as being positioned in the bottom of a well 18 which has been drilled in the ocean floor 19. A wellhead support structure or base 21, which may include guide columns 22, is temporarily positioned in the slot 14 of the barge in any suitable manner, as by a temporary brace 23.

Equipment of this type is described and illustrated in U.S. patent application, Serial No. 830,538, filed July 30, 1959.

Prior to commencing drilling operations, a large diameter conductor pipe or casing 24, which may be say, 8 to 48 or more inches in diameter, is lowered through the bottom of the wellhead support structure 21 and suspended therein in any suitable manner, as by slips 25. The casing 24 may be of large-diameter thick-walled pipe at its upper end which is reduced at a predetermined level to a smaller diameter and, if desired, a thinner-walled pipe. Subsequently, the drill bit 17 and the drill pipe 16 are run down through the conductor pipe or casing string 24 and drilling operations are carried out until a sufficient hole has been drilled in the ocean floor to receive the desired length of conductor pipe. Alternatively, the drill bit 17 and the drill pipe 16 may be run down through the wellhead support structure 21 before hanging the conductor pipe 24 therefrom. The well would then be drilled to the desired depth after which a casing string or conductor pipe 24 would be run down over the drill string until it assumed the position shown in FIGURE 1.

A sufficient number of additional sections of casing would be added to the top of the casing string 24 so that its length would be at least slightly greater than the distance between the temporary hanging slips 25 and the mud line 19 at the top of the well 18. In this operation the drill pipe 16 is left in the well and is used to guide the large diameter casing string 24 into the hole. With the lower end of the casing string 24 positioned in the well 18, the drill string 16 and the drill bit 17 are withdrawn from the well and raised to the operating deck of the barge 11.

At the time the large-diameter well casing 24 is made up, suitable seating device, such as a cement retainer landing nipple 26, is connected into the casing string, preferably between the two lowermost sections thereof to serve as a seat for any suitable type of a cement retainer. Prior to running a cement retainer into the casing string 24, a casinghead 27 may be fixedly secured to the top of the casing 24 and hung in the wellhead support structure 21, as shown in FIGURE 2. A pipe string 28 is then run down into the casing 24, the pipe string 28 having any suitable type of cement retainer fixedly secured near the lower end thereof. The cement retainer 29, which is described in more detail with regard to FIGURE 7, is mounted coaxially on the pipe string 28 which is preferably provided with a splined or vertically-grooved section 31, a portion of which extends through the neck 32 of the cement retainer 29 so as to permit passage of fluid past the cement retainer, outside the pipe string 28. A portion of the pipe string 28, either just above or just below the splined section 31, forms a polished joint 33 which is adapted to be sealed in a fluidtight manner within the neck 32 of the cement retainer 29. The cement retainer 29 is also provided with suitable valve means, for example a flapper valve 34, for closing the central hole through the neck 32 of the cement retainer 29, upon withdrawing the pipe string 28 therefrom.

Referring to FIGURE 7 of the drawing, the cement retainer 29 is shown as being positioned in the cement retainer landing nipple 26 which is mounted in screw-threaded fashion between two sections of the casing string 24. The beveled lower end 35 of the cement retainer 29 is seated on a shoulder 36 formed in the inner wall on the landing nipple 26, thus preventing the cement retainer from dropping out the lower end of the casing. Suitable latching means are provided on the cement retainer 29 for latching it in place against upward movement once it has been seated on shoulder 36. Thus, for example, the cement retainer 29 may be provided with a series of latching dogs which are outwardly expandible by springs 38 into recesses, or in an annular groove 39, formed in the inner wall of the landing nipple 26. The latching dogs 37 are beveled at their lower edge, as at 40,

so as to pass readily into the landing nipple 26. The flapper valve 34 of the cement retainer is spring-loaded by means of a spring 42.

Packing is preferably provided on the inner wall of the neck 32 of the cement retainer 29 to seal against the outer surface of the pipe string 28 in a fluidtight manner when a polished portion thereof is within the neck 32. As illustrated in FIGURE 7, the splined vertically grooved section 31 of the pipe string 28 is shown as being positioned within the neck 32 of the cement retainer 26. A cross-sectional view of this splined section is shown in FIGURE 8 with the fluids flow passages being shown between the splines. During the running of the cement retainer into place on the landing nipple 26, to the position shown in FIGURE 7, the cement retainer 29 is fixedly secured to the splined section 31 by any suitable means, for example by a shear pin 44 or any other arrangement in a manner well-known to the art.

Suitable sealing means, such as a rubber gasket 45, is mounted on the outer surface of the cement retainer 29 to form a fluidtight seal between the outside of the cement retainer and the inner wall of the landing nipple 26. Additionally, the lower edge of the cement retainer 29 is preferably provided with an anti-rotational device of any suitable type, such, for example, as a downwardly-extending prong or lug 46 adapted to seat in a mating groove or recess (not shown) within the shoulder 36 of the landing nipple 26. The use of one or more of these prongs in the lower edge of the cement retainer, prevents the rotation of the cement retainer when it is being drilled out after cementing operations have been completed. Alternatively, instead of seating in recesses in the shoulder 36, the anti-rotation prongs or lugs 46 may contact similar lugs 47 fixedly secured, as by welding, to the inner surface of the landing nipple 26, as shown in FIGURE 9. A seating shoulder 50 is preferably provided on the inner wall of the pipe string 28 near the lower end thereof for catching a plug 51 which is pumped down the pipe string after cement has been pumped therethrough. When the plug 51 seats on the shoulder 50 during pumping operations, a pressure build-up at the surface, or on the drilling barge, indicates that the plug 51 has arrived at the bottom of the pipe string 26 and that all cement has been discharged therefrom.

Referring to FIGURE 2, the cement retainer 29 is shown as being lowered through the casing 24 on the pipe string 28 to its position on the landing nipple 26 as shown in FIGURE 3. While running the cement retainer 29 into the well to its position shown in FIGURE 3, the splined or grooved section 31 of the pipe string 28 provides a fluid bypass through the cement retainer outside the pipe string 28. The use of the splined section 31 is preferred although it is possible to position the cement retainer 29 in the casing 24 without a splined section by permitting the fluid in the well to pass upwardly through the open-ended pipe string 24 during the running-in operation. However, the use of the splined or vertically grooved section 31 on the outside of the pipe string 28 obviates the spilling of well fluid out the upper open end of the pipe string 28 onto the wellhead support structure 31 during the running-in operation.

After the cement retainer 29 is seated and latched in the landing nipple 26 and shear pin 44 is broken, the top of the pipe string 28 may be supported in the casing head 27 by temporary slips or elevators 52, as shown in FIGURE 3, if desired. At this time a running head 53 of any suitable design is secured to the top of the pipe string 28 (FIGURE 4) and lowered onto the top of the casing head 27 where it is fixedly clamped or latched thereon in any suitable manner well known to the art, for example by means of a J-slot connection or a hydraulically-operated connection so that the running head can be readily detached from the casing head 27 in open communication with the pipe string 28. In connecting

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the running head 53 to the top of the pipe string 28, it is essential that the splined or vertically-grooved section 31 on the lower end of the pipe string 28 is inside the neck 32 of the cement retainer when the running head 53 is clamped into position on the casing head 27. The pipe string 28b which forms an extension of pipe string 28 may serve as the means by which the casing head 27, guide columns 22, and casing 24 are all lowered from the drilling barge 11 to the ocean floor 19. In this case, the pipe string 28b is preferably drill pipe or other high-strength pipe which can support the load to be lowered to the ocean floor. The length of the pipe 28b used must necessarily be equal to the distance between the barge and the ocean floor.

As shown in FIGURE 5, the wellhead support structure 21 and casing head 27 have been lowered to the ocean floor 19 by the running string 28b, during which operation the well casing 24 and the cementing pipe string 28 are lowered into the well 18. At this time, with the shear pin 44 broken, the running head 53 is released from the top of the casing head 27 by manipulation of the running string 28b and then raised slightly, say 10 feet, above the casing head 27, to the position shown in FIGURE 6, thereby locating the polished section of the cementing pipe string 28 within the neck 32 of the cement retainer 29 in a fluidtight manner. The running string 28b is then suspended from the rotary table 13 on the barge by means of temporary slips 15, or any other suitable device, and the necessary cementing piping 54 is connected to the upper end of the running string 28b. The cementing piping 54 is in turn connected to the necessary cement pumping equipment (not shown). Cementing operations are carried out in the conventional manner by pumping cement slurry down through the running string 28b, pipe string 28, through the cement retainer 29 and on down through the well casing 24 and up the outside thereof in the annular space between the well casing 24 and the wall of the well 18. After a predetermined amount of cement has been pumped down the pipe string 28b, a displacement dart or plug 51 is pumped down through the pipe string 28b and 28 until it seats on the shoulder 50 (FIGURE 7). At this time the cementing operation has been completed and the pipe strings 28b and 28 are withdrawn upwardly to the drilling barge together with the running tool 53. As the bottom of the pipe string 28 is pulled out of the neck 32 of the cement retainer 29 (FIGURE 7), the flapper valve 34 swings upwardly to close the central opening through the neck 32, thus preventing cement from entering the well casing 24 above the cement retainer 29. After the cement has set and prior to continued drilling of the well, the cement retainer 29, which is made of a drillable material, is drilled out of the well casing in a conventional manner.

I claim as my invention:

1. A method of cementing a string of casing in an offshore well drilled by equipment on a structure positioned on a structure above the surface of a body of water and extending to the formation below, said method comprising the steps of positioning at least a portion of a drill string with at least a portion thereof in a drilled hole of an offshore well so that the drill string extends from a point within the well to a point above the surface of the water to serve as a guide for a casing, running a well casing down over the drill string so that the casing extends from a point above the surface of the water down into at least the proportion of the well, suspending the casing from its upper end in said position in a stationary manner, withdrawing the drill string from said casing, running a cement retainer to a fixed position in the casing near the bottom thereof while providing a flow passageway past the cement retainer as it is run into the casing, fixedly securing said cement retainer to the inner wall of said casing, removably attaching the upper end of the casing to a small-diameter pipe string, lowering the pipe string and casing simultaneously until the top of the

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casing is at a fixed position above the bottom of the body of water and the bottom of the casing is at a predetermined depth in the well but off the bottom thereof, hanging the pipe string by the upper end thereof from the structure above the surface of the water and pumping cement through the pipe string and through the casing below the cement retainer and up the outside of the casing to cement the casing in the well.

2. A method of cementing a string of casing in an offshore well drilled by equipment on a structure positioned on a structure above the surface of a body of water and extending to the formation below, said method comprising the steps of positioning at least a portion of a drill string with at least a portion thereof in a drilled hole of an offshore well so that the drill string extends from a point within the well to a point above the surface of the water to serve as a guide for a casing, running a well casing down over the drill string so that the casing extends from a point above the surface of the water down into at least the top of the well, suspending the casing from its upper end in said position in a stationary manner, with drawing the drill string from said casing, running a cement retainer on a small-diameter pipe string to a fixed position in the casing near the bottom thereof while providing a flow passageway past the cement retainer as it is run into the casing, fixedly securing said cement retainer to the inner wall of said casing, removably attaching the upper end of the casing to the small-diameter pipe string, lowering the pipe string and casing simultaneously until the top of the casing is at a fixed position above the bottom of the body of water and the bottom of the casing is at a predetermined depth in the well but off the bottom thereof, releasing the top of the casing from the pipe string, hanging the pipe string by the upper end thereof from the structure above the surface of the water, then pumping cement through the pipe string and through the casing below the cement retainer and up the outside of the casing to cement the casing in the well, and afterwards removing the pipe string from the cement retainer, and from the casing.

3. A method of cementing a string of casing in an offshore well drilled by equipment on a structure positioned on a structure above the surface of a body of water and extending to the formation below, said method comprising the steps of positioning at least a portion of a drill string with at least a portion thereof in a drilled hole of an offshore well so that the drill string extends from a point within the well to a point above the surface of the water to serve as a guide for a casing, running a well casing down over the drill string so that the casing extends from a point above the surface of the water down into at least the top of the well, suspending the casing from its upper end in said position in a stationary manner, withdrawing the drill string from said casing, running a cement retainer on a small-diameter pipe string extending therethrough to a fixed position in the casing near the bottom thereof while providing a flow passageway past the cement retainer as it is run into the casing, fixedly securing said cement retainer to the inner wall of said casing, removably attaching the upper end of the casing to the small-diameter pipe string, lowering the pipe string and casing simultaneously until the top of the casing is at a fixed position above the bottom of the body of water and the bottom of the casing is at a predetermined depth in the well but off the bottom thereof, releasing the top of the casing from the pipe string, manipulating the pipe string to close the flow passageway outside the pipe string past the cement retainer, hanging the pipe string by the upper end thereof from the structure above the surface of the water, then pumping cement through the pipe string and through the casing below the cement retainer and up the outside of the casing to cement the casing in the well, removing the pipe string from the cement retainer, closing the cement retainer through which the pipe string ex-

tended, and afterwards removing the pipe string from the casing.

4. A method of cementing a string of casing in an offshore well drilled by equipment on a structure positioned on a structure above the surface of a body of water and extending to the formation below, said method comprising the steps of positioning at least a portion of a drill string with at least a portion thereof in a drilled hole of an offshore well so that the drill string extends from a point within the well to a point above the surface of the water to serve as a guide for a casing, suspending the drill string from the top thereof in the well, running a well casing down over the drill string so that the casing extends from a point above the surface of the water down into at least the top of the well, suspending the casing from its upper end in said position in a stationary manner, attaching a casinghead to the top of said casing, withdrawing the drill string from said casing, running a cement retainer affixed to a small-diameter pipe string extending therethrough to a fixed position in the casing near the bottom thereof while providing a flow passageway past the cement retainer as it is run into the casing, fixedly securing said cement retainer to the inner wall of said casing, removably attaching the casinghead at the upper end of the casing to the small-diameter pipe string, lowering the pipe string and casing and casinghead simultaneously until the casinghead is at the bottom of the body of water and the bottom of the casing is at a predetermined depth in the well but off the bottom thereof, releasing the top of the casing from the pipe string, manipulating the pipe string to eliminate its fixed connection with the cement retainer and to close the flow passageway outside the pipe string past the cement retainer, hanging the pipe string by the upper end thereof from the structure above the surface of the water, pumping cement through the pipe string and through the casing to below the cement retainer and up the outside of the casing to cement the casing in the well, pumping a plug down after the cement to close the bottom end of the pipe string, removing the pipe string from the cement retainer, closing the opening in the cement retainer through which the pipe string extended, and removing the pipe string from the casing.

5. Apparatus for installing and cementing a well casing in a well drilled at an offshore location, said apparatus comprising a wellhead support base positioned above a body of water on a floatable drilling barge from which well drilling and cementing operations are carried out, a string of casing extending from the base into at least the top of the well, pipe string supporting means carried on the base, casinghead means attachable to the top of the casing string and forming a support means therefor for hanging said casing string in the well, a small-diameter pipe string adapted to be positioned in said casing string, a cement retainer insertable on said pipe string in said casing string, first connector means fixedly secured to said cement retainer for connection to said casing string near the lower end thereof, port means in said cement retainer for passing fluid therethrough, valve means carried by said cement retainer for closing said port means and being actuatable by said pipe string, and second connector means carried on said pipe string removably securing said pipe string to said casing head for supporting the casinghead means thereto for lowering said casing string into the well and said casinghead means to the ocean floor.

6. Apparatus for installing and cementing a well casing in a well drilled at an offshore location, said apparatus comprising a wellhead support base positioned above a body of water on a floatable drilling barge from which well drilling and cementing operations are carried out, a string of casing extending from the base into at least the top of the well, pipe string supporting means carried on the base, casinghead means attachable to the top of the casing string forming a support means therefor for hanging said casing string in the well, a small-diameter pipe

string adapted to be positioned in said casing string, a cement retainer insertable on said pipe string into said casing string and adapted to be fixedly secured to the casing string near the lower end thereof, port means in said cement retainer for passing cement downwardly and well fluid upwardly therethrough, valve means carried by said cement retainer and actuatable by said pipe string for closing said port means, first connector means for removably connecting said cement retainer to said pipe string, second connector means carried on said pipe string removably securing said pipe string to said casinghead for supporting the casinghead means thereto for lowering said casing string into the well and said casinghead means to the ocean floor, and third connector means carried by said cement retainer for fixedly latching said cement retainer to the casing string.

7. Apparatus for installing and cementing a well casing in a well drilled at an offshore location, said apparatus comprising a wellhead support base positioned above a body of water on a floatable drilling barge from which well drilling and cementing operations are carried out, a string of casing extending from the base into at least the top of the well, pipe string supporting means carried on the base, casinghead means attachable to the top of the casing string forming a support means therefor for hanging said casing string in the well, a small-diameter pipe string adapted to be positioned in said casing string, a cement retainer insertable on said pipe string into said casing string and adapted to be fixedly secured to the casing string near the lower end thereof, port means in said cement retainer for passing cement downwardly therethrough, check valve means carried by said cement retainer for normally closing said port means, first connector means for removably connecting said cement retainer to said pipe string, second connector means carried on said pipe string removably securing said pipe string to said casinghead for supporting the casinghead means thereto for lowering said casing string into the well and said casinghead means to the ocean floor, third connector means carried by said cement retainer for fixedly latching said cement retainer to the casing string, bypass fluid passageway means through said cement retainer for passing fluid thereby, valve means carried by said pipe string for closing said bypass passageway means on manipulation of said pipe string, and a cementing valve manifold at the top of said pipe string for conveying a cement slurry thereto.

8. Apparatus for installing and cementing a well casing in a well drilled at an offshore location, said apparatus comprising a wellhead support base positioned above a body of water on a floatable drilling barge from which well drilling and cementing operations are carried out, a drill string extending from said base into a well drilled in the ocean floor, a string of casing extending from the base into at least the top of the well, said drill string forming guide means for guiding the casing string down through the water to the ocean floor until at least the lower end of the casing string is in the well, means carried on the base for supporting the casing string temporarily therefrom, casinghead means attachable to the top of the casing string forming a support means therefor for hanging said casing string in the well, a small-diameter pipe string adapted to be positioned in said casing string when the drill pipe is withdrawn therefrom, a cement retainer insertable on said pipe string into said casing string and adapted to be fixedly secured to the casing string near the lower end thereof, port means in said cement retainer for passing cement downwardly therethrough, spring-loaded check valve means carried by said cement retainer for normally closing said port means, first connector means for removably connecting said cement retainer to said pipe string, second connector means carried on said pipe string removably securing said pipe string to said casinghead for supporting the casinghead means thereto for lowering said casing string into the well

and said casinghead means to the ocean floor, third connector means carried by said cement retainer for fixedly latching said cement retainer to the casing string, bypass fluid passageway means through said cement retainer for passing fluid thereby, valve means carried by said pipe string for closing said bypass passageway means on manipulation of said pipe string, and a cementing valve manifold at the top of said pipe string for conveying a cement slurry thereto.

References Cited in the file of this patent**UNITED STATES PATENTS**

2,196,657	Burt -----	Apr. 9, 1940
2,833,354	Sailers -----	May 6, 1958
2,909,359	Bauer et al. -----	Oct. 20, 1959
2,917,281	Kofahl -----	Dec. 15, 1959