

Dec. 15, 1959

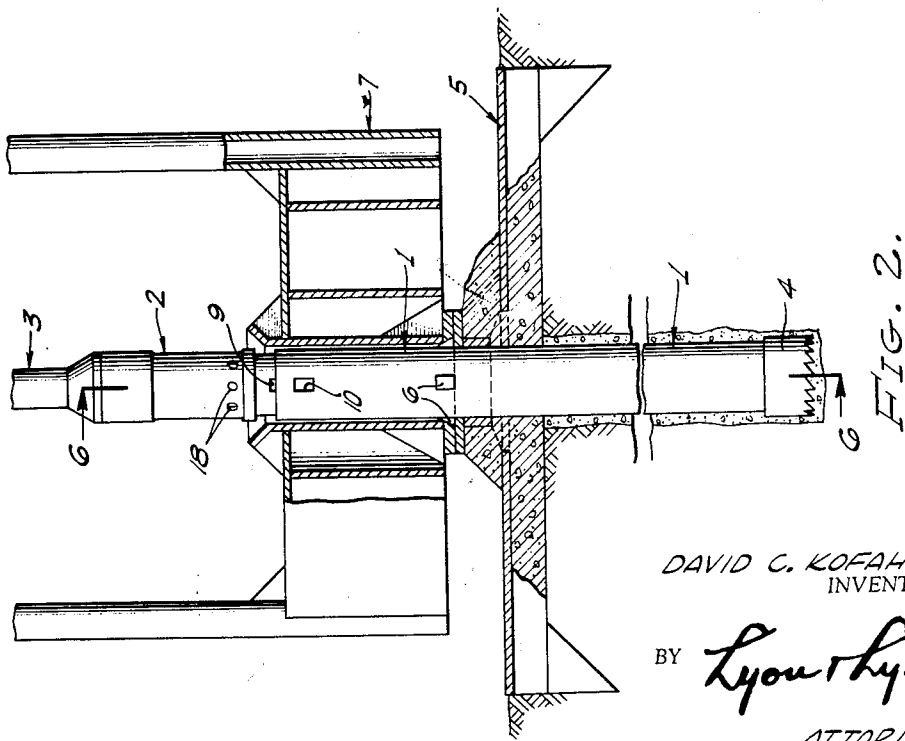
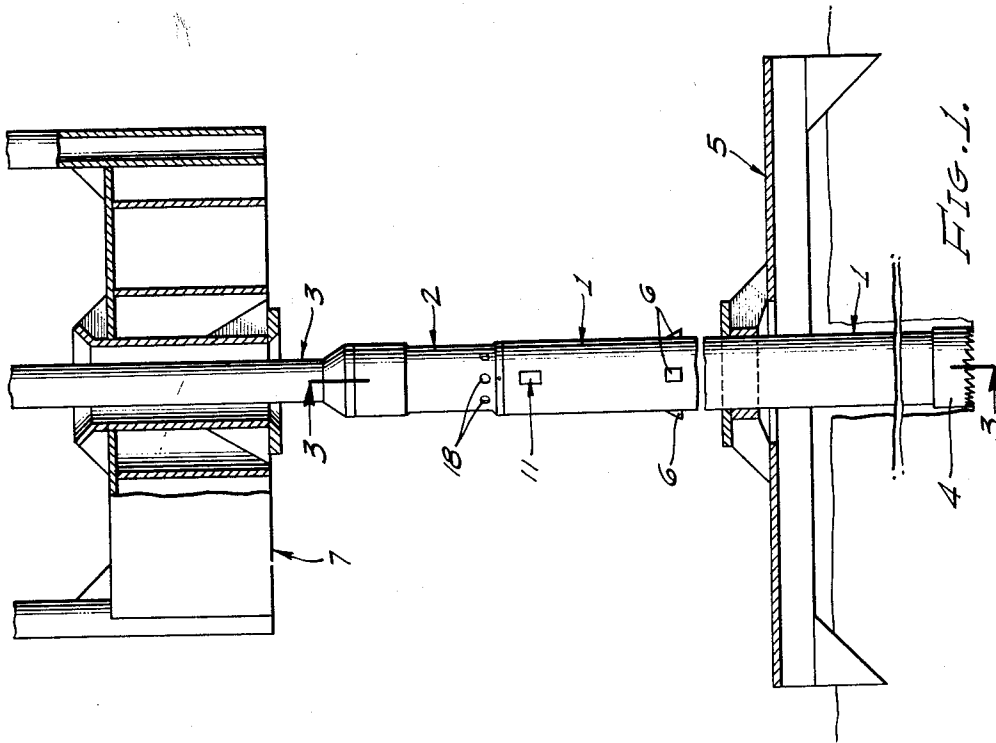
D. C. KOFAHL

2,917,281

RELEASING HEAD FOR SUBMARINE CONDUCTOR CASING

Filed July 26, 1957

3 Sheets-Sheet 1



DAVID C. KOFAHL
INVENTOR.

BY

Lyon & Lyon

ATTORNEYS

Dec. 15, 1959

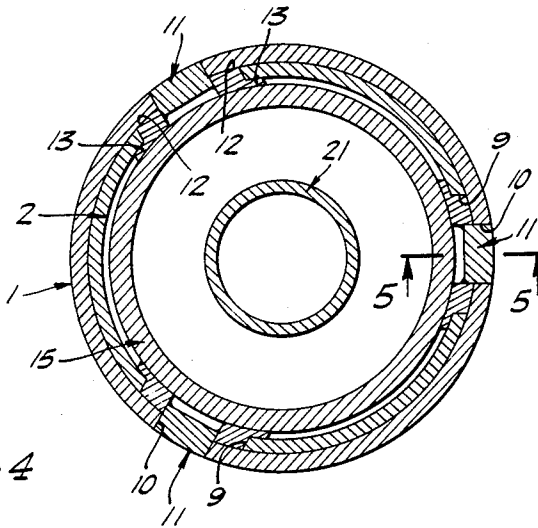
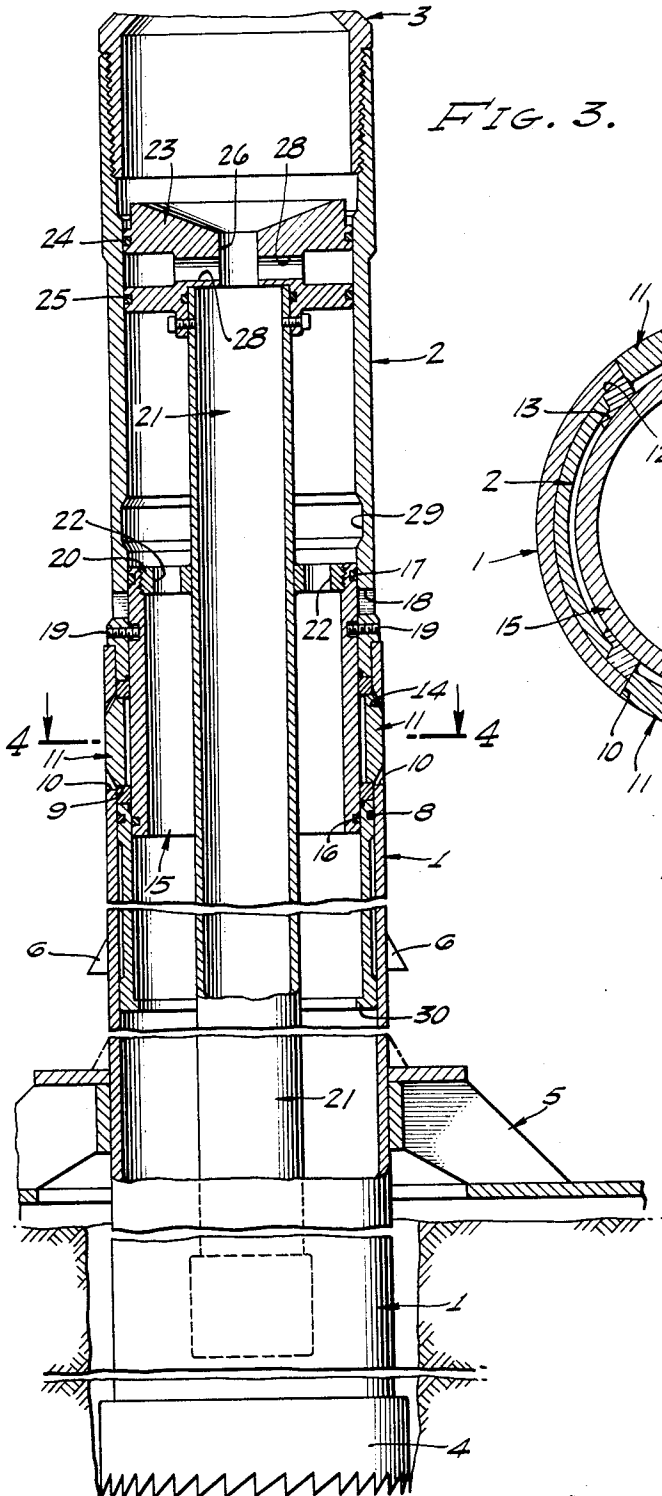
D. C. KOFAHL

2,917,281

RELEASING HEAD FOR SUBMARINE CONDUCTOR CASING

Filed July 26, 1957

3 Sheets-Sheet 2



DAVID C. KOFAHL
INVENTOR.

BY *Lyon & Lyon*
ATTORNEYS

Dec. 15, 1959

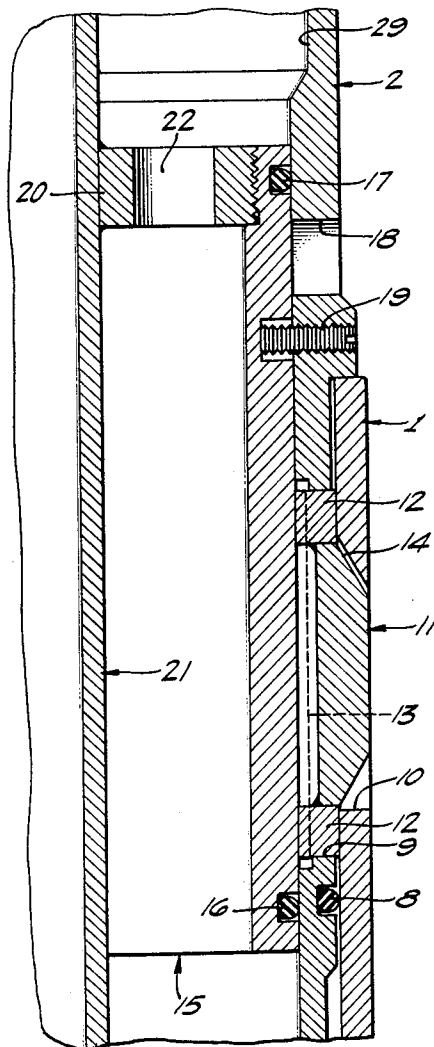
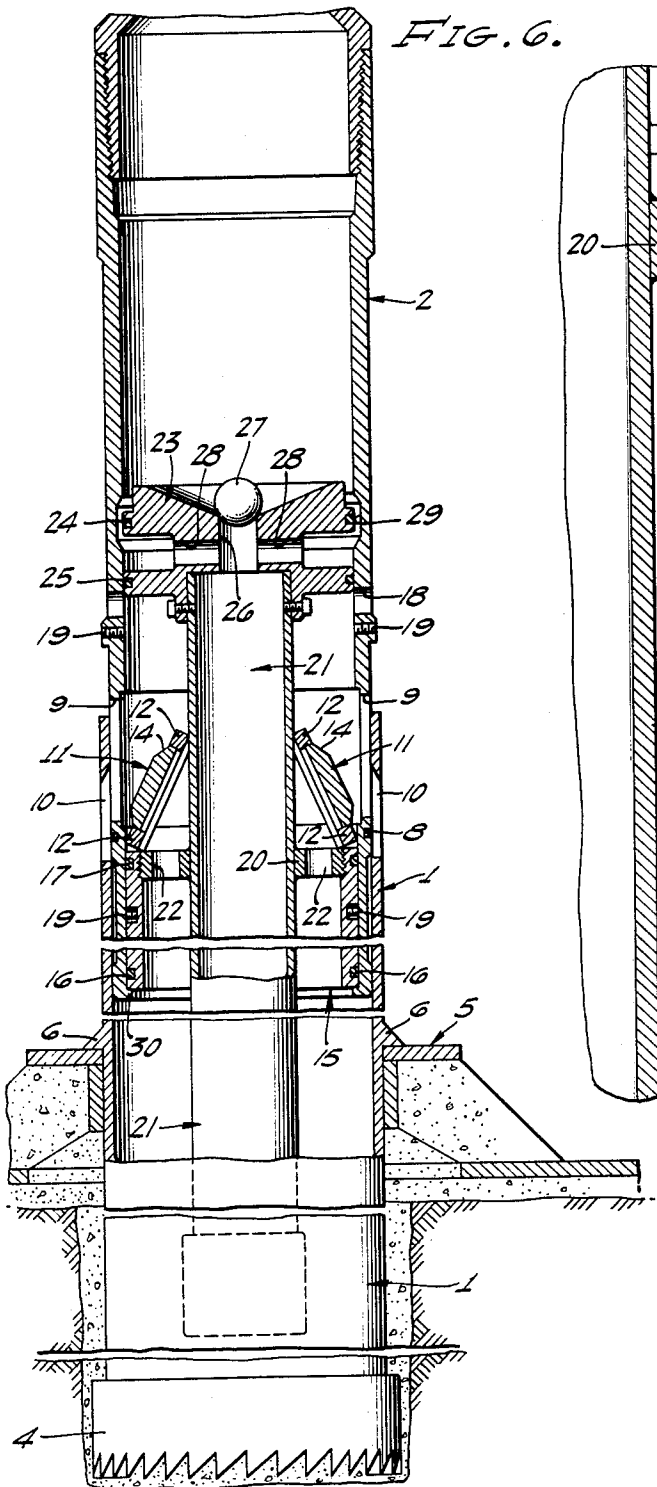
D. C. KOFAHL

2,917,281

RELEASING HEAD FOR SUBMARINE CONDUCTOR CASING

Filed July 26, 1957

3 Sheets-Sheet 3



DAVID C. KOFAHL
INVENTOR.

BY *Lyon & Lyon*
ATTORNEYS

1

2

2,917,281

RELEASING HEAD FOR SUBMARINE CONDUCTOR CASING

David C. Kofahl, Bakersfield, Calif., assignor to Richfield Oil Corporation, Los Angeles, Calif., a corporation of Delaware

Application July 26, 1957, Serial No. 674,411

7 Claims. (Cl. 255—2.5)

My invention relates to releasing head for submarine conductor casing, and is in particular an improvement of the releasing head disclosed in my copending application, Serial No. 628,727, filed December 17, 1950, entitled "Marine Well Drilling Method and Apparatus."

In common with said copending application, this invention finds particular usefulness in connection with well drilling installations wherein the well head equipment is mounted on the ocean floor and wherein the rotary machine, draw-works, and related equipment are mounted on a floating vessel.

It is necessary or desirable to force into the ocean floor a relatively short length, large diameter, conductor casing and cement it in place; then disconnect from the conductor casing. The conductor casing serves to prevent cave-in of the relatively soft ocean floor formation, to guide and protect the upper portion of the drill pipe and casing inserted in the conductor casing, and to anchor or secure the various equipment which may be later at the well mouth on the ocean floor.

Accordingly, then, the objects of the present invention include:

First, to provide a releasing head whereby conductor casing may be initially connected to a drill pipe to withstand the forces necessary to rotate the conductor casing and utilize the conductor casing to drill a bore into the ocean floor, and yet be readily disconnected, when desired, by remote manipulation of the drill pipe.

Second, to provide a releasing head which is arranged for disconnection after cementing of the conductor casing in place, and which includes novel means whereby excess cement remaining in the conductor casing may be flushed out so that, on setting of the cement, drilling of the well may proceed.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a fragmentary, substantially diagrammatical view showing a conductor casing lowered into position and in the initial stage of its drilling operation, indicating in cross section a landing base associated with the conductor casing, and indicating fragmentarily a guide frame which is later lowered into position on the landing base;

Fig. 2 is a similar fragmentary, substantially diagrammatical view, showing the arrangement of the parts after completion of the drilling-in operation of the conductor casing;

Fig. 3 is an enlarged, fragmentary, partial sectional, partial elevational view of the conductor casing and releasing head taken through 3—3 of Fig. 1;

Fig. 4 is a further enlarged, transverse, sectional view through 4—4 of Fig. 3;

Fig. 5 is a still further enlarged, fragmentary, longitudinal, sectional view through 5—5 of Fig. 4;

Fig. 6 is a fragmentary, longitudinal, sectional view through 6—6 of Fig. 2, illustrating the conductor casing and releasing head after completion of the drilling-in op-

eration with the parts positioned for circulation of washing fluid to remove excess cement; the guide frame being omitted.

The releasing head is intended to facilitate the drilling in of a conductor casing 1 which is made of one or several sections of relatively large diameter casing. The purpose of the conductor casing is principally to support the relatively soft or unconsolidated surface formation which may be formed of silt or sand. The conductor casing 1 is connected by a sleeve member 2 to a drill pipe 3, the sleeve member forming a part of the releasing head, which will be described in more detail hereinafter.

The lower end of the conductor casing 1 is provided with a drilling foot 4. This may be merely a collar on which teeth have been formed and, if desired, faced with hard facing material. Such annular drilling foot is satisfactory if the central core, which tends to form within the conductor casing, is easily washed away by the drilling fluid. Alternatively, the drilling foot 4 may be formed of frangible material extending across the bottom of the conductor casing and capable of being drilled by a suitable mill prior to further drilling operations in the well bore. It should be understood that the drilling foot is in any case a conventional member.

As described in more detail in the companion application, Serial No. 628,727, the conductor casing 1 is adapted to carry an anchor frame 5 which in the course of drilling in the conductor casing seats on the ocean floor. The conductor casing is drilled in until stop lugs 6 carried by the conductor casing seat against the anchor frame 5. In a subsequent operation, a guide and supporting frame 7 is lowered over the upper end of the conductor casing 1 and seated on the anchor frame 5.

It is desirable, in order to drill in the conductor casing, that the conductor casing 1 be firmly secured to the drill pipe 3, but that means be provided to effect subsequent separation of the conductor casing and drill pipe.

The present invention is directed primarily to a releasing head which includes the above-mentioned sleeve member 2. The sleeve member extends a short distance within the upper end of the conductor casing 1 and is provided with a seal ring 8. Above the seal ring 8 the sleeve member 2 is provided with several equally spaced, rectangular apertures 9 forming key openings which register with corresponding apertures or key openings 10 formed in the upper portion of the conductor casing 1.

Fitted in each set of registering apertures 9 and 10 is a key member 11. Each aperture 9 is preferably somewhat wider than the aperture 10. Each key member 11 is provided with lateral shoulders 12 to fit snugly within the aperture 9 and bear against the margins of the aperture 10, so that key members 11 are limited in their outward movement through the aperture 10. The key members 11 may have additional lateral shoulders 13 overlying the side margins of the apertures 9. Also, at least the upper end of each key member 11 is beveled at its outer portion, as indicated by 14, and the corresponding apertures 10 are correspondingly beveled.

Fitted within the connecting or main sleeve 2 is a short inner sleeve 15 which bridges the key members 11 and extends to a level a short distance above the conductor casing 1. The inner sleeve 15 is provided with seal rings 16 and 17 at its axial extremities. Immediately below the upper seal ring 17 the main sleeve 2 is provided with lateral ports 18 initially closed by the inner sleeve 15. Also below the upper seal ring 17 the main sleeve 2 is provided with one or more shear screws or pins 19, which extend into the inner sleeve 15 so that the inner sleeve is initially locked in a position to retain the key members 11 and to close the ports 18.

The upper end of the inner sleeve 15 is screwthreaded to the periphery of a supporting flange 20 which is

3

welded or otherwise secured to a flow tube 21, which extends downwardly through the conductor casing 1 and may terminate adjacent the lower extremity thereof. The supporting flange 20 is provided with perforations 22 to permit flow between the flow tube 21 and the casing.

Secured to the upper end of the flow tube 21 is a piston 23 having seal rings 24 and 25. The piston is provided with a central port 26 communicating with the interior of the flow tube 21. The upper end of the piston 23 forms an inverted cone, and thus its surface slopes downward to the central port 26. The central port is intended to be closed by a ball valve 27, which is dropped in place after the drilling-in operation is completed, as will be described in more detail hereinafter.

The piston 23 is provided with radial ports 28 communicating with the interior of the flow tube 21 and intersecting the side walls of the piston between the seal rings 24 and 25. The sleeve member 2 is provided at a location below the initial position of the piston 23 with an internal channel 29 which cooperates with the radial ports 28 to by-pass the piston upon predetermined downward movement of the piston.

The lower end of the main sleeve 2 is provided with an internal flange 30, which serves to limit downward movement of the inner sleeve 15 and the piston 23.

The releasing head is operated as follows:

Initially the parts are in the position shown best in Fig. 3; that is, the key members 11 interlock the main sleeve 2 and conductor casing 1 and are held in place by the inner sleeve 15, which in turn is secured in place by the shear screws 19.

The drill pipe 3 with the conductor casing 1 and anchor frame 5 suspended therefrom are lowered from a surface vessel, not shown, but more fully described in the aforementioned companion application, until the conductor casing 1 is brought into contact with the ocean floor. The drill pipe and casing are rotated so that the casing may drill its way into the surface formation immediately under the ocean floor. The drilling-in operation continues until the stop lugs 6 engage the anchor frame 5, as shown in Fig. 6.

At this stage cement is pumped down the drill pipe and conductor casing and forced upwardly around the exterior of the conductor casing. Sufficient cement is preferably introduced to ensure an excess of cement upwelling around the anchor frame 5 so as to firmly cement both the conductor casing and anchor frame in place. After the cementing operation is completed, the ball valve 27 is dropped to seal the central port 26 of the piston 23.

Fluid pressure is then applied to the upper side of the piston 23 to cause the screws 19 to shear, so that the assembly comprising the piston 23, flow tube 21, and inner sleeve 15 move downward until the inner sleeve 15 is arrested in its movement by the internal flange 30. In doing so the upper end of the inner sleeve 15 clears the key members 11 so that they may be displaced inward free of the conductor casing 1. Also the upper portion of the piston 23 having the seal ring 24 is disposed opposite the internal channel 29 so that the fluid above the piston may by-pass the upper portion of the piston and enter the radial ports 28.

The fluid, which may be sea water or other washing fluid, passes down the flow tube 21 and washes excess cement from the interior of the conductor casing 1, upwardly between the flow tube 21 and conductor casing and out the ports 18. Outward flow may also occur through the apertures 9 and 10 if the key members 11 have been dislodged inwardly.

However, dislodgement of the key members 11 normally does not occur until the drill pipe 3 and main sleeve 2 are raised, as indicated in Fig. 6. This upward movement of the sleeve member 2 relative to the conductor casing 1 results in inward deflection of the key members 11 so that the sleeve may be readily with-

4

drawn from the conductor casing. Before or after the sleeve member 2 is removed the guide and supporting frame 7 is lowered into position, as brought out more fully in the above-mentioned companion application.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of construction set forth, and it embraces such changes, modifications, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. A releasing head structure for submarine conductor casing, comprising: a conductor casing having a drilling foot at its lower end; a drill pipe; a sleeve secured to said drill pipe and telescopically fitting said conductor casing said conductor casing and sleeve having radially aligned key slots; key elements fitted in said key slots and interconnecting said conductor casing and sleeve; means tending to displace said key elements radially inwardly when unsupported at their radially inner sides thereby to free said drill pipe and sleeve from said conductor casing; means within said sleeve and initially engaging the radially inner sides of said key elements to retain said key elements in said key slots, said means being axially movable to release said key elements thereby to free said drill pipe and sleeve from said conductor casing; and seal means disposed below said slots between said casing and sleeve and between said sleeve and key element retaining means.

2. A releasing head structure for submarine conductor casing, comprising: a conductor casing having a drilling foot at its lower end; a drill pipe; a main sleeve secured to said drill pipe and telescopically fitting said conductor casing, said conductor casing and sleeve having radially aligned key slots; key elements fitted in said key slots and interconnecting said conductor casing and main sleeve; means tending to displace said key elements radially inwardly when unsupported at their radially inner sides thereby to free said drill pipe and main sleeve from said conductor casing; an inner sleeve initially positioned to back said key elements and retain said key elements in said key slots, said inner sleeve being axially slidable to clear said key elements; seal means between said conductor casing, main sleeve, and inner sleeve below said slots; shear elements for securing said inner sleeve in its initial position; and pressure actuated means for moving said inner sleeve to shear said shear elements and release said key elements.

3. A releasing head structure for submarine conductor casing, comprising: a conductor casing having a drilling foot at its lower end; a drill pipe; a main sleeve secured to said drill pipe telescopically fitting said conductor casing, said conductor casing and sleeve having radially aligned key slots; key elements fitted in said key slots and interconnecting said conductor casing and main sleeve; means tending to displace said key elements radially inwardly when unsupported at their radially inner sides thereby to free said drill pipe and main sleeve from said conductor casing; an inner sleeve initially positioned to back said key elements and retain said key elements in said key slots, said inner sleeve being axially slidable to clear said key elements; seal means between said conductor casing, main sleeve, and inner sleeve below said slots; shear elements for securing said inner sleeve in its initial position; a flow tube within said main sleeve extending into said conductor casing and joined to said inner sleeve; a piston head on said flow tube having an axial port communicating with said flow tube; and valve means insertable from the upper end of said drill pipe for closing said port, whereby fluid pressure may be applied to said piston to force said piston, flow tube, and inner sleeve downwardly to shear said shear elements and release said key elements, thereby to free said drill pipe and main sleeve from said conductor casing.

5

4. A releasing head structure for submarine conductor casing, comprising: a conductor casing having a drilling foot at its lower end; a drill pipe; a main sleeve secured to said drill pipe and telescopically fitting said conductor casing, said conductor casing and sleeve having radially aligned key slots; key elements fitted in said key slots and interconnecting said conductor casing and main sleeve; means tending to displace said key elements radially inwardly when unsupported at their radially inner sides thereby to free said drill pipe and main sleeve from said conductor casing; an inner sleeve initially positioned to back said key elements and retain said key elements in said key slots, said inner sleeve being axially slidable to clear said key elements; shear elements for securing said inner sleeve in its initial position; a flow tube within said main sleeve extending into said conductor casing and joined to said inner sleeve; a piston head on said flow tube having an axial port communicating with said flow tube; valve means insertable from the upper end of said drill pipe for closing said port, whereby fluid pressure may be applied to said piston to force said piston, flow tube, and inner sleeve downwardly to shear said shear elements and release said key elements, thereby to free said drill and main sleeve from said conductor casing; means operable on axial displacement of said piston to define a by-pass around said valve means to permit flow of washing fluid down said flow tube; and ports in said conductor casing adapted to be uncovered on displacement of said main sleeve to permit upward flow of said washing fluid between said flow tube and conductor casing, and discharge through said ports.

5. A releasing head structure for submarine conductor casing, comprising: a main sleeve adapted to telescope into the upper end of a length of conductor casing, said upper end having key slots in its side walls, and said main sleeve having mating key slots; key elements fitting said key slots to interlock said main sleeve and conductor casing; means for moving said key elements radially inwardly to disconnect said main sleeve from said casing; an inner sleeve initially positioned to retain said key elements in their locking position and axially movable to free said key elements, said key elements being arranged to fall radially inwardly on being freed; releasable means for securing said inner sleeve in its initial position; means for moving said inner sleeve axially to a position below said slots thereby to effect disconnection of said main sleeve from said conductor casing; and means at the upper end of said inner sleeve to collect said key elements.

6. A releasing head structure for submarine conductor casing, comprising: a main sleeve adapted to telescope into the upper end of a length of conductor casing, said upper end having key slots in its side walls, and said main sleeve having mating key slots; key elements fitting said key slots to interlock said main sleeve and con-

6

ductor casing; means for moving said key elements radially inwardly to disconnect said main sleeve from said casing; an inner sleeve initially positioned to retain said key elements in their locking position and axially movable to free said key elements, said key elements being arranged to fall radially inwardly on being freed; releasable means for securing said inner sleeve in its initial position; means for moving said inner sleeve axially to a position below said slots thereby to effect disconnection of said main sleeve from said conductor casing; a drill pipe connected with said main sleeve for rotating said conductor casing and supplying drilling fluid thereto; a piston in said main sleeve and connected to said inner sleeve, said piston having a normally open port therethrough; and means for closing said port whereby a pressure differential may be established across said port to force said piston and inner sleeve axially to release said key elements, thereby to disconnect said main sleeve from said conductor casing; means at the upper end of said inner sleeve to collect said key elements.

7. A releasing head structure for submarine conductor casing, comprising: a main sleeve adapted to telescope into the upper end of a length of conductor casing, said upper end having key slots in its side walls, and said main sleeve having mating key slots; key elements fitting said key slots to interlock said main sleeve and conductor casing; means for moving said key elements radially inwardly to disconnect said main sleeve from said casing; an inner sleeve initially positioned to retain said key elements in their locking position and axially movable to free said key elements; seal means disposed below said slots between said casing and sleeve and between said sleeve and key element retaining means; means for moving said inner sleeve axially thereby to effect disconnection of said main sleeve from said conductor casing; a drill pipe connected with said main sleeve for rotating said conductor casing and supplying drilling fluid thereto; a piston in said main sleeve and connected to said inner sleeve, said piston having a normally open port therethrough; means for closing said port whereby a pressure differential may be established across said port to force said piston and inner sleeve axially to release said key elements, thereby to disconnect said main sleeve from said conductor casing; a flow tube depending from said piston; and means operable on axial displacement of said piston to establish a flow path around said piston, downwardly through said flow tube, upwardly between said flow tube and conductor casing, and out of the upper portion of said conductor casing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,945,943	Layne	Feb. 6, 1934
2,210,885	Christian	Aug. 13, 1940
2,532,686	Ware	Dec. 5, 1950