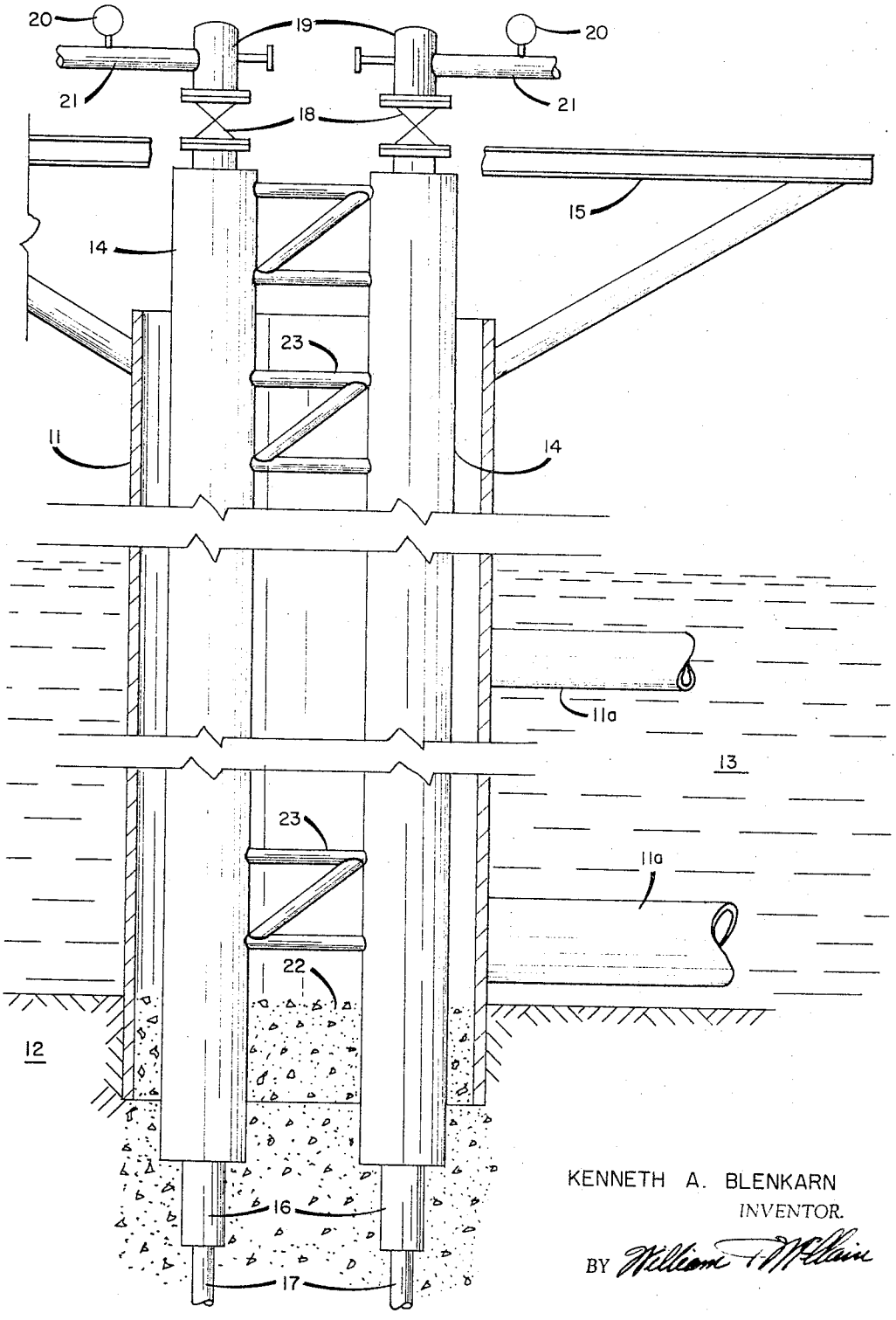
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MARINE STRUCTURE

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# MARINE STRUCTURE

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This invention relates to marine structures, and more particularly it relates to an improved offshore well structure for use in locations where forces are imposed on the offshore equipment by moving sheets of ice and the like.

In offshore oil and gas operations, wells may be drilled into formations underlying water having a depth ranging from a few feet up to several hundred feet. After drilling and completing such a well, the wellhead may be located beneath the water or above the surface, according to the needs for the particular location. In various instances it is desirable to locate the wellhead above the surface of the water. However, in certain cold-weather locations, for example, in the Cook Inlet area of Alaska, flowing sheets of ice present considerable problems in designing and constructing such facilities to withstand the ice forces. It has been found that structures can be constructed to withstand the high level forces imposed by the flowing ice. However, it has been observed that the action of the ice in striking a structure such as a production platform, breaking up and moving around it subjects the platform to rapidly varying loads. As a result, the platform may vibrate violently and continuously as the ice sheets move past it. In respect of the wellhead equipment atop a completed well, such vibration is highly undesirable, since the wellhead equipment may be damaged thereby, causing the release of high-pressure well fluids. Secondly, such violent shaking of the structure causes difficult working conditions.

In marine drilling operations, a conductor pipe may be extended from the surface of the water to the well for the purpose of guiding equipment into the well and for circulating drilling fluid between the well and equipment above the water. A conductor pipe may be employed when drilling from a platform, or a submersible or jack-up barge. When the well is to be completed above water, the conductor pipe may remain connected to the well and the production wellhead mounted atop the conductor. According to prior art methods, the caisson or jacket is designed as a load-bearing structure to withstand any forces imposed on the structure by moving ice or other floating material and/or to support a platform above the high water level. However, according to such methods, one or more conductor pipes placed in such a caisson or jacket have been structurally connected to the load-bearing structure by ring supports, cementing or lateral bracing. If such a prior art structure is employed in a location where moving ice must be contended with, the vibration of the load-bearing structure by the moving ice will be transferred to the production equipment so as to bring about the unwanted vibration of the wellhead and other associated production equipment.

According to the present invention an improved marine structure, in which the tendency for vibration of operating equipment is reduced, is provided by structurally isolating a conduit, such as a conductor pipe, positioned inside a large diameter protective tubular member, so that the lateral movement of the protective member is not transferred to the inner conduit.

The present invention provides a marine structure comprising a large diameter load-bearing tubular member having its lower end affixed to a formation underlying a body of water and extending upwardly from said formation to a point above the surface of the water; a conduit



member having its lower end connected to a well in the underwater formation and extending upwardly from the well to above the surface of the water; a wellhead assembly mounted on the conduit member above the surface of the water; said second tubular member being positioned inside the large diameter member and structurally isolated therefrom continuously above a point adjacent the formation. The large diameter tubular member may be a single caisson or a leg of a platform jacket, and one or more conduit members may be positioned inside of the large diameter member, as in the case where multiple wells are drilled through a single platform leg.

The present invention will be better understood by reference to the following description of the invention and to the accompanying drawing which schematically illustrates a partial view of a production platform in accordance with the invention.

Referring to the drawing, a large diameter load-bearing tubular member **11** is affixed to a formation **12** underlying a body of water **13**. This large-diameter member is capable of withstanding the ice forces and of supporting a platform **15**, if desired. In the instance where a caisson is employed, the caisson may be affixed to the formation by lowering the cylindrical caisson from the surface of the water to the formation and driving, jetting or drilling the lower open end of the caisson into the sea floor to a suitable depth, so that the lower end is stabilized against movement by wind, water or other forces. Also, the caisson is set in the formation to a depth where the caisson is supported vertically either by bedrock or skin friction. In other instances where a multilegged platform is employed, a leg of the platform may serve a similar purpose. In the drawing only one leg of a platform is shown, and of course, the various legs of the platform jacket are usually structurally interconnected by members **11***a* or the like. In such instances the platform jacket may be lowered through the water to rest on the formation. Generally, it is desirable to affix the legs of the platform to the formation by piles extending through the platform jacket legs into the formation and tying-in the legs to the piles adjacent the formation with a cementitious material. Alternatively, one or more conductor pipes or casing strings extending into the formation to a suitable depth may be cemented and tied to the platform leg to affix the platform leg to the formation.

One or more well conductors **14** extend through the large-diameter tubular member from the well to above the water. The lower end of each well conductor typically is driven, jetted or drilled into formation **12** to a suitable depth, and, if desired, may be cemented to the formation, according to well-known techniques. Various methods for setting the well conductors are well known in the art and need not be described in detail herein. Inside each well conductor and extending to a desired depth in the formation there may be positioned one or more casing strings **16** extending downwardly into the well. Typically, production tubing **17** inside the casing extends from a producing formation in the well upwardly through the casing and conductor pipe to a location above the upper end of the large-diameter tubular member, and a wellhead assembly is secured to the top of the well casing. Typically, the wellhead assembly comprises a control valve **18**, choke **19**, and pressure gauge **20**. A production flow line **21** leads from the wellhead assembly to storage facilities (not shown) for accumulating the produced fluids.

The conductor pipe extends upwardly from the well on the inside of the large-diameter tubular member and is structurally isolated from the large-diameter tubular member continuously above a point adjacent the formation. As mentioned above, the conductor pipe may be structurally tied into the large-diameter member by cement **22** or other means at a point substantially at the sea floor,

since little movement of the large-diameter member occurs in the area adjacent the formation. However, at increasing heights above the formation the magnitude of the movement resulting from vibrations caused by the flowing ice increases, and it is increasingly important that the isolation of the well conductor be maintained at increasing distances above the sea floor. Further, the spacing between the conductor pipe and the large-diameter member should be such that the large-diameter member does not contact the well conductor, since such contact can cause unwanted vibrations in the conductor pipe and the wellhead connected thereto. Advantageously, this spacing is greater than one-half the maximum amplitude of the large-diameter member.

Typically, the large-diameter member may be constructed of steel or other suitable material with a wall thickness in the range of about 2 to 3 inches and a nominal diameter of about 12 to 16 feet. The conductor pipes typically will have a diameter of about 30 inches, and where multiple conductors are installed in a single platform leg, the conductors may be arranged in approximately an 8- to 10-foot circle so that the conductors are spaced approximately 3 to 4 feet from the platform leg.

The conductor pipe installed inside the large-diameter member may be self-supporting, since the conductor pipe is not subjected to any significant forces of wind, water and ice. However, in the case of multiple well conductors in a single platform leg, the conductor pipes may be cross-braced by braces **23** serving to connect the conductors to each other to provide further stability.

If desired, a platform may be attached above the water level to the large-diameter tubular member, in which case the structural isolation between the well heads and the platform is maintained as described above in order that vibrations are not transferred to the wellhead. However, if desired, the platform may be connected directly to the top of one or more conductor pipes, and the above structural isolation maintained between these members and large-diameter member.

While the present invention has been described in terms of a preferred embodiment thereof, it will be understood that from the foregoing description various modifications and alterations falling within the spirit and scope of the invention will become apparent to one having ordinary skill in this art.

I claim:

**1.** A marine structure comprising a large-diameter tubular member having its lower end affixed to a formation underlying a body of water and extending upwardly from said formation to a point above the surface of the water; a conduit member having its lower end connected to a well in said formation and extending upwardly from said well to the surface of the water; said conduit member being positioned inside said large-diameter member and structurally isolated therefrom continuously above a point adjacent said formation, whereby vibrations induced in said large-diameter member are prevented from being transmitted to said conduit member; and a well head assembly mounted on said conduit member above the surface of the water; and a platform supported by said large diameter tubular member and isolated from said well head assembly.



**2.** A marine well production facility comprising a large-diameter tubular structural member having its lower end affixed to a formation underlying a body of water and extending upwardly from said formation to a point above the surface of said water; a well conduit positioned in said large-diameter member, said well conduit extending upwardly from a well in said formation and having its upper end above the surface of the water; a wellhead mounted atop the upper end of said well conduit; said well conduit being structurally isolated from said large-diameter member continuously above a point adjacent said formation, whereby vibrations induced in said large-diameter member are prevented from being transmitted to said well conduit a platform supported by said large diameter tubular structural member and isolated from said wellhead, said platform being above the surface of the water but at a height not greater than the position of said wellhead.


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