

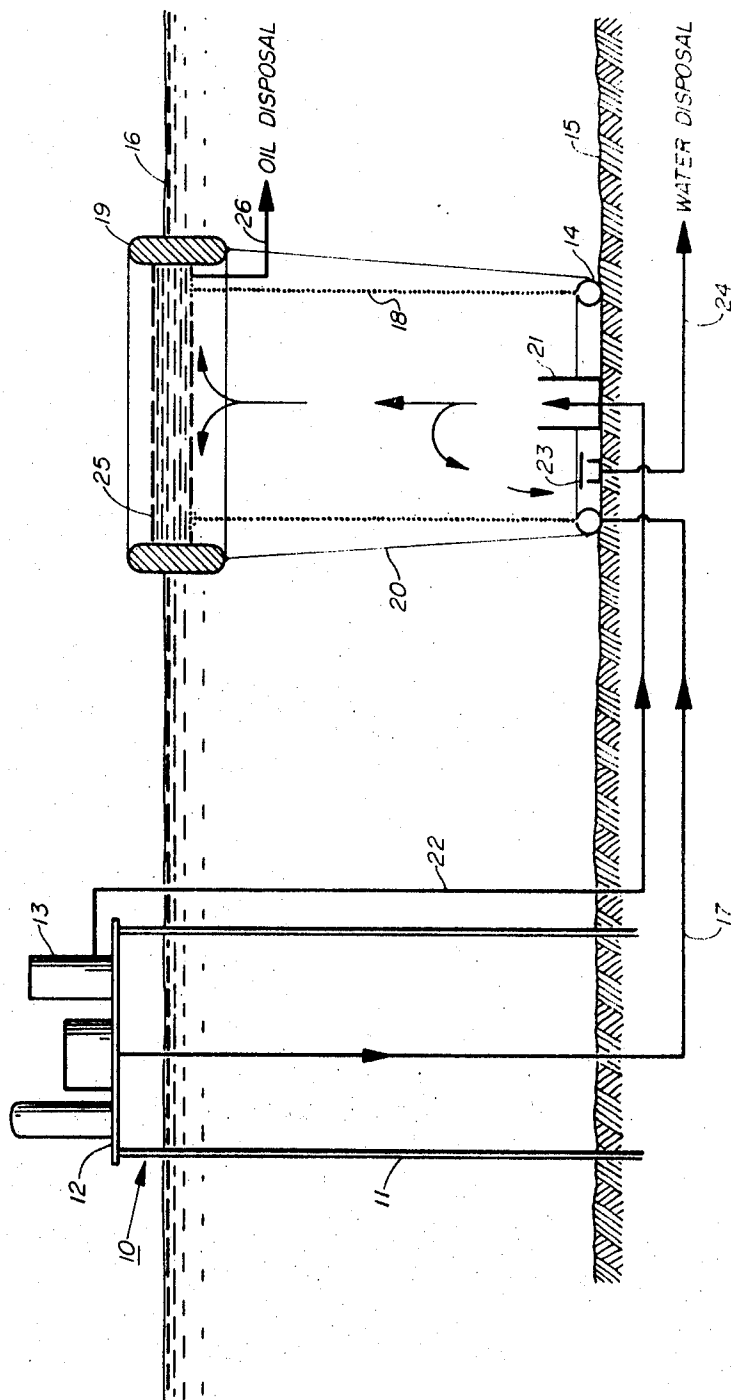
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OFF-SHORE TANK SYSTEM

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OFF-SHORE TANK SYSTEM

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4 Claims

ABSTRACT OF THE DISCLOSURE

A gas discharge distributor is disclosed at a subsurface location within a body of water generating an ascending curtain of bubbles as an effective retainer of liquid. Liquid is being introduced near the bottom of the enclosure. The liquid is contained as it ascends by the bubble curtain until the liquid reaches the surface. A floating ring at the surface is receiving the bubbles and ascended liquid and retaining the liquid while it is drained for disposal by a system not shown.

BACKGROUND OF THE INVENTION

Field of the invention.—The present invention relates to liquid storage or processing in bodies of water as represented by the sea. More specifically, the invention relates to the formation of a storage or processing tank between the surface of a body of water and its bottom without employing the usual siding of solid material to retain the liquid influent for and/or storage.

Description of the prior art.—Off-shore platforms have been used in drilling and producing oil wells for many years, particularly the last fifteen to twenty years. These platforms are well known for the costly, limited deck space they provide for mounting production equipment which is necessary to the field processing of the oil well fluids prior to their transport to a refinery or other point of use. The platforms are very costly and the space they provide is correspondingly valuable. Although the limited space of off-shore platforms is the more well-known of the problems of off-shore platforms, the weight of equipment mounted on these platforms is also critical.

Into the basic space-weight problem of the off-shore platform is thrust the increasing problem of produced water disposal. Although the cleaning of produced water for reinjection in secondary recovery may become a more important objective, the present problem is that of simply cleaning this by-product of oil production, regardless of its end use, so it may be disposed of in the sea without pollution. Administrative control of potential pollution is increasing through governmental regulation. It is evident that requirements to reduce this source of pollution will increase steadily in the future.

The processing and/or storage of oil-polluted water in large bulk is a problem of the off-shore platform. A structure is required which is readily accessible from the platform which will provide the residence time within which separation of oil and water can take place, not encroach upon the present platform space available, nor add to the weight on the platform.

SUMMARY OF THE INVENTION

A principal object of the invention is to provide an effective processing and/or storage tank for liquids in the water accessible to an off-shore oil well platform.

Another object is to provide walls for the tank in the form of a curtain of gaseous bubbles.

Another object is to control the withdrawal of water separated from its contaminants to prevent rupture of the gaseous curtain.

Another object is to provide a body for positioning

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retention at the surface of the water for materials of the tank which are buoyed to the surface of the water in which the tank is provided.

The present invention contemplates locating a dispersal structure about a bottom area near an off-shore platform and supplying the structure with gas which will ascend as a curtain of bubbles to form the walls of an effective tank. The contaminants of polluted water conducted into the tank will ascend while the separated water will be drawn from the lower portion of the tank at a rate which will prevent the water from penetrating the bubble curtain and carrying contaminants with it into the open sea. A fully buoyant or semi-submerged ring is anchored above and about the bottom area to receive and retain the ascending bubbles and contaminants. The contaminants are drawn off as required to prevent escape from the buoyant ring.

Other objects, advantages and features of this invention will become apparent to one skilled in the art upon consideration of the written specification, appended claims, and attached drawing, wherein;

The single drawing figure represents an embodiment of the invention in a somewhat diagrammatic elevation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

At this time, there has been no actual reduction to practice of the invention. However, the basic natural laws of fluid behavior have been relied upon in this disclosure. There are many conditions that obviously must be assumed to presume practical operativeness of the embodying system. However, reason is not unduly taxed to visualize practical application of the principles disclosed.

In the drawing, off-shore platform 10 is depicted in one of the conventional forms. Essentially, pilings 11 are driven in the bottom and floor 12 carried by such supports. Production equipment is indicated as mounted on floor 12. A water-treating unit 13 is a prominent feature on this floor.

No further detail of the production equipment on platform 10 need be disclosed. Unit 13 receives large quantities of fluids, predominantly the formation water produced from the well. The volume of unit 13 is limited. The problem is to provide additional volume for the contaminated water which is continually produced and in which the contaminants of the water can separate in the residence time provided by the additional volume. The essential elements of the invention provide this additional volume.

Under the concepts of the invention, a manifold 14 of generally circular form is fixed to bottom 15 below water surface 16. A source of gaseous fluid is connected to manifold 14. This connection is indicated with conduit 17. The drawing implies a source of gas would be on platform 10, but this need not be the location.

Circular manifold 14 has perforations from which a curtain of gaseous bubbles 18 ascend toward surface 16. The size and precise distribution to develop an effective curtain, or wall, could vary, depending on many factors. The concept is to generate a wall which will offer some measure of resistance to penetration by the contaminants rising within the cylinder of bubbles.

Directly above the manifold 14 is mounted a ring-shaped retainer 19. Preferably, retainer 19 has a larger diameter than the diameter of manifold 14. The concept is that the curtain of bubbles will surface within this retainer 19. Solid contaminants, rising to the surface within the walls 18, will be more positively captured within the retainer 19. The retainer 19 will be tethered, or moored, by some means indicated at 20. Thus the retain-

er will be maintained in register with the cylinder 18 of bubbles.

Basically, a tank has now been formed. The walls are of bubbles. A collector ring is mounted on the top of the cylinder of bubbles. The height is the distance between the bottom 15 and the surface 16. A large volume is thus available to platform 10 for waste water to separate from contaminants such as oil.

The remainder of the disclosure is subordinate to the foregoing features. A central dispersal structure 21 is mounted near the bottom of my unique tank. A conduit 22 conducts the water and contaminating oil to this structure.

The oil starts floating upward. The water spills over the structure 21 and descends. If the large volume of water is not drawn from the relatively fragile walls 18, it could carry oil through these bubbles and contaminate the surrounding sea water. A draw-off structure 23 is depicted near the bottom. A conduit 24 is part of a draw-off system not shown as a part of this disclosure.

The oil, and/or other contaminants, rises within walls 18, ascends to form a body 25 within upper retainer 19. Here again, a draw-off system is used to prevent exceeding the retaining capacity of 19. Conduit 26 is a part of this draw-off system not shown as a part of this disclosure.

CONCLUSION

I do not ignore the many practical problems of adapting my concepts to off-shore installations. Wind, wave action and currents are forces to be considered in reducing my invention to practice.

There must be available a suitable gaseous fluid and disposal system for the separated water and contaminants. The depth of water will be a factor as well as the buoyancy of the contaminant. However, the basic concept is a valid base for actual reduction to practice and contributes significantly to the art of providing tankage to off-shore installations.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it

is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A processing and/or storage structure, including, a dispersal structure of elongated and closed form for gaseous fluid positioned on the bottom of a body of water,
- a supply of gaseous fluid connected to the dispersal structure to cause the gaseous fluid to be discharged in dispersion from the structure and form a closed curtain of bubbles which rises toward the surface of the body of water,
- a buoyant body of elongated and closed form, moored at the surface of the body of water over the dispersal structure to receive the curtain of bubbles, and an inlet connected to a source of liquid mixture so the mixture will flow into the enclosure formed by bottom and the curtain and result in a constituent of the mixture floating upwards within the enclosure and being retained by the buoyant body.
2. The structure of claim 1, wherein, the dispersal structure is in the form of a generally circular ring which is perforated to release gaseous material with substantial uniformity along its length.
3. The structure of claim 1, including, a system for withdrawing the constituents which float upward and are retained by the buoyant body, and a system for withdrawing liquids which do not float upward.
4. The structure of claim 1, including, an off-shore platform on which units are mounted for producing an oil well and on which units are mounted for supplying the gaseous fluid for the curtain of bubbles and liquid mixture.

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