

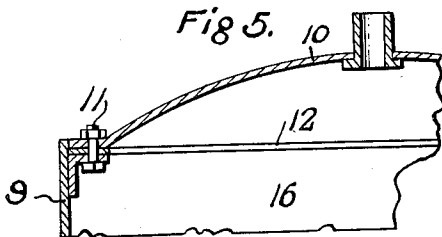
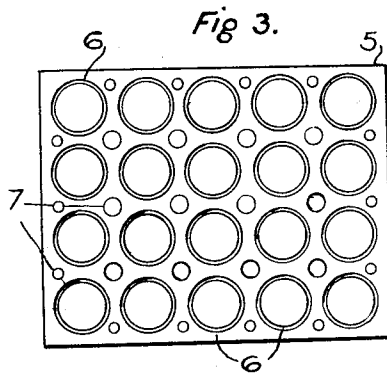
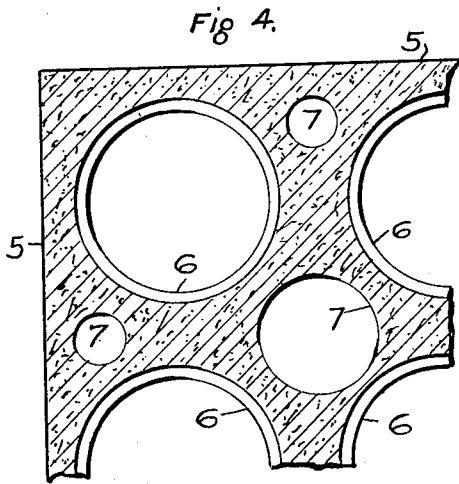
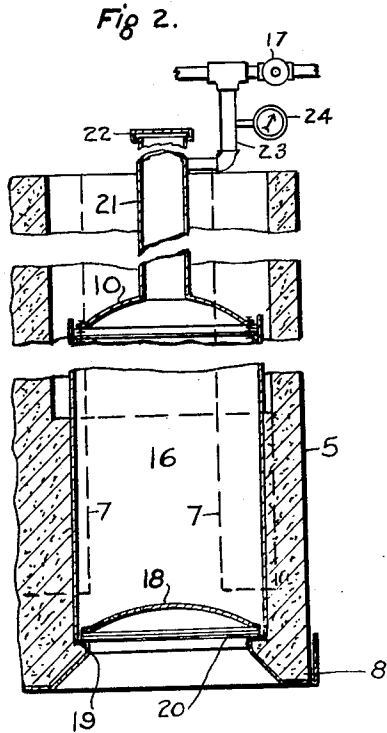
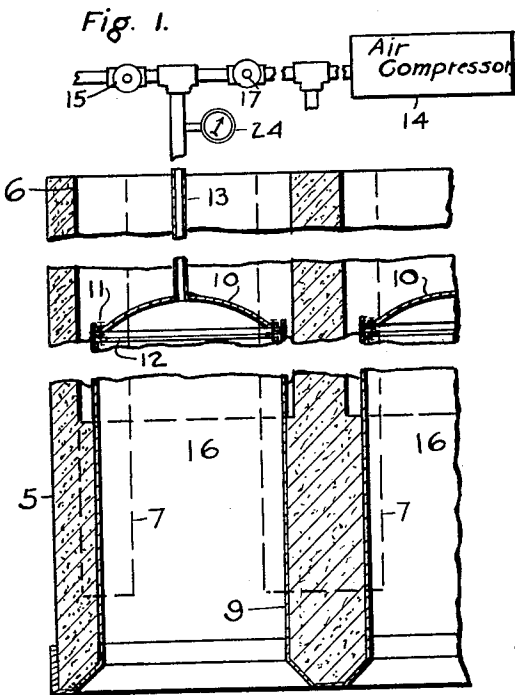
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FOUNDATION CAISSON

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5 Claims. (Cl. 61—81)

It is the object of this invention to provide a novel caisson adapted to facilitate the construction of subaqueous foundations in deep water or where the nature of the material beneath the water or various combinations of water and unstable bottom make the work relatively difficult with the structures heretofore employed.

In the accompanying drawing, which illustrates the best form of my invention at present known to me;

Figure 1 is a fragmentary, vertical section through my improved caisson and showing diagrammatically the connections for supplying compressed air to the several air chambers and for regulating the pressure therein;

Fig. 2 is a similar section through a slightly modified form of the invention;

Fig. 3 is a diagrammatic plan view of the caisson,

Fig. 4 is a fragmentary, horizontal section through the same, and

Fig. 5 is a fragmentary vertical section through the upper portion of one of the air chambers.

The caisson has a body 5 of concrete formed with a multiplicity of vertically extending wells 6 open at the top and bottom faces of the body. In order to further lighten the body 5 so that it may be floated into place, it is formed with a series of smaller wells 7 which are preferably closed at the bottom as indicated in Figs. 1 and 2. The walls of the caisson at the bottom are formed with cutting edges 8 fitted with metal caps to facilitate sinking into the soil beneath the water. The thickness of the walls diminishes upward, said walls being made as thin as possible while having the requisite strength to resist hydrostatic pressures and at the same time properly locate the center of gravity in order that the entire structure may float without danger of overturning while in the process of construction.

Each of the wells 6 is provided with a metal lining 9 extending upward from the bottom a distance dependent upon the size and proportions of the caisson and condition of the soil into which it is to be driven. In some cases this lining may reach to the top of the concrete body. The upper extremity of the lining is fitted with a bulkhead 10 which is readily removable, being secured in place by bolts 11. Suitable gaskets 12 are placed between the bulkhead and an internal flange on the lining 9 to seal the joint. As shown in Fig. 1, a pipe 13 communicates with the interior of the chamber formed beneath the bulkhead 10 and an air compressor 14 is

arranged to supply air under pressure through the pipe 13. A valve 15 controls an air escape pipe or port for further facilitating the regulation of the air pressure within the chamber 16. Where the compressor 14 is connected to a number of the air chambers, each chamber may be cut off from the compressor by closing a valve such as the valve 17.

In the form of the invention shown in Fig. 2, a bottom 18 closes the lower end of the air chamber 16 and rests on the top of an inwardly extending flange 19. The bottom 18 is held in place by air pressure within the chamber 16, a suitable gasket 20 being placed between the bottom 18 and flange 19. As further shown in Fig. 2, the bulkhead 10 at the top of the chamber 16 is sometimes fitted with an upwardly extending conduit 21 having a closure or removable cap 22 on its upper end. This conduit 21 may be connected to the suction pipe of a dredge to provide for the removal of material from the chamber 16 without removing the bulkhead 10. A pipe 23 communicates with the chamber 16 shown in Fig. 2 for connection with the compressor, as in Fig. 1. The several chambers are also provided with air pressure gauges 24 and pressure relief valves 15 and 17.

The caisson may be built on shore and launched on launchways or constructed on barges and supported on suitable floats until assembled. Concrete for extending the walls of the caisson upward may then be poured. The chambers 16 are ordinarily left open at the bottom but if by reason of wave action or other cause it appears likely that varying hydraulic pressure may cause said chambers to partially lose their air pressure then the bottoms 18 and gaskets 20 are used and sufficient air pressure is maintained in the chambers 16 to hold the bottoms 18 in place.

The caisson is floated to the location where it is to be sunk. Accurate control of the position of the caisson is maintained during this step of the procedure by regulating the air pressure in the several chambers 16. When the caisson is to be sunk air is allowed to escape through the valves 15 so that the water enters the lower ends of the chambers 16. As the structure sinks the caisson walls may be extended upward by construction of suitable forms and pouring of the concrete in continuation of the top. The top of the caisson is at all times kept above the water level. When the caisson has been sunk so that it rests on the soil beneath the water, air pressure in the chambers 16 is gradually reduced, allowing the caisson to sink into the soil and when the point is reached

where the caisson no longer continues to sink after the air pressure is released, one or more of the chambers 16 is opened by removing the bulkheads 10 and also the bottoms 18 where the latter are used. This is accomplished quickly and easily with my steel bulkheads as compared to prior caissons known to me. Excavation of the soil beneath the caisson is now accomplished by working within the open wells 6. As the caisson meets increased resistance other chambers 16 may be opened by removal of the bulkheads 10 and after all the chambers are open the dredging process is continued and the body of the caisson built up until it has been lowered to where it rests on a sufficiently solid foundation. Obviously, upon removal of the bulkheads 10, sinking may be continued until the entire metal linings 9 are driven into the soil beneath the water.

My improved caisson greatly facilitates the control of the rate of sinking of the structure. Thus in case it sinks too fast, the air pressure in the unopened chambers 16 is merely increased until the caisson sinks at a slower rate. If the material beneath the caisson is of such consistency as to give a tendency for one side of the caisson to sink faster than the other, the air pressure in the chambers controlling the buoyancy at the first side is merely increased so as to prevent uneven settlement. The smaller wells 7 are filled with concrete at such time as the resistance of the soil beneath the caisson requires greater weight to be brought to bear upon it in order to continue the sinking of the caisson into the soil. Where the condition of the soil beneath the water at the location of the foundation is of such consistency that it is likely to completely fill the chambers 16, the bulkheads 10 with the conduits 21 for dredging are employed. Thus if any chamber 16 becomes filled with silt or soil the dredging may be conducted until the loose material is removed and thereafter air pressure may be applied in the chambers to reduce the rate of sinking of any part of the caisson.

If it is found necessary to change the location of the caisson after it has once been sunk to the earth underlying the water, the caisson may be raised and refloated by increasing its buoyancy by the application of increased air pressure in the chambers 16. Notwithstanding the facility of control afforded by my improved caisson, it will be evident that the lower end is free to penetrate the material encountered at the bottom of the water to great depths.

As hereinbefore stated, the lining 9 extends upward from the bottom of the caisson a distance depending on the condition of the subaqueous soil and the position of the bulkheads 10 is determined by the height of the linings 9. A preliminary survey of the site of the pier indicates the depth of the deposit of soft, subaqueous silt and the lining should extend upward a distance proportionate to the depth of such deposit, otherwise it is necessary to employ the form of the invention shown in Fig. 2 wherein dredging in the wells may be accomplished without removing the bulkhead 10. In cases where the chamber 16 becomes filled with silt and, in the absence of such provision for dredging, removal of the bulkhead 10 is difficult because of the pressure of the

silt thereon. The present invention is primarily adapted for use where the pier is of such depth that pneumatic excavation is impractical. In any such case the air chambers of the several wells should be located in the lower portion only of the wells, that is, in the lower half thereof. By this arrangement a minimum of compressed air is required to fill the chambers and at the same time give the desired control during the sinking operation.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A caisson for use as a foundation in subaqueous soil comprising, a body formed with a multiplicity of wells extending from top to bottom of said body and so proportioned as to permit floating of the lower portion of the caisson, a series of removable bulkheads mounted in said wells and spaced a substantial distance from the lower ends thereof, said bulkheads forming air-tight chambers in the lower portions of said wells and said chambers having a depth not greater than half the depth of the wells in the finished caisson, means for supplying compressed air to the several chambers and means for regulating the air pressure within the same.

2. A caisson comprising, a body formed with a multiplicity of wells extending from top to bottom of said body and so proportioned and distributed as to permit floating of the caisson, a series of steel shells fixed in the lower portions of said wells, bulkheads removably secured to the upper ends of said shells, said bulkheads and shells forming air-tight chambers within the lower half only of said wells and means for regulating the air pressure within said chambers.

3. A caisson comprising, an integral body of concrete formed with a multiplicity of wells open at the top and bottom of said body and so distributed and proportioned as to permit the floating of said body, an upwardly removable bottom in each of said wells, removable bulkheads spaced upward from said bottoms in said wells and forming air-tight chambers in said wells and means for controlling the air pressure within said chambers.

4. A caisson comprising, an integral body of concrete formed with a multiplicity of wells extending to the top and bottom of said body, an upwardly removable bottom in each of said wells, a removable bulkhead spaced upward from said bottom and forming air-tight chambers in said wells and means for supplying air under pressure to said chambers severally, said bottoms being held in sealing engagement with the lower ends of said wells solely by air pressure within said chambers.

5. A caisson comprising, a body formed with a multiplicity of vertically disposed wells, proportioned and distributed to permit the floating of the caisson and open at the bottom of said body to permit the dredging of material beneath the body by the open dredging method, removable bulkheads mounted in said wells to form air-tight chambers in the lower half thereof and means communicating with said chambers to permit the dredging of material within the same while retaining said bulkheads in said wells.

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