Sept. 29, 1953 S. E. McCULLOUGH 2,653,451

PEDESTAL

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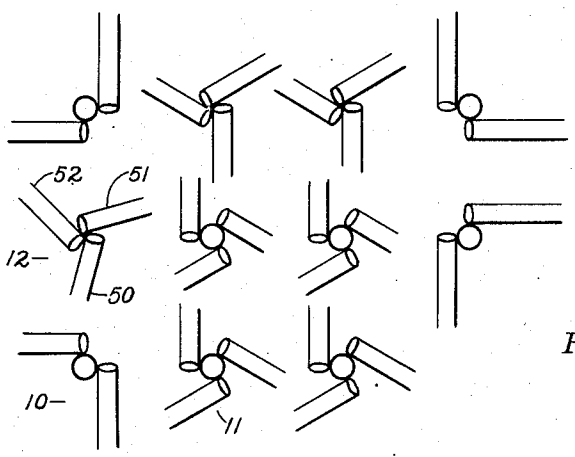

Fig. 1

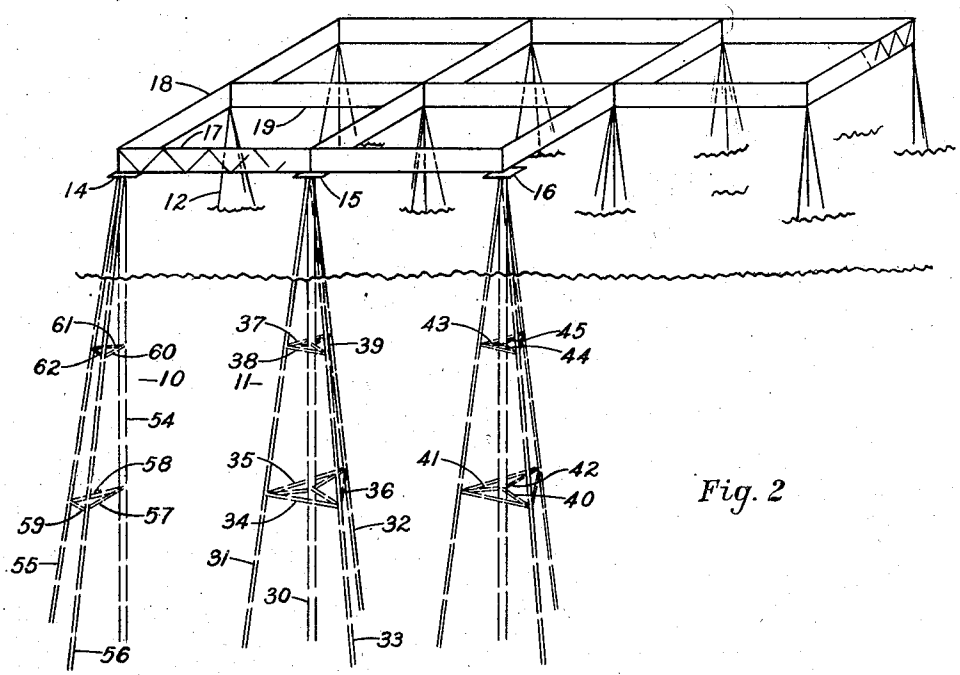

Fig. 2

INVENTOR.
STIRLING E. McCULLOUGH
BY:
Murray Robinson
ATTORNEY

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Fig. 3

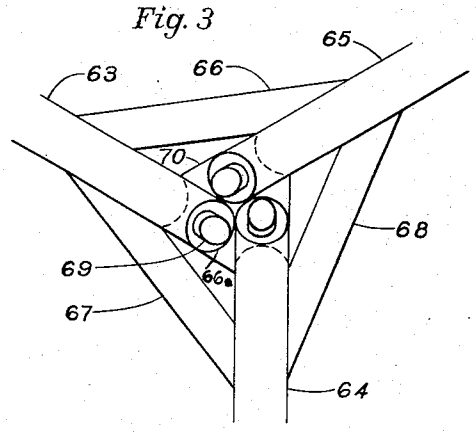


Fig. 4

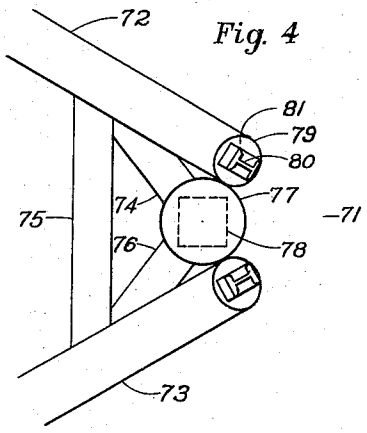


Fig. 5

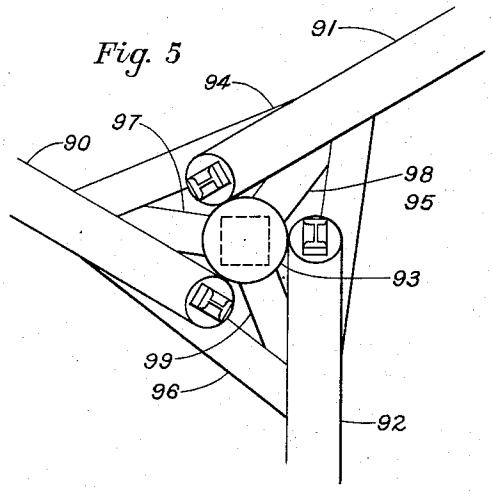
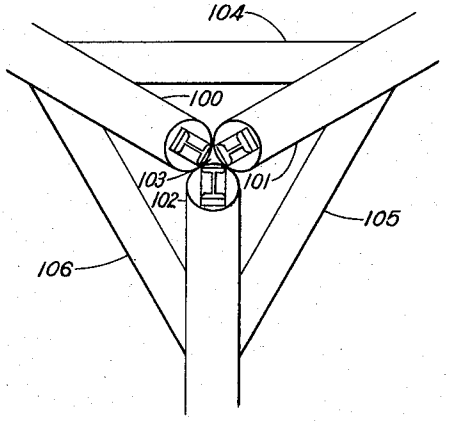


Fig. 6



INVENTOR.
STIRLING E. McCULLOUGH
BY:
Murray Robinson
ATTORNEY

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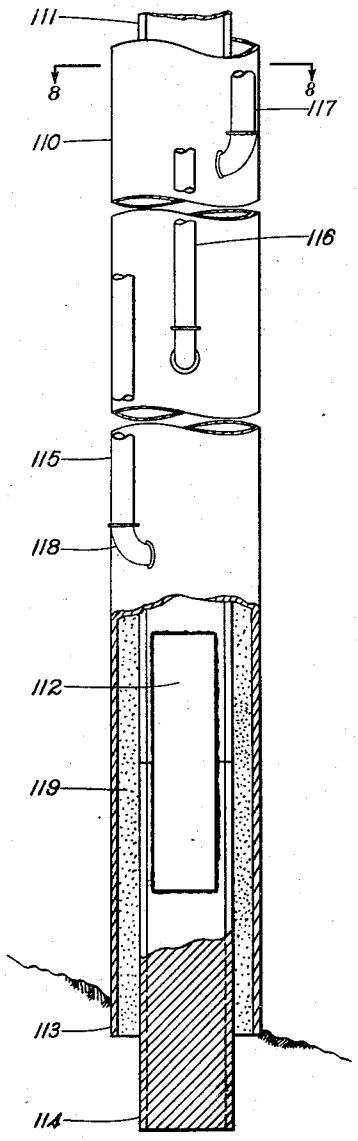

Fig. 7

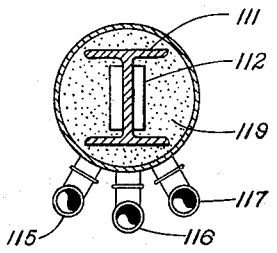

Fig. 8

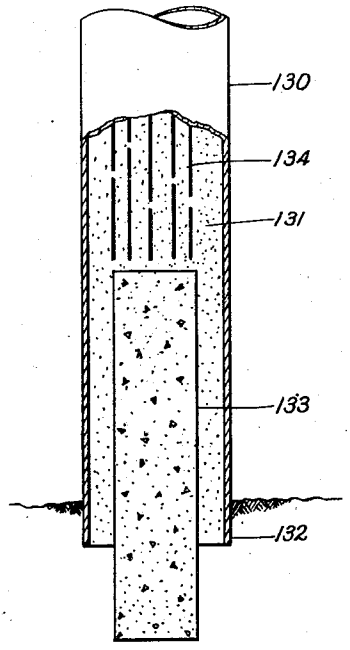

Fig. 9

INVENTOR.
STIRLING E. McCULLOUGH
BY:
Murray Robinson
ATTORNEY

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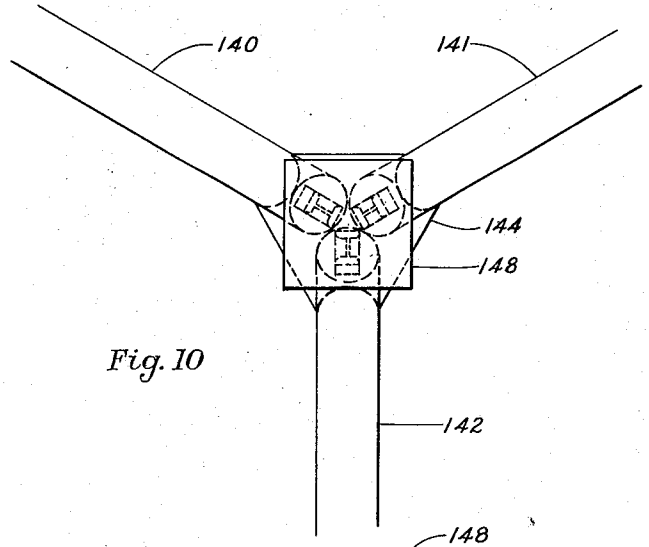

Fig. 10

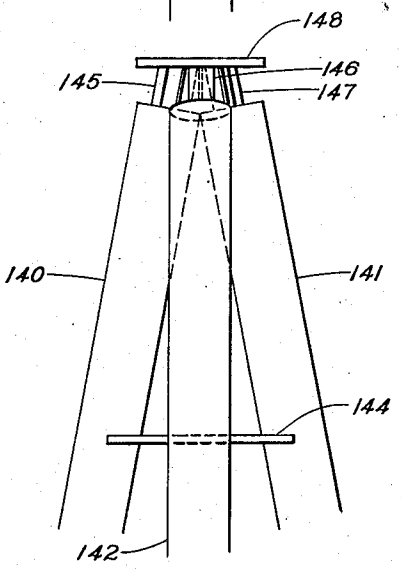

Fig. 11

INVENTOR.
STIRLING E. McCULLOUGH
BY:
Murray Robinson
ATTORNEY

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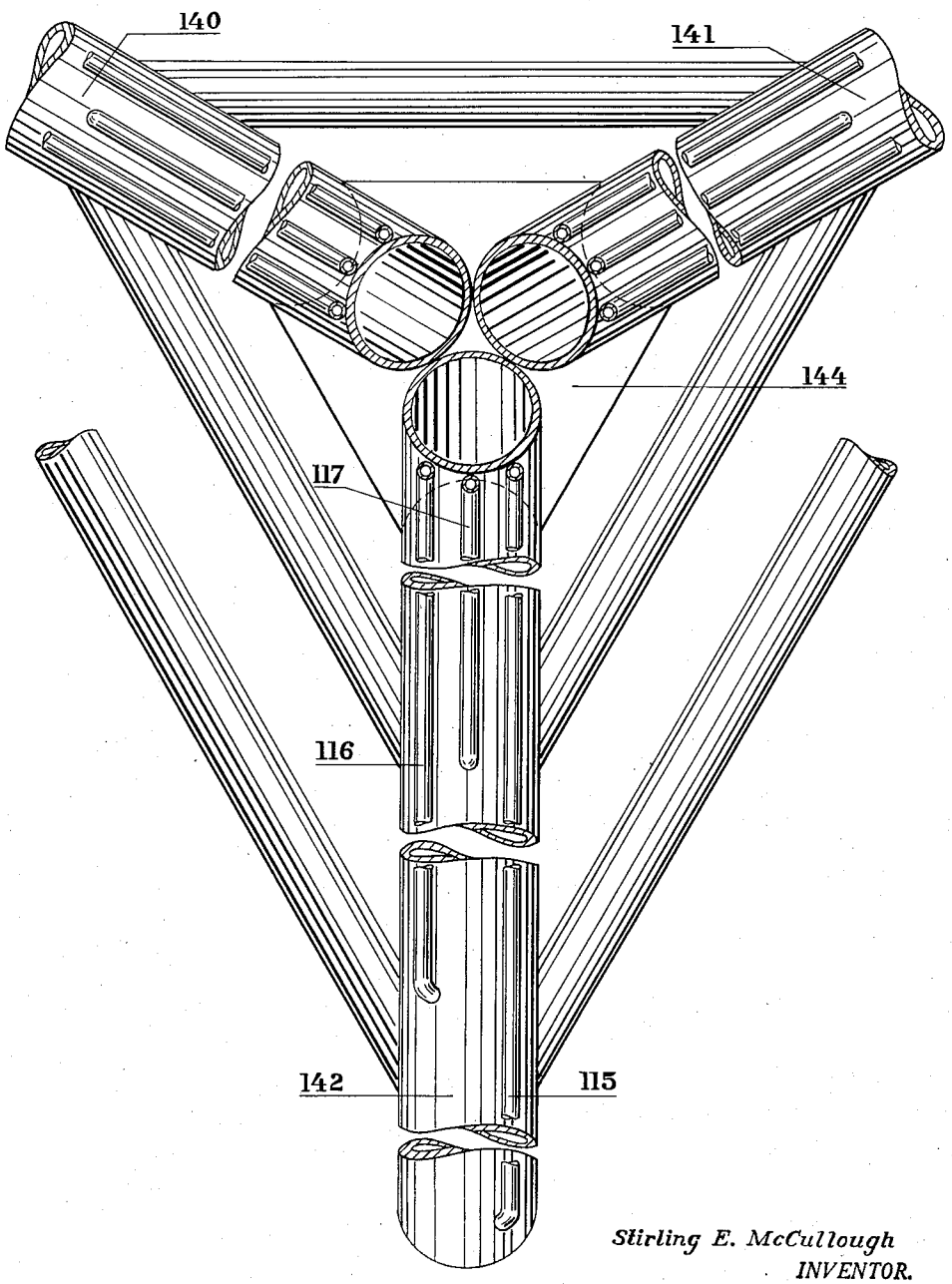

Fig. 12

Stirling E. McCullough
INVENTOR.

BY *Murray Robinson*
ATTORNEY

Patented Sept. 29, 1953 2,653,451

UNITED STATES PATENT OFFICE

2,653,451

PEDESTAL

Stirling E. McCullough, Houston, Tex., assignor to Brown and Root, Inc., Houston, Tex., a corporation of Texas

Application July 2, 1948, Serial No. 36,594

1 Claim. (Cl. 61—46)

1

This invention pertains to a structure for supporting objects above the surface of the earth and more particularly to a pedestal based structure for supporting an oil well drilling platform over water and to a pedestal therefor and to a method of making the pedestal.

The principal object of the invention is to provide a support that is economical, simple and inexpensive to construct, that is adaptable without radical change of design to support objects of different loads and at different heights above the earth's surface, and that is strong and durable. Other objects and advantages of the invention will appear as the description thereof proceeds.

Briefly, the invention comprises the fabrication on shore of a pedestal skeleton made up of several lengths of pipe angularly disposed relative to each other approximately in the positions of the edges of a pyramid with their tops welded or otherwise fastened together and with smaller horizontal pipes between the bottoms of the pipes bracing them against lateral displacement, the brace pipes preferably being welded to the main pipes. Running lengthwise of the main pipes from their tops part way down and terminating at different levels are a plurality of small pipes used to convey liquid cement or grout. The skeleton is taken to the water and floated out to location either by placing it on a barge or tying it to pontoons, or, if deep water is available from a pier, rendering it self-floating by placing removable plugs or frangible discs in the pipes to seal them at either the top or bottom. At the desired position the skeleton is lowered to the floor of the body of water. With the help of fluid jets inserted into the pipes they are lowered sufficiently into the ground until the axes of the pipes are disposed in the proper directions relative to the earth's surface. Steel or other piling is then lowered into each pipe successively, being spliced as required if the pipes of the skeleton are longer than the lengths of piling available. When the piling rests on the ground at the bottom of the pipe a pile driver is used to drive it to refusal or until it presents a prescribed resistance to further movement. If necessary, the piling may be spliced further as it is driven.

After each pipe has a pile driven therein, the space between the pile and the inside of the pipe is filled with cement by pumping grout under high pressure first through the grout pipe extending to the lowest level and then successively through the grout pipes extending to the levels next above. In this manner there is first formed a cement plug in the bottom of the pipe and thereafter the water in the pipe is lifted by the grout and forced out at the top of the pipe When the cement has set the tops of the piles are cut off and a suitable plate welded to their tops to provide a base or pillow for the girders to be supported thereon. Girders are then placed on the pillows and fastened thereto so as to connect together the tops of all the pedestals. A suitable deck may then be placed on top of the girders.

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For a further and more detailed description of the invention reference will now be made to the accompanying drawings in which:

Figure 1 is a schematic plan view showing the relative disposition of the piles of the pedestals used to support a typical oil well drilling platform;

Figure 2 is a perspective schematic view showing the girders or trusswork connecting together the tops of the pedestals;

Figure 3 is a plan view showing the top portion of one form of pedestal employing three inclined non-intersecting piles;

Figure 4 is a view similar to Figure 3 showing another form of pedestal employing one vertical and two inclined non-intersecting piles, suitable for a corner of the structure;

Figure 5 is a similar view of another form of pedestal employing one vertical and three non-intersecting inclined piles, suitable for supporting a very heavy vertical load;

Figure 6 is a similar view of another form of pedestal employing three inclined piles whose projected axes intersect;

Figures 3 through 6 are partly schematic in that certain details such as the grout pipes and (except in Figures 3 and 6) the top gusset plates have been omitted;

Figure 7 is an elevation partly in section of one form of pedestal leg;

Figure 8 is a transverse section taken on line 8—8 of Figure 7;

Figure 9 is a view similar to Figure 7 showing the lowermost portion of another form of pedestal leg;

Figures 10 and 11 are respectively plan and elevational views of the top portion of one form of pedestal showing the details of one mode of tying together the tops of the pedestal legs and supporting a cap plate or pillow thereon; and

Figure 12 is a top view of a pedestal skeleton.

Referring to Figures 1 and 2, there is shown the general arrangement of a support constructed according to the invention and particularly adapted for supporting an oil well drilling platform. The support comprises a plurality of pedestals such as those shown at 10, 11, and 12, rising from the surface of the ocean floor and extending above the surface of the water. To the top of each pedestal there is secured a cap plate or pillow as indicated at 14, 15, and 16 in Figure 2. Suitably secured to the cap plates so as to interconnect the pedestals are a plurality of girders as shown at 17, 18, and 19. The girders may be solid shapes, built up shapes, or truss work, depending upon the particular loading con-

ditions. As shown in the drawing they are constituted by suitable trusses.

Each of the pedestals is composed of a plurality of upwardly converging upstanding members provided with suitable bracing under water to tie them together and also secured together at their tops. Different numbers and dispositions of these upstanding members are used for different ones of the pedestals according to their location at the corners, edges or interior of the support and according to the particular load carried by the support at a point immediately above the pedestal. Thus pedestal 11 is composed of four upstanding members, namely, a vertical member 30 and three inclined or angularly disposed members 31, 32, and 33. The angularly disposed members are connected at a number of levels by means of horizontal braces such as those shown at 34, 35, 36, and 37, 38, 39. They are also connected to the vertical member by braces such as those shown at 40, 41, 42 and 43, 44, 45. It is contemplated that pedestal 12 and the other three of the four pedestals shown in Figure 1 having four upstanding members will be located immediately below the seat of the derrick on the drilling platform. Pedestal 12, which it is not anticipated will need to carry such a heavy load, is composed of three upstanding members, 50, 51, and 52, all angularly disposed and braced together in the same manner as the three angularly disposed members of pedestal 11. Corner pedestals such as pedestal 10 are preferably formed with one vertical member such as that shown at 54 and two angularly disposed members 55 and 56. These members are also connected together at a number of levels by horizontal braces such as those shown at 57, 58, 59, and 60, 61, 62. As best shown in Figure 1, the various upstanding members forming the legs of each of the pedestals are so disposed relative to the members of the other pedestals that the downward projections of the axes of the legs do not intersect. This means that there is no interference when the piles are driven through the supporting skeleton.

Referring to Figures 3, 4, 5, and 6, there are shown the details of the top ends of a number of forms of pedestal constructed according to the invention. The pedestal shown in Figure 3 is a three member pedestal similar to pedestal 12 of Figures 1 and 2. The three upstanding members are shown at 63, 64, and 65 and the uppermost braces are indicated at 66, 67, and 68. Each of the upstanding members is formed of an exterior or skeleton pipe such as that indicated at 66*a* and an interior pipe pile such as that indicated at 69 and cement or concrete filling the space between pipes 63 and 69 and also filling the interior of pipe 69. The braces 66, 67, and 68 are preferably pipes of a smaller diameter than the upstanding skeleton pipe and are suitably secured thereto as by welding. The extreme top ends of the skeleton pipes are secured together by a gusset plate welded thereto such as indicated at 70. The axes of the three members 63, 64, and 65, do not intersect so that during the process of making the pedestal, after one of the pipe piles has been driven through the skeleton pipe within which it is located, there is no interference with the space at the ends of the other two skeleton pipes so that the other pipe piles can be driven. As shown, after the pipe piles have been driven they are cut off in a horizontal plane a short distance above the top ends of the skeleton pipes.

The pedestal shown in Figure 4 corresponds generally to the pedestal 10 shown in Figures 1 and 2. The pedestal comprises one vertical member 71 and two angularly disposed members 72 and 73. The uppermost brace members are shown at 74, 75, and 76. Gusset plates similar to that shown in Figure 3 are used at the extreme top of the pedestal but have been omitted from the drawing for clarity. The central member 71 comprises an outer skeleton pipe 77 and concrete filling the interior thereof, a portion of the concrete being in the form of a concrete pile 78 near the bottom of the member and the rest of the concrete being poured after the skeleton has been placed and the concrete pile driven. The two angularly disposed members 72 and 73 each comprise an outer pipe such as that shown at 79 and a beam of H section or other structural section, such as that shown at 80. The space 81 between the skeleton pipe and the H beam is filled with cement. In contrast with the pedestal shown in Figure 3, the axes of the two inclined members intersect. This is permissible since the tops of the members are spaced by the vertical member 71 therebetween. It is also to be noted that the vertical member 71 is of a larger diameter than the angularly disposed members. The vertical member 71 is intended to carry most of the compressive loads while the angularly disposed members 72 and 73 are provided to take the bending load. The top ends of the H beams are cut off in a horizontal plane slightly above the level of the top ends of the inclined skeleton pipes. A suitable structural steel shape may be imbedded in the top portion of the concrete of member 71 and cut off at the same level as the steel beam 80 or alternatively the vertical skeleton pipe may be carried up to that level. Cap plates or pillows such as those shown at 14, 15, and 16 in Figure 2 are suitably secured to the top ends of the H beams and the structural shape imbedded in the top of member 70 or the top end of the vertical pipe.

Referring to Figure 5, there is shown the top end of a pedestal similar to that shown at 11 Figures 1 and 2. The inclined members are shown at 90, 91, and 92 and the vertical member at 93. Pipes forming the upper group of braces are indicated at 94, 95, 96 and 97, 98, 99. Gusset plates (not shown) are welded to the top ends of the members to secure them together at the top. The three inclined members each comprise an outer skeleton pipe and an inner H beam with cement filling the space therebetween in the same manner as for the inclined pipes 72 and 73 of the pedestal shown in Figure 4. The central or vertical member 93 is also constructed similarly to the vertical member 71 of the pedestal shown in Figure 4. In contrast to the Figure 4 construction, however, the axes of the inclined members do not intersect.

In Figure 6 there is shown a pedestal comprising three angularly disposed members 100, 101, and 102. Each of these members comprises an outer skeleton pipe and an inner H beam with cement therebetween the same as the inclined members of the pedestals shown in Figures 4 and 5. The pedestal also has horizontally disposed brace pipes as shown at 104, 105, and 106. The axes of the three members intersect in the pedestal shown in Figure 6, which makes the three members support each other better. This construction can only be used where the angle of inclination of the members is not great so that after one of the H beams has been driven and cut off at the desired level there remains sufficient room for the other H beams to be driven. A triangular gusset plate 103 is shown welded to the top ends of the skeleton pipes for securing them

together. The H beam piles are disposed with their planes of maximum stiffness, that is, the planes of the central webs, intersecting the vertical axis of the pipe. This is a special case of the general rule for disposition of the piles. As shown in Figures 4 and 5 the plane of maximum stiffness should be in a vertical plane.

From the foregoing examples shown in Figures 3, 4, 5 and 6, it will be seen that each of the pedestals comprises at least three pipes in a tripod-like disposition and that at the upper ends of the pipes the pipe axes approach intersection with each other to within a distance of the order of magnitude of the diameter of the pipes.

Referring to Figures 7 and 8, there are shown the details of one form of construction particularly suitable for an inclined pedestal leg. The leg comprises an outer skeleton pipe 110 and an inner piling 111 formed of a plurality of H-beams spliced together end to end. The splice may be made in the usual manner as shown in the sectional part of the figure wherein a steel strip 112 is shown welded to the abutting ends of two H-beams. The strip 112 is shown connected to the central web of the H beams. If desired, additional strips could be secured in the same manner to the flanges. As shown in the drawing, the bottom end 113 of the skeleton pipe projects only a short way into the ground. The bottom end 114 of the H-beam piling, however, extends beyond the end of the skeleton pipe and on into the ground a considerable distance. The grout lines or pipes used for filling the space between the piling and the skeleton pipe are shown at 115, 116, and 117. Each of these grout pipes comprises an elbow extending outwardly and upwardly from the side of the skeleton pipe at 118 and a vertical pipe rising therefrom to the top of the pedestal, the elbows forming the bottom ends of the grout pipes connect into the skeleton pipe at spaced levels. Usually three or four such grout pipes equally spaced will be adequate. The cement filling the space between the H-beam piling and the outer skeleton pipe is indicated at 119.

Referring to Figure 9, there is shown the details of a construction particularly suitable for a vertical pedestal leg. The leg comprises an outer skeleton pipe 130 which is filled with concrete or cement as indicated at 131. The bottom end 132 of the pipe extends slightly into the ground. A concrete pile 133 extends through the bottom of the skeleton pipe on into the ground a considerable distance. The cement or concrete 131 filling the space inside pipe 130 is reinforced above pile 133 with steel rods such as those shown at 134. In forming a pedestal leg of this type, the concrete pile 133 is driven with the aid of a follower which may be a length of wood piling temporarily inserted in the pipe 130 so as to rest on top of pile 133. After pile 133 has been driven, the follower is removed and the skeleton pipe filled with cement or concrete with the aid of grout pipes (not shown in Figure 9).

Figures 10 and 11 show a pedestal of a type similar to that shown in Figure 6. The pedestal comprises three inclined members 140, 141, 142. A different type of gusset plate from that shown in Figure 6 is provided for securing together the tops of the inclined members as shown at 144. H-beam piles 145, 146, and 147 are shown extending out of the tops of the inclined members.

A cap plate or pillow 148 is welded directly to the tops of the H-beams. If desired, clip angles may be welded to the tops of the H-beams to provide additional surface to which to weld the cap plate.

A pedestal supported structure constructed according to the methods and plans of the invention described above has a number of important advantages. The method of construction is adaptable without major change to any height pedestal and depth of water. The piles which are driven through the outer skeleton pipes into the ground and which constitute the principal supporting elements are protected against the action of the sea water below the water level and the action of air and salt spray above by the outer skeleton pipes. The outer pipes also protect the piles from injury which they might receive when ships draw alongside and batter the pedestals. Filling the space between the piles and the outer skeleton pipes with cement or concrete bonds the two together and fully develops their combined strengths, although in cases where salvage of the supporting structure following completion of the operations for which it was set up is important, the cement or concrete filling may be omitted in whole or in part. The structure as a whole presents a minimum resistance to the forces of wind, water, waves, tides, and ocean currents so that it is less apt to be injured thereby.

While a preferred embodiment of the invention and certain variations thereof have been described and illustrated, it is obvious that many modifications thereof can be made without departing from the spirit of the invention. It is intended to protect by Letters Patent all forms of the invention falling within the scope of the following claim.

I claim:

A pedestal skeleton comprising at least three pipes angularly disposed to each other and converging to form a tripod-like structure, the axes of the pipes at the level of the upper ends of the pipes approaching intersection within a distance of the order of magnitude of the diameters of the pipes and at the level of the bottom ends of the pipes being spaced apart with at least three of the pipe axes not in the same plane, means securing the pipes together at their tops, braces interconnecting the pipes beneath their tops, and a series of grout lines running from the top of each pipe to different levels therebelow ranging from the bottom to the top of the pipe and in communication at their lower ends with the interior of the pipe.

STIRLING E. McCULLOUGH.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
999,431	Beall	Aug. 1, 1911
1,715,808	West	June 4, 1929
2,077,044	Grace	Apr. 13, 1937
2,210,408	Henry	Aug. 6, 1940
2,429,952	Willey	Oct. 28, 1947

FOREIGN PATENTS

Number	Country	Date
587,218	France	of 1924
725,711	France	Feb. 16, 1932
537,560	Great Britain	of 1941