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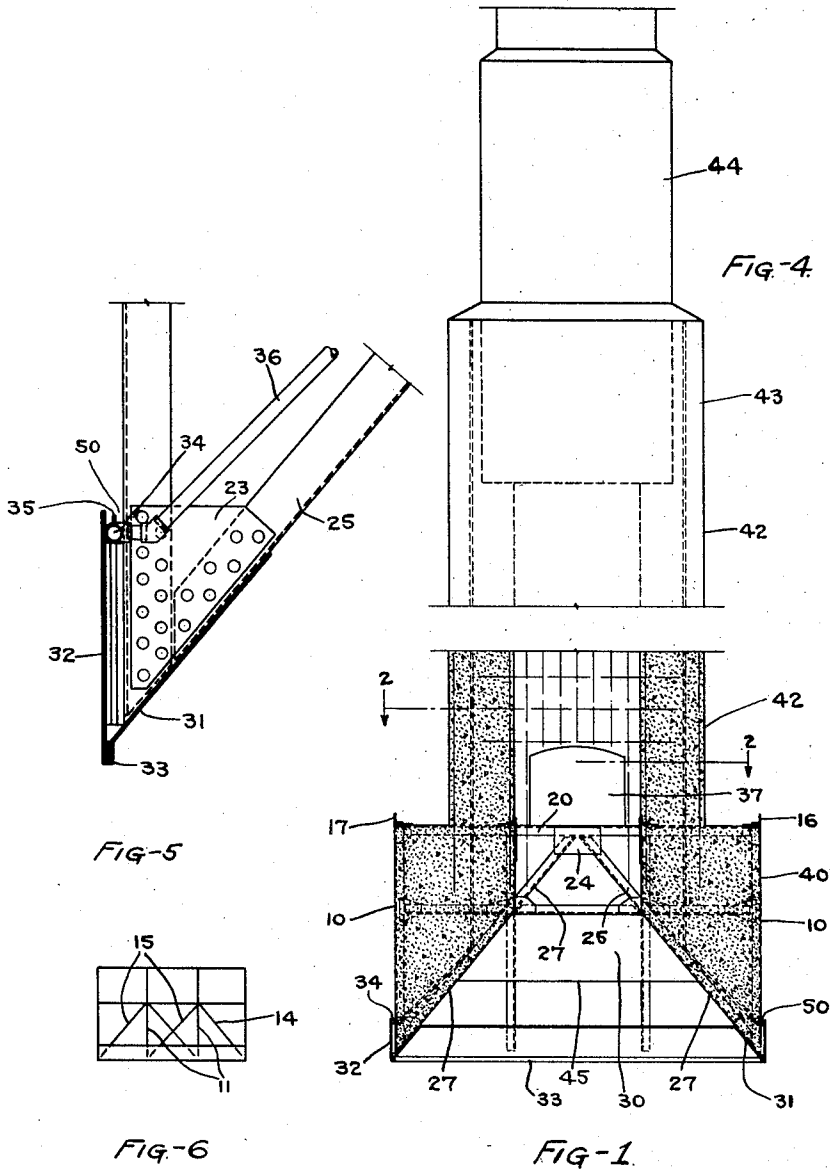
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C. A. P. TURNER

REINFORCED CONCRETE FOUNDATION AND PIER AND METHOD OF SINKING THE SAME

Filed Oct. 6, 1921

2 Sheets-Sheet 1



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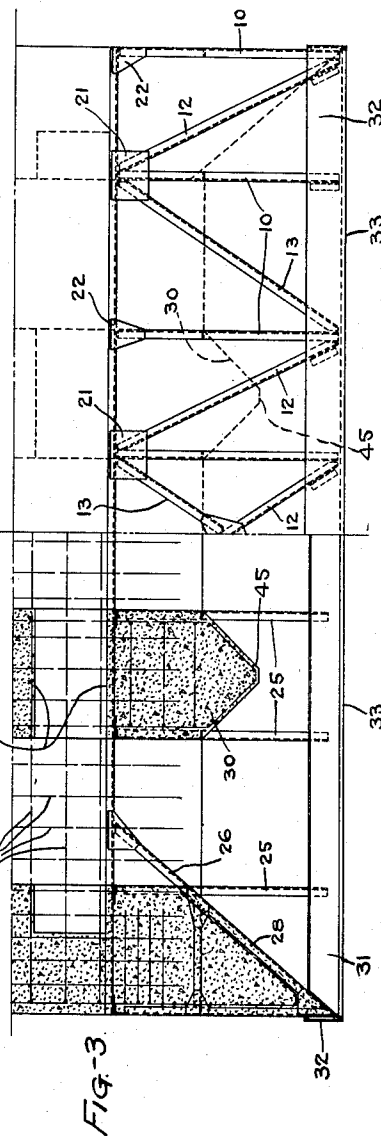
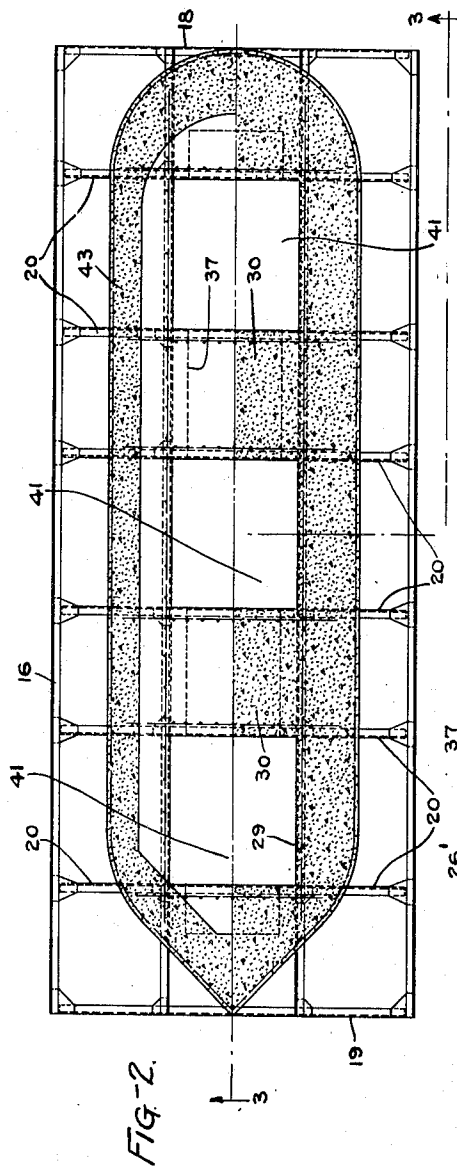
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

CLAUDE A. P. TURNER, OF MINNEAPOLIS, MINNESOTA.

REENFORCED-CONCRETE FOUNDATION AND PIER AND METHOD OF SINKING THE SAME.

Application filed October 6, 1921. Serial No. 505,902.

To all whom it may concern:

Be it known that I, CLAUDE A. P. TURNER, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Reenforced-Concrete Foundations and Piers and Methods of Sinking the Same, of which the following is a specification.

My invention relates to reenforced concrete foundation and pier and method of sinking the same, and has for its object to provide a reenforced concrete bottom section adapted to be self-sinking. As the earth is excavated through the hollow interior of the lower section, sections of the pier member to be supported by the foundation are formed of reenforced concrete and added to the footing member and cast integral therewith as the footing section is sunk.

My method of forming and sinking piers embodies the following steps, to-wit, the provision of a footing member of reenforced concrete construction and of greater cross-section than the cross-sectional area of the pier, having a cutting edge and being provided with a hollow interior extending downwardly through the member and obliquely outwardly to the said cutting edge, the cutting edge being in alinement with the extreme outside dimension of the footing, and making the excavation through said member, applying water in circulation to or adjacent to the cutting edge and casting pier sections having a hollow interior which form a continuation of the first-named hollow interior whereby the operation in conjunction with the excavation within the member will cause the footing member and the pier member to sink until hard footing support in the earth is reached, and when the hollow pier has been so formed, excavated and sunk and brought into proper horizontal and vertical alinement filling the hollow portion of the pier with rock and cement to make the same solid.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and the novel features embodied in my invention are particularly pointed out in the claims.

In the drawings illustrating an application of my invention in one form,—

Fig. 1 is a sectional elevation view of a

portion of an abutment and pier. Fig. 2 is a sectional plan on line 2—2 of Fig. 1. Fig. 3 is a side elevation part sectional view on line 3—3 of Fig. 2. Fig. 4 is an end elevation view of a part of the pier above the footing. Fig. 5 is an enlarged detail view of a portion of the cutting edge more fully illustrated in Fig. 4. Fig. 6 is a diagrammatic end elevation view of the reenforcing frame.

As illustrated in the drawing, the primary abutment construction comprises a truss frame of channel and web steel comprising a multiplicity of verticals 10 in the sides and similar verticals 11 in the ends of the main abutment structure. Between the verticals in the plane of the rectangular outside of the abutment or footing are diagonal struts 12, 13, there being corresponding diagonal struts 14, 15 in the vertical end walls. Upon the tops of the vertical side pieces 16, 17 of end pieces 18, 19 are secured in any well-known manner, and a suitable number of cross-pieces 20 are secured from the side pieces and the ends of the verticals, preferably being secured together by webs or plates 21, 22 in a well-known manner. In this manner a substantially steel frame rectangular in cross-section and entirely open at the bottom is provided, which on its sides is braced and cross-braced to provide substantial truss members.

Extending from the lower end of the verticals 10 to points near the center of the end members 18, 19, and bolted at their respective ends by plates 23, 24 to the uprights or verticals and to the transverse members 20 are a multiplicity of obliquely-disposed struts or pieces 25, similar oblique struts 26 being carried from the end members 18, 19 to the nearest cross members 20. There is thus provided a structural steel cage intimately united having an upwardly-converging central space open at the bottom and extending to the outside of the cage and a rectangular space surrounding the open space. Concrete suitably reenforced with crossing rods 26' is molded into this cage in the following manner. The cage is entirely filled with concrete united with the steel framework therewith so as to form sloping interior walls 27 on the sides and 28 on the ends to provide an oblong inverted funnel, which however is truncated as indicated at

29 so as to leave vertical spaces or hollows on the interior. Transverse sections of concrete 30, however, are cast across the cage between pairs of transverse frame members 20, as clearly indicated, these transverse members being formed of reenforced concrete intimately bonded into the concrete within the cage and to the cage itself. Steel plates 31, 32, riveted or otherwise, secured together at 33, cover the lower portion of the framework and provide a cutting edge entirely surrounding the bottom outer periphery of the abutment, the outer plates 32 being somewhat spaced from the vertical wall of the bottom section as indicated at 50. As clearly shown in Fig. 5, a pipe 34 extends around the upper edge of plate 32, being provided with upwardly-turned nozzles 35. The pipe 34 is fed with water from a feed-pipe 36 whereby water will be forced out of nozzles 35 and overflow the edge of the plate 32 and along the side walls of the foundation abutment, thus relieving to some extent the friction and aiding in the sinking of the foundation. As best shown in Figs. 2 and 3, passageways 37 are provided through the transverse webs 30 which simplify the matter of distribution of material from one end to the other of the pier, these passageways of course being of relatively large size.

In practice the steel work of the main foundation abutment cage is first fabricated with the cutting edge, then concrete is poured and molded into the steel frame or cage, the earth is then excavated within the expanded open-mouthed opening and elevated through the rectangular wells 41. As the earth is excavated the weight of the footing in connection with its cutting edge will carry the same down and additional sections 42 of reenforced concrete forming the main pier body are added. Still other sections 43 of less wall thickness may be added to the sections 42 until the pier foundation is complete, that is until the footing has been sunk the requisite distance to find stable support and the pier foundation built up from such point of support, the hollow interior passages are then filled with heavy rock and concrete to the top and the pier superstructure 44 is built thereupon.

It is noted that the transverse bonding members 30 of reenforced concrete are provided with a lower edge 45 of substantially V-shape, which edge may engage with the material as the bottom section of the pier is being sunk. This transverse edge of the bond members 30 provides a part of the support for the bottom section and also provides means for regulating the sinking of the same so as to keep the bottom section and the pier member built thereon at all times substantially vertical. Thus, if the bottom section tends to go down too rapidly at one

side so as to throw the section and the pier supported thereby out of vertical planes parallel with the longitudinal center, logs or other heavy supporting members may be thrown under the edge of the part 30 on the side which tends to sink most rapidly, thus increasing the resistance on that side and causing the pier member to right itself. Similarly, if either end of the pier member tends to sink more rapidly than the other end a set of logs or obstructions may be placed under both ends of the edge of member 30 adjacent the end which is sinking too rapidly and that end retarded in movement. In this way the bottom section of the pier may at all times be kept substantially horizontal and the pier be sunk to the point desired and with its elements in proper vertical and horizontal position. It is easy to place these resistances as above indicated because of the fact that the edge 45 of the bonding members 30 are all above the horizontal plane of the cutting edge 33.

The advantages of my invention will be apparent. The structural steel cage bonded with heavy footing slab forms a cutting edge at the bottom of the footing capable of resisting extraordinary and unexpected stresses. In fact this part of the construction has such strength and capacity for resistance that it will remain intact under any form of stress to which it may be subjected, such as rise of a river in which the pier is being sunk, washing away of parts of the support so that the footing loses some part of its support, and from any other cause. Furthermore, no caissons of wood or other material, or coffer-dams need be employed in the sinking of a pier foundation when employing my structure and method. The hollow interior provides means for excavating and lifting the excavated material. If desired said hollow interior may from time to time be sealed and air pressure put within it and the interior pumped out for direct work at the bottom. It is further true that at certain depths the bottom section may seal itself against water pressure and the interior be pumped out and work conducted at atmosphere pressure, where the pier is seated in material such as shale clay, or upon rock. It is to be noted that the bottom section of the pier if formed of concrete has to be sunk while the concrete is yet green and comparatively weak in resisting shear or other strains. In the sinking of this section in rivers or where there is much running water, it not infrequently happens that the water will rise or the current increase as the foundation is being sunk and the supporting earth be entirely washed away under some part of the foundation. The structural steel cage herein provided will adequately take care of abnormal strains thrown on the foundation by such

causes, whereas fresh concrete under such conditions would break and shear away and perhaps the entire pier section be lost.

I claim:

5 1. A foundation footing for piers comprising a structural steel cage having an outer periphery formed of vertical uprights and longitudinal members and other members extending upwardly and inwardly in
10 an oblique direction from the lower edge of the outer periphery, steel plates secured to said members and forming a continuous cutting edge at the bottom thereof, reenforced concrete united with said cage to
15 form a hollow block of concrete and steel provided with a cutting edge, and transverse bonding blocks of concrete extending across the opening within said block and provided with a V-shaped edge spaced above
20 the plane of said cutting edge.

2. A foundation footing for piers comprising a hollow oblong block of steel and concrete having inwardly-sloping walls extending from the outer margins of said
25 block to the hollow portion thereof, and a plurality of bonding members of reenforced concrete extending across the oblong opening within said block, the bottoms of said bonding members being V-shaped with their

lower margins extending across the inwardly sloping opening at points above the bottom plane of said block.

3. The method of sinking piers which consists in providing a footing section of reenforced concrete and steel having a hollow interior with walls sloping from the outer edges thereof and bonding members of reenforced concrete extending across said hollow interior, causing the section to sink by gravity by the removal of earth and other material through the said opening, causing the section and the pier supported thereby to position itself in proper vertical and horizontal position by increasing sinking resistance through the application of removable members under said transverse bonding members at points where the bottom section tends to sink more rapidly than the other parts thereof, adding sections of the pier integrated with the bottom and succeeding sections until the bottom section reaches suitable support, and thereafter filling the hollow interior of the bottom and succeeding pier sections with concrete and rock to produce a solid structure.

In testimony whereof I hereunto affix my signature.

CLAUDE A. P. TURNER.