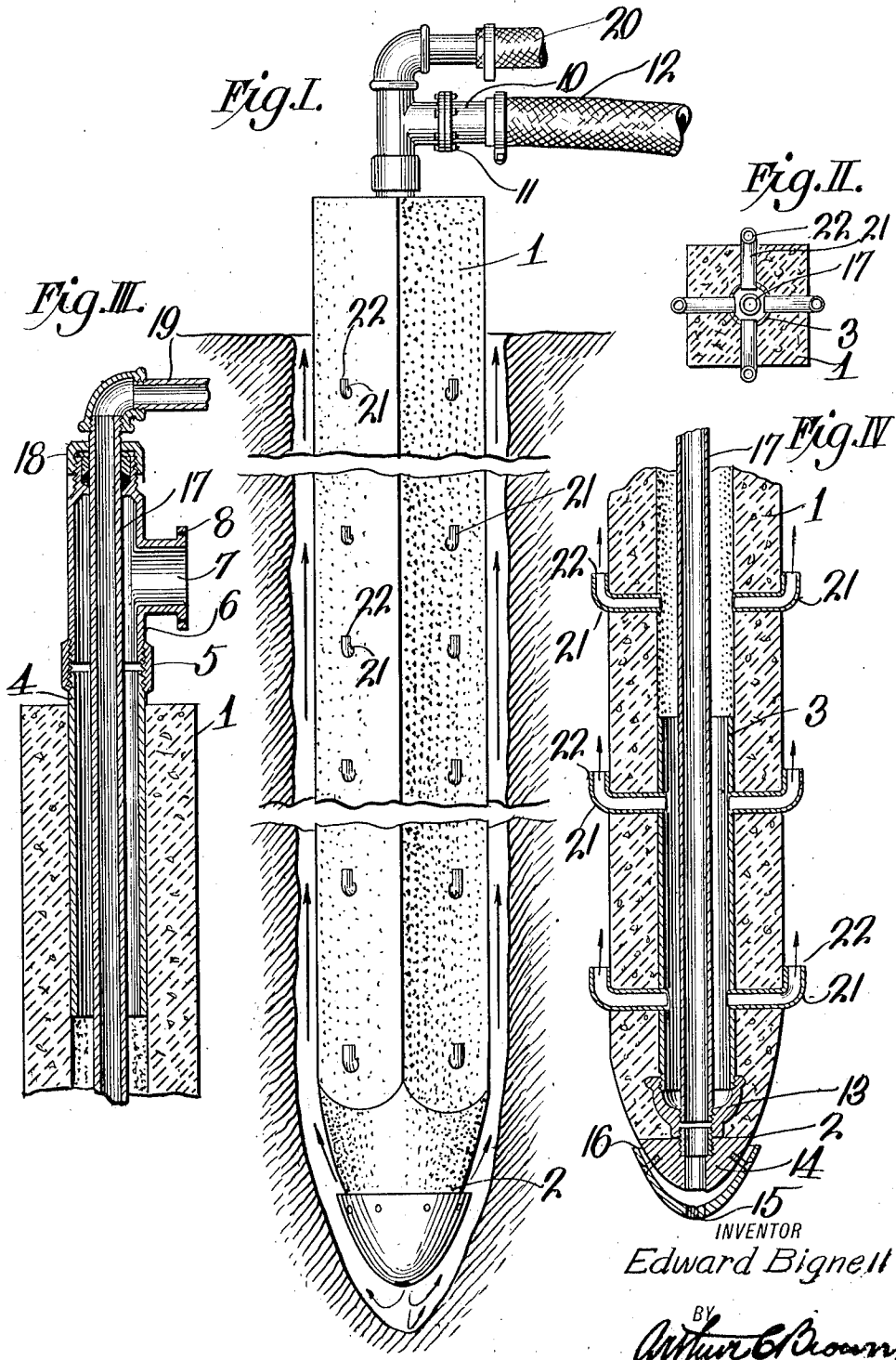


E. BIGNELL.
CONSTRUCTION OF AND METHOD OF SINKING PILES.
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INVENTOR
Edward Bignell
BY
Arthur C. Brown
ATTORNEY

UNITED STATES PATENT OFFICE.

EDWARD BIGNELL, OF LINCOLN, NEBRASKA, ASSIGNOR TO CONCRETE PILING COMPANY, OF SEWARD, NEBRASKA, A CORPORATION OF NEBRASKA.

CONSTRUCTION OF AND METHOD OF SINKING PILES.

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Specification of Letters Patent.

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Continuation of application No. 773,882, filed June 16, 1913. This application filed January 31, 1916.
Serial No. 75,313.

To all whom it may concern:

Be it known that I, EDWARD BIGNELL, a citizen of the United States, residing at Lincoln, in the county of Lancaster and State of Nebraska, have invented certain new and useful Improvements in Construction of and Methods of Sinking Piles; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to the construction of and method of sinking piling, sheet piling, caissons, or any structure which is adapted to be entirely or partially sunk in the earth to serve as a foundation for a superstructure, or obstruction, such as a dike, breakwater or the like, and which will be hereinafter referred to merely as piling, although I do not wish to be understood as limiting the use of the method to the specific structure ordinarily understood by that term, the present application being a continuation of my application filed June 16, 1913, Serial No. 773,882.

More particularly the invention relates to the construction of and method of sinking piles which have previously been formed or molded from a plastic material, such as cement or concrete, and are carried to the work and lowered to position partially by their own weight and partially by artificial displacement on the earth in advance thereof.

I have discovered that in placing piles of this construction the greatest resistance is due to adhesion of the earth against the sides of the piles, the earth through which the pile is usually driven being in a semi-fluid state so that pressure due to its own weight is exerted laterally against the sides of the pile, and holds same against original placement, or against displacement or removal after it has been seated.

I have also discovered that a head of water forced through the lower end of the pile will displace earth in advance of the pile, so that the latter can sink to place by its own weight, but that water discharged only at the bottom of the pile is diffused into

the surrounding earth so that while an opening is made in advance of the pile into which the latter may sink, the semi-fluid earth is immediately forced back against the sides of the piling, and the objectionable adhesion again retards the travel.

I have further discovered that by providing the pile with nozzles, which are fed from an interior source and directed upwardly at the sides of the pile, at such close intervals that jets of water discharged from the nozzle will exert a siphonic jet action tending to lift the loose earth after it has been displaced in advance of the piling, force same upwardly around and along the sides of the piling so that a film is formed thereabout that will hold back the earth and maintain a uniform liquefaction throughout the depth of the piling and will prevent the objectionable adhesion heretofore mentioned and prevent channeling, the jets and film also serving as an elevator for carrying the displaced material to the surface and forming a pocket in advance of and about the piling which will allow the latter to sink quickly as long as the water jets are active.

In the accompanying drawings I have illustrated a preferred form of piling and mechanical structure for carrying out my invention, and will refer thereto for clearness of description. In the drawings:—
Figure I, is a corner elevation of a piling adapted for use in accordance with my invention.

Fig. II, is a cross-section of same, illustrating the side jets.

Fig. III, is a vertical section of the upper portion of the piling, showing connections for water supply pipes.

Fig. IV, is a longitudinal section of the lower portion of the piling, showing the digging nozzle for displacing earth in advance of the piling.

Referring more in detail to the drawings:—

1, designates a piling which is preferably constructed of cement or concrete, and is square in cross-section but provided with a convex lower end or nose 2. The piling is provided with an interior channel having a pipe lining 3, which terminates slightly within the lower nose 2 and projects slightly from the upper end to form a tip 4.

Mounted on the tip 4, preferably by means

of a screw threaded collar 5, is a connection 6 having an intake collar 7, provided with a flange 8 to which the flange 9 of a tip 10 is attached, preferably by the bolts 11, the tip 10 being in turn connected with a hose 12 which may extend to a source of water supply.

The lower end of the pipe 3 carries a reduction cap 13, and attached to said cap is a nozzle 14 which projects through the end of the piling and has an opening 15 for producing a strong jet in advance of the piling when the latter is being sunk, and an annular, lateral opening 16 for directing a head of water laterally and upwardly around the bottom of the pile, to hold the loosened earth back and direct it upwardly to the siphon jets.

Extending through the pipe 3 is a smaller pipe 17, the lower end of which is threaded into the reduction cap 13, and the upper end extended through a stuffing box 18, on the top of connection 6, and connected with a supply pipe 19, which, in turn, is fed through a hose 20 that also extends to a source of water supply, the hose 12 and 20 being provided with suitable controlling mechanism or valves (not shown).

Opening from the outer pipe 3, and extending through the body of the piling, are jet members 21, having upturned ends 22 lying close along the outer faces of the piling, so that when water is forced there-through it will be directed upwardly in a plurality of jets, which are arranged at such close intervals relative to the excavating jet and to each other that material displaced by the excavating jet is stepped upwardly along the sides of the pile to the surface of the earth through which the pile is being sunk. The members 21 are preferably larger toward the bottom of the piles than near the top, as greater force is required at the bottom to lift the greater head of fluid and earth, although the invention need not be limited to the use of jet members of graduated diameter.

With the equipment described, when a piling is to be sunk in the usual class of earth, such as sand, silt or any earth which will mix with or be displaced by water, the pile is upended at the point where it is to be sunk, and water forced into the large and small pipes, a greater pressure being preferably turned into the small pipe on account of the greater force required to dig a hole in advance of the piling than is necessary to carry upward the displaced material.

The water, being discharged through the small pipe in a strong jet, displaces the earth about the nose of the piling, so that the latter may sink to place of its own weight and water passing through the large pipe impacts against the dead end cap 13, lending the force of the hydraulic head to the sink-

ing process, and, at the same time, being forced laterally through the jet members 21 to be discharged upwardly along the sides of the piling. The upturned jets displace material along the sides of the piling and force said material upwardly toward the surface, the displacement adjacent the mouth of the jet forming a vacuum, into which the earth displaced in advance of the piling is drawn by siphonic action and forced upwardly by the action of the side nozzles.

By placing the jets at proper distances apart, the displaced material is stepped upwardly from one jet member to the other, until it reaches the surface, the upward travel of the water, with the material in solution or suspension, forming a protective film or sheet about the piling which serves to keep back the semi-fluid earth and prevent the disadvantageous adhesion.

It is apparent from the foregoing that my method utilizes two natural forces in the sinking of the piling; first, the weight of the pile itself, which will naturally cause the pile to descend when the earth is displaced therebeneath; and, second, the hydraulic head through the small pipe against the nozzle 16, and through the large pipe against the reduction cap and the various jet members. These forces are assisted by the protective film that not only keeps back the earth but also serves to carry the displaced earth in solution or suspension to the surface.

Having thus described my invention, what I claim as new therein and desire to secure by Letters-Patent is:

1. The method of sinking a structure consisting of excavating in advance of the structure and conducting displaced material upwardly to the surface of the earth into which the structure is sunk by stepped jets of water directed upwardly along the surface of the structure.

2. The method of sinking a structure consisting of excavating in advance of the structure by means of water under substantial pressure, and conducting displaced material upwardly to the surface of the earth into which the structure is sunk by stepped jets of water directed upwardly along the surface of the structure.

3. The method of sinking a structure consisting of excavating in advance of the structure and conducting displaced material upwardly to the surface of the earth into which the structure is sunk by stepped jets of water directed upwardly along the surface of the structure at sufficiently close intervals to maintain constant acceleration of the water and material from the nose of the pile to the surface of the earth.

4. The method of sinking a structure which consists in excavating in advance of the structure by jetting and in then rapidly con-

ducting by relaying the displaced material by a series of jets of water circumferentially disposed about and upwardly directed under high pressure along the surface of the structure.

5 5. The method of sinking a structure consisting of excavating by jetting in advance of the structure and rapidly conducting the displaced material upwardly to the surface 10 of the earth into which the structure is sunk by step jets of water circumferentially disposed and directed upwardly under high pressure along the surface of the structure and at sufficiently close intervals to maintain 15 a constant acceleration or movement of the water and material from the lower end of the structure to the surface of the earth.

20 6. The method of sinking an elongated structure consisting of directing water in advance of the structure under sufficient pressure to loosen the material, directing a jet of water under sufficient pressure upwardly along the side of the structure to elevate the loosened material a certain distance and 25 directing another jet of water under sufficient pressure upwardly at a point where the loosened material carried by said first jet will be delivered to it and carried upwardly farther.

30 7. The method of sinking an elongated structure consisting of directing water in advance of the structure under sufficient pressure to displace material, directing jets of water upwardly at points about the structure and along the sides thereof to elevate 35 the displaced material, and directing other jets of water upwardly at points about the

structure to which the displaced material is elevated by lower jets to further elevate the material, whereby the material is eventually 40 delivered to the surface of the earth into which the structure is sunk.

8. The method of sinking a structure consisting of directing water under high pressure in advance of the structure to excavate 45 therefor and directing jets of water under relatively low pressure upwardly along the outer surface of the structure at sufficiently close intervals to dispose of the material from the lower end of the structure to the 50 surface of the earth into which the structure is sunk.

9. The method of sinking a structure consisting of discharging a jet of water in advance thereof to excavate therefor, discharg- 55 ing jets of water of gradually reduced volume upwardly along the sides of the structure at sufficiently close intervals to maintain a constant acceleration or movement of the water and material from the nose of the 60 structure to the surface of the earth.

10. A structure comprising an elongated body member, means for directing water under sufficient pressure in advance of the body member to loosen the material, and 65 means for directing jets of water under sufficient pressure upwardly at intervals along the sides of the structure to relay the loosened material upwardly, said jets being so spaced and directed that the loosened material carried by one jet will be delivered to 70 the jet above it.

In testimony whereof I affix my signature.
EDWARD BIGNELL.