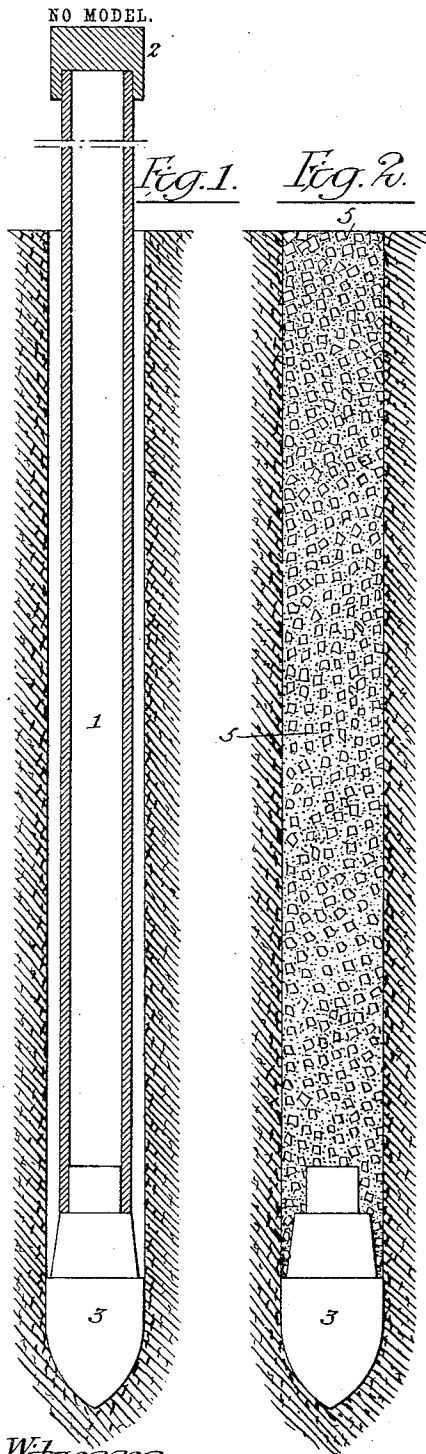
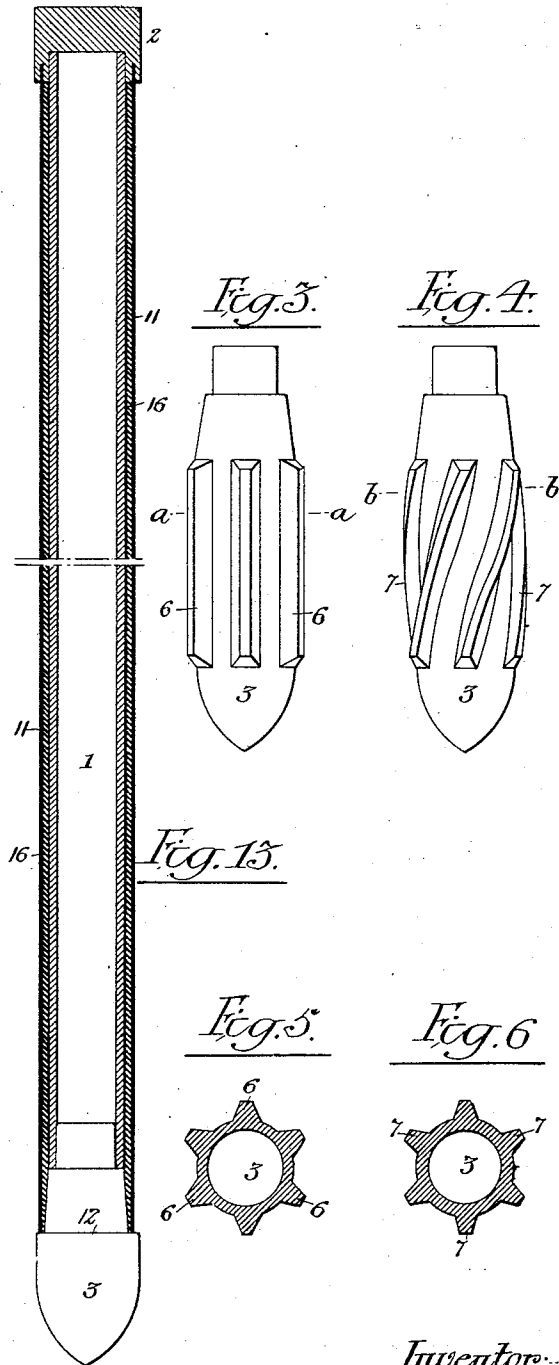
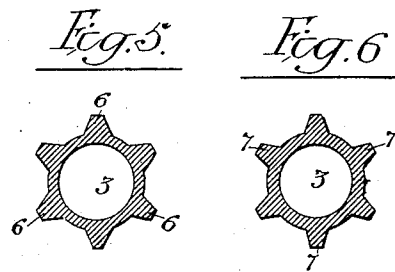


F. SHUMAN.
REMOVABLE PILE FOR FORMING CONCRETE PILING.

APPLICATION FILED APR. 23, 1903.

3 SHEETS—SHEET 1.



Witnesses:-

Titus H. Jones.
Kamilton S. Turner

Inventor:
Frank Shuman,
by his Attorneys

James H. Brown

No. 733,288.

PATENTED JULY 7, 1903.

F. SHUMAN.

REMOVABLE PILE FOR FORMING CONCRETE PILING.

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NO MODEL.

3 SHEETS—SHEET 2.

Fig. 7.

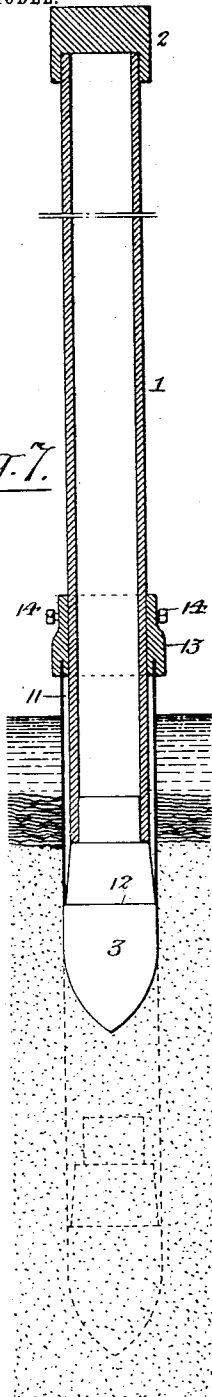


Fig. 8.

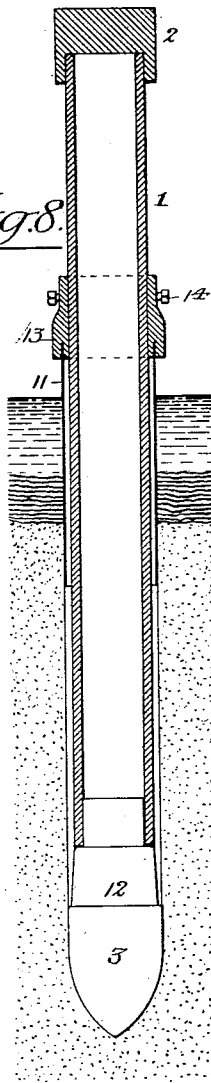
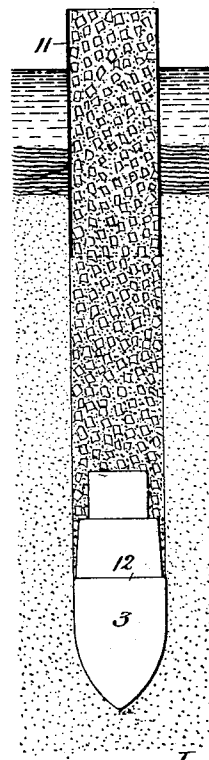


Fig. 9.



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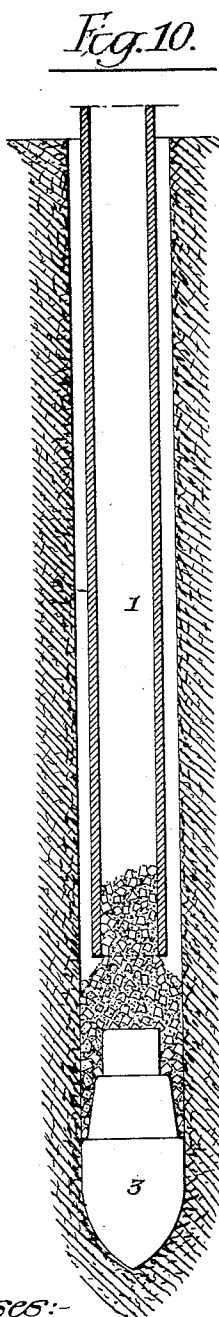
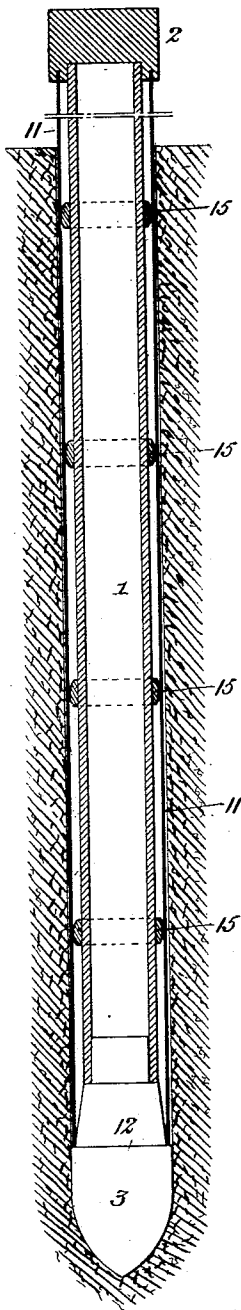
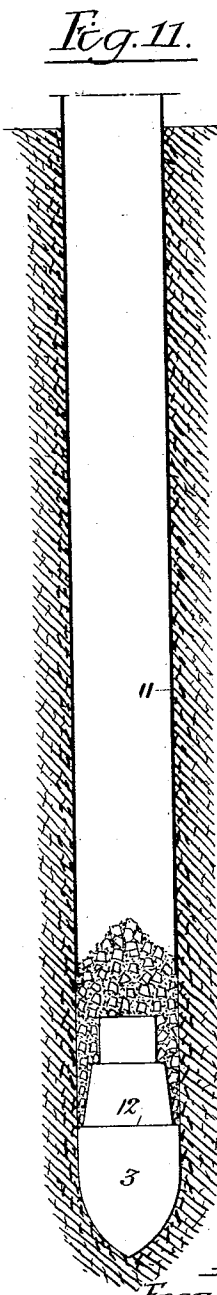
REMOVABLE PILE FOR FORMING CONCRETE PILING.

APPLICATION FILED APR. 23, 1903.

NO MODEL.

3 SHEETS—SHEET 3.

Fig. 12.



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UNITED STATES PATENT OFFICE.

FRANK SHUMAN, OF PHILADELPHIA, PENNSYLVANIA.

REMOVABLE PILE FOR FORMING CONCRETE PILING.

SPECIFICATION forming part of Letters Patent No. 733,288, dated July 7, 1903.

Original application filed January 13, 1903, Serial No. 138,921. Divided and this application filed April 23, 1903. Serial No. 153,975. (No model.)

To all whom it may concern:

Be it known that I, FRANK SHUMAN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Removable Piles for Forming Concrete Piling, (the same being a division of my application Serial No. 138,921, filed January 13, 1903,) of which the following is a specification.

My invention relates to that method of forming piles of concrete or cement which consists in first driving a pile into the ground, then withdrawing said pile, and then filling the opening formed thereby with concrete or cement in plastic or fluid form, which when it sets forms the permanent pile.

One object of my invention is to provide for driving or withdrawing the removable pile with the exercise of much less power than is required when piles of this class as heretofore constructed are used, a further object being to render said removable pile available for under-water work or for use in unstable ground, another object being to so construct the pile that it will consist of but few parts, all of which can be easily made so strong as to effectually resist the shocks or strains to which they are subjected in use, and a still further object being to provide at the bottom of the opening formed by the removable pile a base for the permanent cement or concrete pile.

In the accompanying drawings, Figure 1 is a vertical section of a removable preparatory pile and its point constructed in accordance with my invention, showing the pile driven into the ground in order to form the opening for the subsequent reception of the permanent pile. Fig. 2 is a view showing the permanent pile produced by filling the opening with cement or concrete after the withdrawal of the preparatory pile. Figs. 3 and 4 are side elevations of special forms of point for the pile. Figs. 5 and 6 are respectively sections on the lines *aa*, Fig. 3, and *bb*, Fig. 4. Figs. 7, 8, and 9 are views illustrating the successive steps in the formation of a concrete pile in accordance with my invention where a coffer-dam has to be employed to restrain the inflow of water or the caving in of unstable earth. Fig. 10 illustrates a special method of

filling in the concrete which is adopted in some cases. Fig. 11 illustrates the same method of filling in when a coffer-dam is employed, and Figs. 12 and 13 illustrate different forms of coffer-dam pile.

For the purpose of forming in the ground openings for the reception of concrete or cement to constitute permanent piling the use of an ordinary wooden or metal preparatory pile of cylindrical form or tapering inwardly from top to bottom is objectionable, for the reason that the frictional hold of the earth upon the sides of the pile is such that the pile cannot be driven beyond a limited distance without the exercise of destructive force and cannot be withdrawn after being driven without the exercise of still greater force, the frictional hold of the earth upon the pile being now assisted by atmospheric pressure, owing to the fact that the withdrawal of the pile tends to create a partial vacuum in the opening left thereby. For this reason various forms of collapsible piles have been proposed; but such piles, owing to their sectional character, are necessarily limited in strength and, moreover, do not overcome the objection of resistance due to the frictional hold of the earth thereupon while they are being driven. When the pile tapers inwardly from top to bottom, there is the same resistance to the driving of the pile, and the resistance to the withdrawal of the pile is also excessive, because, owing to the atmospheric pressure, the earth is caused to firmly cling to the pile, so as to increase the difficulty of starting the same. Hence its movement is retarded for some time after it is started. In carrying out my invention, therefore, I provide the pile with an enlarged point, so as to displace the earth laterally at and near the point of the pile to a greater extent than the diameter of said pile, thereby freeing the pile, except as to a limited area at and near the point, from frictional contact with the walls of the opening formed thereby, thus facilitating the driving of the pile and practically removing any limit in the depth to which the pile can be driven. To facilitate the withdrawal of the pile, I make this enlarged point detachable therefrom. Hence the withdrawal of said pile can be effected

without frictional contact of the walls of the opening to any material extent with the sides of the pile. The point, which remains at the bottom of the opening, forms an acceptable base or foundation for the permanent pile of cement or concrete.

The pile shown in Fig. 1 consists of a metal tube 1, although it may be a solid pile, of wood or metal, if desired, this pile being provided at the top with a suitable driving-head 2 and at the bottom with a point 3, which is of so much greater diameter than the pile 1 that there is no likelihood of the latter coming into contact to any material extent with the walls of the opening formed by driving the pile. The point 3 has a horizontal cross-section approximating that of the pile 1, but of greater area, so that the strains upon the pile during the driving of the same are distributed with substantial equality about its periphery. Hence there is no tendency of the pile to deflect from a direct line while it is being driven. The point 3 has a tapering lower end, so as to gradually displace the earth laterally as it advances. After the preparatory pile has been withdrawn, leaving its point at the base of the opening, the concrete or cement is poured into the opening, as shown in Fig. 2, so as to form the permanent pile 5, resting upon said point 3 as a base or foundation. Owing to the limited area of the point which is in contact with the earth the said point may without materially increasing the difficulty of driving the pile be ribbed externally, so as to form corresponding grooves in the sides of the opening formed by the point. These ribs may be straight, as shown at 6 in Figs. 3 and 5, or spiral, as shown at 7 in Figs. 4 and 6.

In under-water work or when working in unstable ground I provide the preparatory pile with a coffer-dam for preventing access of water or silt to the opening formed by said preparatory pile in the firm ground beneath or for preventing the caving in of the walls of the opening when the latter is being formed in unstable ground. As shown in Fig. 7, the coffer-dam consists of a tubular casing 11, of sheet metal or other available material, resting at its lower end on a shoulder 12 of the point 3 and of sufficient length to extend from a point above the water-level to a point so far beneath the surface of the firm ground as to prevent leakage around the casing. The upper end of the casing 11 is attached to a tubular clamp 13, which is secured to the pile 1 by set-screws 14 or other suitable means until the pile has been driven so far that the casing 11 projects to the desired extent beneath the surface of the firm ground, whereupon the clamp is loosened, so that the continued driving of the pile, as shown in Fig. 8, can be effected without any further downward movement of said casing, and when the desired depth of opening has been formed the pile can be withdrawn, leaving the point at

the bottom of the opening and without disturbing the position of the casing 11, which thus serves to keep the opening free from water or mud until the formation of the concrete pile has been completed, as shown in Fig. 9. If the point is attached to the pile, the casing 11 will be sufficiently large to permit of the withdrawal of said point through the same, and the clamp 13 will be lifted from the casing 11 when in withdrawing the pile the point comes into contact with said clamp.

The pile and its point can be made of any desired horizontal cross-sectional shape, and the point can be made of wood, cast or wrought iron, steel, glass, asphaltum, concrete, or combinations of the same, or, in fact, of any material which will withstand the shock of driving, the preferable material for the point being concrete, as the material of which the permanent pile is composed will effect a firmer union with such concrete point than with a point of other material.

In case the ground is in the nature of quicksand or such as to preclude the opening from retaining its shape after the pile has been pulled out the casing 11 may be of the full length of the pile and riveted or otherwise firmly fastened to the point and permitted to remain in the opening with said point when the pile is withdrawn, the casing being preferably slightly less in diameter than the greatest diameter of the point. The casing in a pile of this character should preferably be supported at different points or throughout its entire length by the pile 1 in such manner as not to interfere with the free withdrawal of said pile. Such support may be provided by means of interposed rings, as shown at 15 in Fig. 12, or the entire space between the pile 1 and the shell 11 may be filled with mineral pitch or other easily-melted material, such as shown at 16 in Fig. 13, which material will retain its solid form and provide the necessary support for the shell 11 during the driving of the pile and can then be readily melted by forcing steam or heated air into the pile 1 preparatory to the withdrawal of the same. By this means a very thin shell can be driven to a great depth into very bad ground.

Another method of forming openings under water consists in forming a temporary watertight joint between the hollow pile 1 and the detachable point 3 and, after the latter has been driven to the proper depth, pouring the concrete into the hollow pile and withdrawing the latter, either slowly or a little at a time, the temporary water-tight joint being broken on the withdrawal of the pile, so that the concrete can escape into the opening above the point, as shown in Fig. 10, the concrete gradually displacing the water in the opening from the bottom of the same to the top. The concrete is introduced into the hollow pile at such a rate as always to maintain a head of concrete at the bottom of the same.

This system of filling can also be adopted in cases where the nature of the ground is unstable, so as not to sustain the shape of the opening if the pile is wholly removed before introducing the concrete, or, as shown in Fig. 11, it can be employed in cases where the long coffer-dam casing 11 is used, the concrete being filled into the latter slowly or intermittently and the coffer-dam casing being withdrawn slowly or intermittently, so as to form the pile from the bottom to the top.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having an enlarged point which is detachable from the pile, whereby said pile can be removed from the opening formed thereby, leaving the point at the bottom of the opening to form the base or foundation for the permanent pile, substantially as specified.

2. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having an enlarged point which is detachable from the pile and in horizontal cross-section approximates in shape but is greater in area than a like section of the body of the pile, substantially as specified.

3. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having an enlarged point which is detachable from the pile and has external ribs, substantially as specified.

4. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point which is detachable from the pile and has external ribs disposed in spiral form thereon, substantially as specified.

5. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having a coffer-dam detachably secured thereto in such manner that the two can be driven together and the pile can be afterward withdrawn, leaving the coffer-dam in the opening, substantially as specified.

6. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having a detachable point and a casing serving as a coffer-dam, substantially as specified.

7. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having a detachable point, a casing serving as a coffer-dam, and means for securing said casing to and releasing it from the pile, substantially as specified.

8. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having a coffer-dam detachably secured thereto by an interposed fusible body, whereby after the two have been driven as a unit, said fusible connection can be melted and the pile withdrawn, substantially as specified.

9. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point and a casing serving as a coffer-dam, substantially as specified.

10. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point, a casing serving as a coffer-dam, and means for securing said casing to and releasing it from the pile, substantially as specified.

11. As a device for forming in the ground an opening for the subsequent reception of concrete or other plastic or fluid material, a removable pile having an enlarged point which is detachable from the pile, and a casing serving as a coffer-dam, substantially as specified.

12. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point which is detachable from the pile, a casing serving as a coffer-dam and means for securing said casing to and releasing it from the pile, substantially as specified.

13. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point, a casing surrounding the pile, and serving as a coffer-dam, and a fusible connection between said casing and the pile, substantially as specified.

14. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable pile having an enlarged point which is detachable from the pile, a casing surrounding the pile, and serving as a coffer-dam, and a fusible connection between said casing and the pile, substantially as specified.

15. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having a detachable non-metallic point, substantially as specified.

16. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having an enlarged and detachable non-metallic point, substantially as specified.

17. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a removable preparatory pile having a detach-
5 able point composed of concrete, substantially as specified.

18. As a device for forming in the ground an opening for the subsequent reception of concrete or other fluid or plastic material, a
10 removable preparatory pile having an enlarged and detachable point composed of concrete, substantially as specified.

19. As a device for forming in the ground an opening for the subsequent reception of
15 concrete or other fluid or plastic material, a removable metallic preparatory pile having a detachable non-metallic point, substantially as specified.

20. As a device for forming in the ground
20 an opening for the subsequent reception of concrete or other fluid or plastic material, a removable metallic preparatory pile having

an enlarged and detachable non-metallic point, substantially as specified.

21. As a device for forming in the ground 25
an opening for the subsequent reception of concrete or other plastic or fluid material, a removable metallic preparatory pile having a detachable point composed of concrete, sub-
stantially as specified. 30

22. As a device for forming in the ground
an opening for the subsequent reception of concrete or other fluid or plastic material, a removable metallic preparatory pile having
an enlarged and detachable point composed 35
of concrete, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK SHUMAN.

Witnesses:

F. E. BECHTOLD,
JOS. H. KLEIN.