

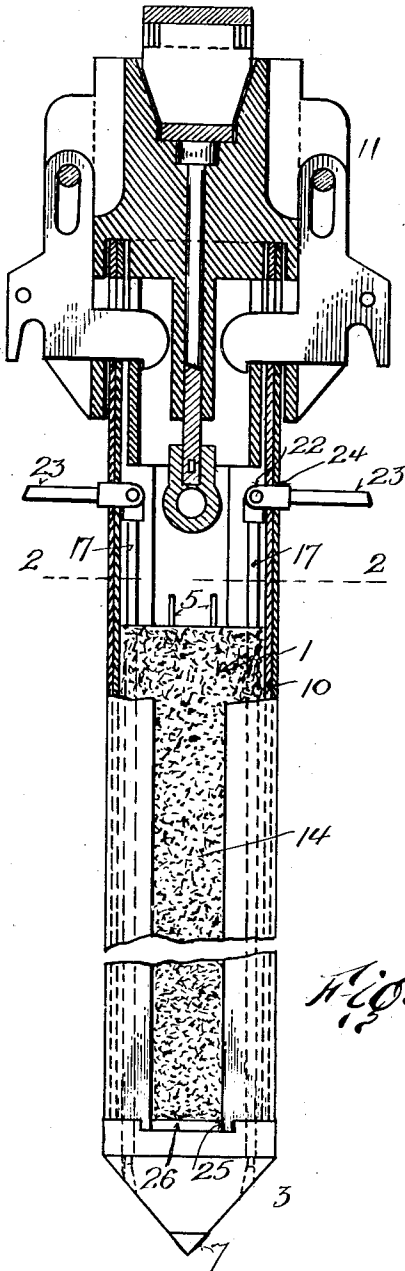
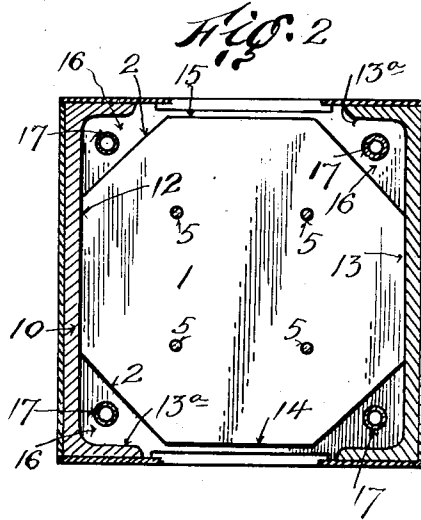
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APPLICATION FILED JAN. 17, 1920.

1,366,460.

Patented Jan. 25, 1921.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

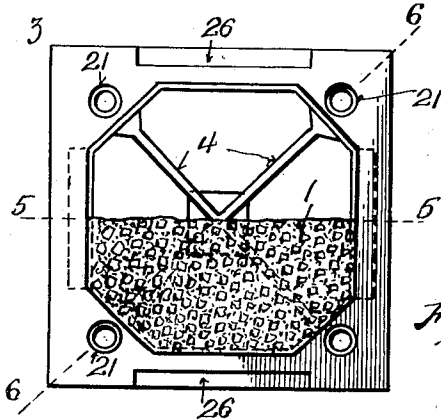


FIG. 3.

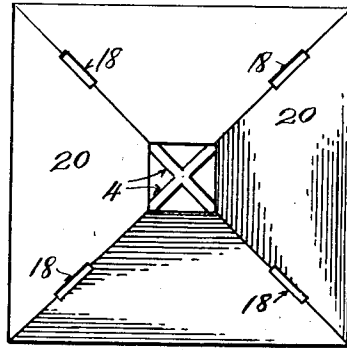


FIG. 4.

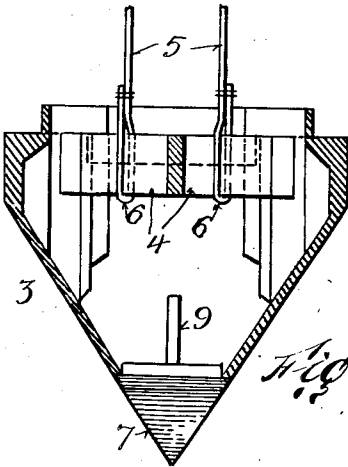


FIG. 5.

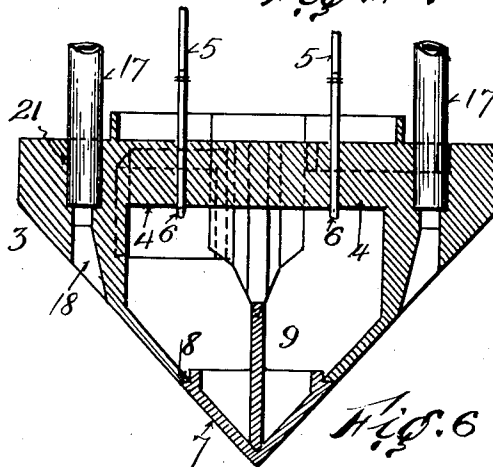


FIG. 6.

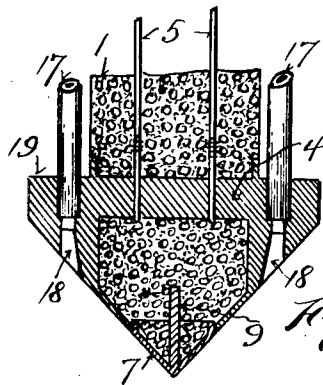


FIG. 7.

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1,366,460.

Specification of Letters Patent.

Patented Jan. 25, 1921.

Application filed January 17, 1920. Serial No. 352,048.

To all whom it may concern:

Be it known that I, CLARENCE S. HOWELL, a citizen of the United States, and a resident of the borough of the Bronx, in the city and State of New York, have invented certain new and useful Improvements in Piles, of which the following is a specification.

The present invention relates to precast concrete piles and their driving apparatus and the object thereof is to provide a precast pile which may be placed in the ground either by driving it by hammer blows or by jetting it down. The pile may be simultaneously driven and jetted or it may be jetted part way down and then driven down to a greater penetration. It is a well known fact that in certain locations piles, such as are used for foundation purposes, may be placed in the ground much faster by jetting than by driving, depending upon the character of the soil. It may occur that in placing a long pile into the ground the top strata of soil encountered will be of such a character that the pile may be jetted down much faster and with less energy than by driving it. After the pile has penetrated to lower depths the soil encountered may, on the other hand, be of such nature that the pile may be driven faster than it can be jetted.

In some soils, on the other hand, it is easier to both jet and drive the pile at the same time.

In nearly every instance where the pile is to be used for foundation purposes the final penetration is secured by driving.

It will be apparent, therefore, that in order to be able to take advantage of these various conditions it is preferable to employ a pile which may be either jetted or driven or both jetted and driven and the object of my invention is to provide a pile of this character.

Heretofore, where precast concrete piles have been jetted into the ground two general methods have been employed. One is to cast the pile with one or more pipes embedded in the concrete and extending lengthwise therethrough. Streams of water are forced through these pipes under considerable pressure, the water being forced into the ground below the point of the pile for the purpose of dislodging the soil below the point to form a hole into which the pile is lowered by gravity. The other method is to attach one or more pipes to

the exterior of the pile by tying them to it and water is likewise forced through these pipes to dislodge the soil below the point of the pile, for the purpose set forth above. One objection to the first method is that as the pipes are embedded in the concrete the pile is not exactly monolithic and it is not desirable to have the pipes remain permanently in the pile as they necessarily will in this method.

Under the second method it is difficult to maintain the pipes in position around the pile, especially if the latter is simultaneously jetted and driven. Another disadvantage is due to the difficulty of withdrawing the pipes after the pile has been placed, and generally in this method they are withdrawn. It is necessary that the pipe ends or nozzles discharge under the point of the pile and where the pipes are secured to the exterior of the pile it is difficult to maintain the nozzles in their proper positions and the pipes are generally turned in the ground to move the nozzles free of the point of the pile to permit the pipes to be withdrawn.

The present invention overcomes all the objections heretofore encountered. The present invention preferably embodies the features of the invention shown and described in my copending application Ser. No. 48533. In the present case a driving form composed of channel members partially incloses the pile, so that the total earth friction is divided between the pile itself and its driving form. One or preferably a plurality of pipes for jetting are disposed in free spaces between this driving form and the pile. Thus, the pipes are not disposed within the pile itself nor, on the other hand, are they in contact with the earth and subjected to earth friction. The nozzles are formed in the driving point of the pile and the pipes are detachably connected therewith. Thus, the pile may be a perfect monolith, the pipes are completely protected against earth friction so that they are easily maintained in position and so that they may be very readily withdrawn, and the jetting and driving operations may proceed simultaneously if desired.

Other advantages will be apparent from the detailed description which follows.

In the drawings forming part of this application,

Figure 1 is an elevation, partly in section, of the pile ready to be placed in the ground,

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Fig. 2 is an enlarged cross section, taken on the line 2—2 of Fig. 1,

Fig. 3 is a plan view of the driving point with part only of the concrete of the pile shown,

Fig. 4 is an inverted plan view of one member of the driving point,

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3, and

Fig. 7 is a vertical sectional view of the driving point and the lower end of the pile, and showing the jetting pipes.

As stated above, the present invention may be combined with the one shown in my said copending application to at once secure the advantages of both inventions and I will herein describe the present invention as thus embodied though I wish it to be understood that in its broadest aspect my present invention is not limited to use with that of my said copending application.

I will first describe the preferred form of pile and its driving form.

The pile, as stated above, is a precast shaft of concrete of monolithic construction, and I have indicated this shaft as 1 in the drawings. While this shaft may have any cross sectional shape I prefer to make it generally rectangular in cross section with its corners chamfered as shown at 2 to provide the necessary space for the reception of the jetting pipes. This concrete shaft may be of any length and it is cast with a metal driving point 3 as an integral part thereof. The point is shown hollow, with diagonal, integral webs 4 for stiffening the point, which is otherwise hollow, and to provide means to which the reinforcing bars may be securely and permanently tied. The entire interior of the driving point, except for the space occupied by the webs 4, is filled with concrete forming part of the shaft 1 and which is cast above ground simultaneously therewith.

The reinforcing bars 5 are embedded in the concrete shaft, being placed in position before the concrete is poured and these bars extend throughout substantially the length of the pile and they may extend beyond the head of the pile at their upper ends. At their lower ends 6 these bars are securely and permanently tied to the several webs 4 so that the driving point, concrete and reinforcing bars become integral parts of the complete pile. These bars 5 are preferably disposed as shown in the drawings, in order that the stresses exerted through them will be distributed throughout the entire cross section of the pile.

The driving point herein shown is constructed in two sections 3 and 7 the former containing the webs 4. The member 7 is made separate to permit the reinforcing bars

5 to be inserted through the opening 8 and to be tied to the webs 4 before the pile is cast. After these rods have been thus inserted, the separate member 7 is placed on the lower end of the member 3 and it has a central dowel 9 which projects into the concrete and maintains the member 7 centered.

The driving point may be formed in a single unit, if desired, as is shown in my said copending case.

At the upper ends of the channels 10, constituting the driving form, there is a driving head 11 the details of which are not described here as they form the subject matter of another application.

The channels 10 are disposed at opposite sides of the pile 1 and they partially inclose the pile; that is, they inclose the opposite sides 12, 13 and their angular webs 13^a extend partly around the sides 14, 15 of the pile. Thus, parts of the sides 14, 15 are exposed to earth friction whereas the earth friction which would otherwise develop on the sides 12, 13 of the pile comes on the driving channels. This results in a division of the total earth friction between the pile and the driving form. The pile 1 has its corners cut away or chamfered at 2 to provide longitudinal spaces 16 between the pile and the inclosing channels, and these spaces are preferably provided at the four corners of the pile. The pipes 17 for jetting purposes are arranged vertically in the spaces 16, so that each pipe lies between a corner of the pile and the adjacent portion of one of the channels. The driving point is formed with jetting nozzles 18 extending vertically from the top face 19 and near each corner, through the driving point. They are preferably elongated as shown, and they open through the under or angular surfaces 20 of the driving point so that the streams of water will be discharged under pressure below the driving point. The upper portions of the nozzles terminate in round sockets 21 into which the lower ends of the pipes 17 are detachably fitted.

The upper ends of the pipes 17 may be provided with elbows 22 and with sections 23 which are carried through apertures 24 in the channels. On the outer ends of the section 23 flexible pipes or tubes (not shown) are connected and these are supplied with water under pressure from any source in any well known manner.

The jetting pipes 17 are carried by the driving channels from which they need not be detached between different driving operations. When the pile is being prepared for driving, the channels 10 are supported upright in the pile driver, with the pipes 17 arranged in the corners of the channels, and the pile 1 is either placed between the channels or else it is placed against one of the channels and the other channel is then

placed against the opposite side of the pile. The projections 25 at the lower end of the channels fit into sockets 26 in the driving point to prevent the lower ends of the channels from spreading, or from disengaging from the driving point; and the upper ends of the channels are securely held by the driving head 11.

If desired, the pile may be jetted down during the first part of the penetration and then final penetration may be obtained by driving the pile with the hammer of the pile driver. Or, in some cases, it may occur that a hard top earth stratum may be better penetrated by first driving the pile and a softer, lower stratum may be more rapidly penetrated by jetting the pile after the higher, hard stratum has been penetrated. In some cases the character of the soil may be such that more rapid penetration may be obtained by jetting and simultaneously driving the pile. The present device is suited for each and all of these operations. If, for example, the pile is to be first jetted and then driven, the procedure will be as follows: Water under pressure will be forced through the pipes 17 and it will be discharged through the nozzles 18 under the driving point serving to dislodge the soil to form a hole into which the pile is lowered by its own gravity. The water will have a tendency to flow upwardly along the channels 10 as it is characteristic for water to flow along a smooth surface in preference to flowing through the soil. Thus the water will flow along the surfaces of the channels and rise to the surface of the ground and in doing so it will lubricate the surfaces of the channels which are in contact with the earth. This tendency of the water to flow upwardly along the channels will also keep the water from flowing out through the earth and reaching other piles previously driven in adjacent positions.

As the soil is displaced by the jets and the pile is lowered, penetration will finally reach a point where the pile either fails to move or where its penetration is very slow. In any case, it is advisable that final penetration be had by driving. Therefore, when the jetting operation is finished the hammer of the pile driver is caused to act on the driving block 27, the flow of water through the pipes having been discontinued. The force of the blows acts on the driving channels 10 to overcome the resistance due to earth friction on these channels and the remainder of the force is applied to the driving point. Part of this force is utilized to overcome resistance to penetration of the point. The remainder of the force places the reinforcing rods in tension and this force is distributed throughout the length and entire cross section of the pile, serving together with gravity, to pull the pile into

the ground. The force thus acting on the pile is sufficient to overcome the earth friction developed upon the exposed portions of the concrete pile.

It will be obvious that the jetting and driving operations may proceed simultaneously, or these operations may be alternated in any way which will give the best results in the particular soils encountered.

After the pile has been lowered to final penetration the driving form 10 and jetting pipes 17 are withdrawn. Where feasible, both channels may be withdrawn from the ground endwise as a unit. Or, where necessary, one of the channels may be uncoupled from the driving head 11 and the channels may be withdrawn separately.

The jetting pipes 17 are preferably withdrawn with the channels. As the channels are pulled upwardly the projections 25 disengage from the driving point, and the channels, together with the pipes 17, are pulled up to the top of the ground, and they are then ready for use on another pile.

It will be observed that with the present device I am able to secure all the advantages set forth in my said copending application and in addition, I provide for the jetting operation. In the present construction the jetting pipes may be coupled with the nozzles in the driving point while the pile is above ground. While the pile is penetrating the soil the jetting pipes are not subjected to earth friction because they lie in the spaces 16 between the pile and the driving channels, being inclosed by the latter. Therefore, these pipes are not subject to displacement in relation to the pile and driving point during penetration. On the other hand, the pipes are not cast integral with the pile, so that the latter is not weakened by the presence of the pipes within its cross section. Furthermore, the pipes are not permanently attached within or to the pile so that they may be readily withdrawn and used over again. These pipes 17 are not only free of earth friction while the pile is being lowered but they are protected to a great extent from earth friction while being withdrawn, by the channels.

Having described my invention, what I claim is:

1. A solid, precast, concrete pile, a driving form partially inclosing the pile and a pipe for conducting a liquid to the lower end of the pile and disposed between the pile and said driving form.

2. A solid, precast, concrete pile, a driving form partially inclosing the pile and constructed to leave a portion of the pile subject to earth friction, and a pipe for conducting liquid to the lower end of the pile, arranged between the pile and said driving form and protected by the latter from earth friction.

3. A solid, precast concrete pile, having chamfered corners, a driving form partially inclosing the pile and constructed to leave a portion of the pile subject to earth friction, and pipes for conducting liquid to the lower end of the pile disposed between said chamfered corners of the pile and said driving form and protected by the latter from earth friction.
4. A solid, precast, concrete pile having chamfered corners, a driving form comprising channels inclosing opposite surfaces of the pile to relieve the latter of earth friction, and having webs inclosing the chamfered corners of the pile, and pipes for conducting liquid to the lower end of the pile, disposed between said chamfered corners of the pile and said channels and protected by the latter from earth friction.
5. A solid, precast, concrete pile, a driving form partially inclosing the pile and constructed to leave a portion of the pile subject to earth friction, and pipes for conducting liquid to the lower end of the pile, disposed between the pile and said driving form and protected by the latter from earth friction and constructed to be simultaneously withdrawn with said driving form after the pile has been driven.
6. A solid, precast concrete pile, an integral driving point thereon, reinforcing bars embedded in said pile and having their lower ends tied to said driving point, a driving form partially inclosing the pile and subjected to part of the earth friction which would otherwise act upon the pile, said driving form transmitting driving force to said driving point to drive the pile, and pipes for conducting liquid to the lower end of the pile, disposed between the driving form and protected by the latter from earth friction.
7. A solid, precast concrete pile, an integral driving point thereon having jetting nozzles formed therein to discharge liquid below said point, a driving form partially inclosing said pile, and jetting pipes disposed between said pile and said form and protected from earth friction by the latter, said jetting pipes being detachably connected with said jetting nozzles.
8. A solid, precast, concrete pile of rectangular cross section, having chamfered corners, an integral driving point having a rectangular top, and provided with jetting nozzles, for discharging liquid below said point, a driving form partially inclosing said pile, and jetting pipes disposed between said chamfered corners of the pile and said driving form and protected from earth friction by the latter, said jetting pipes being detachably connected with said nozzles in the driving point and adapted to be withdrawn with the driving form.

Signed at the city, county, and State of New York, this 7th day of January, 1920.
CLARENCE S. HOWELL.