O. WILHELMI.

METHOD OF MAKING CONCRETE OR REINFORCED CONCRETE (FERROCONCRETE) PILES.

APPLICATION FILED DEC. 11, 1913.

1,213,441. Patented Jan. 23, 1917

Fig. 1.

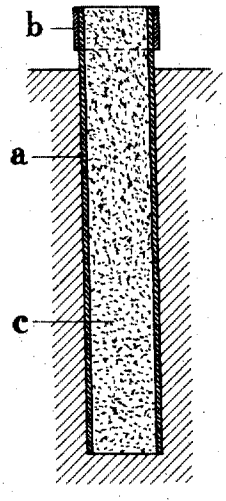


Fig. 2.

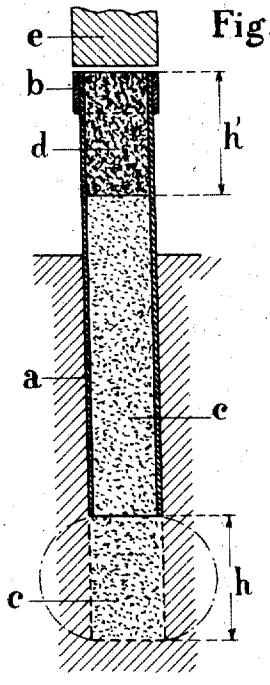
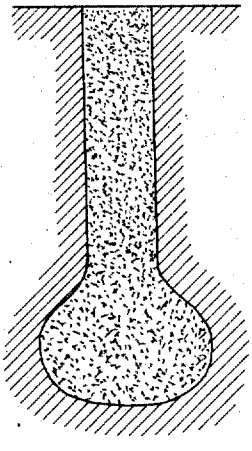


Fig. 3.



Witnesses:
H. A. Kelling
Ben B. Newcomb

Inventor
Otto Wilhelmi
by B. Singer
Atty

UNITED STATES PATENT OFFICE.

OTTO WILHELMI, OF LUCERNE, SWITZERLAND, ASSIGNOR TO THE FIRM OF INTERNATIONALE SIEGWARTBALKEN-GESELLSCHAFT, OF LUCERNE, SWITZERLAND.

METHOD OF MAKING CONCRETE OR REINFORCED-CONCRETE (FERROCONCRETE) PILES.

1,213,441. Specification of Letters Patent. Patented Jan. 23, 1917.

Application filed December 11, 1913. Serial No. 806,011.

To all whom it may concern:

Be it known that I, OTTO WILHELMI, subject of the Emperor of Germany, and resident of Mailhofstrasse, Lucerne, Switzerland, have invented certain new and useful Improvements in Methods of Making Concrete or Reinforced-Concrete (Ferroconcrete) Piles, of which the following is a specification.

The object of the present invention is an improved process for the manufacture *in situ* of concrete, ferroconcrete, or the like piles having an enlargement of the concrete at the foot or other point of the pile.

According to the invention I drive a recoverable feed pipe or shell into the ground. I prefer to drive said pipe or sleeve while the same contains a stake or core as illustrated in Figure 1 of the patent to Abbott, No. 887,175, so that when the core is withdrawn there will be no earth within the shell. However, the shell may be driven without the core whenever circumstances make it seem preferable, and the earth within the shell removed by the pneumatic process, the use of a water jet, an earth auger, or the point of the casing may be closed by a shoe or plug, which is removable, all as mentioned in lines 35 to 42, page 3, of the patent to Goldsborough, No. 961,492. I then fill the shell to the top with light concrete. The feed pipe is then raised a certain distance and the whole space at the top is filled with concrete or the like. The pipe may be provided at the top with a suitable collar. The top is then sealed and pressure applied in suitable manner, *e. g.*, a rammer may be employed. This causes the liquid concrete which is in the earth beyond the feed pipe to expand laterally to form an annular enlargement. The feed pipe is then again raised, filled at the top and stamped down. These operations are repeated until finally the feed pipe is completely removed. In some cases conical or wedge-shaped members may be inserted in the liquid concrete to facilitate lateral expansion.

The improved method is illustrated in the accompanying drawing.

Fig. 1 is a sectional view of concrete pipe containing liquid concrete. Fig. 2 is a sectional view showing liquid cement contained in the pipe, the pipe raised and refilled with concrete. Fig. 3 is a sectional view of the pile after having been filled with concrete and the pipe entirely withdrawn.

a is the lining pipe, *b* a collar or thickening of its upper edge, *c* the concrete filling, *d* the subsequent filling and *e* the monkey or rammer, pressure punch or the like.

Figs. 1 and 2 show intermediate phases in making the piles, and Fig. 3 shows the finished pile.

By this improved method the concrete column *c* held by the lining pipe *a*, is itself used as press rammer, so it is possible to dispense with separate appliances for expelling the compressed concrete from the tube while an excellent homogeneity of the concrete column at the base and in the direction of pressure is produced and any constriction and shearing off is avoided. The forcing down of the concrete column is effected by ramming or otherwise pressing on a closing plate or short plug projecting into the interior of the pipe and placed on the upper end of the tube.

In the ordinary method of pile driving, concrete is lowered through a lining or feed pipe, and during the ramming with special ramming appliances the concrete is caused to yield laterally inside the pipe until an appreciable compression no longer takes place. The concrete must, however, be rammed through the lining pipe, while this is simultaneously raised. As is well known owing to the unavoidable compression of the concrete constrictions and shearings take place when drawing up the feed pipe. In this improved method however, the concrete is not rammed through the pipe, the concrete standing in the earth sheath or lining is rammed or pressed and laterally expanded, but by means of the column of concrete filled in above it cannot escape at the top owing to the column of concrete which is pressed down by the ram and thus closed, and it cannot escape downward in the wrong direction since the earth will have been packed tight by the ramming of the feed tube. The concrete column *h* freed from the lining tube is forced down owing to the weight of the concrete column held together by the lining tube which receives temporary seal or load at the top either by placing of the monkey thereon or otherwise,

also the pressure exerted so as to penetrate laterally into the walls of the pile hole. The superimposed concrete column (which is constricted to a certain extent) can be regarded as a heavy press plunger. The lateral expansion of the concrete at the base is facilitated because in the previous formation of the pile hole in known manner by a preliminary driving pile, the point of the pile strongly compresses the ground.

This method assumes the use of liquid concrete which does not undergo compression like dry or earth-moist concrete during the ramming through the pipe. It is well known that this compression causes a breaking or constriction of the concrete beneath the lower edge of the pipe, when the pipe is drawn up when there is the danger that the pile may thus become divided by a layer of earth.

If the ramming or pressing were only exerted on the concrete inside the lining pipe, as in the methods previously mentioned, the pressure would jam the concrete like water in a rubber tube thus causing an annular pressure and the vertical components of pressure would diminish or be lost at the bottom. On the other hand concrete which is constricted and prevented from expanding laterally (and the concrete in the lining tube must be regarded as such) can only exert the swelling or expanding action on the unconstricted portion, that is to say, on the concrete which is surrounded by the yielding earth walls.

Having now described my invention, what I desire to secure by a patent of the United States is:

1. A process of manufacturing monolithic piles which consists in preparing a vertical opening in the ground lined by a sleeve, filling the sleeve with a fluid concrete, raising the sleeve, refilling the sleeve with fluid concrete, and then simultaneously forcing said concrete and sleeve into the ground, said sleeve being maintained open at its lower end during the remainder of the process after said raising of the sleeve.

2. A process of manufacturing monolithic piles which consists in preparing a vertical opening in the ground lined by a sleeve, filling said sleeve with a liquid plastic, raising said sleeve a predetermined height, refilling said sleeve with a plastic, then simultaneously forcing said plastic and sleeve into the ground and repeating the operation until the pile formed is composed entirely of plastic material, said sleeve being maintained open at its lower end during the remainder of the process after said raising of the sleeve.

3. A process of manufacturing monolithic piles which consists in preparing a vertical opening in the ground lined by a sleeve, filling said sleeve with a liquid plastic mass, raising said sleeve a predetermined height, refilling said sleeve with a plastic mass and then simultaneously forcing said sleeve and mass into the ground, said liquid plastic mass adapted to expand laterally and provide a base section of enlarged cross-sectional area, the operation being repeated until the enlarged base area and column have been entirely filled with said plastic mass, said sleeve being maintained open at its lower end during the remainder of the process after said raising of the sleeve.

4. A process of manufacturing monolithic piles which consists in preparing a vertical opening in the ground lined by a sleeve, providing a liquid plastic mass, filling said sleeve with said mass, raising said sleeve a predetermined height, refilling said sleeve and simultaneously forcing said sleeve and mass into the ground the operation being repeated until the entire column is formed some portion of the column formed of liquid plastic mass being of a greater cross-sectional area than the other portion of the column, said sleeve being maintained open at its lower end during the remainder of the process after said raising of the sleeve.

5. A process of manufacturing monolithic piles which consists in preparing a vertical opening in the ground lined by a sleeve, filling said sleeve with a plastic mass, raising said sleeve a predetermined height, refilling said sleeve with said plastic mass then simultaneously forcing said sleeve and mass into the ground to its original depth, then again raising said sleeve a predetermined height and refilling the same with said plastic mass and again forcing said sleeve and mass into the ground thereby laterally expanding the base of the pile to be formed to a predetermined width, substantially as described, said sleeve being maintained open at its lower end during the remainder of the process after said raising of the sleeve.

In testimony whereof I affix my signature in presence of two witnesses.

OTTO WILHELMI.

Witnesses:
FRANZ HOPPEN,
ALFRED MEYER.