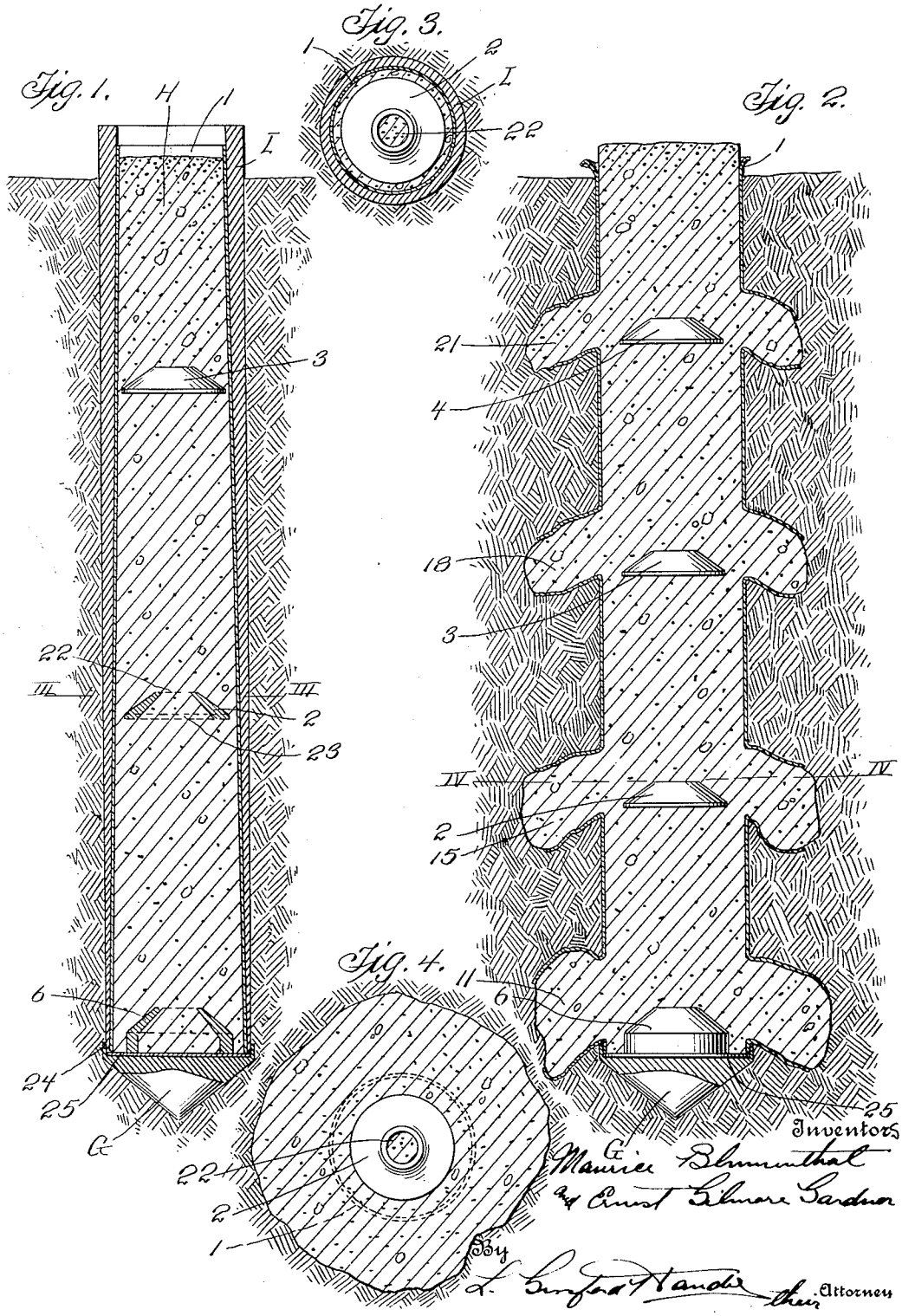
July 15, 1924. 1,501,643

M. BLUMENTHAL ET AL

CONCRETE PILE AND MEANS FOR AND METHOD OF PRODUCING SAME

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July 15, 1924. 1,501,643

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CONCRETE PILE AND MEANS FOR AND METHOD OF PRODUCING SAME

Filed Jan. 2, 1920 2 Sheets-Sheet 2

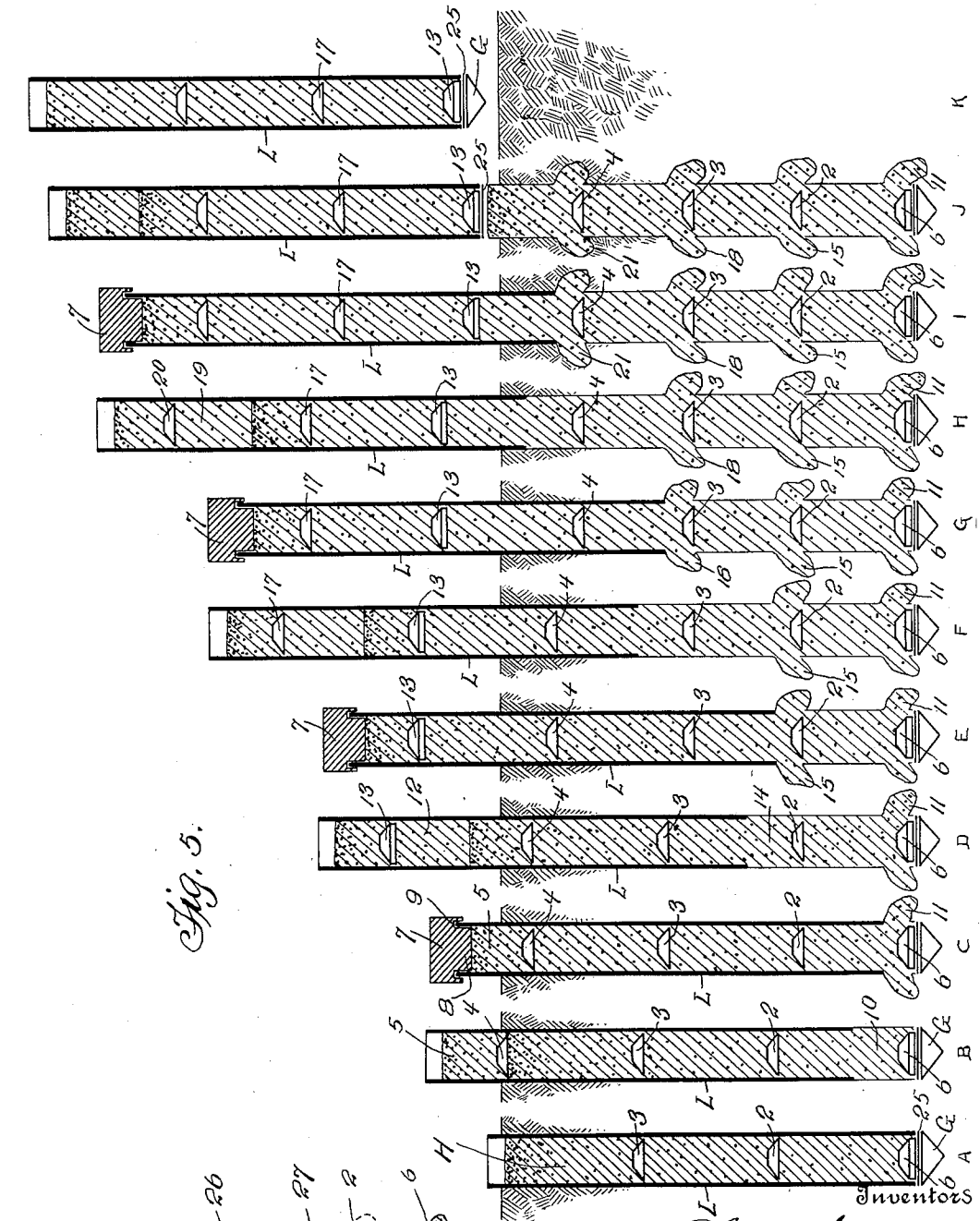


Fig. 5.

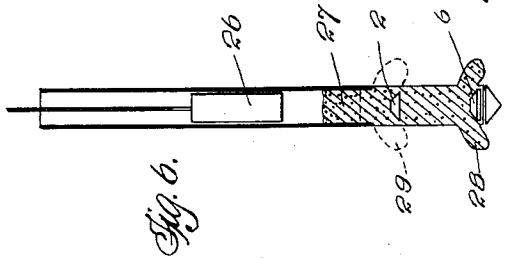


Fig. 6.

Inventors

Maurice Blumenthal

and Ernst Edmund Gardner

By Linford Handley their Attorney

Patented July 15, 1924. 1,501,643

UNITED STATES PATENT OFFICE.

MAURICE BLUMENTHAL AND ERNEST GILMORE GARDNER, OF BROOKLYN, NEW YORK.

CONCRETE PILE AND MEANS FOR AND METHOD OF PRODUCING SAME.

Application filed January 2, 1920. Serial No. 349,024.

To all whom it may concern:

Be it known that we, MAURICE BLUMENTHAL and ERNEST GILMORE GARDNER, both residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Concrete Piles and Means for and Methods of Producing Same, of which the following is a specification.

This invention relates to new and improved concrete piles and means for and method of producing the same.

An object of the invention is to provide means whereby concrete piles may be produced within the earth of such character as to have an unusually powerful grip upon the earth restraining the pile from sinking below its appointed position in the earth.

A furthermore detailed object is to provide means whereby lateral extending portions may be formed integral with the pile at desired points upon the pile beneath the surface of the earth.

A further object is to provide a new and improved pile.

A further object is to provide a new and improved method for sinking such piles.

Other objects and aims of the invention, more or less specific than those referred to above, will be in part obvious and in part pointed out in the course of the following description of the elements, combination, arrangements of parts and applications of principles, constituting the invention; and the scope of protection contemplated will be indicated in the appended claims.

In the accompanying drawings which are to be taken as a part of this specification, and in which we have shown merely a preferred form of embodiment of the invention:—

Figure 1 is a longitudinal sectional view thru a pile shell showing the same sunk into the earth and filled with concrete material and also showing the presence of deflectors, etc., as will be presently fully described.

Figure 2 is a similar sectional view showing the completed pile after the shell has been removed.

Figure 3 is a transverse sectional view taken substanitally upon the plane of line III of Fig. 1.

Figure 4 is a transverse sectional view taken substantially upon the plane of line IV of Fig. 2, and

Figure 5 includes a series of diagrammatic views graphically illustrating the succeeding steps occurring during the formation of the completed pile of this invention.

Figure 6 is a diagrammatic view illustrating a modified method of producing the lateral projections at spaced points upon a pile in accordance with this invention.

Referring to the drawings for describing in detail the structure which is illustrated therein, the reference character L indicates the pile shell. This may be made of any appropriate cross section but usually is circular, as seen in Fig. 3. At its lower end it is closed by a driving point G which serves as a means to facilitate entrance of the shell into the earth during the driving operation. The shell may be made of the usual constant diameter or it may be tapered longitudinally as suggested in pending application of Ernest G. Gardner, Serial No. 542,636, filed Dec. 5, 1919, so that its interior diameter is greater at the lower end than at the upper end. Such a tapered shell has material advantages over the non-tapered shell, as fully set forth in said pending application, and is, therefore, illustrated herein in Fig. 1, altho, of course, the non-tapered shell may be employed if desired without altering the features of the present invention.

Within the shell may be employed a liner, as 1, if desired, of the general character such as is fully illustrated and described in co-pending application Serial No. 354,368, filed January 27, 1920. Altho such a liner may afford material points of advantage during the formation of the pile of this invention, yet it will be understood that the invention is not to be limited in all respects to the use of a liner of the character, or in fact to the use of any liner whatever.

The concrete material, as H, may be placed within the shell together with certain deflectors 2 and 3 presently to be described, either before or after the shell is driven into the earth.

Where a liner is employed the concrete and said deflectors are placed within the liner so that the liner serves to hold the concrete material out of direct contact with

the surface of the shell and thus to relieve the shell of a very considerable frictional resistance to the subsequent removal of the shell.

In accordance with the present improved method the shell will be filled before being sunk, as follows:—

When the shell and its contents are in position within the earth, as seen in Fig. 1, and as diagrammatically represented in the diagram A in Fig. 5, the shell is first lifted a short distance, as indicated by diagram B. The body of concrete material will not lift with the shell but on the contrary will slightly settle due to the flowing of the concrete into the space left by the lifting shell, as will be readily understood. Upon the upper surface of the body of concrete then is placed a deflector 4 similar to the deflectors 2 and 3, and a quantity of concrete material, as 5, is placed within the shell to substantially fill the same above the deflector 4.

At the upper surface of the driving point G is a deflector 6 and the distance between all of the deflectors 6, 2, 3 and 4 is preferably, tho not necessarily, approximately equal longitudinally of the shell.

After the concrete material 5 has been placed, as seen in diagram B, the upper end of the shell is sealed. For this purpose a driving head, as 7, is preferably employed and this has a portion 8 for extending a short distance into the shell into direct engagement with the upper surface of the concrete material 5. An annular surface portion 9 of the driving head may engage the upper annular edge of the shell and the portion 8 may, if desired, be of such length that it will engage the upper surface of the concrete material before the surface 9 engages the shell.

After the driving head has been placed in position suitable force is applied thereagainst for driving the shell and its whole contents bodily downwardly to a point short of its original position substantially as suggested by the diagram C. By this action the body of concrete material, represented at 10 in diagram B, is forced outwardly from its original column shape and into the surrounding earth forming a lateral extension 11 upon the pile which may be of any appropriate dimensions, the limits and the contour of which are determined by the texture and the degree of hardness of the earth at different radial points and to the bulk of concrete present in the part 10, as well, of course, as to the degree of power applied for forcing down the shell.

It is to be particularly noted in this connection that the operation of thus forcing the concrete material outwardly into the earth may be made to very greatly compact the earth immediately surrounding the extension 11, thus adding much to the supporting power of the earth.

It is also to be noted that in forcing the concrete into the earth in this manner the force effective for compacting the earth is equally effective for compacting the concrete material itself. The whole body of concrete material as well as the extension 11, becomes gradually compacted so that voids therein are almost an impossibility.

Where the power exerted for driving down the shell is applied as a succession of heavy blows upon the upper surface of the driving head 7, as is preferably the case, the resultant vibration and agitation of the concrete material during its compression will naturally greatly assist in expelling therefrom any and all air pockets. In this way the whole body of concrete material is bound to become one solid mass and the texture of this mass is substantially uni- from thruout the body and the extension 11, it being noted particularly that the extension is not formed by the mere flowing, under only gravity pressure, of relatively thin portions of the concrete material into pockets prepared to receive it, but rather that it is formed by a powerful expansion of the main body of concrete material itself.

The function of the deflector 6 is to facilitate and give direction, as far as possible, to the outwardly moving mass forming the extension 11. This deflector, as well as all the other deflectors, is conical in shape and is placed substantially concentric within the shell. As the concrete material is forced downwardly against the cone-shaped surface of the deflector 6 it is given a tendency to spread equally in all directions so that the projection 11 may become of a general mushroom shape with the main body of the pile at its center.

After the shell has been thus driven for producing the extension 11 it is again raised for a suitable distance, as seen in diagram D, the distance being determined by the position of the deflector 2. The lifting of the shell in this instance is carried to a point where the lower end of the shell is approximately the same distance above the deflector 2 as it was previously carried above the deflector 6, diagram B. Again the body of concrete material is not lifted by the lifting shell but is allowed to stand and to expand into the space left by the shell. Into the upper end of the shell is then placed an additional quantity, as 12, of concrete material, together with a further deflector, as 13, said deflector being spaced an equi-distance with the other deflectors. The driving head 7 is then placed in position as before, and the whole driven downwardly a slight distance; that is, to approximately the same distance above the deflector

2 as described before with reference to the deflector 6, all as seen in diagram E. The downward movement in this instance will cause the body of concrete material 14 between the lower end of the shell and the upper surface of the deflector 2, as seen in diagram D, to spread outwardly over the surface of the deflector 2 and to thereby produce a mushroom-like extension 15 adjacent the deflector 2 similar to the extension 11.

After the extension 15 has been formed the shell may be lifted above the deflector 3, filled with a further addition of concrete material, as 16, at its upper end and a further deflector 17, and then again driven for producing an extension 18. The shell may then be lifted above the deflector 4, filled at its upper end with concrete material, as at 19, and a further deflector 20, and it may then be driven to produce an extension 21.

Any number of extensions may be produced upon the pile in this manner and each of them be of substantially the same heavily compressed material as was the first or lowermost extension. The shell itself is at all times kept filled with concrete material which has been heavily compacted under agitation and vibration and having the necessary deflectors therein all in proper position.

After a pile has been completed, as seen in diagram J, the shell above it stands full of this concrete material and only needs to be supplied with a driving point G, as seen in diagram K, to make it ready for immediate sinking into the earth as in diagram A.

A continuous operation is thus provided for which renders it possible to rapidly drive a series of piles with great efficiency. The operation is of such character that all of the workmen for performing it, as well as all the paraphernalia required, are continually engaged. There is no appreciable period of idleness for the shell drivers for instance while the fillers are at work and likewise there is no appreciable period of idleness for the concrete mixers and the shell fillers while the pile driving machine is at work. A single shell filled as in diagram K, may be driven into the earth as in diagram A. It may be gradually raised and kept filled until the pile is completed, as shown in diagrams B to J, and it may then again be immediately driven most proper in an immediately adjoining position.

This continuous employment of a working gang is a matter of very considerable importance.

The deflectors are all preferably hollow, in fact they are mere shells, and they are open at their upper and lower ends, as at 22 and 23, so that the concrete material may readily flow thereinto and fill them to thus provide a suitably strong and efficient bond between superposed portions of the body of concrete material.

It is noted that the deflector 13 placed within the shell in diagram D ultimately becomes the lowermost deflector in the shell at the time when the pile is completed. This deflector in diagram K, therefore, corresponds with the deflector which is in diagram A. Since it is intended to cooperate with the driving point G it is preferably formed of slightly greater height than the remaining deflectors so that it will serve to suitably direct the concrete material over the marginal bead 24 of the driving point. This feature, however, is merely a detail and may be modified in accordance with the type of driving point employed.

Any appropriate and satisfactory means may be employed for facilitating the attachment of the driving point G to the lower end of the filled shell after the shell has been raised, as in diagram J. For illustrative purposes, however, a simple plate, as 25, is shown as having been slid into position just beneath the deflector 13 for supporting the deflector and the concrete material above it while the driving point is being attached.

Such a plate may be allowed to remain after the driving point is attached, if desired, as seen in Fig. 1.

In addition to presenting a smooth conical surface for directing the expanding force of the concrete in the formation of the lateral mushroom-like projections the deflectors within the concrete material serve to a suitable extent for holding together the body of concrete immediately beneath them and thus tends to prevent lateral expansion of the portions of concrete between the projections. During the driving operation the relatively broad under portions of the deflectors impart the driving pressure substantially uniformly thruout the cross sectional area of the concrete column tending to drive the whole column downwardly rather than to spread the column. The frictional grip of the component parts of the concrete material against each other is usually sufficient to prevent spreading of the concrete between the extension under this direct pressure.

Furthermore, where the liner 1 is employed it serves to greatly strengthen the intermediate portions of the column against bursting strains. The liner is, of course, readily burst thru by the excessive bursting strains present adjacent the upper surfaces of the deflectors, as is clearly seen in Fig. 2.

It should be here noted that when the material of the liner is burst thru by the pressure of the concrete material during the formation of the mushroom extensions the material of the liner naturally is forced

outwardly along with the concrete material and serves to a greater or less extent to confine the concrete material within more or less definite form; that is, it prevents undesirable migration of the concrete material into extensive, tho unimportant voids which may be present in the earth. A suitably definite contour of the extensions is in this way assured.

In the method herein described no pressure is applied by the driving hammer for driving the concrete material downwardly thru the shell, but on the contrary, the shell and the concrete material therein move as a single body. The back pressure from the concrete material beneath the lower end of the shell of course causes compression of the concrete material within the shell and tends to burst the shell but this is of no moment since the shell is, of course, of ample strength to sustain such a strain and is not intended to have any downward movement relative to the concrete within it.

The downward pressure against the portions of the concrete below the lower end of the shell employed for producing the extensions upon the pile causes the surface of the concrete material where it presses against the surrounding earth surface to become rough and irregular in accordance with the contour, as well as in accordance with the consistency of various portions of the earth surface; that is, the portions of the earth surface which are relatively soft and yielding will permit relative projecting portions to be formed upon the surface of the concrete material, whereas adjacent relatively hard portions of the earth surface will offer greater resistance to the pressure of the concrete and will thereby produce relatively indented portions upon the concrete surface. The concrete material and the earth incidentally will become equally compacted and solidified so that a very great sustaining power is given to the grip of the concrete upon the earth. Here it should be noted that the portions of the body of concrete intermediate the lateral projections of said body in their tendency to spread under the pressure from above likewise produce a very effective grip upon the earth intermediate the projections in the same manner as just referred to. At the same time the portions of the earth intermediate the projections are caused to be greatly compacted and solidified by the pressure exerted thereagainst during the formation of the projections thus enhancing the grip upon the earth of the intermediate portions of the pile between the projections. Where a liner, as 1, is employed the same may prevent to a certain degree the roughening of the intermediate portons of the concrete between the projections under the pressure from above but it is intended that this liner be preferably of such consistency, as for instance when the liner is made of paper, as to enable the surface of the concrete to follow the contour of the surrounding earth to a suitably efficient degree.

The shells employed in connection with this invention may, if desired, be of the sectional type; that is, they may consist of two or more semi-circular sections connected by seams extending longitudinally of the pile, so as to facilitate the lifting of the shells. Such shells of course should be furnished with suitable means for maintaining the sections in proper assembled relation during the operation of the process herein set forth.

In the modification Fig. 6, it is seen that if desired an operator may utilize the deflectors 6, 2, 3 and 4, etc., above described, for producing lateral extensions upon his pile by employing a ram, as 26, movable within the shell to tamp down small quantities, as 27, of the concrete material for forming the individual projections, as 28 and 29, upon the pile. In this method of use the operator simply places within the shell a sufficient quantity of concrete to form the projection 28. He then raises the lower end of the shell for a distance equal to the height of the projection 28 and tamps down, with the ram 26, upon the concrete material within the shell so as to drive the same outwardly beneath the lower end of the shell to form the projection 28. He then places within the shell a further quantity of concrete material and upon the upper surface of this places the cone or deflector 2. Over this deflector he places within the shell a further quantity of concrete material, lifts the shell a slight distance above the deflector 2, and again tamps down with the ram 26 so as to form the projection 29. Additional cones may be inserted and this process of operation be repeated and continued thruout the vertical length of the pile, making as many projections upon the pile as may be desired, the cones always serving to localize the efforts of the ram so that the position and the general contour of the projections is made definite.

As many changes could be made in this construction without departing from the scope of the invention as defined in the following claims, it is intended that all matter contained in the above description or shown in the accompanying drawings, shall be interpreted as illustrative only and not in a limiting sense.

It will, of course, be understood that a liner as above referred to may be employed in connection with the operation set forth regarding Fig. 6, if desired, and that in this instance, as before, the liner will remain not lifted during the lifting of the shell so that a portion of the liner will project below

the lower end of the shell after the shell is lifted and will confine the concrete material until burst thru by pressure from above.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. A deflector member adapted for use in the manner set forth, said deflector member having its upper surface inclining downwardly and outwardly in all directions so as to act as a wedge outwardly over which concrete material may spread, and the deflector being hollow and having an opening extending from its interior thru said upper surface so that concrete material may enter and occupy said interior.

2. A deflector member adapted for use in the manner set forth, said deflector member having its upper surface inclining downwardly and outwardly in all directions so as to act as a wedge outwardly over which concrete material may spread, and the deflector having an opening extending therethru thru which concrete material above the deflector may connect with the concrete material below the deflector.

3. The herein described method of producing within the earth a concrete pile having a portion thereof spread laterally from the main body, which method consists in positioning within the earth a pile shell having a liner therein, filling said liner with concrete material, lifting said shell a suitable distance without said liner or concrete material, adding a quantity of concrete material within the upper end of the liner, and then forcing the shell and the upper portion of the liner with the contained concrete material downwardly to a position short of the original position of the shell to thereby burst the portion of the liner then below the lower end of the shell and produce spreading of the portion of concrete material below the end of the shell.

4. The herein described method of producing within the earth a concrete pile having a plurality of spread portions therein at spaced points in the length of the pile, which method consists in positioning within the earth a pile shell having a liner therein, filling said liner with concrete material, lifting said shell a suitable distance without said liner or concrete material, adding a quantity of concrete material within the upper end of the liner, then forcing the shell and the upper portion of the liner with the contained concrete material downwardly to a position short of the original position of the shell to thereby burst the portion of the liner then below the end of the shell and produce spreading of the portion of concrete material below the lower end of the shell, again raising the shell without the liner or the concrete material for a further suitable distance, positioning a second added quantity of concrete material within the upper end of the liner, again forcing the shell and the upper portion of the liner with the contained concrete material downwardly to a position short of the position from which it was last raised to thereby burst the liner at a point above the first bursting point and to spread another portion of the concrete material outwardly beneath the lower end of the shell at a point spaced above the first spread portion, and then repeating this operation for producing as many spread portions spaced vertically above each other along the length of the pile as desired.

5. The herein described method of producing within the earth a concrete pile having a portion thereof spread laterally from the main body, which method consists in positioning within the earth a pile shell having a liner therein, filling said liner with concrete material, lifting the shell a suitable distance without said liner or concrete material, and then forcing the shell and the upper portion of the liner with the contained concrete material downwardly to a position short of the original position of the shell to thereby burst the portion of the liner then below the lower end of the shell and produce spreading of the portion of concrete material below the end of the shell.

6. The herein described method of producing within the earth concrete piles, which method consists in sinking within the earth a pile shell, said shell being filled with concrete material entirely withdrawing the shell without the concrete material meanwhile adding concrete material within the upper end of the shell to maintain the shell filled, sinking the shell while thus filled again into the earth in a different location, again withdrawing the shell without the concrete material meanwhile adding further concrete material within the upper end of the shell to maintain the shell filled, and repeating this operation as desired.

7. The herein described method of producing within the earth concrete piles having lateral projections at spaced points in the length thereof, which method consists in sinking within the earth a pile shell, said shell being filled with concrete material containing a plurality of deflectors embedded within the concrete material spaced apart in the length of the shell, successively lifting the shell by relatively long steps and without the concrete material above the respective deflectors, after each lifting step forcing down the shell a relatively short step together with the contained concrete material to near the respective deflectors whereby to spread outwardly into the earth the concrete material adjacent the respective deflectors, adding further deflectors and

quantities of concrete material within the upper end of the shell to maintain the shell filled while the shell is entirely withdrawn, sinking the shell while filled again into the earth in a different location, again entirely withdrawing the shell by successive long and short steps as described while always maintaining the shell filled, and repeating this operation as desired.

8. Means for forming concrete piles comprising a liner member adapted to be positioned within a pile shaped opening within the earth and to contain a body of concrete material, said liner member being burstable by pressure of the concrete material thereagainst, and means to direct the force of the downward pressure of the body of concrete material laterally against a pre-determined portion of said liner member to thereby burst said liner and form a lateral projection at a pre-determined locality upon said body of concrete.

In testimony whereof we affix our signatures in the presence of two witnesses.

MAURICE BLUMENTHAL.
ERNEST GILMORE GARDNER.

Witnesses as to signature of Maurice Blumenthal:

DAVID HERSHFELD,
JANE M. MONAGLE.

Witnesses as to signature of Ernest Gilmore Gardner:

L. GESSFORD HANDY,
MAY SCHULZ.