April 30, 1940. A. W. BAILEY 2,198,985

STEEL PILE STRUCTURE

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Fig. 1.

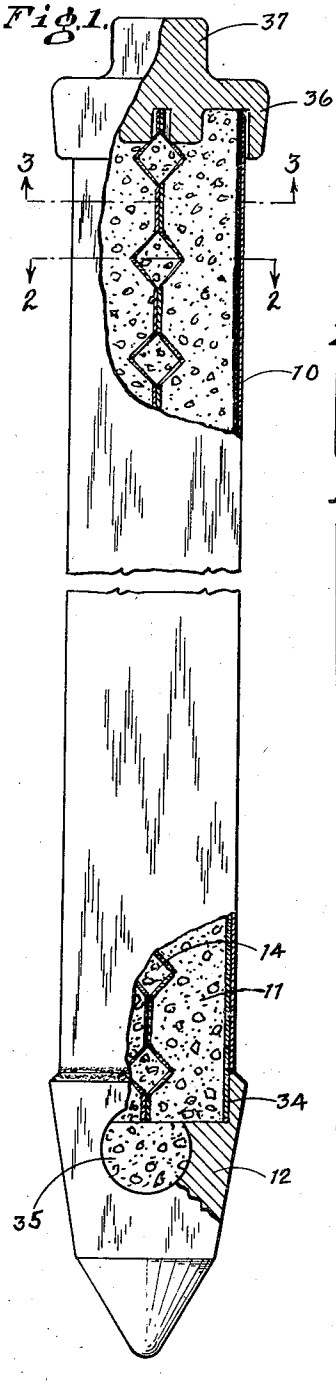


Fig. 2.

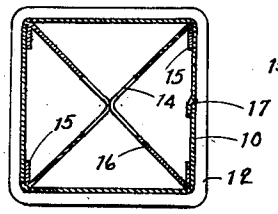


Fig. 3.

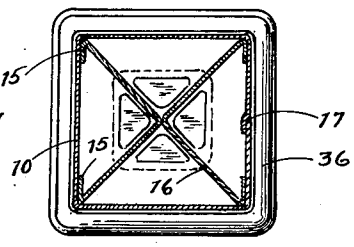


Fig. 5.

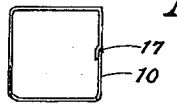


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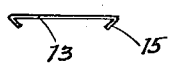


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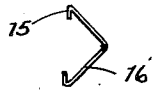


Fig. 11.

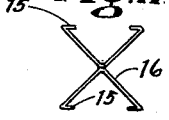


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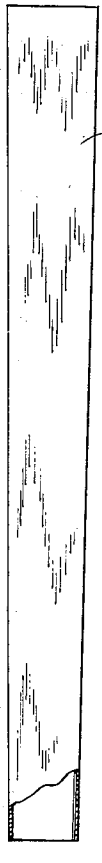


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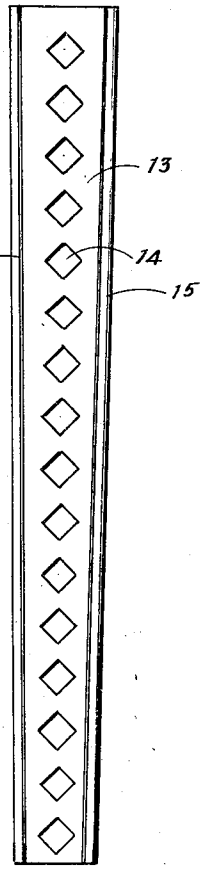


Fig. 8.

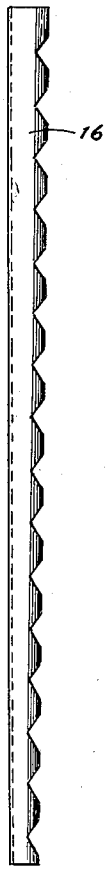
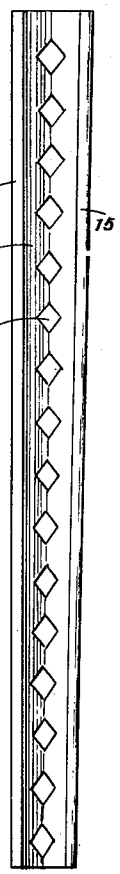


Fig. 10.



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Fig. 12.

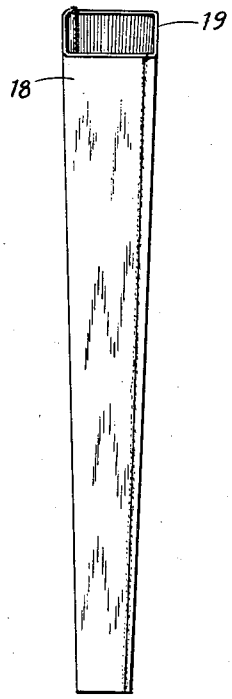


Fig. 13.

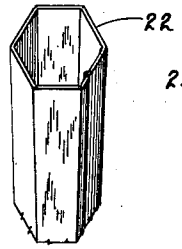


Fig. 14.

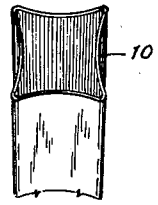


Fig. 15.

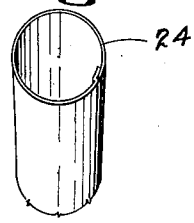


Fig. 16.

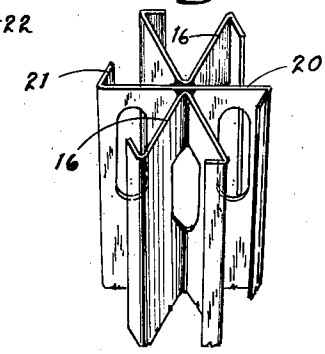


Fig. 17.

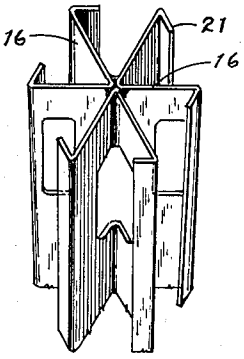


Fig. 18.

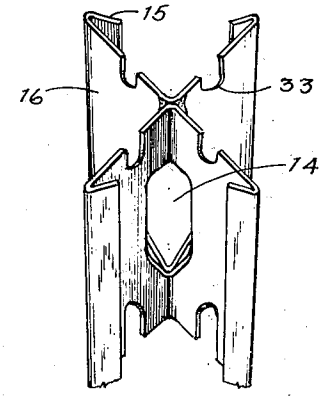
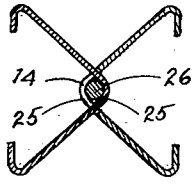


Fig. 20.



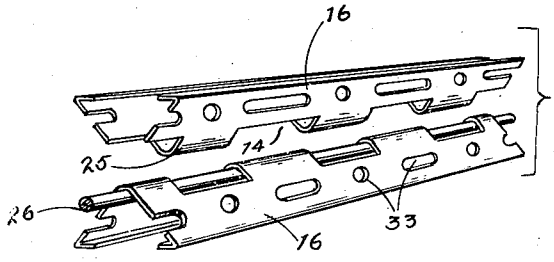


Fig. 19.

Fig. 21.

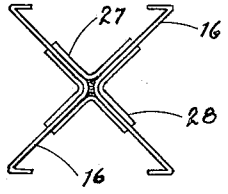
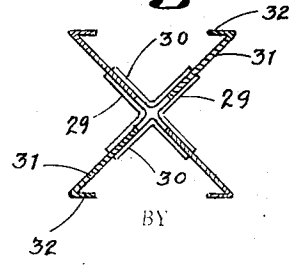


Fig. 22.



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Patented Apr. 30, 1940 2,198,985

UNITED STATES PATENT OFFICE

2,198,985

STEEL PILE STRUCTURE

Alonzo W. Bailey, Cleveland, Ohio

Application August 19, 1938, Serial No. 225,745

3 Claims. (Cl. 61—53)

This invention relates broadly to fabricated steel piles and more specifically to an improved pile structure which comprises a composite structural steel column constructed to resist the driving loads imposed thereon and formed for the support of a tubular sheet metal shell.

One of the objects of the invention is to provide a steel shaft frame work, formed from rolled steel plate sections which are fabricated to constitute a reinforcing medium for the concrete core of the pile.

Another object of the invention is to provide a pile embodying a sheet metal casing and a structural steel core, both of which are so constructed as to accommodate the ready assembly thereof and the economic production of the pile.

Another object of the invention is to provide a pile core which is formed with divergent webs having transverse apertures thereon to facilitate the anchorage of the concrete poured within the pile casing after the pile has been driven.

Another object of the invention is to provide a core member which is formed to accommodate the affixation of the steel driving point and the shell in such a manner as to obviate the use of the mandrel customarily employed in driving thin walled tubular piles of this character.

Another object of the invention is to provide structural steel shaft encased with a shell adapted for the reception of a material which will form a monolithic core structure, the shaft constituting the reinforcing element for the core.

Another object of the invention is to provide a pile core structure formed from rolled and fabricated steel plates so fashioned as to facilitate the ready assembly of the members with each other and with the shell mounted thereon.

Other objects more or less ancillary of the foregoing and the manner in which all the various objects are realized will appear in the following description which, considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention.

As illustrated in the accompanying drawings, Figure 1 is an elevational view partially in section of one form of the improved pile, the drawing including a driving anvil mounted in operative position upon the upper end of the pile.

Figure 2 is a transverse section of the pile illustrated in Figure 1, the section being taken on a plane indicated by the line 2—2 in Figure 1;

Figure 3 is a similar transverse section of the pile shown in Figure 1, a section being taken from the plane indicated by the line 3—3 of Figure 1;

Figure 4 is an elevational view of a shell of the character shown in Figure 1, a portion of the end thereof being broken away and shown in section;

Figure 5 is a plan view of the shell shown in Figure 4;

Figure 6 is an elevational view of a core blank member of the type shown in Figure 1, the drawing illustrating the form of the core blank after it is fabricated and flanged but before it is rolled in configuration of a V-bar structure or angle iron;

Figure 7 is a plan view of the partially formed blank shown in Figure 6;

Figure 8 is a slide elevational view of the core blank illustrated in Figure 6 after it is rolled in configuration of a V-bar or angle iron;

Figure 9 is a plan view thereof;

Figure 10 is an elevational view of the core after the members thereof are bent and welded in assembled relation;

Figure 11 is a plan view of the assembly of the core member shown in Figure 10;

Figures 12, 13, 14 and 15 are modified forms of the shell or pile casing;

Figure 16 is a modified form of a core assembly adapted for use with pile casings of the type shown in Figure 13. In this structure the core members embody a pair of opposed angle irons having a Z-rail disposed between the vertices of the V-sections;

Figure 17 is a modified form of a similar core structure to that shown in Figure 16, but formed of three angle iron sections welded together along their vertices;

Figure 18 is a view in perspective of a fragmentary portion of a core similar to that illustrated in Figure 1, showing another form in which the blanks may be pierced and illustrating the appearance of the welded connection between the V-bar members;

Figure 19 is a view in perspective of a pair of angle irons fabricated to facilitate the assembly thereof with a rod interlaced between the tongue and slot structure formed in the vertices of the rails;

Figure 20 is a transverse sectional view of the rails and rod shown in Figure 19;

Figure 21 is a plan view of a modified form of a core structure of the type shown in Figure 1, the core members being united in this case by angle iron clips welded to the inner and outer faces of the V-bars adjacent the vertices thereof; and

Figure 22 is another modified form of the core structure of the type shown in Figure 1, the

assembly embodying a plurality of rails having flanged end portions assembled in cruciform relation by angle gusset plates welded to the opposed faces of the convergent ends of the rails.

Referring first to Figure 1, the pile comprises a shell 10 which encases a core 11 having a shoe or tip 12 mounted on the end thereof. The core members are preferably constructed from blanked plates or steel strips 13 suitably pierced along their medial axes to provide openings 14 which may be arranged in contiguous relation upon assembly of the core unit. The strips 13 are also constructed with flanges 15 in their marginal edges to provide bearing faces for the support of the casing member or shell 10. The pile core blanks may be rectangular as shown in Figure 1 or sheared to form a section having slightly tapered side walls as illustrated in Figure 6, the blanks of either form being rolled or bent along their medial axes to form a rail of suitable angular configuration to accommodate the support of the type of shell contemplated for use therewith. The strips or rails 13 thus formed are then arranged with the vertices thereof disposed in opposed relation so that the stock intermediate the apertures 14 in each member may be welded together to form a structure of cruciform cross section. As will be seen by comparison of the drawings illustrating the flanges 15, the end portion of the core members are bent at suitable angles to facilitate the welded connection of the shell 10 thereto. The shell may be constructed, as shown in Figure 5, from a single strip of sheet steel having the marginal edges thereof overlapped and welded along the seam 17 or, if desired, may be formed of a plurality of strips 18 and 19 welded along their marginal edges as shown in Figure 12. In the construction of the longer piles the core members are arranged in end to end relation and butt welded, the shell sections in such structure being overlapped and welded or abutted and reinforced by overhung strips or bands welded thereto. In the construction of piles which are intended for use in relatively hard material or subjected to heavy driving strains the core is formed with a greater number of divergent ribs or veins than provided by the structure illustrated in Figure 1. The construction of such a core member contemplates the use of a plurality of V-rails 16 arranged with their vertices disposed along a common axis as shown in Figure 17, or as illustrated in Figure 16 the vertices of the V-rails 16 may be welded to the Z-bar 20 along the medial axis thereof. The flanges 21 in the free ends of such core members may be bent to accommodate the support of the hexagonal shell 22 illustrated in Figure 13, or the cylindrical shell 24 illustrated in Figure 15.

In the embodiment illustrated in Figure 19 the rails are fabricated with rectangular apertures 14 arranged in staggered relation in the respective sections of the assembly so that the tongues or loops 25 defined by the stock intermediate the apertures may be inserted within the apertures of the opposed rail and the two members united by a rod 26 interlaced within the loops. If desired the engaged parts of the hinge structure thus formed may be welded, at intervals, to prevent displacement of the rod and relative movement of the rails.

The connection between the V-rails 16 may be reinforced or formed in its entirety by angle clips or rails 27 welded to the outer faces of the veins of opposed pairs of V-rails 16 as shown in Figure 21, and further reinforced with angle irons 28 welded upon the inner faces of the V-rails adjacent the vertices thereof.

Although the core sections disclosed in the foregoing contemplate the use of V-rails or commercial structural angle irons, it is obvious that a core member having divergent veins may be constructed by enclosing the lineal edge of plates between the flanges of angle irons arranged with the vertices of the angles disposed in parallel relation. Thus, as shown in Figure 22 the angle irons 29 and 30 support the plates 31 through a welding connection between the flanges of the angles and the inner marginal edges of the plates. As in the former embodiments the free ends of the divergent plates are formed with flanged edges 32 which may be bent to facilitate the support of a shell of any desired configuration. In the fabrication of the core blanks included in the foregoing forms the apertures 14 may be of any size or configuration which will accommodate an unrestricted flow of the concrete therethrough. The apertures, however, should be disposed in such a manner as to preserve the strength of the material under the longitudinal load imposed thereon during the driving operation of the pile.

The divergent veins of the piles illustrated in Figures 21 and 22 are formed with apertures in the outer edge thereof similar to the openings 33 in Figure 19 to facilitate the anchorage of the concrete with the structural iron reinforcing members or the core.

The shoe or driving tip 12 is preferably formed with a recess 34 of suitable proportions to accommodate the reception of the end portion of the core and to facilitate a welded connection between the engaged members of the assembly. The shoe may, if desired, be formed with a transverse opening 35 communicating with the recess 34 in order to permit the concrete to flow therethrough and form in certain types of strata a bulbous end upon the pile.

The pile may be driven by an anvil 36 having radial grooves therein formed in configuration of the transverse section of the core member and adapted to telescopically engage the upper end of the core member and shell 10. The upper end portion 37 of the anvil may be of any configuration which will accommodate the type of hammer or driving rig employed in setting the piles.

After the piles are driven and the anvil 36 removed the shell is filled with concrete, which will flow through the apertures in the core veins and be bonded therewith, thus forming, when hardened, a monolithic structure reinforced by the steel core member.

It is recognized, in concrete construction work that a superior product may be attained if the forms or concrete casing are agitated or vibrated after the mixture has been poured, but before it is set. To date, however, such practice could not be used in pile installation work as none of the commercially known concrete pile shell were formed to accommodate the application of a vibrator or mechanism for effectuating the agitation of the filler. It is readily apparent that with the improved pile structure disclosed herein the anvil 36 may be replaced or a mechanical vibrator attached to the core when the casing is filled or partially filled with concrete and the entire pile structure suitably tapped or pounded to assure dissipation of air from the mixture and the flow of concrete in and about the fabricated metal frame work of the core.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. A pile comprising a sheet metal shell, a fabricated steel core, a driving shoe on said core, and a concrete filler in said shell, said core comprising a plurality of vertically disposed plates having apertures therein to facilitate the flow of concrete therethrough and a plurality of veins formed for the support of said shell, said driving shoe having a transverse opening extended therethrough communicating with the interior of said shell for the reception of said concrete filler.

2. A pile comprising a sheet metal shell, a fabricated steel core, a driving shoe on said core, and a concrete filler in said shell, said core comprising a pair of relatively heavy structural angle irons adapted to resist the driving blows to which the pile is subjected during the setting thereof, said angle irons being welded together along their vertices and having apertures therein to facilitate the flow of said concrete filler therethrough, the upper end of said shoe having a recess therein, the end of said core being seated in said recess, said shell being welded to the longitudinal edges of the angle irons forming said core and welded to said shoe.

3. A pile embodying a shoe, a core and a shell supported thereby, said core comprising a pair of rolled V-bars having apertures therein disposed in staggered relation in the vertices of each bar, the stock intermediate the aperture in one bar being inserted in the aperture in the other bar, a rod within and extending through the portions of each bar projecting through said apertures, said shoe having a recess in the end portion thereof, said core being seated in said recess and being welded to said shoe.

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