Oct. 17, 1933. E. BURKHARDT 1,931,249

PILE

Filed April 23, 1929

Fig. 1

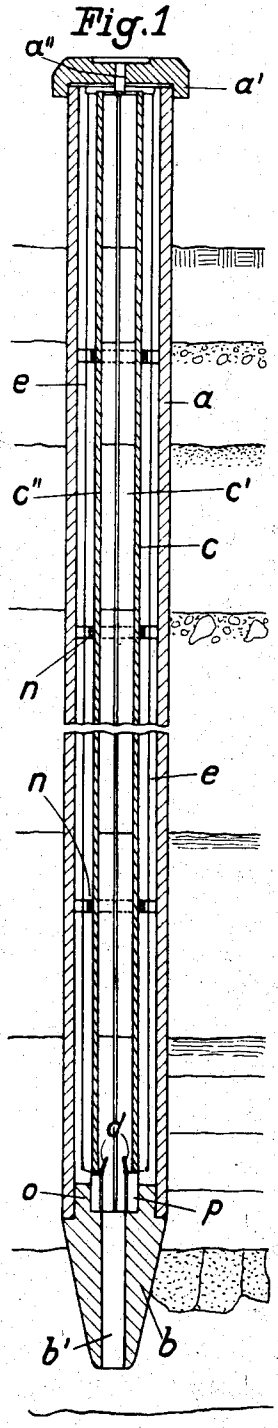


Fig. 2

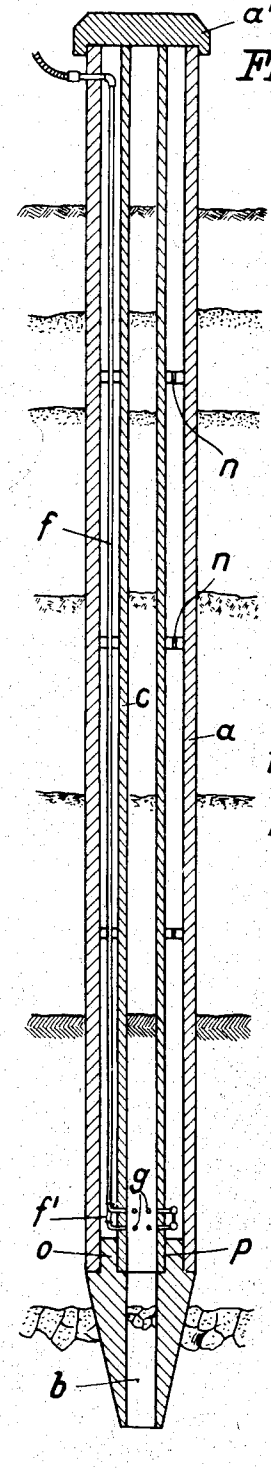
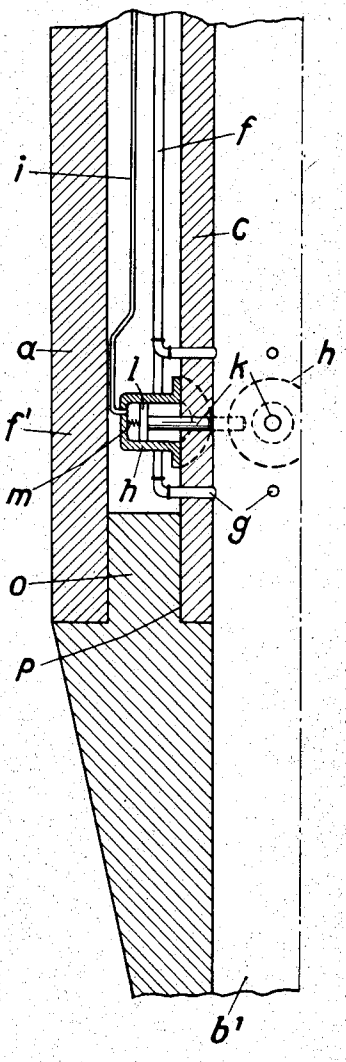


Fig. 3



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Patented Oct. 17, 1933 1,931,249

UNITED STATES PATENT OFFICE

1,931,249

PILE

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Application April 23, 1929, Serial No. 357,596, and in Germany May 8, 1928

7 Claims. (Cl. 61—53)

The present invention relates to a method and apparatus for ground drilling and more particularly to a driving pile and method of driving the same whereby the exact nature and occurrence of the ground strata may be accurately determined.

Previously known driving piles and methods for driving the same employ open shafts and are limited in that the driving is rendered expensive, troublesome and time consuming and can only be accomplished at relatively shallow depths, especially when subterranean waters are encountered. Also if special rotary boring machinery is used to effect the drilling, it will be found that the continuity and structure of the stratification will be disarranged as a result of this manner of excavation and this is more particularly true if the drilling is being effected in the presence of underground waters.

The principal object of the present invention is the provision of a driving pile and a method of driving the same whereby the driving may be effected rapidly and advantageously at the same time rendering it possible for the operator to readily examine undisturbed cross-sections of the ground strata so that the geological composition, supporting and chemical properties of the ground, nature of subterranean waters and the chemical admixtures thereof, may be easily and accurately determined.

Other objects of the invention will be apparent to skilled workers in the driving pile art as the description of my improved method and apparatus proceeds hereinafter.

The apparatus of the invention comprises a hollow pipe and concentric examining tube abutting on a driving point with a central bore coaxial with said examining tube. The examining tube is provided with means to effect closing of its lower end, may be readily removed from the hollow pile and is adapted to be parted longitudinally after removal to allow inspection without disturbance of its contents. This apparatus is driven into the ground in a suitable manner, the closure means for the bottom of the examining tube operated, the examining tube is withdrawn, opened longitudinally and inspected.

The accompanying drawing illustrates several embodiments of the apparatus of the invention and similar elements are designated by like reference characters thereon.

Figure 1 shows a longitudinal vertical cross-section of the apparatus illustrating the various strata of the ground.

Figure 2 shows a longitudinal vertical cross-section of the apparatus with a modified form of closure means for the examining tube.

Figure 3 shows a partial vertical longitudinal cross-section of still another closure means for the lower end of the examining tube.

A hollow pile *a* engages, at the lower end thereof, a restricted portion *o* of a conical driving point *b* which is provided with a central bore *b'*. A driving anvil *a'* caps said hollow pile *a* and is provided with a central hole *a''* for sounding purposes.

An examining tube *c* is concentrically positioned within said hollow pile *a* and comprises semi-cylindrical halves *c'* and *c''*. Said examining tube *c* is held in spaced relation to said hollow pile *a* by means of a plurality of brackets *n* and its lower end enters a recessed portion *p* of the conical drill point *b* so that the central bore *b'* thereof and the interior of the examining tube *c* form a continuous conduit.

Semi-circular flap valves *d* are hingedly and interiorly mounted at the lower ends of the semi-cylindrical halves *c'* and *c''* of examining tube *c*. Rods *e* are attached to said flap valves *d*, extended between examining tube *c* and hollow pile *a* to the top thereof and are adapted to close flap valves *d*, see Figure 1.

The lower end of examining tube *c* may be closed by hardening the core of material therein. A plurality of holes *g* are provided in said lower end of said tube *c*, see Figure 2, and are interconnected and connected in the space between tube *c* and pile *a* by feeding tubes *f'* and *f*, respectively. Appropriate chemicals or refrigerating substances may be introduced through feeding tubes *f* and *f'* to harden the material and frictionally hold the same undisturbed within tube *c* during withdrawal thereof.

The hardened portion of the core of material within tube *c* may also be held mechanically as well as frictionally, see Figure 3. A plurality of cylinders *h*, preferably four in quadrature, are fastened to the lower exterior of examining tube *c*. A piston *l* is slidably placed in each of cylinders *h* and is guided by a pin *k* which passes through the wall of tube *c* and which is adapted to enter the interior thereof. A spring *m* acting between the head of cylinder *h* and piston *l* holds the pin *k* in retracted position. A pipe *i* is connected to the head of each cylinder *h* and is adapted to allow the creation of a hydraulic or pneumatic pressure on piston *l* for driving the pin *k* into the hardened portion of the core as shown in dotted lines in Figure 3.

The driving operation according to the present invention is effected as follows:

The hollow pile *a*, said driving point *b* and examining tube are assembled and capped by the driving anvil *a'*. The whole assembly is driven by a ram or pile driver (not shown) striking the driving anvil *a'*, through the various strata of the ground shown in Figures 1 and 2. During the driving of said assembly the various strata of the subsoil enter into the conduit formed by the bore *b'* and examining tube *c*.

To determine the nature of the ground through which the driving is being effected the lower end of tube *c* is closed by closing flap valves *d*, by hardening or freezing the core of material or by hardening and traction of pins *k*. Whereupon the tube *c* is withdrawn and one-half thereof removed to reveal to the operator very accurate evidence as to subterranean conditions.

If more driving is necessary tube *c* may be cleaned and replaced so that driving of the assembly may be continued as desired. Upon completion of driving the tube *c* is removed while pile *a* and driving point *b* may be left in the ground as a supporting pile.

It is within the contemplation of the invention that the ground may be of such a nature that the determination of the nature of the ground and driving may be carried out with the examining tube *c* only.

Having now particularly described my invention what I desire to secure by Letters Patent of the United States and what I claim is:—

1. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination with a hollow bored driving point and a driving anvil; of a pair of concentrically disposed tubes the outer one of which is normally rigid with said driving point but loosely connected with said driving anvil, the inner tube of said pair being separately arranged with a space about the same within the outer tube and forming interiorly a uniform continuation of the bore of said driving point and being longitudinally divided in order to provide for inspection in undisturbed condition of a core of subsoil within said inner tube upon withdrawal thereof from the outer tube and removal of one section of said inner tube and means near the lower extremity of said inner tube for securely closing the same and thereby retaining said core of subsoil intact within the same, an operating device therefore actuated from the upper portion of the pile preparatory to the withdrawal of said inner tube; said retaining means comprising feeding pipes to introduce a hardening substance to harden a portion of the subsoil, said pipes being arranged in the intermediate space between the tubes and leading to a plurality of holes near the lower extremity of said inner tube.

2. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination with a hollow bored driving point and a driving anvil; of a pair of concentrically disposed tubes, the outer one of which is normally rigid with said driving point but loosely connected with said driving anvil, the inner tube of said pair being separately arranged with a space about the same within the outer tube and forming interiorly a uniform continuation of the bore of said driving point and being longitudinally divided in order to provide for inspection in undisturbed condition of a core of subsoil within said inner tube upon withdrawal thereof from the outer tube and removal of one section of said inner tube and means near the lower extremity of said inner tube for securely closing the same and thereby retaining said core of subsoil intact within the same, an operating device therefore actuated from the upper portion of the pile preparatory to the withdrawal of said inner tube; said retaining means comprising feeding pipes to introduce a hardening substance to harden a portion of the subsoil, said pipes being arranged in the intermediate space between the tubes and leading to a plurality of holes near the lower extremity of said inner tube upon withdrawal thereof from the outer tube and removal of one section of said inner tube and means near the lower extremity of said inner tube for securely closing the same and thereby retaining said core of subsoil intact within the same, an operating device therefore actuated from the upper portion of the pile preparatory to the withdrawal of said inner tube; said retaining means comprising feeding pipes to introduce a hardening substance to harden a portion of the subsoil, said pipes being arranged in the intermediate space between the tubes and leading to a plurality of holes near the lower extremity of said inner tube, a plurality of fluid operated means engaging the hardened portion of the subsoil core.

3. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination with a hollow bored driving point and a driving anvil; of a pair of concentrically disposed tubes, the outer one of which is normally rigid with said driving point but loosely connected with said driving anvil, the inner tube of said pair being separately arranged with a space about the same within the outer tube and forming interiorly a uniform continuation of the bore of said driving point and being longitudinally divided in order to provide for inspection in undisturbed condition of a core of subsoil within said inner tube upon withdrawal thereof from the outer tube and removal of one section of said inner tube and means near the lower extremity of said inner tube for securely closing the same and thereby retaining said core of subsoil intact within the same, an operating device therefore actuated from the upper portion of the pile preparatory to the withdrawal of said inner tube; said retaining means comprising feeding pipes to introduce a hardening substance to harden a portion of the subsoil, said pipes being arranged in the intermediate space between the tubes and leading to a plurality of holes near the lower extremity of said inner tube, a plurality of fluid operated pistons and pins normally retracted and adapted to be impressed into the interior of said inner tube and the hardened subsoil therein.

4. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination, with a hollow bored driving point and a driving anvil, of a pair of concentrically disposed tubes of which the outer tube is rigid with said driving point but loosely connected with said driving anvil, while the inner tube of said pair is separately arranged in the outer tube and both split throughout its length and provided at its lower end with a closing device which may be actuated from above for securely closing the lower end of the inner tube, in order that after the tubes have been driven into the subsoil, the outer tube may rest in the subsoil while the inner tube may be withdrawn from it for inspection of the securely enclosed and undisturbed core of subsoil in said inner tube.

5. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination, with a hollow bored driving point and a driving anvil, of a pair of concentrically disposed tubes, of which the outer tube is rigid with said driving point but loosely connected with said driving anvil, while the inner tube of said pair is arranged with a space about the same within the outer tube and both split throughout its length and provided at its lower end with a closing device adapted to be actuated

from above, an actuating device being adapted to be arranged in the intermediate space between the tubes for securely closing the lower end of the inner tube in order that after the tubes have been driven into the subsoil, the outer tube may rest in the subsoil while the inner tube is withdrawn from it for inspection of the securely enclosed and undisturbed core of subsoil in said inner tube.

6. A pile for direct driving into the subsoil and raising a sample core with an undisturbed inner structure for determining the nature thereof, comprising a hollow pile, a driving anvil placed upon said pile, a driving point secured to said pile and provided with a bore, an examining tube, which is separately removably arranged with an intermediate space about said tube within said pile and which rests directly on said driving point within the same, to form a practically continuous and uniform conduit with the central bore thereof, said examining tube consisting of two semi-cylindrical members, and retaining means associated with said examining tube to securely close its lower end and thereby to retain a core of subsoil intact therein, said means being provided with an operating device arranged in the intermediate space between the tubes and actuated from the upper portion of said pile preparatory to the withdrawal of the examining tube.

7. A pile for direct driving into the subsoil and for determining the nature thereof, including the combination with a hollow bored driving point and driving anvil, of a pair of concentrically disposed tubes, of which the outer tube is normally rigid with said driving point but loosely connected with said driving anvil, the inner tube of said pair being separately arranged with a space about the same within the outer tube and forming interiorly a practically uniform continuation of the bore of said driving point and being longitudinally divided in order to provide for inspection in undisturbed condition of a core of subsoil within said inner tube upon withdrawal thereof from the outer tube and removal of one section of said inner tube and means at the lower end of said inner tube for securely closing the same and thereby retaining said core of subsoil intact within the same and an operating device therefor actuated from the upper portion of the pile preparatory to the withdrawal of said inner tube, said retaining means comprising flap valves and rods arranged in the intermediate space between the tubes and actuating said flap valves from the upper portion of the pile to close said inner tube preparatory to the withdrawal of the same.

EMIL BURKHARDT.