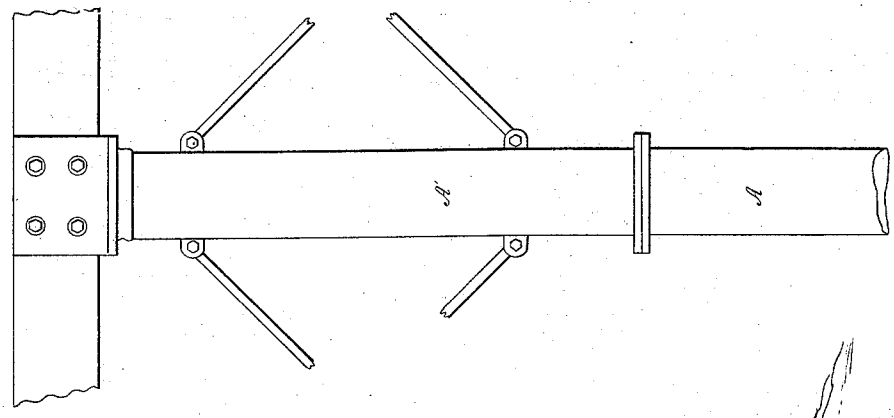
S. J. Seely.

Pile Driver.

No. 44,761. Patented Oct. 18, 1864.

Fig. 4



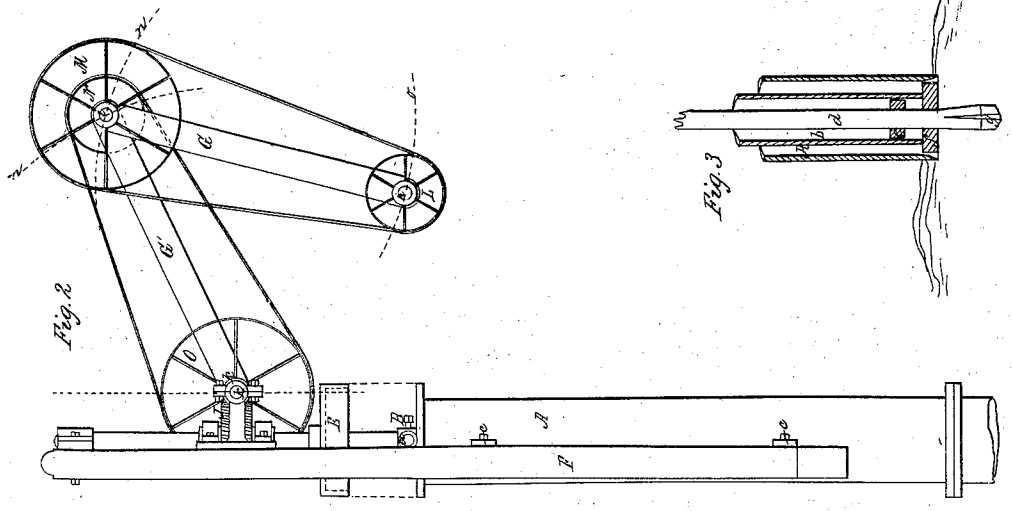
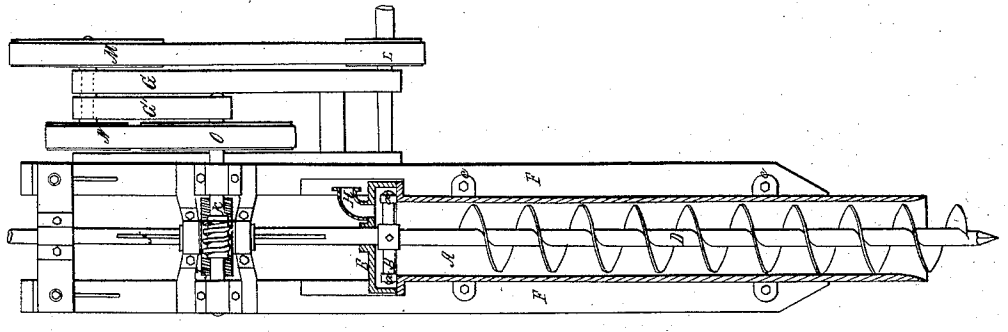


Fig. 2

Fig. 3

Fig. 1



Witnesses;
L. B. Volk
A. I. Millard

Inventor;
Saml J. Seely

UNITED STATES PATENT OFFICE.

SAMUEL J. SEELY, OF NEW YORK, N. Y.

IMPROVED MODE OF SINKING PILES.

Specification forming part of Letters Patent No. **44,751**, dated October 18, 1864.

To all whom it may concern:

Be it known that I, SAMUEL J. SEELY, of the city, county, and State of New York, have invented certain new and useful Improvements in Setting Iron Piles and in the Mode of Securing Pile Foundations; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the annexed drawings, making part of this specification, and to the letters and figures of reference marked thereon, similar letters of reference representing corresponding parts.

The nature of my invention consists in the use of a metallic tube, usually of a cylindrical form; but I do not confine myself to any particular form of tube with appropriate fastenings for attaching it to a rock bed, and also fitted and adapted to support and guide a borer or screw, and to set down the pile by excavating, boring, or pressing away from beneath its base the earth or material obstructing its downward movement, and also fitted with a cap making an air-tight joint with the flanged head of the pile with openings through which the air, wind, and water within the tube may be forced or sucked out, as the case may require, so constructed as to enable a vacuum to be formed within the tube when atmospheric pressure is used to set down the pile; and also to receive any mechanical force applied either alone or as an auxiliary in driving or pressing down the pile.

To enable others skilled in the arts to which my invention appertains to make and use the same, I will proceed to describe its construction and operation.

A A′ represent a metallic tube of any required form, size, or length, usually made of cast-iron, but capable of being made of other metallic substances. The lower edge of the tube is sharp, so as to cut readily through earth or gravel, as shown at A, Fig. 1. The upper end of the tube is flanged for the purpose of receiving and attaching the cap E, and also for the purpose of connecting together additional lengths when a single length is insufficient, and for connecting the pile with the superstructure to be placed upon it.

CC are lugs, four in number, on each length of the tube, two above and two below, cast on the outer surface of the tube with holes through them to attach to them the frame F, by means of bolts, hooks, or screws, and also as points of attachment for rods, braces, or beams forming part of the structure with which the pile is to be connected. After having placed the pile perpendicularly over the position on which its foot is intended to rest when in place, I attach to it, by means of the lugs, the frame F, consisting of two upright pieces braced by one or more cross-pieces, to which is attached the driving-gear of the borer hereinafter described.

The borer D is attached to the driving-gear by means enabling it to be removed from its position without detaching the driving-gear from the frame F, the object of its removal being to substitute a screw of a greater or less pitch of thread according to the material to be excavated, and where rock is to be penetrated to enable a drill to be used in its stead. The screw-borer consists of a rod carrying one or more turns of a thread of such form as may best adapt it to the character of the materials to which it is to be applied. The diameter of the screw-borer should be as near that of the interior of the pile as practicable, due regard being had to avoiding friction, so as to enable it to clear the interior of the pile of mud and the other materials excavated.

The shaft of the screw-borer may consist of lengths screwed together, and when of great length a few turns of the thread may be attached at different heights to its shaft to facilitate the action of removing the excavated material. The borer-shaft is provided with a feather, *j*, by which it is driven by the wheel J.

Different forms of borers may be conveniently adopted under circumstances of variation in the size of the pile, and the character of the material through which it is to be forced. In certain cases it may be found most serviceable to use a borer with a conical end, or its equivalent form, filling the cavity of the tube at the lower end, as nearly as may be, with due regard to avoiding friction, such borer to act as a drill or punch, so as to separate the earth below the pile merely, not permitting it to pass into the interior of the tube.

Under other circumstances a form of screw may be adopted acting the reverse of a screw-borer, as above described—that is to say, its cutting-planes so adapted as to push the material aside and force a vertical opening for the passage of the pile.

The borer-shaft is connected with the pile

by means of the cross-arm B, which is attached to the shaft by means of a set-screw or other equivalent means, so that its height upon the shaft may be varied at pleasure, to enable the borer to extend to such depth below the pile as may be required. This arm is provided with friction-rollers *a*. *a* at each extremity, resting, when in action, in the flanged head of the pile. The object of this arm is to transmit to the pile the downward pressure resulting from revolving the screw-borer as a means of drawing down the pile.

The cap E is movable, being secured by screws or other suitable means to the flanged head of the pile, having an opening for the borer-shaft, and making, with the flanged head and the borer-shaft, air-tight joints. It is also fitted with a nozzle, H, of suitable size to allow the materials excavated by the screw-borer to pass through it. I have represented this nozzle as bent to a horizontal position, for the conveniences of attaching to it a centrifugal or other suitable pump; but its position will be affected by the shape that may be given to the cap, whether flat, arched, or cylindrical. I have shown the form of gearing, which I regard as the most advantageous for revolving the borer, which consists of the stationary pulley L, worked by the engine, the movable pulleys M, N, and O attached to the elbow-lever G G′, which has a motion on the center *h*, on which it swings, as indicated by the red line *n*, while G, the portion of the elbow-lever connected with the pile, has an additional motion on center *i*, as indicated by the red line *l*, enabling it to follow the motion of the pile. The pulleys M and N being fastened on the same shaft, the motion of the stationary pulley L is transmitted to the movable pulley O.

The immediate driving-gear consists of a worm or screw, K, attached to an axle carried by the movable pulley O, which works into corresponding teeth on the wheel J, communicating its motion to the borer-shaft by means of a splined groove corresponding to the feather of the shaft.

Fig. 3 represents the mode of attaching the pile to a rock bottom, consisting in drilling into the rock in continuation of the cylindrical interior of the tube, and inserting the plug *d*, split at its lower end and carrying a wedge, *g*, which, acting on the bottom of the drilled hole, spreads the foot of the plug, so as to anchor the plug firmly to the rock.

The apparatus for connecting the plug to the pile, so as to anchor the pile, consists of a disk, *f*, permanently attached to the plug intended to center the pile upon the plug, and therefore fitting as closely as practicable to the inner surface of the pile; also, the disk *e*, attached permanently to the plug at an elevation above the disk *f*, varying according to the circumstances of the case. The diameter of the disk *e* should be less than that of the interior of the tube, its object being to anchor the plug to the cement, concrete, or other substance with which the tube is to be filled.

Instead of the disk *e*, projecting points may be attached to the shaft of the plug at different elevations, which, when embedded in the filling, will serve to attach the pile to its plug.

In order to give additional security to the superstructure supported by the pile, the plug *d* may be elongated, so as to form a continuous shaft extending upward through the center of the pile to a point of attachment with such superstructure, or to where it may be conveniently riveted or bolted to the pile itself.

After having sunk the pile to a sufficient depth, I withdraw the borer, and if upon a rock bottom I proceed to anchor the pile, as hereinbefore described. I then fill the cavity of the pile with cement, mortar, concrete, or other substance that will set or harden, so as to form a solid support to the superstructure, and at the same time stiffen the pile. Before the cement or other filling begins to set or harden I usually subject it to pressure, varied according to circumstances, the effect of which is to thoroughly fill the pile and to force the filling underneath the bottom of the pile, so as to form a mass around its bottom. This pressure may be applied by reversing the action of the screw, or by the use of a rotary or other pump.

Having set the pile so that an interval is left between the top of the pile and the bottom of the superstructure, I prepare a metallic tube of the same diameter as that of the pile, flanged at its bottom to be attached to the flanged head of the pile, and having at its upper extremity a chair cast upon it of suitable form to support and be attached to the superstructure. This tube is fitted with lugs or points of attachment and support for rods or braces running to any part of the superstructure requiring support.

It may be convenient in many cases, when the borer is likely to anchor itself firmly in the bottom, to attach a revolving drum to the frame F, which may be used for raising the borer or for forcing down the pile, as the case may be, the connection between the drum and the borer in this case being a chair attached to the borer-shaft, or any other suitable driver accomplishing the same substantial result.

The mode of operation above described has manifest advantages over any plan of sinking hollow iron piles heretofore practiced. It is adapted to piles of comparatively small diameter, within which all other modes of excavation would be impracticable. It may be employed with or without atmospheric pressure.

Should the diameter of the pile be of sufficient dimensions to make atmospheric pressure available, the air-tight cap and the nozzle to which an air-pump may be readily adjusted admit of its easy application.

Inasmuch as it is within the power of the operator to raise or lower the screw at any

time relatively to the pile by simply adjusting the height of the arm B on the borer-shaft advantage may be taken of all descriptions of rails, so that in a soft bottom the screw may be permitted to embed itself deeply below the foot of the pile, while in hard soils a much less penetration below the pile may be permitted. By these means a hold may be obtained on the bottom capable of serving as a means of pressing the pile downward, the power in this case being applied to rotate the drum, which, resting for support on the pile, would tend to thrust down the pile until the resistance offered by the pile was greater than that requisite to raise the borer.

The above-described plan offers peculiar advantages for anchoring the work to a rock bottom, as well as for making an artificial bottom when the soil is necessarily loose at the foot of the pile. In the former case plugs of various forms and modes of operation may be employed, substantially as above described, adapting the foundation to different classes of structure subjected to varied kinds of strain. A short plug filled in with cement or other suitable substance capable of being introduced in a liquid or semi-liquid state and of afterward hardening, may be employed when no great upward tension is anticipated; but when that form of strain is to be expected a continuous rod or shaft, plugged at the bottom and connected with the superstructure, may be employed, acting as a cord or tie, the space between that and the sides of the pile being filled with concrete. In addition to these modes of security, when rock foundations are obtained the use of forcing cement through the tube is to form a solid mass of cement in and around the foot and sides of the pile, equalizing any irregularities that may exist in the surface of the rock acting as a bearing-surface to the pile, thus giving equal support to all parts of the foot of the pile, and also forming an additional security against any alteration of the position of the pile on the rock bottom.

When the material beneath the pile is of an earthy or gravelly nature an additional advantage is derived from the application of pressure to the cement, inasmuch as by raising that pressure to a point equal to the test of strength required for the pile the cement may be driven out from the pile in a mass, which, when solidified, would constitute a secure foundation.

Instead of cement, concrete in many cases will be used, the choice between the two being determined in accordance with the nature of the soil and the size of the tubes. It is proper to remark that when cement is to be used in conjunction with a plug the lower disk should be perforated to permit its passage.

I do not claim a tubular pile; but

What I do claim as my invention, and desire to secure by Letters Patent, is—

1. The use of a borer or excavator constructed and operating, substantially as above described, within a tubular pile in order to facilitate the sinking of such pile by loosening, removing, or pressing aside earthy material or gravel from beneath or about the foot of the pile, and then withdrawing the borer and leaving the pile in place for the purpose of forming pile foundations.

2. The use of a screw-borer with an arm, B, resting on the pile or its equivalent to facilitate the sinking of tubular piles by applying the force generated by the rotation of the screw to draw down the pile, substantially as above described.

3. The formation of a cement or concrete or similar suitable foundation beneath or about the foot and sides of a tubular pile by the application of pressure to such cementing substance while in a soft state, so as to drive it through and out at the foot of the pile, substantially as above described.

SAML. J. SEELY.

Witnesses:

L. B. VALK,

A. I. WILLARD.