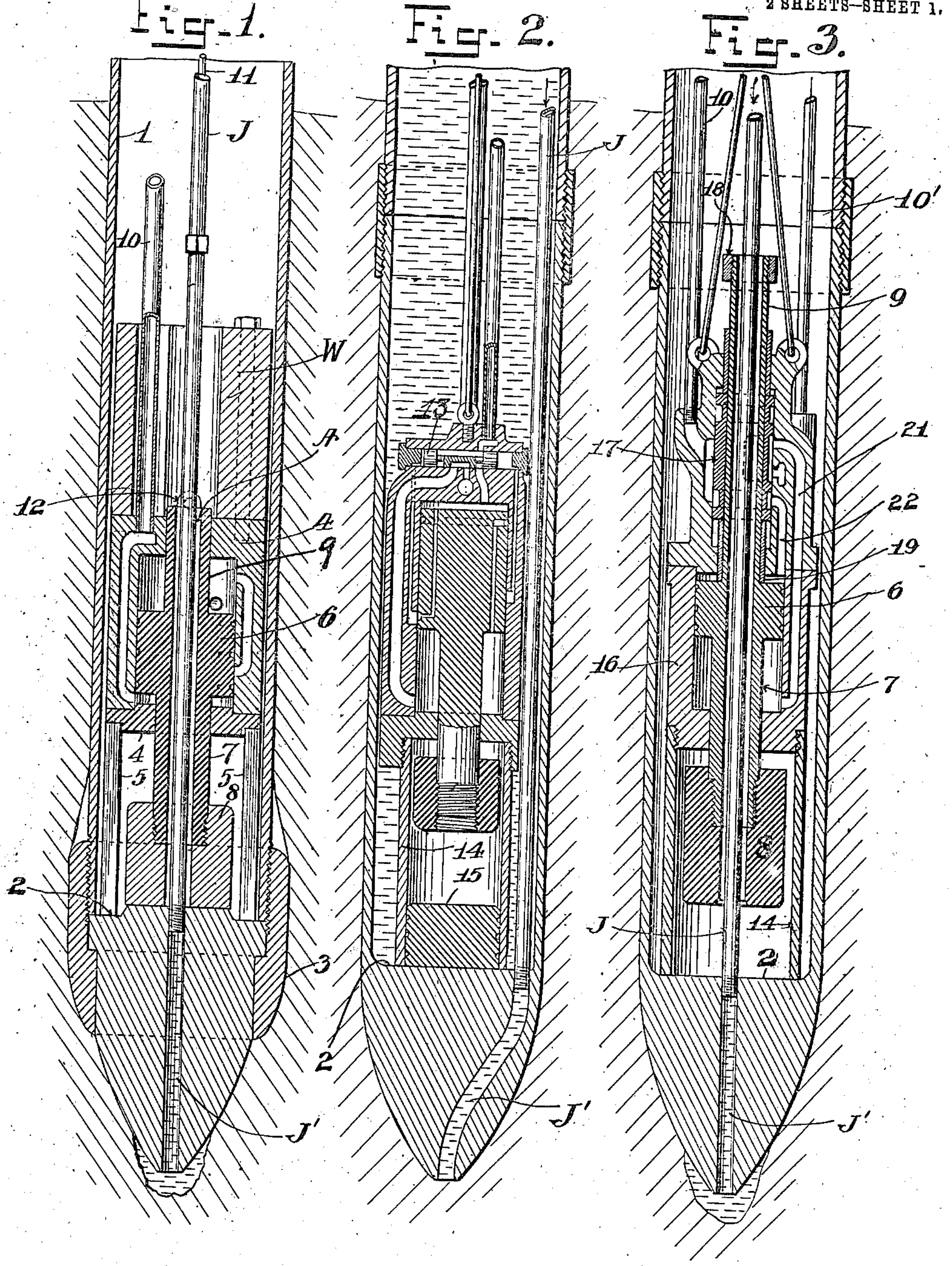
A. B. CLARK.

APPARATUS FOR SINKING TUBULAR PILES.

APPLICATION FILED SEPT. 5, 1905. RENEWED NOV. 18, 1909.

1,005,770. Patented Oct. 10, 1911.

2 SHEETS—SHEET 1.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 4.

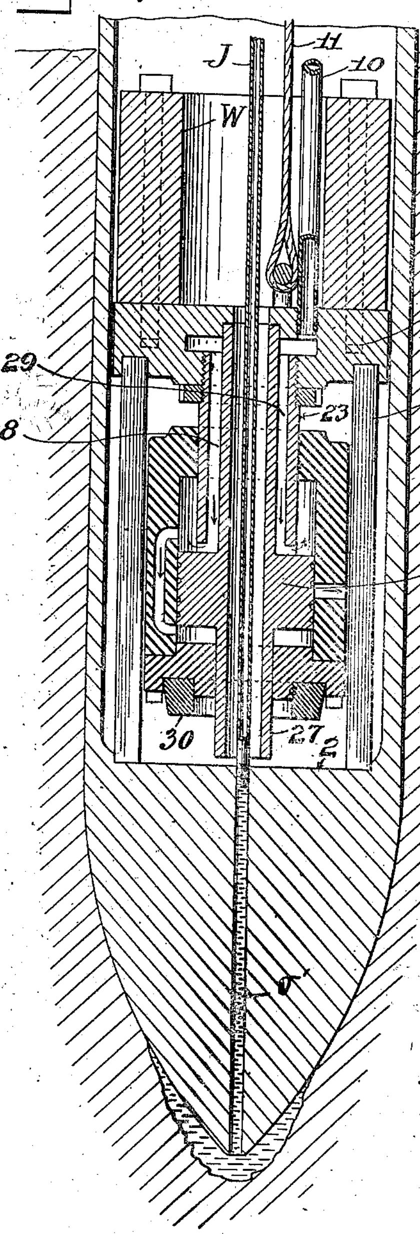
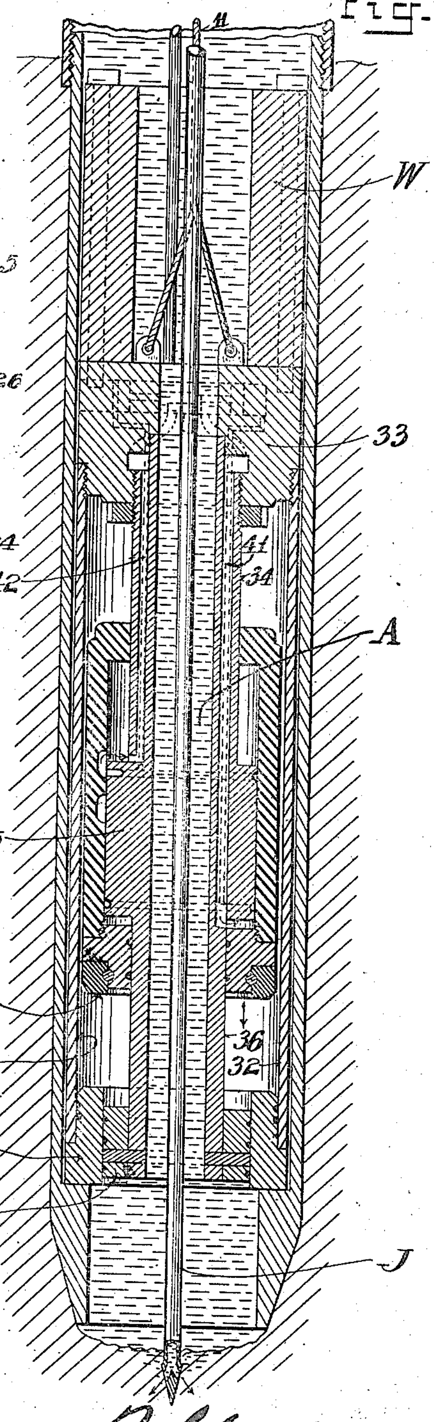


Fig. 5.



Witnesses

Amasa B. Clark Inventor

By his Attorneys

UNITED STATES PATENT OFFICE.

AMASA B. CLARK, OF NEW YORK, N. Y.

APPARATUS FOR SINKING TUBULAR PILES.

1,005,770. Specification of Letters Patent. Patented Oct. 10, 1911.

Application filed September 5, 1905, Serial No. 276,915. Renewed November 18, 1909. Serial No. 528,766.

To all whom it may concern:

Be it known that I, AMASA B. CLARK, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Sinking Tubular Piles, of which the following is a full, true, and concise specification.

My invention relates to apparatus for sinking tubular piles, and consists in the provision and construction of a self-contained motor-driven hammer mechanism which is adapted to be inserted within the pile and exert its driving force against the interior thereof, though it can be used elsewhere, the power for actuating the said mechanism being supplied by means of some suitable flexible connection from the exterior of the pile.

The invention also involves features of construction and arrangement of parts which will be hereinafter described and more particularly pointed out in the accompanying claims.

Referring to the drawings forming a part hereof, Figures 1 to 4 illustrate in longitudinal central section a number of machines embodying this invention in different forms, the said machines being each shown in operative position within their respective piles; Fig. 5 is a similar view of a machine more especially adapted for use in sinking open ended piles.

The tubular piles with which the present invention is intended to be employed are most conveniently formed of sections of pipe 1 coupled together as indicated. One of the sections, usually the lowermost, is formed with an interior transverse surface 2 upon which the apparatus may rest and against which it strikes to sink the pile.

In Fig. 1 the bearing surface is provided by a solid point coupled to the pipe section by means of a screw collar 3, but in Figs. 2—4 the head is shown as being integral with the lowermost section, and in Fig. 5 the pile is open ended but yet provided with a transverse ledge 2.

The form of pile sinking apparatus shown by Fig. 1 comprises a cylinder 4 which is formed and adapted to be inserted within the pile and supported therein upon the surface 2, by means of its legs 5, 5. The cylinder contains a piston 6 and piston rod 7 which carries on its exterior end a hammer 8, the latter being therefore adapted to reciprocate in the space between the legs and strike directly against the pile. The piston also carries a tail rod or extension 9 protruding through the upper head of the cylinder, and an aperture A is provided through the tail rod, the piston and the hammer, through which a wash or jet pipe J is adapted to be inserted and screwed into a tapped bore J′ in the solid point, as shown. The fluid pressure for operating the motor is supplied through the hose 10, and in the figure referred to is appropriately controlled to produce the reciprocation of the hammer by the movement of the piston itself within the cylinder, the arrangement of the ports for this purpose being according to the well-known principle of so-called valveless engines. A weight W may also be added to the apparatus, if desired, such weight being preferably of annular form so as to surround the protruding end of the tail rod 9 and not obstruct access to the central jet pipe aperture A. When the apparatus is to be employed, it is lowered into the tubular pile or into the first section thereof by means of the cable 11 fastened to the lug 12 on the cylinder, until the legs 5, 5 rest on the bottom of the pile. The motive fluid is then transmitted through the hose 10 and the blows struck by the hammer element against the interior of the pile serve to sink it into the ground in obvious manner. When circumstances require it, a stream of water may be forced through the jet pipe J and the bore J′, into the surrounding soil and by loosening the same, facilitate the descent of the pile. As the first or lowermost pile section descends, additional sections may be successively superposed and coupled together until the pile thus formed reaches its depth. At the same time that additional pile sections are added, the jet pipe may also be built up by connecting additional sections thereto or a flexible hose may be coupled to the pipe and paid out as the pile descends. At the completion of the sinking operation, the jet pipe J may be unscrewed from the point and the entire apparatus may be then hauled out by the cable 11, whereupon the pile may be filled with concrete and capped as usual.

As compared with the usual methods of driving piles by a force applied at their upper ends, it will be observed that the use of the above described apparatus permits the piles to be sunk in inaccessible quarters

where there might be no room for an ordinary exterior pile-driver and also that the necessity of providing special protecting means on top of each successive section, against which the exterior pile-driver may strike, is entirely obviated. Numerous other important advantages of the new apparatus in the respect of economy of material and of time will also be obvious.

The jet-pipe J should be provided with a left-hand thread where it screws into the bore J′, and with right-hand threads where its several sections are coupled together, so that when the pile has been sunk the pipe may be disconnected from the solid point without unscrewing the intermediate couplings, these being opened during or after the withdrawal of the pipe.

The modification shown by Fig. 2 involves the same principles as the device of Fig. 1, but in this apparatus the pressure is controlled by a separate valve mechanism 13 carried on the cylinder and the latter is supported on the bottom of the pile by means of a cylindrical wall 14 which surrounds the reciprocating hammer and contains a follower block 15 fitting snugly into the bore thereof. An aperture for the jet pipe is provided in this machine at one side of the cylinder and the tail rod is therefore omitted from the piston, which latter, as well as the hammer, is a solid member. The advantage of this construction over Fig. 1 lies principally in the fact that the hammer reciprocates in an inclosed air space, and the water which is almost certain to leak into piles that are sunk into wet ground cannot therefore interfere with its action. Moreover, the location of the jet pipe aperture at one side permits the full mass of a solid piston and solid hammer to be availed of in sinking the pile, which fact is important when the piles are of small diameter. The hammer strikes against the follower block 15, which is free to move in the end of the cylinder 14 and through it, imparts its energy to the pile. The valve mechanism of this modification is of the ordinary piston-valve type operated by the fluid pressure and does not require detailed explanation.

Fig. 3 represents a development of the invention wherein the motor cylinder 16 is also supported by a closed supporting cylinder and the piston 6, piston rod 7, tail rod 9, and hammer 8 are each hollow, as in Fig. 1, to provide a jet pipe aperture, the valve mechanism being operated directly by the movement of the piston. The supporting cylinder 14 is screwed or otherwise secured to the bottom head of the cylinder being closed at its top as in Fig. 2 and open at its lower end. The valve 17 of this apparatus surrounds the hollow tail rod 9 and is positively actuated, being moved in one direction by a collar 18 on the upper end of said rod and in the other direction by a sliding sleeve 19 which also surrounds the tail rod and is encountered by the ascending piston to lift the said valve. The valve and the ports controlled by it are so arranged that fluid pressure entering by the pipe 10 passes alternately through passages 21 and 22 into the opposite ends of the cylinder so as to produce the requisite reciprocation of the hammer, and the exhaust from the cylinder finds its escape through the exhaust pipe 10′ which leads upwardly from the valve casing toward the top of the pile. The purpose of conducting the exhaust to the top of the pile is to prevent a back pressure at the exhaust port and the possibility of the entrance of the water in the pile into the valve mechanism when the apparatus is not working, but a check valve may be provided in the exhaust port for this purpose, if desired.

Fig. 4 represents another modification of the invention which differs from the forms above described in the feature of having the piston stationary and the reciprocating cylinder formed as an annular hammer, thereby employing the relatively large mass necessarily present in the cylinder casting as a means for augmenting the momentum of the hammer element while the mass of the piston and other parts may be reduced to a minimum. In this form the stationary piston rod 23 and its piston 24 are carried by a cross-head 25 having legs 26 which are adapted to rest on the transverse floor or bottom of the pile, the piston-rod and piston being hollow and the tail rod or extension 27 being also hollow to provide a suitable passage or aperture through the apparatus for the reception of a jet pipe J. This apparatus has also a superposed weight W which may be bolted to the top of the cross-head and a cable 11 is provided for hoisting it out of the pile. Fluid pressure introduced by way of the hose or pipe 10 into the cross-head which is hollow, from thence passes through the passages 28 and 29 in the stationary piston rod 23 into the cylinder where it is allowed to act alternately on opposite sides of the piston as is customary in the ordinary valveless engines. The bottom end of the hammer cylinder is provided with a striking piece 30 which acts directly against the bottom of the pile.

In the further development of the invention, shown by Fig. 5, the entire motor-driven apparatus is incased in a cylindrical protecting inclosure and is specially adapted for sinking open ended piles such as illustrated in that figure. These piles have their lowermost sections formed with an attached or integral chisel point which affords a transverse annular bearing for the apparatus to rest upon, as in the preceding

figures. The aperture A through this form of the apparatus is isolated from the moving parts of the machine and is sufficiently wide to receive the jet pipe J and at the same time to provide an escape for the water forced out of the pipe, which water rises in the pile, mixed with the loosened soil, and overflows at its top.

The construction of the motor-driven apparatus is as follows: The supporting cylinder 32 carries a cross-head or top-plate 33 securely fastened to its upper end. The tubular piston rod 34 is screwed and locked into this plate and carries the piston 35 and hollow tail rod 36. The latter is fitted at its lower end with a packed ring 37 which is surrounded by a follower block 38. The latter is, of course, annular in form, being located between the tubular extension 36 and the end of the cylinder, and it is also provided with a peripheral rabbet slot or groove in which the foot of the cylinder 32 rests, the vertical wall of the block above the groove being provided with a number of packing rings to make a tight yet sliding fit. In this manner the weight of the stationary piston rod and its adjacent parts is supported by the follower block which rests on the pile. The reciprocating hammer cylinder occupies the annular space between the piston and the casing, being provided at its lower end with a striking piece 40 approximately keyed thereto. The top plate or cross-head 33 contains the valve mechanism, as shown in dotted lines, and fluid pressure admitted by way of the pipe 10, as usual, is delivered by the valve alternately into the passages 41 and 42 in the piston rod which lead respectively to the opposite ends of the cylinder. In striking against the follower block, the latter moves relatively to the cylinder 32 and the tail rod 36, but during the ascending stroke of the hammer cylinder, the superposed weight W again seats the cylinder in the annular rabbet slot.

I do not claim herein broadly the construction of a pile sinking apparatus in which provisions are made for the reception or insertion of a jet-pipe, as such subject-matter is claimed in another application filed of even date herewith.

The term self-contained as used herein is meant to refer to the structural unity of the hammer and its driving motor and co-operating parts, whereby upon being lowered into the pile the supplying of motive power is all that is required to cause its operation.

Claims:

1. As a means for sinking tubular piles, a motor formed and adapted to be lowered bodily into a tubular pile and provided with a reciprocating hammer member adapted to exert a succession of blows against the interior of said tubular pile, in combination with means for conducting the motive power to said motor from the exterior of the pile.

2. As a means for sinking tubular piles, a self-contained motor-driven hammer mechanism, formed and adapted to be lowered bodily into a tubular pile and to exert its energy in a longitudinal direction against the interior of said pile.

3. Apparatus for sinking tubular piles, comprising a self-contained motor-driven hammer mechanism formed with an external contour adapted to fit within a tubular pile and arranged to rest on a transverse floor within the same, and having its reciprocating hammer element arranged to exert its energy against the interior of said pile to sink the same in the ground.

4. Apparatus for sinking tubular piles comprising a motor-driven hammer-mechanism adapted to be lowered bodily into a tubular pile to exert its driving force against the interior thereof, said mechanism being provided with a longitudinal aperture through the same for the reception of a jet pipe.

5. As a means for sinking tubular piles, a motor-driven hammer mechanism adapted to be inserted bodily into a tubular pile and comprising a cylinder and piston, said piston being provided with an aperture passing through the cylinder adapted to receive a jet pipe.

6. As a means for sinking tubular piles, a hammer mechanism adapted to be inserted bodily within a tubular pile and comprising a cylinder and piston, and a tail rod on said piston protruding through the end of the cylinder, said mechanism being provided with a longitudinal jet-pipe aperture passing through said tail rod and piston and through the cylinder.

7. As a means for sinking tubular piles, a self-contained motor-driven hammer mechanism, an inclosure therefor adapted to protect the same from surrounding water, and an aperture passing through said mechanism, isolated from moving parts thereof and suited to receive a jet pipe.

8. As a means for sinking tubular piles, a self-contained motor-driven hammer mechanism, an inclosure therefor adapted to prevent the admission of surrounding water to the moving parts thereof, a longitudinal aperture through the said mechanism for receiving a jet pipe, said aperture being isolated from the said moving parts and formed of sufficient diameter to provide an escape for the mixed soil and water.

9. In an apparatus for sinking tubular piles, a motor-driven hammer mechanism, comprising a hammer element and adapted to be inserted bodily into a tubular pile, in combination with a casing closed at its top

and forming a chamber in which said hammer element is reciprocated.

10. A self-contained motor-driven hammer mechanism adapted to be inserted into tubular piles, a casing for supporting said mechanism within the pile and formed to provide an air chamber in which the hammer element of said mechanism may operate.

11. Apparatus for sinking tubular piles, comprising a motor and a hammer element reciprocated thereby, in combination with a water-tight casing surrounding said hammer element, and a movable watertight closure for said casing constituting a means of transmitting the energy of the hammer element to the exterior thereof.

12. A mechanism for sinking tubular piles, adapted to be inserted bodily therein, comprising a reciprocating motor and a hammer element operated thereby, a longitudinal aperture being provided through said mechanism, in combination with an annular weight superposed on said mechanism around the aperture therein.

13. A self-contained mechanism for sinking tubular piles adapted to be inserted bodily therein, comprising a reciprocating hammer element, a cylinder, piston and valve mechanism for operating the same, a central jet-pipe aperture provided in said mechanism and a casing providing an air space in which said hammer element may reciprocate.

14. A motor-driven hammer mechanism adapted to be inserted bodily within a tubular pile, comprising a supporting casing, a piston within the same supported thereby and a reciprocating cylinder surrounding said piston within the casing, said casing being closed at its upper end whereby an air space is provided in which said cylinder may reciprocate.

15. A motor-driven hammer mechanism adapted to be bodily inserted into a tubular pile, comprising a tubular supporting casing, a cross-head secured to the upper end of said casing and closing the same, and a piston supported by said cross-head within the casing and provided with a central aperture, in combination with a reciprocating cylinder around said piston, and valve mechanism carried by said cross-head for admitting fluid pressure thereto.

16. A motor-driven hammer-mechanism adapted to be bodily inserted into a tubular pile, comprising a tubular casing, a piston supported within the same and a reciprocating cylinder surrounding said piston, in combination with a tail-rod on said piston and an annular follower-block closing the space between the end of said rod and the end of the casing.

17. A motor-driven hammer-mechanism adapted to be inserted bodily into a tubular pile, comprising a tubular casing, a piston supported within the casing and a reciprocating cylinder surrounding said piston, in combination with a sliding follower-block fitting the end of said casing and forming a support upon which the said casing rests.

18. A motor-driven hammer mechanism for tubular piles, comprising a stationary piston rod and piston and a reciprocating hammer cylinder surrounding the same, in combination with valve ports for said cylinder contained in the said piston rod and means for supplying fluid pressure to said ports.

19. A motor-driven hammer-mechanism, comprising a stationary hollow piston-rod and piston and a reciprocating hammer cylinder surrounding the same, in combination with a motor valve mechanism and valve ports leading therefrom through said hollow piston rod into the cylinder.

20. In apparatus for sinking tubular piles, a fluid operated motor having valve ports and adapted to be bodily inserted into the pile, a hammer element operated by said motor to impart its energy to the interior of the pile, in combination with means for preventing the admission of surrounding water into said valve ports.

21. In apparatus for sinking piles, a casing forming a protecting inclosure, a motor mechanism sustained within the same, a relatively movable follower block forming a closure to the end of the casing and a hammer element reciprocated by the motor mechanism to strike the follower block.

In testimony whereof, I have signed my name to the specification in the presence of two subscribing witnesses.

AMASA B. CLARK.

Witnesses:
A. HARRISON,
D. T. O'DAY.