G. R. HECKLE.

PILE.

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1,348,994.

Patented Aug. 10, 1920.

Fig. 1

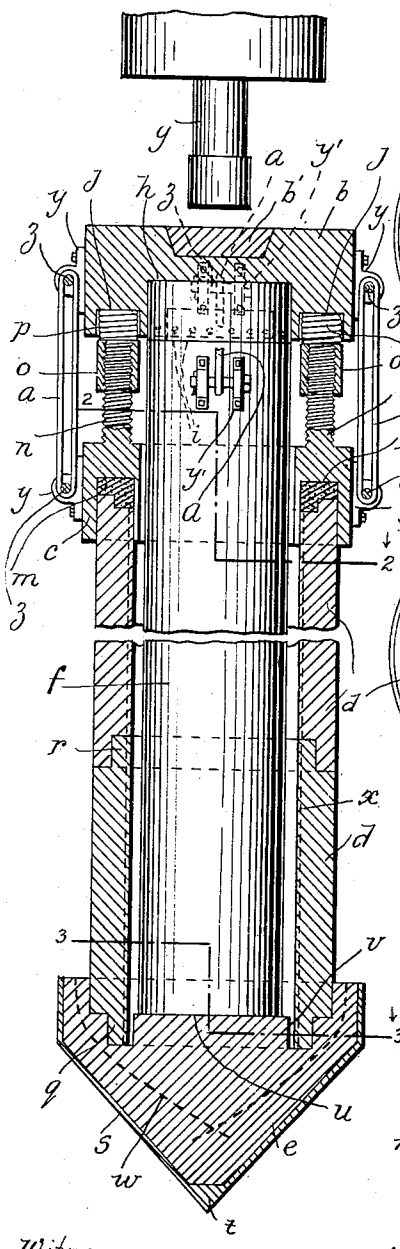


Fig. 2.

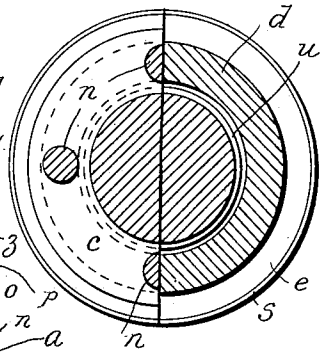


Fig. 3.

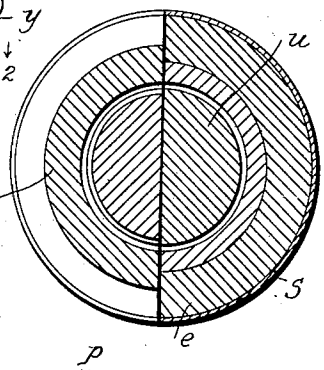


Fig. 4.

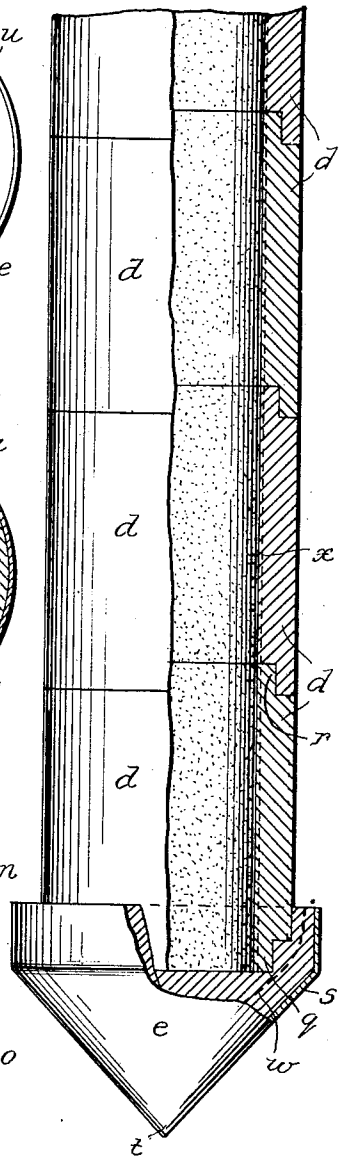


Fig. 5.

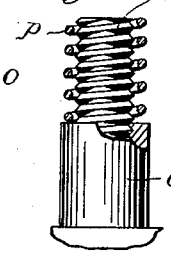
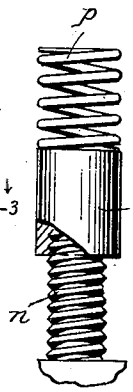


Fig. 6.



Witness:

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UNITED STATES PATENT OFFICE.

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PILE.

1,348,994. Specification of Letters Patent. Patented Aug. 10, 1920.

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To all whom it may concern:

Be it known that I, GEORGE R. HECKLE, of the city of Montreal, Province of Quebec, Dominion of Canada, have invented certain new and useful Improvements in Piles; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention has for its object to drive a comparatively frail pile casing having a relatively solid point, by the usual impacts, of a hammer for instance; such impacts being partially directed to the point and partially translated into a uniformly progressive yielding force transmitted to the pile case. A further object of the invention is to provide a pile of low cost and high compressive resistance.

The invention may be said briefly to consist of a driving pile including the foundational pile proper, the pile proper to remain in the earth, and an apparatus through which it is driven, the pile consisting of a duplex head the members of which are respectively a solid cap and an annulus spaced and connected by adjustable means so that the impacts on the one part will be translated and transmitted to the other either by uniform progressive force, or by direct connection through which the intermittent impacts of the hammer may be transmitted from one member to the other. The comparatively frail hollow case has one member of the duplex head bearing thereon and the opposite end bears upon a solid point and a driving core effecting a direct rigid connection between the cap member of the head and the point whereby the impacts of the hammer upon the duplex head are transmitted directly to the point. The members of the duplex head are connected together and to the driving core by suitable means to permit them to be lifted from the hole after the point and case have been driven such point and case being preferably left in the earth, and the latter when left in the earth is finally charged with a filler which may be concrete, sand, rubble, or other material to meet the requirements of the work. If desired, however, the case if not left in the earth may be made of other material than concrete, within the spirit of my invention.

For full comprehension, however, of my invention reference must be had to the accompanying drawings forming a part of this specification in which similar reference characters indicate the same parts, and wherein:—

Figure 1 is a vertical sectional view taken diametrically through the pile and apparatus for driving the same, on line 1—1 Fig. 2;

Fig. 2 is a transverse sectional view taken on line 2—2 Fig. 1;

Fig. 3 is a transverse sectional view taken on line 3—3 Fig. 1;

Fig. 4 is a side elevation of a driven pile partly broken away for purposes of illustration; and

Figs. 5 and 6 are details drawn to an enlarged scale and illustrating particularly the adjustable yielding means effecting connection between the members of the duplex head.

The members of the duplex head are indicated at *b* and *c* respectively, the section of the hollow shaft at *d* and the point at *e*. In order to prevent shattering of the concrete hollow shaft while being caused to follow the driven point to protect a case otherwise formed of a different and comparatively frail material, I provide the duplex head with a yielding connection between its members; and the driving of the point is effected through a solid rigid core indicated at *f*.

The member *b* of the head is a cast-iron cap having countersunk in the middle of its top a wooden block *b'* to receive the impacts of the steam hammer, the striking head of which is indicated at *g*. The underside of the cap has a central recess or seat *h* to receive the upper end of the core which is reinforced by a cap or head of extra toughness relatively to the material of the core, in order to withstand the impacts. This cap may be connected to the core by rivets *i* or any other suitable means; and surrounding this seat are preferably four uniformly circumferentially spaced seats *j*. The part *c*, of the duplex head, is of annular form and channel cross-section to present a circumferential recess or seat *k* for the upper end of the hollow case *d* or the upper end of its top-most section if it is of sec-

tional form as illustrated. The opening through this annular member is slightly larger than the core to provide play and prevent binding of the annulus upon the core. A packing *m* of rope or hemp or other similar cushioning material is first inserted into the seat *k* in order to cushion the bearing of the annulus on the shaft section. The top of this annular head member is provided with posts or standards *n* corresponding in number and located in juxtaposition with the seats *j*, these posts being screw-threaded and having a screw-threaded sleeve *o* screwed thereon. The tops of the sleeves carry helical springs *p* of substantially the same diameter as the sleeve and the posts. Sleeves and springs are of such relative length that when the sleeves are screwed down to the bottom of the posts the springs will follow and their upper ends will sink beneath the tops of the posts. This form of yielding connection between the members of the head enable my improved pile-driver to be used in connection with either frangible shaft sections such as concrete which has a tendency to shatter when driven by intermittent impacts, or comparatively infrangible sections such as metal reinforced or cased concrete members or wooden or other relatively infrangible material. The joint between the different sections of this shaft and between the lowermost section and the solid point consists of male and female ends *q* and *r* respectively such as usually employed for the union between drain-pipes, culverts and conduit or other similar sections.

The solid point consists of an inverted cone of thin steel sheeting *s* with a solid apex *t* and a base of slightly greater diameter than either the shaft or the duplex head and formed with a sold central anvil *u* encircled by a seat *v* for the lower end of the shaft, the anvil being adapted to support the lower end of the driving core. This point is reinforced by reinforcing steel bars or mesh indicated at *w*.

In order to adapt the hollow shaft when left in the ground to hold sand or other loose material the pressure or impacts upon which causes it to exert lateral strains upon the confining shell, I line each section with reinforcing mesh, expanded metal or the like, indicated at *x*.

It is my practice to, after a pile, constructed according to my invention, has been driven, withdraw the core and the duplex head, and to facilitate this I cast the annular member at diametrically opposite sides with a pair of lugs *y* which carry a clevis *z;* and the corresponding sides of the cap *b* and the head of the core are cast with similar lugs *y;* while a loop *a* of wire-rope or rope of any suitable material, is looped around these clevises in such a manner that when the steam hammer is displaced and the cap is lifted the annulus and core will go with it.

Operation.

In the operation of driving a frangible pile according to my invention several sections, sufficient for a complete pile if not too long, are fitted together and coupled and having the duplex head fitted thereon, the yielding connection is adjusted to cause the springs *p* to project above the posts *n* sufficiently to cause the pressure of the cap member *b* to be exerted on the annular member, resting on the frangible sections, through the springs. The sleeves are adjusted along the posts to take up any play between the members of the head. When the steam hammer is started its impacts are exerted on the wooden block *g* and transmitted therefrom to the point *e* by means of the cast-iron structure of the cap and the core. Simultaneously a certain portion of the intermittent impacts are absorbed by the springs *p* and translated into a continuous pressure which, supplemented by the weight of the annulus has the effect of causing the hollow shaft to follow the point.

When it is desired to drive more rigid pile-bodies or the frangible sections through relatively soft material the sleeves *o* are screwed down upon the posts *n* until the tops of the springs are beneath the tops of the latter. In the driving of a relatively infrangible shaft the effect is the same in the shaft sections as in the point through the driving core, with the advantage that the driving force is distributed throughout practically the entire surface of the point.

An important advantage of the duplex head is that different resistances encountered may be met by driving force adjusted to meet the specific resistance. For instance, in the event of a pile being driven first through, say, a material offering comparatively little resistance, the tension of the springs will be reduced to the required degree by lowering the sleeves on the ports and when a material offering greater resistance is encountered the sleeves should be raised. In this manner any resistance within reasonable limits may be taken care of.

The construction above described providing as it does a sectional hollow pile, is adapted to be filled with any suitable filler after having been driven; and the metallic point with its permanently connected reinforced concrete body obviates the necessity of the steel shells usually employed with similar pile bodies; while the duplex driving head with the adjustable yielding resistance contained therein for causing the pile body to progress uniformly under the intermittent impacts of the hammer, has the advantageous effect of permitting the

solid point with frangible bodies to be sunk when otherwise there would be danger of the pile body being shattered by the blows of the hammer. This latter advantage is due to the fact that the rapid vibrations or impacts of the hammer have no direct solid conductor leading to these frangible shaft sections but the successive shocks are absorbed by the springs *p* and the accumulating force is demonstrated in a practically uniform forward movement having a strength commensurate with the aggregate tension of the shock-absorbing springs.

In carrying on this operation if it is found that with the number of shaft sections accommodated by the driving core, the pile does not meet the resistance required for the load it is to carry, then the head and core are withdrawn and the driving element is increased in length sufficiently to meet the requirements. This may be done either by adding core sections to the core and supplemental shaft sections, or the driven core sections may be charged with the filler and the shaft sections supplemented by others the driving operations being then continued with the impacts delivered through the same core onto the filler, whatever it may be, wet concrete, sand or other material. This supplementing of the shaft sections may be thus continued until the required resistance is met.

Although I have described in detail how my invention may be applied to frangible pile cases such as the concrete shaft *d*, it may be employed in connection with the driving of any relatively frail shaft and a solid core whether the shaft is made of concrete or consists of a metal case or other similar device for the purpose of giving form to the material of the pile, provided the power is transmitted in a manner to prevent the direct impacts of the hammer from reaching the shaft but are translated into progressive pressure. Another advantage attendant upon the use of my invention is that the driving force is distributed between the point and the shaft in accordance with the resistance encountered in the process of driving, in other words, if the resistance is greater at the point the greater part of the driving force is absorbed there, whereas if the resistance is relatively greater on the shaft the larger portion of the force is distributed to the shaft but owing to the fact that the impact is translated into a progressive pressure the relatively frail shaft overcomes this without damage. This effect is obtained whether the shaft is of a fragile nature or otherwise.

What I claim is as follows:—

1. A pile driving apparatus consisting of an infrangible point, a hollow shaft, a removable core within the shaft and bearing upon the point and of greater height than the shaft, a head on the top of the core, and resilient means effecting a connection between the head and shaft whereby the driving impact is in part transmitted to the core and in part translated into a progressive pressure upon the shaft.

2. A pile driving apparatus consisting of a point, a hollow shaft, a removable core within the shaft and bearing upon the point and of greater height than the shaft, a duplex head one member of which is in driving relation with the hollow shaft and the other member in driving relation with the core, and resilient means effecting a connection between the members of the head whereby the driving impact is in part transmitted through one member of the duplex head to the core and in part translated into a progressive pressure upon the shaft.

3. The combination with a pile consisting of a point and a hollow frail shaft; of a removable core within the shaft and bearing upon the point, a duplex head for receiving the driving impact and comprising a pair of members one of which is distinct from and connected to the shaft and the other distinct from and connected to the core, and means effecting a resilient connection between the members of the head to translate a portion of the driving impact into a progressive uniform pressure upon the shaft.

4. A pile driving apparatus consisting of an infrangible point, a sectional hollow shaft, a removable core within the shaft and bearing upon the point and of greater height than the shaft, a duplex head one member of which is carried upon the top of the hollow shaft and the other member on the top of the core, and resilient means effecting a connection between the members of the head whereby the driving impact is in part transmitted through the one member of the duplex head to the core and in part translated into a progressive pressure upon the shaft.

5. The combination with a pile consisting of an infrangible point and a sectional hollow fragile shaft; of a removable core within the shaft and bearing upon the point, a duplex head for receiving the driving impact and comprising a pair of members one of which is distinct from and connected to the shaft and the other distinct from and connected to the core, and means effecting a resilient connection between the members of the head to translate a portion of the driving impact into a progressive uniform pressure upon the shaft.

6. An apparatus for driving a pile consisting of a comparatively infrangible point, a relatively frangible hollow body, of a duplex head comprising a solid metal cap and an annulus relatively spaced and united by a series of posts carried by the annulus,

a series of springs encircling the posts, adjustable spring supports for adjusting the height of the springs with relation to the posts, the annulus being adapted to exert pressure upon the hollow shaft, and a core having the cap upon its upper end and its lower end resting upon the point.

7. An apparatus for driving a pile consisting of a comparatively infrangible point the base of which presents an anvil surface, a relatively frangible hollow body, a duplex head comprising a solid metal cap and an annulus relatively spaced and united by a series of posts carried by the annulus, a series of springs encircling the posts, adjustable spring supports for adjusting the height of the springs with relation to the posts, the annulus being adapted to exert pressure upon the hollow shaft and a core having the cap upon its upper end and its lower end resting upon the said anvil surface.

8. An apparatus for driving a pile consisting of a comparatively infrangible point the base of which presents an anvil surface, a relatively frangible hollow body, a duplex head comprising a solid metal cap and an annulus relatively spaced and united by a series of posts carried by the annulus, a series of springs encircling the posts, adjustable spring supports for adjusting the height of the springs to the posts with relation to the posts, the annulus being adapted to exert pressure upon the hollow shaft and a core having the cap upon its upper end and its lower end resting upon the said anvil surface, the seat between the annulus and shaft being cushioned.

9. An apparatus for driving a pile consisting of a comparatively infrangible point the base of which presents an anvil surface, a relatively frangible hollow body, a duplex head comprising a solid metal cap and an annulus relatively spaced and united by a series of posts carried by the annulus, a series of springs encircling the posts, adjustable spring supports for adjusting the height of the springs with relation to the posts, the annulus being adapted to exert pressure upon the hollow shaft; and a core having the cap upon its upper end and its lower end resting upon the said anvil surface, the seat between the annulus and shaft being cushioned, lugs upon the sides of the members of the head and loops connecting the lugs of one member to the lugs of the other to facilitate withdrawal of the annulus with the cap and core.

In testimony whereof I have signed my name to this specification in the presence of two witnesses:

GEORGE R. HECKLE.

Witnesses:

WILLIAM J. C. HEWETSON,

C. J. E. CHARBONNEAU.