(No Model.) 3 Sheets—Sheet 1.

C. J. VAN DEPOELE, Dec'd.

C. A. COFFIN & A. WAHL, Executors.

RECIPROCATING ELECTRIC PILE DRIVER.

No. 479,965. Patented Aug. 2, 1892.

Fig. 1.

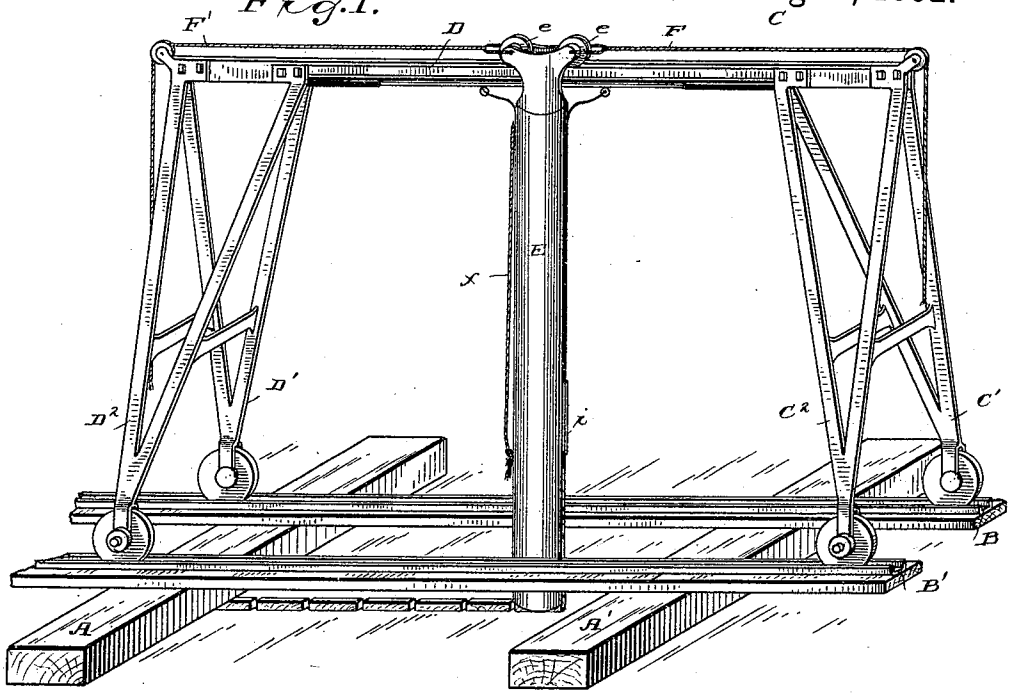
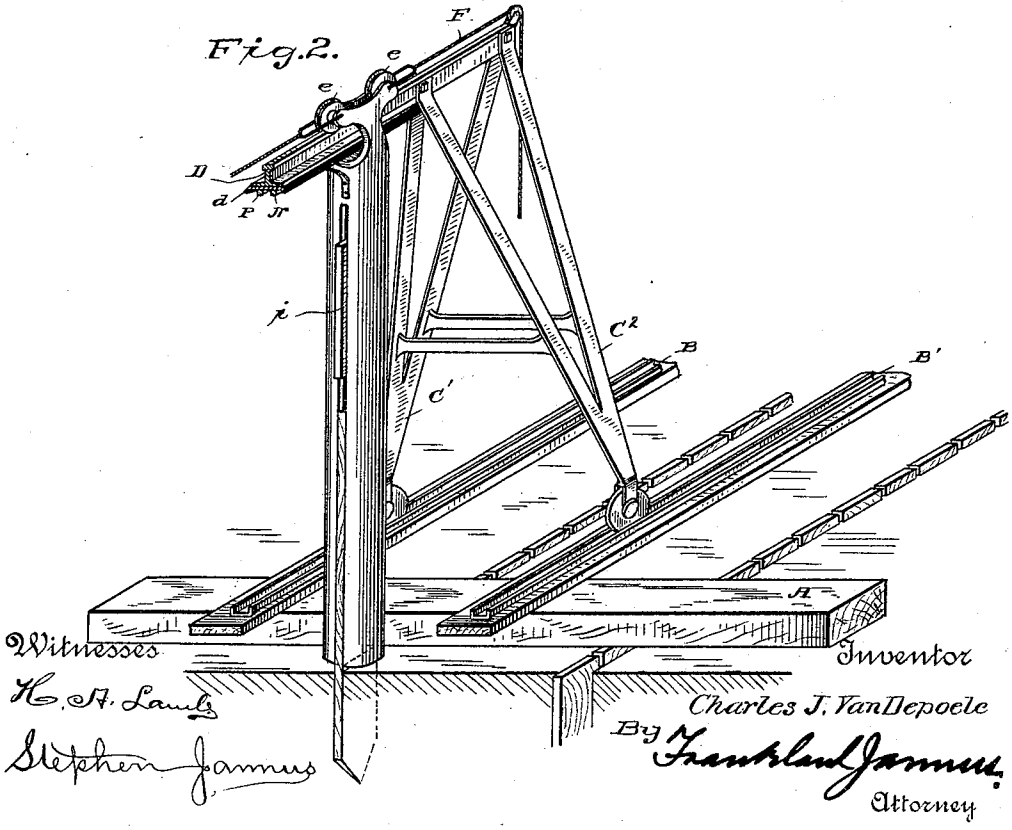


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

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RECIPROCATING ELECTRIC PILE DRIVER.

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Fig. 3.

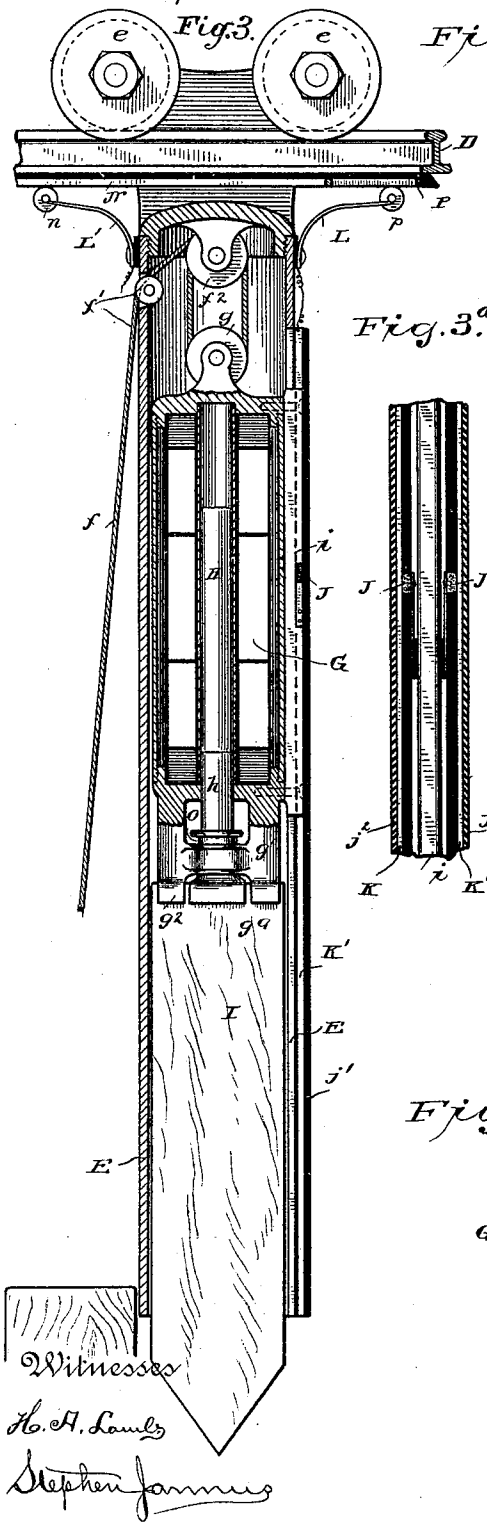


Fig. 3ª.

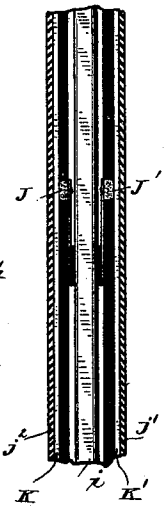


Fig. 4.

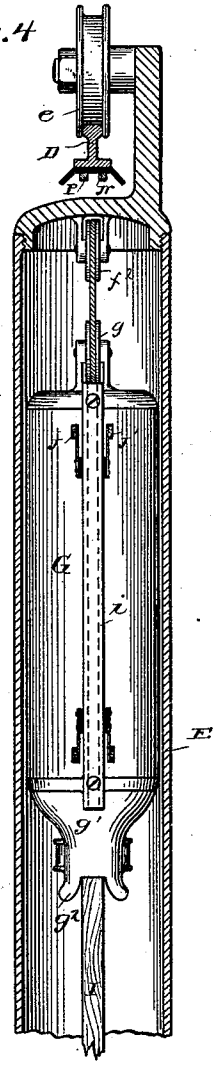


Fig. 5.

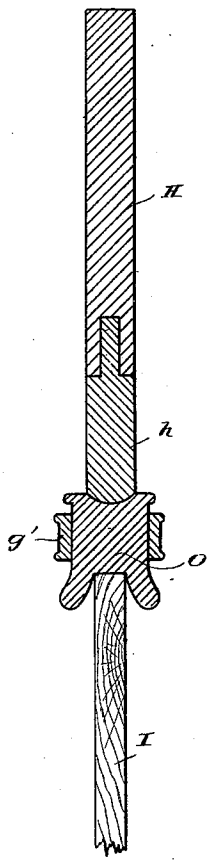
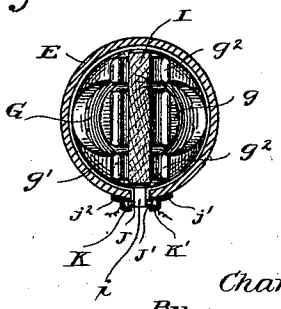


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

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RECIPROCATING ELECTRIC PILE DRIVER.

No. 479,965. Patented Aug. 2, 1892.

Fig. 7.

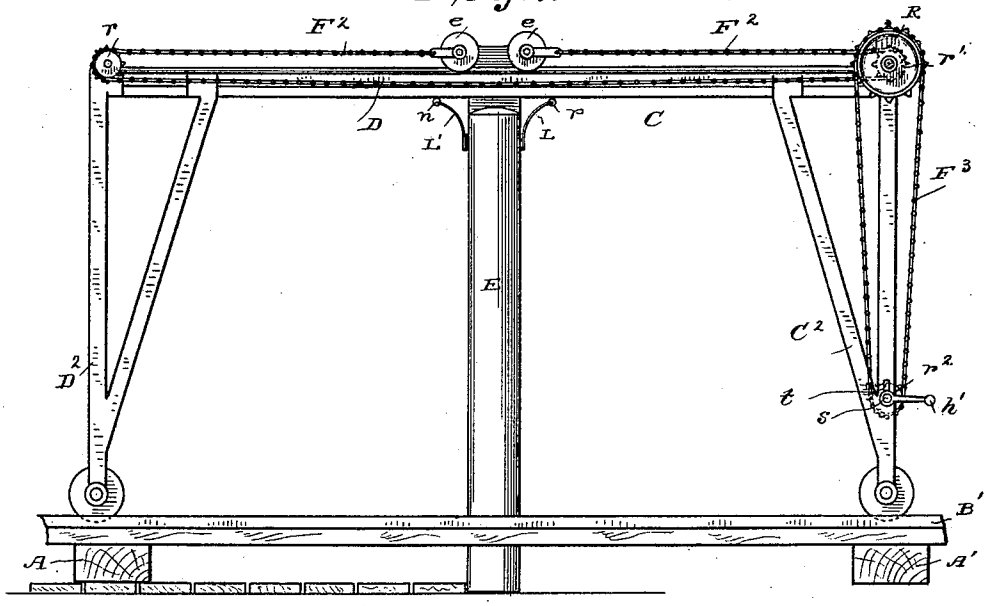
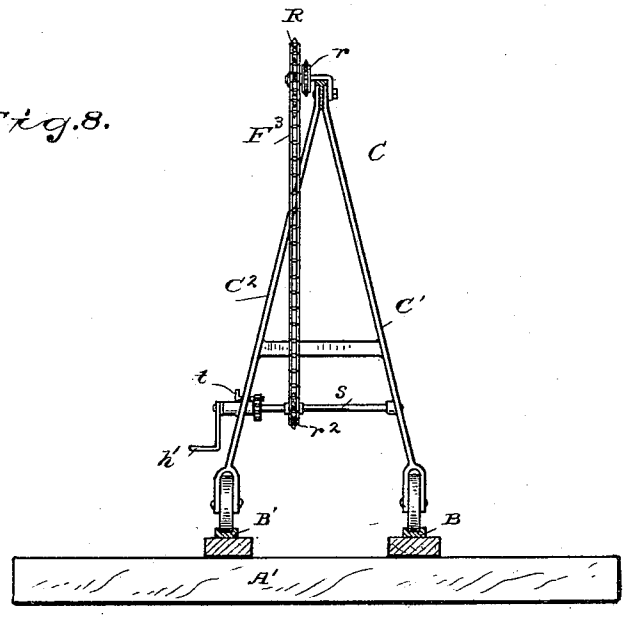


Fig. 8.



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UNITED STATES PATENT OFFICE.

CHARLES J. VAN DEPOELE, OF LYNN; C. A. COFFIN AND ALBERT WAHL, EXECUTORS OF SAID VAN DEPOELE, DECEASED, ASSIGNORS TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF BOSTON, MASSACHUSETTS.

RECIPROCATING ELECTRIC PILE-DRIVER.

SPECIFICATION forming part of Letters Patent No. 479,965, dated August 2, 1892.

Application filed May 23, 1891. Serial No. 393,848. (No model.)

To all whom it may concern.

Be it known that I, CHARLES J. VAN DEPOELE, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Reciprocating Electric Pile-Drivers, of which the following is a description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to improvements in reciprocating electric machinery and comprises a reciprocating electro-dynamic apparatus which I have called an "electric pile-driver," the object being to provide a machine which is self-contained, easily handled, quick and effective in operation, and which will facilitate the driving of piles and such work, and which by reason of its lightness and availability may be employed where from a combination of circumstances power could not previously be used. This follows from the convenience with which an electric circuit can be run or an existing circuit tapped to operate machines of this class.

Many different forms of electric reciprocating engine might be employed in connection with the remainder of the apparatus hereinafter referred to; but I prefer to use some one or other of the different species of reciprocating engines patented to me March 4, 1890, No. 422,855, which said engines are of the closed-circuit type—that is to say, the shifting of the current from one set of coils to the other to produce reciprocation of the plunger is effected by mechanism applied to the generator or source of current as distinguished from that class of engines in which the current is shifted at the engine by commutating devices, there being according to my plan no moving parts whatever directly connected with the engine for controlling the circuits thereof.

In the accompanying drawings the invention is illustrated in connection with a pile-driver particularly designed for sheet-piling, it being understood, however, that round piles may be driven thereby and that the machine may be applied to any other purpose for which it is suited.

In the drawings, Figure 1 is a view in perspective, showing my electric pile-driver in operative position. Fig. 2 is also a view in perspective, showing a portion of an electric pile-driver embodying the invention. Fig. 3 is an enlarged detail in sectional side elevation of my improved electric pile-driver, showing, also, portions of the supporting mechanism. Fig. 3ª is an enlarged detail of part of Fig. 3. Fig. 4 is an enlarged detail showing an edge view, partly in section, of my improved electric pile-driver. Fig. 5 is a detail view showing the magnetic piston, the non-magnetic hammer, the drift, and part of one of the piles. Fig. 6 is an inverted plan view of the parts seen in Fig. 4. Figs. 7 and 8 show in detail means for moving the casing E and reciprocator G therein back and forth within the limits of the frame C.

In the drawings, Figs. 1 and 2, A A′ are timbers laid across the cut or ditch. B B′ are rails laid upon stringer upon the timbers A A′, the rails being preferably grooved.

C is a carriage, which comprises a central girder D, sustained at each end by two legs D′ D^2 C′ C^2, which legs spread apart and are strongly braced to the central rail D and are provided with wheels at their lower extremities, which wheels run in the grooved rails B B′. The legs of the frame C are attached to the rail D and braced to and from each other, forming a very strong and rigid frame, which moves as a unit. An insulating shield or roof *d* is fastened underneath the rail D, and positive and negative conductors P N are secured under the protecting-shield D, where they are protected from injury and also from the elements.

E is a slitted metallic envelope in the form of a tube, which is some eight, ten, or more inches in diameter, large enough to contain the reciprocating engine or ram by which the driving is actually done, and also to contain and to guide the board or other form of pile

which is to be driven. This exterior tube or casing E is provided at its upper extremity with two rollers or sheaves *e e*, which run upon the rail D and sustain the casing E in position. Ropes F F′ are fastened to the upper part of the casing E and extend over each end of the frame C, where they serve to move the casing, with connected parts, in the desired direction to adjust the machine for operation, and when so adjusted the ropes are both of them secured in position, where they serve to hold the casing E until it is again desired to move it.

Within the casing E is placed a reciprocating electric engine G, which may be of the two or three coil type—such, for example, as shown in my Letters Patent No. 431,494, dated July 1, 1890, or No. 451,786, dated May 5, 1891. The precise construction of the reciprocating engine is not, however, the essential feature of the present invention, as I propose to employ that form of my reciprocating electric engine which proves to be best suited to the particular work in hand. The engine G is suspended by a rope *f*, which should run over pulleys *f′ f² g*, and more if necessary, in order to diminish the friction and place the same under easy control of the operator. The casing E is formed with a slit at one side, through which the pile I is readily inserted. The reciprocator G is provided with a guide-rib *i*, secured thereto and adapted to run in the slit of the casing, so as to prevent twisting or displacement of the engine. The rib *i* acts also to carry contact devices in the form of springs or brushes J J′, of which one or more sets may be provided and conveniently secured upon either side of the rib *i* and connected with the terminals of the motor-coils of the reciprocator G.

Upon each side of the slot of the casing E is located a stout rib of insulating material *j′ j²*. These insulating-strips are grooved, and embedded in the grooves thereof are copper conducting-strips K K′, which, being embedded and contained within the grooves of the insulating-strips, are fully and effectually insulated from the metallic tube E. The contact-brushes J J′, carried by the reciprocating engine G, are so placed as to engage the strips K K′, so that in whatever part of the tube E the engine may be it will always be in contact with its supply-conductors. Although I have also shown two conducting-strips, it must be understood that where it is desired to employ more than one form of current for the engine additional conducting-strips and collecting-brushes will be provided, the insulating-supports *j′ j²* being provided with a sufficient number of grooves to contain the desired number of conductors.

Current is collected from the conductors P N, carried by the frame C, by means of some convenient form of running contact—as, for instance, by means of trolley-wheels or brushes *p n*, which are carried upon and held in engagement with their respective conductors by springs L L′, connected with and thoroughly insulated from the tube E. The contacts *p n* are connected, respectively, by separate insulated conductors with the conducting-strips K K′, from which the motor-coils of the reciprocating engine are supplied with current. The reciprocating electric engine G is provided with an exterior iron envelope, as usual, upon the upper part of which is located a sheave or roller *g*. The lower part of the engine is provided with an extension *g′*, which is formed at its lowest part into feet *g²*, adapted to straddle the top end of a plank or piece of sheet piling I. Within the engine is the magnetic piston H, which is provided at its lower extremity with an extension *h*, which for convenience sake is best made of phosphor-bronze or some tough metal of that description, and, furthermore, by making the extension of some diamagnetic metal the magnetic circuits of the engine are not interfered with. Again, a detachable end piece is very desirable in order that when worn out it may be replaced without affecting the plunger H. The foot *g′* of the engine G is formed with a central apertured collar, within which is fitted a drift O, this being a stout piece of metal capable of moving vertically up and down within its collar and formed with V-shaped extensions at its lower end to pass over the top of the piece of sheet piling. The neck or shank of the drift O is a little longer than the distance through which the piston H can drive the pile at one blow, and as the parts normally rest by their own weight upon the object to be driven the blows of the hammer are received by the upper end of the drift O and communicated therethrough to the pile I, which is driven down as far as the force of the blow permits. In view of the fact that the entire weight of the driving-machine G rests upon the pile I as the hammer strikes the drift O, the same will be driven downwardly and simultaneously a part of the force of said blow will be expended in raising the engine G, which, the next instant in descending will add a second blow and also place itself in position to resist the succeeding stroke of the piston H. The alternate blows of the piston through the drift O and of the descending weight of the reciprocating engine through the feet *g²* will rapidly lower the pile to be driven, and as the engine G is free to follow its work it will gradually descend in the tube G as the pile is driven downward, the said tube serving as a guide for all the parts. When the pile has been driven far enough, the engine G is raised by means of the rope F, and temporarily secured in its elevated position, when the tube E and connected parts is moved forward by means of the ropes F F′ into the desired position for the next pile to be driven. It will thus be seen that an extremely compact, useful, and economical machine is provided for performing work for

which it is believed no special provision has heretofore been made. The rate at which the piston H can be reciprocated is very high, so that comparatively small parts may be used, for even if the pile be driven but a short distance at each stroke the strokes will follow each other with such rapidity that the total amount of work accomplished in a short time will be very great.

As seen in Figs. 7 and 8, a chain F^2 is attached to the sheaves *e e* and passes over the sprocket-wheels *r r'* at each end of the frame C. The wheel *r'* is fastened to the large sprocket-wheel R and turns therewith, and a second chain F^3 passes over the wheel R and down over a smaller wheel r^2, which is mounted upon a shaft *s*, supported in bearings upon the legs C' C^2 of the frame C. A handle *h'* is provided to revolve the shaft *s*, and a stop mechanism *t*, of any well-known form, is employed to secure the whole device in any desired position. While I have shown a tube as an effective guide for the engine G, it will be understood that I do not limit myself to that specific form.

Various minor changes in the non-essential features of my invention may, of course, be made without departing from the spirit or nature thereof, and it will be further understood that the essential features may be considerably modified without the exercise of invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An electric pile-driver comprising a longitudinally-movable tubular casing, a reciprocating electric engine vertically movable within said casing, a frame supporting the casing in operative position, and electrical connections between the frame, the casing, and the reciprocating electric engine, substantially as described.

2. In an electric pile-driver, the combination of a movable track, a frame movable upon the track, a way upon the frame, a tubular casing suspended from the way, a reciprocating electric engine within the casing, insulated conductors carried by the way on the frame, traveling contacts between said conductors and insulated conductors carried by the casing, and traveling collector-brushes connected with the electric engine.

3. In an electric pile-driver, the combination, with a suitable frame including a horizontal way, of a tubular casing adapted to be moved longitudinally upon the way and formed with a vertical slit, said casing being adapted to receive and to guide the object to be driven, and a vertically-movable electric engine within the casing, substantially as described.

4. A reciprocating electric engine for pile-drivers, having an exterior casting provided with feet for resting upon the object to be driven, a loose drift also carried by the casting and having a foot-rest upon the object to be driven, and a reciprocating plunger within the casing arranged to strike the drift at each stroke, substantially as described.

5. A reciprocating electric engine for pile-drivers, having feet for resting upon the object to be driven, a loose drift also having a foot-rest upon the object to be driven, and a reciprocating plunger arranged to strike the drift at each stroke, a tubular metallic casing within which the engine and the object to be driven are sustained and guided, and means for raising the engine in the casing after the completion of each operation, substantially as described.

6. In an electric pile-driver, the combination, with a movable horizontal way, of a tubular casing or guide suspended from said way and formed with a vertical slit, through which the object to be driven can be inserted, if desired, a reciprocating electric engine adapted to move vertically within the casing, bare conductors carried by the casing, traveling contacts carried by the engine engaging said conductors, and traveling connections between the casing and suitable conductors carried by the horizontal way, substantially as described.

7. In an electric pile-driver, a vertical horizontally-movable tubular casing formed with a vertical slit, a suitable supporting-frame having a horizontal way, from which the casing is suspended, and a reciprocating electric engine arranged to move vertically within the casing and provided with a guide arranged to travel in the slit of the casing and provided with feet at its lower extremity adapted to rest upon and sustain the entire weight of the reciprocating engine upon the object to be driven.

8. The combination, with a suitable support, of a tubular casing having a vertical slit and adapted to contain and guide the object to be driven, a reciprocating electric engine adapted to move vertically within the casing and provided with feet for resting upon the object to be driven and having, also, a guide moving in the slit of the casing, and means whereby the engine may be raised and lowered within the casing.

9. In an electric pile-driver, the combination, with a vertical tubular casing adapted to receive and guide the object to be driven, of a reciprocating electric engine arranged within and adapted to move vertically within the casing, feet upon the engine resting and sustaining the weight thereof upon the object to be driven, and a vertically-movable part or drift resting upon the object to be driven and arranged in the path of the reciprocating plunger of the engine, whereby the recoil of the engine is rendered effective.

10. In an electric pile-driving machine, a reciprocating electric engine having a metallic exterior envelope, suspending devices at its upper end and feet at its lower end, a

central aperture between the feet, a loose part or drift movable in the aperture and resting upon the object to be driven, a magnetic plunger for the engine, and a non-magnetic extension or hammer upon said plunger, said hammer adapted to strike the drift at each downward stroke.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES J. VAN DEPOELE.

Witnesses:
JOHN W. GIBBONEY,
CHAS. A. OLIN.