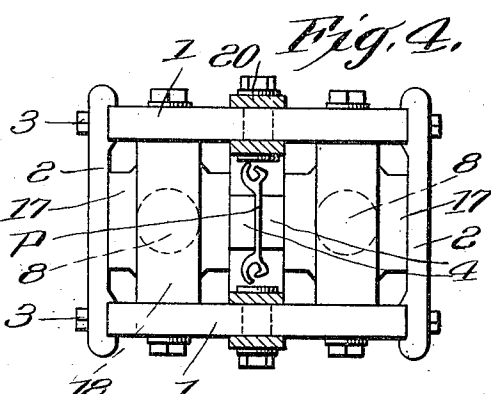
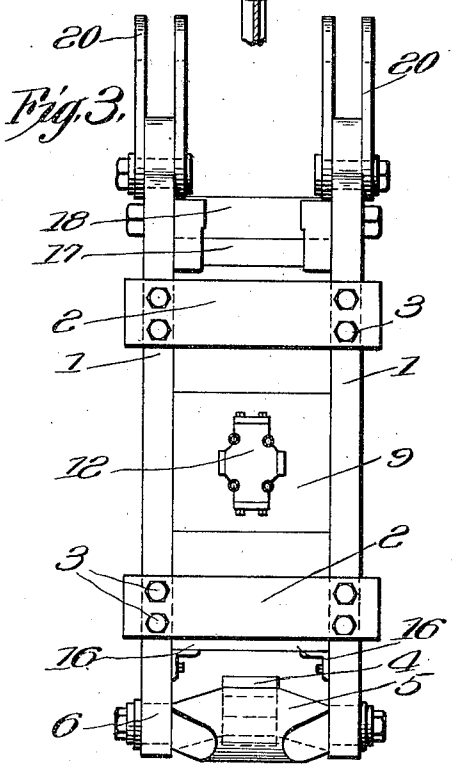
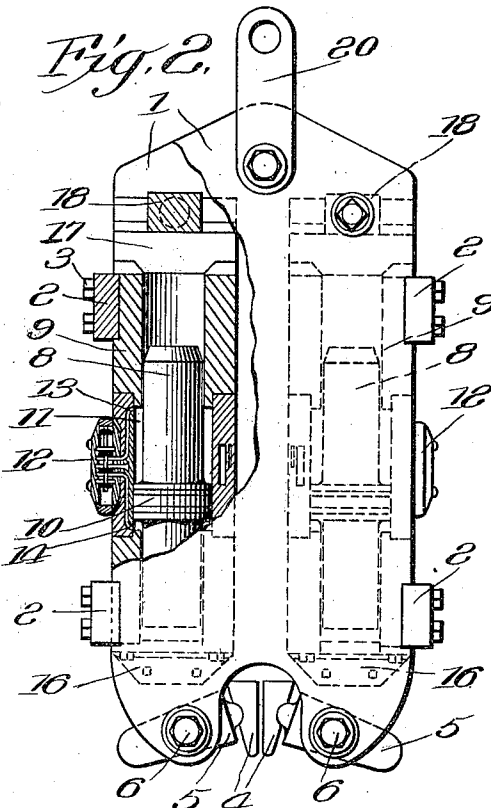
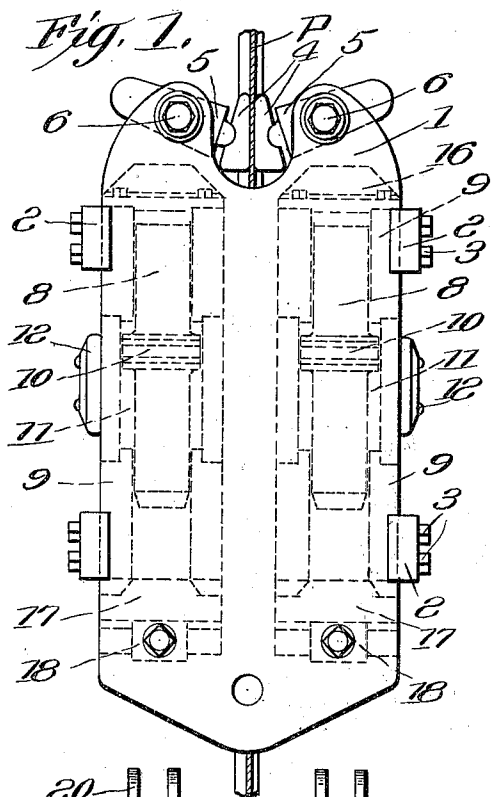


C. S. BOARDMAN.
 PILE DRIVER AND PULLER.
 APPLICATION FILED AUG. 5, 1915.

1,310,408.

Patented July 22, 1919.



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PILE DRIVER AND PULLER.

1,310,408.

Specification of Letters Patent.

Patented July 22, 1919.

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To all whom it may concern:

Be it known that I, CHARLES S. BOARDMAN, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Pile Drivers and Pullers, of which the following is a specification.

This invention relates to pile drivers and consists in an essentially new structure whereby the blow may be applied to the pile below the end thereof and as near the point of penetration as may be desired.

Heretofore, so far as I know, all pile-drivers and similar mechanisms operate to strike the pile at its upper end and can only so operate. And with such arrangement, considerable space or "head room" is necessary to accommodate the guides and other supports for the striking-part and to permit a sufficient extent of movement of said striking-part above the pile end. Also all piles are more or less flexible; there is therefore a dissipation of the force of the blows owing to the bending of the pile, and sometimes the pile itself is distorted or broken.

To overcome these disadvantages and as a radical departure from these old mechanisms, I have devised a pile-driver with which head-room is not necessary, but the pile is gripped at any convenient point below the top, and the force of the blow delivered below the point of grip and near the point of penetration. Thus the force is applied down on the pile, and the dissipation of the force due to the flexibility of the pile becomes negligible. Furthermore the fact that all the mechanism of the pile-driver is arranged entirely below the upper end of the pile permits the driving in many locations impossible with the ordinary pile-driver and often permits the use of longer piles desirable for the particular installation. In some cases a longer pile is necessary for the safety and stability of the structure.

My invention will be understood by reference to the accompanying drawing wherein the reference numerals of this description are applied to the same parts in the different views. Figure 1 is an elevation of my improved pile-driver with parts broken away and parts shown in section. Fig. 2 is a similar view, slightly modified, showing

the device in inverted position for pulling the piles. Fig. 3 is a side elevation of Fig. 2. Fig. 4 is a top plan of Fig. 2.

My improved driving tool or hammer as here shown has supporting side-plates or yoke-plates 1—1 clamped together by clamping-bars 2—2, which are secured to the plates by the bolts 3—3. A supporting frame is thus formed with the side-plates separated to leave an open space through the frame for the passage of the pile or piling section P. Engagement with the latter is effected by any suitable gripping device. A desirable form is shown composed of the contact-plates or jaws 4—4 on the toggle-links 5—5 pivotally supported on the pins 6—6 carried by the plates 1, and spanning the space between them, as shown. This gripping mechanism operates very firmly to grip the pile and to prevent movement of the frame relative to the pile section in one direction, while permitting the frame to be moved longitudinally in the other direction for readjustment of its position as hereinafter referred to. I do not propose to limit myself to this grip for that is merely a detail and any suitable form of grip or means for engaging the pile, may be used.

To the supporting frame I fit the hammers 8—8 in any suitable way, preferably in the manner here shown, wherein the hammers are each complete self-contained hammer-units (of any desirable form) for instance composed of the striking part 8 operating within the cylinder casing, or block, 9, and provided with a piston-head 10 fitting the cylindrical chamber 11 formed within the cylinder casing. The elastic fluid, usually steam or air, for operating the hammer is controlled by a suitable valve 12 of usual form for introducing the fluid through the ports 13 and 14 respectively above and below the piston head.

As shown best in Figs. 2 and 4, the hammer-units are clamped in position within the frame, and, where two are employed, as here shown, they are arranged symmetrically on opposite sides, so that the pile will pass upwardly between them. Supporting cross-pieces 16 are arranged to support the hammer units at their upper ends, and at their bottom ends they are supported upon the anvils, or dolly-plates 17, which rest upon

the supporting cross bars, or keys 18 carried by the frame as shown. The impact of the striking part is received by the anvils 17 and the force thereof is communicated to the frame through the keys 18 and thence to the piling section through the gripping jaws 4—4 described.

I do not propose to limit myself to the form of frame or of hammer here shown, for the details of the frame may be varied and any suitable form of hammer unit used therewith. A single hammer only, may be used if desired, the arrangement shown permitting the hammer to be easily removed as a complete unit for independent use. On the other hand the hammers may be made a permanent part of the puller, so as to decrease the size and weight thereof, if desired.

The arrangement shown, whereby the pile-section may freely pass between the hammers and the gripping jaws, permits the adjustment of the pile-driver with reference to the pile at any desirable elevation so that the impact of the striking part may be communicated to the pile at a point close to the point of penetration, and, as the pile is driven, obviously the hammer may be raised step by step, as required for obtaining a renewed grip upon the pile.

Thus, as above suggested, my new form of pile-driver, operating in a new manner and on a new principle, makes possible the driving of piling in locations where before impossible on account of lack of head-room, for instance under bridges, in basements of old buildings, as for reinforcing foundations, etc. With my pile-driver, piles extending throughout the entire head-room can be driven, and this in places where longer sections are important as for protecting bridges etc. Thus in some locations, without my peculiar pile-driver, no piling installations at all would be possible for piles of sufficient length to be of any practical value could not be used.

Often the piling is to be driven under water, or down into the ground, where a follower is necessary, and with my pile-driver the follower is steadied and stiffened till the section is driven home. Often there will be locations where, with the ordinary type of pile driver, a follower could not be used, or could not be used of desirable length.

As a matter of course, my pile-driver may be used in the ordinary manner, and in that case the keys 18 are removed, the dolly plates 17 withdrawn, and the pile-driver arranged so that the striking part strikes directly on the upper end of the pile. When so used it has the advantage of operating on two adjacent piles at once, or alternately; a driving cap of usual structure is preferably set on the ends of the piles, one or more being driven. Such caps may have a single

round socket to fit a bearing pile and grooves for two sheet piles. The two adjacent piling sections may be driven by alternate or simultaneous blows.

Another important feature of my improved mechanism is that it can be used in an inverted position and in conjunction with pulling tackle, or any pulling appliance, to impart upwardly directed impulses to the pile so as to assist the loosening and withdrawal of the pile, by applying rapid jerks and continuous vibration thereto, at the same time that the pulling strain is being exerted thereon.

When so used for pulling, the driver-puller is inverted as shown in Fig. 2, and in this position also may be arranged at any desired elevation with reference to the pile, preferably close to the ground, and the pulling power is applied from the usual hoisting engine to the (then) upper end of the driver-puller, and through the same imparted to the piles. To that end the side-plates 1—1 are provided on their then upper ends with straps 20—20 or other means for supporting the driver-puller on the pulling tackle or lever, so that the driver-puller provides the connection between the tackle and the pile section.

As will be readily understood, my improved driver-puller may be raised to any height required for pulling the entire length of pile or it may be kept at a low elevation at all times by releasing the grips when the pile has been pulled a short distance and then sliding down along the pile for a second engagement of the grips to pull from a lower elevation and so on down step by step. Often the blows are needed only initially to loosen and start the pile.

While my invention is particularly useful with metal sheet piling, yet it may be used with any form of piling, and much modified in form without departing from the spirit of my invention. As here shown the gripping jaws are designed particularly for engaging the web portions of steel sheet piling but they may conveniently be modified to correspond to the type of pile desired to be driven, for instance round piles, or bearing piles of other forms, or piles made of wood, reinforced concrete or other materials.

Two hammer units in each driver are convenient as here shown and for the reasons given. But the structure might be easily modified for one hammer-unit, or more than two. Said hammer units may be of any convenient form or may be ordinary commercial hammers, easily assembled in my structure and easy to knock down if it happens that they are to be used in original form. By reason of my invention, a much lower and smaller frame or equipment to handle the pile-driver can be used than with

the ordinary types of pile-driver, with economy in initial cost, transportation and handling.

Having described my invention I claim:

1. A pile driver-puller comprising a suitable frame, one or more hammer-units suitably arranged on the frame, a pair of jaws for gripping the sides of the pile adjacent one end of the frame and toggle supports for the jaws adapted to insure firm engagement of the jaws with the pile, when force is applied to the device in one direction, but to permit the jaws to loosen and the device to move along the pile when the force is applied in the opposite direction.

2. In a pile driver-puller a suitable supporting frame, driving parts supported on the frame, abutments on the frame to receive the blows of the driving parts and to communicate the impact through the device to the pile, and gripping parts on the frame, all the parts being spaced to leave an open center through the device for the passage of the pile and the gripping parts being arranged firmly to grip the sides of the pile when force is applied to the device longitudinally in one direction but to loosen and permit the device to slide along the pile when force is applied thereto in the other direction.

3. A device of the character described comprising a pair of side plates arranged parallel and having ears at one end and a recess between the ears, clamping bars for securing the plates together and maintaining them parallel, bolts for securing the bars to the edges of the plates, a pair of hammer-units arranged between the plates and within the bars said units having striking parts and means for operating the same, cross pieces secured between the side plates to support the hammer-units at the end adjacent the ears, pins in said ears, toggle-links pivotally supported on the pins, parallel jaws on the inner ends of the links, and arranged in the recess to grip the sides of the pile cross-bars extending between the side-plates adjacent their opposite ends, said cross-bars being removable, anvils on the cross-bars to receive the blows of the striking-parts and suspending straps connected to the side-plates adjacent the cross bar ends, substantially as shown.

4. A device of the character described comprising a pair of similar, separate side plates, a plurality of hammer units arranged between the plates, means for firmly connecting the side plates together in parallel relation and securing the hammer units in position between the plates, a grip on the plates to engage with the pile and abutments between the plates and connected thereto to receive the impact of the hammers.

5. In a device of the character described, corresponding side-plates, a pair of ham-

mer-unit elements symmetrically arranged between the plates, detachable means to secure the plates together to secure the hammer-units in place, means to engage with the pile adjacent one end of the plates, and abutments adjacent the other end to receive the blows of the hammer.

6. In a pile-driver for applying the blow to the pile adjacent the point of penetration, the combination with a suitable frame, one or more hammers sustained thereon, means to operate the hammers, an abutment secured on the frame to receive the blow of each hammer, and means to engage with the pile, said means being arranged above the hammers when the pile is being driven.

7. In a pile-driver for applying the force of the blow to the pile below its upper end comprising a suitable frame, one or more hammers arranged thereon, means to operate the hammers, abutments on the frame to receive the blows of the hammers, and means on the frame to engage with the sides of the pile, said means being adapted to be arranged above the hammers and the abutments when the pile is being driven, and all parts of the device being spaced to leave an open center from end to end, permitting the pile to extend through and above the device.

8. A device adapted for driving and pulling piles comprising a suitable frame, hammer units arranged on the frame, abutments to receive the impact of the hammers, means carried by the frame and adapted frictionally to engage with the pile to couple the pile thereto under pressure in one direction and to release the pile under pressure in the opposite direction and all parts thereof being symmetrically arranged about the center and arranged to leave an open passage through the device from end to end to permit the pile to extend therethrough.

9. A reversible device adapted for driving or pulling piles comprising a suitable frame, hammers secured thereon, means for operating the hammers, abutments to receive the blows of the hammers and means frictionally to engage with the pile, said abutments being arranged adjacent one end of the device and said engaging means adjacent the other and all of the parts being arranged to leave a central vertical passage therethrough to permit the pile to extend through and above the device.

10. In a device of the character described, the combination with side-plates, hammer units arranged between the plates, means for securing the plates together and the units between the plates, abutments secured between the plates to receive the impact of the hammers, and a grip secured on the plates to engage with the sides of the pile, said abutments being arranged adjacent one end, and said grips adjacent the

other end of the device, said device being adapted to be arranged with the abutments downwardly for driving piles, and to be reversed with the grip downwardly for loosening the piles.

11. In a pile driver for applying the blow to the pile adjacent the point of penetration, the combination with a suitable frame, one or more hammers sustained thereon, means to operate the hammers and means carried by the frame and adapted frictionally to engage with the pile to couple the pile thereto when moved in one direction and to release its grip when moved in the other direction substantially as described.

12. A reversible device adapted for driving or pulling piles comprising a suitable frame, one or more hammers sustained thereon, means to operate the hammers and

means carried by the frame and adapted frictionally to engage with the pile to couple the pile thereto when moved in one direction and to release the grip when moved in the other direction substantially as described.

13. A reversible device adapted for driving or pulling piles comprising a suitable frame, one or more hammers sustained thereon, means to operate the hammers and means carried by the frame and adapted frictionally to engage with the pile to couple the pile thereto and all of the parts being arranged to leave a central vertical passage therethrough to permit the pile to extend through and above the device.

In testimony whereof I have signed my name to this specification.

CHARLES S. BOARDMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."