

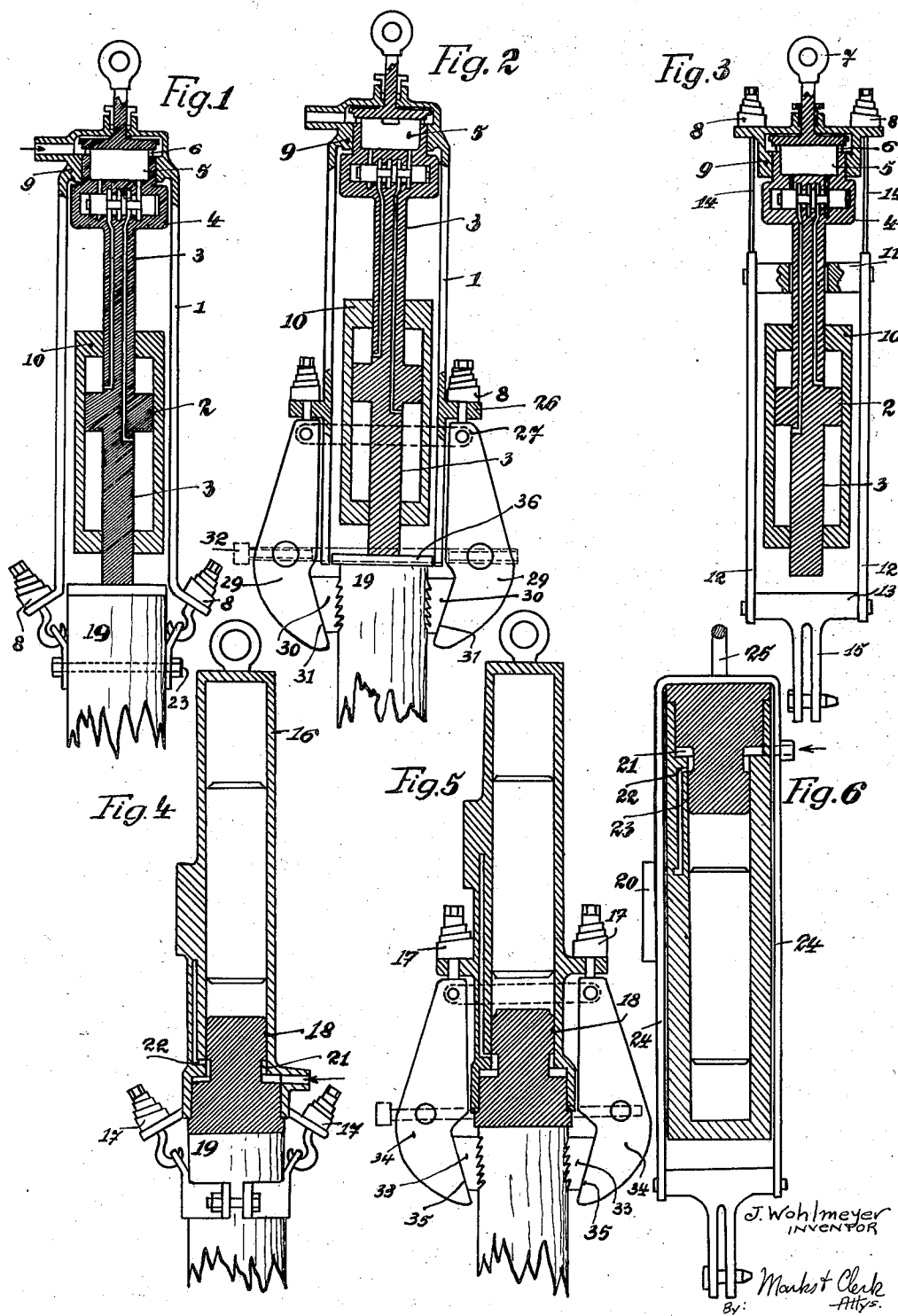
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PISTON PILE DRIVER

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PISTON PILE DRIVER

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This invention relates to an improved method of and appropriate means for driving piles and the like. The hitherto known pile-drivers in which the tup is moved in both directions by means of a gaseous medium under pressure (air, steam, or the like) necessitate the use of a heavy casing. The casing is made so heavy that the reaction pressure of the driving medium acting in an upward direction on the delivery of the blow is not capable of effecting any appreciable jumping of the parts of the driver not pertaining to the tup, i. e. the non-impelled parts of the apparatus, which parts are herein to be understood as comprised under the term casing.

The present invention provides a piling-driving method and apparatus which permits of the casing being made of very light weight, and which consequently reduces the total weight of the plant to a great extent as compared with hitherto known types of construction. This result is achieved by the arrangement that the casing of the pile-driver is resiliently connected to the pile or other object to be driven, so that at first the weight of the pile, and later on the increasing adhesion of the pile in the ground, are utilized for the absorption of the upwardly acting forces of reaction.

This principle is incompatible with the rigid connection of the pile to the casing of the driver, as already proposed for other purposes, since the intermittent movements of the pile produced by the blows delivered by the driver would be transmitted to the casing, with the result that the casing would become damaged and the connection loosened or disengaged. The resilient yielding connection provided in accordance with the present invention obviates these drawbacks.

A further feature of the invention consists in the automatic arresting of the percussion action on the occurrence of slackening or disengaging of the connection between the casing and the pile.

Forms of construction embodying the invention are shown, by way of example, in the accompanying drawing, in which:

Figs. 1, 2, and 3 show the percussion head of a pile-driver or -drawer in which the cylinder serves as the tup.

Figs. 4, 5, and 6 show the percussion head of a pile-driver or pile-drawer in which a piston is constructed to serve as the tup.

In the form of construction shown in Fig. 1 the percussion casing, consisting of the frame 1 and the upper portion 9 of the casing, is connected to the pile 19 by means of a transverse bolt 23,

with the interposition of springs 8. The connecting of the casing to the pile can also be effected in any other known manner, for instance by means of gripping jaws, clamp rings, chains, and the like. The closing of the connecting grip or fastening on the pile can be effected either by hand, with the aid of screws and the like, or by means of the gaseous pressure medium used in the operation of the pile-driver itself. The cylinder and piston constituting the actuating means proper can also be used in place of the resilient interposed means (springs or the like) mentioned above.

With the construction shown in Fig. 1, in which the cylinder 10 of the percussion head serves as the tup of the pile-driver, in order to prevent this cylinder from delivering injurious idle blows or blows upon the piston 2, in the event of the percussion head casing becoming disconnected from or but loosely connected to the pile, an automatic stopping device is provided in accordance with the invention as mentioned above, by which the rigid system comprising piston rod 3, piston 2, and controlling head 4 is shaped at its upper end in the form of a piston 5 which is provided with peripheral slots or apertures 6 for the admission of the compressed driving medium, and which fits and travels tightly in the upper portion 9 of the casing. The inlet slots 6 are arranged at such a level that they are covered over by the cylindrical wall of the upper portion 9 of the casing when the piston 5 is in its lowest position. When the percussion head casing 1 is firmly connected up to the pile 19, the descent of the piston system 5, 4, 3, 2 is prevented by the pile 19 against which it bears. As soon, however, as this connection becomes slack or disengaged the driving medium in the upper portion 9 of the casing will press the piston 5 into its lowest position, with the result that the admission of driving medium to the control head 4 is interrupted, and the driver is stopped. For effecting the relative displacement between the tup member bearing upon the upper end of the pile and the casing to be attached to the pile spring force can also be employed instead of the force of the driving medium. In this case, and also in the case of the previously described form of construction, the interruption of the supply of the driving medium can be effected by means of a closure member actuated by the above-mentioned relative movement.

This arrangement can be employed in connection with any type of double acting hammer with percussion cylinder, including the normal type of pile-driver with heavy casing adapted merely to

be placed in position upon the upper end of the pile. In the latter case the arresting action will occur as soon as the tup does not bear with its full weight upon the pile.

5 If the ramming device with percussion cylinder be employed as a pile-drawer, with the utilization of the percussion effect of the ascending tup against a cross-bar, the arresting device according to the invention can be used for the automatic
10 stopping of the plant as soon as the static tension under which the pile-drawer must be retained falls below the prescribed limit.

In the arrangement shown in Fig. 3 the static tension is applied at the upper eyelet 7 to the piston
15 system 5, 4, 3, 2. The cylinder strikes against a cross-head 11 which embraces the piston rod, and which is provided at each end with a dependent traction link 12. The lower ends of the latter are connected to a cross-bar 13 to which there is articulated a suitable gripper 15 for the grasping
20 of the various types of piles used. In accordance with the invention the two traction links terminate at the upper end in two spindles 14 adapted to pull against springs 8 which bear against the
25 upper portion 9 of the casing. When the gripper 15 has once been connected up to the pile, and a steady tension applied to the upper eyelet 7 which is equal to or greater than the pressure of the driving medium on the portion 5 of the piston system, then the latter will ascend as far as possible
30 relatively to the upper portion 9 of the percussion head casing, thereby disclosing the inlet apertures 6, so that the pile-drawer can begin to strike. As soon, however, as the steady tension in an upward direction diminishes, in consequence of the
35 extraction of the pile from the ground, weakening of the pull at the winch, or for any other reason, to such an extent that it becomes less than the pressure of the driving medium on the piston
40 5 it will be clear that the latter will descend to its lowest position relative to the upper portion 9 of the percussion head casing, and thereby interrupt the supply of the driving medium until the required tractive force is resumed.

45 Similar arrangements can also be employed in connection with rammers of all kinds in which the tup is in the form of a percussion piston (see Figs. 4, 5, and 6).

Fig. 4 shows a device of this nature in the form
50 of a percussion hammer. In this case the light weight cylinder casing 16 is attached to the pile 19 rigidly or with the interposition of springs 17. The anvil 18 takes the form of an off-set piston against the annular collar surface of which the
55 driving medium is brought to bear. In the highest position of the anvil relatively to the casing 16 the driving medium is admitted to the control port manifold 20, since the neck 21 of the anvil exposes the slots or ports 22. As soon, however,
60 as the tension of the springs 17 becomes less than the pressure of the driving medium upon the annular collar surface of the anvil this latter moves outwards relatively to the casing 16 and thereby covers the slots 22, with the result that
65 the admission of the driving medium is interrupted until the required tension is restored.

The same arrangement can also be employed with the usual rammers with heavy casing which are not connected to but merely placed in position upon the pile. In this case the pile-driving
70 plant can only work when the rammer bears with the entire weight of its casing upon the pile.

Fig. 6 shows a type of construction for a pile-drawer with percussion piston in which, in the
75 conventional manner, the rammer shown in Fig.

2 is suspended in the reverse position for use as a pile-drawer. In this case the anvil 23 acts upon the traction links 24 either directly, as shown in the drawing, or through the intermediary of a cross-head. As soon as the steady pull on the
5 eyelet 25 becomes less than the pressure of the driving medium on the annular collar surface of the anvil, the latter ascends relatively to the casing and the slots 22 are covered over, with the result that the pile-drawer is arrested until the
10 necessary tension is restored. As in the case of ramming, the stopping of the plant when serving as a pile-drawer can likewise be effected indirectly and also by spring action.

Finally, in accordance with the invention the
15 pressure of the arresting piston is also made use of to effect the gripping of the pile by bringing about the closing movement of a clamping or gripping appliance.

Fig. 2 shows a form of construction in which
20 the two wedge-shaped jaws 30, which grasp the pile 19, are arranged to slide on two oblique surfaces 31 on the gripper arms 29. These arms can be set to suit the diameter of the pile by means of the two tension screws 32, the cheeks
25 being maintained in the uppermost position by means of springs. The admission of the driving medium to the percussion head 9 causes the piston system 5, 4, 3, 2 to be depressed whereby the
30 two jaws 30 are caused to grip the pile 19 with great strength by the jamming action of the sloping surfaces 31 on the gripping arms.

The pressure of the arresting piston 5 can also be arranged to act directly through the anvil
35 plate 36 upon the wedge-shaped jaws 30, so that these latter are pressed downwards without previous frictional closure against the pile.

Fig. 5 shows an analogous arrangement for use with rammers having a percussion piston. In this case the pressure of the anvil 18 acts upon two
40 wedge-shaped jaws 33 which coast with oblique surfaces 35 provided on the gripper arms 34.

I claim:

1. Apparatus of the character described comprising a percussion rammer having a tup portion adapted to bear against the object to be
45 rammed, a casing portion, means for connecting the casing portion resiliently to the said object, means for supplying a driving medium to the rammer and means associated with the said portions for interrupting the supply of driving
50 medium to the said rammer automatically on the occurrence of loosening of the said connecting means.

2. Apparatus as claimed in claim 1 in which the said automatic interrupting means comprise
55 through passages and a closure member adapted to close off the said passages on the occurrence of relative movement between the said tup portion and casing portion in response to the pressure of
60 the said driving medium.

3. Apparatus as claimed in claim 1 in which the said automatic interrupting means comprise
65 through passages, a closure member adapted to close off the said passages, and spring actuating means, the said closure member being adapted to become operative on the occurrence of relative movement between the said tup portion and casing portion in response to the pressure of the
70 said spring actuating means.

4. Apparatus as claimed in claim 1, when employed for pile-drawing the said automatic interrupting means being adapted to act in response
75 to the reduction of the tractive force applied from

the outside to the rammer below a predetermined limit.

5 5. Apparatus as claimed in claim 1 in which the said rammer includes a rigid system composed of a piston, a piston rod, and a control head, the tup portion being in the form of a cylinder, the upper end of the rigid system being shaped to form a piston having apertures at its periphery for the admission of a driving medium, and
10 adapted to move with accurate fit in the upper part of the said casing portion, so that when the said piston is in its lowest position the said apertures are closed by the inner surface of the said upper part.

15 6. Apparatus as claimed in claim 1 in which the said tup portion is in the form of a piston, and further comprising an anvil in the form of a piston of off-set reduced diameter, and adapted to admit the said supply of driving medium when
20 the said casing portion is in its lowermost position and to interrupt the same when the said casing portion becomes moved away from the said anvil, the said driving medium having the tendency to retain the said anvil in the position
25 of closure, whereas during the working of the rammer the weight of the said casing portion together with the inherent weight and adhesion to the ground of the object rammed tend to retain the said anvil in the position of admission.

30 7. Apparatus as claimed in claim 1, when employed for pile-drawing, and in which the said tup portion consists of a percussion cylinder, characterized by the fact that traction links coupled to the pile are adapted to act upon

springs bearing against the upper part of the said casing portion, while the tensile force required for the pulling of the pile-drawer is applied to a rigid system comprising piston, piston rod, and control head, through the intermediary
5 of a rod traversing the said upper part.

8. Apparatus as claimed in claim 1 when employed for pile-drawing and in which the said
10 tup portion is in the form of a piston, characterized by the fact that traction links are articulated to an anvil in the form of a piston of off-set reduced diameter, while the tensile force necessary for the straining of the pile-drawer is applied to the said casing portion and brings this
15 latter, when the said tensile force exceeds a predetermined limit, against the pressure of the driving medium acting upon the said anvil, into its upper most position in which the inlet passages for the driving medium are disclosed.

9. Apparatus as claimed in claim 1, characterized by the fact that the pressure of the said
20 tup portion bearing upon the object to be rammed effects the closing gripping movement of the connecting means upon the said object.

10. Apparatus as claimed in claim 1, characterized by the fact that the pressure of an arresting
25 piston effects the closing gripping movement of the connecting means upon the said object.

11. Apparatus as claimed in claim 1, characterized by the fact that the pressure of an arresting
30 piston acts upon two wedge-shaped jaws adapted to coact with converging inclined surfaces on gripper arms.

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