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RAM FOR DRIVING PILES AND THE LIKE

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2 Sheets-Sheet 1

Fig. 1.

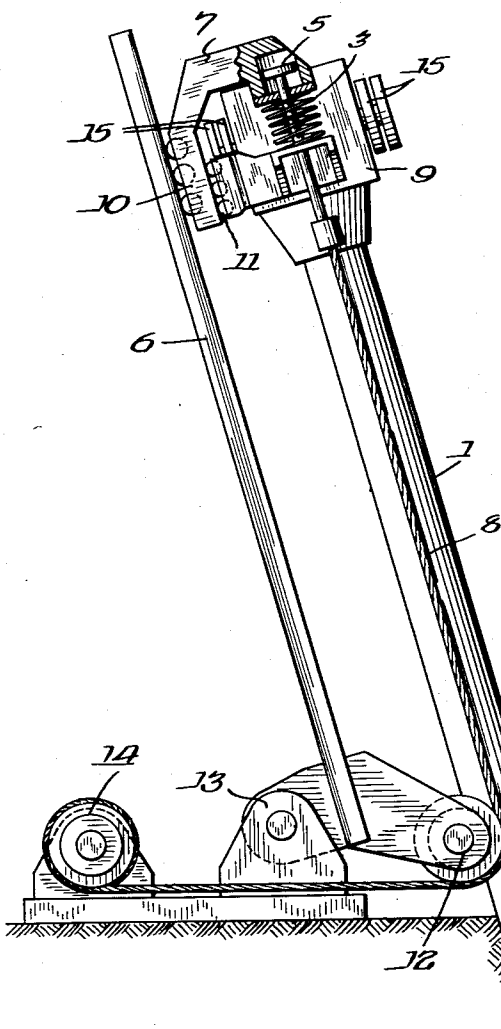
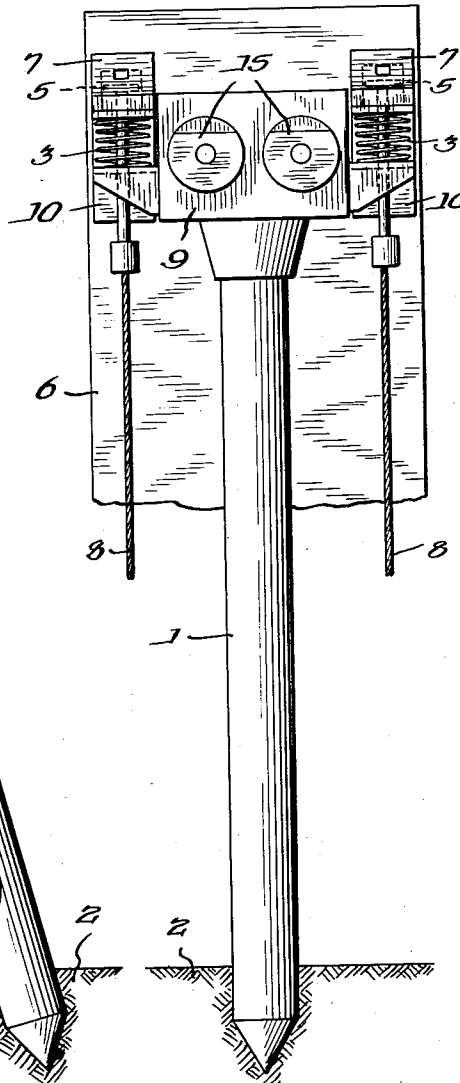


Fig. 2.



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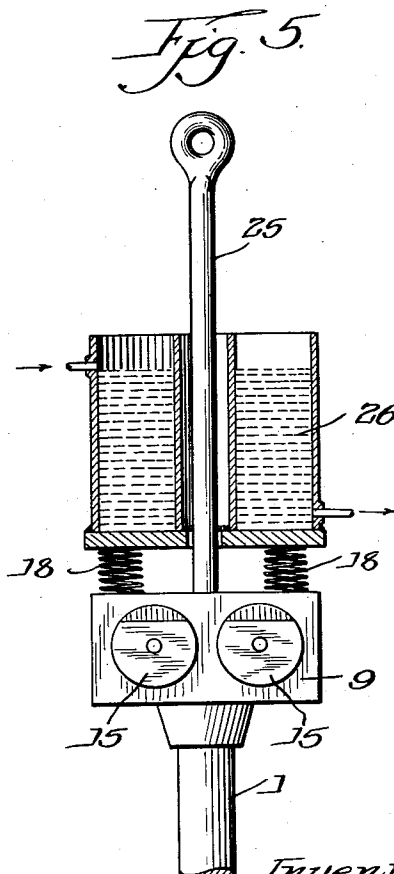
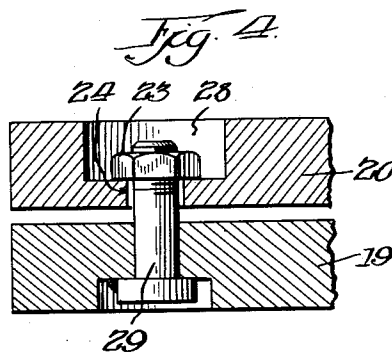
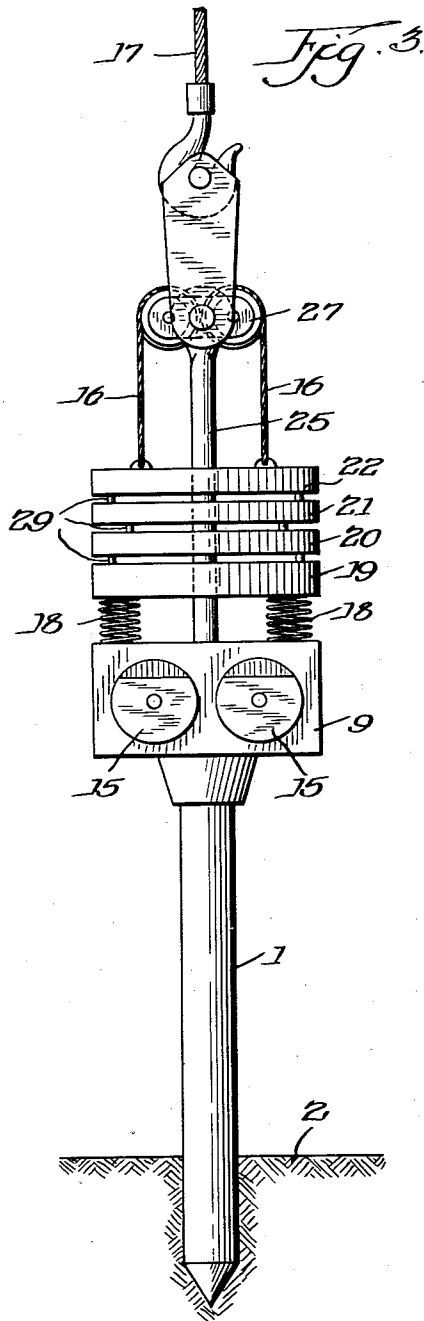
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RAM FOR DRIVING PILES AND THE LIKE

Ludwig Müller, Marburg (Lahn), and Günther Müller, Darmstadt, Germany, assignors to Carl Schenck, Maschinenfabrik G.m.b.H. Darmstadt, Darmstadt, Germany, a corporation of Germany, and Ludwig Müller, Marburg (Lahn), Germany, jointly
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1 Claim. (Cl. 175—55)

This invention is concerned with rams or pile drivers and the like, that is, with devices for ramming into the ground piles, tubes, posts, etc., by the application of directional dynamic forces as well as static forces produced by loading elements such as springs, heavy masses, and the like.

The application of additional static forces is in connection with the above indicated requirement absolutely necessary for, if the weight of the ram as compared with the directional dynamic forces should be negligibly small, the system would only execute oscillations with respect to a median normal position, making the driving, for example, of a pile into the ground, impossible. Accordingly, the weight of the oscillating system is of decisive importance for the ramming or driving effect, quite apart from the manner in which the periodically operative, so-called dynamic forces, are generated.

The invention shows that the optimum ramming action and ramming speed require a certain ratio between the frequency of the dynamic forces or their amplitude and the static forces, such ratio depending in turn upon the ground conditions and the depth to which a pile or the like has to be driven.

Accordingly, the setting of the force ratios to the optimum ramming action requires variable adjustment either of the dynamic forces or of the static forces. It has been found in this connection, that variation of the static forces is of considerably greater importance.

Prior proposals suggested to adjust the static forces by the use of plates acting as weights which, however, requires stopping of the ramming operation for the purpose of adding weight-plates as may be needed. Continuous operation, especially in the case of varying ground structure with strongly changing ramming resistance, requires adjustment during the ramming operation. Apart from the fact that repeated stopping of the ramming operation for adding or removing load or weight-plates is in practice not carried out because it is cumbersome, the adjustment to the optimum ramming action according to the prior proposal is difficult since the action of the ram due to the changing of the static forces is not directly apparent.

The invention avoids these drawbacks by the use of load elements the generation of the forces of which is to a far reaching extent finely adjustable during the ramming operation.

In accordance with an object and feature of the invention, the load generating elements may be in the form of springs anchored to a stationary construction frame, and means for regulating the force expended thereby with respect to the oscillating ram, by changing the tensioning thereof. For this purpose, there may be provided yokes suitably guided on the stationary construction frame, forming mountings for the load springs, and means for adjusting the vertical position of such yokes so as to change the tensioning of the springs.

In accordance with another object and feature of the invention, the load producing element may be a mass, the operatively effective weight of which may be changed during the ramming operation. In order to prevent oscillation of such mass with the ram, it may be coupled therewith so loosely, for example, by spring means, that it remains practically unaffected by the oscillations. The

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mass may be in the form of drums upon which various lengths of chain or cable or the like is wound so as to change the load during the ramming operation. The load mass may also be in the form of a container carrying a liquid the volume of which may be changed during the ramming operation.

In accordance with a further feature of the invention, the load mass may be in the form of mutually interconnected plates, desired numbers of which may be set upon or lifted off from a spring mounting during the ramming operation. According to the invention, each plate may be suitably interconnected, with some play, with the next higher plate, and the top plate may be connected with the construction frame by means of a cable or the like.

The connections between the plates may comprise bolts fixedly connected with the bottom plate and respectively loosely journaled in recesses or bearing means of the respectively vertically next successive plate.

In accordance with still another object and feature of the invention, the force expended by load elements is regulated depending upon the action of the oscillating generating motor, the amplitude of oscillation, the speed of the ram, or by suitable combination of the corresponding values, thereby producing a ram or pile driver which will always operate with optimum ramming action.

The foregoing and further objects and features of the invention will appear from the description of embodiments which will be rendered below with reference to the accompanying schematic drawings. In these drawings:

FIG. 1 shows a ram or pile driver comprising load producing elements in the form of springs which are anchored at a stationary construction frame;

FIG. 2 shows parts of the structure according to FIG. 1, as seen from the front, that is, when looking at FIG. 1 from the right thereof;

FIG. 3 shows a part of a ram according to the invention, comprising plates forming the load producing elements, and means for respectively setting such plates upon spring mountings and lifting them therefrom during the ramming operation;

FIG. 4 shows the manner in which the individual plates may be interconnected; and

FIG. 5 indicates parts of a ram equipped with a load producing element comprising container means which may be filled with and emptied of liquid during the ramming operation.

The ram head 9 in FIGS. 1 and 2, for the ramming of an element, for example, a post 1, is carried by a supporting yoke 7 having preloading springs 3, the yoke being carried by a stationary construction frame 6 positioned on the ground indicated at 2. The tension of the springs 3, producing a load on the ram head 9, may be varied by means of cables 8 extending over idler rollers 12 to a pulley 14. The ram head 9 is movably journaled on the yoke 7 by means of bearing rollers 11, and the yoke 7 is movably disposed on the frame 6 by means of bearing rollers 10. Unbalanced weight masses 15 driven synchronously in opposite direction of rotation, for example, by an electric motor (not shown) generate the oscillations imparted to the ram head 9. Damping means 5 prevent undesired propagation of oscillations from the ram head 9 to the cables 8. The frame 6 is rockably mounted at 13, thus permitting adjustment of the operating parts in any desired angular position with respect to the ground.

In the embodiment according to FIG. 3, the ram is assumed to be suspended from a crane by means of the crane hook 17 in engagement with a cradle extending from the shaft 25 which connects with the ram head 9 carrying the part to be rammed, for example, a post 1. Numeral 15 again indicates the rotatable unbalanced weight masses which generate the oscillations for the

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ram head 9, and 18 indicates the preloading springs corresponding to the springs 3 in FIG. 1. The variable loading of the ram head 9 is in this embodiment effected by plates 19, 20, 21, 22, disposed above the springs 18. The uppermost plate 22 is suspended, by means of cables 16, from pulleys 27 which are rotatably mounted in the cradle carried by the crane hook 17. The pulleys 27 may be driven by suitable motor means (not shown) to raise and lower the uppermost plate 22 as desired so as to vary the load on the springs 18 and therewith on the ram head 9. The plates 19—22 may rest against the springs 18 or may hang from the cables 16, depending upon the lengths of the cables that may be respectively wound upon the pulleys and released therefrom.

The individual plates 19—22 may be interconnected as indicated in FIG. 4 in connection with the plates 19 and 20. A bolt 29 is fixedly connected with the bottom plate 19, such bolt extending through a bore 24 in the plate 20 and carrying a nut 23 disposed within a recess 28 formed in the plate 20. The plate 20 is in turn similarly interconnected with the plate 21 and the latter is likewise similarly interconnected with the top plate 22.

It will be seen at once that, with completely slackened cables 16, the plates will rest one upon the other, all plates resting on the springs 18 forming a load for the ram head 9. Pulling up of the cables, more or less, will lift more or fewer of the plates, the lifted plates hanging together over the interconnecting bolts 29, thus reducing the load on the ram head correspondingly. While the structure does not permit continuous variation of the static load forces acting upon the ram head 9, it provides for a convenient and quick load variation which will be sufficiently fine for most practical cases.

In the embodiment according to FIG. 5, the ram head 9 provided with the rotatable unbalanced weight masses 15 is again assumed to be suspended from a crane hook (not shown) which engages the shaft 25. The preloading of the ram head 9 is in this case effected over springs 18 carrying a container 26 for receiving a liquid, for example, water. The amount of water in the container 26 may be continuously varied by respectively draining and filling the container by way of suitable inlet and outlet means, as may be desired, for the purpose of producing

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desired loading of the ram head. The structure permits perfect adjustment of the required static forces with respect to the ramming resistance that may prevail in any instant of use thereof.

Changes may be made within the scope and spirit of the appended claim.

We claim:

- In a ram for driving piles and the like, having a ram head for engagement with the end of a pile to be driven and having unbalanced weight vibrator means carried by said ram head for generating dynamic forces exerted upon the pile to be driven in the direction of driving such pile, the combination of a yoke member, means for supporting said yoke member comprising a base member and a yoke supporting member pivotally connected at one end thereto, roller means operatively connecting said yoke and said yoke supporting member, roller means operatively connecting said yoke and said ram head for movement parallel to the movement of said yoke relative to said supporting member, spring means operatively disposed between said yoke and said ram head acting in the driving direction of said head operative to statically load the latter, pulley means operatively aligned with said yoke, cable means connected to the latter and extending downwardly therefrom parallel to the driving direction over said pulley means, and means carried by said base member for adjustably applying tension forces to said cable means in the driving direction to provide a variable loading on said ram head.

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