

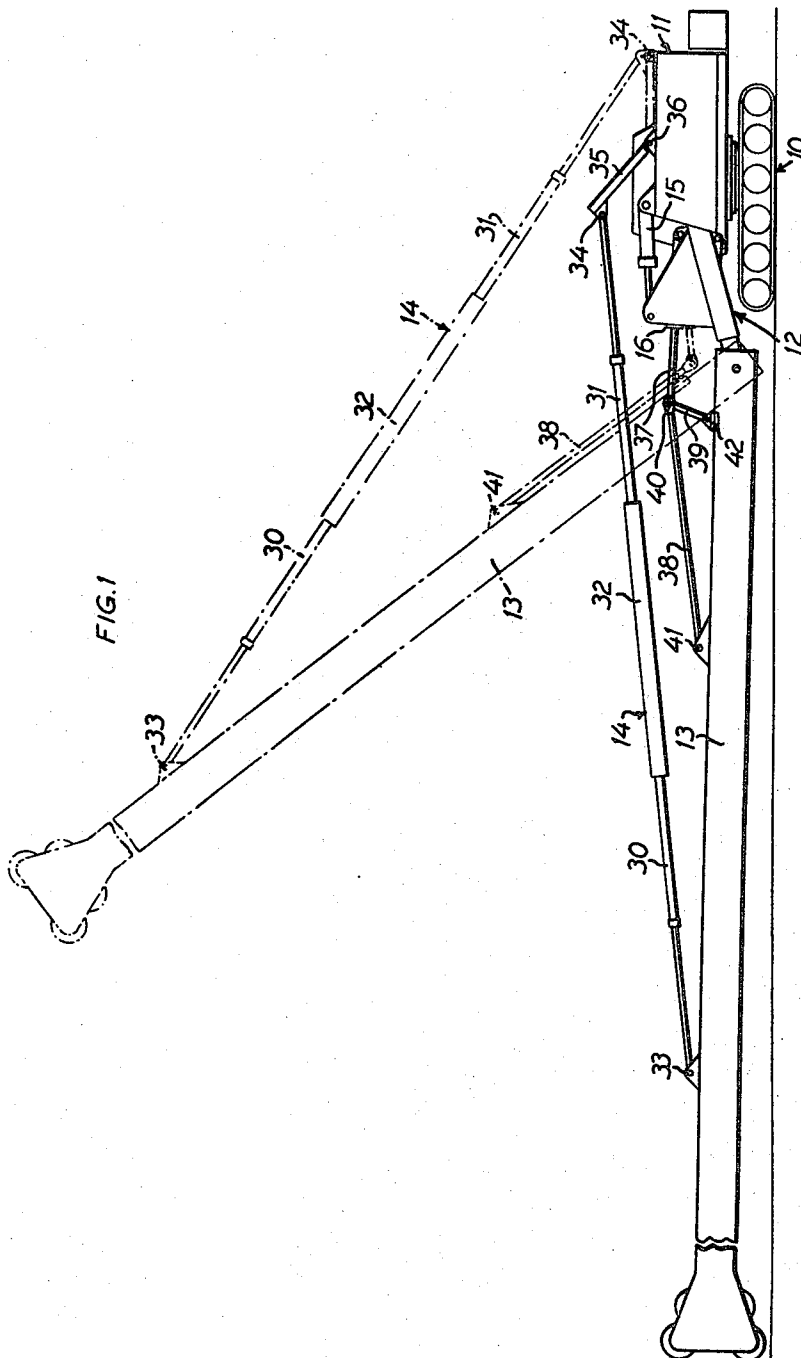
Dec. 24, 1968

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IN PILE DRIVING ATTACHMENTS

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2 Sheets-Sheet 1



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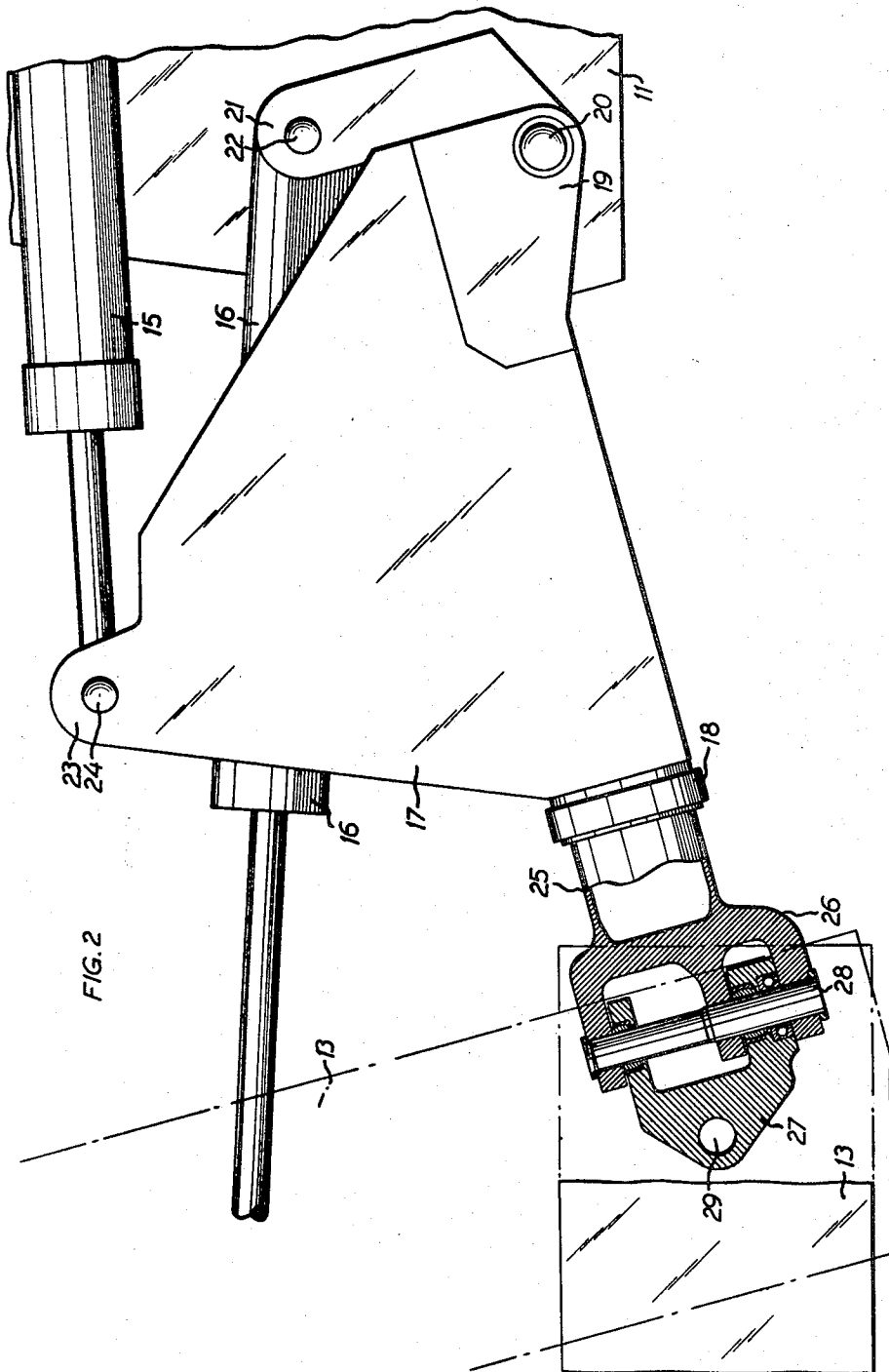
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DEVICES FOR OPERATING THE HAMMER LEADS IN PILE DRIVING ATTACHMENTS

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6 Claims. (Cl. 52—115)

ABSTRACT OF THE DISCLOSURE

A tractor crane having a rotatable windlass frame, the hammer lead being universally pivoted to said windlass frame and the requisite movements of the hammer lead being brought about by a small number of hydraulic power means.

This invention relates to a device for operating a hammer lead which together with a hammer movable along said lead is mounted on an excavating machine or other vehicle to form a pile driving attachment.

In a prior-art pile driving attachment of the above type the connection between the hammer lead and the short radius frame permits swinging of the hammer lead in two relatively perpendicular vertical planes. Though said prior art machine has proved extremely useful it suffers from the disadvantage that it cannot or only with great difficulty be used wherever an obstacle of some kind, for instance the wall of a house, prevents a lateral displacement of the machine and a series of interengaging beams is to extend altogether up to said obstacle, because the longitudinal axis of the vehicle, normally perpendicular to said series of beams, would make an acute angle with the longitudinal direction of said beam series, should it even reach into the corner between said obstacle and said beam series. Moreover, at a forward or rearward adjustment of the hammer lead the entire machine has to be moved, which may prove difficult since exactitude is required, and also has to be continuously moved laterally, all of which is extremely time-consuming. In addition to the lines used for raising the hammer and a beam or pile to be driven into the ground, there are also provided lines for erecting the hammer lead, said latter lines extending from various points of the hammer lead, being cumbersome, subjected to wear and necessitating time-consuming operations for moving the hammer lead into and out of operating position. It is therefore aimed at substituting hydraulic power units for said latter lines, while retaining the lines required for the hammer and for lifting the pile.

One object of the present invention is to provide a more useful and rapid machine.

Another object of the invention is to realize the requisite movements of the hammer lead with the aid of as few operating means as possible.

To this end, it is suggested by the present invention that the connection between the hammer lead and the short radius frame consist of a first member movable in said radius frame longitudinally thereof and arranged for rotation about its longitudinal axis, and a second member connected to said first member for pivotment about an axis at right angles to the axis of rotation of said first member, said second member having a fastening for a pin hingedly connecting the hammer lead to said second member and being at right angles to the longitudinal direction of the hammer lead.

The above and further objects of the invention and the advantages to be gained thereby will appear from the following detailed description in which reference is

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made to the accompanying drawings diagrammatically illustrating an embodiment of the hammer lead operating device according to the invention. In the drawings:

FIG. 1 is a side view of a vehicle having a pile driving attachment mounted thereon, said attachment including a hammer lead shown in horizontal transport position and in partly erected position;

FIG. 2 is a view of a linkage for the connection of the hammer lead to the vehicle.

FIG. 1 shows a tractor crane vehicle having a sub-frame 10 and a superstructure including a windlass frame 11 which is arranged for rotation about a vertical axis. A hammer lead 13 is mounted on the vehicle by means of a linkage generally designated 12. The linkage 12 is so arranged as to permit swinging of the hammer lead in two relatively perpendicular vertical planes and about a pivot axis parallel with but spaced slightly apart from the longitudinal axis of the hammer lead, and shifting of the hammer lead in the longitudinal direction as well as towards and away from the vehicle. Hydraulic power units 14, 15 and 16 are provided to bring about said movements. Two hydraulic units 14 have their one ends attached to the upper half of the hammer lead and their other ends connected to the vehicle, preferably adjacent the rear corner thereof, so as to form an inverted V as viewed longitudinally of the vehicle, while two hydraulic units 15 are connected between the vehicle and the linkage 12, and finally two hydraulic power units 16 are provided between the linkage 12 and the hammer lead 13. FIG. 1 shows only the parts necessary to elucidate the invention, whereas such essential details as the hammer, the lines thereof etc. have been omitted, which will not, however, cause those skilled in the art any difficulties in understanding the drawings.

The linkage 12 comprises a short radius frame including a sleeve means 18, and on either side of said sleeve means upwardly directed limbs 17 which, as will appear from FIG. 2, taper towards their free ends so as to be largely triangular in side view. The limbs 17 constitute part of a U-shaped holder to the web of which the sleeve means 18 is fixedly connected, extending along the basis of the triangular limbs 17. At the rear ends of the limbs 17 the sleeve means 18 has mounted thereon downwardly directed lugs 19 with registering openings 20 to accommodate a pivot mounting the sleeve means 18 on the superstructure 11 of the vehicle. Also arranged at said rear ends are upwardly directed lugs 21 with registering bores 22 through which extends a pin mounting the hydraulic power units 16. Mounted at the upper free ends of the limbs 17 are upwardly directed lugs 23 having registering bores 24 for accommodation of a pivot pin for connection of the limbs 17 with the piston rods of the hydraulic power units 15 pivoted to the superstructure 11 of the vehicle. The linkage 12 further comprises a fork element 26 having three forwardly directed prongs and an oppositely directed tubular stem 25 which is axially movable in the sleeve means 18. The limbs of a yoke member 27 project between the prongs of the fork element 26, and the prongs of the fork element 26 and the limbs of the yoke member 27 are pivotally interconnected by means of a pivot pin 28 passing through bores in said prongs and limbs. The yoke member 27 is pivotally connected to the hammer lead 13 by means of a pivot pin extending through a bore 29 in the member 27. Thus, elements 25, 26, 27, 28 and 29 form a universal connection between the radius frame 17, 18, and the hammer lead 13. Heavy-duty constructions being concerned here, stiffening and strengthening devices are of course provided particularly between the limbs 17. These devices, however, have been omitted here for greater simplicity of the specification.

The hydraulic power units 14 each comprise two hydraulic power cylinders 30 and 31 which are connected together with the aid of a sleeve 32. The piston rod of the upper hydraulic power cylinder 30 is pivotally connected at 33 to the upper portion of the hammer lead, while the piston rod of the lower hydraulic power cylinder 31 is pivotally connected at 34 to one end of a short arm in the shape of a plate 35 extending throughout the width of the superstructure and having the other end pivoted at 36 to the vehicle superstructure 11 at a distance from the rear side thereof corresponding to the length of the arm. Each of the hydraulic power cylinders 31 is disposed close to one side of the plate 35, i.e. spaced the largest possible distance apart transversely of the vehicle. As will appear from FIG. 1, the plate 35 is arranged for pivotment between a front position and a rear position parallel with the upper side of the superstructure 11; in the latter position the plate can be blocked against forward pivotment. The purpose of this arrangement will be described more in detail in the following. The supply of pressure medium to the hydraulic power cylinders 30 and 31 may suitably be effected through pasageways in the piston rods of the cylinders 31.

Each of the piston rods 37 of the juxtaposed hydraulic power units 16 is connected with the hammer lead 13 at a hinge point 40 by means of two pull rods 38 and 39 forming a unit. One of these pull rods, 39, is short and extends from the hinge point 40 to an attachment point 42 at a short distance from the end of the hammer lead, while the other pull rod 38 is long and extends from the hinge point 40 to an attachment point 41 on the hammer lead at a considerably greater distance from the end of the hammer lead. The hinge point 40 is at a slight distance above the hammer lead 13 when the latter is in horizontal position, and is retained at such distance until the hammer lead has been erected so far that the hydraulic power units 14 can take over, proceeding with the erection of the hammer lead. In this position the rods 38 and 39 are moved into and locked in juxtaposition with the hammer lead. The attachment points 41 and 42 of the pull rods 38 and 39 are disposed at so large a distance as possible transversely of the hammer lead from the second pair of pull rods 38, 39.

The pile driving attachment according to the invention is utilized in the following way. From the horizontal or transport position in which the hinge points 40 of the hydraulic power units 16 and the pull rods 38, 39 are spaced slightly above the hammer lead and the arms 35 are forwardly swung, as shown by full lines in FIG. 1, the hammer lead is moved into vertical or operating position in that firstly the hydraulic power units 16 are made operative so as to exert pull at the rods 38 and 39 whereby the hammer lead is swung on its pivot axis at the linkage 12. After a given swinging movement the hydraulic power units 14 are able to take over proceeding with the erection of the hammer lead, and the pull rods 38, 39 are now swung into and locked in juxtaposition with the hammer lead. At the same time the plate 35 has described an arcuate path and now is adjacent the upper surface of the vehicle superstructure 11, as is shown by dash-and-dot lines in FIG. 1, in which position it is also locked. Secondly, the hydraulic power cylinders 30 and 31 are made operative whereby the hammer lead is swung into vertical position. The vehicle is driven to the place where piling is to be effected and the position of the vertical hammer lead longitudinally of the vehicle is finely adjusted with the aid of the hydraulic power units 16 which—due to the hinge point 40 and the pull rods 38 and 39 being locked with the hammer lead—by simultaneously operation move the hammer lead towards or away from the vehicle by means of the stem 25 axially movable in the sleeve means 18. After this adjustment the hydraulic power units 15 are made operative so that the sleeve means 18 is swung towards the ground until the lower end of the hammer

lead 13 rests on the ground whereupon pile driving can take place. Should the piles be driven down obliquely towards or away from the vehicle or, for instance, on inclining ground level, obliquely in either lateral direction, adjustment is effected with the aid of the hydraulic power cylinders 30 and 31 in the former case about the pivot axis of the hammer lead in the yoke member 27 and in the latter case by rotation of the stem 25 in the sleeve means 18. If pile driving is to be effected at a location where the vehicle cannot be placed opposite the pile to be driven, for instance where the wall of a house or other obstacle makes it impossible to move the vehicle laterally but piles are to be driven into the ground up to this very obstacle, the vehicle superstructure is first swung into a suitable position in which the hammer lead will be slightly oblique with regard to the position in which the pile is to be driven, and then either hydraulic power unit 16 is made operative, the hammer lead being swung about the pivot pin 28 into alignment with said position. Such arrangement of course is also extremely advantageous in normal pile driving since the lateral range of action of the pile driving attachment is increased considerably, which implies that the machine need not be moved laterally as often as prior art machines.

The above embodiment of the invention was described for purposes of illustration rather than limitation. All possible variations and modifications of the invention are understood as being included within the scope of the appended claims.

What we claim and desire to secure by Letters Patent is:

1. In a tractor crane having a rotatable windlass frame, the combination of a pile driving attachment, said pile driving attachment comprising a hammer lead, a short radius frame, pivotal connecting means connecting said radius frame to said windlass frame, a universal connection between said radius frame and said hammer lead at a relatively short distance from the lower end thereof, said universal connection including a first member rigidly secured to said radius frame, a second member rotationally and slidably connected to said first member, a third member, means hingedly connecting said third member to said second member about an axis perpendicular to the axis of rotation of said second member and means pivotally connecting said third member to said hammer lead at right angles to the longitudinal direction of the hammer lead, means for erecting the hammer lead from a substantially horizontal position to an upright position, means for rotating and sliding said second member, third member and hammer lead in respect of said first member, means for hingedly connecting said third member to said second member and means for pivoting said radius frame on said windlass frame in a vertical plane for raising and lowering said hammer lead when in erected position.

2. The combination set forth in claim 1, wherein said means hingedly connecting said third member to said second member comprises a fork-shaped portion on the second member, means on the third member projecting between the fork prongs, a pivot pin extending through the fork prongs and the means between them, said pivot pin being substantially parallel with the longitudinal direction of the hammer lead.

3. The combination set forth in claim 2, wherein said means pivotally connecting said third member to said hammer lead comprises a pivot passing through a lug of the third member and bearings on the hammer lead, said pivot being at right angles to the longitudinal direction of the hammer lead and spaced from the pivot pin passing through the fork prongs.

4. The combination set forth in claim 1, wherein said means for erecting said hammer lead comprises hydraulic power units rotatably attached to said radius frame and connected to the hammer lead adjacent the lower end thereof, and two separately extendable struts having their one ends connected to the hammer lead at a relatively large distance from the lower end thereof, and having

their other ends connected with a forwardly swingable support at the rear end of the windlass frame.

5. In a tractor crane having a rotatable windlass frame, the combination of a pile driving attachment, said pile driving attachment comprising a hammer lead, a short radius frame, pivotal connecting means connecting said radius frame to said windlass frame, a universal connection between said radius frame and said hammer lead at a relatively short distance from the lower end thereof, said universal connection including a first member rigidly secured to said radius frame, a second member rotationally and slidably connected to said first member, a third member, means hingedly connecting said third member to said second member about an axis perpendicular to the axis of rotation of said second member and means pivotally connecting said third member to said hammer lead at right angles to the longitudinal direction of the hammer lead, means for erecting the hammer lead from a substantially horizontal position to an upright position, for rotating and sliding said second member, said third member and said hammer lead in respect of said first member, for rotating said third member and said hammer lead in respect of said second member, and for rotating said hammer lead in respect of said third member, said means comprising two separately extendable struts having their one ends connected to the hammer lead at a relatively large distance from the lower end thereof and having their other ends connected with a forwardly swingable support at the rear end of the windlass frame, two hydraulic power units on the short radius frame placed in the same horizontal plane and connected to the hammer lead each at one point, said points being spaced from each other transversely of the hammer lead, means for making each of said struts and said hydraulic power units operative independently of each other and for making said struts and said hydraulic power units, respec-

tively, operative in common, and means for pivoting said radius frame on said windlass frame in a vertical plane for raising and lowering said hammer lead when in erected position.

6. The combination set forth in claim 5, wherein said hydraulic power units are each connected to said hammer lead by two pull rods having their one ends connected to the piston rod of the hydraulic power unit and their other ends connected to the hammer lead at two points spaced apart in the longitudinal direction of the hammer lead, the arrangement being such that said pull rods from their connection points on the hammer lead extend obliquely upwardly to the connection point between said piston rod and said pull rods when the hammer lead is in horizontal position but are moved into substantially parallel juxtaposition with the hammer lead after a given swinging of the hammer lead towards vertical position by a pull exerted at the pull rods by means of said hydraulic power units to facilitate the erection of said hammer lead, and that the pull rods are lockable in substantially parallel juxtaposition with the hammer lead.

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