March 2, 1965 H. G. WARRINGTON 3,171,552

PILE DRIVING APPARATUS

Filed Nov. 5, 1962 3 Sheets-Sheet 1

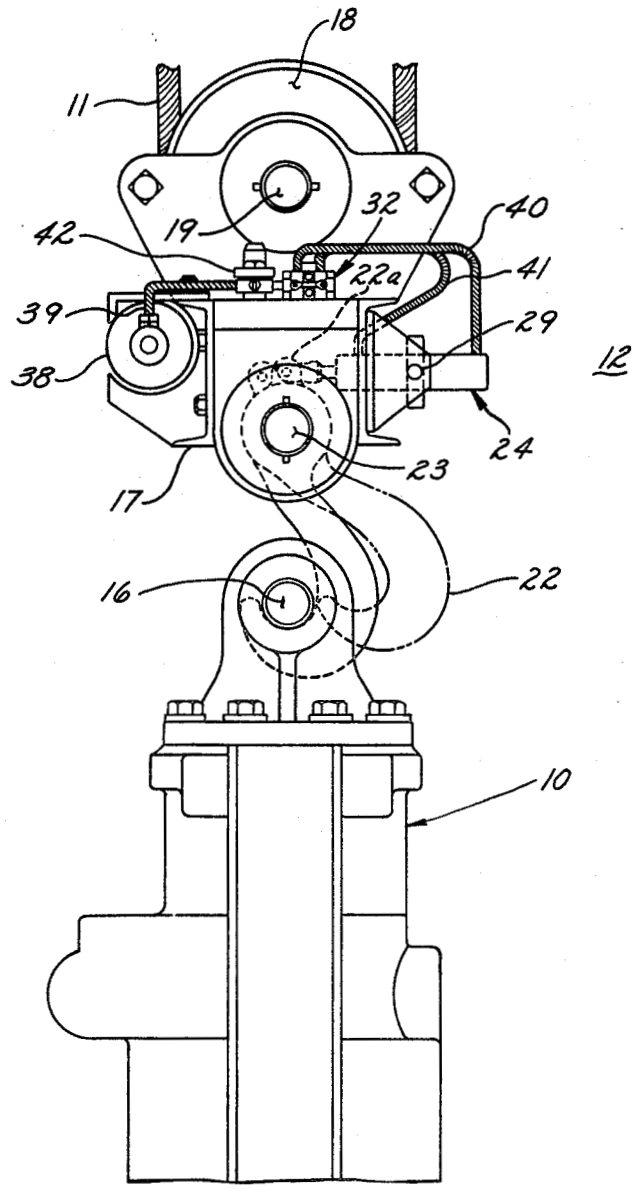

Fig-1-

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PILE DRIVING APPARATUS

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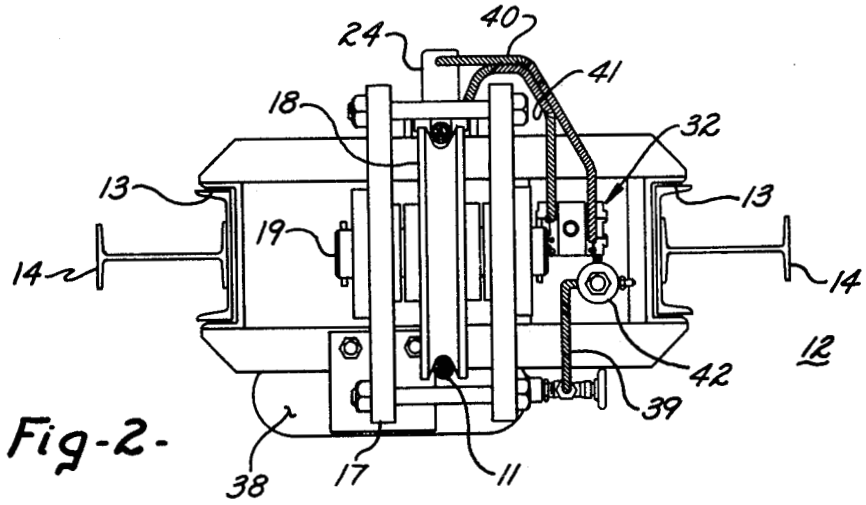

Fig-2-

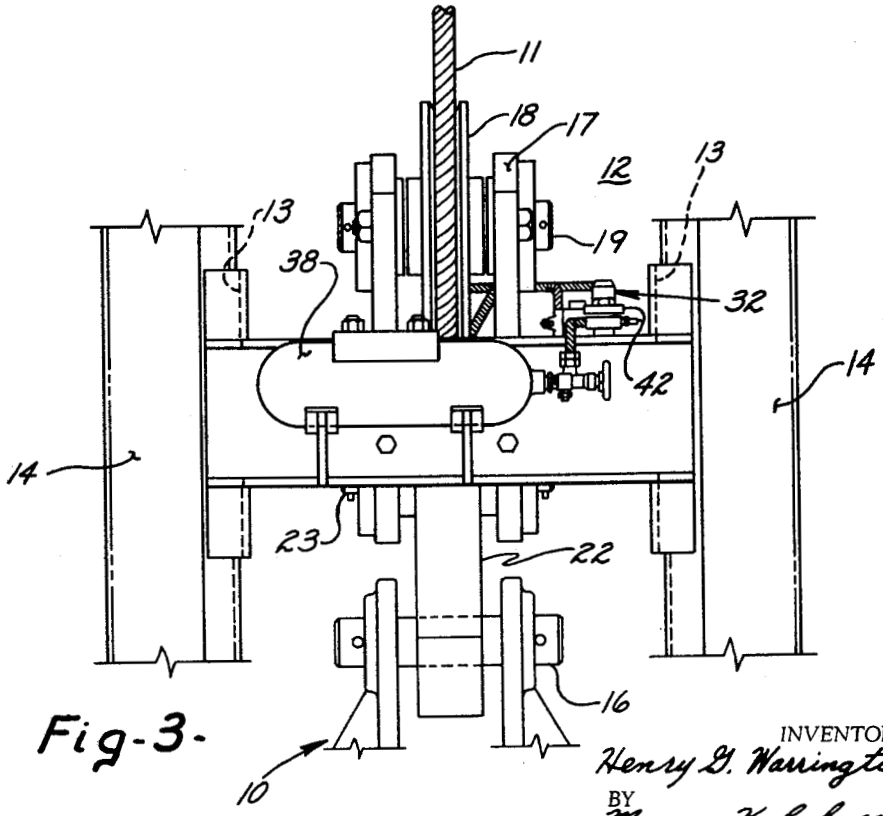

Fig-3-

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PILE DRIVING APPARATUS

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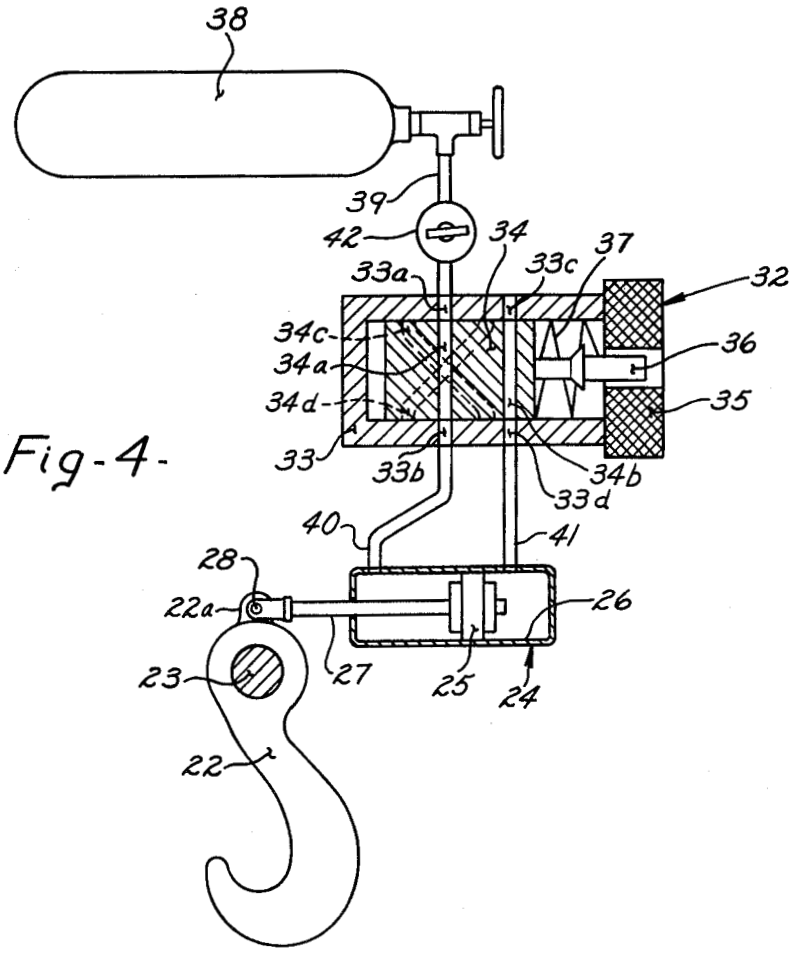
Fig-4-



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PILE DRIVING APPARATUS

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1 Claim. (Cl. 214—95)

The present invention relates to pile driving apparatus, and, more particularly, to a servo pneumatic hook block for connecting the hoisting rope of a crane or other hoisting device to a pile driving hammer.

Existing pile driving hammers for transmitting pile driving blows to a pile are conventionally lifted or hoisted to the top of a pile and guided in their downward movement through guide tracks in the hammer cooperating with leaders for vertical movement on the top of the pile. In this manner the pile driving hammer can ride down as the pile is driven into the ground and the hoisting rope may be slackened so that the entire weight of the pile driving hammer is applied to the pile. It is conventional in pile driving hammers to provide sheaves in the upper end or cylinder block of the hammer for the purpose of hoisting the hammer upwardly in the leaders and also for lowering the hammer downwardly in the leaders.

Heretofore, difficulty has sometimes arisen in allowing the hammer to ride freely in the leaders during the driving of the pile. Moreover, since the hoisting rope is always threaded through the sheaves of the hammer, difficulty may be experienced in raising and lowering the hammer, in removing the hammer from the hoisting rope, and the like. Accordingly, it would be desirable to provide a means for quickly and simply disconnecting the hoisting rope from the pile driving hammer.

It is therefore an object of the present invention to provide a new and improved pile driving apparatus.

A further object of the present invention is to provide a new and improved hook block for use with a pile driving hammer which will provide for selective engagement and separation or release of the hoisting rope from the pile driving hammer.

A further object of the present invention is to provide a new and improved means for connecting a hoisting rope with a pile driving hammer.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claim annexed to and forming a part of this specification.

In accordance with these and other objects, there is provided improved means for connecting a pile driving hammer to a hoisting rope. The invention is particularly adapted for use with a hammer of the type guided for vertical movement by one or more leaders.

According to the present invention, there is provided a hook block including a frame and having a pivotally mounted hook on the frame for hooking engagement with the hammer. Sheave means are carried by the frame for connection to the hoisting rope. The hook block additionally includes means operatively connected to the hook for selectively pivoting the hook into and out of a hammer engaging position. The sheaves conventionally included in the cylinder head of a pile driving hammer are replaced in the hammer by a lifting pin or eye pin. The hook is adapted in its hammer engaging position to engage the lifting pin or eye bolt. In a preferred embodiment the hook operating means includes a fluid cylinder connected to the hook and arranged to pivot the hook into and out of its hammer engaging position. The fluid cylinder is operated by a source of pressurized fluid which conveniently may consist of a tank of nitrogen gas under pressure. A solenoid controlled distributing valve controls the operation of the cylinder. The solenoid may be remotely controlled electrically by a push button at a station at the crane operator's position.

For a better understanding of the present invention, reference may be had to the accompanying drawings, wherein:

FIG. 1 is a side elevational view of an improved hook block according to the present invention and fragmentarily illustrating a pile driving hammer connected thereto;

FIG. 2 is a plan view of the improved hook block according to the present invention and illustrated in guided relation with a pair of leaders;

FIG. 3 is a front elevational view of the hook block of FIG. 2, illustrated between the pair of leaders; and

FIG. 4 is a somewhat schematic illustration of the control system of the hook block of FIGS. 1 to 3.

Referring now to the drawings, there is illustrated a pile driving apparatus including a pile driving hammer fragmentarily illustrated at **10** supported from a hoisting rope **11** of a crane (not shown) or other hoisting or lifting device through an improved hook block **12** according to the present invention. As best seen in FIGS. 2 and 3, the hook block **12** is provided with a guide track **13** on opposed sides thereof which guide the hook block **12** between a pair of vertical leaders or tracks **14** for vertical movement. It is understood, as is conventional with pile driving apparatus, that the hammer **10** is provided with similar guide tracks (not shown) which guide the hammer **10** for vertical movement between the leaders **14**.

As has heretofore been described, the pile driving hammer **10** may have conventional pile driving means, and, more specifically, may be of the type disclosed in Patent No. 2,004,180, issued June 11, 1935. However, the conventional pile driving hammer **10** for use with the improved hook block **12** according to the present invention is modified from the conventional to provide lifting hook means such as the lifting pin **16** at its upper end, here shown as extending from the cylinder head of an otherwise conventional hammer **10**. It is, of course, understood that other suitable lifting or hoisting means such as an eye bolt may be provided at the top of the hammer **10**.

The hook block **12** according to the present invention includes a hook block board or frame **17** which carries the pertinent parts including the guide track **13** and which rides upwardly and downwardly in the leaders **14**. A sheave **18**, here shown as a single pulley sheave, is rotatably supported from a sheave pin **19** from the upper end of the frame **17**. To provide for interconnecting the hook block **12** and the hammer **10**, the hook block **12** is provided with a hook **22** pivotally mounted from the frame **17** on a hook pin **23**. The hook **22** is swingable from a first position, illustrated in solid in FIG. 1, wherein it engages the hammer **10** through the lifting pin **16** thereof, to a second position, illustrated in phantom in FIG. 1, wherein it is separated from engagement with the hammer **10** and the hammer **10** is released from the hook block and hoisting rope **11**.

For actuating the hook **12** between its engaged and its released position, there is provided a fluid cylinder assembly **24** operatively connected to the hook for selectively pivoting the hook into and out of hammer engaging positions. More specifically, as best illustrated in FIGS. 1 and 4, the hook **22** is provided with a dog portion **22***a* eccentrically located relative to the pivotal axis of the hook **22**. As illustrated, the fluid cylinder assembly **24** is of the double acting type and includes a pistion **25** reciprocally movable within a cylinder **26**. The outer end

of a connecting rod **27** extending from the piston **25** is pivotally connected to the dog portion **22***a* of the hook **22** through a pivot pin **28**. Movement of the piston **25** in the cylinder **26** is, of course, effective to pivot the hook **22**. To prevent improper alignment or binding of the piston **25** and connecting rod **27** throughout the length of its stroke, the cylinder assembly **24** is connected to the frame **17** through an oscillatory pivot connection **29**, FIG. 1, to permit rocking of the cylinder assembly **24**.

Movement of the piston **25** in the cylinder **26** is controlled by a solenoid distributing valve **32**, best illustrated in FIG. 4, and including a valve body **33** and a valve element **34**. An electrical solenoid **35** provided with an armature **36** is connected to the valve element **34** to move the valve element **34** in a first direction upon energization of the solenoid **35**. A compression spring **37** in the valve **32** is adapted to return the valve element **34** when the solenoid **35** is deenergized.

A suitable source of pressurized fluid is provided for actuating the cylinder assembly **24**. As herein illustrated, the fluid includes a tank **38** of compressed nitrogen gas connected to the cylinder assembly **24** through the valve **32** by means of conduits **39**, **40** and **41**. If desired, a pressure regulator valve **42** may be used to control the pressure from the fluid tank **38**.

To provide the control for the cylinder assembly **24**, the solenoid distributing valve **32** is provided with a plurality of ports and passageways which selectively connect conduit **39** with conduits **40** or **41**. Specifically, the valve body **33** is provided with two sets of aligned ports, FIG. 4, indicated by **33***a* and **33***b*, and **33***c* and **33***d*. The valve port **33***a* is a fluid inlet port and is connected through the pressure regulator **42** and conduit **39** to the source of pressurized fluid in the fluid tank **38**; the port **33***c* is an exhaust port exhausting to atmosphere; the ports **33***b* and **33***d* are connected to opposite sides of the cylinder **26** through conduits **40** and **41** respectively. Additionally, the valve element **34** is provided with two pairs of fluid passageways **34***a* and **34***b*, and **34***c* and **34***d* which are effective when the valve element **34** is moved between its two positions to reverse the direction of fluid pressure in the cylinder **26**. Specifically, when the solenoid **35** is deenergized, as illustrated in FIG. 4, so that the valve element **34** is to the left as viewed in FIG. 4, the passageway **34***a* interconnects the ports **33***a* and **33***b* and the passageway **34***b* interconnects the ports **33***c* and **33***d* thereby applying fluid pressure to the left-hand end of the cylinder **26** and exhausting the right-hand end thereof to the atmosphere. However, upon electrical energization of the solenoid **35**, the armature **36** is drawn into the solenoid and the valve element **34** moves to the right as viewed in FIG. 4 against the return bias of the compression spring **37**. In this position the passageway **34***c* interconnects the port **33***a* with the port **33***d* and the passageway **34***d* interconnects the port **33***c* with the port **33***b* thereby applying fluid pressure to the right-hand side of the cylinder **26** and exhausting the left-hand side thereof to the atmosphere.

In operation, it will be understand that with the hook **22** engaging the lifting pin **16** as illustrated in solid in FIG. 1, the pile driving hammer **10** may be lifted vertically between the leaders **14** and placed in position on top of a pile. With the hammer **10** at rest on top of the pile between the leaders **14**, the solenoid **35** may be energized as by a push-button in the control cab of the crane which is effective to admit fluid under pressure to the right-hand side of the cylinder **26** and to pivot the hook **22** counterclockwise to the position illustrated in phantom in FIG. 1. In this position the pile driving hammer **10** is free to ride

on top of the pile and to follow the pile down. The hook block **12** may be moved clear of the driving hammer **10**. Once the hammer **10** reaches the bottom of its travel, the hook block **12** may be lowered by means of the hoisting rope **11** to a position immediately above the hammer **10**, and the hook **22** may again be rotated to its released position illustrated in phantom in FIG. 1 until it clears the lifting pin **16**. The solenoid **35** may then be deenergized and the hook **22** will be rotated clockwise into locking engagement with the lifting pin **16** thereby to engage the hammer **10**.

Although the present invention has been described by reference to only a single embodiment thereof, it will be apparent that numerous other modifications and embodiments may be devised by those skilled in the art, for example, a single acting cylinder may be employed and the hook **22** may be spring-biased to one of its positions. Moreover, the lower forward edge of the hook **22** may form a camming surface which would be effective to cause the hook **22** to slide over the lifting pin **16** as the hook block **12** is lowered downwardly into engagement with the hammer **10**. Accordingly, it is intended in the appended claim to cover all modifications and embodiments which will fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

A hook block for use with a pile driving hammer of the type adapted for guided vertical movement, said hook block comprising frame means for guided vertical movement with a pile driving hammer, pivoted hook means mounted on said frame means for movement between a hammer engaging and hammer releasing position, sheave means carried by said frame for connection to hoisting means, a fluid cylinder pivoted to said frame, a piston in said cylinder operatively connected to said hook means for moving said hook means into one of said positions, fluid supply means including a tank of pressurized fluid carried by said frame means, conduit means interconnecting said fluid supply means and said fluid cylinder, and solenoid operated control valve means in said conduit means for selectively controlling the admission of fluid to said fluid cylinder to selectively position said hook means.

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