Dec. 6, 1960 E. A. SMITH 2,963,100

PILE DRIVING HAMMERS

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Fig. 1.

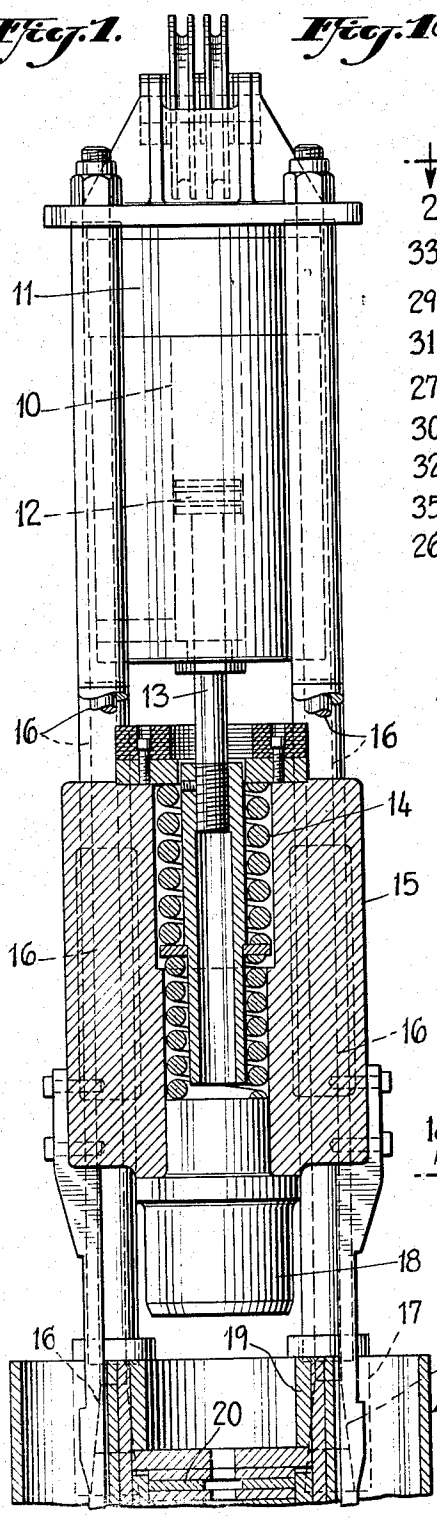



Fig. 1a.

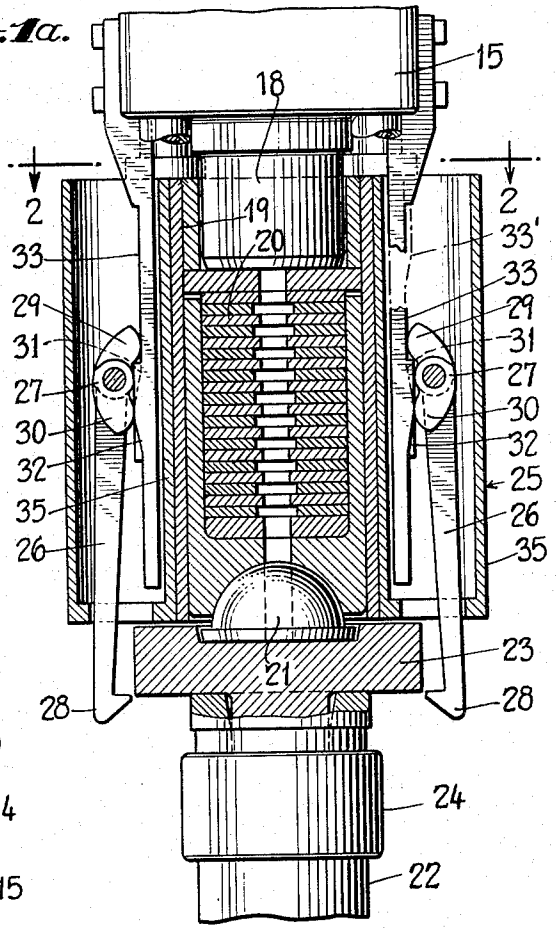
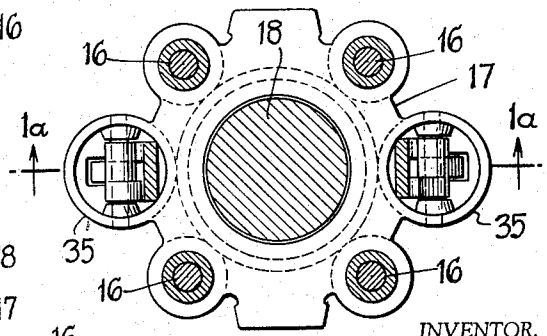



Fig. 2.




INVENTOR.
EDWARD A. SMITH.
BY
Arad Neal Haselton Orme & McElhannon
ATTORNEYS.

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Fig. 3.

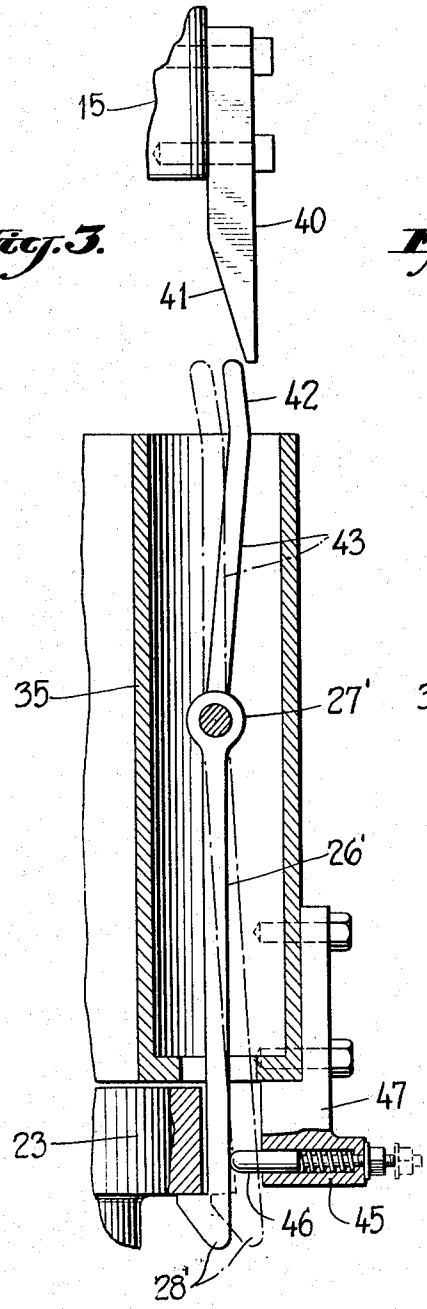
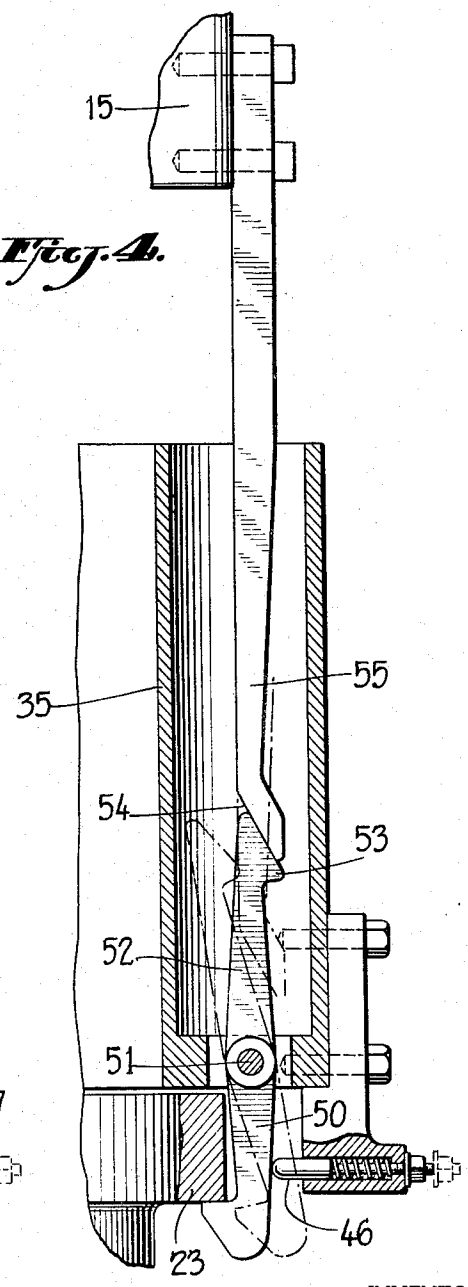



Fig. 4.




INVENTOR.
EDWARD A. SMITH.
BY
Ward, Neal, Haselton, Orme & McElhannon
ATTORNEYS.

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# PILE DRIVING HAMMERS

Edward A. Smith, Chatham, N.J., assignor to Raymond International Inc., New York, N.Y., a corporation of New Jersey

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6 Claims. (Cl. 175—146)

This invention relates to double-acting fluid pressure operable power hammer constructions of an improved type particularly adapted, among other possible uses, to the driving of piles or pile cores.

In applicant's copending application Serial No. 582,386, filed May 3, 1956, a fluid pressure operated pile driving hammer is disclosed in assembly with the core head of a pile driving core, the body of the hammer having connections to the core head comprising spring means acting to hold down the hammer against the core head during the downstrokes of the piston and hammer ram, but such spring connecting means allowing the core head yieldably to advance further downwardly relative to the hammer body when the core head receives the hammer impacts. Such a "hold-down" means for connecting the hammer body to a core head or other element being driven is highly advantageous, if so made that the connection will permit the core head to advance upon occurrence of the impacts without being unduly retarded by the inertia of the hammer body and in such manner that the heavy forces of the impacts will not be applied to and cause damage to the hammer body. That is, the provision of such a hold-down means in effect permits adding the weight of the core being driven to the weight of the body of the hammer whereby in a typical case, the fluid pressure against the hammer cylinder head may be doubled without causing objectionable "dancing" of the hammer. And with the increased pressure of that magnitude it is possible for the hammer in a typical case to deliver 50 percent more impact energy as well as greatly increasing the speed of its operation as compared with cases where the hammer is not connected to the core head by such a hold-down means.

While the provision of a hold-down means embodying compressible springs, as disclosed in said copending application, is quite satisfactory in may cases, yet in cases where for example it is possible to drive the pile shell down a considerable distance on each impact, such a spring hold-down connection may tend to retard the downward movement of the pile core because same will not be completely freed from the inertia of the hammer body, but will remain connected thereto by the spring means which will be more and more heavily tensioned as the hammer and core head tend to become more widely separated in cases where the soil is such that the pile core may advance for a considerable distance upon each impact.

In accordance with the present invention, a hold-down connection arrangement is provided between the hammer and the element being driven, in the form of hook means or the like so arranged that the core head or other element being driven is positively connected to the hammer during each downstroke and until the moment of impact, whereupon the hook means is automatically disengaged and then, at the end of the downward movement of the element being driven, the hook means will again be engaged automatically, ready for



the next downstroke. Thus, the invention provides a positive connection during each downstroke permitting full advantage to be taken of holding down the hammer during the downstroke yet at the moment of impact permitting the connection to be released so that the element being driven may advance into the earth quite free of the inertia of the cylinder or main body portions of the hammer, and the latter are free of any danger of damage from the impacts.

The invention is particularly advantageous for use with powerful high-speed hydraulic pile driving hammers and accordingly, the invention will be herein described and illustrated in connection with a hammer of that type.

Other and more specific objects, features and advantages of the invention will appear from the detailed description given below taken in connection with the accompanying drawings which form a part of this specification and illustrate by way of example the presently preferred embodiments of the invention.

In the drawings:

Fig. 1 is an elevational view shown partly in vertical sections, as indicated, of a hydraulic hammer to which the invention is applicable, certain of the lower portions of the hammer being omitted in Fig. 1 but same are shown in Fig. 1*a* in vertical section taken substantially along line 1*a*—1*a* of Fig. 2;

Fig. 2 is a horizontal sectional view taken substantially along line 2—2 of Fig. 1*a*; and

Figs. 3 and 4 are elevational views partly in vertical section showing two embodiments of hook arrangements alternative to the embodiment shown in Fig. 1*a*.

Referring now to the drawings in further detail, there is shown in Fig. 1 a hydraulic type hammer having a cylinder portion **10**, a cylinder head **11**, a piston **12**, and a piston rod **13** connected through a spring arrangement shown generally at **14** to a ram **15**. Suitable valve means for controlling the admission and escape of hydraulic fluid pressure for the cylinder may be provided in or upon the cylinder head and of a construction for example such as described in U.S. Patent No. 2,798,363, granted July 9, 1957, to John T. Hazak and William P. Kinneman. The spring connecting arrangement between the piston rod and the ram as indicated generally at **14** may also be of the construction and for the purpose disclosed in said patent which also discloses further features involving no part of the present invention but which may be utilized for the type of hydraulic hammer here shown.

The ram **15** may be slidably arranged on column assemblies as at **16** which also connect the cylinder and cylinder head portions of the hammer to a base portion indicated at **17**, such column means being, if desired, of a construction such as disclosed in applicant's copending U.S. patent application Serial No. 544 225, filed November 1, 1955, and now Patent No. 2,885,862, entitled "Power Hammer Construction."

The ram **15** may be provided with a ram point **18** of a type such as also disclosed in said Patent No. 2,798,363 and which upon each downstroke enters a lower hammer base portion **19** (Fig. 1*a*) and thereupon applies an impact to a cap block assembly indicated generally at **20**. Such cap block assembly, if desired, may be of a construction and arrangement such as shown in applicant's Patent No. 2,723,532, granted November 15, 1955. Ball and socket means as at **21** may be located beneath the cap block assembly and such means may be of a construction also disclosed, and for the purposes explained in said Patent No. 2,723,532.

As further shown in Fig. 1*a*, the hammer base is shown in assembled relation with a pile driving core **22** which

is surmounted by a core head 23. Such core head may be formed integrally with the core as disclosed in applicant's said copending application Serial No. 582,386, or, if preferred, the core head may be attached to the core by any suitable form of detachable coupling means at a position schematically indicated at 24.

As further indicated in Fig. 1*a*, a plurality of the hook-type hold-down arrangements as above referred to may be positioned along the sides of the hammer base, two of these being here shown and located on opposite sides of the hammer base and as generally indicated by the numeral 25. The presently preferred embodiment of such hook means as shown in Fig. 1*a* comprises a member 26 suitably pivoted at 27 in a position so that a hook portion 28 thereon normally extends down in hooked engagement wtih the underside of the core head 23. The upper portion of the member 26 is formed with two lug-like cam portions 29 and 30 which are adapted respectively to be engaged by cam portions 31 and 32 formed on a cam rod 33 which is secured as by bolting to the side of the ram, as indicated at the upper portion of Fig. 1*a*. The cam rod 33 is shown in full lines in Fig. 1*a* at a position which it will assume during the downstroke of the hammer and just as the cam portion 32 thereon has fully engaged the cam portion 30, and just prior to the moment of impact of the hammer. Then it will be apparent that the member 26 will be swung to the left, as viewed, so that its hook portion 28 will release the core head at the moment the latter receives an impact. This will free the core and core head with respect to the body portions of the hammer and thus the core and core head will be driven down free of the inertia of the hammer body, and the hammer body will be freed from any danger of being damaged by the force of the impact. Then, as the hammer piston and ram start an upstroke, the hammer base will fall again into contact with the core head and the hook portions 28 will be swung automatically back into hooking engagement with the core head by the interengaging action of the cam portions 29 and 31 as the cam rod is being elevated further during the upstroke. An elevated position which the cam rod will later assume is indicated by dotted lines at 33'.

If desired, the cam means above described, and the associated parts may be contained in a suitable housing as at 35 formed on or mounted upon the side of the hammer base.

With the alternative form of the invention shown in Fig. 3, similar hook means 28' is formed on a member 26' suitably pivoted as at 27'. Instead of the cam means as shown in Fig. 1*a*, the arrangement shown in Fig. 3 is such that a cam rod as at 40 (mounted in the same manner as the cam rod 33) has at its lower end a cam surface 41 adapted to engage a cam surface 42 on an upwardly extending lever portion 43 affixed to the member 26'. As the cam rod 40 descends during the downstroke of the hammer, it will be apparent that the cam surfaces 41 and 42 will engage and cause the lever portion 43 to swing to the left, as indicated by dotted lines, thus swinging the hook portion 28' out of engagement with the core head. In order automatically to restore the hook portion back to hooking engagement with the core head when the cam rod has started to rise on the upstroke, suitable spring pressed means may be provided as indicated generally at 45. For example, this may comprise a detent member 46 mounted in suitable bracket means 47 and normally spring-pressed outwardly into engagement with the hook portion 28' but being yieldable or depressable to the position indicated by the dotted lines when the hook is disengaged. Then, as the cam rod rises out of contact with the cam portion 42, this spring-pressed detent will again cause the hook portion to be brought back into engagement with the core head.

The embodiment of the invention shown in Fig. 4 is similar in principle to that shown in Fig. 3. However, the hook means shown at 50 is pivoted as at 51 relatively nearer its lower end and the hook portion has a relatively shorter upper portion 52 terminating with a cam surface 53 adapted to engage a cam surface 54 on a downwardly elongated cam rod member 55. Fig. 4 shows the parts at a time when the cam surfaces have just engaged and are about to move the hook portion to disengaging position against the pressure of the spring-pressed detent means 46 which normally holds the hook portion in engaging position. The positions which the parts 50, 52, 53 and 54 will assume after the cam portions have come into effective engagement, are shown in dotted lines.

Although certain particular embodiments of the invention are herein disclosed for purposes of explanation, various further modifications thereof, after study of this specification, will be apparent to those skilled in the art to which this invention pertains. Reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A double-acting fluid pressure operable power hammer to be assembled with an element to be driven thereby and comprising in combination: a cylinder and cylinder head; a piston in the cylinder and ram means associated therewith; connecting means active releasably to hold said element against the hammer in opposition to upward fluid pressure against the cylinder head during downstrokes of the piston; and cam means connected to said ram means for movement therewith to actuate said connecting means to release said element from the hammer when said element receives impacts resulting from such downstrokes of the piston.

2. A double-acting fluid pressure operable power hammer to be assembled with an element to be driven thereby and comprising in combination: a cylinder and cylinder head; a piston in the cylinder and ram means associated therewith; connecting means active releasably to hold said element against the hammer in opposition to upward fluid pressure against the cylinder head during downstrokes of the piston; cam means connected to said ram means for movement therewith to actuate said connecting means to release said element from the hammer when said element receives impacts resulting from such downstrokes of the piston, and means also associated with said ram means for movement therewith to restore the active condition of said connecting means to hold said element against said hammer during upstrokes of the ram.

3. A double-acting fluid pressure operable power hammer adapted to be assembled with a core head of a pile core to be driven thereby and comprising in combination: a cylinder and cylinder head; piston means in the cylinder; ram means associated with the piston means; releasable connection means between the hammer and said core head for holding the hammer down against the core head in opposition to upward fluid pressure against the cylinder head during downstrokes of the piston; and cam means associated with a cam operating rod mounted on the ram for automatically releasing said releasable connection means to allow the core to move downwardly with respect to the hammer generally approximately when said element receives impacts resulting from such downstrokes.

4. The combination of a double-acting fluid pressure operable power hammer in assembly with an element to be driven thereby and comprising: a cylinder and cylinder head; piston means in the cylinder; a hammer base connected to the cylinder and cylinder head assembly; ram means associated with the piston means; hook-like means for substantially positively holding down the hammer base with respect to said element in opposition to upward fluid pressure against the cylinder head during downstrokes of the piston; and mechanism associated with such hook-like means and the ram for moving such hook-like means to release position when said element receives impacts imparted from the piston and connected ram.

5. The combination of a double-acting fluid pressure

operable power hammer in assembly with an element to be driven thereby and comprising: a cylinder and cylinder head; piston means in the cylinder; a hammer base connected to the cylinder and cylinder head assembly; ram means associated with the piston means; hook-like means mounted on the hammer base in position for hooking engagement with said element to normally hold down the base with respect to said element; and cam mechanism associated with such hook-like means and the ram for moving such hook-like means to release position during approximately the time while the ram is imparting an impact.

6. The combination of a double-acting fluid pressure operable power hammer in assembly with an element to be driven thereby and comprising: a cylinder and cylinder head; piston means in the cylinder; a hammer base connected to the cylinder and cylinder head assembly; ram means associated with the piston means; hook-like means pivotally mounted on the hammer base in position for



hooking engagement with said element normally to hold down the base with respect to said element; a cam operating rod depending from the ram; and cam mechanism associated with such hook-like means and said rod for moving such hook-like means to release position during approximately the time while the ram is imparting an impact and for thereafter returning the hook-like means to hooking engagement with said element.

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