

[54] **PERCUSSION HAMMER**
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173/133, 134, 137

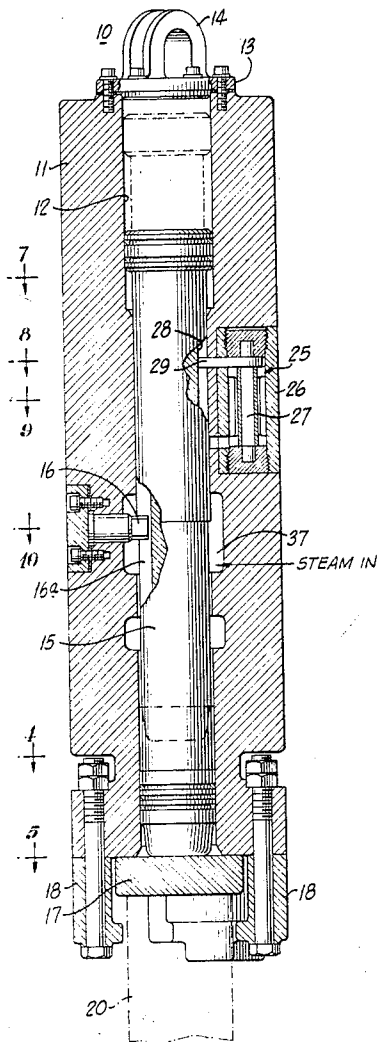
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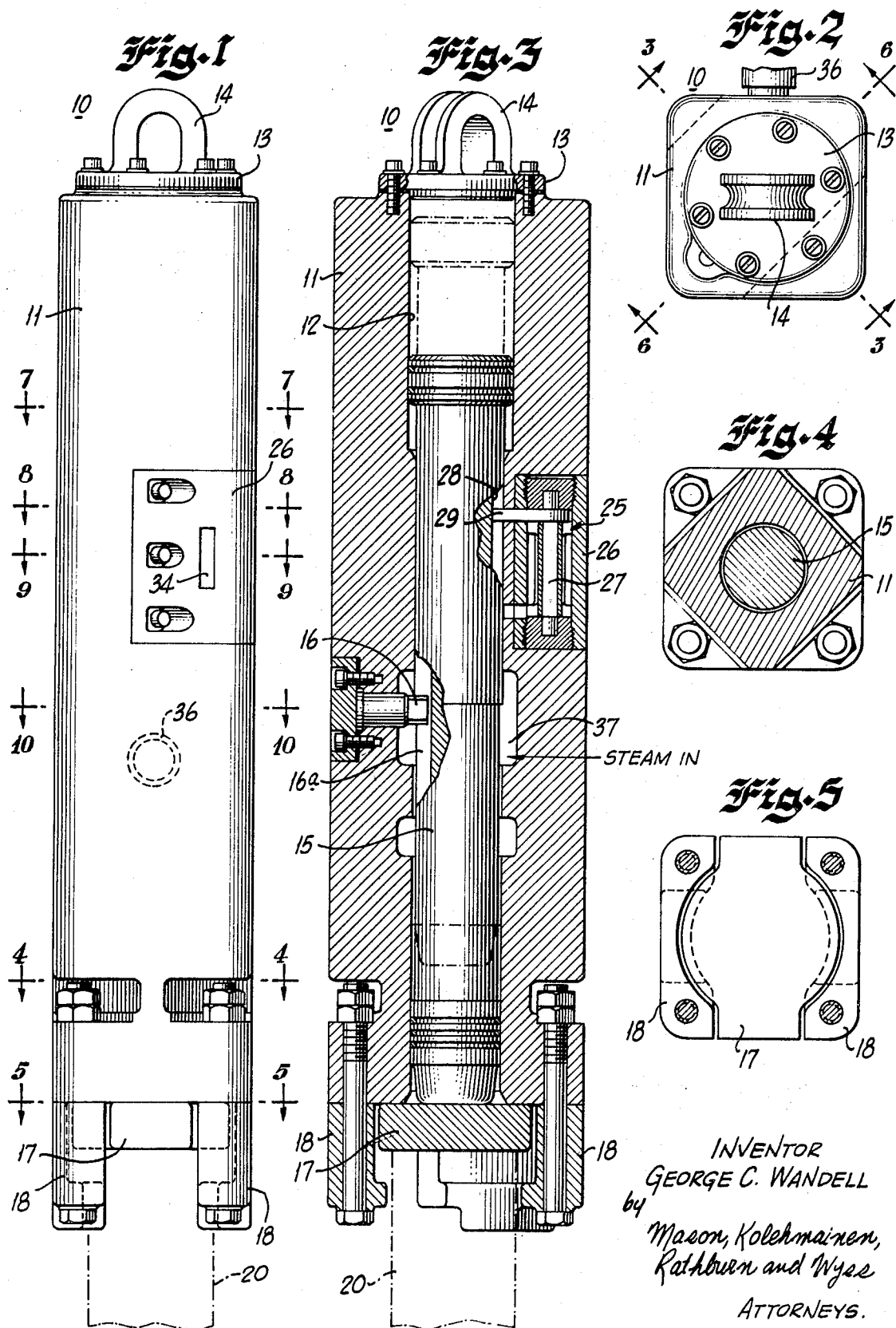
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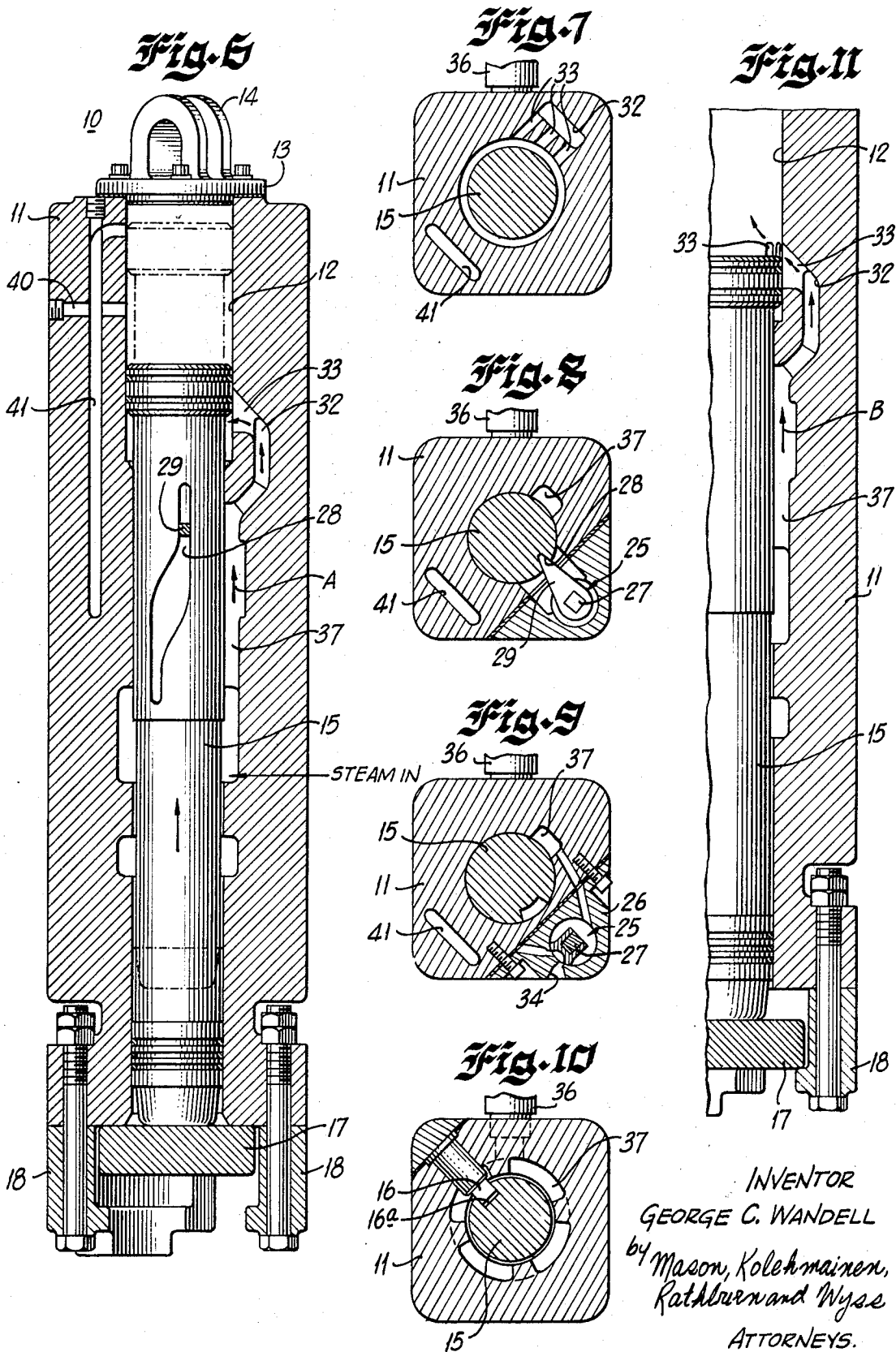
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[57] **ABSTRACT**
There is provided a percussion hammer of the type used for driving piles and the like, and including a differential diameter piston defining a ram reciprocally positioned within a differential diameter cylinder. An anvil is mounted for limited movement in one end of the cylinder positioned in the path of the ram to receive percussion blows therefrom. Valve means are provided for controlling the inlet of working fluid and the exhaust of the working fluid from the cylinder so as to cycle the ram through power and return strokes. Safety means are provided for rendering the valve inoperative to cycle the ram when the percussion hammer is out of engagement with a pile.

2 Claims, 11 Drawing Figures







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PERCUSSION HAMMER

The present invention relates to a percussion hammer and, more particularly, to a percussion hammer for driving piles and the like.

Power-driving percussion hammers are conventionally supported from a crane or the like, and supported on the top of a pile to be driven. The pile-driving hammer will include an impact anvil engaging the top of the pile, and a ram within the hammer will be reciprocated so as to strike impact blows on the impact anvil, thus driving the pile. Commercial pile-driving hammers may be of a variety of types, and may be classified as single acting or double acting. In single-acting pile-driving hammers, the ram is lifted by the working medium, which may be steam, air, or other medium, and dropped against the anvil by gravity. In a double-acting hammer, the ram after lifting is driven against the anvil by the force of the working medium, in addition to the force of gravity. Such hammers are moved from one pile to the next by the crane or other supporting structure, and during this movement the cycling of the ram should be stopped to prevent damage to the hammer. However, in the event that the working fluid is not turned off during such movement, or in the event that the pile-driving hammer slips off the top of the pile, difficulty is encountered with the continued cycling of the ram.

One object of the present invention, therefore, is the provision of a new and improved percussion hammer.

Another object of the present invention is the provision of a new and improved percussion hammer having a safety means which prevents cycling of the ram, when the hammer is out of engagement with a pile.

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 claims annexed to and forming a part of this specification.

In accordance with these and other objects of the present invention, there is provided an improved percussion hammer of the type for driving pile and the like. The percussion hammer is provided with a differential diameter piston defining a ram and reciprocally positioned within a differential diameter cylinder. An impact anvil is mounted in one end of the cylinder positioned in the path of the ram to receive percussion blows therefrom. Suitable control means are provided for controlling the exhaust and inlet of the working fluid out of and into the cylinder to cycle the ram through power and return strokes. Advantageously in accordance with the present invention, suitable means are provided for preventing further cycling of the ram if the percussion hammer is out of engagement with a pile.

In accordance with a preferred embodiment of the invention, the impact anvil is positioned at the lower end of the cylinder for limited movement between an upper and a lower position; the impact anvil is held in the upper position when the percussion hammer rests on a pile, and drops to its lower position if the percussion hammer is out of engagement with a pile. The piston defining the ram has a working stroke between an upper position in which the ram is raised above the impact anvil, and an intermediate position wherein the impact ram strikes the impact anvil when the hammer rests on a pile so that the anvil is in its upper position; and the ram will move to a lower position when the impact anvil is in its lower position with the hammer out of engagement with a pile. When the impact anvil is in the lower position, the piston opens a bypass for the fluid from the space defined between the differential diameters of the piston and cylinder, to a space exhausting the fluid, and thus arresting further cycling of the ram.

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

FIG. 1 is an elevational view of the improved percussion hammer according to the present invention;

FIG. 2 is a top view of the percussion hammer of FIG. 1;

FIG. 3 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 4—4 of FIG. 1;

FIG. 5 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 5—5 of FIG. 1;

FIG. 6 is an elevational cross-sectional view of the percussion hammer of FIG. 1, taken along line 6—6 of FIG. 2;

FIG. 7 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 7—7 of FIG. 1;

FIG. 8 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 8—8 of FIG. 1;

FIG. 9 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 9—9 of FIG. 1;

FIG. 10 is a cross-sectional view of the percussion hammer of FIG. 1, taken along line 10—10 of FIG. 1; and

FIG. 11 is a fragmentary elevational cross-sectional view of the percussion hammer of FIG. 1, corresponding to the view of FIG. 6, but illustrating the piston and ram in their lowermost position wherein further movement of the ram has been arrested.

Referring now to the drawings, there is illustrated an improved percussion hammer 10 in accordance with the present invention, and including a housing 11 defining a differential diameter cylinder 12, being closed at the top by a cylinder head 13 forming a lifting bail 14. The lifting bail 14 is adapted to swing from the cable of a crane or other mechanism so as to position the percussion hammer onto the top of a pile represented in phantom in FIGS. 1 and 3 at 20.

Within the cylinder 12 is a differential diameter piston 15 defining a ram. Conveniently the ram 15 may be a one-piece forging, completely contained within the cylinder 12. In the illustrated hammer, the cycle of the hammer is single acting, so that the ram 15 is powered up and dropped by gravity. The ram 15 is prevented from radial rotation by a guide pin 16, FIGS. 3 and 10, extending through the housing 11 and aligned within a groove 16a in the piston wall. The ram 15 is positioned to impinge upon an impact anvil 17 in the lower end of the cylinder 12. The anvil 17 is mounted for limited vertical movement between suitable guides 18 between an upper position, illustrated in FIGS. 1, 3, and 6, and a lower position, illustrated in FIG. 11.

Control of the piston 15 is by a valve gear mechanism 25 within a fluid chamber or steam chest 26, and best illustrated in FIGS. 3, 8, and 9. It is understood that the valve gear mechanism 25 may be of any known type to control the reciprocation of the piston 15, and in the illustrated embodiment the valve gear mechanism 25 includes a rotary valve element 27 controlled by a surface cam 28 defined as a groove in the longitudinal side surface of the piston 15, and receiving a valve actuator portion or cam follower 29 on the end of a valve arm extending out of the fluid chamber 26. The surface cam 28, upon vertical reciprocation of the piston 15, will reciprocate the valve arm and rotary element 27 controlling the cycling of the piston 15.

To control the reciprocation of the piston 15 defining the ram, there is provided a plurality of fluid passageways interconnecting the fluid chamber 26, valve element 27, and the cylinder 12. More specifically, there is provided a passageway 32 interconnecting the fluid chamber 26 with the cylinder 12, opening by a plurality of longitudinally elongated passageway ports 33 intermediate the large and small diameter portions of the piston 15. An exhaust passageway 34, FIGS. 1 and 9, extends from the fluid chamber 26 communicating with the atmosphere. An inlet fitting 36 provides for the connecting of the fluid chamber 26 to the source of working fluid, such as steam, through an inlet passageway 37. The valve element 27 rocks about its central axis wherein the cylinder 12 is selectively exhausted through the passageway ports 33 to the atmosphere, or connected to the source of pressurized fluid, as illustrated in FIG. 9.

In accordance with the present invention, the piston 15 and associated ram have a working stroke between an upper position, illustrated in phantom in FIGS. 3 and 6, wherein the ram is raised above the impact anvil 17, and an intermediate position, illustrated in solid in FIGS. 3 and 6, wherein the ram

strikes upon the impact anvil 17 when the hammer 10 rests on a pile so that the anvil 17 is in its upper position, and the piston 15 and associated ram are movable to a lower position illustrated in FIG. 11 wherein the ram rests on the impact anvil 17 when the hammer 10 is out of engagement with a pile so that the anvil 17 is in its lowest position. Thus, it will be understood that when the ram is at its intermediate position, as illustrated in solid in FIGS. 3 and 6, the valve element will be in the position illustrated in FIG. 9 connecting the inlet fitting 36 and the inlet passageway 37 to the port 33 through the passageway 32. The working fluid will be effective to act against the lower surface of the enlarged diameter portion of the cylinder 15. The working fluid will, of course, act against an area equal to the difference in diameter between the enlarged portion of the piston 15 and the small diameter portion thereof. This working fluid will be effective to raise the piston 15 upwardly, from the position illustrated in solid in FIGS. 3 and 6 to the position illustrated in phantom therein. However, as the piston 15 approaches the top of its stroke, the valve element 27 will shift disconnecting the cylinder 12 from the source of pressurized fluid, and exhausting the cylinder to atmosphere through the passageway 32 and the exhaust passageway 34. The piston 15 defining the ram will now drop by gravity to provide an impact blow against the anvil 17. The movement of the piston and associated ram to the position wherein it strikes the anvil 17 will again cause return of the rotary valve element 27 to the position illustrated in FIG. 9, and thus will redirect the working fluid into the space between the differential diameters of the piston and cylinder, and will recycle the tool.

In accordance with the present invention, there is provided a safety means arresting the cycling of the ram when the hammer 10 is out of engagement with a pile. More specifically, when the anvil 17 drops to its lowermost position, as illustrated in FIG. 11, the piston 15 and associated ram will drop to their lowermost position, below its working stroke, as illustrated in FIG. 11. In this position the upper end of the piston 15 uncovers or opens the passageway ports 33 to the upper end of the cylinder 12, exhausting the same to atmosphere through relief ports 40 and 41, FIG. 6. Thus, the piston 15 will not move upwardly, and further cycling of the piston will be arrested. However, as soon as the percussion hammer 10 is placed on top and in engagement with the top of a pile to be driven, the impact anvil 17 will move from the

lower position illustrated in FIG. 11 to its upper position illustrated in FIGS. 3 and 6, and will move the piston 15 to its intermediate position, redirecting the working fluid into the space between the differential diameter portions of the piston 15 and cylinder 12 and recycling the ram.

From the above detailed description, it will be seen that there is provided a means for automatically arresting the cycling of the ram in a percussion hammer when the hammer is out of engagement with a pile. Advantageously damage to the hammer is avoided.

Although the present invention has been described by reference to only a single embodiment hereof, it will be apparent that numerous other modifications and embodiments will be devised by those skilled in the art which will fall within the true spirit and scope of the principles of the present invention.

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

1. A percussion hammer adapted to rest on a pile and comprising a housing having defined therein a differential diameter cylinder; a piston of corresponding different diameters mounted in said cylinder and defining a ram; an impact anvil mounted for limited movement in one end of said cylinder positioned in the path of said ram, said anvil being supported in an upper position when the hammer rests on a pile and dropping to a lower position when the hammer is out of engagement with a pile; valve means for controlling the inlet and exhaust of working fluid into the space in said cylinder between the differential diameters of said cylinder and said piston to cycle said ram through power and return strokes; and safety means including passage means bypassing said piston when said hammer is out of engagement with a pile.

2. A percussion hammer as set forth in claim 2 wherein said piston has a working stroke between an upper position in which said ram is raised above said impact anvil, and an intermediate position wherein said ram strikes said impact anvil when said hammer rests on a pile so that said anvil is in its upper position, and a lower position wherein said ram rests on said impact anvil when said hammer is out of engagement with a pile so that said anvil is in its lower position; and wherein said passage means bypasses said piston when said ram is in said lower position.

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