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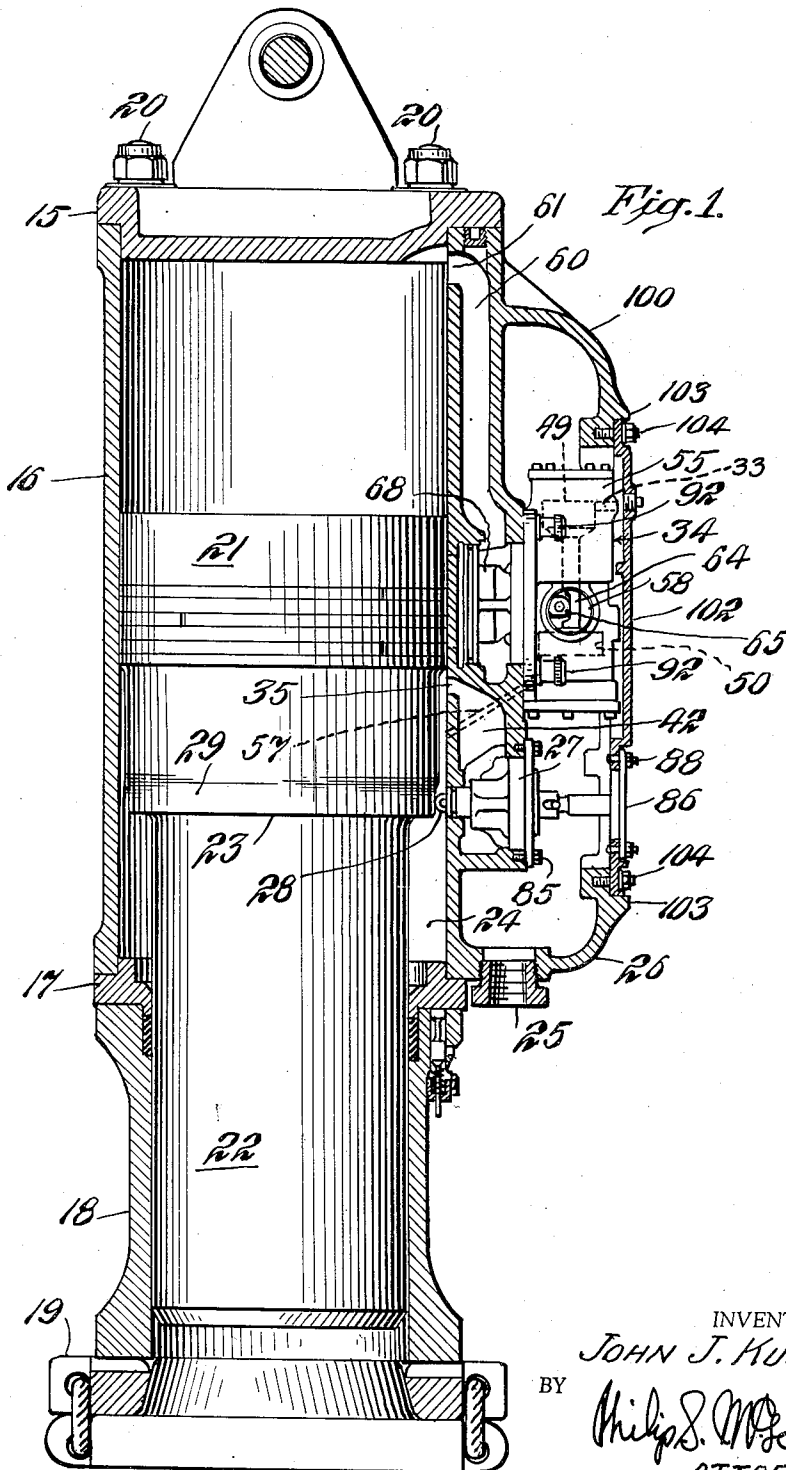
J. J. KUPKA

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PILE HAMMER HAVING INTEGRAL BUILT-IN SURGE TANK
AND ENCLOSED PROTECTED VALVE GEAR

Filed April 10, 1957

2 Sheets-Sheet 1



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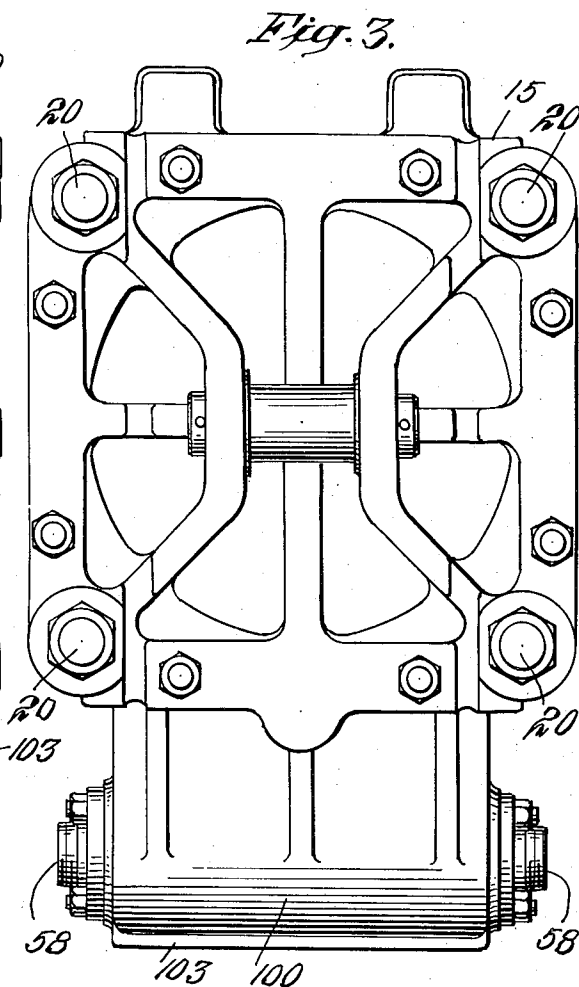
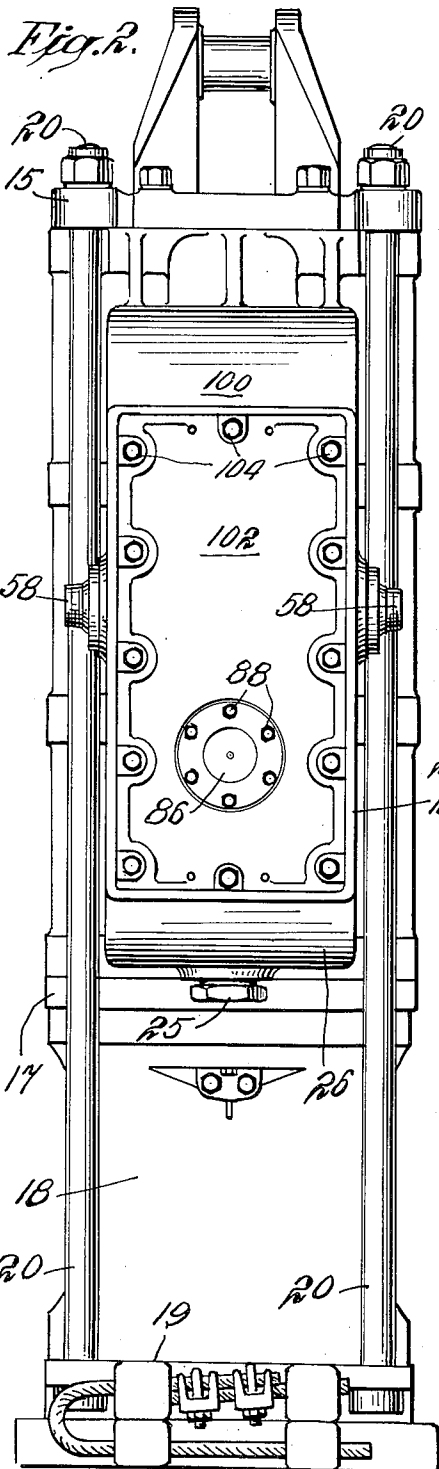
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PILE HAMMER HAVING INTEGRAL BUILT-IN SURGE TANK AND ENCLOSED PROTECTED VALVE GEAR

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2 Claims. (Cl. 121—13)

The invention here disclosed relates to reciprocating tools in the nature of power hammers particularly compound hammers such as covered in copending patent application Serial No. 550,718 filed December 2, 1955, now Patent 2,789,540 of April 23, 1957.

These hammers operate on steam or compressed air. To reduce and so far as possible eliminate fluctuations and otherwise improve the action, it has been the practice to interpose a surge tank between the boiler or compressor and the hammer. These surge tanks add objectionable bulk and constitute somewhat of a hazard in that under the pounding, vibration and rough usage of the hammer, they may disintegrate or break loose or otherwise create dangerous conditions.

One of the objects of the present invention is to utilize the desirable features of the surge tank but to incorporate it in such a way as to avoid and eliminate objectionable features such as mentioned.

Another object of this invention is to free the hammer structure of projecting parts such as have heretofore been in the way, and in many cases, been broken loose or knocked off in the relatively rough handling to which these machines are subjected.

Particularly, it is a purpose of this invention to protect the valve gear and to locate it where it cannot be broken off or injured even in such rough action as skidding the hammer over the ground as sometimes happens.

Other important objects of the invention are to prevent icing up of the valve mechanism in the case of air operation, and to prevent excessive condensation in the case of steam operation.

Further objects are to simplify, strengthen, and generally improve the hammer structure and operation.

All the foregoing and other desirable objects have been accomplished by novel features of construction, combinations and relations of parts, as hereinafter described and claimed and illustrated by way of example in the accompanying drawings. In the drawings referred to, a present, practical commercial embodiment of the invention is illustrated, but it will become apparent that structure may be modified and changed all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 of the drawings is a vertical, sectional view of one of the hammers showing the ram up off the anvil far enough on upstroke for the cam on the ram to permit closing of the admission valve or, on downstroke, for the cam about to open the admission valve to initiate the upstroke.

Fig. 2 is a side elevation looking at the outer or valve face side of the hammer.

Fig. 3 is an enlarged plan view of the hammer.

The hammer illustrated is like that of the patent above identified in that it is made up of an upper head 15, upper cylinder 16, intermediate head 17, lower cylinder 18, and bottom head 19 secured by tie rods 20 and a ram having a larger upper end portion 21 operating as a piston in the upper cylinder and a lower smaller guide portion 22

2

operating in the lower cylinder, with an intermediate annular shoulder 23 opposed to the intermediate head 17 and providing with the surrounding upper cylinder wall, an annular expansion chamber 24.

Steam or compressed air is supplied at 25 to the lower end of the chest 26 containing admission valve 27, the latter having a roller 28 engageable by a cam 29 on the lower end of the upper piston portion of the ram.

In operation of this machine, the admission valve 27 closes as piston cam 29 leaves engagement with roller 28 and expansion continues until approximately three-quarters upstroke, whereupon a differential valve 34 operates to close off the exhaust valve and open a transfer or compounding valve for passing partially expanded live steam or air from below to above the piston for cushioning upstroke and for accelerating downstroke of the piston.

When the admission valve is opened by engagement of cam 29 with valve roller 28 at the end of the downstroke of the ram, live steam or compressed air will be passed from chest 26 up through passages 42 and out through ports 35 into the expansion chamber 24 beneath the upper piston portion of the ram.

In the present invention, the steam chest 26 is extended upward to near the top of the hammer to form a surge tank or chamber 100 of substantial proportions, and a special feature of this construction is that the walls forming this enclosure are integral with the upper cylinder and constitute, in effect, integral reinforcements of the same.

A further important feature is that the differential valve 34 is located within this surge chamber, where it is guarded and protected against mechanical injury and where it is preheated, lubricated, and kept in smooth working condition, and from which it directly derives the pressure for actuating it in one direction.

This differential valve may be considered as similar to that shown in Fig. 5 of Patent 2,789,540 involving an upper smaller diameter piston 49 and a connected lower larger diameter piston 50 carrying a cam 63 for actuating valve 68 controlling transfer of partially expanded steam or air from exhaust ports in the cylinder up through passage 60 and ports 61 into the top of the cylinder above the piston.

These passages and ports 60 and 61 serve alternately for compounding to drive the piston downwardly and for exhausting from the top of the cylinder during upstroke of the piston as controlled by the differential valve.

This valve is operated automatically in the present invention by taking pressure from the expansion chamber 24 through a passage 57 to the underside of the lower larger differential piston 50 and by leaving the upper smaller differential piston 49 exposed to the live steam or compressed air pressure in the surge chamber by way of opening 33 in the top of the upper differential cylinder 55.

With full pressure from the expansion chamber on the lower larger piston, the two connected pistons will be raised to the upper position to open exhaust ports and permit escape from the top of the cylinder down through passage 60 and out the exhaust pipes 58 and, as pressure reduces as the ram piston approaches the top of its stroke, the normal pressure present in the surge chamber acting on the upper smaller piston through opening 33, will force the differential pistons downward to close the exhaust valve and open the compounding valve 68 to transfer the partially reduced pressure power forces up through passage 60 into the top of the cylinder for cushioning upstroke and accelerating downstroke of the ram.

The differential valve is shown solidly secured to the body of the cylinder by bolts 92, and the admission valve by bolts 85 so that these valves may be readily

removed and replaced as separate, independent units, after removal of the cover plate 102 closing the surge chamber.

This cover is shown as of relatively large size so as to provide full access to the interior of the surge chamber and as recessed within a surrounding flange 103 so as to be protected against abrasion and other forces such as might result from skidding or sledding the hammer on its side.

The surge chamber cover is shown removably secured by stud bolts 104 and a supplemental cover 86 is shown secured by bolts 88 on the main cover, providing access to the admission valve without requiring removal of the large main cover.

The surge chamber tank being an integral built-in portion of the top cylinder does not add bulk or appreciable projection and adds strength and reinforcement to the structure. The vertical extension of this chamber enables narrowing to fit in between the tie rods as shown in Fig. 2, and yet, provide ample surge compensating facility.

The outside of the surge chamber is practically smooth and flush and free of projecting elements so that, if need be, the hammer may be dragged or pushed over ground or other supporting surface without injury.

The location of all valve mechanism within the surge chamber affords mechanical protection of such parts and desirable preheating and anti-icing characteristics. By admission of steam or compressed air, the valve mechanism will be preheated, ready to start operations even after long shut-down under exposed cold weather conditions. This preheating and maintaining the valve gear in heated condition, reduces condensation and, in the case of compressed air operation, prevents icing up.

The location of the valve gear in the surge chamber also avoids need for separate connections to operate the differential valve since this valve can then take the normal pressure for balancing it against the variable pressure directly from within the surge chamber by a simple open passage 33.

The construction is simple and rugged and all moving parts are fully protected within an enclosure which in ad-

dition to serving as a surge chamber, reinforces the construction and effects preheating and deicing and facilitates lubrication since lubrication of these machines is usually effected by introducing lubricant with the steam or air and this admitted to the surge chamber in heated condition operates to thoroughly lubricate all parts.

The integral surge chamber encloses all cylinder passages and ports, reducing heat losses and aiding preheating.

The upper and lower ends of this chest are shown as rounded to ride over a supporting surface and reduce obstruction in the case of it being necessary to drag the hammer as in shifting from one location to another.

What is claimed is:

1. Power hammer comprising the combination of cylinder and ram reciprocating therein, said cylinder having a longitudinally extending integral surge chamber on one side thereof provided with an inlet for actuating fluid at the lower end, an admission valve in the lower portion of said chamber controlling communication between the interior of said chamber and the cylinder, and valve mechanism in the upper portion of said surge chamber controlling communication between opposite end portions of the cylinder and including passages communicating with the cylinder enclosed within said surge chamber.

2. Power hammer comprising the combination of cylinder and ram reciprocating therein, said cylinder having an integral surge chamber on one side and differential valve mechanism enclosed within said surge chamber and connected to control passage of motive fluid to and from the cylinder, said differential valve mechanism including opposed pistons of different areas and a connection extending from the cylinder to one of said pistons, and a connection to the other of said pistons open to the interior of said surge chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

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2,789,540	Kupka et al.	Apr. 23, 1957