(No Model.) 2 Sheets—Sheet 1.

L. W. HARDY.

STEAM PUMP.

No. 492,797. Patented Mar. 7, 1893.

Fig. 1.

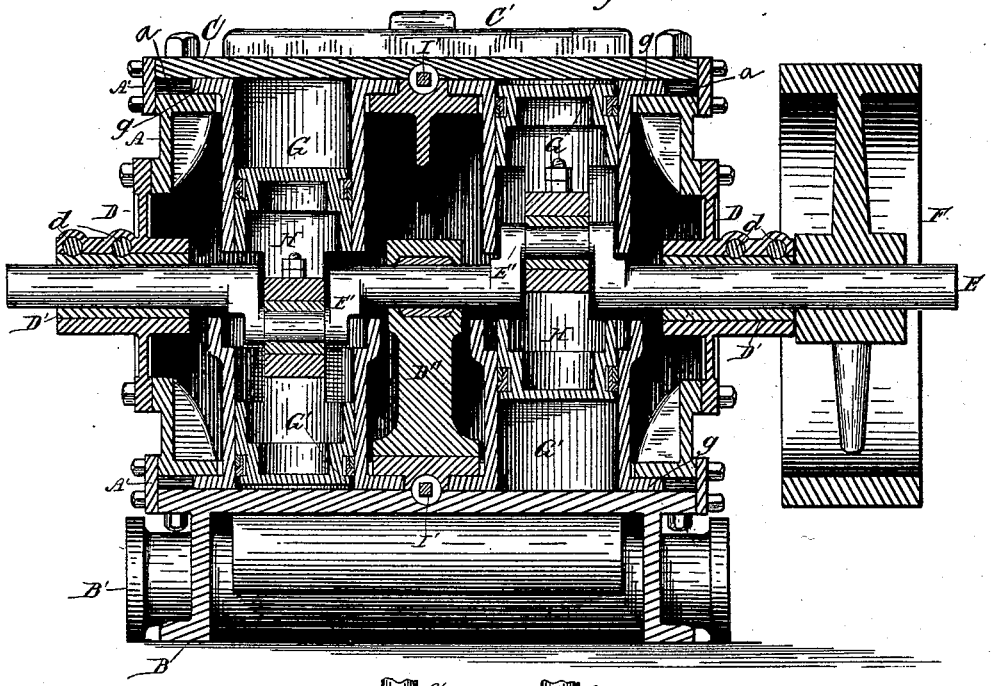
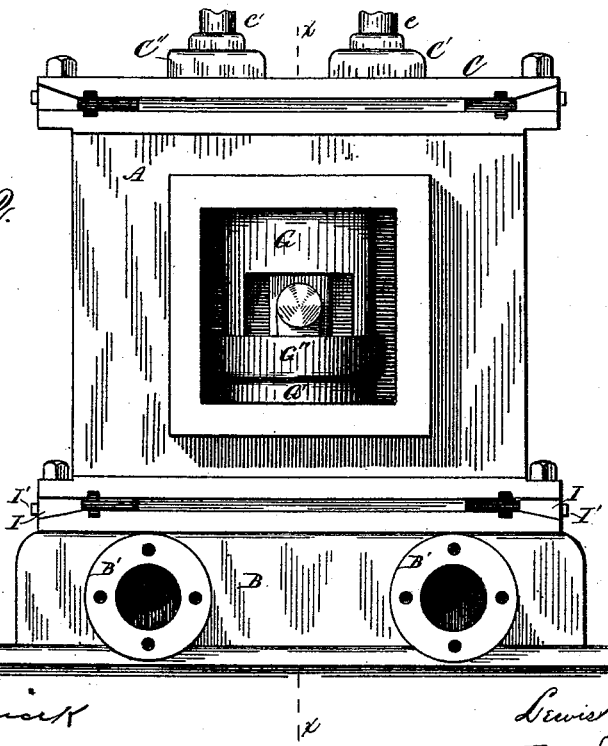


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

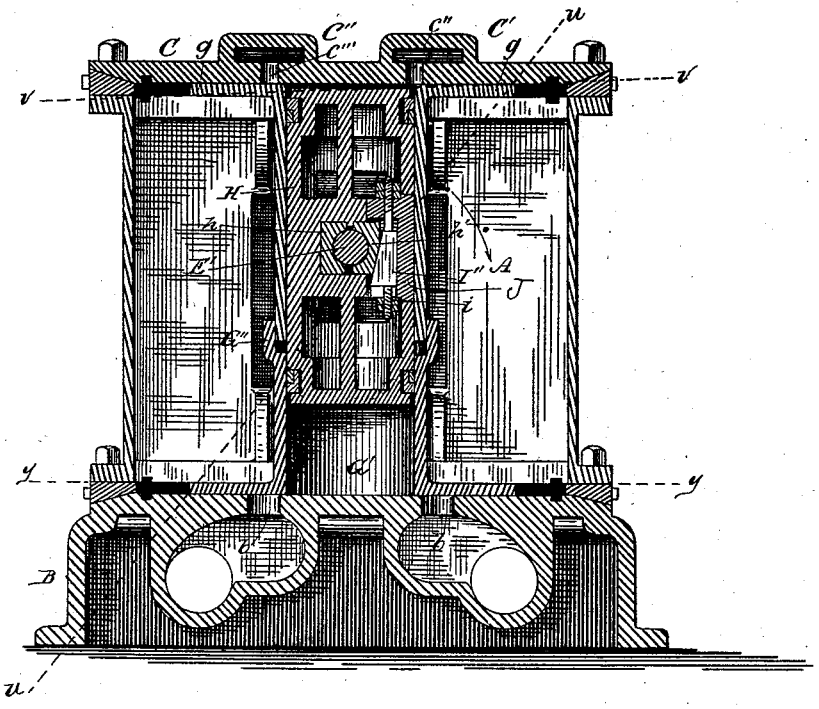


Fig. 4.

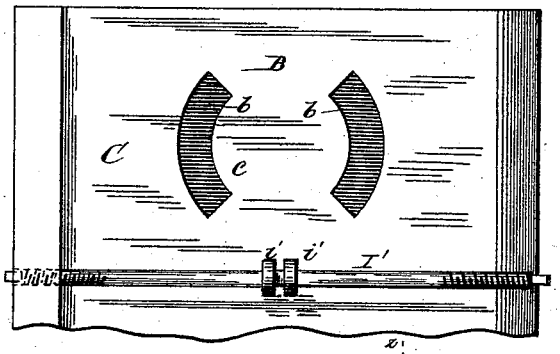


Fig. 6.

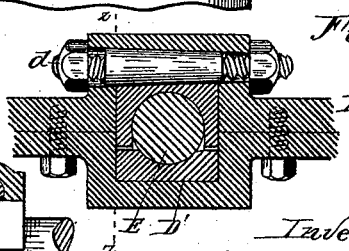
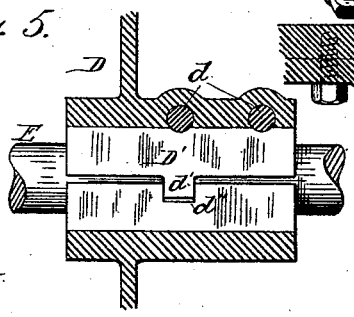


Fig. 5.



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UNITED STATES PATENT OFFICE.

LEWIS W. HARDY, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO HENRY RICKEL AND JULIUS A. WARD, OF CEDAR RAPIDS, IOWA.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 492,797, dated March 7, 1893.

Application filed January 21, 1892. Serial No. 418,848. (No model.)

To all whom it may concern:

Be it known that I, LEWIS W. HARDY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to steam pumps of a peculiar type, the parts of the pump having certain characteristics in common with a steam engine in which the cylinders and pistons are carried back and forth in a rectangular shell by the motion of the crank-shaft; and the object of this invention is to produce a novel and powerful steam pump by the application of certain principles embodied in part in the steam engine referred to.

The invention consists in the peculiar construction, combination, and arrangement of elements to this end, as hereinafter fully set forth and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a vertical section of a pump embodying my invention, on the line of the center of the crank-shaft. Fig. 2 is a side elevation of the same, with one of the crank-shaft bearings removed, showing the position of the piston and cylinder inside. Fig. 3, Sheet 2, is a transverse section of the same on the line of the center of one of the cylinders. Fig. 4 is a fragmentary plan view of the base, showing the arrangement of water-ports and of a device for adjusting the shell and the base with respect to each other. Fig. 5 is a longitudinal section of the housing for one of the crank bearings, on the line Z Z. Fig. 6 is a central, transverse section of the same.

Similar letters of reference indicate corresponding parts.

Referring now to the drawings, A represents a rectangular shell open at the top and bottom. This shell is provided with inwardly extending flanges *a a* to serve as bearings for corresponding flanges *g g* of the cylinders G G and G′ G′. Below these flanges *g g*, and supporting them, is the base B which has a perfectly plane surface. Over the flanges of the cylinders G G is mounted the head or cap-plate C. These parts are suitably connected together by bolts in the usual way. Within the cylinders, which are open at both ends, is mounted a pair of pistons H H connected with the cranks E′ of the crank-shaft E. This crank-shaft is mounted in bearings D′ fitted to suitable housings D D, attached to the sides of the shell by suitable bolts. F is a balance wheel which may also be a belt wheel if desired.

Referring to Fig. 3, the arrangement of ports in the pump will be seen. C′ and C″ are bosses formed on the head C and suitably cored out to provide steam and exhaust ports respectively C″ and C‴. These ports pass through the shell, as represented, and communicate with the cylinder direct as it moves back and forth across them. Similar ports *b b* communicate through the upper part of the base with the chambers B′ B′ which are adapted to be connected with the water pipe at either end. The pistons having a direct connection with the cranks, and being adapted to move back and forth in the cylinders, it will be understood that the pistons have a gyratory motion about the shaft while the cylinders move back and forth horizontally in the shell, the operation of the pump in this respect corresponding with the engine above referred to.

In the adaptation of the device to the purpose of a pump, certain novel arrangements and devices have been introduced, which will now be specifically described. In the use of the engine above referred to, a common difficulty experienced was a certain tendency of the end flanges of the cylinders to tilt slightly in the shell by reason of the straining action of the crank, thus causing the cylinders to bind to a certain extent in their bearings, which were the internal surfaces of the shell. One improvement herein relates to a device for overcoming this twisting action of the cylinders by providing a long bearing for each flange, so that instead of the twisting strain upon the cylinders being distributed between opposite corners of the entire cylinder the strain is really confined within each flange, and the action of the cylinders in their reciprocating motion is thus rendered very

smooth and uniform. To render this the more clear, attention is directed to the dotted lines in Fig. 3, the line *u u* representing the extremes of the bearing in the case of the engine referred to, while the line *v v* represents the extremes of the bearing in the case of the present invention.

To compensate for the natural wear on these parts, I provide for an adjustment of the shell with respect to its head, which consists of the following device: In two sides, between the head and the shell, one of which should be suitably tapered, is mounted a pair of wedges I I. With these wedges, which are suitably threaded for that purpose, is connected a right and left-hand threaded rod I', the squared ends of which extend slightly beyond the side of the shell to receive a suitable wrench for adjustment. The middle portion of the rod should be provided with suitable collars *i' i'* lying each side of a suitable bearing forming a part of or connected with the standard D'' or some corresponding internal portion of the shell. It will now be understood that by simply turning upon this rod the wedges are forced inwardly or outwardly, separating the head from the shell, or otherwise, as the case may be.

As the shell is intended to contain oil for the lubrication of the parts, it is necessary to close the space between the head and the shell, which is done by attaching thereto suitable strips A', the bolt holes in which should be a little large, or slotted, in order to allow for the adjustment as above described.

A further improvement consists in the special construction of the cylinders to compensate for the expansion and contraction incident to the use of the engine. Referring more particularly to Fig. 3, this construction will be seen, and it will be observed that the cylinders G and G' are separate but fitted together in the middle, the cylinder G', having a counterbored portion G'' corresponding in internal size to the exterior of the cylinder G. This counter-bore, as will be seen, is sufficiently deep to allow for considerable extension of the cylinders toward each other, so that as the heat of the steam causes the cylinders to expand, the ends thereof are adapted to slip with respect to each other, and thus avoid undue binding upon their flanged ends, as would be the case without some provision of this kind. In the same figure will be seen a certain improvement in the construction of the piston and its bearing on the crank-shaft. In the middle of the piston, which is for the most part hollow, is a seat for the bearings *h h'* which incloses the wrist of the crank. Against the half-box *h'*, which is suitably beveled for that purpose, is placed a wedge I'' provided with suitable threaded tail pieces *i* and nuts whereby the wedge may be drawn back or forth at will. The outer part of this wedge bears against an L-shaped plate J which in turn bears against the internal face of the cylinder G. Now by simply screwing up on the adjusting nuts of the wedge, the half-box *h* may be tightened against the wrist and at the same time all lost motion taken up as between the piston and the cylinder, thus entirely preventing any tendency of the parts to "pound."

It will be understood that the L-shaped plate J, in its movement, does not travel over any portion of the cylinder covered by the steam fitted portions of the piston, so that the wear of this part upon the cylinder does not affect the steam fitting of the piston.

In Figs. 5 and 6 are shown certain improvements in the detail of the main bearings for the crank-shaft. In a suitable housing D which is bolted to the side of the shell, is mounted a pair of half-boxes D'. To prevent any longitudinal slipping of the parts with respect to each other, the one is provided with a lug *d'* and the other with a notch *d''*, which fit together, and, in addition to this purpose, serve the better to prevent the oil from passing out of the space between the boxes at the sides. Over the upper half-box and through the housing above referred to, or more exactly the hub or extension of the housing, I place one or more tapered bolts *d* provided with suitable nuts, and by the simple screwing up or back of these nuts the upper box is adjusted with respect to the shaft, the bolt serving at the same time to prevent longitudinal displacement of the boxes.

The operation of the device will now be readily understood. Steam being admitted through the steam ports *c''* when the parts are in the position represented in Fig. 3, the piston is carried downwardly and the crank moves in the direction indicated by the arrow. Having passed to a certain point, the exhaust port *c'''* is opened, and the steam escapes. At the same time, the cylinder connected with the other crank of the shaft is carried to the primary position and is operated upon in the same manner, the steam entering and escaping from both cylinders at the same end. At the same time, the action of the lower end of the piston corresponds to that of the plunger of an ordinary pump, it being understood that the cylinder G' as represented in Fig. 3, is full of water drawn through the chamber B' at the left in said figure. Now, as the cylinder moves to the right the port of the right chamber is opened, and the water is forced through by the descent of the piston.

It is to be especially noted that the action of the pump is such that there is no limit as to the speed at which it may be run, there being no check valves or other gravity devices to restrict the action of the water according to the speed at which the pump may be run. The pump, from the nature of the case, is positive in its action both in drawing and forcing, and the cylinder in its movement across the base alternately cuts off the chamber at the left, which is supposed to be connected with the supply, and the chamber at the right, which is the outlet chamber. It

may be further stated that in actual practice the pump has been tested, and from those tests it would appear that there is really no limitation to the speed at which it may be operated. The practical effect of this is from the nature of the case to not only discharge a large supply of water, but to create a powerful pressure such as is required in fire engines and devices of that nature.

Having thus fully described my invention, what I claim as new is—

1. The combination in a steam pump of a pair of steam cylinders and a pair of water cylinders opposite thereto; a pair of pistons reciprocating in said cylinders and connected with the cranks of a crank-shaft; a shell having bearings at the side for said crank-shaft and terminal bearings for said cylinders, the said cylinders having terminal flanges, and the bearings therefor being provided with steam-ports and water-ports respectively, whereby, by the reciprocating action of the cylinders, and the gyratory action of the pistons, the said steam and water ports are alternately opened and closed, substantially as described.

2. In a steam pump substantially as described, the combination of the flanged cylinders G G and G′ G′, the shell A having internal flanges *a a* bearing on the inner side of the flanges *g g* and the head C and base B having plane faces forming a bearing for the outer faces of the flanged portion of said cylinders.

3. In a steam pump, the combination of the flanged cylinders substantially as described, the shell having internal flanges to bear on the inner side of the flanges of the cylinders, the head or base having a plane surface to bear on the outer face of said flanges, wedges mounted between the shell and the head and base, and means substantially as described for adjusting the same, for the purpose set forth.

4. In a steam pump, the combination of flanged cylinders substantially as described, a shell having internal flanges upon which the flanges of the cylinders bear, a head and base having a plane inner surface forming the outer bearing for the cylinder flanges and adjustable with respect to the shell, and the external plates A′ adapted to close the space between the head or base and the shell.

5. In a steam pump substantially as described, the combination of the piston H having a seat therein for boxes *h h′*, the wedge I″ with means for adjusting the same, bearing upon the half-box *h′* and the L shaped plate J with its outer face bearing upon the internal face of the cylinder G substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

LEWIS W. HARDY.

Witnesses:
L. A. ST. JOHN,
J. M. SHIELDS.