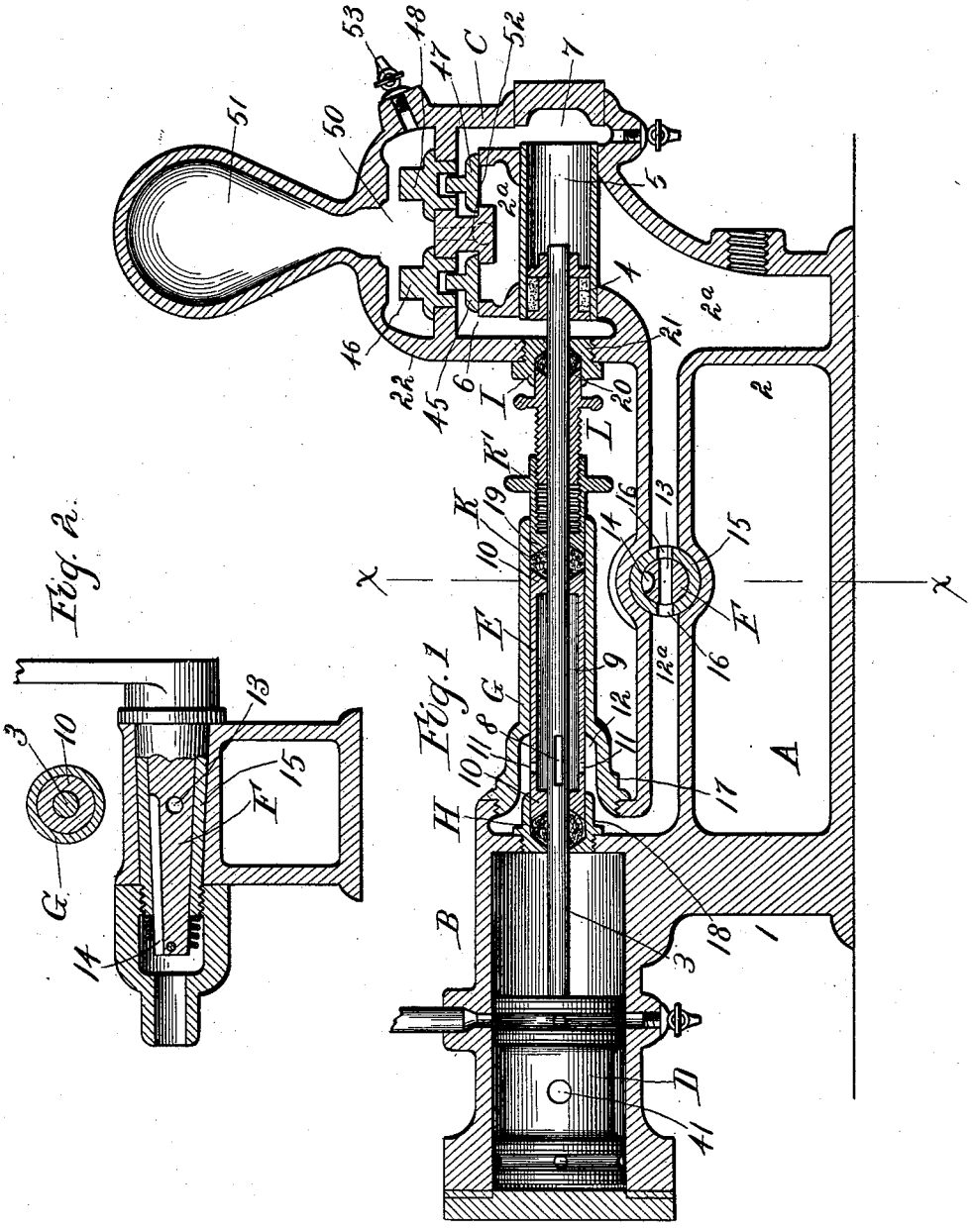
No. 606,844. Patented July 5, 1898.

J. B. RHODES.

STEAM PUMP.

(Application filed Jan. 23, 1897.)

(No Model.) 2 Sheets—Sheet 1.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 3.

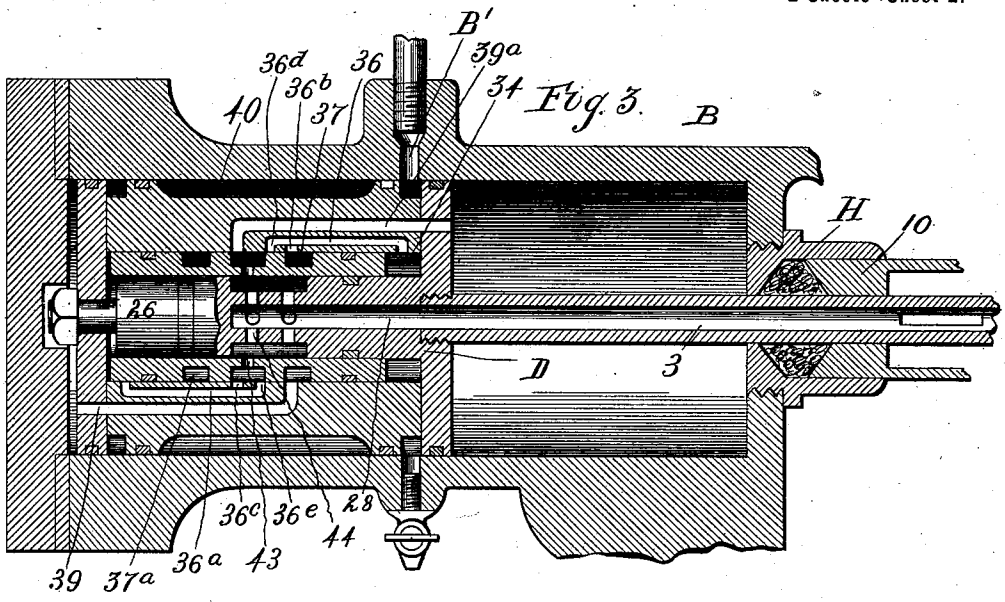


Fig. 4.

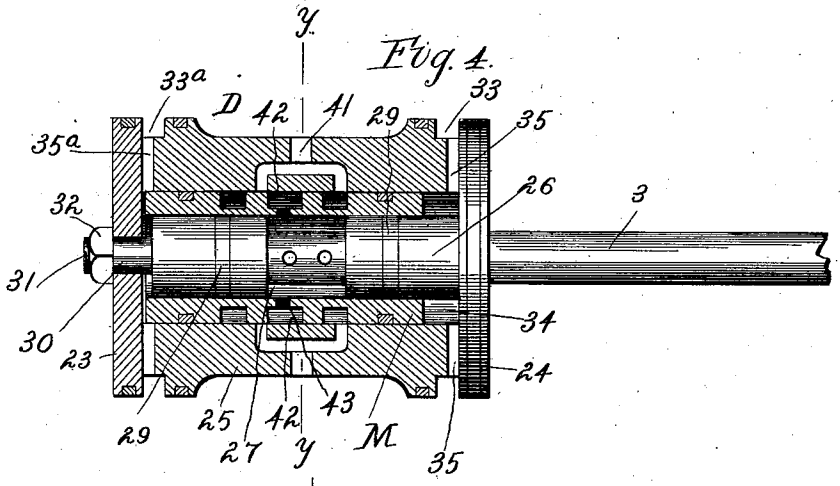
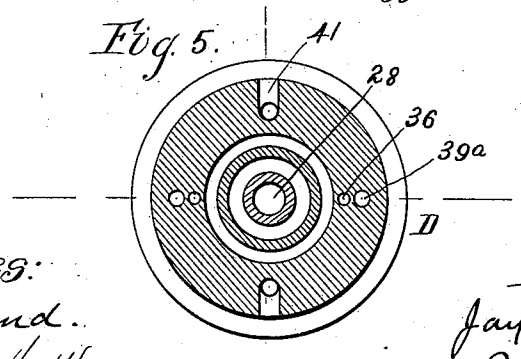


Fig. 5.



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UNITED STATES PATENT OFFICE.

JAY B. RHODES, OF CHICAGO, ILLINOIS, ASSIGNOR TO FREDERICK C. AUSTIN, OF SAME PLACE.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 606,844, dated July 5, 1898.

Application filed January 23, 1897. Serial No. 620,386. (No model.)

To all whom it may concern:

Be it known that I, JAY B. RHODES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Steam-Pumps, of which the following is a specification.

My invention relates to steam-actuated hydraulic pumps, and particularly to a construction comprising a reciprocating steam-operated piston having a hollow rod or stem through which the exhaust from the steam-piston cylinder is conducted and having at one end of such rod or stem a head or plunger by which the pumping is effected.

Prominent objects of my invention are to provide for the ready and effective adjustment or tightening up of the packing-boxes for the piston-rod arranged between the piston-cylinder and pumping-chamber and to permit such adjustment or tightening up to be made without the removal of bolts, caps, or other parts of the apparatus and without in any way dismembering or taking apart the same; to provide a simple and desirable construction and arrangement for taking the exhaust from the hollow piston-rod and discharging the same either into the water-chamber or into the open air and at the same time to effectively protect the hollow piston-rod from dirt; to provide an improved construction of piston and valve therefor, and to provide certain further details serving to generally improve the construction of steam-actuated hydraulic pumps.

In the accompanying drawings, Figure 1 is a longitudinal section of a steam-pump embodying my invention. Fig. 2 is a transverse section taken on line x x in Fig. 1. Fig. 3 is a longitudinal section of the cylinder, piston, and valve on an enlarged scale. Fig. 4 is a longitudinal section of the piston, taken on a plane at right angles to the one of Fig. 3, showing the valve in elevation. Fig. 5 is a transverse section taken on line y y in Fig. 4.

The base or bed A of the apparatus is conveniently provided with a couple of oppositely-arranged upright end portions 1 and 2, the former of which serves as a support for the piston-cylinder B. The upright end portion 2 of the bed affords a support for the part of the apparatus which contains the pumping devices and is made hollow, so as to afford an enlarged passage or chamber 2^a, which primarily receives the water through a suitable port and which communicates with the valved pumping-chamber C through suitable valved ports. The piston D is arranged to work within the cylinder B and has its stem 3 extended to the pumping portion of the apparatus and therein provided with a head or plunger 4. Said plunger 4 is arranged to work within a pump-barrel 5, which latter is open at both ends and arranged with its ends respectively in open communication with one and the other of the two portions 6 and 7 of the pumping-chamber.

The piston-rod is made hollow, so as to provide an exhaust-passage arranged to take the exhaust from the piston-cylinder and discharge the same by way of a lateral port 8 in the hollow piston-rod into an annular chamber or passage 9, through which the said rod extends. This exhaust chamber or passage 9 is formed by the space within a sleeve E, having closed ends 10, through which the piston-rod is arranged to work. These ends 10 also severally constitute portions of packing-boxes. The sleeve E is provided with one or more lateral ports 11, which open into an exhaust-passage 12, arranged around the ported portion of said sleeve and extended to the water chamber or passage 2^a, whereby the exhaust may be let into such water-chamber when so desired. The exhaust may, however, be cut off from the water-chamber and discharged into the open air, and to such end the passage is provided with a valve-cock F, having a diametrically-arranged port 13 for permitting the exhaust to pass to the water-chamber and also having a longitudinally-arranged port 14, through which the exhaust will pass to the open air when the valve-cock is properly adjusted, it being observed that the valve-cock is arranged to turn as a plug in a cylindric shell 15, having lateral ports 16.

The portion 12^a of the exhaust-passage 12, which is provided with the valve-cock F, extends horizontally from one to the other of the upright end portions 1 and 2 of the base of the apparatus and is arranged below and away from the piston-rod, by which arrange-

ment the walls of such passage can unite or connect with said upright end portions 1 and 2 at points below and clear of the packing-boxes for the piston-rod and also provide a convenient rigid connection between the two standards or upright frame portions 1 and 2. The sleeve E, which provides certain portions of a couple of packing-boxes and which also provides the exhaust chamber or passage 9, is fitted within a tubular casing G and adapted for end adjustment within the same. This outer casing G has a flared end 17, which is connected with the frame portion at one end of the cylinder B by a threaded connection and which is sufficiently expanded to provide about the sleeve E the aforesaid annular portion 12 of the exhaust-passage.

In the construction illustrated I have provided three packing-boxes for the piston-rod. Of these the packing-box II is at one end of the piston-cylinder between the same and the exhaust-chamber 9. The packing-box I is at one side of the pump-chamber, and the third packing-box K is arranged between the said two packing-boxes II and I and formed at one end of the exhaust chamber or passage 9. The stationary part 18 of the packing-box II is formed with or secured to one end of the piston-cylinder, while the opposing adjustable part of said box is formed by an end 10 of the sleeve E, which said end also provides a bearing for the piston-rod and further closes one end of the exhaust-chamber 9. The opposite end of the sleeve E, likewise indicated by the numeral 10, provides one part of the packing-box K, the opposing part of such box being provided by the end 19 of a long sleeve-like nut K′, having one of its ends fitted within one end of the sleeve or casing G. This nut K′ has its threaded bore made of greater diameter than the diameter of the piston-stem, so as to receive the threaded end portion of an externally-threaded sleeve L, which is arranged upon the piston-stem and adapted at its opposite end 20 to provide the movable part of the packing-box I, the stationary part 21 of such box being formed with or secured to the side of the shell or casing 22 of the pump.

By the foregoing-described arrangement the packing-boxes I and K can be readily tightened up by simply turning the nut K′, and obviously such adjustment on the part of said nut will also tend to adjust the sleeve E within its casing G in a direction to tighten up the packing-box II. Hence a rotary adjustment on the part of the nut K′ will serve to simultaneously tighten up all three of the packing-boxes. It will also be seen that a like adjustment can be attained by turning the sleeve L. This arrangement also permits access to be easily had to the packing-boxes, it being observed that the casing G, sleeve E, nut K′, and threaded sleeve L are all detachable and arranged so that they can be easily detached. It will be further seen that in case there were no intermediate exhaust-chamber E the sleeve-like nut K′ could be employed as a part of the steam-cylinder packing-box H in the manner in which it is shown as a part of the exhaust-chamber packing-box K, it being observed that in either case the piston-rod is provided with a couple of packing-boxes arranged intermediate of the steam and pumping cylinders.

The stem of the piston is desirably screwed into one end of the piston-head or piston proper, whereby it can be conveniently made and applied. The "piston-head" or "piston," as it may be termed, comprises a couple of end plates 23 and 24, a hollow body portion 25 confined and clamped between said end plates, and a central cylindric portion 26, which is rigid with and preferably cast in one piece with the end plate 24. This inner or central portion 26 of the piston is of greater diameter than the diameter of the stem, but of less diameter than the diameter of the diametric area of the bore or cylindric chamber 34 within the said hollow body portion 25 of the piston, so as to leave within such chamber a suitable annular working space for a reciprocating cylindric valve M, which is arranged to slide between the inner and outer concentric portions 25 and 26 of the piston. This valve is formed with a straight bore, and the central cylindric portions 26 of the piston is provided at its middle with an annular recess 27, which, in effect, forms the valve-chamber, it being seen that by such arrangement the said valve-chamber is formed in the piston and not in the valve, also that the central portion 26 of the piston is of greater diameter than the stem 3, so as to permit it to be provided both with a central duct 28, arranged coincident with and extending to the bore of the stem, and with annular peripherally-arranged grooves for packing-rings 29. One end of the central portion 26 of the piston is united with the end plate 24, as aforesaid, while its opposite end is provided with a stem 30, arranged to extend through an opening in the end plate 23 and having its terminal portion 31, which extends beyond the end plate 23, suitably threaded, so as to receive a tightening-nut 32. It will be seen, therefore, that the piston, regardless of any arrangement of circumferentially-formed recesses or passages, is externally of ordinary form and that it contains a long annular chamber 34, within which the valve is arranged to work, also that the middle annular space or chamber 27 is formed in a portion of the piston and not in the valve, which latter has a straight cylindric inner face arranged to slide along the cylindric face of the central portion 26 of the piston. The construction of piston and valve thus far described comprises a simple and highly-desirable arrangement and is exceedingly advantageous with regard to economy in and accuracy of manufacture and with regard to adjustment and replacement of parts during service.

The valve and piston can be operated by

steam admitted and exhausted through any known or suitable arrangement of ports, and the pump valve or valves and other details of the pumping portion of the apparatus can also be constructed and arranged in any known or suitable way.

With reference to the arrangement of ports and pump details herein selected by way of illustrating a working apparatus the operation of the piston and of the pumping portion will be readily understood from the following: Live steam is let in through a side port B′ in the cylinder, and when the piston D is at the left, as indicated in Fig. 3, the steam passes into an annular recess 33, formed at one end of the outer body portion 25 of the piston, and thence into the central annular space or chamber 34 of the piston by way of ports 35, Fig. 4, which said ports connect said recess 33 and chamber 34. The valve M therefore moves to the left. During this movement of the valve M to the left one end of an exhaust-port 36 in the piston is uncovered, thereby allowing steam to pass from the chamber 34 in the valve M by way of a side opening 36^b. From the latter it passes into a longitudinal port or passage 39, formed in the piston and extending between said chamber 34 and the left-hand end of the piston, and through said port into the interior of the cylinder, where it operates to drive the piston to the right. When the piston has moved in this direction sufficiently to put the wide annular recess 40, formed in its body part 25, into communication with the steam-port B′, live steam passes into the chamber 34 through the right-hand inner end of a port or passage 41 in the body part 25 of the piston, Fig. 4, connecting said recess 40 and chamber 34, thence into the valve-recess 37, and out through the port 39, as before. Upon the arrival of the piston at the right-hand end of the cylinder an annular recess 33^a, corresponding to recess 33, is put into communication with the steam-port B′, whereupon live steam enters the chamber 34 through ports 35^a, corresponding to ports 35, and drives the valve M to the right. This movement of the valve exposes one end of an exhaust-port 36^a, corresponding to port 36, whereupon steam passes from the chamber 34 into port 36^a, thence by way of a side opening 36^c into an annular recess 37^a, formed in the periphery of the valve M and corresponding to the recess 37, and thence into a port 39^a, corresponding to port 39, and through said port 39^a into the cylinder at the right-hand side of the piston. The resulting movement of the piston to the left places the annular recess 40 into communication with the steam-port B′, whereupon steam passes into port 41 and through the left-hand inner end of the same into recess 37^a, and thence into and through port 39^a, as before. When the movement of the piston allows recess 33 to again come into communication with port B′, the previously-described operation is repeated. During the movement of the valve M to the right steam is exhausted from the right-hand end of the chamber 34 into port 36 and out through the end 36^d of said port into an annular recess 42, formed in the periphery of valve M intermediate of the recesses 37 and 37^a, it being observed that the side opening 36^b of said port 36 is closed at such time by the valve M. From the recess 42 the steam passes into the interior exhaust-duct 28 of the central piston portion 26 through ports 43 and 44, of which the former connect the valve-recess 42 with the chamber formed by the spindle-recess 27, and the latter connect said recess 27 with the interior duct 28. During the movement of the valve M to the left exhaust-steam passes in a similar manner from the left-hand end of the chamber 34 into the duct 28 by way of port 36^a, opening 36^c of said port, annular recess 42, and ports 43 and 44. The exhaust-steam from the cylinder passes likewise into recess 42 and thence into duct 28. This exhaust occurs during the movement of the piston to the right through port 39^a and during the movement of the same to the left through port 39. The movement of the piston D effects a corresponding movement of the pumping-plunger 4, as aforesaid, and this movement of the pumping-plunger results in the pumping operation by means of suitable check-valves 45, 46, 47, and 48, which are arranged upon suitable seats provided at the upper portion of and above the pumping-chamber C. The pumping operation occurs as follows: When the plunger 4 moves to the left, the valve 47 is lifted by the suction caused by such movement and water passes from the water-compartment 2^a into the pumping-cylinder 5 by way of the passage 7. At the same time water is forced by the plunger 4 from the other end of said cylinder 5, whereupon the valve 46 lifts and the water passes into a chamber 50, which is arranged between an air-bulb 51 and the pumping-cylinder 5 and is provided with a suitable outlet-socket 53, it being observed that in order to insure the proper working of the pump the passages 6 and 7 are separated by a suitable partition 52, which also serves to provide the inner seats for the check-valves. Upon the return stroke of the pump-plunger from left to right the check-valves 45 and 48 are lifted, the former allowing the water to flow into the left-hand end of the cylinder 5 by way of the passage 6 and the latter allowing water forced out of the right-hand end of said cylinder to pass into the chamber 50.

It is distinctly understood that while I have herein designated the apparatus as a "steam-actuated" hydraulic pump it may be operated by air or gas under pressure and may be used for pumping any liquid, that any fluid under pressure as a means for operating the piston is herein considered as an equivalent for steam, and that in the following claims the term "steam," which is employed for the sake of brevity, includes other equivalent means, such as other fluids under pressure, it being

also understood that the terms "steam" and "steam-cylinder" are conveniently employed in the following claims to readily distinguish both the motive fluid which operates the piston and the piston-cylinder in which a piston is operated by such motive fluid from the fluid in the pumping device and the pump-plunger and its cylinder, but that wherever the word "steam" occurs it is understood to include other motive fluid under pressure.

What I claim is—

1. In a steam-actuated hydraulic pump, the combination with the oppositely-arranged steam and pumping cylinders, of a hollow pump-plunger-operating piston-rod which serves as an exhaust-outlet for the steam exhausting from the steam-cylinder; an exhaust-chamber into which the piston-rod extends, and discharges the steam exhausting from the steam-cylinder; piston-rod packing-boxes for the steam and pumping cylinders, and for the exhaust-chamber, and means for simultaneously adjusting the adjustable packing-glands with which the steam and pumping cylinder, and exhaust-chamber packing-boxes are provided; substantially as set forth.

2. In a steam-actuated hydraulic pump, the combination with the oppositely-arranged steam and pumping cylinders, of a hollow pump-plunger-operating piston-rod which serves as an exhaust-outlet for the steam exhausting from the steam-cylinder; an exhaust-chamber inclosing the piston-rod between the steam and pumping cylinders, and receiving the exhaust from said piston-rod exhaust-port; a couple of rotary and longitudinally-adjustable piston-inclosing sleeves having their adjacent ends respectively internally and externally screw-threaded so as to fit together the one within the other, so that the sleeves can be relatively adjusted simultaneously in opposite directions, and having their opposite ends formed so as to provide packing-glands for one and the other of a couple of piston-rod packing-boxes which are situated at the adjacent ends of the pumping-cylinder and the exhaust-chamber; and a ported longitudinally-movable sleeve arranged over the piston-rod within the exhaust-chamber and having its ends formed so as to provide packing-glands for one and the other of a couple of piston-rod packing-boxes which are arranged at the adjacent ends of the steam-cylinder and the exhaust-chamber, substantially as set forth.

3. In a steam-actuated engine, the combination with the steam-cylinder and the piston working therein, of the piston-rod extending from the cylinder and serving as an exhaust-outlet for the steam exhausting therefrom; an exhaust-chamber into and through which the piston-rod extends, and into which it discharges the steam exhausting from the steam-cylinder; a couple of piston-rod packing-boxes arranged at the opposite sides of the exhaust-chamber, and provided with adjustable packing-glands; and means for simultaneously and coincidently adjusting the adjustable packing-glands of both of said packing-boxes, substantially as set forth.

4. In a steam-actuated engine, the combination with the steam-cylinder and the piston working therein, of the piston-rod extending from the cylinder and serving as an exhaust-outlet for the steam exhausting therefrom; an exhaust-chamber into and through which the piston-rod extends, and into which it discharges the steam exhausting from the steam-cylinder; a ported longitudinally-adjustable sleeve inclosing the piston-rod within the exhaust-chamber; a couple of piston-rod packing-boxes for the exhaust-chamber, each of which has one of its glands provided by one of the ends of said longitudinally-adjustable piston-inclosing sleeve, and one of which has its other gland independently adjustable along the piston-rod so as to permit of its tightening the packing between itself and the end of the sleeve forming the other gland thereof and thereby simultaneously and coincidently adjusting said sleeve longitudinally so as to tighten the packing in the other packing-gland, substantially as set forth.

5. In a steam-actuated engine, the combination of a steam-cylinder having one of its ends provided with an outwardly-extending shell or casing which provides an exhaust-steam chamber; a hollow piston-rod extending from the steam-cylinder into the exhaust-chamber and providing an outlet for the exhaust-steam, and having an exhaust-port which communicates with said exhaust-chamber; a ported longitudinally-adjustable piston-rod-inclosing sleeve arranged within the exhaust-chamber and constructed so as to be removable therefrom by way of the open outer end of the shell or casing without detaching the shell or casing from the cylinder; a piston-rod packing-box intermediate of and common to, the piston-cylinder and the exhaust-chamber, and having its adjustable packing-gland provided by one of the ends of said sleeve; and means for adjusting said sleeve so as to adjust the packing-gland provided thereby, independently of the shell or casing, said means being fitted within the open outer end of the shell or casing, and constructed so as to be exteriorly manipulated for adjustment, substantially as set forth.

6. In a steam-actuated engine, the combination with the steam-cylinder and the piston working therein, of the piston-rod extending from the steam-cylinder and serving as an exhaust-outlet for the steam exhausting therefrom; an exhaust-chamber into and through which the piston-rod extends, and into which it discharges the steam exhausting from the steam-cylinder; piston-rod packing-boxes for the steam-cylinder and for the opposite sides of the exhaust-chamber, said boxes being provided with adjustable packing-glands; and means for simultaneously and coincidently adjusting the adjustable packing-glands of

all of said packing-boxes; substantially as set forth.

7. In a steam-actuated hydraulic pump, the combination with the oppositely-arranged steam and pumping cylinders, and with the steam-actuated piston and pump-plunger therefor, of the piston-rod extending between the steam and pumping cylinders and serving as an exhaust-outlet for the steam exhausting from the steam-cylinder; an exhaust-chamber into and through which the piston-rod extends, and into which it discharges the steam exhausting from the steam-cylinder; piston-rod packing-boxes for the pumping-cylinder, and for the opposite sides of the exhaust-chamber, said boxes being provided with adjustable packing-glands; and means for simultaneously and coincidently adjusting the adjustable packing-glands of all of said packing-boxes; substantially as set forth.

8. In a steam-actuated engine, a steam-cylinder having one of its ends provided with a tubular packing-box H having its inner end formed so as to provide a packing-gland, and provided also with an outwardly-extending shell or casing which provides an exhaust-steam chamber; a hollow piston-rod extending from the steam-cylinder into the exhaust-chamber and out of the latter by way of the open outer end of the shell or casing, and providing an outlet for the steam exhausting from the steam-chamber, and having an exhaust-port which communicates with the exhaust-chamber; a ported longitudinally-adjustable piston-inclosing sleeve arranged within the shell or casing and constructed so as to be removable therefrom by way of the open outer end thereof, and also constructed so that its inner end fits within the tubular packing-box H and provides an adjustable gland therefor, and also so that its outer end fits within the outer end of the shell or casing and provides an adjustable packing-gland therefor; and a second and independently longitudinally adjustable sleeve inclosing the piston-rod and having its inner end fitted within the open outer end of the shell or casing and constructed so as to provide the other packing-gland therefor, substantially as set forth.

9. The combination of a cylinder having a suitable supply-port; a piston working in said cylinder and comprising an outer hollow cylindric portion and an inner concentrically-arranged hollow central portion having a peripheral exhaust-recess which communicates with its interior, and also having its external diameter less than that of the internal diameter of the bore of the outer cylindric portion so as to form an annular space between the two; and a steam-actuated valve working in said annular space and having a straight bore adapted to fit over the central portion of the piston; said outer portion of the piston and said steam-actuated valve being provided with coöperating ports adapted to receive steam from the cylinder supply-port and to exhaust the same into the peripheral recess of the central piston portion, and to cause a continuous reciprocation of the piston; and a hollow piston-rod which receives the exhaust from the interior of the central portion of the piston; substantially as set forth.

10. The combination of a steam-cylinder having a suitable supply-port; a piston working in said cylinder and comprising a pair of oppositely-arranged cylindric heads, an intermediate hollow body part 25 clamped between said heads, and a concentrically-arranged hollow central portion 26 having a peripheral exhaust-recess 27 which communicates with its interior, and also having an external diameter less than that of the bore of the body part 25 so as to form an annular space between the two; a steam-actuated valve working in said annular space and having a straight bore adapting it to fit over the central portion 26; said body part 25 and steam-actuated valve being provided with coöperating ports adapted to receive steam from the cylinder supply-port and to exhaust the same into the peripheral exhaust-recess 27 of the central piston portion 26, and to effect a continuous reciprocation of the piston; and a hollow exhaust-receiving piston-rod having an external diameter less than that of the central piston portion 26, and fitting in a socket formed in the same; substantially as set forth.

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