

No. 670,215.

Patented Mar. 19, 1901.

M. J. ULRICH.
VALVE PORT LINE.

(Application filed June 30, 1900.)

(No Model.)

Fig. 5.

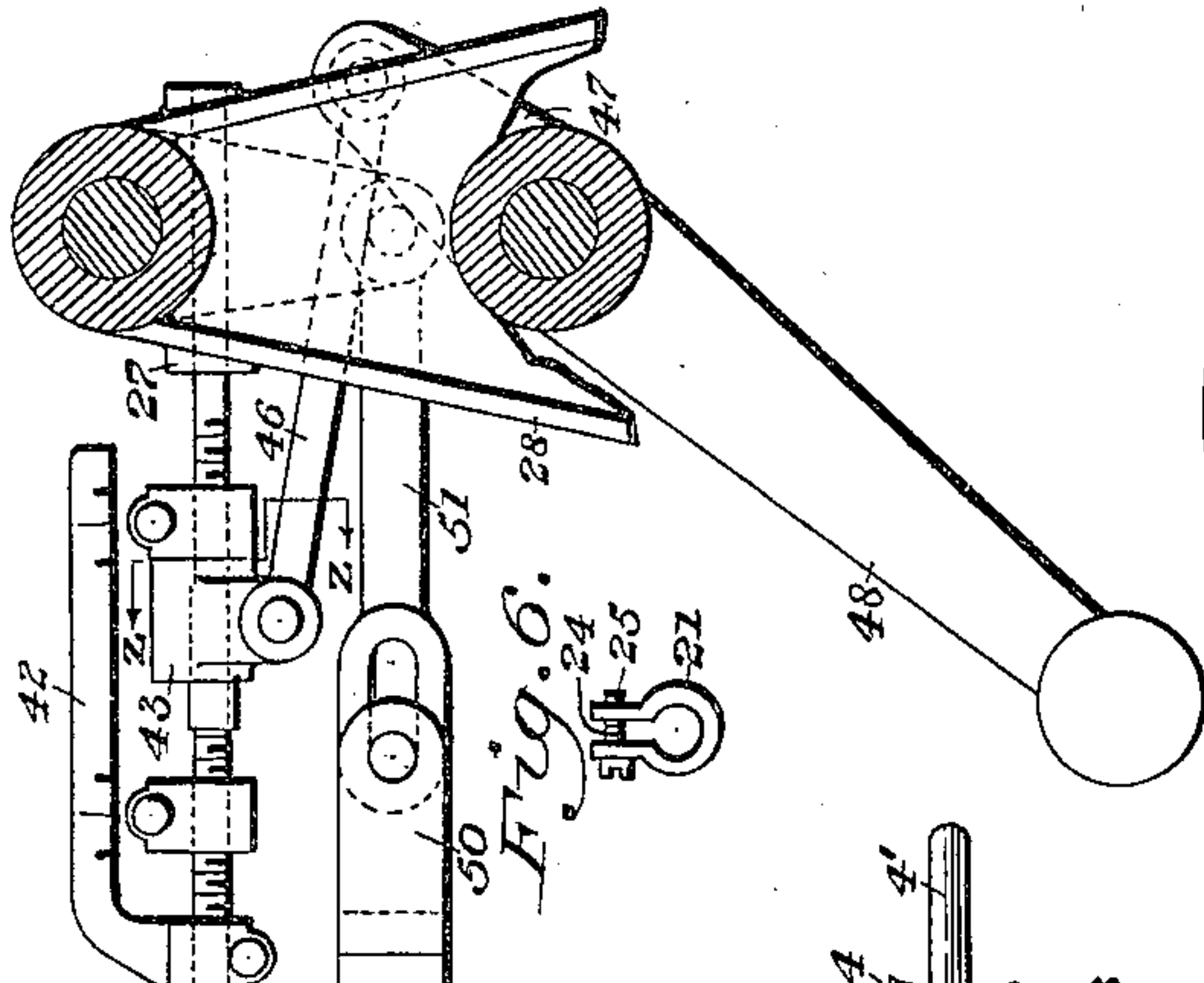


Fig. 6.

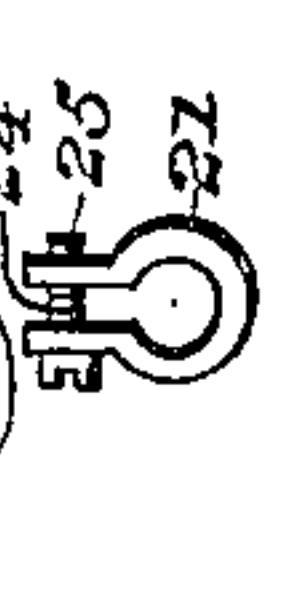


Fig. 3.

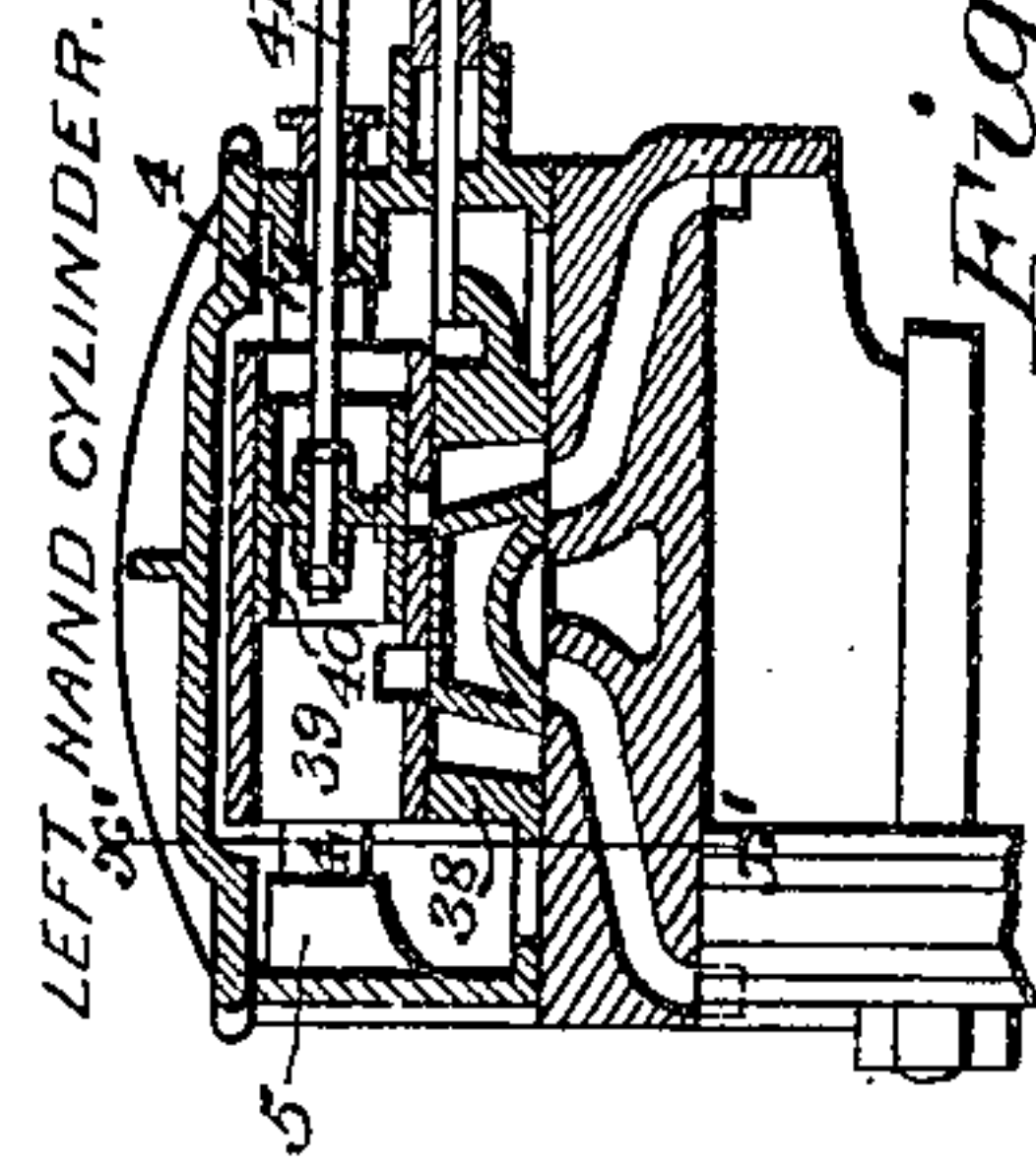


Fig. 7.

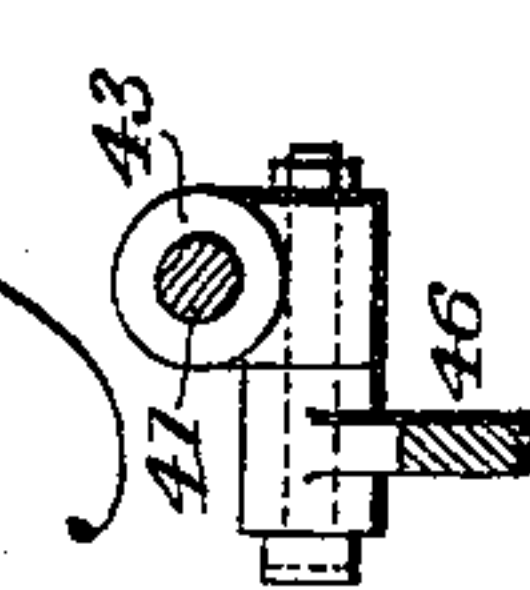


Fig. 2.

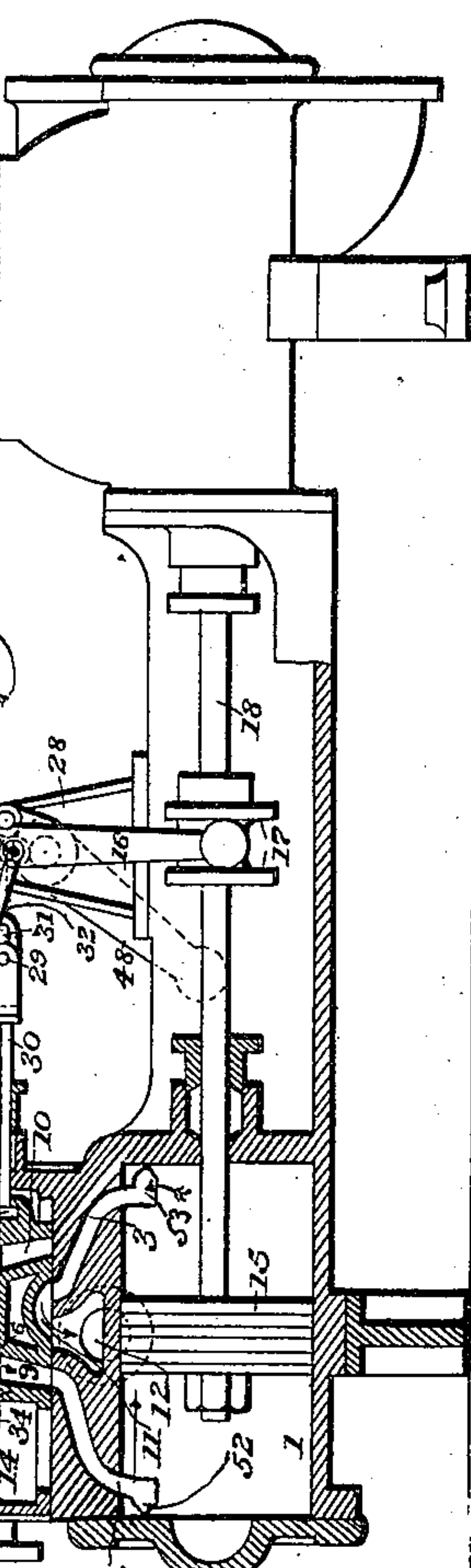


Fig. 4.

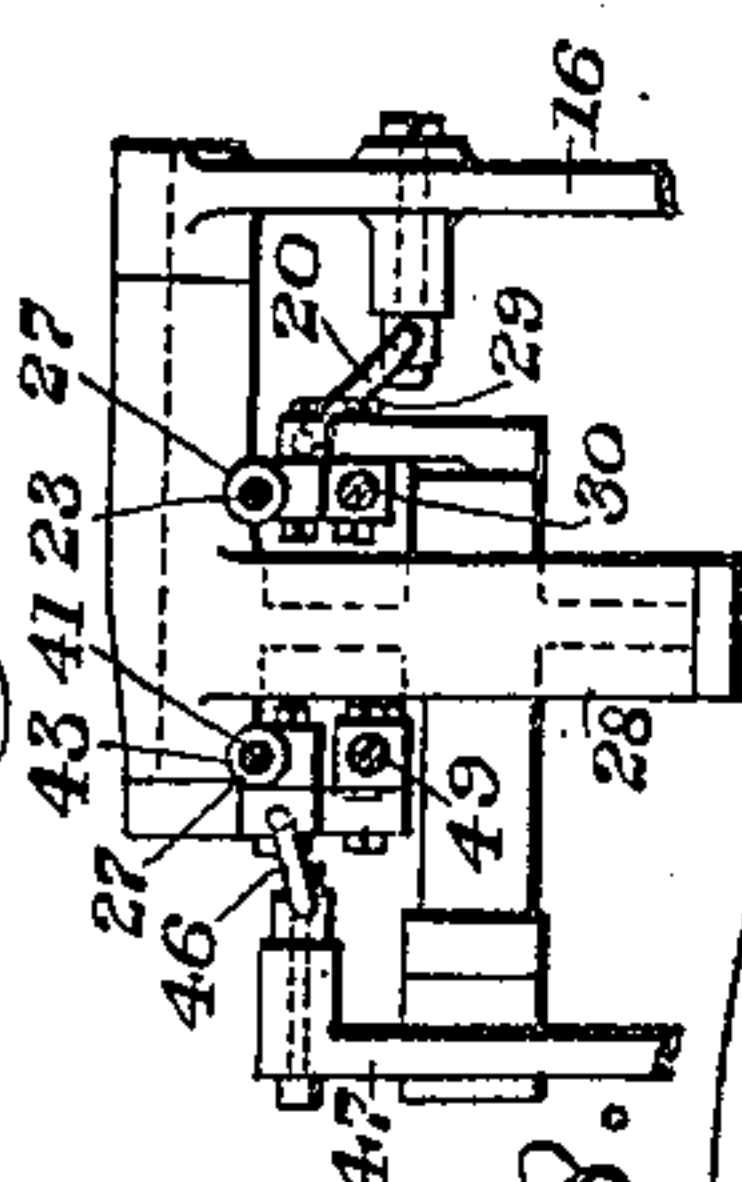


Fig. 8.

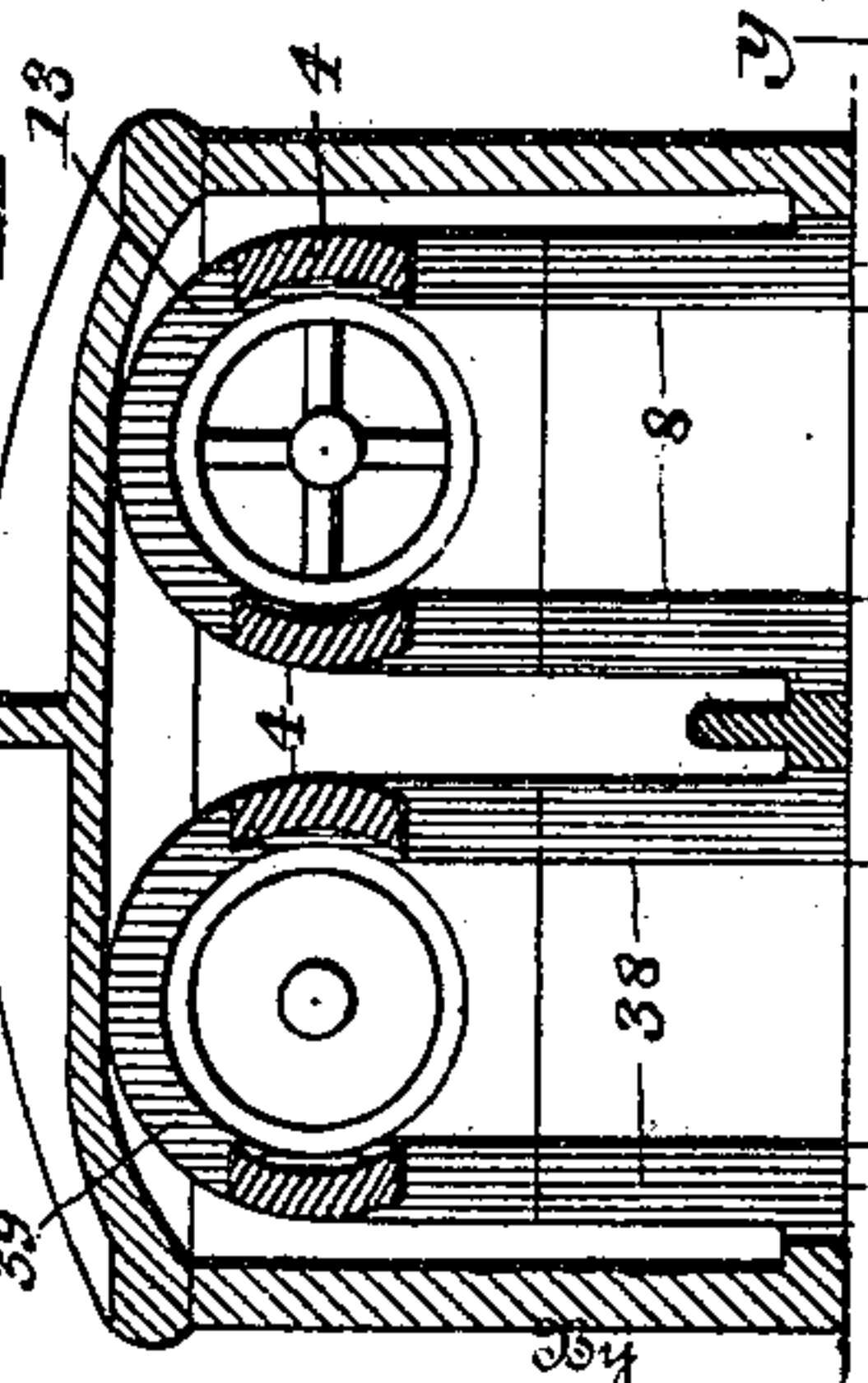
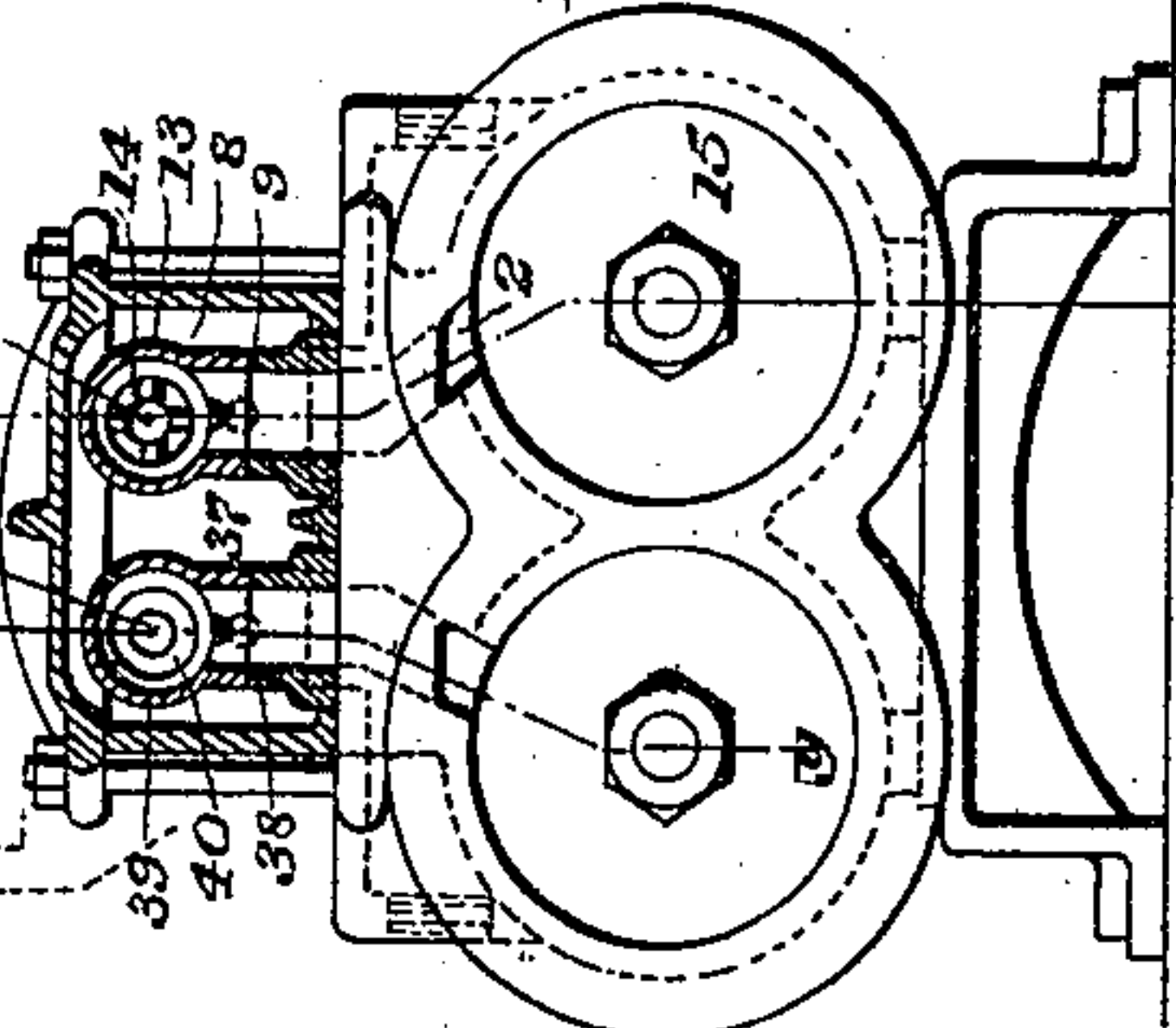


Fig. 1.



Witnesses

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VALVE-PORT LINE.

SPECIFICATION forming part of Letters Patent No. 670,215, dated March 19, 1901.

Application filed June 30, 1900. Serial No. 22,136. (No model.)

To all whom it may concern:

Be it known that I, MAX J. ULRICH, a citizen of the United States, residing at Holyoke, in the county of Hampden, State of Massachusetts, have invented a new and useful Improvement in Valve-Port Liners, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of an improved construction of a valve-port liner which is adapted to be interposed between a cut-off valve and a slide-valve, said cut-off valve reciprocating within said valve-port liner, whereby a positive cut-off is secured at the desired intervals whether the pump or engine runs normal, full, or short stroke.

It also consists in the novel combination of my improved valve-port liner with suitable valve mechanism, whereby the necessary movements are imparted at the proper intervals to the slide and cut-off valves.

It further consists in the provision of means for holding the valve-port liner immovable longitudinally, but permitting said liner to
25 move vertically to compensate for wear.

It further consists of novel details of construction, all as will be hereinafter more fully described, and particularly pointed out in the claims.

30 Figure 1 represents an end view of a cut-off valve, slide-valve, and the interposed valve-port liner embodying my invention, a portion of the valve-chest being shown in section. Fig. 2 represents a section on line xx , Fig. 1,
35 showing the right-hand cut-off valve, valve-port liner, main valve, and their adjuncts in assembled position. Fig. 3 represents a section on line yy , Fig. 1, showing the left-hand cut-off valve, valve-port liner, main valve,
40 and their adjuncts. Fig. 4 represents an outside view showing the relative positions of the valve-rods and their adjuncts. Fig. 5 represents, on an enlarged scale, a side elevation of a portion of the valve mechanism seen
45 in Fig. 3, whereby the slide and cut-off valves between which the valve-port liner is interposed are actuated. Fig. 6 represents an end view of an adjustable collar, seen in detached position. Fig. 7 represents a section on line
50 zz , Fig. 5. Fig. 8 represents, on an enlarged scale, a sectional view showing the valve-port

liner, cut-off and main valves, and the lugs, whereby longitudinal movement of said liner is prevented, the section being taken on line $x'x'$, Fig. 3. Fig. 9 represents, on an enlarged scale, a sectional perspective view of
55 the left-hand valve-port liner and cut-off valve.

Similar numerals of reference indicate corresponding parts in the figures. 60

Referring to the drawings, 1 designates the right-hand steam-cylinder, which is provided with only single ports 2 and 3 in each end thereof, as contradistinguished from the usual style of duplex-pump steam-cylinder wherein
65 two ports at each end are employed to form a steam-cushion, it being apparent that in my style of cylinder, having one port at each end, the clearance is considerably reduced.

8 designates the main slide-valve, which is
70 provided with the ports 9 and 10, which permit the inlet of the motive fluid to each end of its cylinder, said valve having also the recess or port 11, whereby the exhaust is permitted when the parts are in the position seen in
75 Fig. 2 to flow to the main exhaust-port 12.

13 designates the valve-port liner, which is supported upon the main slide-valve and is adapted to receive the cut-off valve 14, said
80 main slide-valve receiving its motion, as usual, from the opposite steam side, while the cut-off valve obtains its motion from its own side of the engine. The valve-port liner 13 is an open-ended casing, provided at its opposite
85 ends with the lugs 4, which abut against the ribs 5, located at the ends of the steam-chest, said liner being interposed between the main and cut-off valves and provided with the ports 6 and 7, it being apparent that while
90 the liner 13 is immovable longitudinally it is free to move vertically or transversely to compensate for wear, the lugs 4 and ribs 5 serving as guides.

Referring now to Fig. 2, it will be seen that if three-quarters cut-off is desired after the
95 right-hand steam-piston 15 has traveled three-quarters of its stroke the main lever 16, which operates in unison with said piston by reason of its engagement with the spool 17 on the rod 18, will, because of its con-
100 nection to the tappet 19 by the link 20, in conjunction with the collars 21 or 22, at the

proper time close the steam-port of the main slide-valve. Thus to effect a cut-off on the right-hand side the cut-off valve will have to travel in the same direction as its piston is traveling, while on the left-hand side the corresponding cut-off valve has to travel in a direction opposite to its piston, the main slide-valves thus being constructed alike, while the cut-off valves slightly differ in construction. The motion and regulation of each of the cut-off valves is effected by the proper tappet, which receives its motion from the proper main lever. The collars 21 and 22 are similar and threaded internally to engage the threaded portions of the cut-off-valve rod 23, and when said collars are adjusted nearer to the tappet an early cut-off results, and when adjusted farther apart a late cut-off results. Each collar is slotted, as at 24, and provided with set-screws 25, whereby they can be retained in any desired position.

26 designates an index secured to each cut-off-valve rod to indicate precisely at what cut-off each steam end is working under, each of said cut-off-valve rods having its free end guided in ways 27 in the bearing-stand 28. The lost motion of the main slide-valve, which must necessarily exist in this class of pumps, is either of the fixed or adjustable type, and I have changed the usual location of the lost-motion block to the valve-rod head, thereby diminishing the length of the steam-chest and simplifying the construction, and thus reducing the cost of manufacturing to a minimum. The valve-rod head-pin 29 of the main right-hand valve-rod 30 runs directly in the slot 31 of its link 32 without necessitating the employment of any blocks as used heretofore, provided a so-called "fixed inadjustable lost motion" is used.

It will be seen from Fig. 2 that the distance between the steam-ports on the upper portion of the main slide-valve is dimensioned so that at the desired cut-off there will always be a free opening for the entering steam at either the forward or return stroke, said main valve having on its front end a pocket 33 to receive the collar of the valve-rod, no lost motion being allowed here. The cut-off valves are preferably cylindrical, so as to enable them to work with the greatest possible freedom, each cut-off valve being balanced and guided in the valve-port liner, which is a very important feature in case the steam end of the pump should stand upright or be hung vertically.

The right-hand cut-off valve 14 is made in the sections 34 and 35 in order to get short straight ports in the main valve 8, said sections being joined by the neck 36, adjacent to which are ports 37, whereby steam can enter from the valve-chest at any time from both ends to fill the inner portion of the right-hand cut-off valve and thence enter its steam-cylinder.

38 designates the main valve of the left-

hand cylinder, said valve being provided with ports and supporting the valve-port liner 39, which is constructed substantially like the right-hand liner 13.

40 designates the left-hand cut-off valve, (best seen in Fig. 3,) which may be a cylinder having a hub, wherein is secured an end of the left-hand cut-off-valve rod 41, which carries an index 42, tappet 43, and adjustable collars 44 and 45, all of which are similar to the corresponding parts seen in Fig. 2, said cut-off-valve rod 41 also having its free end guided and supported in its bearing-stand. The left-hand tappet 43 has connected thereto one end of the link 46, the other end of the latter being connected to the lever extension 47 of the left-hand main lever 48, it being of course understood that the well-known duplex motion is employed in the left-hand as well as the right-hand side of the pump or engine, as already explained, one piston following the other after the first has nearly completed its stroke. In other words, each slide-valve receives its motion as usual from the opposite piston while each cut-off valve obtains its motion from the main lever on its own side. The left-hand main-valve rod 49 is provided with a lost-motion connection between the valve-rod head 50 and 51, as will be clearly understood from Figs. 3 and 5, said lost-motion connection being similar to that already described in connection with Fig. 3. It will thus be seen that by my variable cut-off-valve gear any ratio of expansion can be had in the limit of one-half stroke to full stroke on each side and that, furthermore, the right-hand and left-hand side can be adjusted independently of each other, which also holds good for the yoke end and head end of each cylinder.

I have shown in Fig. 2 an arrangement of the ports which is especially applicable to my construction of valve mechanism, wherein I employ three ports on the cylinder-face and but a single port communicating with the bore of the cylinder at each end thereof, said ports being located far enough in the bore to effect the requisite cushioning of the steam-piston. I also employ the V-shaped ports 52 and 53, located at the ends of the cylinders, in order to permit the new live steam to enter behind the piston and give the same its initial start, the V-shaped ports (seen in Fig. 2) being of course applicable to both cylinders.

I desire to lay especial emphasis upon my novel feature of providing each high-pressure cylinder in a duplex engine with but a single port leading into each extremity of each steam-cylinder, each of the latter being provided with a cut-off valve coacting with its main slide-valve and the interposed valve-port liner, in combination with the other novel features of my invention. As is well known to those skilled in this art, in the high-pressure steam-cylinders of a duplex pumping-engine where no cut-off is employed it is the usual practice to employ two ports at

each end of said cylinders for the purpose of creating a cushioning effect upon the piston, it being evident that the live steam has to fill these two ports before any propulsion of the steam-piston can take place, it being also apparent that as quick as the main slide-valve opens to the atmosphere said live steam contained in these two ports will escape to the atmosphere without doing any useful work, said ports having to be refilled at every stroke, which is very wasteful, as is evident. Now when a cut-off valve is employed for each cylinder in conjunction with a single port at each end of each cylinder it is unnecessary to make allowance for any cushioning, since the latter is perfectly under the control of the operator and is effected by adjusting the cut-off, whereby the piston is prevented from striking the cylinder-heads and a single port leading into the end of each cylinder will suffice.

My invention can be readily applied to the smallest as well as the largest steam-pumps and is also equally well adapted to compound or triple-expansion pumping-engines.

It will be apparent that a duplex pump equipped with my invention can readily show an economy or saving of thirty per cent. to fifty per cent. in fuel, and that under certain conditions its efficiency will equal that of a compound pumping-engine.

It will be understood that I do not limit myself to steam pumping-engines exclusively, as the principle of my invention is equally well adapted to compressed air and all other engines or motors as well.

When my invention is applied to compound or triple-expansion engines, it will of course be apparent that the cut-off valve is applied to the high-pressure cylinder only, and in such cases cut-off valves of various shapes may be employed, if desired. In cases where an intermediate cylinder is employed between the high-pressure and low-pressure cylinders in a triple-expansion engine it will be understood that the low-pressure and intermediate cylinders will have the usual slide-valves, which will coact with the main slide-valve on the high-pressure cylinder, upon which latter slide-valve my improved valve-port liner and cut-off valve are mounted.

I have deemed it unnecessary to illustrate the various modifications hereinabove referred to, as the principle of operation is the same in each instance.

I desire to lay especial stress upon the employment of my novel construction of valve-port liner, which is longitudinally immovable, but free to move in an opposite direction or transversely to compensate for wear, wherefrom it will be apparent that the cut-off valves will positively cut off at the desired part of the stroke under all conditions, whether the pump runs normal, full, or short stroke, or in whatever position the same may stand.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A duplex steam-pump consisting of a plurality of high-pressure steam-cylinders, steam-chests therefor, each cylinder having three ports on its face, and a single port communicating with each end of each cylinder, main slide-valves for each cylinder, cut-off valves for each of said slide-valves, a valve-port liner between said main and cut-off valves, said valve-port liner being immovable longitudinally but capable of transverse movement, means for causing one of said cut-off valves to travel in the same direction as its piston, and means for causing the other cut-off valve to travel in an opposite direction to its piston.

2. In a duplex steam-pump, a plurality of cylinders, steam-chests therefor, each of said cylinders having three ports on each of their faces and a single port communicating with each end of each cylinder, main slide-valves for each cylinder, cut-off valves, a valve-port liner between said main and cut-off valves, said valve-port liner being immovable longitudinally but capable of transverse movement, means for actuating said slide-valves, means for causing one of said cut-off valves to travel in the same direction as its piston, and means for causing the other cut-off valve to travel in an opposite direction to its piston.

3. The combination of a plurality of cylinders, main slide-valves therefor, cut-off valves, one of said cut-off valves consisting of sections joined by a hub, ports in said sections adjacent said hub for permitting the motive fluid to flow therethrough to said slide-valves, a movable valve-port liner intermediate said cut-off and slide valves and means for actuating the latter and said cut-off valves.

4. The combination of a cylinder, a main slide-valve therefor, a valve-port liner mounted on said slide-valve and immovable longitudinally but capable of transverse movement to compensate for wear, a cut-off valve located within said liner, said cut-off valve consisting of a section joined by a hub, ports in said sections adjacent said hub, and mechanism for operating said slide and cut-off valves.

5. In a duplex pumping-engine, a pair of cylinders having pistons therein, main slide-valves for said cylinder, cut-off valves for said main valves, a valve-port liner interposed between said valves and capable of transverse movement to compensate for wear, one of said cut-off valves being composed of sections joined by a hub or necks, ports in said sections adjacent each hub, the other cut-off valve being a plain cylinder, and means for actuating said main and cut-off valves.

6. A steam pumping-engine, consisting of a

plurality of high-pressure steam-cylinders, a
single port leading to each end of each of said
cylinders, main slide-valves for each cylinder,
cut-off valves for each of said slide-valves,
5 a valve-port liner interposed between said
valves and capable of transverse movement
to compensate for wear, one of said cut-off

valves consisting of sections joined by a hub,
ports in said sections adjacent said hub and
means for actuating said valves.

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