

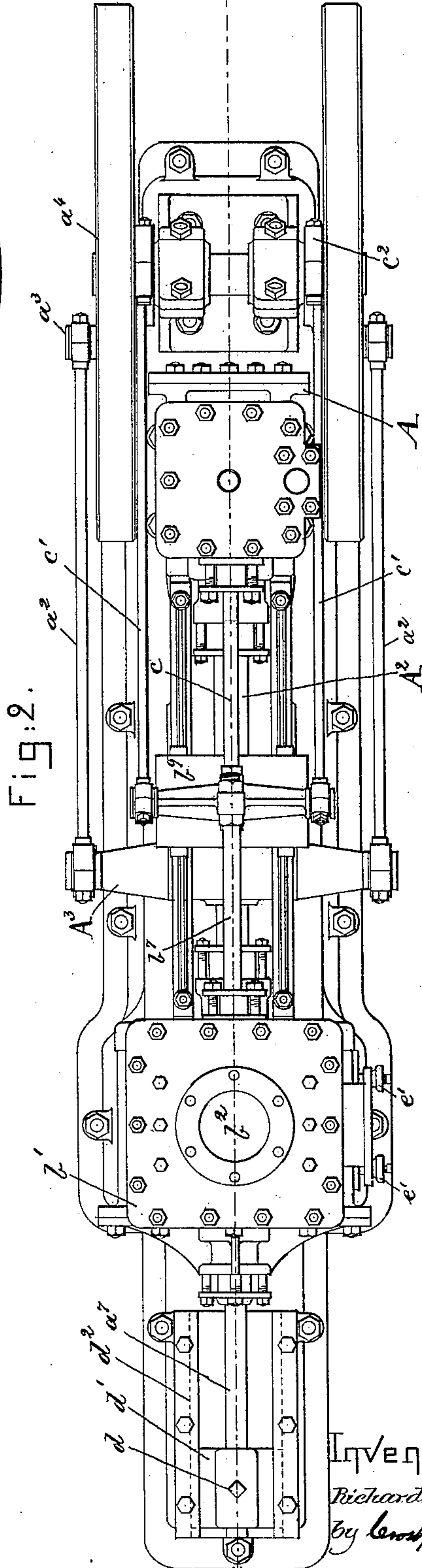
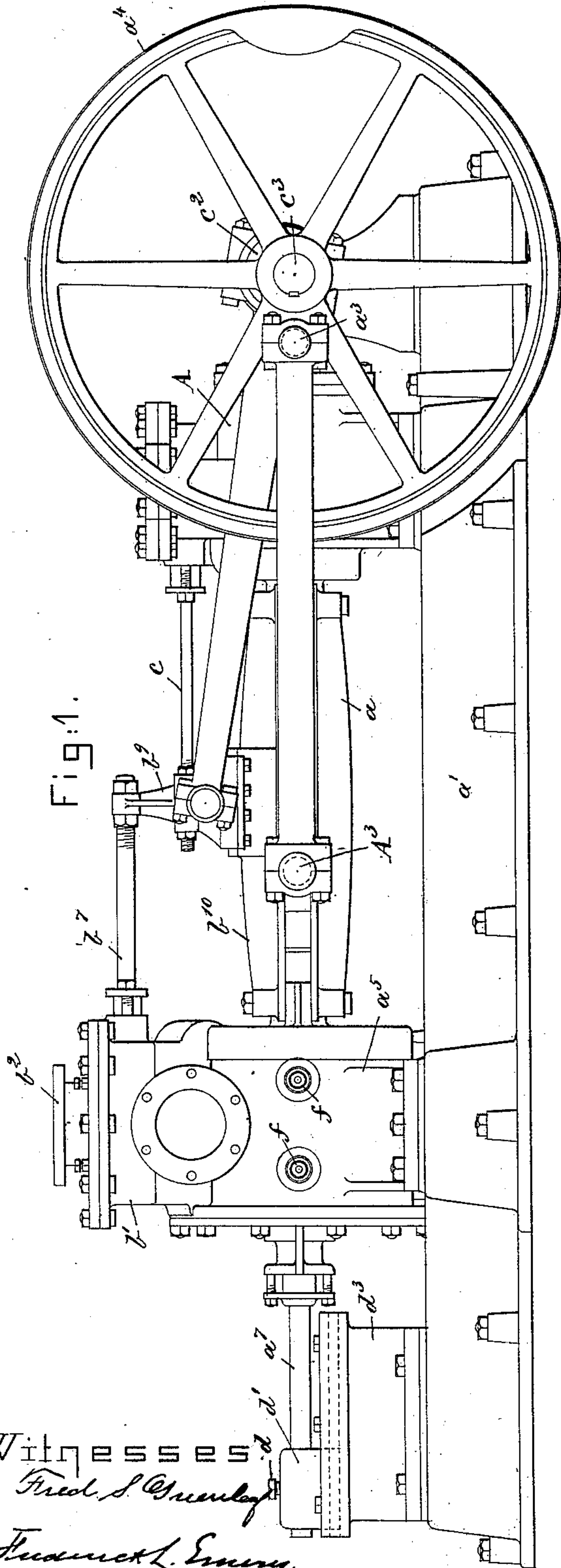
(No Model.)

2 Sheets—Sheet 1.

R. LAVERY.  
PUMP.

No. 428,682.

Patented May 27, 1890.



Witnesses  
Fred. S. Greenleaf  
Frederick L. Emery.

Inventor  
Richard Lavery  
by *Levy & Co.*  
Attys

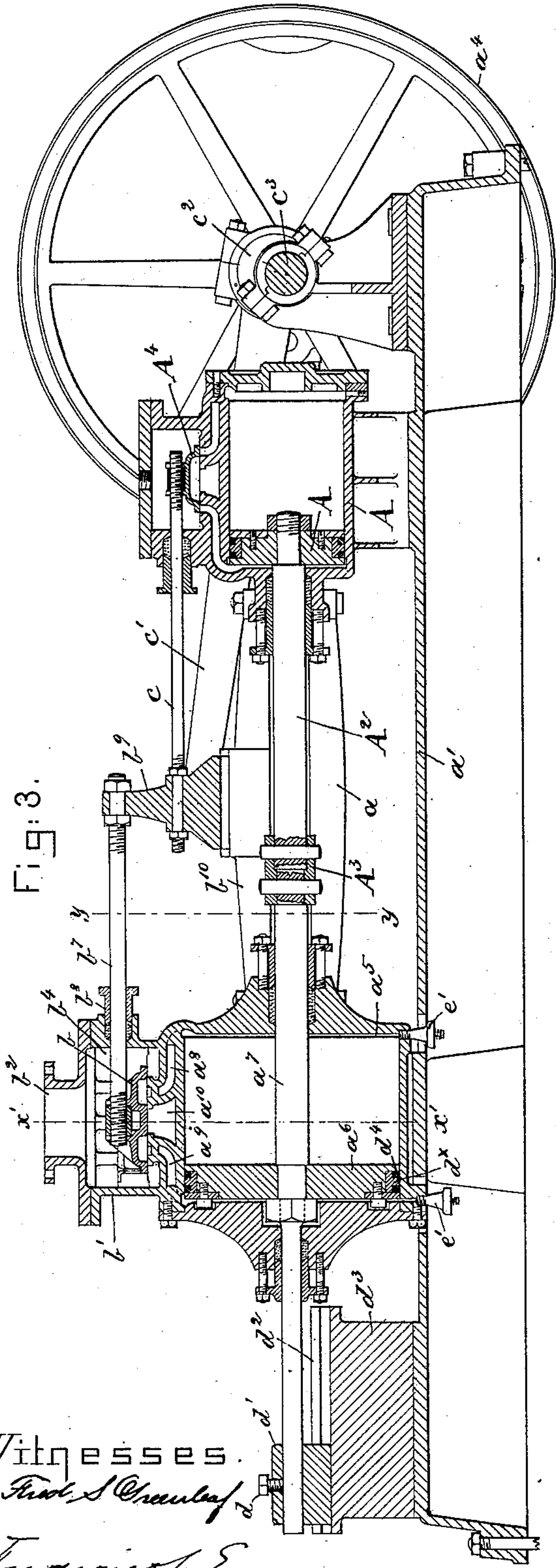
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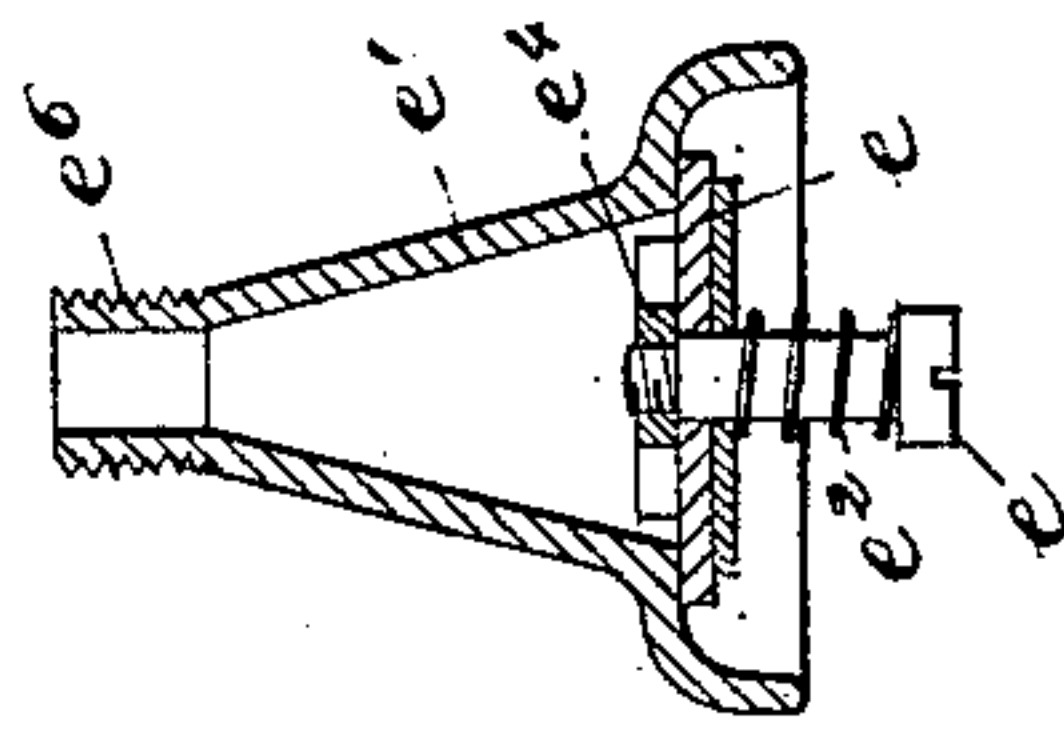


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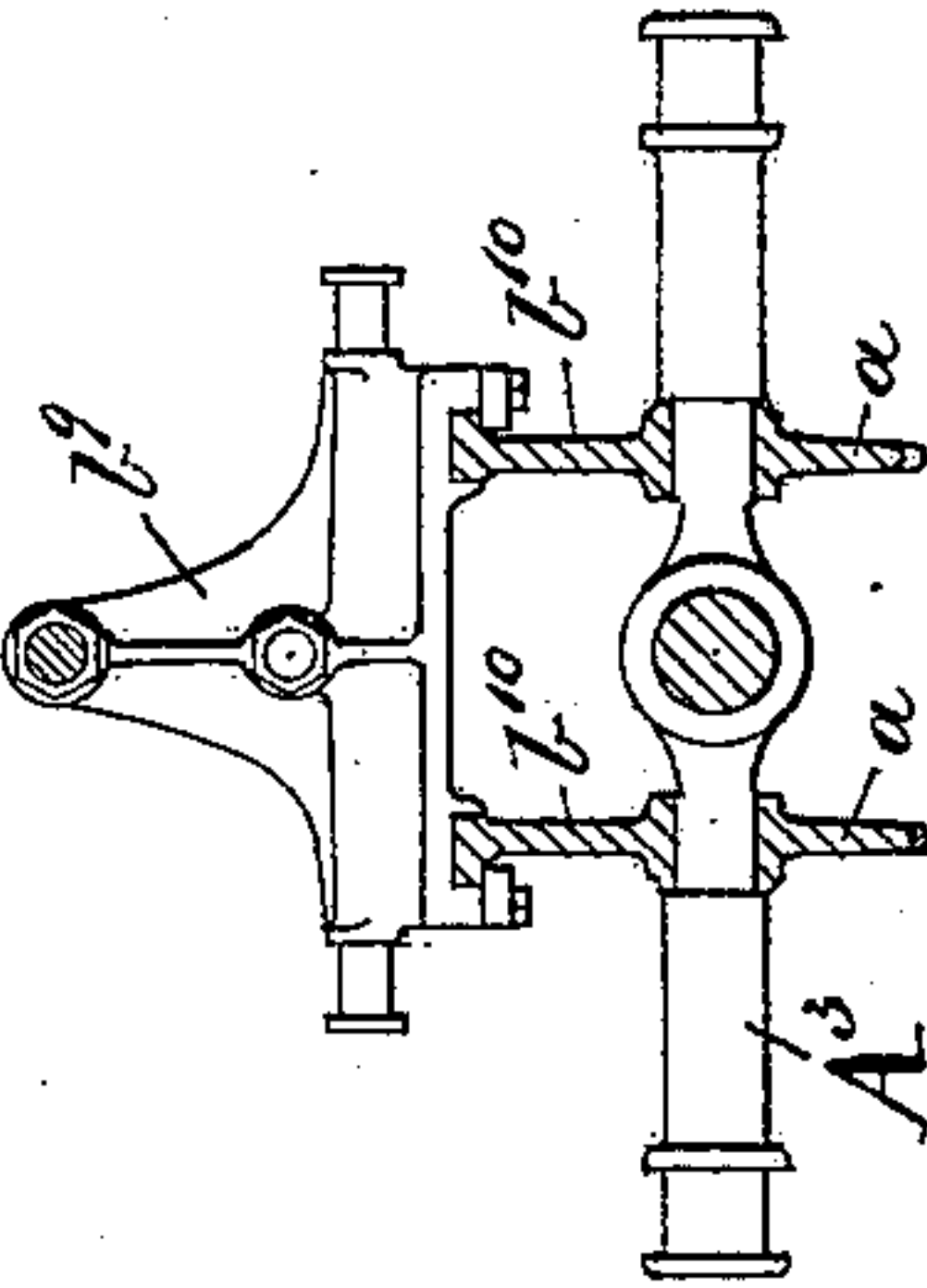
Witnesses.

Frank S. Churchill

Frederick L. Emery.



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5.6.17

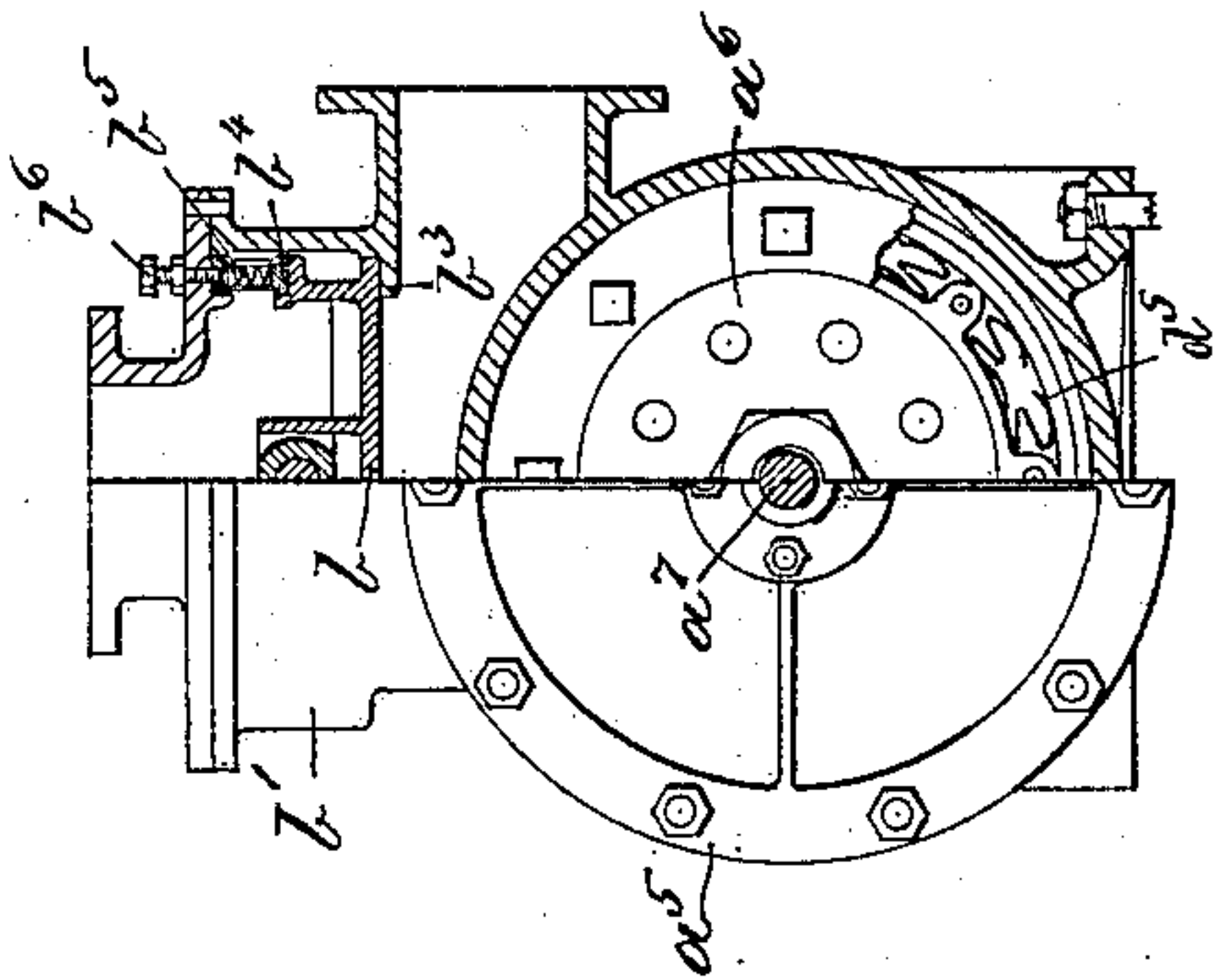


Fig. 4.

Inventor.

Richard Lavery,  
by Lewis & Gregory Attys.



# UNITED STATES PATENT OFFICE.

RICHARD LAVERY, OF BOSTON, MASSACHUSETTS.

## PUMP.

SPECIFICATION forming part of Letters Patent No. 428,682, dated May 27, 1890.

Application filed December 10, 1888. Serial No. 293,072. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD LAVERY, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in  
5 Pumps, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to pumps of that  
10 class employing a slide-valve, and has for its object to improve the construction of the same, whereby a smoother, steadier-running, and more durable pump is obtained, and one especially adapted to be used as a dry-gas or  
15 air pump.

My improved pump, among other things, is especially designed for exhausting sulphurous-acid gas in the manufacture of sulphites and bisulphites.

20 My invention in pumps therefore consists, essentially, of the steam-cylinder, its piston and piston-rod, the pump-cylinder substantially in line with the steam-cylinder, the pump-cylinder piston and its piston-rod, the  
25 sliding cross-head between said cylinders, to which the said piston-rods are connected to operate the said piston simultaneously in opposite directions, a main shaft connected to said cross-head to be operated by it, and slide-  
30 valves to control the movement of the said pistons, combined with a sliding cross-head between the said slide-valves, and to which the stems of the said valves are directly connected, and eccentrics on the main shaft to  
35 which the ends of the valve-stem cross-head are connected, whereby vibratory motion of the valve-stem is obviated.

Other features of my invention will be pointed out in the claim at the end of this  
40 specification.

Figure 1 is a side elevation of a pump embodying my invention; Fig. 2, a top or plan view of the pump shown in Fig. 1; Fig. 3, a longitudinal section of the pump shown in  
45 Fig. 2 on line  $x x$ ; Fig. 4, a partial end elevation and transverse section of the pump cylinder and valve, the section being supposed to be taken on line  $x' x'$ , Fig. 3, and the piston being supposed to be at the opposite end  
50 of its cylinder from that shown in Fig. 3; Fig. 5, a sectional detail to more clearly show

the cross-head, the section being taken on line  $y y$ , Fig. 3; and Fig. 6, a sectional detail of the relief-valve for the cylinder.

The steam-engine of the pump, comprising 55 the cylinder A, piston A', having its piston-rod A<sup>2</sup> connected to the cross-head A<sup>3</sup>, and provided with steam and exhaust ports controlled by the valve A<sup>4</sup>, may be of any usual or well-known construction. 60

The cross-head A<sup>3</sup> is mounted to slide upon guides  $a$ , supported upon a suitable bed  $a'$ , the said cross-head being joined, as herein shown, on opposite sides of the pump by  
65 connecting-rods  $a^2$  to crank-pins  $a^3$  on fly-wheels  $a^4$ .

The bed  $a'$ , of iron or other suitable material of sufficient strength to sustain the working parts of the apparatus, supports the pump-cylinder  $a^5$ , having its piston  $a^6$  connected by  
70 the piston-rod  $a^7$  to the cross-head A<sup>3</sup>, as shown in Fig. 3.

The cylinder  $a^5$  is provided, as herein shown, with inlet-ports  $a^8 a^9$ , leading to opposite ends of the said cylinder, and a central exhaust-  
75 port  $a^{10}$ .

The ports of the pump-cylinder  $a^5$  are controlled, as herein shown, by a slide-valve  $b$  of the type known as a B-valve, the said valve being located in a valve-chest  $b'$ , mounted  
80 upon the said cylinder and provided with an inlet port or mouth  $b^2$ .

The valve  $b$  is adapted to reciprocate between side flanges  $b^3$  on the valve-chest and  
85 gibs  $b^4$ , only one of which is shown, (see Fig. 4,) the said gibs being normally pressed down upon the said valve, as herein shown, by spiral springs  $b^5$ , the tension of which may be adjusted by set-screws  $b^6$ , whereby wear  
90 upon the valve and its seat is automatically taken up.

The valve  $b$  has its valve-rod  $b^7$  extended through the valve-chest and, as herein shown, through a suitable stuffing-box  $b^8$ , the said  
95 stem being connected at its outer end to the upright arm of a cross-head  $b^9$ .

The cross-head  $b^9$  is mounted to slide upon guides  $b^{10}$ , secured in a suitable manner to the cylinder-heads, and is supported above the cross-head A<sup>3</sup>, so that the cross-head A<sup>3</sup> can  
100 reciprocate between the guides  $a$  and  $b^{10}$ . (See Fig. 4.)



The cross-head  $b^9$  has secured to it the valve-stem  $c$  of the steam-valve  $A^4$ , and has its opposite ends joined directly by eccentric-rods  $c'$  and straps to eccentrics  $c^2$  on the main shaft  $c^3$  of the engine.

The piston-rod  $a^7$  of the pump-piston is herein shown as reduced in diameter and extended through the front head of the pump-cylinder and secured near its end, as by set-screw  $d$ , to a second cross-head adapted to slide in guides  $d^2$  of a block  $d^3$ , supported by the bed.

The piston  $a^6$  is provided at its periphery with a junk-ring  $d^x$ , T-shaped in cross-section, with its larger diameter equal to the bore of the cylinder, the annular spaces between the cylinder and junk-ring being filled with packing-rings  $d^4$ , which are normally pressed gas and air tight against the inner circumference of the cylinder by springs  $d^5$ , located in pockets in the piston and pressing against the junk-ring, as shown in Fig. 4. By means of the cross-head  $b^9$ , provided with the upright arm, the valve-rods  $b^7 c$  are made straight, and a more rigid connection is obtained than can be obtained by valve-stems made with an offset.

In operation it will be noticed that the steam-valve  $A^4$  and the pump-valve  $b$  are moved in the same direction and at the same time by the cross-head  $b^9$ , the latter being moved in a direct path by the eccentric-rods  $c'$ . By connecting the opposite ends of the cross-head  $b^9$  to eccentrics on the main shaft all twisting effect upon the cross-head and unequal wear of the valve  $b$  upon its seat are obviated, so that the said valve is worn uniformly and maintained gas and air tight, the wear upon the said valve and its seat being compensated for by the adjusting-springs  $b^5$ , acting on the gibbs  $b^4$ , the said springs being adapted to be compressed when worn by the set-screws  $b^6$ . By supporting the piston-rod of the pump-piston at its opposite ends outside of the cylinder in sliding cross-heads all downward wear upon the said piston and the walls of its cylinder and the piston-rod and its packing is prevented, thereby prolonging the life of the pump and maintaining the said piston gas and air tight.

The piston and cylinder and valve of the pump and the other bearings exposed to the action of the gas are preferably made of phosphor-bronze.

My improved pump is designed to be used for exhausting sulphurous acid in the formation of sulphites and bisulphites; and in order that any moisture conveyed by the said gas

into the pump-cylinder and therein deposited may escape from the said cylinder I have provided, as shown in Fig. 3, a relief-valve  $e$ , located in a shell  $e'$ , (see Fig. 6,) the said valve being normally pressed against its seat by a spring  $e^2$ , encircling a post  $e^3$ , secured to a cross-bar or web  $e^4$  of the said shell.

The shell  $e'$ , as herein shown, is provided with screw-threads  $e^6$ , by which the said shell is adapted to be secured to the bottom of the pump-cylinder, there being one such valve-shell at each end of the said cylinder.

In order that the pressure of the steam and gas or air may be downward upon the valves  $A^4 b$ , one is made as a B-valve and the other a D-valve, which are interchangeable—that is, the steam-valve may be a B-valve and the gas or air valve a D-valve; but instead of the arrangement shown I may employ any other form of slide-valve, mechanical means being employed to balance the same.

I have herein described my improved pump as especially adapted for exhausting gases and air; but it is evident the pump may be used to compress the same and also for pumping liquids.

When used for pumping liquids, the pump-cylinder will be provided with additional and larger relief-valves  $f$ , of any desired or usual construction, the said valves being preferably applied to the sides of the cylinder, as shown in Fig. 1.

I claim—

The steam-cylinder, its piston and piston-rod, the pump-cylinder substantially in line with the steam-cylinder, the pump-cylinder piston and its piston-rod, the sliding cross-head between said cylinders, to which the said piston-rods are connected to operate the said piston simultaneously in opposite directions, a main shaft connected to said cross-head to be operated by it, and slide-valves to control the movement of the said pistons, combined with a sliding cross-head between the said slide-valves and to which the stems of the said valves are directly connected, and eccentrics on the main shaft, to which the ends of the valve-stem cross-head are connected, whereby vibratory motion of the valve-stem is obviated, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHARD LAVERY.

Witnesses:

JAS. H. CHURCHILL,  
F. L. EMERY.