

No. 639,282.

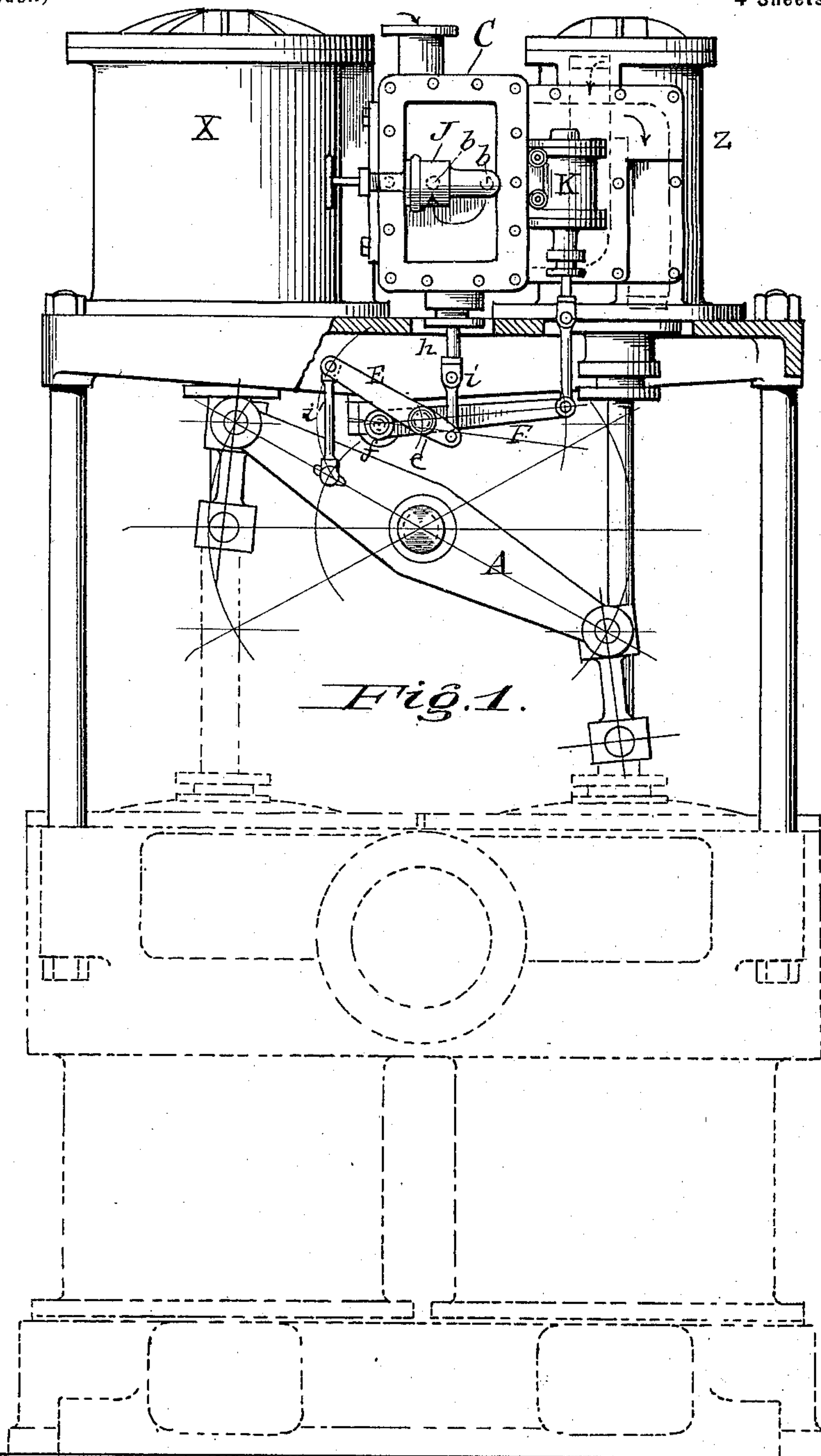
Patented Dec. 19, 1899.

H. L. PERRINE.  
DUPLEX PUMPING ENGINE.

(Application filed Apr. 19, 1899.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:

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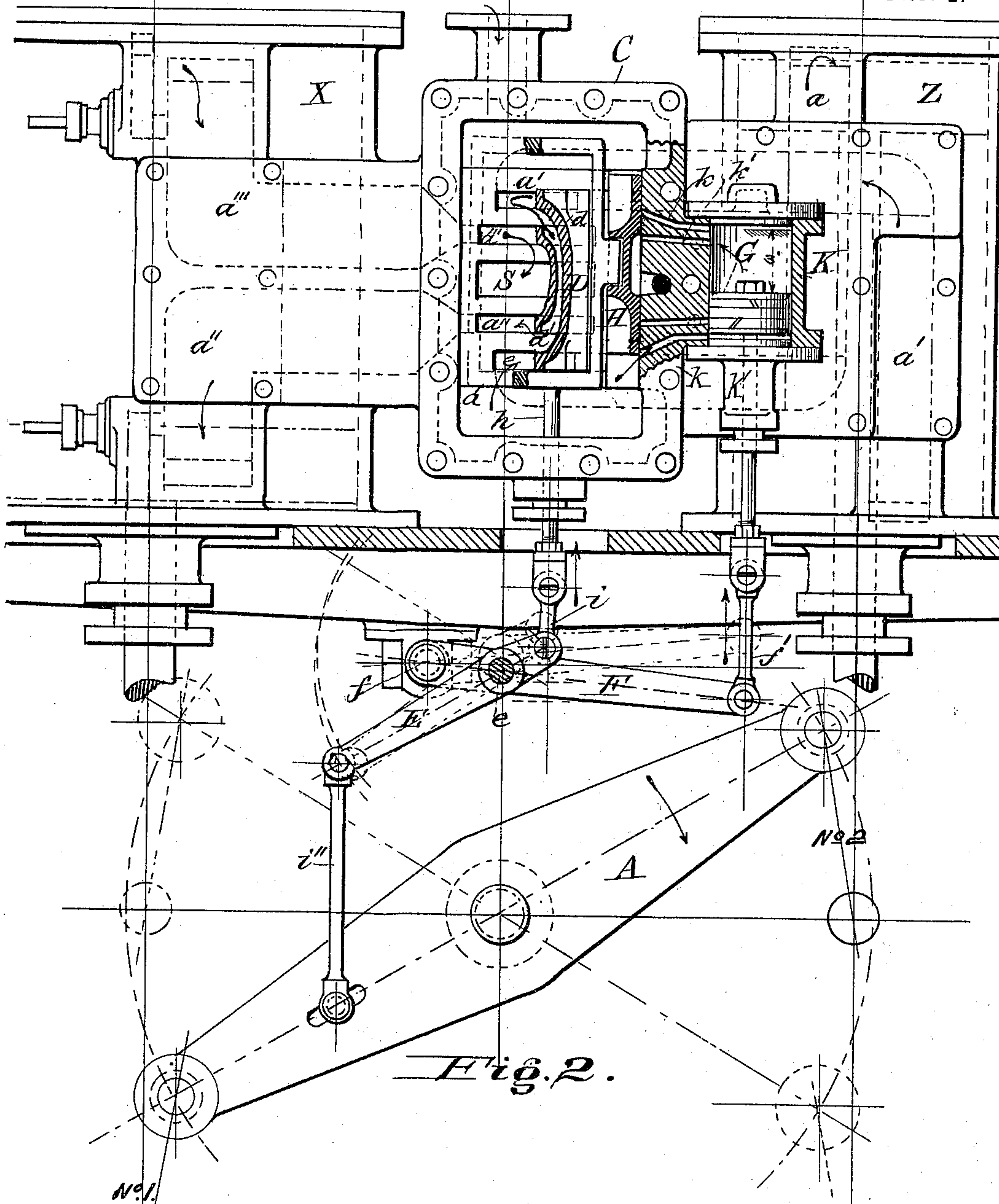


Fig. 2.

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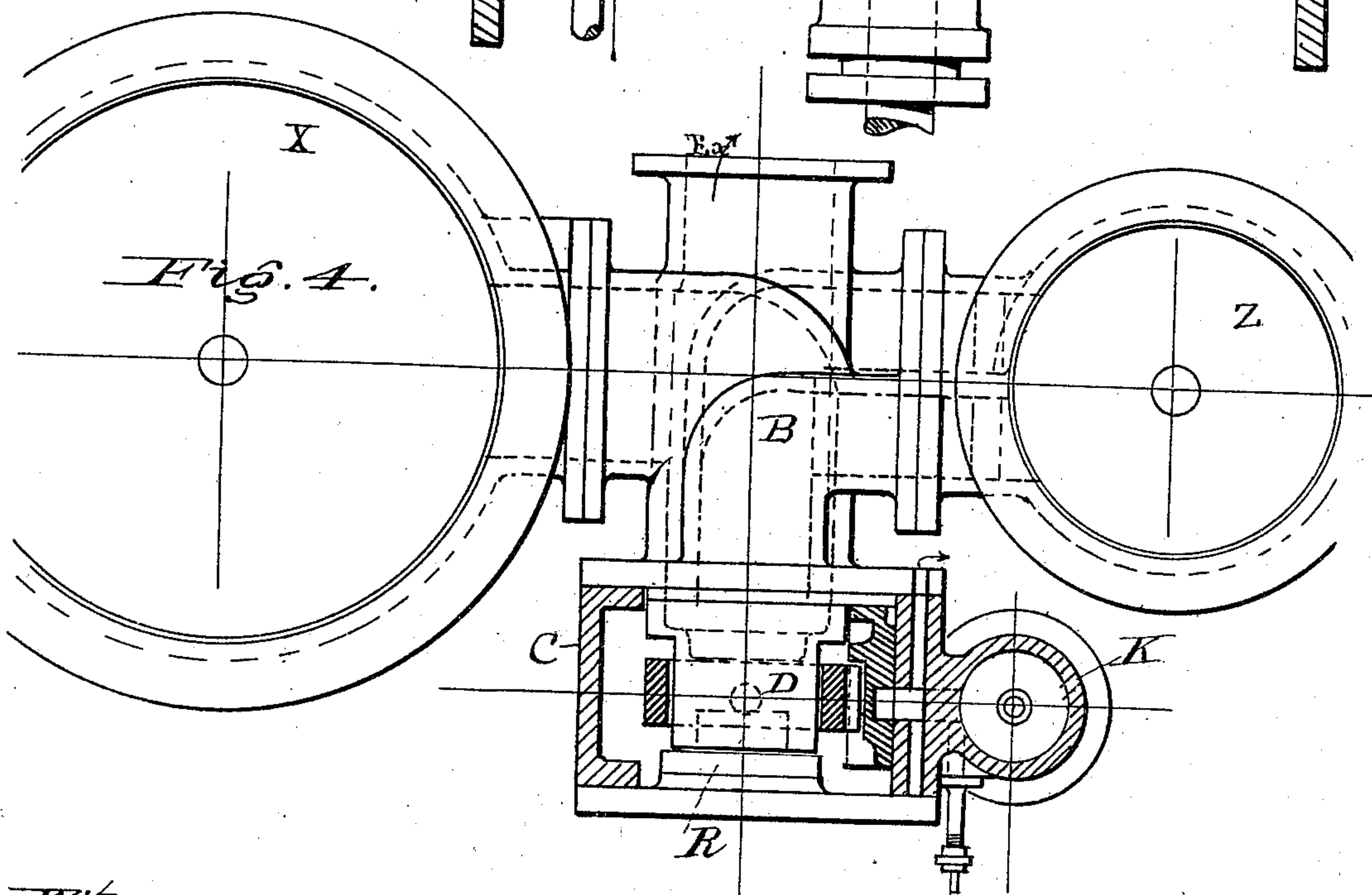
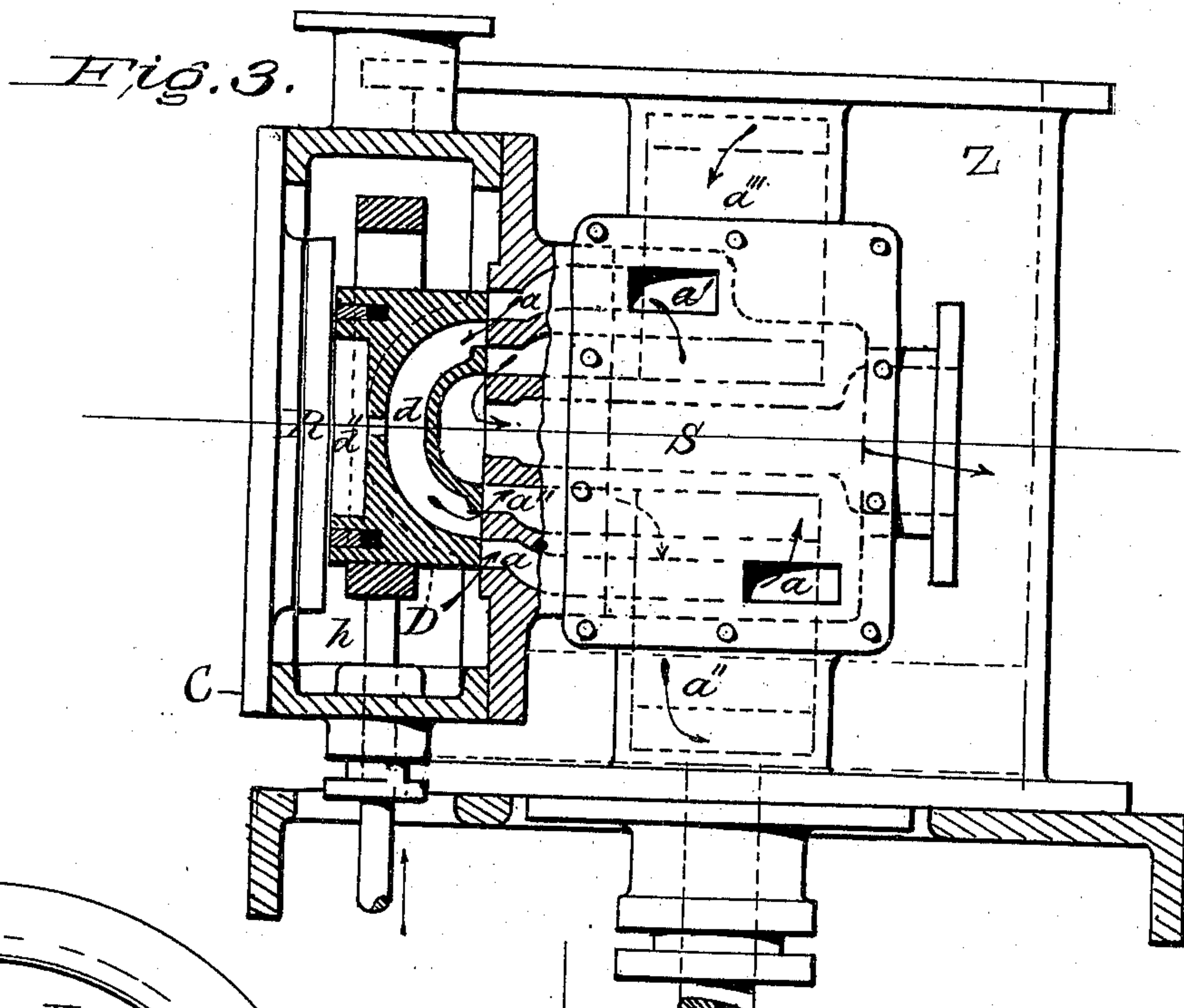
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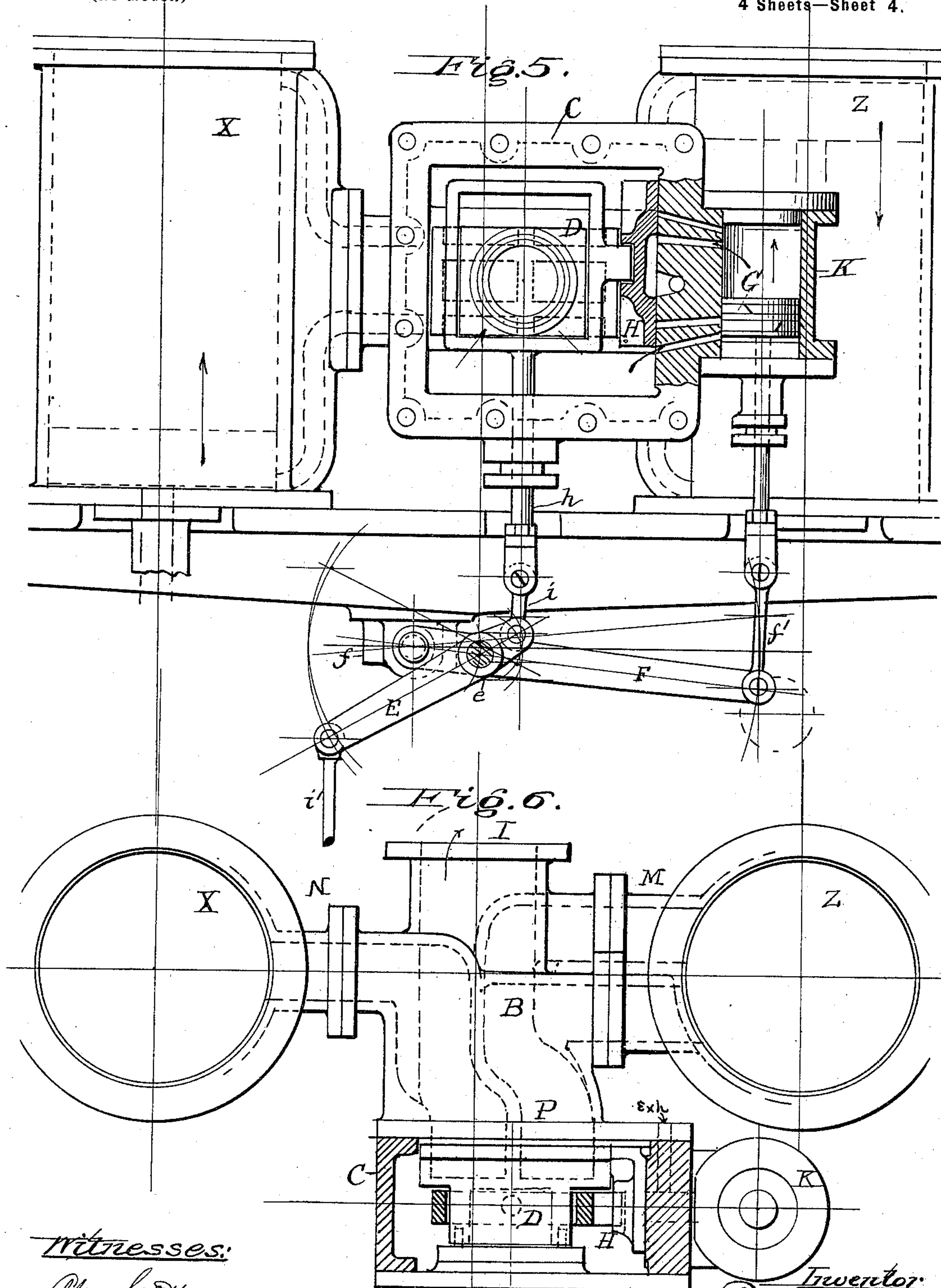
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4 Sheets—Sheet 4.





# UNITED STATES PATENT OFFICE.

HARMANUS LANSING PERRINE, OF MILWAUKEE, WISCONSIN.

## DUPLEX PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 639,282, dated December 19, 1899.

Application filed April 19, 1899. Serial No. 713,663. (No model.)

*To all whom it may concern:*

Be it known that I, HARMANUS LANSING PERRINE, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Duplex Pumping-Engines, of which the following is a specification, which, in connection with the accompanying drawings, will enable those skilled in the art to make and use the same.

Referring to the drawings, Figure 1 shows in side elevation a direct-acting vertical twin air-pump in which the valve mechanism is operated and controlled from the working beam in accordance with my improvement. Fig. 2 shows in enlarged elevation the valve-gear, the steam-chest cover being removed, the main and the auxiliary slide-valves, and the cylinder of the reversing-piston in section, the reversing-piston in position ready to reverse the stroke of the steam-pistons. Fig. 3 is a horizontal section, taken through the main steam-chest, showing the slide-valve moving up in position to effect the reversing of the steam-pistons. Fig. 4 shows in top view the ported casting, which connects the steam-cylinders, and, in section, the steam-chest, the main and auxiliary valves, and the cylinder of the reversing-piston. Fig. 5 is a view like that shown in Fig. 2, but in which the valve-gear is arranged with a double plain slide-valve for controlling two high-pressure cylinders; and Fig. 6 is a view similar to that shown in Fig. 4, showing the steam-chest in section and connecting the ported casting.

The invention herein is directed to improvements in the class of twin vertical air-pumps wherein two high or a high and a low pressure steam-cylinder is employed with a working beam; and my said improvements consist of certain parts and combinations of parts in which the working beam, the valve-gear, and one slide-valve cooperate for controlling two steam-pistons of a duplex steam end in a way and by means which I shall particularly point out and designate in the claims concluding this specification.

Referring to the drawings, the steam end and valve-gear are shown as applied to air-pumps, which may be of any well-known construction and are indicated in dotted outline in Fig. 1; but my new combination may be

applied to a plunger or piston water-pump or air-compressor.

A port-casting of novel construction connects the two steam-cylinders and forms a face for the steam-chest, the valve-seat, and ports in connection with the slide-valve, while the valve-gear in its connections with the slide-valve and the reversing-piston also constitute a feature of my improvement.

In Figs. 1, 2, 3, and 4 I have shown the vertical twin steam-cylinders as connected by the ported casting, and in the construction shown I use the well-known "Allen" slide-valve for admitting and exhausting steam to and from the compound cylinders. In Fig. 2 it is better seen how the ports cross to the high-pressure cylinder X, which may be called the "twelve-inch diameter," and the low-pressure cylinder Z, which may be called "twenty-inch diameter," being about three ratios to one, so that the steam used in the high-pressure cylinder at sixty pounds pressure at, say, twenty pounds. In this figure the position of the piston in the low-pressure cylinder is at the bottom of its stroke, and the piston of the high-pressure cylinder is at the top thereof, both pistons being connected to and actuated by the beam A, which is suitably mounted in the frame. These cylinders are connected by a ported casting B, so that a center line drawn through said casting will intersect the centers lengthwise of the vertical cylinders, Figs. 4 and 6, while the steam-chest is mounted upon one side of the ported casting. This construction gives a convenient arrangement of the cross position of the ports that is necessary for admitting or exhausting steam to one or the other of the cylinders, which is shown on the high-pressure cylinder in Fig. 2. It also gives a convenient arrangement of the steam-chest and its valves and the valve-gear for controlling said ports. The ported casting for this purpose has port-faces at three of its sides, two of which join the port sides of the cylinders and one the port side of the steam-chest for operating the pistons, as I will more particularly presently state. The fourth side opens to the exhaust at I, Figs. 4 and 6. Between the steam-chest and the working beam is mounted a horizontal fulcrum-pin e, and



to said pin an auxiliary beam or lever E is secured, which by a link  $i''$  at its long end connects with the beam A, and a link  $i$  at its short end connects with the rod  $h$  of the slide-valve D, and the fulcrum-pin  $e$  for this purpose is at one side of the vertical rod  $h$  of said valve. The yoke of this valve connects with and actuates the auxiliary valve H, which controls the ports of the auxiliary reversing-piston G, that actuates and controls the lever F, so as to carry the main slide-valve over the ports. This lever F is mounted in a fixed bearing  $f$  and carries the pin  $e$ , which forms the fulcrum of the lever E, so that these levers move in common with the fulcrum-pin. The cylinder K of the auxiliary reversing-piston is cast integral with the steam-chest of the slide-valve and on the side of the high-pressure cylinder Z, and its piston connects by a link  $f'$  with the long arm of the lever F. This arrangement of levers and their valve connections locates the fulcrum  $e$  of the lever E at a point between the fixed bearing  $f$  of the lever E and the vertical rod  $h$  of the slide-valve; and it is this pivotal location and connection of the valve-gear in its relation to the valves and the steam-cylinders which constitutes a feature of my improvement.

Referring to Fig. 2, No. 1 illustrates the piston movement of the low-pressure cylinder, and No. 2 the relative piston movement of the high-pressure cylinder, and in the positions of these pistons and their controlling-valves steam is being admitted to port  $a$  at the high-pressure piston at the same time the exhaust from under the piston is exhausting through port  $a'$  into the valve-port  $a''$  to the under side of the low-pressure piston for the upstroke, while in the meantime the exhaust passes out of port  $a'''$  into the main exhaust S. This action is reversed by the beam and the auxiliary piston G, the admission-ports  $k$   $k$  and the exhaust-ports  $k'$   $k'$  being seen with the auxiliary piston in position just ready to reverse the stroke of the steam-pistons and carry the main valve across the ports to wide open.

In Fig. 3 the slide-valve D is shown to line and line, from which position it is caused to move across the ports by the action of the auxiliary piston.

The lost motion between the yoke-lugs of the valve-rod  $h$  is twice the width of the ports—say three-fourths-inch port equals one and one-half inches lost motion—and the auxiliary piston G must have sufficient travel to move the valve-rod  $h$ , so that it will move the main slide-valve over the ports.

The location of the ported casting having the construction described with respect to the twin cylinders is an important feature of my improvement, because it gives a very advantageous arrangement for the auxiliary piston and for the steam-chest of the main slide-valves by reason of making all the movable joint connections of the valve-gear much more direct, compact, and shorter, and as a result

thereby reducing the extent of condensing-surface in the ports and causing the steam to have better effect on the piston.

In my new combination the employment of a single main slide-valve for both steam-cylinders greatly enhances the compactness of the twin structure and conduces to the better working of the steam-pistons.

As seen in Fig. 2, the ported casting is faced on its front side to form the valve-seat and is also faced on two other sides to form corresponding joint-port facing with the steam-cylinders, and it is this construction that forms the three ported sides. This casting is bolted to the front side of the cylinders as in Figs. 1 and 2 for the purpose of illustrating the crossing of the ports which is necessary in one or the other of the cylinders in order that the pistons may be driven in opposite directions. The construction shown in Figs. 3 and 4 will be used in practice. On the valve-face of this casting the steam-chest is bolted, while on the long end of this chest and forming part of the same casting is the valve-reversing cylinder, and on one side of this casting is formed the valve-face of the reversing-cylinder. On this valve-face is carried the valve which controls the reversing-piston and has a continuous movement by direct mechanical connections with the beam.

In Figs. 5 and 6 the ordinary D-valve is seen in connection with the double-ported casting, where two high-pressure cylinders are used, so that one slide-valve covers the four ports of the two cylinders and a single slide-valve operates two high-pressure cylinders.

I claim as my improvement—

1. In a duplex pumping-engine and in combination with separate steam-cylinders and their pistons, a casting between and joining said cylinders with ported faces, and having an intermediate third ported face, the ports whereof communicate with said cylinders, a steam-chest on said third ported face a main slide-valve controlling said intermediate ported face, a reversing-piston on said chest, an auxiliary slide-valve actuated by the said main-slide-valve rod and yoke, a working beam connected to the main slide-valve and with the reversing-piston for operating the same, whereby both main and auxiliary slide-valves are caused to have direct and coincident movement with the main piston and the chest-piston.

2. In a duplex pumping-engine and in combination with the steam-cylinders and their pistons, a casting between the cylinders having three ported faces, two of which join the cylinders, a steam-chest on the third ported face, a double-ported main slide-valve on said chest-face, a ported cylinder on the long end of said chest, an auxiliary valve at said long chest end actuated by the main-slide-valve rod and yoke, a reversing-piston for said cylinder, the working beam and means for connecting it with the rod of the main and aux-



iliary slide-valves, and the reversing-piston for effecting their direct and coincident movements.

3. In a duplex pumping-engine and in combination with the steam-cylinders and their pistons, a casting between the cylinders joining them with ported faces and having an intermediate main valve-seat, a steam-chest covering said main valve-seat, and having a side seat on its long end forming part of said chest, a double-ported main slide-valve for the intermediate seat, and an auxiliary single-ported slide-valve for said side seat actuated by said main-slide-valve rod and yoke, an auxiliary cylinder for said side ported seat, a reversing-piston at the ported side seat, and means connecting the slide-valves and the reversing-piston consisting of the working beam, the lever E directly connecting the beam and the double-ported slide-valve, and the lever F having the fulcrum for the lever E and connecting the reversing-piston, substantially as described.

4. In a duplex pumping-engine and in combination with the steam-cylinders and their

pistons, a casting between and joining the cylinders with communicating ported faces on a line intersecting the centers of said cylinders, and having an intermediate double-ported seat, a steam-chest covering said seat and having a side seat at its long end, a double-ported slide-valve for the intermediate seat and a single-ported slide-valve for the side seat actuated by said main-slide-valve rod and yoke, a ported cylinder on the long end of said chest, a reversing-piston, a working beam, and a pair of levers standing in opposite directions, one directly connecting the beam and the double-ported slide-valve, the other connecting the piston of the reversing-cylinder, both levers pivoted together for actuating the main and auxiliary slide-valves and the reversing-piston with coincident movements.

In testimony whereof I hereunto sign this specification.

HARMANUS LANSING PERRINE.

Witnesses:

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ALONZO G. COLLINS.