

No. 654,918.

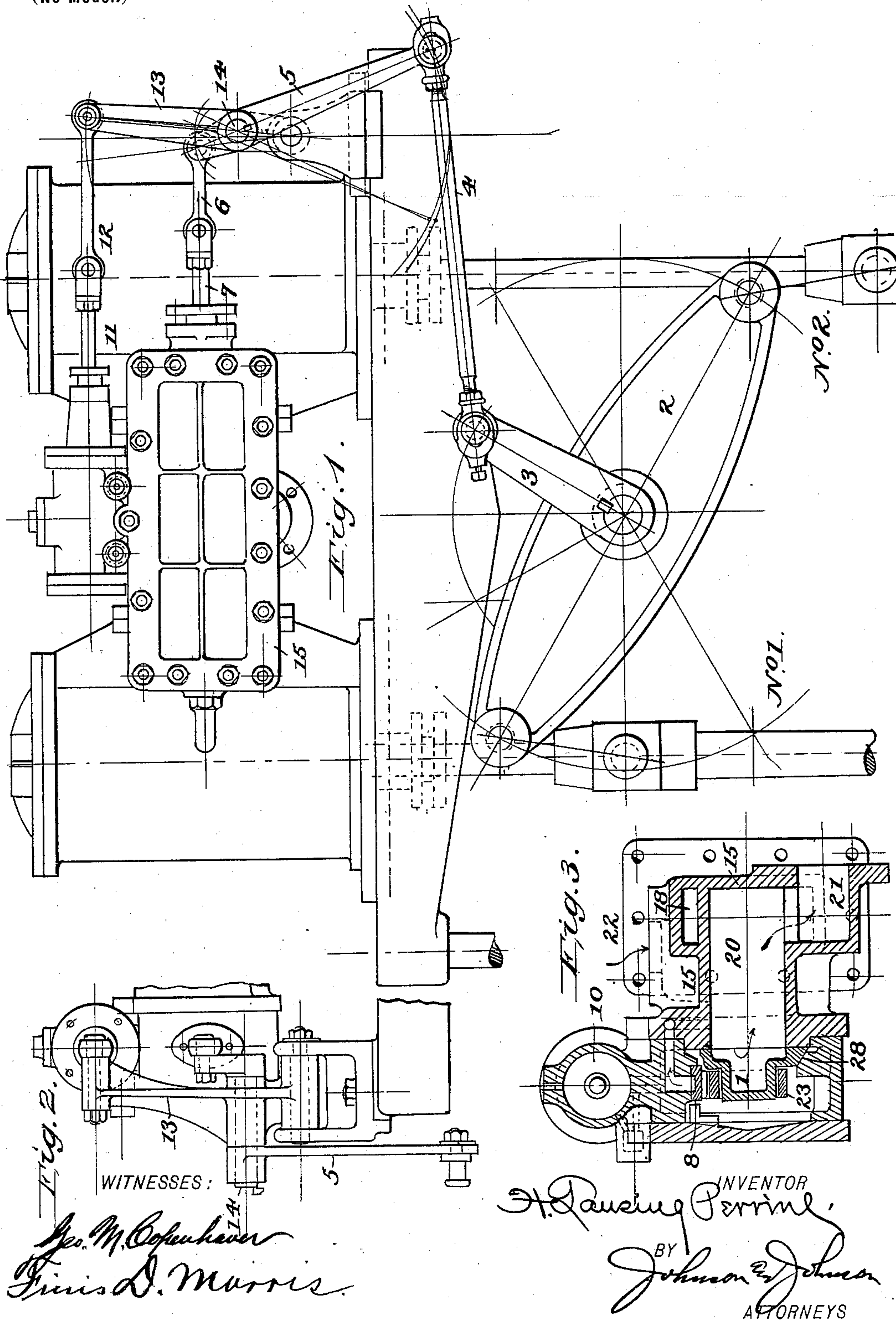
Patented July 31, 1900.

H. L. PERRINE.
DUPLEX STEAM PUMP.

(Application filed Nov. 16, 1899.)

(No Model.)

3 Sheets—Sheet 1.



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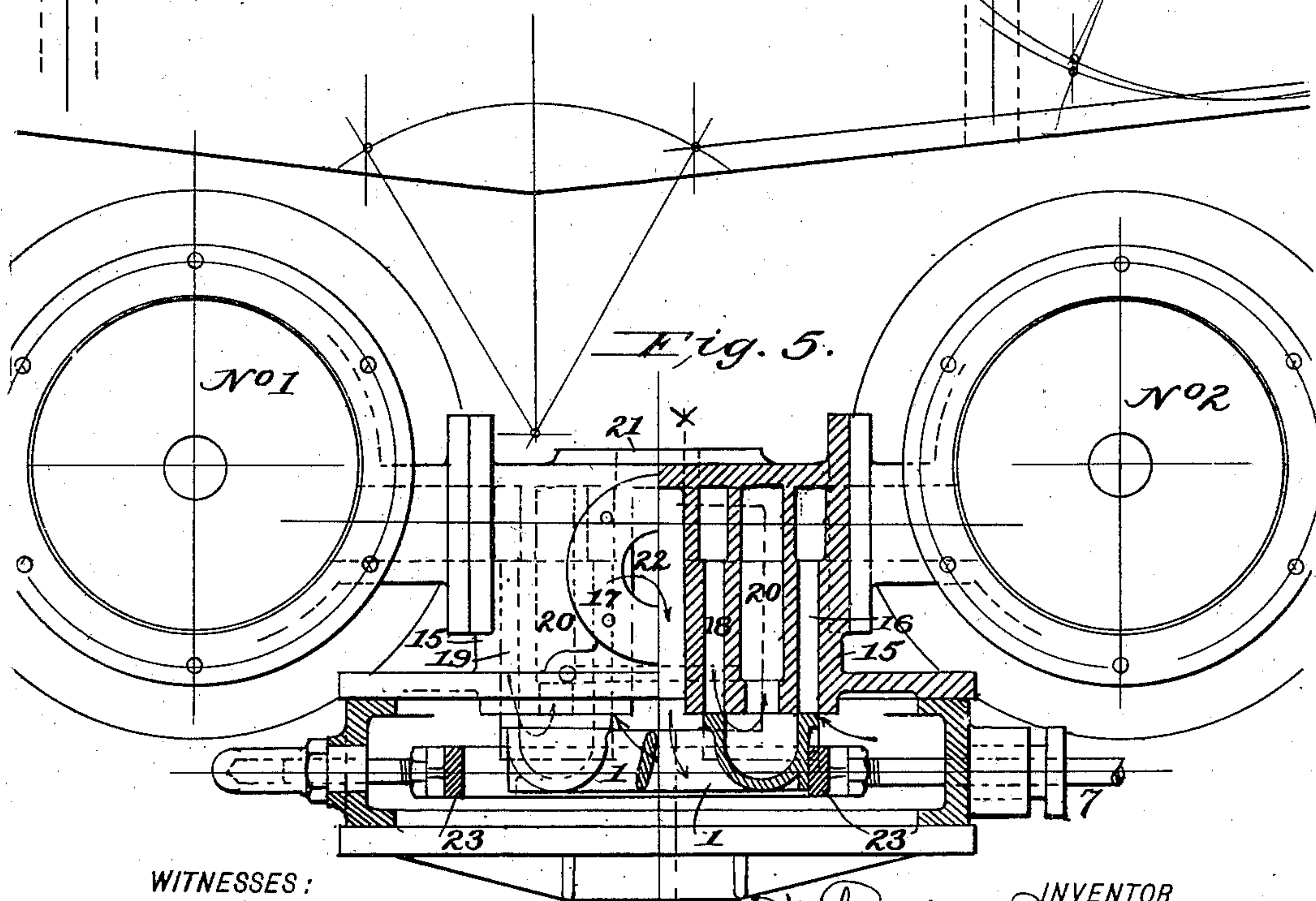
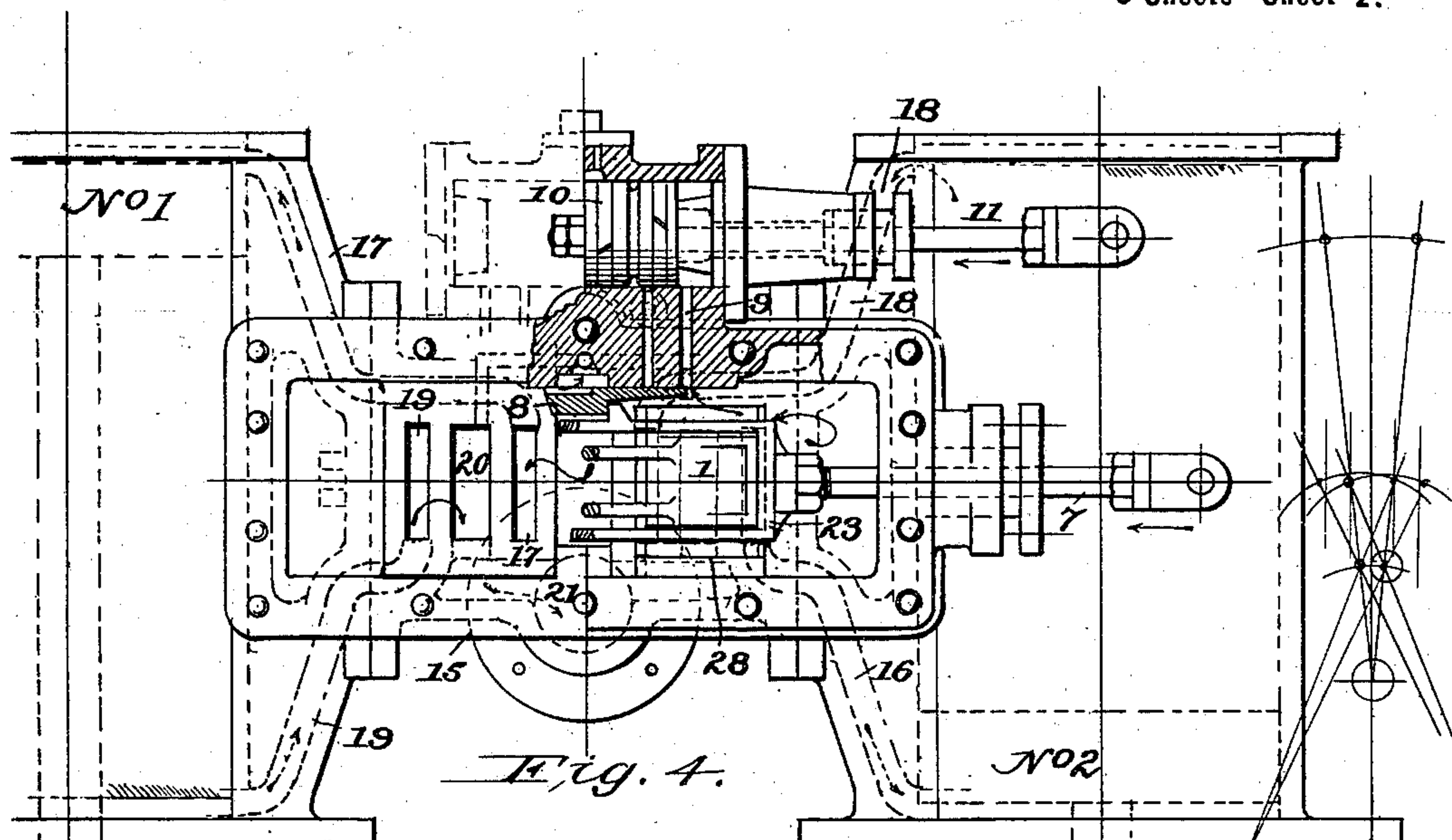
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3 Sheets—Sheet 2.



WITNESSES:

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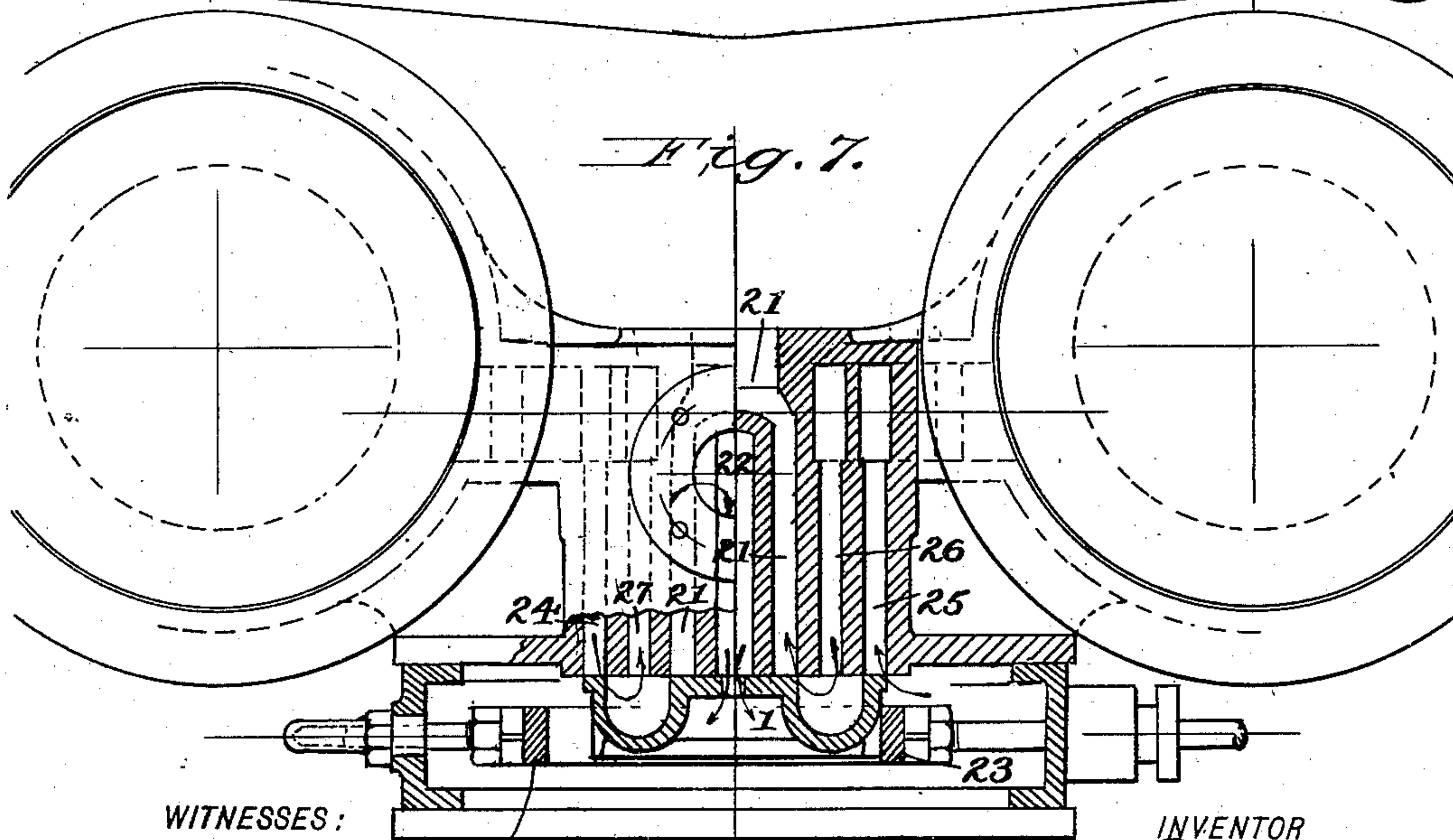
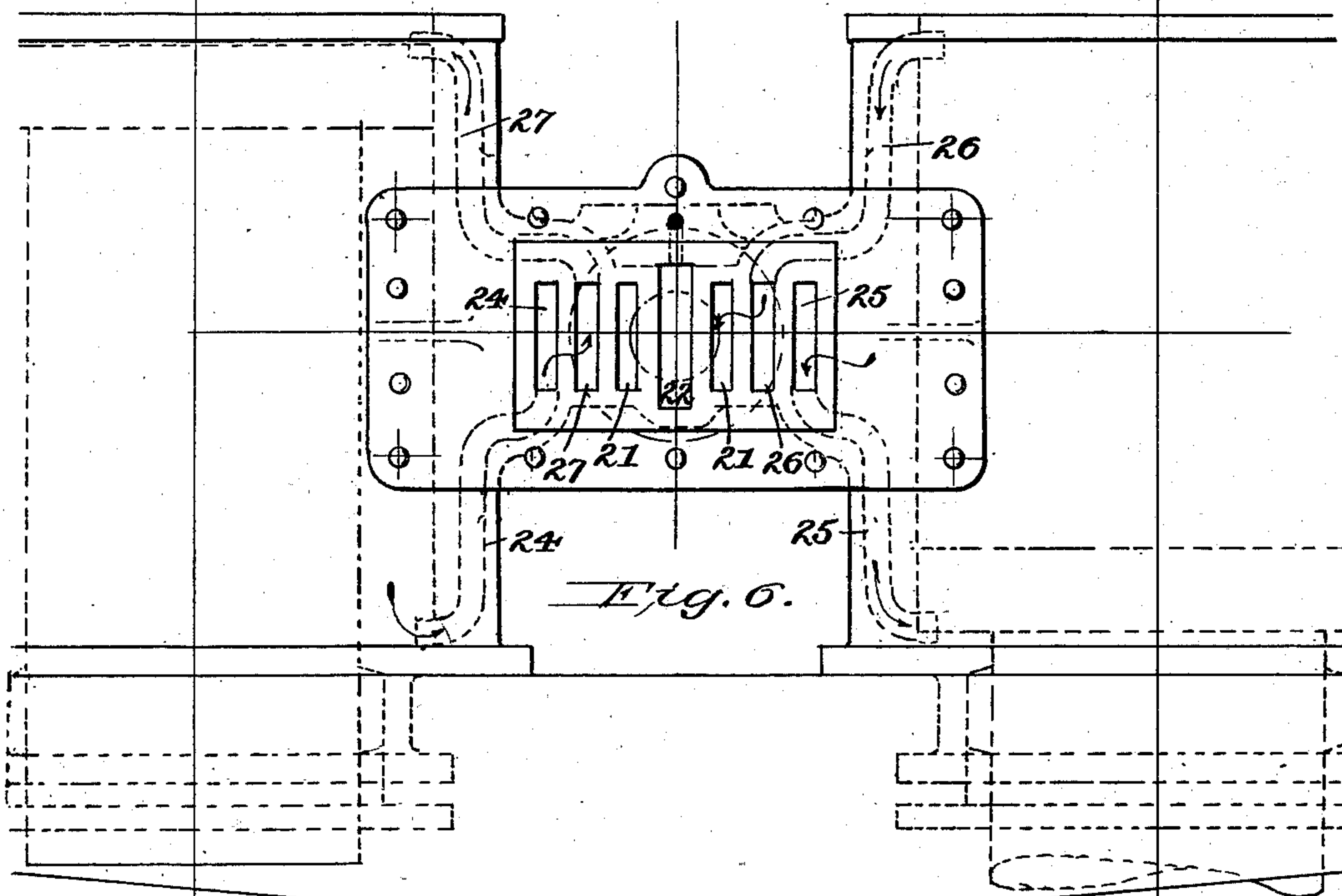
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

HARMANUS LANSING PERRINE, OF MILWAUKEE, WISCONSIN.

DUPLEX STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 654,918, dated July 31, 1900.

Application filed November 16, 1899. Serial No. 737,214. (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 Vertical Steam Ends for Twin Air and Water Pumps, of which the following is a specification.

10 The invention herein relates to improvements in vertical duplex steam ends, wherein two high-pressure or simple steam-cylinders of equal diameter and stroke are employed with a working beam; and my said improvements consist of certain combinations of parts in which the working beam, valve-gear, and slide-valves coöperate for controlling two steam-pistons of a duplex steam end in a way and by a novel combination when applied to drive a pair of vertical pumps; more particularly vertical air-pumps, in connection with a condensing apparatus, either of the surface or jet type.

25 The object of my new combination is to work two high-pressure steam-cylinders with a single valve comprising two D-valves in one rigidly connected and in line and in such manner that the two pistons are caused to travel in opposite directions, crossing in the center of the stroke, the uniform movement of each being maintained through the working beam.

30 In the drawings which embody my improvement, Figure 1 shows in front elevation a pair of simple steam-cylinders, valve-gear, and work-beam, as may be applied to a vertical twin pump in which the valve mechanism is operated and controlled from the work-beam in accordance with my improvement. Fig. 2 shows an end view of the compound levers forming a part of the valve-gear. Fig. 3 is a vertical cross-section of the port-casting, taken on the line *xx* of Fig. 5, showing the steam-chest, the auxiliary cylinder, slide-valve, comprising two D-valves in one rigidly connected in line, and exhaust-port for No. 2 cylinder. Fig. 4 is an enlarged elevation of the steam-cylinders, the chest-cover being removed to expose the valve-seat, and the ports seen in dotted lines for cylinder No. 1, while the double D slide and auxiliary valves and yoke, together with the

reversing-piston and its cylinder, are seen partially in section and partially in elevation. Fig. 5 is a plan view of Fig. 4 with the port-casting partially in horizontal section, showing the steam and exhaust ports for cylinder No. 2 and in dotted lines for cylinder No. 1. Fig. 6 is a front elevation of a pair of cylinders fitted with differential or trunk pistons, the steam-chest removed to expose in the valve-seat the steam and exhaust ports for each cylinder, together with the steam-supply port, and in which the cylinders and ports are in one casting; and Fig. 7 is a plan view of Fig. 6, showing the steam and exhaust ports of No. 2 cylinder in section and the position of the double D slide-valve at the point of reversal of the stroke.

As shown, the two steam-cylinders are faced and bolted to a three-faced casting or distance-piece 15 in order to accommodate steam-cylinders of different sizes, Figs. 3, 4, and 5. On the third face is located the steam-chest and reversing-cylinder, with the main double D slide and auxiliary valves. These valves and the reversing-piston have a horizontal movement at right angles to the travel of the main pistons through the connections and compound levers shown in Figs. 1, 2, and 3. I employ a double D slide-valve, both valve parts rigidly connected in line and covering two common three-ported valve-seats, so that each steam-cylinder has its own steam-ports, the exhaust from each merging into one common opening to the atmosphere or condenser. The main double D slide-valve 1 in these figures is seen as having been moved to line and line by direct connection from the beam 2 through the crank-arm 3, the link 4, the lever 5, and the valve-rod 7, and link 6, as seen in Fig. 1. The inverted auxiliary slide-valve 8, having a slight lead, has uncovered the port 9, Fig. 4, admitting live steam behind the chest or reversing-piston, which is driven to the left, pulling through the rods 11 12 the lever 13, which carries the rock-shaft 14, the lever 5, link 6, and the valve-rod 7, which engages the double D slide-valve and moves it across the steam-port 16, admitting steam under the main piston No. 2 for the upstroke, and port 17 for the downstroke of the main piston No. 1, exhausting to atmosphere or condenser through ports

18 and 19, and out into the exhaust-passages 20 20 into a common exhaust 21. Live steam is admitted at 22, Fig. 5. Thus the action is reversed at the end of each stroke, as it will be seen that a continuous and coincident movement with the main pistons is effected through the levers, whereby the auxiliary valve 8, carried on the valve-yoke 23, has a constant travel, controlling the reversing-piston, while the main double D slide-valve has an intermittent movement twice the width of the ports and is brought to line and line by direct action of the main pistons and is carried across the ports half of its maximum travel by the reversing-piston through the lever 13, which carries the lever 5 and rock-shaft 14.

In Figs. 6 and 7 I have shown the application of the double D slide-valve as applied to a pair of differential or trunk pistons, live steam being used only for the upstroke of each piston and expanded from under to upper side of each piston alternately. In this arrangement the steam-ports for each cylinder are side by side, Fig. 7, with a central or common exhaust 21. No. 1 piston having made its upstroke, port 24 is closed and port 25 about to uncover, admitting live steam to under side of piston No. 2, while the upper side of No. 2 is exhausting through port 26 to condenser and the steam under piston No. 1 is expanding to upper side through port 27. This action is reversed by the gearing above described. (See Fig. 7.)

In Fig. 3 I have shown a section through the steam-chest, double D slide-valve, and the exhaust-passages 20 and 21 in the port-casting, and in this figure is seen that the main slide D valve has a beveled bearing 28 on the bottom side of the chest, so as to insure its seating against the vertical seat or face of the port-casting.

By placing the steam-chest with the reversing-piston and the double D slide-valve in a horizontal position I am enabled to control the separate admission and exhaust from two cylinders by practically one valve and at the same time insure its seating and provide a bearing for its support (instead of a balancing-plate, as when the valve is placed vertical) and am enabled to provide a support on the platform or entablature for the compound lever valve-gear at a point where it is least liable to damage or disarrangement, rendering the parts easily accessible and adjustable and in full view of the attendant.

I have described and shown the port-casting as a third element or part when fitted to and uniting two steam-cylinders side by side, which will be the form of construction when different-sized cylinders are used with one size of valve-gear and chest. It may be desirable, however, in making standard patterns with fixed centers to mold the two steam-cylinders and their ports and valve-seat all in one casting, as shown in Figs. 6 and 7.

It will be noticed that the ported casting while connecting the two steam-cylinders forms a face for the steam-chest, a beveled seat for the double D-valve inclining so as to cause the valve to maintain its joint and to support the valve in vertical position, and that the movement of said valve upon its seat is at right angles to the movements of the pistons. It will also be seen that the cylinders are connected to the ported casting, so that a center line drawn through said casting will intersect the centers lengthwise of the vertical cylinders.

The arrangement of the compound gear gives the advantage of supporting it upon a single bracket fixed on the end of the frame, and this bracket forms the pivot-bearing for the lever, which stands upward, while medially of the cylinders and below the frame-entablature is mounted the working beam, which is connected to the lower end of the hanging lever, which is fulcrumed on the upward-standing lever above its bracket-pivot, while above said fulcrum the lever by its short end connects with the double D slide-valve rod.

I claim—

1. In a duplex pumping-engine and in combination with two simple or high-pressure steam-cylinders and their pistons having equal diameter and stroke, each cylinder having its own three-ported seat, a ported-casting between and joining said cylinders with ported faces in communication therewith, a steam-chest on the third ported face, a reversing-piston in said chest, a slide-valve comprising two D-valves in one rigidly connected in line and a cavity in each valve part for each three-ported seat and having a movement at right angles with the travel of the pistons, the auxiliary slide-valve and mechanism connecting the double D-valve, the auxiliary slide-valve and the reversing-piston for operation as described.

2. In a duplex pumping-engine and in combination with two steam-cylinders and their pistons having equal diameter and stroke, each cylinder having its own three-ported valve-seat, a casting between and joining said cylinders with ported faces in communication therewith, of a slide-valve comprising two D-valves in one rigidly connected in line and having a cavity in each valve part for each three-ported seat and having a movement at right angles with the travel of the pistons, the auxiliary slide-valve the reversing-piston and the compound levers connecting the double D-valve and the reversing-piston for operation in the way described.

3. In a duplex pumping-engine and in combination with two steam-cylinders and their pistons, each cylinder having its own three-ported seat, a casting between and joining said cylinders with ported faces in communication therewith, of a slide-valve comprising two D-valves in one rigidly connected in line

and a cavity in each valve part for each three-ported seat standing vertical supported upon an inward-beveled seat and having a movement at right angles with the travel of the
5 pistons, the auxiliary slide-valve, the reversing-piston and the compound levers connecting the double D-valve and the reversing-piston.

4. In a duplex pumping-engine the combination of two vertical trunk or differential
10 steam-cylinders and their pistons a working beam connecting said pistons a ported casting between and in communication with said cylinder three-ported valve-seats thereon one
15 for each cylinder, a double D slide-valve each valve part rigidly connected in line and covering both three-ported valve-seats having a separate cavity for each valve-seat, a steam-chest and the auxiliary slide-valve, with a re-
20 versing-piston and mechanism connecting said reversing-piston, the double D slide-

valve and the auxiliary slide-valve for operation in the way described.

5. In a duplex pumping-engine and in combination with two differential steam-cylinders, a ported casting between, joining and
25 in communication therewith, a three-ported valve-seat for each cylinder on said casting, a slide-valve comprising two D-valves in one rigidly connected and in line and covering
30 both of said three-ported valve-seats, a steam-chest and the auxiliary slide-valve, a reversing-piston and mechanism connecting said reversing-piston, the double D-valve and the
35 auxiliary slide-valve for operation as described.

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

HARMANUS LANSING PERRINE.

Witnesses:

A. E. H. JOHNSON,

A. ROLAND JOHNSON.