

(No Model.)

A. P. MASSEY.  
STEAM AIR PUMP.

No. 428,120.

Patented May 20, 1890.

FIG. 1.

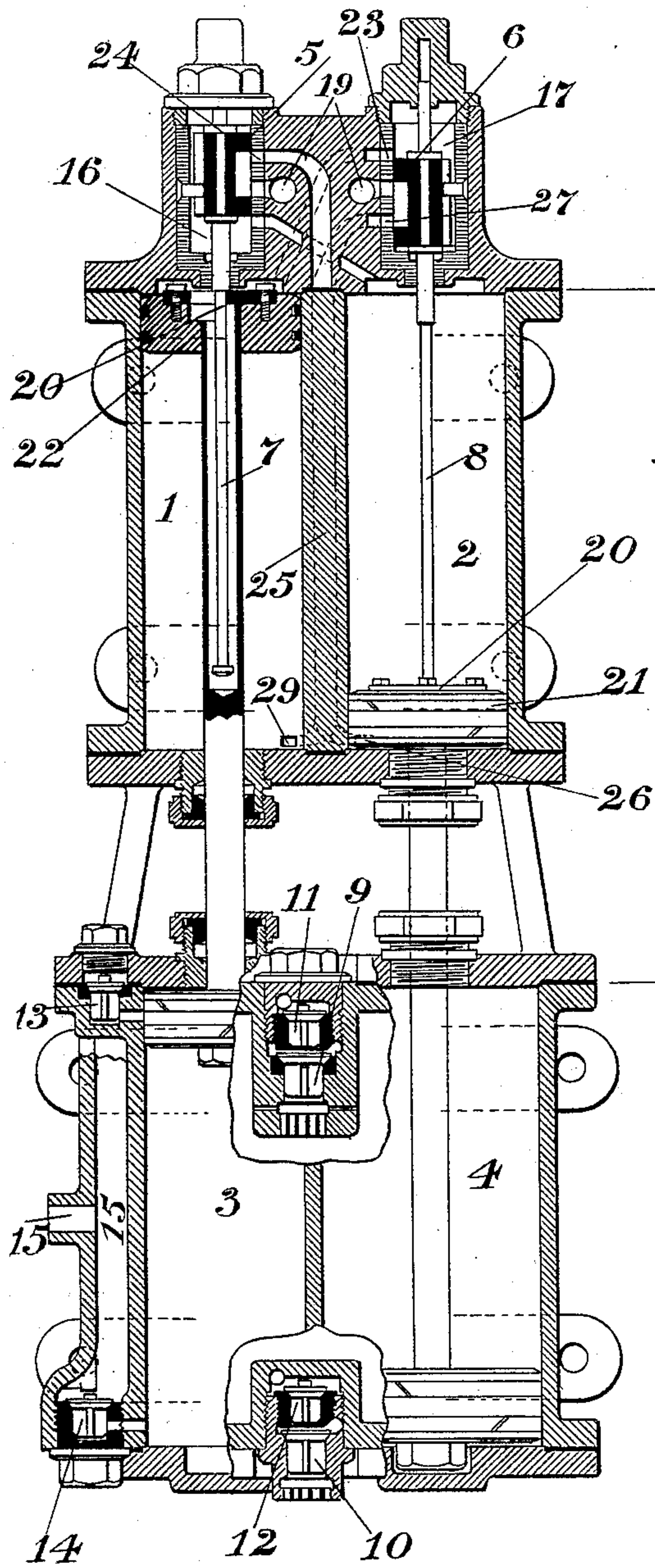


FIG. 2.

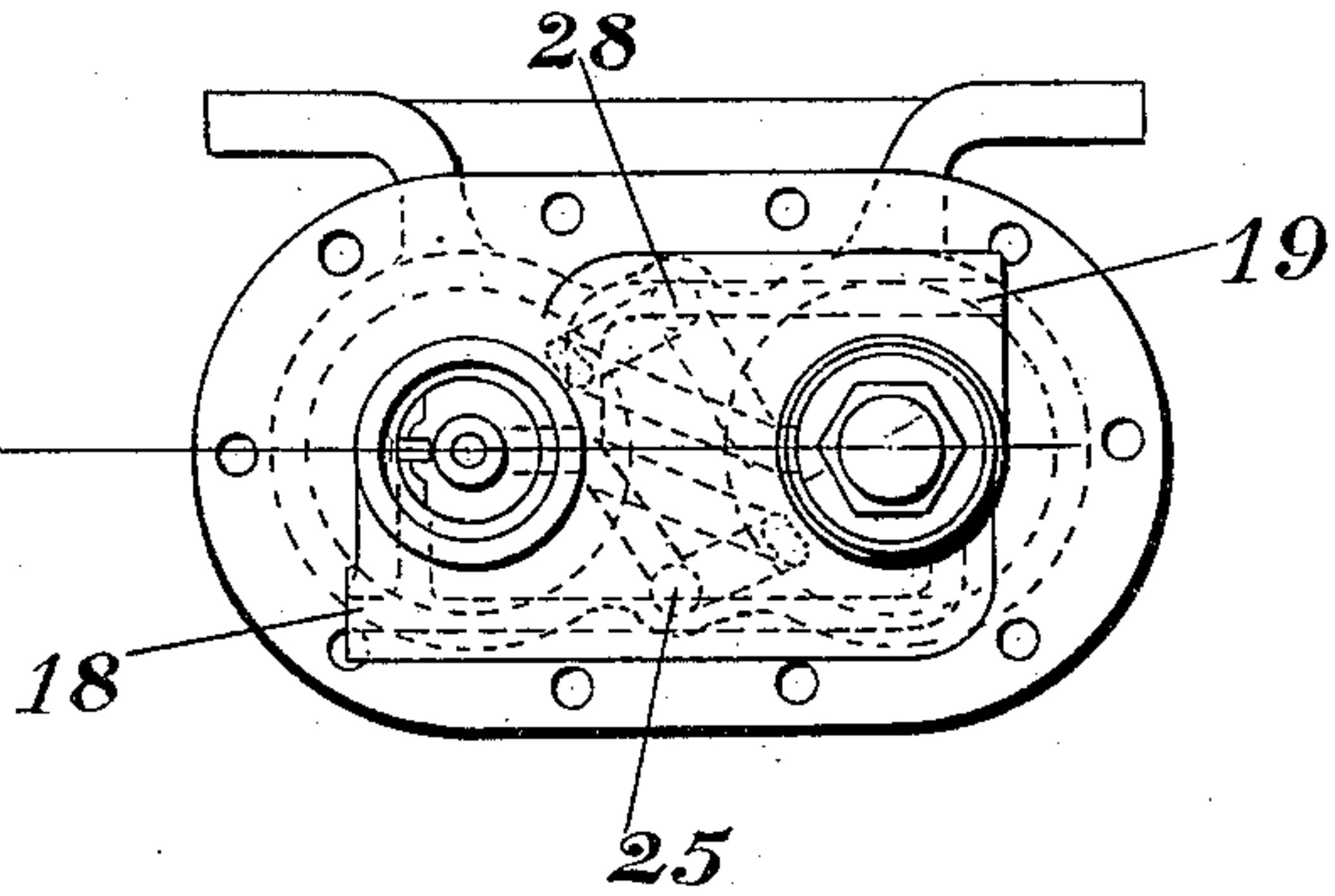
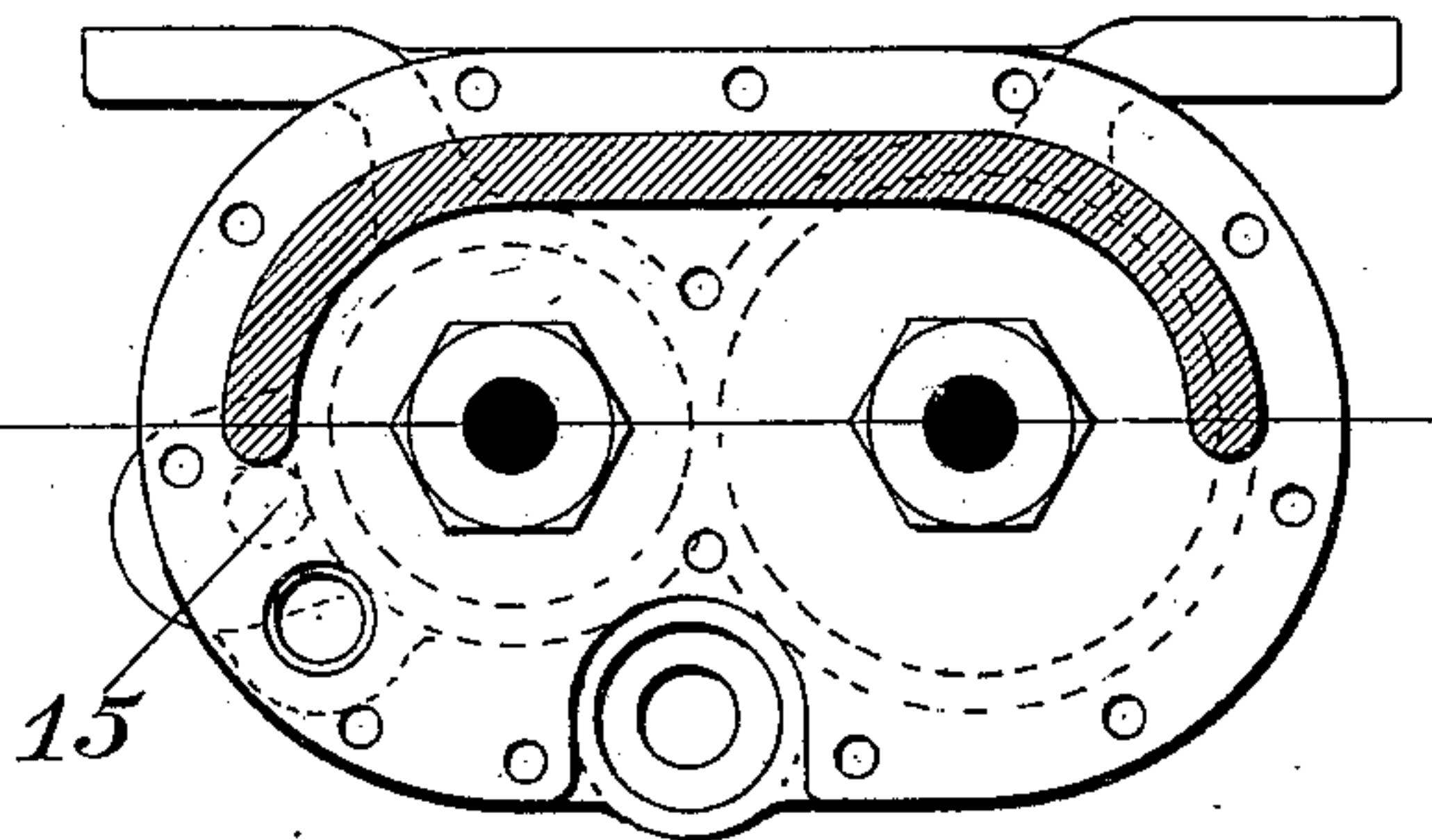


FIG. 3.



WITNESSES

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INVENTOR

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# UNITED STATES PATENT OFFICE.

ALBERT P. MASSEY, OF WATERTOWN, NEW YORK.

## STEAM AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 428,120, dated May 20, 1890.

Application filed February 14, 1890. Serial No. 340,406. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT P. MASSEY, a citizen of the United States, residing in the city of Watertown, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Steam Air-Pumps, of which the following, taken in connection with the accompanying drawings, is a specification.

10 The object of my invention is to produce a duplex steam air-pump that will work with greater economy of steam than those at present in use. I compress the contents of two air-cylinders of unequal size into the smaller  
15 cylinder by means of one steam-piston, and then compress the contents of the smaller cylinder still further by means of another steam-piston.

Figure 1 is a sectional view of the complete  
20 apparatus. Fig. 2 is a view of the upper head of the steam-cylinders. Fig. 3 is a view of the upper head of the air-cylinders.

The steam-valves are actuated by what is known as the "duplex system."

25 In the drawings, 1 and 2 are steam-cylinders.

3 and 4 are air-cylinders.

5 and 6 are valves for controlling the action of the steam-pistons.

30 7 and 8 are valve-stems.

9 and 10 are valves admitting air alternately to the larger air-cylinder.

11 and 12 are valves between the two air-cylinders.

35 13 and 14 are valves between the smaller air-cylinder and the reservoir connected to pump at 15.

40 Steam is admitted to the steam-chests 16 and 17 through port 18, and is exhausted through port 19.

The valve-stems 7 and 8 are actuated by the plates 20, which are secured to the pistons and come in contact with the tappets on the valve-stem in a manner described in Patent No. 115,668, issued to George Westinghouse, June 6, 1871.

45 The cycle of operations is as follows: In the position shown the air-piston in cylinder 4 has completed its downward stroke and compressed its contents through valve 12 into  
50 cylinder 3. The plate 20 on steam-piston 21 has moved valve 6 to its lowest position. This

admits steam through port 23 to upper side of piston 22, and will cause the piston to descend and expel the partially-compressed air 55 in cylinder 3 through valve 14 and passage 15 into the reservoir. Meanwhile the cylinder 4 has become filled above the piston with air at atmospheric pressure through valve 9, and the cylinder 3 will be filled with air at 60 atmospheric pressure through valves 9 and 11, both of which open inward and are seated by gravity. When piston 22 reaches the end of its downward stroke, the plate 20 strikes the tappet on valve-stem 7 and moves valve 65 5 to its lowest position, thus uncovering port 24 and admitting steam through port 24 25 26 to the lower side of piston 21, thus causing piston 21 to rise and compress the air which is in cylinder 4 through valve 11 into upper 70 part of cylinder 3. Just as piston 21 completes its stroke its plate 20 strikes the tappet on valve-stem 8 and moves valve 6 to its highest position, uncovering port 27 and admitting steam through 27 28 29 to the lower 75 side of piston 22, causing the piston to rise and expel the partially-compressed air in cylinder 3 through valve 13 into passage 15, and thence into the reservoir. While the pistons were compressing the air above them into the 80 reservoir, the air-cylinder below the pistons would fill with air at atmospheric pressure through valves 10 and 12, ready for another cycle of operation.

In a single-cylinder air-pump the resistance 85 in the air-cylinder varies each stroke from naught to the extreme pressure in the reservoir—say one hundred pounds. The steam-piston must therefore have sufficient area to produce this final pressure and expel the air 90 into the reservoir. In other words, the steam-piston must be as large as the air-piston in ordinary locomotive practice, where the usual pressure in the boiler is from one hundred and twenty pounds upward.

95 In my invention the extreme resistance to the leading piston 21 is to compress the contents of the two air-cylinders into one. The area of the leading air-cylinder 4 can therefore be as much greater than the steam- 100 cylinder as the steam-pressure exceeds the final pressure in the air-cylinder with due allowance for friction, &c. In practice the area of cylinder 4 may be twice that of cyl-

inder 2. The other cylinders 1 and 3 are the same size as 2. It follows, therefore, that the final resistance in cylinder 4 would be the pressure resulting from compressing three  
5 volumes of air into one volume or thirty pounds above atmospheric pressure. A steam-cylinder of one-third the area would therefore be ample with steam at one hundred and twenty pounds; but the ratio of two to  
10 one serves for illustration. When the cylinder 3 is filled with air at thirty pounds pressure, the resistance each stroke will vary from thirty pounds to one hundred pounds, and a steam-piston of the same area will be required  
15 to expel the air into the reservoir. Thus it may be seen that two cylinders full or volumes of steam at boiler-pressure will deliver three volumes of air into the reservoir, whereas in a single-cylinder air-pump two volumes  
20 of steam at boiler-pressure would deliver but two volumes of air into the reservoir.

As I claim novel features in both the en-

gine and the pump, I have made a separate application for those pertaining to the pump, which was filed September 21, 1889, Serial No. 25 324,619.

What I claim as new, and desire to secure by Letters Patent, is—

In a duplex steam air-pump, the cylinders 1 and 2 and pistons 22 and 21, each connected 30 to a piston in an air-cylinder, in combination with valve-stems 7 and 8, tappets 20, and valves 5 and 6, with ports communicating with each end of the opposite cylinder, substantially as set forth. 35

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 10th day of February, A. D. 1890.

ALBERT P. MASSEY.

Witnesses:

HENRY W. BOYER,  
MICHAEL J. MORKIN.