

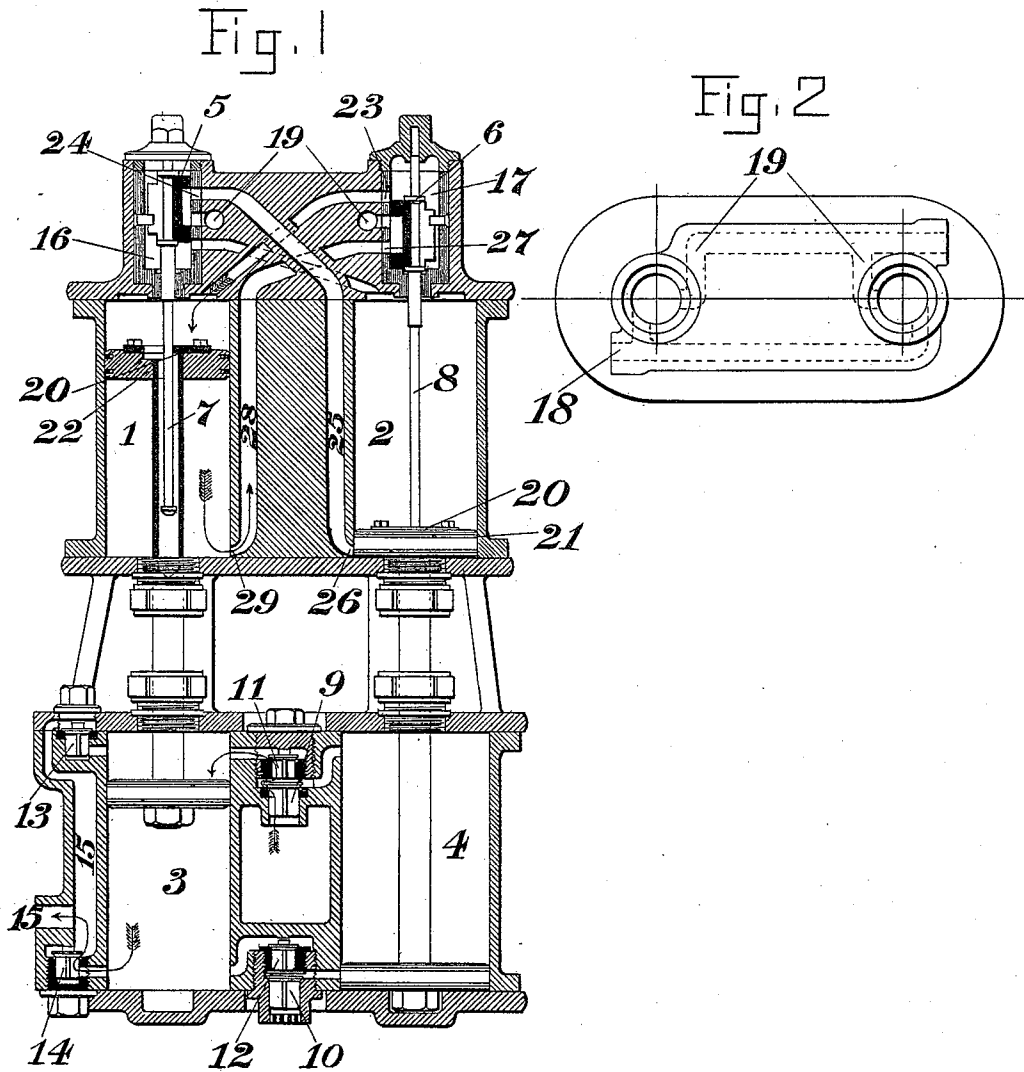
(No Model.)

2 Sheets—Sheet 1.

A. P. MASSEY.
AIR PUMP.

No. 434,089.

Patented Aug. 12, 1890.



WITNESSES
E. L. Forman
F. L. Massey

INVENTOR
Albert P. Massey

(No Model.)

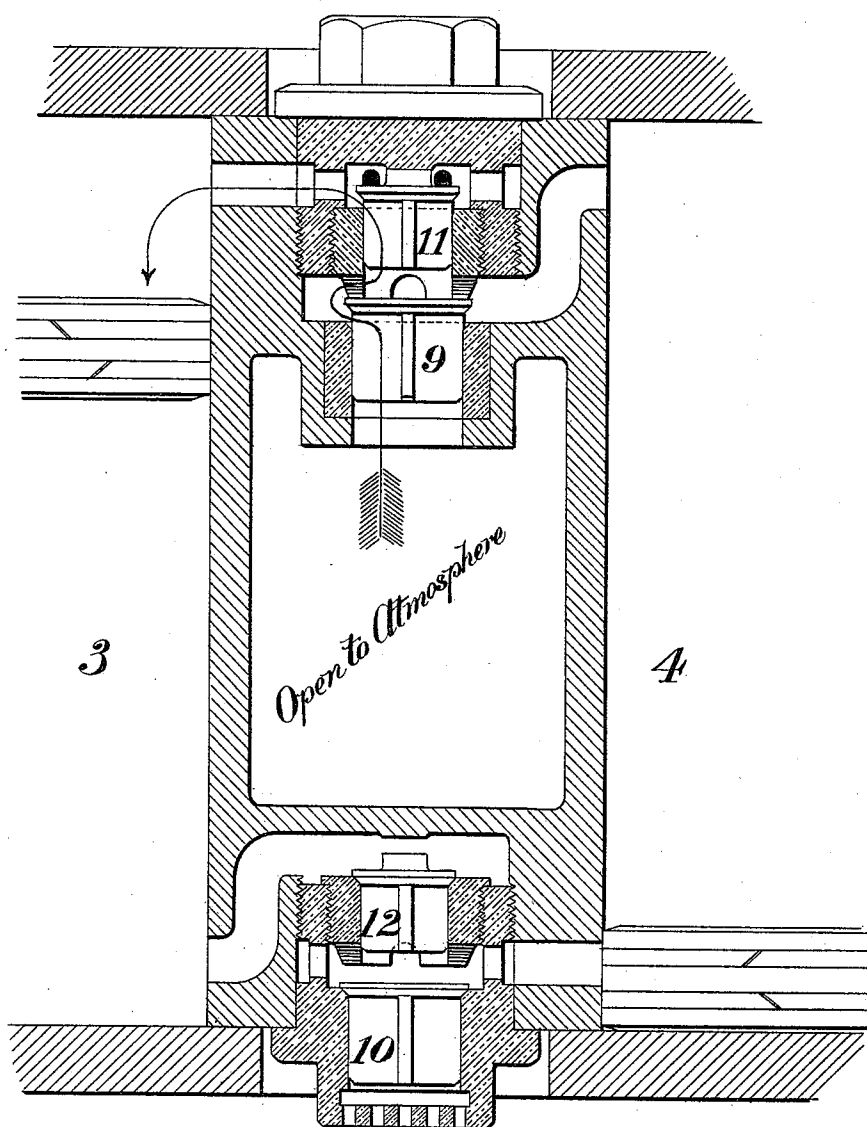
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Fig. 3



WITNESSES

the forman
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INVENTOR

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UNITED STATES PATENT OFFICE.

ALBERT P. MASSEY, OF WATERTOWN, NEW YORK, ASSIGNOR TO THE
EAMES VACUUM BRAKE COMPANY.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 434,089, dated August 12, 1890.

Application filed September 21, 1889. Serial No. 324,619. (No model.)

To all whom it may concern:

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

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

Figure 1 is a sectional view of the complete apparatus. Fig. 2 is a view of the upper head of the steam-cylinders. Fig. 3 is an enlarged detail section of the air-valves between the two air-cylinders.

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

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.

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. The bushings which form the valve-seats of valves 11 and 12 are serrated on their lower edge, so that the tops of valves 9 and 10 cannot impede the flow of air through the valves 11 or 12 when valves 9 and 10 are open.

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

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.

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 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 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 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 5 to its lowest position, thus uncovering port 24 and admitting steam through ports 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 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 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 are compressing the air above them into the reservoir the air-cylinders below the pistons will 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 in the air-cylinder varies each stroke from zero 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 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.

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-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 cylinder 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 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 one serves for illustration. When the cylinder 3 is filled with air at thirty-pounds' pressure, the resistance each stroke will vary is from thirty pounds to one hundred pounds, and a steam-piston of the same area will be required 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 of steam at boiler-pressure would deliver but two volumes of air into the reservoir.

As I claim novel features in both the engine and the pump, I have included the claims pertaining to the engine in an application enclosed with this, to which I refer.

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

1. A duplex air-pump consisting of two air-cylinders in which the stroke of one piston is practically completed before the other piston

starts, combined with valves arranged to admit air at atmospheric pressure to both cylinders and on the return-stroke to compress the air from the larger cylinder into the smaller cylinder before the smaller piston starts, and then expel the air from the smaller cylinder into the reservoir, substantially as set forth.

2. A duplex air-pump consisting of two steam-cylinders containing pistons connected with pistons in two air-cylinders, two steam-valves arranged in line with said pistons and actuated by them, a series of ports connecting each steam-valve with both ends of the opposite cylinder, so that the action of each piston controls the movements of the other, two air-cylinders with inlet-valves from the atmosphere to the larger cylinder, valves between the larger cylinder and the smaller cylinder, which will admit air to the smaller cylinder first from the atmosphere through the main inlet-valve chambers, and, secondly, from the larger cylinder to the smaller cylinder, and valves between the smaller cylinder and a passage leading to a reservoir, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 17th day of September, A. D. 1889.

ALBERT P. MASSEY.

Witnesses:

GEO. B. MASSEY,
MICHAEL J. MORKIN.