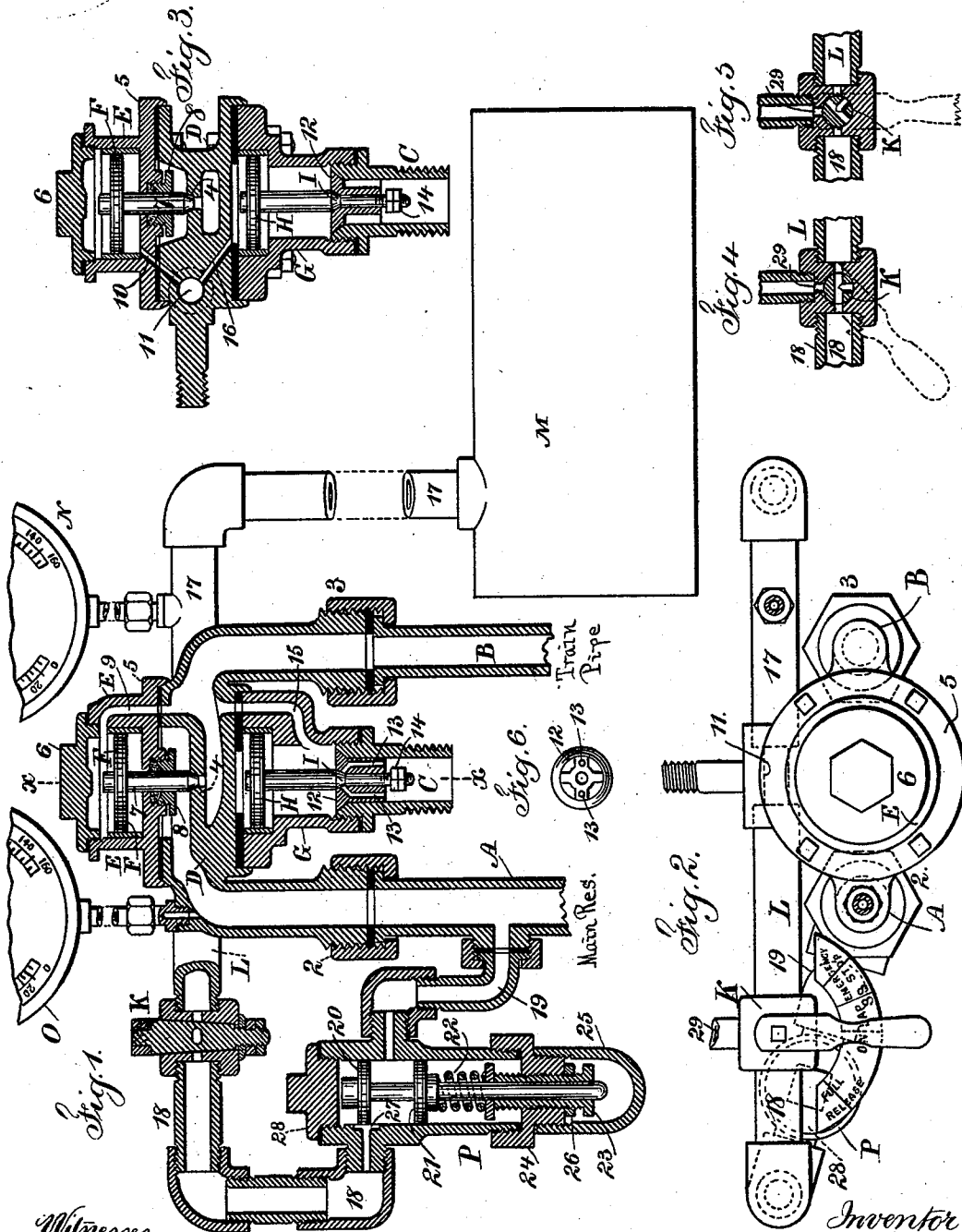


(No Model.)

J. F. VOORHEES.
VALVE FOR AIR BRAKES.

No. 521,996.

Patented June 26, 1894.



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JEREMIAH F. VOORHEES, OF PHILADELPHIA, PENNSYLVANIA.

VALVE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 521,996, dated June 26, 1894.

Application filed August 23, 1893. Serial No. 483,818. (No model.)

To all whom it may concern:

Be it known that I, JEREMIAH F. VOORHEES, a citizen of the United States, residing at West Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in Valves for Air-Brakes, of which the following is a specification.

In air brakes for railway trains it has been usual to provide on the engine a pump for compressing air into a main reservoir, and the engineer's valve is applied in a pipe that passes from the main reservoir to the train pipe, and by moving this valve the engineer admits air to pass from the main reservoir along the train pipe so as to store the air in the auxiliary reservoirs beneath the respective cars, and from these auxiliary reservoirs the air is allowed to act in the brake cylinder and apply the brakes when the pressure in the train pipe is lessened.

In some characters of air brake apparatus it is important to lessen the pressure of air in the train pipe to a predetermined pressure and to hold or maintain that pressure throughout the train apparatus, even though there may be leaks in the train pipe or the brake cylinders, and with the engineer's brake and equalizing discharge valve heretofore made use of, difficulty has been experienced in controlling the pressure of the air in the train pipe reliably.

The present invention is made with reference to admitting air under pressure into the train pipe when the pressure in the train pipe is less than the pressure desired, so as to maintain in such train pipe whatever pressure is necessary for operating upon the brake mechanism, or to relieve the pressure to any desired extent.

With this object in view I make use of a regulating valve applied at a valve seat between the main reservoir and the train pipe, and to this regulating valve a piston is connected within a cylinder and the pressure from the train pipe is admitted to one side of this piston and a pressure from a small storage reservoir is admitted to the other side of this piston, and the valve is moved either one way or the other according to which pressure predominates. The valve which the engineer manipulates admits air under pressure into

the small storage reservoir, and to this small storage reservoir a gage is applied, so that the engineer can, by inspection, ascertain the pressure in the small storage reservoir, and in consequence of the regulating valve aforesaid the pressure in the train pipe is made to correspond or nearly so to the pressure in the small storage reservoir; and I make use of an exhaust valve to which a piston is connected in a cylinder, and one side of the piston is open to the pressure in the train pipe and the other side of the piston is open to the pressure in the small storage reservoir, so that when the pressure in the train pipe exceeds the pressure in the small storage reservoir, the escape valve is opened to allow the air to pass out of the train pipe until the pressures are equalized, thus placing the air pressure in the train pipe entirely under the control of the engineer; and I employ an automatic regulating valve between the main reservoir and the engineer's valve so as to prevent the pressure employed in the brake mechanism from becoming too high under any circumstances.

In the drawings, Figure 1 is a vertical section of the improved valve mechanism. Fig. 2 is a plan of the same. Fig. 3 is a cross section at the line *x, x*. Figs. 4 and 5 are diagrammatic sections of the engineer's cock, and Fig. 6 is an inverted plan of the valve in the exhaust pipe.

The pipe A leads from the ordinary main reservoir upon the engine into which the air is pumped in the usual manner, and B is the connection to the train pipe that extends throughout the railway train for actuating the brakes as usual, and C is the exhaust pipe open to the atmosphere. The body of the valve is made of a casting D having a coupling connection 2 for the pipe A from the air reservoir and a coupling connection 3 for the train pipe, and in this valve body or case is a division forming a valve seat 4, and upon the case D a cylinder E with a flange 5 is firmly bolted, the parts being made air-tight by suitable packing material, and this cylinder E has a removable head 6, and within the cylinder E is a piston F with a stem 7 forming a valve that closes upon the seat 4, and the stem of this valve 7 passes through a packing gland 8, and there is a port 9 leading from

the train pipe B to the upper side of the piston F, and there is a port 10 leading from the pipe or passage 11 into the cylinder E at the under side of the piston. The cylinder G is properly bolted to the body or case D and is also connected to the exhaust pipe C, and in this cylinder G is a piston H with a valve I upon the piston rod, and this valve I is seated in a movable seat 12 which also forms a main air valve, and through this main air valve 12 are passage ways 13 which open at their upper ends through the conical seat of the valve I, and the stem of the valve I extends through the main air valve 12 and terminates with nuts 14 below the main air valve, so that when the piston H is moved downwardly, the valve I closes the passage ways 13; when such piston H and valve I are slightly lifted the valve I opens the passage ways 13, and when the piston H is lifted still farther the nuts 14 lift the main air valve 12 off its seat, allowing the free and rapid escape of air through the exhaust pipe C, the passage way or port 15 leading from the train pipe B into the cylinder G below the piston H; and there is a port 16 leading from the pipe 11 into the cylinder G above the piston H.

The engineer's valve K is in a pipe L leading from the main reservoir pipe A to the passage or pipe 11, and from this pipe 11 the pipe 17 leads to the small reservoir M, and a pressure gage is to be applied at N upon the pipe 17, and there should be another pressure gage O upon the pipe A from the main reservoir.

The pipe 18 to the engineer's valve K might lead direct from the pipe A or main reservoir; I however prefer to employ a pressure regulator P between the pipe 18 and the pipe 19 that connects to the pipe A. This pressure regulator is in the form of a cylinder having within it two pistons 20 and 21 connected together by a stem and moved in one direction by a spring 22 which can be adjusted for more or less pressure by a screw sleeve 23 passing through the head 24 of the pressure regulator cylinder P, and the removable cap 25 is screwed upon the head 24 to prevent access to the screw sleeve 23 until the said cap 25 has been removed; and it is advantageous to employ a lock nut 26 to prevent the screw sleeve 23 becoming loose or the adjustment varied by the jar and vibration of the engine.

The pistons 20 and 21 are to move air-tight or substantially so in the pressure regulator cylinder P, and there is a groove 27 near the entrance to the pipe 18 and the air pressure from the pipe A between the pistons 20 and 21 is balanced; and the air pressure between the cap 28 and the piston 20 is equal to the pressure between the pistons 20 and 21 whenever the piston 20 is adjacent to the groove 27, and the air pressure upon the piston 21 is resisted by the spring 22, and whenever the pressure in the pipe 18, and on the top of the piston 20, is less than the pressure on the under side of said piston 20, the spring moves

the parts and causes the piston 20, to admit air to said pipe 18, and by this means the maximum pressure of air in the pipe 18, will be regulated by the adjustment of the spring 22.

The engineer's cock K is three-way, as illustrated in the diagram Figs. 4 and 5, so that when turned into the position represented in Fig. 4 the air pressure will pass by 18, L, 11 and 17 into the storage reservoir M, and the pressure in such storage reservoir M will be the maximum pressure to which the pressure regulator P may be set. When the plug is turned into the position indicated in Fig. 5, the pressure will be maintained in the small storage reservoir M as the ports of the engineer's valve are all closed, and by turning the valve around the air may be allowed to escape from the small storage reservoir to the atmosphere by the port 29.

It is now to be understood that under ordinary circumstances the engineer turns the valve K and admits air into the small storage reservoir M until the gage N indicates the pressure desired in the train pipe, and this pressure will be substantially maintained because if the pressure in the train pipe becomes less than the pressure in the storage reservoir M the pressure from M acting through 11 and 10 lifts the piston F and valve 7, allowing pressure from the main reservoir to pass by the pipe A and valve seat 4 into the train pipe, and as soon as the pressure in the train pipe equals that in the storage reservoir the valve 7 again closes on its seat; and the supply of air will be in proportion to the demand for the same in the train pipe at all times, and should there be leakage the same will be made up so as to maintain the pressure; and on the other hand, if the pressure in the train pipe increases beyond the pressure in the storage reservoir from any cause, the train pipe pressure acting below the piston H will raise the piston and the valve I, allowing the train pipe pressure to escape until it equalizes the pressure upon the top of the piston H.

If the brakes are to be applied, the engineer turns his valve, allowing pressure to escape from the small storage reservoir so as to reduce the pressure above the piston H, and the train pipe pressure lifts the valve I, allowing the air to discharge from the train pipe more or less rapidly. For an emergency stop the plug of the engineer's valve is turned to fully open the escape to the atmosphere from the storage reservoir through the port and pipe 29, and the sudden relief of the pressure causes the train pipe pressure to lift the piston H, valve I and also the main air valve 12, so as to give free and rapid discharge for the air from the train pipe. In this manner the brakes will be applied rapidly for an emergency stop, and for controlling the brakes while the train may be running on a down grade, or for relieving the brakes gradually when coming to a stop, the engineer can maintain in the train pipe any desired pressure,

and that pressure will be indicated by the gage N regardless of the pressure indicated by the gage O.

It will be observed that the apparatus might be regulated by the engineer's valve without the use of a small storage reservoir, but it is advantageous to employ this small storage reservoir in order that there may be a sufficient reserve of air under pressure retained in that reservoir for acting in connection with the valves without requiring such constant and careful attention as would be necessary on the part of the engineer if the said storage reservoir were dispensed with. It will also be apparent that the pressure regulator P might be dispensed with and that the special advantage in using the said pressure regulator is to determine the maximum pressure that can be used in the train pipe, because the pressure in the small storage reservoir can never exceed the pressure which the regulator P is set to admit, and hence the pressure in the train pipe is regulated thereby through the intervention of the pistons that are controlled by the pressure in the storage reservoir, and the pressure regulator P prevents the engineer applying too much pressure in the train pipe through carelessness or inattention, and this is convenient because a more nearly uniform pressure can be maintained in the brake apparatus of different trains by providing such pressure regulator upon all the engines, thus removing a difficulty that is sometimes found in throwing off all the brakes upon the train where a train may be made up of one or more cars upon which the brake may have been applied by a greater pressure from the engine from which such car has been disconnected than is employed in the engine of the train to which such car is connected.

It is to be understood that the handle of the engineer's valve may be provided with a segment or dial as indicated in Fig. 2 and that when the handle and plug are in the position indicated in Fig. 5, the mark on the dial or segment should be that ordinarily applied in air brakes, namely "On lap," and the mark "Emergency stop" should correspond to the handle when the passage ways are entirely open to the air pipe 29, and the mark "Service stop" should be intermediate between the "On lap" and the "Emergency stop," and when the plug is in the position indicated in Fig. 4, the handle should correspond to the "Full release" mark on the dial. By the present improvements the capacity of the engineer's valve is increased, because, in addition to the duties heretofore performed by the ordinary engineer's brake and equalizing discharge valve, the engineer is enabled to control the pressure in the train pipe by simply turning the handle until the pressure in the gage N indicates the pressure desired for the train pipe, and the operations of the parts thereafter are automatic, saving and excepting the risk of leakage which may lessen the

pressure in the small storage reservoir, but this can be instantly restored by the engineer turning the handle of his valve for that purpose.

The engineer's valve is the only device of this apparatus that is necessarily placed within the cab, and the air valves can be located in any desired position which is advantageous, because the parts need not be exposed to the heat of the boiler, and besides this the air blowing out from the exhaust valve need not come into the cab and the risk of dust being blown into the engineer's eyes is lessened, and the durability and reliability of the parts are increased by being able to locate the valves where they are not exposed to heat; and by my improvements I avoid the use of springs and levers for acting upon the valves and control such valves entirely by the air pressure, and the three-way cock or valve that is acted upon by the engineer is of simple construction and not liable to become clogged or to leak and is much more simple than the valves heretofore usually employed, and under all circumstances the gradual application of pressure through the train pipe or the gradual reduction of that pressure so as to regulate the action of the brakes is controlled by the engineer in the most simple and efficient manner.

I claim as my invention—

1. In the engineer's valve of an air brake apparatus, the combination with the cylinder and piston and the air discharge valve controlled thereby, of a movable seat for the smaller air discharge valve, which movable seat forms the main air discharge valve and has through it air passage ways that are opened and closed by the smaller air discharge valve, there being a passage way or port for admitting air under pressure from the train pipe to lift the air discharge valve, and means for controlling an air pressure acting upon the piston to close such air discharge valve, substantially as set forth.

2. The combination in an air brake apparatus with the pipe for supplying air under pressure, and the train pipe, of a valve to admit air to the train pipe, a cylinder and piston connected with the valve for moving the same, a port for admitting air at one side of the piston from the train pipe, a storage reservoir and a connection from the same for admitting air to the other side of the piston, a valve for admitting air under pressure to the storage reservoir, and a gage for indicating the pressure, whereby the pressure in the train pipe will correspond substantially to that indicated by the gage, substantially as set forth.

3. The combination in an air brake apparatus, of a pipe for supplying air under pressure from a reservoir, a small storage reservoir, a pipe from the main supply pipe and a pressure regulator for limiting the pressure of air admitted to the storage reservoir, a valve under the control of the engineer for

regulating the pressure in the small storage reservoir, a train pipe, an air inlet valve, an air discharge valve for the same, and automatic mechanism controlled by the pressure of the air in the storage reservoir for regulating the action of the valve, substantially as set forth.

4. In an air brake apparatus, the combination with the train pipe and the pipe that supplies air under pressure, of an intermediate valve body having a seat between the air supply and the train pipe, a removable cylinder bolted to the body of the valve, an air supply valve and its piston within the cylinder, ports for supplying air at opposite sides of the piston to open and close the valve, substantially as set forth.

5. In an air brake apparatus the combination with the train pipe and the pipe that sup-

plies air under pressure, of an intermediate valve body having a seat between the air supply and the train pipe, a removable cylinder bolted to the body of the valve, an air supply valve and its piston within the cylinder, ports for supplying air at opposite sides of the piston to open and close the valve, an air discharge valve, a piston for moving the same, and a cylinder for the piston connected to the body of the valve, there being ports for the admission of air to act upon the piston and regulate the discharge valve, substantially as set forth.

Signed by me this 19th day of August, 1893.

JEREMIAH F. VOORHEES.

Witnesses:

FRANCIS C. W. ROVER,
WM. F. BOYD.