(No Model.) 2 Sheets—Sheet 1.

J. F. VOORHEES.

AIR BRAKE FOR CARS.

No. 525,876. Patented Sept. 11, 1894.

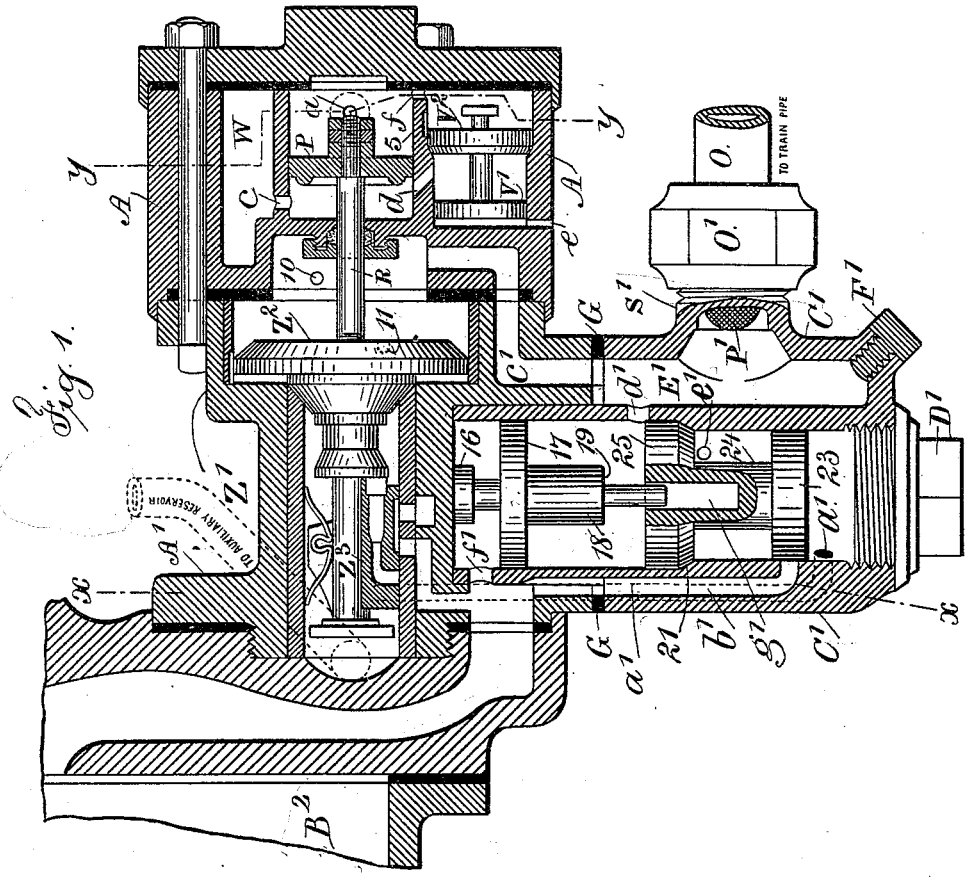

Fig. 1.

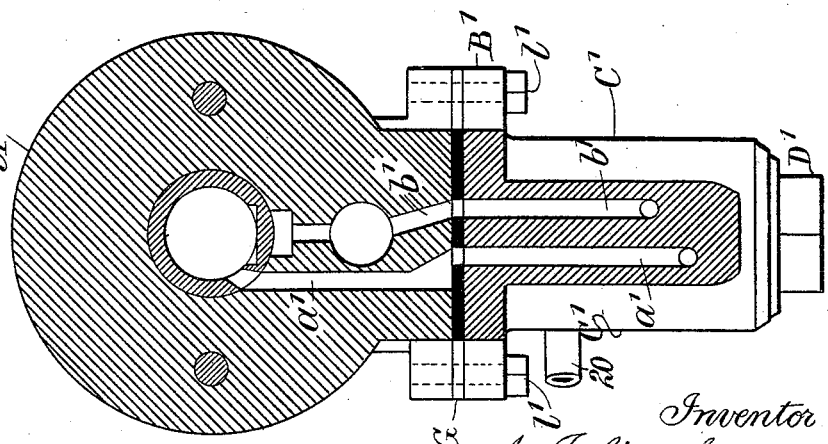

Fig. 2.

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Fig. 4.

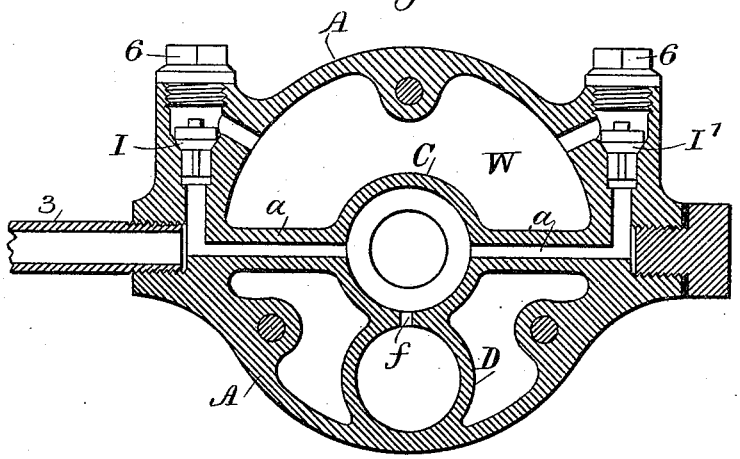


Fig. 5.

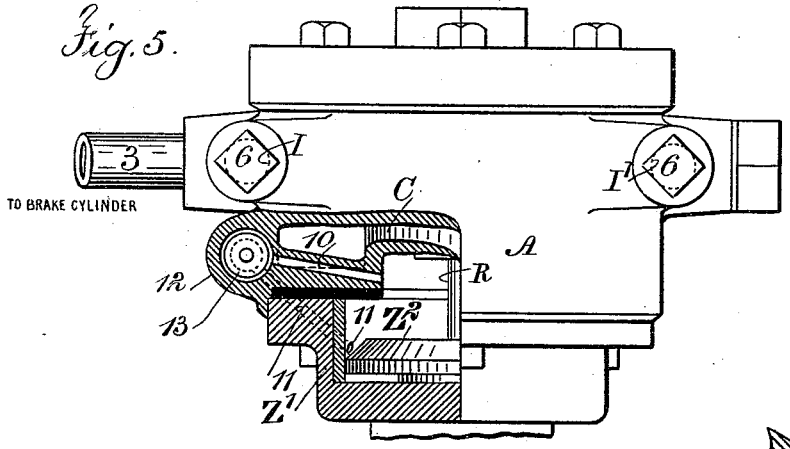


Fig. 6.

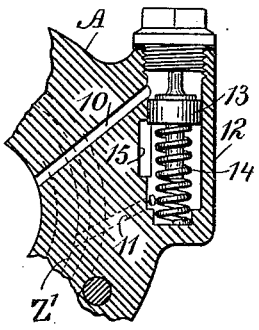
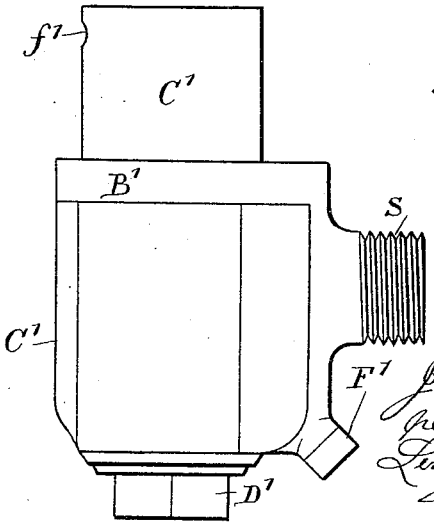


Fig. 3.



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UNITED STATES PATENT OFFICE.

JEREMIAH F. VOORHEES, OF PHILADELPHIA, PENNSYLVANIA.

AIR-BRAKE FOR CARS.

SPECIFICATION forming part of Letters Patent No. 525,876, dated September 11, 1894.

Application filed April 23, 1894. Serial No. 508,556. (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 Air-Brakes for Cars, of which the following is a specification.

This invention relates to that class of brakes, especially automatic brakes, in which compressed air is made use of for applying the brakes and in which there is an auxiliary reservoir under each car connected to the brake cylinder and to the main train pipe. Air under pressure enters the auxiliary reservoir from the train pipe, through what is commonly called a triple valve, and is allowed to pass from the auxiliary reservoir to the brake cylinder by the automatic action of the said triple valve when the pressure in the train pipe is reduced. It will be apparent that in applying the brakes on long trains, by reducing the train pipe pressure through the engineer's valve, if such reduction is rapid the brakes will be applied to the forward part of the train in advance of those toward the rear part, because the air must pass to the engineer's valve to escape to the open air. I am aware of the fact that devices are used to cause a quick action when the brakes are to be suddenly applied by allowing air from the train pipe to enter the brake cylinder, thereby causing the brakes to be applied with greater force and rapidity than when a slow application is made, but with this class of brakes last referred to the quick action is not available to partially apply the brakes.

The object of the present invention is to secure a more uniform as well as a quick action of the brakes when a partial application only is desired, or to suddenly apply the brakes with full force without giving any greater pressure in the brake cylinder than when slowly applied to the maximum, and to also allow the engineer to partially apply the brakes, and then complete the application full force on quick action, if desired. I do not change the train pipes, auxiliary reservoir or the brake cylinder, but apply to the triple valve the additional devices hereinafter described.

In the drawings, Figure 1 is a longitudinal section of the devices I employ shown in connection with a triple valve of ordinary construction. Fig. 2 is a cross section at the line $x\ x$. Fig. 3 is an elevation of the attachment separately. Fig. 4 is a cross section at the line $y\ y$ of Fig. 1. Fig. 5 is a plan partially in section through the intermediate valve, and Fig. 6 is a vertical section through said valve.

A′ represents the flange on the triple valve case by which it is secured to the brake cylinder head B^2 and having an extra port or way a' which is always open and leads from the auxiliary reservoir, and there is a second port b' leading from the brake cylinder port, and these ports match similar ports or ways in my attachment, which ports open into the cylinder C′ of the attachment, as shown by the full and dotted lines, Fig. 1. The valve Z^3 and valve moving piston Z^2 of the triple valve are of ordinary construction and act in the usual manner.

The attachment consists of a cylinder C′ having a flange B′ near the upper end, having holes through it for the bolts $l'\ l'$ to pass, which are threaded to screw into holes in the base or flange A′ on the lower part of the triple valve case as shown in Fig. 2. The upper part of the cylinder C′ preferably extends into a circular recess in the triple valve case that forms the top or head for the cylinder C′ and is made tight by the use of a gasket or washer G having holes through it to match the ports a' and b'. One side of the cylinder C′ is sufficiently thick for the ways or ports a' and b' to pass through it and open into the cylinder C′. On the opposite side of the cylinder C′ is a chamber E′ having a connection S′ by which is attached the train pipe O by the union nut O′. A washer is used to make a tight joint, and a screen P′ may be placed in the connection S′ to prevent particles of dirt passing from the train pipe into the apparatus. This connection is usually employed in air brakes. The lower end of the cylinder C′ is closed preferably by a screw cap D′. A screw plug F′ is usually provided at the lower part of the chamber E′ to drain off water that may accumulate. The inside of the cylinder C′ is of two different diameters and into it are fitted differential pistons 23 and 25 connected together by a stem 24. There is a central hole g' extending through the piston 25 and partly through the stem 24, and the piston 17 is fitted into the cylinder C′ above the piston 25 having a stem 18 with

a smaller end fitting into the hole g' to act as a guide. There is a stop 16 between the piston 17 and the end of the cylinder which stop is shown as upon the piston 17. The shoulder 19 acts as a stop to the upward movement of the piston 25 and the seat 21 arrests its downward movement. The lower outer edge of the piston 25 is preferably beveled at the same angle as the seat. There is a port c' leading from the chamber E' to the triple valve for supplying air under pressure to the auxiliary reservoir through the said triple valve. There is also a port d' leading from the chamber E' into the cylinder C' above the piston 25 when in its normal position. There is also a port e' into which a pipe 20, Fig. 2 may be fitted, opening to the atmosphere. The port e' should be somewhat smaller than the port d' for reasons which will be stated hereinafter. The lower end of the port b' is covered by the piston 23 when in its normal position, and the port a' is always open to the cylinder C' below the piston 23. There is a branch port f' leading from the brake cylinder port to the cylinder C' above the piston 17.

The operation of the parts which have been added, and by which the application of the brakes will be more uniform when quickly applied, will be understood as follows: When the engineer's valve is turned so as to reduce the pressure of air in the train pipe O and chamber E', it is also reduced in the cylinder C' above the piston 25, the pressure from the auxiliary reservoir, acting through the port a' on the lower surface of the piston 23 will force it and the piston 25 upward until the latter comes in contact with the shoulder 19 on the stem 18. The port b' will now be uncovered and pressure from the auxiliary reservoir passes into the lower part of the cylinder C' and through the port b' and unites with that admitted through the port in the slide valve Z^3 of the triple valve and the brakes will be applied. It will be apparent that when the piston 25 has reached the limit of its upward travel, the port d' will be in communication with the cylinder C' below the piston 25 and above the piston 23, and air from the chamber E' and from the train pipe will pass through the port d' and escape to the atmosphere through the port e', and if the latter is somewhat smaller than the port d', nearly the same pressure will be maintained in the cylinder C' between the pistons 23 and 25 as in the chamber E', and the effective pressure on the larger area of the piston 25 will help hold it up until the pressure in the auxiliary reservoir has decreased by expansion into the brake cylinder, and the pressure that is stored above the piston 25 predominates and acts on the said piston 25 to force it downward, or the train pipe pressure decreasing, will cause less effective pressure to act on the lower surface of the piston 25, which will allow the pistons to descend before the pressures are equal below 23 and above 25 because of the larger area of the latter. When the pistons descend and the port d' is open to the cylinder C' above the piston 25 the pressure which is confined in the cylinder above the said piston 25 will equalize with that in the chamber E', and if the pressure in the auxiliary reservoir predominates to a certain degree the before described action will be repeated by the auxiliary reservoir pressure acting below 23 to lift 23 and 25. Should the pressure in the train pipe be less than in the brake cylinder, which is identical with that in the auxiliary reservoir when the brakes are applied full force by these pressures equalizing, the brake cylinder pressure acting on the upper surface of the piston 17 will be sufficient to force it and the pistons 23 and 25 also downward to the normal position shown in the drawings, thus preventing any further escape of air from the train pipe through the ports d' and e', and when the train pipe pressure is increased sufficiently to cause the piston 17 to rise, it will be sufficient to hold the pistons 23 and 25 in their normal positions. It will now be understood that by allowing the train pipe pressure to escape, by the ports d' and e' when the pistons 23 and 25 are raised, to the atmosphere, the reduction of such pressure will quickly be effected at each car in succession in a manner corresponding to the action of the engineer's valve, thereby causing the application of the brakes to be quick and nearly uniform by the forward car helping to apply the brakes to the following one and so on until all are applied and the pressure is instantly reduced throughout the train pipe, instead of the engineer's valve being the only outlet. It will also be apparent that by the pistons descending and allowing the pressure confined above the piston 25 to become equal to that in the chamber E', the quick action of the brakes on the forward part of the train will be somewhat checked by the piston 23 closing the port b' until the automatic brakes on the rear part of the train have commenced to act, thereby lessening the shock to the train by the forward brakes being applied full force before those on the rear part of the train have commenced to act.

The brakes will be applied reasonably quick, because the extra ports a' b' between the auxiliary reservoir and brake cylinder are opened. The brakes may by this means be quickly applied with full force without train pipe pressure passing directly to the brake cylinder, but the application will be gradual so that the strain on the brake rigging will be uniform and the liability to slide the car wheels will be less than when the brakes are applied with the present forms of quick acting brakes.

In making a quick application of the brakes the engineer can limit the action by placing the handle of his valve on "lap" position when the pressure as indicated by

the gage has decreased to a certain extent, but if the valve is allowed to remain on the application position until the gage shows a reduction greater than a point where the pressure in the auxiliary reservoir and the brake cylinder will equalize, which occurs when the brakes are applied full force, or when the train pipe pressure is reduced that amount, by the train parting, or pipe or hose bursting, the brakes are quickly applied full force in the manner before described.

I have found that with the differential pistons 23 and 25 so proportioned that with seventy pounds maximum pressure to the square inch a quick reduction of eight or nine pounds above the larger piston 25 will allow the pistons to be moved upward and the most favorable results will be obtained. With a greater pressure for a maximum, a greater decrease would be necessary, and with a smaller amount of pressure for a maximum a less amount. The action being governed entirely by the air pressures without the use of springs, a more uniform action is insured than where they are used.

It is to be borne in mind that the rapidity in the action of the automatic brake depends largely upon the size of the ports, especially the port in the valve of the automatic triple valve, and by the present improvement I am able to employ larger ports than can be made use of in the ordinary Westinghouse system, and I am able to dispense with the extra port that is sometimes provided in the valve that is brought into action by the emergency application, because in my improvements the pressure in the train pipe never passes directly to the brake cylinder, and my automatic valve which is controlled by the relative air pressures in the train pipe and the auxiliary reservoir by opening a discharge directly to the atmosphere, effects the reduction of pressure in the train pipe all along the train to nearly uniform pressure, because a small portion of the air from the train pipe is allowed to escape at each car. For this reason the difficulty heretofore experienced is avoided, because in the application of the emergency brake the speed of the front of the train is checked so suddenly by the brake that the rear cars by their inertia strike the cars that are in front forcibly, producing disagreeable and sometimes injurious concussion, but by the present improvements the brakes can be applied with almost any desired rapidity, because the reduction of pressure in the train pipe is effected so instantly and uniformly throughout the entire length of the train that the brakes are applied to the rear cars almost as soon as they are to the front cars, and the rapidity of application is in proportion to the decrease of pressure in the train pipe and partially according to the size of the ports through which the air passes.

In the drawings I have represented a slight modification in the attachment represented in my Patent No. 524,050, dated August 7, 1894. In the present improvement the piston P on the stem R is made use of within the cylinder C, and the air from the brake cylinder supplied by the pipe 3 passes through the tube *a* into the said cylinder C, and I make use of two check valves I and I′, one at each side of the cylinder C, so that the check valves are accessible from the outside by removing the screw caps shown at 6, and the pipe to the brake cylinder can be connected at either side. It will be observed that the air rushing in from the brake cylinder through the port or pipe *a* may pass across the cylinder C and through both check valves I I′ so as to equalize the pressure in the chamber W to that in the cylinder C in order that the pressure upon both sides of the piston P may be equalized as rapidly as possible through the port *c*, and the pressure will also be equalized in the cylinder D between the valves V′ and V^2 through the ports *d* and *f*; but I provide an opening or port at *e* to the atmosphere behind the piston valve V′ and a groove 5 in the cylinder D adjacent to the valve V^2. Hence the piston P acts to control the movement of the valve Z^3 and its piston Z^2, and when the brake cylinder pressure is lessened in taking off the brakes, the confined air in the chamber W when it predominates acts against the piston P to draw the piston Z^2 and the valve Z^3 to lap position and the pressure being lessened at the right side of the piston P and of the valve V^2 in proportion to the lessening of the pressure in the brake cylinder will when it has been nearly exhausted to atmospheric pressure allow the valves V′ V^2 to move by the superior pressure between the valves V′ and V^2 acting on the larger area of the valve V^2 and thereby the port 5 is uncovered and pressure escapes from the left of the piston P and from the air chamber W through the ports *c d*, the channel 5 and the port *f* to the brake cylinder, and the channel or port 5 will remain open so that the pressure in the chamber W will be reduced to atmospheric pressure or nearly so as the pressure escapes from the brake cylinder as the brake is entirely taken off, and upon the next application of the brake the pressure passing from the brake cylinder through the pipe 3 and acting upon the piston P, also acts upon the valve V^2 to move the same to its seat and close the port or groove 5, so that the air pressure passing into the chamber W will be confined and act at the left of the piston P in regulating the movement of the automatic valve Z^3, as before described.

In my aforesaid application a valve is represented between the train pipe and the auxiliary reservoir; that is to say, the train pipe pressure acts on the piston valve resisted by a spring, and when the train pipe pressure is sufficient to move the valve, the air passes to the auxiliary reservoir through the passageway from said valve case which opens between the piston and the triple valve when in position to apply brakes so that whenever the

pressure in the train pipe is sufficiently in excess when the brake is reapplied, the valve is moved against the action of the spring and air passes to the auxiliary reservoir to replenish the same.

In the present invention the cylinder 12 containing the piston 13, resisted by the spring 14, is made a part of the cylinder A, and the port 10 that admits air from the train pipe is in said cylinder A, and the port 11 that leads from below the piston 13 passes through the cylinder A and into the cylinder Z′ opening at the opposite side of the piston Z^3 so as to allow air to pass through the port 15 and by the port 11 into the cylinder of the triple valve and thence to the auxiliary reservoir as described. By this construction it is only necessary to extend the port 11 as before mentioned when applying this improvement to a triple valve apparatus already constructed.

I claim as my invention—

1. The combination in an air brake apparatus upon a car with a triple valve that admits air from the auxiliary reservoir to the brake cylinder, of a separate automatic valve controlled by the relative pressures of air existing in the train pipe and in the auxiliary reservoir and acting to open and close an additional port between the auxiliary reservoir and the brake cylinder and independent of the triple valve and without admitting air from the train pipe to the brake cylinder, substantially as set forth.

2. The combination in an air brake apparatus upon a car and having an auxiliary reservoir, brake cylinder and a triple valve of a piston connected to the triple valve, and a cylinder for such piston and connections to admit air under pressure from the brake cylinder to act at both sides of the piston and regulate the movement of the triple valve, a separate valve automatically controlled by the relative pressures in the auxiliary reservoir, brake cylinder and train pipe for allowing the escape of train pipe air to the external atmosphere, substantially as set forth.

3. The combination in an air brake apparatus upon a car and having an auxiliary reservoir, brake cylinder and triple valve, of a separate valve automatically controlled by the relative air pressures in the train pipe and in the auxiliary reservoir and acting to allow air to escape to the external atmosphere from the train pipe, and also to open and close an additional port between the auxiliary reservoir and the brake cylinder, substantially as set forth.

4. The combination in an air brake apparatus upon a car and having an auxiliary reservoir, brake cylinder and triple valve, of a separate valve automatically controlled by the relative air pressures in the train pipe and in the auxiliary reservoir and acting to allow air to escape to the external atmosphere from the train pipe, and also to open and close an additional port between the auxiliary reservoir and the brake cylinder, and an automatic valve that allows air to pass from the train pipe to the reservoir when the pressure in the train pipe exceeds the pressure in the reservoir sufficiently to open the said valve when applying the brakes, substantially as set forth.

5. The combination with the train pipe and auxiliary reservoir in an automatic air brake, of an air discharge and auxiliary brake valve, consisting of a cylinder having different inside diameters, into which are fitted differential pistons connected by a stem, the offset in the cylinder forming a seat for the larger piston, a port for admitting air from the auxiliary reservoir to act on one side of the smaller piston, a port for admitting air from the train pipe to act on the larger piston, a port leading from the cylinder between the connected pistons to the open air, an independent regulating piston within the cylinder and a stem acting as a stop for the differential pistons, a knob or stop being provided at the opposite side of the regulating piston, a port for admitting air from the brake cylinder to act on top of the regulating piston, the air from the train pipe acting on the under side of the regulating piston and simultaneously on top of the larger differential piston, and a port for admitting air under pressure from the auxiliary reservoir to the brake cylinder covered by the smaller differential piston when in its normal position, substantially as set forth.

6. In a car brake apparatus, the combination with an automatic air brake, of the cylinder C′ attached to the triple valve and having different inside diameters, the offset in the cylinder forming a seat, the differential pistons 23 and 25 connected by a stem 24, a piston 17 having a stem 18 attached to it with a smaller end fitting into a hole in the piston 25 and the stem 24 within the cylinder C′, there being ports or ways a' and b' leading from the cylinder C′ to the auxiliary reservoir and the brake cylinder through similar ports in the flange A′ of the triple valve, a branch port f' leading from the brake cylinder to the cylinder C′, a chamber E′ having a connection for the train pipe, a port c' leading from the chamber E′ to the triple valve, a port d' from the chamber E′ into the cylinder C′, a port e' from the cylinder C′ to the atmosphere, the lower end of the cylinder C′ being closed by a cap D′, an air-tight joint being secured by the use of a gasket G between the flanges A′ of the triple valve and B′ on the cylinder C′ which are held together by the bolts l' l' for uniformly and quickly applying the brakes, substantially as set forth.

Signed by me this 23d day of February, 1894.

JEREMIAH F. VOORHEES.

Witnesses:
FRANCIS C. W. RORER,
WM. F. BOYD.