

Patented April 22, 1879.



# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN RAILWAY AIR-BRAKE APPARATUS.

Specification forming part of Letters Patent No. **214,603**, dated April 22, 1879; application filed March 19, 1875.

*To all whom it may concern:*

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Railway Air-Brake Apparatus; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 shows such parts of an automatic air-brake apparatus as are necessary to illustrate my present improvement, and Fig. 2 is an enlarged vertical section of the relief and check valve and valve-case.

My present improvement relates more particularly to that class of steam-power air-brakes commonly known as "automatic" or "safety" brakes.

In such brake apparatus as made and used previous to the date of my present invention, an air-compressor compressed air to the desired density into a main reservoir on the locomotive. The brake-pipes, attached to each car and connected by hose and couplings between cars, are kept charged with compressed air when the train is in running condition, with the brakes off. An auxiliary reservoir and brake-cylinder are then arranged on each car, with a pipe-connection from one to the other, and from both to the brake-pipe through an interposed valve device such that, while the brakes are off and the train is running, the piston of the brake-cylinder shall be subject to atmospheric pressure only, and the air-pressure shall be transmitted from the brake-pipe to each auxiliary reservoir, so as to charge the same and keep it charged, and also such that, on the reduction of the air-pressure in the brake-pipe, by accident or otherwise, the entire power of the stored-up air in each auxiliary reservoir shall be admitted to the brake-cylinder, so as to apply the brakes.

My present improvement differs in its mode of operation chiefly in this—that each brake-cylinder is, while the brakes are off, charged and kept charged with compressed air at the same density or degree of compression as the brake-pipe and auxiliary reservoir, but in such way that its piston shall be nearly or quite in

*equilibrio*, and with connections such that, on the reduction of such pressure on one side of the piston, the equilibrium will be destroyed, and the brakes shall be applied by the action of the compressed air from the auxiliary reservoir on the other side.

By such construction and operation I am enabled to dispense with the valve device commonly used to change the direction of the flow of air, one form of such device being shown in Patent No. 149,901, granted to me April 21, 1874.

In the drawings, B represents the brake-pipe; C, the brake-cylinder, and R the auxiliary reservoir, as fitted on or attached to each car. These, as shown, are of the construction already in use for kindred purposes. A branch pipe, *b*, leads from the brake-pipe B to one end of the brake-cylinder C, and a pipe, *d*, from the other end of the brake-cylinder to the reservoir R. The piston *a* of the brake-cylinder has a cup-leather packing, *a'*, so arranged as to allow air to pass around the piston *a* from the pipe *b*, through the pipe *d*, to the reservoir R. By the piston-stem *p* the power is communicated at its outward stroke through suitable interposed devices to the brake-shoes, so as to apply the brakes, and the reverse stroke in releasing is secured by a spring or other means, already known in the art, the desired working air-pressure now being kept up in the pipe B and passed by the pipe *b* into the cylinder C, and around the cylinder past the cup-leather packing *a'*, so as to exert nearly or exactly the same pressure on both sides of the piston *a*, and so as at the same time to charge and keep charged the reservoir R. Hence, in this condition, the brakes will be off, and the train in running order.

In order, now, to apply the brakes, the engineer, by the use of a suitable cock, lowers the pressure in pipe B, much or little, as he may desire, or as circumstances may require. The equilibrium of pressure on the opposite sides of the piston *a* is thereby destroyed, the pressure in front of the piston being correspondingly lowered, and that back of the piston, from the reservoir R, not being able to escape past the cup-leather *a'*, acts with full force against the back of the piston, drives

out the stem, and applies the brakes. On the restoration of the pressure the piston *a* is again *in equilibrio*, and the spring or other device used for that purpose carries it back to its original position, and the brakes are off, and the reservoir *R* is recharged.

The operation is the same in applying the brakes in case of any accident, which causes the separation of the pipe-couplings or the rupture of the brake-pipe; but instead of a cup-leather packing (which, besides acting as a packing, performs the function of a check-valve) other known suitable form of valve may be employed as the mechanical equivalent thereof which will allow the air-pressure to pass from the side of the piston toward which the piston moves in applying the brakes (that being considered here as the charging side) to the opposite side, such opposite side being in communication, or, when the brakes are to be applied, being brought into communication, with the reservoir *R*; such valve, however, preventing the reverse flow of air. Nor is it essential that the compressed air should be charged into the reservoir *R* through the brake-cylinder, since, by a communicating-pipe, *g*, from *b* to *d*, or by any suitable pipe or port which passes the piston *a* inside or outside of it, the same result may be secured in substantially the same way; but such pipe or port should have a check-valve, such as will, on the reduction of the pressure in *B*, prevent the escape of compressed air from the reservoir *R* except into the brake-cylinder. One such form of check-valve is shown at *c*.

The construction and operation of this valve, both as a check-valve and as, under certain circumstances, a relief-valve, will appear, in part, by reference to the Patent No. 149,901, above referred to, or to the Westinghouse automatic brake, now in common use.

At *n n*, I have shown cocks for closing the ends of the brake-pipe when a car is detached. In such case, if, as will sometimes happen, the air leaks slightly from the brake-pipe, the reduction of the air-pressure caused thereby in the charging end of the cylinder *C* would result in the application or setting of the brakes by air-pressure from the reservoir *R*. To remedy this I arrange the valve *c* in the line of communication from one side of the piston *a* to the other, and make in it a small groove, *c'*, which will allow leakage to take place from the reservoir *R* as rapidly as under ordinary circumstances it will take place from the pipe *B*; or I seat the valve on its port, so that it will be raised by a leaking-pressure; but I so

adjust the action of the valve *c* to the pressure that when the pressure employed in working the brakes is brought to bear on it it will act as a check-valve to close the back escape.

In constructing the apparatus, account should be taken of the fact that the area of piston subject to air-pressure is greater on one side than on the other by the area of the piston-stem *p* in cross-section. Hence the power of the spring or other device by which the piston receives its back-stroke should be a little in excess of what would be deemed necessary with an absolutely perfect balance; but this difference in area may be made to operate in aid of the reverse stroke by charging the cylinder *C* at its opposite end through a pipe, *b'*, (leading from *B*), and carrying a pipe, *d'*, from what would then be the back end of the cylinder to the reservoir with a reversal of the cup-leather, and such change in the connections of the stem *p* that the brakes would be applied by a pulling instead of a pushing action. The other modifications to be made in connection with such reversed action will readily occur to those skilled in the art.

In order that, after each application of the brakes, they may be quickly released by a quick restoration of the air-pressure, it is desirable that a somewhat higher pressure be maintained in the main reservoir on the locomotive than is kept up in the brake-pipes, and the apparatus is preferably fitted up and constructed so as to attain that end.

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

1. The combination of brake-cylinder *C*, piston *a'*, auxiliary reservoir *R*, a pipe, *b* or *b'*, from the main brake-pipe to one end of brake-cylinder, and a pipe, *d* or *d'*, from the other end of the brake-cylinder to the auxiliary reservoir, substantially as set forth.

2. The combination of pipes *b*, *d*, and *g* with cylinder *C* and reservoir *R*, arranged and connected for conjoint action, substantially as set forth.

3. A relief-valve, *c*, in combination with the brake-cylinder and reservoir, arranged with a direct open communication from one to the other, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

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