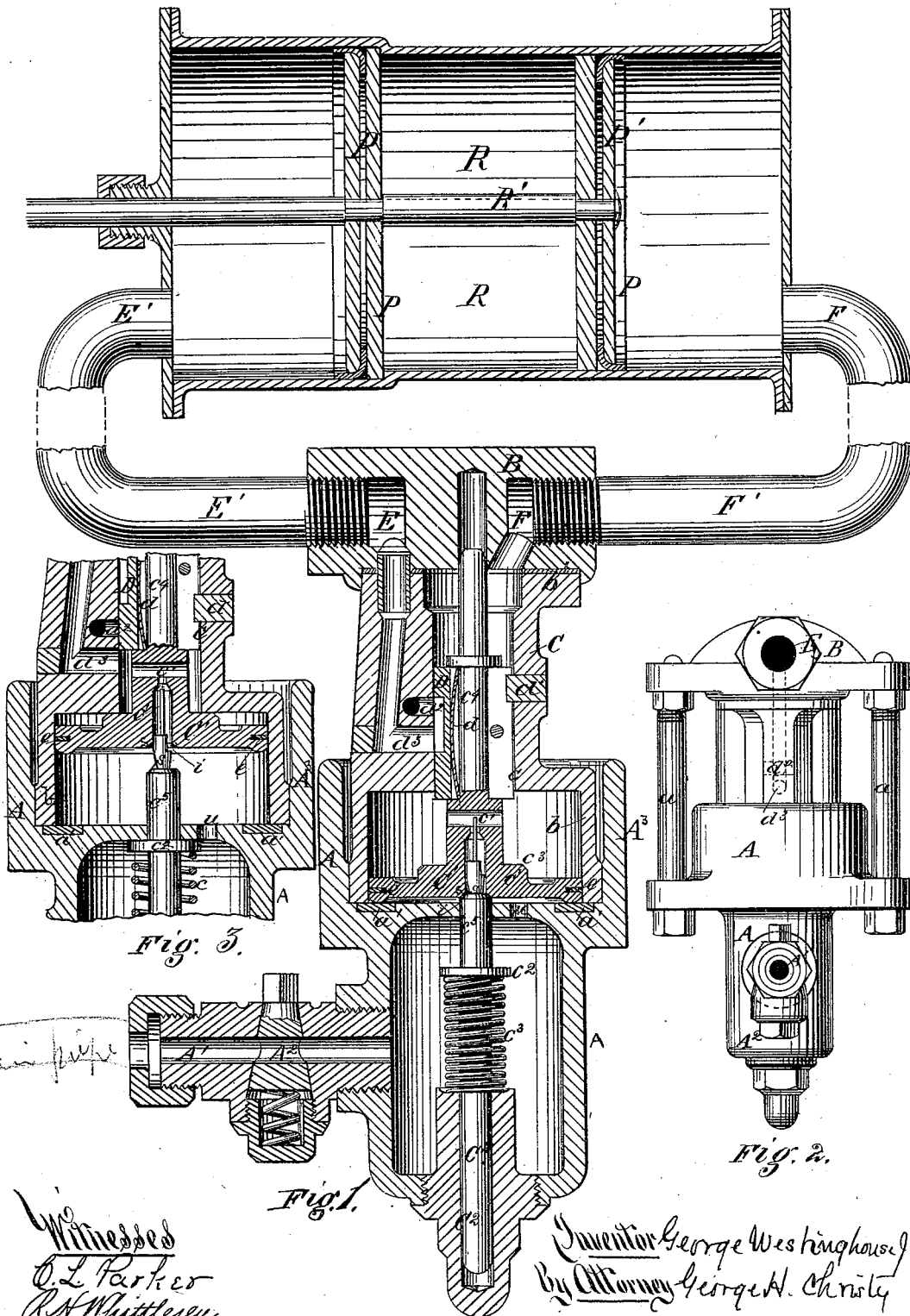


G. WESTINGHOUSE, Jr.  
Fluid-Pressure Brake Apparatus.

No. 217,836.

Patented July 22, 1879.



# UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN FLUID-PRESSURE-BRAKE APPARATUS.

Specification forming part of Letters Patent No. **217,836**, dated July 22, 1879; application filed May 28, 1879.

*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 Fluid-Pressure-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 is a sectional view of an apparatus illustrative of my present invention. Fig. 2 is an elevation thereof to a reduced scale; and Fig. 3 is a detached sectional view, showing the devices in the reverse operation to that represented in Fig. 1.

My present invention relates to certain improvements in railway fluid-pressure-brake apparatus of the general type commonly known as the "automatic;" but instead of using an auxiliary reservoir under each car, in combination with a brake-cylinder, I use what I term "differential pistons and cylinder," or a cylinder fitted with pistons of different areas subject to air-pressure, and on the same stem, in such manner that while the pistons are subject to air-pressure operating on both, the excess of aggregate pressure, acting on the larger piston, shall hold both pistons back, in which position the brakes will be "off;" but on the escape of air from in front of the larger piston, the pressure on the other piston will give both pistons a forward stroke, and so apply the brakes. This apparatus belongs more especially to that class known commonly as the "automatic," in which while air-pressure is kept up the brakes are off, but on the reduction of air-pressure in the brake-pipes the brakes are applied.

A cylinder of the kind referred to is represented at R. One end is made larger than the other, so that the piston P therein shall have an area subject to air-pressure somewhat greater than the other or smaller piston, P'. Both pistons are packed as against the pressure, and both are secured on the same stem R', which latter has the usual or any required connection with the brake-levers. As a means of regulating or governing the application of air-pressure to these pistons, I make use of a

device which in many respects resembles that described in United States Patent No. 172,064, granted to me January 11, 1876; but for greater simplicity and convenience, as well as to secure greater durability, I prefer to make the valve-case in three parts, (designated generally as A, B, and C,) the ends of C being seated in the adjacent faces of A and B, the joints packed by gaskets *a'* and *b'*, and all secured together by screw-bolts *a*.

Connection is made with the brake-pipe by the branch A<sup>1</sup>, governed by a cock, A<sup>2</sup>, so as to cut the apparatus of any one car out of action in case of accident to any of its parts.

A cylindrical extension, A<sup>3</sup>, projects up around the piston-barrel *b*.

The central section, C, except as herein explained, is the same in mechanical structure and operation as the corresponding part in the patent above named, as also the piston C' and valve D; but the stem *c*<sup>5</sup> differs from the corresponding device in said patent in having a valve-shaped shoulder at its upper end, which operates against a properly-shaped seat, as at *s*, in the lower face of the piston C'.

The collar *c*<sup>2</sup> and spring *c*<sup>3</sup> operate in the manner set forth in said patent, as also the extension *c*<sup>1</sup>, except that the lower part of the latter, which fits the passage through the piston, and is so long that its upper end remains in such passage at the extreme end of the stroke of the piston, has a notch, *i*, in one side of it, which, when the piston is raised into the position shown in Fig. 3, allows the air-pressure to flow from below the piston, through the passage, into the chamber above. The stem *c*<sup>4</sup> carries a slide-valve, D, held down by a spring, *d*, and prevented from turning by a stud, *d*<sup>1</sup>, as in said patent.

The port E leads, by a pipe, E', to the larger or forward end of the brake-cylinder R, and the port F, by a like pipe, F', to the opposite end. The port *d*<sup>3</sup> leads from the interior air-passages to E, and the port *d*<sup>2</sup> leads to the external air. By a port, *u*, provision is made for admitting the compressed air to the under side of the piston C.

The operation is as follows: Air or other fluid pressure, being admitted at A<sup>1</sup>, acts on the under side of C', so as to bring the devices to the position shown in Fig. 3. The escape-

port  $d^2$  is then closed by the valve D, and the port  $d^3$  is open. Air-pressure then passes through the central passage in the piston C', and through pipes E' and F', so as to charge both ends of the brake-cylinder; but the piston P being the larger, the excess of pressure thereon will force both pistons and their stem to the right, and the brakes will be off and the train in running order; but on a reduction of air-pressure in A', the back-pressure of the air on the piston C' will result in giving the piston a reverse stroke, so as to close the passage through it, and then bring all the devices to the position shown in Fig. 1. The ports  $d^2$  and  $d^3$  will thus be brought into communication, and the pressure on the cylinder P will be released; but as the air-pressure still remains effective on P', both pistons and their stem will be forced to the left, and the brakes will thereby be brought into action.

Effective pressure in either direction may be varied at pleasure in the manner recited in said patent, or in the one to which it refers, and like changes and modifications can be made in this as in those; also, the brake-cylinder pistons may be reversed in their action, if so preferred; or, if a considerable difference be made in their areas, air-pressure through F' may be introduced between them to force them one way, and a counterbalancing pressure through E' to give a reverse stroke; also, the pistons P P' may be inclosed in separate cylinders, if so preferred, but with such connections that in the manner described—that is, being of different areas and air under pressure being alternately applied to and discharged from one—they shall co-operate in giving the brakes the desired action, and for the purposes of the present case I use the term "differential piston" to designate this double arrangement of pistons of different areas.

The valve case or shell containing the devices for governing the application of the fluid-pressure is in effect a four-ported device—one port, A', admitting air-pressure, two, E F, for applying the same, and one,  $d^2$ , for escaping. The piston, valve, and stem regulate the flow of fluid-pressure.

Instead of making the extension  $c'$  with the notch  $i$ , as described, it may be made round, with a sufficient reduction in diameter to allow the air to pass, or it may have any irregular shape which will admit of the performance of the same function.

It will also be within my invention to substitute for the smaller piston a piston rod or stem so enlarged that it may perform the function of a piston, or vary to the desired extent the relative areas of the main piston, which, on its opposite sides, are subject to variations of air-pressure under the conditions named, and the valve device described may be advantageously used with such an arrangement. Such an enlarged stem may in this connection, and within the purview of the claims hereinafter stated, be considered as the mechanical equivalent of the smaller piston, P'.

I claim herein as my invention—

1. A differential piston, in combination with a four-ported valve-case, and suitable devices therein for directing the passage of fluid-pressure received through one of the ports through two of the others, whereby it shall be caused to act simultaneously in opposite directions on the differential piston, and also for directing such fluid-pressure at pleasure back from one of such two ports and out by the fourth, substantially as set forth.

2. The notched and reduced stem  $c'$ , in combination with ported piston C', substantially as set forth.

3. The arrangement of the escape-port  $d^2$  above the port  $d^3$ , in relation to the stroke of the valve D and piston C', whereby the charging-stroke of the piston shall uncover  $d^3$ , but close  $d^2$ , but on the reverse stroke shall bring them into communication, substantially as set forth.

4. A valve-case made up of the part A, having a tubular extension, A', and the part C, seated at one end in such tubular extension, and at its other end in the face of the third part, B, the whole being united by screw-bolts  $a$ , substantially as described.

5. The valve end  $s$  of the stem  $c^2$ , in combination with a valve-seat around the air-passage of the piston C', substantially as described.

In testimony whereof I have hereunto set my hand.

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Witnesses:

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