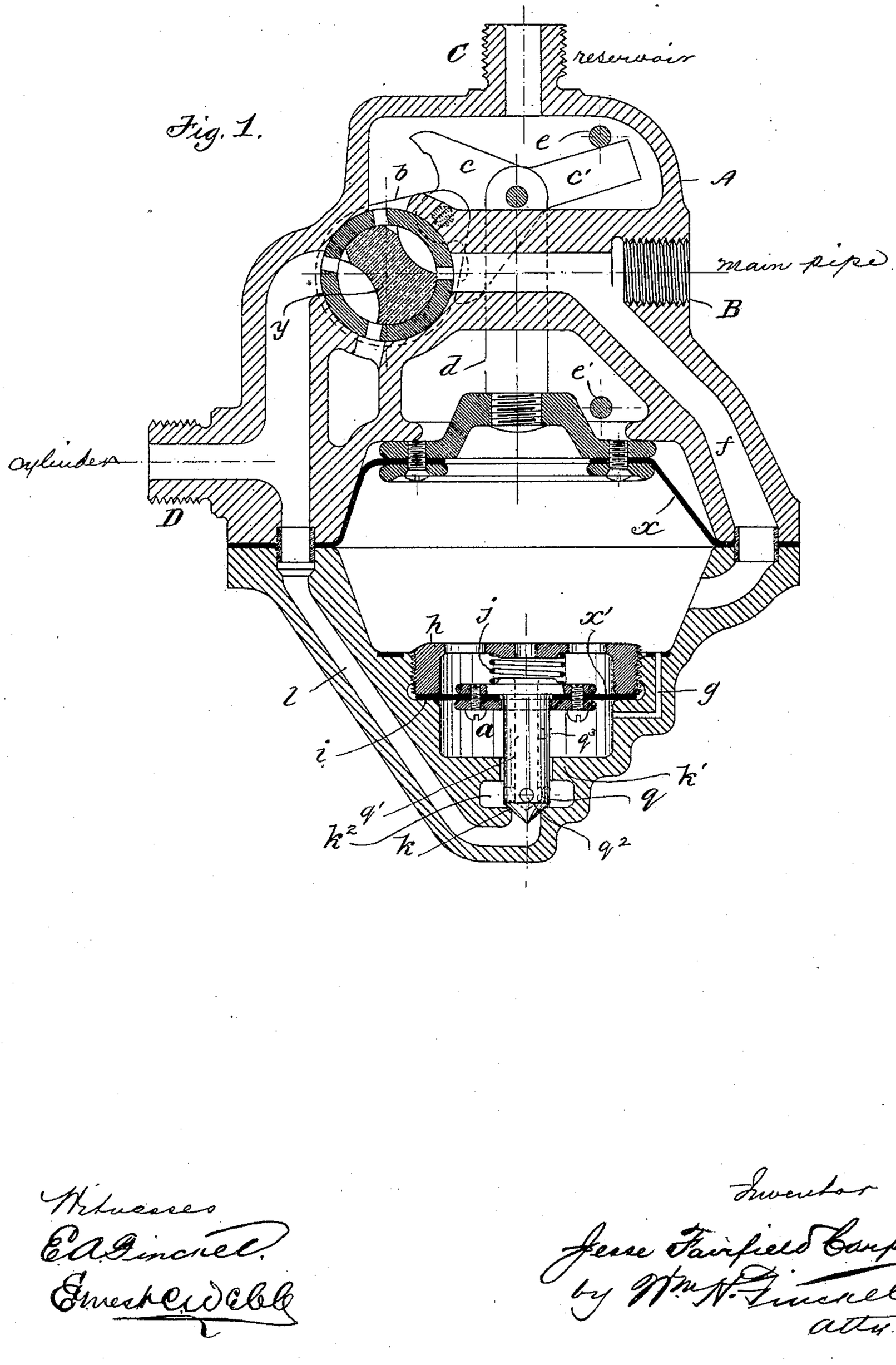
(No Model.) 2 Sheets—Sheet 1.

J. F. CARPENTER.

AUTOMATIC VALVE FOR AIR BRAKES.

No. 431,331. Patented July 1, 1890.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

J. F. CARPENTER.

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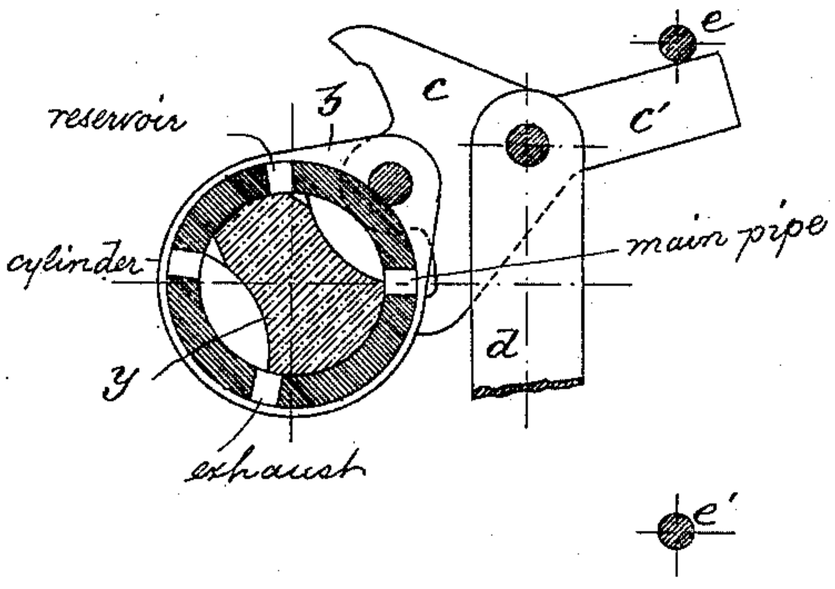
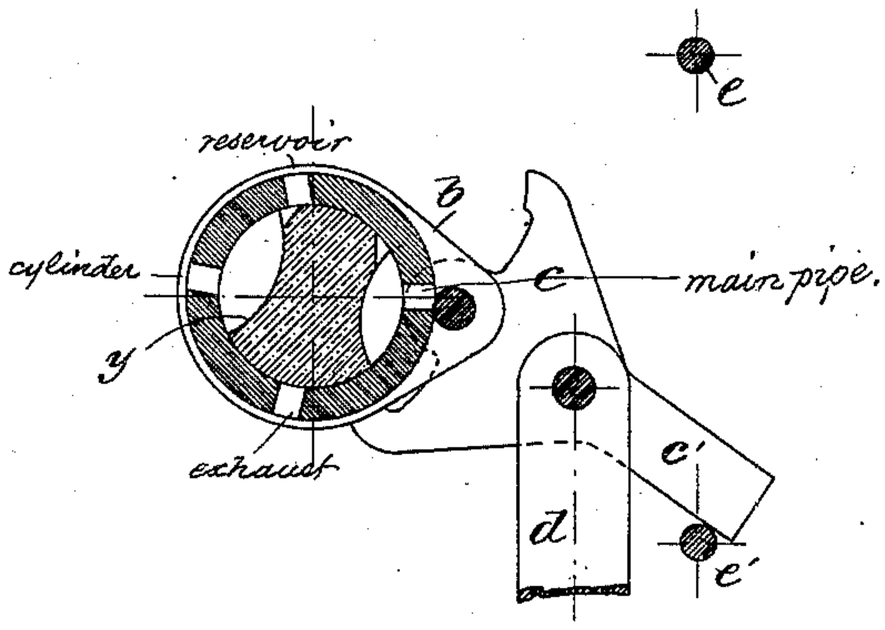
Brake off.

Fig. 2



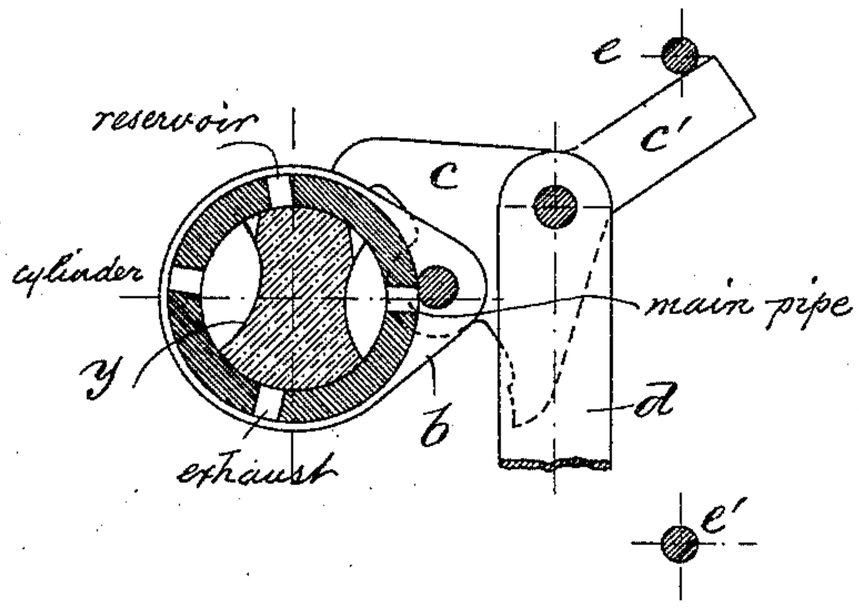
Brake half on.

Fig. 3.



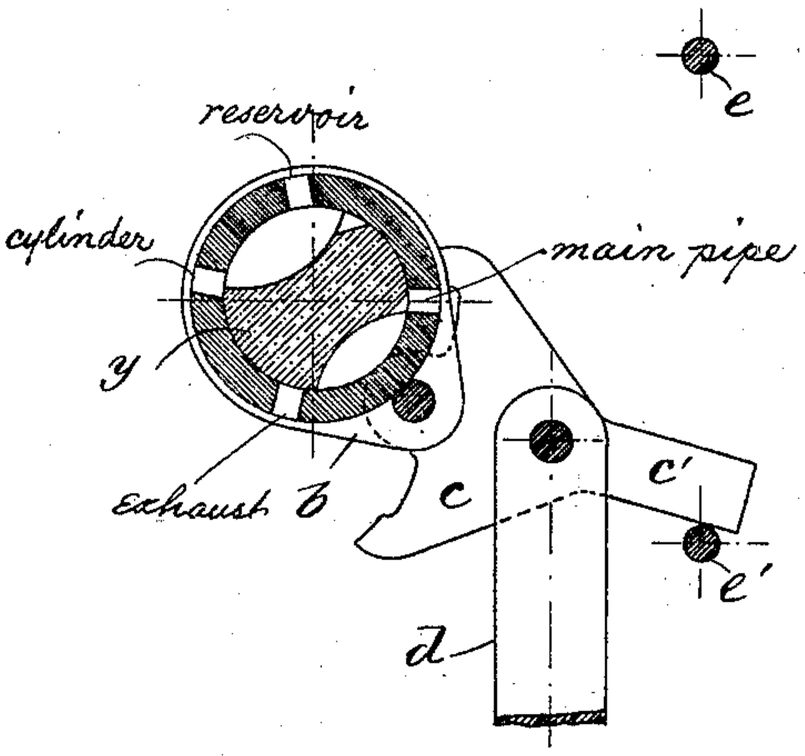
Brake held on.

Fig. 4.



Brake fully applied.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JESSE FAIRFIELD CARPENTER, OF BERLIN, GERMANY.

AUTOMATIC VALVE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 431,331, dated July 1, 1890.

Application filed September 28, 1889. Serial No. 325,394. (No model.)

To all whom it may concern:

Be it known that I, JESSE FAIRFIELD CARPENTER, a citizen of the United States of America, residing at Berlin, in the county of Brandenburg, Prussia, Germany, have invented certain new and useful Improvements in Automatic Valves for Air-Brakes, of which the following is a full, clear, and exact description.

This invention consists of a further improvement upon the valve mechanism already patented to me in the United States by Letters Patent No. 386,523, dated July 24, 1888, and No. 405,694, dated June 25, 1889, and No. 412,463, dated October 8, 1889.

The specially new feature here to be described and claimed consists of the addition of a diaphragm-valve mechanism arranged at the bottom of the valve-cover to take the place of the double plug-cock arrangement previously used, the smaller or auxiliary plug-cock, together with the attendant passages, being eliminated altogether.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a vertical section. Figs. 2, 3, 4, and 5 are sectional elevations of the plug-cock and portions of the compound lever, showing the said parts in the four several positions of "brake off" and "brake half on" and "brake held on" and "brake fully applied."

The shell or box A may be of approved construction, and is provided with a nipple or inlet B for the main pipe, a nipple or outlet C, leading to the auxiliary reservoir, and a nipple D, leading to the brake-cylinder. The rotary plug-valve *y* intercepts the passages between the main pipe-inlet, reservoir, and cylinder, and is provided with an arm *b*, to which is pivoted the compound lever *c*, which in turn is pivoted to the stem *d*, and this latter in turn is secured to the main diaphragm *x*, so that the said rotary plug-cock will be operated by the movement of the said diaphragm, substantially in the manner and for the purposes explained in Figs. 2, 3, 4, and 5, but as modified by the additional valve to be described. The compound lever *c* has the arm *c'*, which cooperates with the stops *e* and *e'* to complete the movement of the plug at the opposite extremes of movement of the main diaphragm—that is to say, the brake is off when the parts are as in Figs. 1 and 2—and the air passes from the main pipe through the "main pipe" and "reservoir" ports of the plug to the auxiliary reservoir, and the air escapes from the brake-cylinder to the atmosphere through the "cylinder" and "exhaust-ports." Slight reduction of pressure in the main pipe will cause the main diaphragm to descend and move the plug into the position Fig. 3 or into the position Fig. 4 with the brake half on or held on, as the case may be, while large reduction of pressure in the first instance or otherwise will give the position shown in Fig. 5, fully applying the brake.

The pressure from the main pipe enters the valve-box, as shown, and passes the main plug-cock *y* to the reservoir, (not shown,) which latter in turn is connected to and forms one chamber with the space in the valve-box above the diaphragm *x*. A branch passage or canal *f* extends into the chamber below the diaphragm *x*.

A diaphragm-valve mechanism *a*, located in the bottom of the valve-box, forms a main feature of this invention. This valve mechanism comprises a diaphragm *x'*, held to its seat in the valve-box by a screw-cap *h* or other suitable means, and this screw-cap is perforated to open communication with the chamber between the diaphragms *x* and *x'*. The pin-valve *q* is secured to and moves with the diaphragm *x'*, and has a passage *q'* in open communication with the chamber between the two diaphragms and leading to lateral passages q^2 in the lower part of said valve. A spring *j* may be interposed between the diaphragm and its cap *h* to hold normally the said pin-valve to its seat *k* in a passage or canal *l*, leading thence to the brake-cylinder passage. Between the valve-seat *k* and the septum *k'* is a chamber k^2, which contains air-pressure when the pin-valve is seated. The pin-valve passes loosely through the septum *k'*, so as to permit leakage from the chamber k^2 into the chamber between the said septum and the diaphragm *x'*; but any other form of pin-valve may be employed without departing from the principle of my invention. Obviously as the air passes from the main pipe into the valve-box it also passes through the pin-valve into the chamber k^2.

Supplemental to the devices described for conveying air from the main chamber to the chamber k^2 the pin-valve might also have the opening q^3 for use when a canal g is employed communicating with the chamber between the two diaphragms.

The operation is as follows: Air entering the valve-box between the two diaphragms x and x' by the canal f passes at the same time into chamber k^2 through the pin-valve, and thence leaks into the chamber above the septum k'. The pin-valve being loosely fitted in said septum, the air can pass slowly into and out of the chamber between the diaphragm x' and septum at any variation of pressure taking place in the air between the two diaphragms. Now, if the air-pressure in the main pipe be suddenly reduced, the air-pressure between the diaphragms x and x' will also be suddenly reduced, and the pressure confined under diaphragm x' will lift said diaphragm and the pin-valve momentarily and let out air through the pin-valve and canal l to the brake-cylinder, and at the same time the diaphragm x will be moved down and the plug y turned, as described. Since the pin-valve q is more sensitive and quicker in its movements (having no friction) than the plug-valve y, it follows that at the slightest reduction of pressure in the main pipe the pin-valve q will open, and as its operating-chamber is soon relieved of its extra pressure through leakage at septum k' the valve soon shuts again. Hence I get an intermittent quick opening and shutting of the pin-valve for every reduction of pressure in the main pipe. This gives a greatly-enhanced quickness in working the brake and at the same time enables me to regulate the force as desired, for the pin-valve shuts itself quickly and automatically before it has let too much pressure out of the main pipe. To apply the brake, the slightest reduction of air-pressure from the main pipe destroys the equilibrium of both the diaphragms; but the auxiliary diaphragm x' can lift its attached pin-valve q much easier than the diaphragm x can turn the large plug y, and the result is that more air-pressure instantly passes to the brake-cylinder through the opened pin-valve q by way of the canal l, and thence at first it escapes to the atmosphere through the cylinder-exhaust until the plug y being turned to apply the brake this exhaust is closed, and the air-pressure from canal l then passes directly into the brake-cylinder, thereby still further reducing the pressure under the main diaphragm, and thereby materially shortening the time necessary to turn the large plug y and apply the brake. Hence there is a materially great accelleration of the action of the brake on long trains. In other words, the substitution of the easily-lifted pin-valve q for the previously-used secondary plug-valve results in a much quicker brake, and also in a great saving of time and of air-pressure in actuating the same. The pin-valve q, and with it the main-pipe exhaust will be closed, as it was opened, independently of the movement of the main diaphragm x and the plug-cock y, for so soon as the excess of pressure in the small chamber under the diaphragm x' has leaked out through the pin-valve passages q^2 q' into the main chamber above the diaphragm x' the pressure on both sides of the diaphragm x' will be equalized, and valve q will be closed by the spring j.

The use of a pin-valve or small seat-area in comparison to the lifting member or agent (piston or diaphragm for air, armature for electric current) used to actuate it has been shown in the previous patents of mine—namely, United States Patents Nos. 377,989, dated February 14, 1888, and 378,657 and 378,658, dated February 28, 1888; but these patents show the construction of the combined mechanism as a whole somewhat different from that here described.

What I claim is—

1. In an automatic valve for air-brakes, a diaphragm and a pin-valve of relatively very small seat-area in comparison to its diaphragm, and said valve, by its diaphragm, being actuated directly by the air-pressure from the main pipe, and directly controlling a passage connected with the brake-cylinder, in combination with independent valve mechanism, substantially such as described, for directly actuating the brake, substantially as specified.

2. In an automatic valve for air-brakes, a rotatable plug-cock, a compound lever pivotally connected thereto, a stem to which the lever is pivoted, and a diaphragm to which the stem is secured and by which it is moved, in combination with an independent auxiliary diaphragm provided with a pin-valve and actuated by the air-pressure from the main pipe, and controlling a passage connected with the brake-cylinder, and having a relatively very small seat-area in comparison to its diaphragm, substantially as described.

3. In an air-brake mechanism, the combination, with an automatic main valve of usual or approved construction, of an independent valve and passages controlled thereby and leading to the brake-cylinder and atmosphere, said independent valve being more sensitive than the automatic main valve and separately supported and actuated, and lifted or opened by air-pressure confined in a separate chamber, whence a slow passage or leakage of pressure serves to actuate the independent valve intermittently or momentarily at every decrease of pressure in the main pipe, substantially as described.

4. In an air-brake mechanism, the combination, with an automatic main valve of usual or approved construction and a main pressure-chamber which communicates with the main pipe, of an auxiliary valve supported and actuated independently of the main valve, a pressure-chamber for said auxiliary valve and passages controlled by said auxil-

iary valve and communicating with the main pressure-chamber, the brake-cylinder, and the atmosphere whereby exhaust of the main pipe to the brake-cylinder and atmosphere may be secured prior to even a slight application of the brake and to the brake-cylinder for a full application of the brake, substantially as described.

In testimony whereof I have hereunto set my hand this 13th day of September, A. D. 1889.

JESSE FAIRFIELD CARPENTER.

Witnesses:
GEO. H. MURPHY,
PAUL SANDER.