No. 676,019. Patented June 11, 1901.

A. J. WISNER & J. S. ELY.

AIR BRAKE.

(Application filed Oct. 4, 1899.)

(No Model.) 3 Sheets—Sheet I.

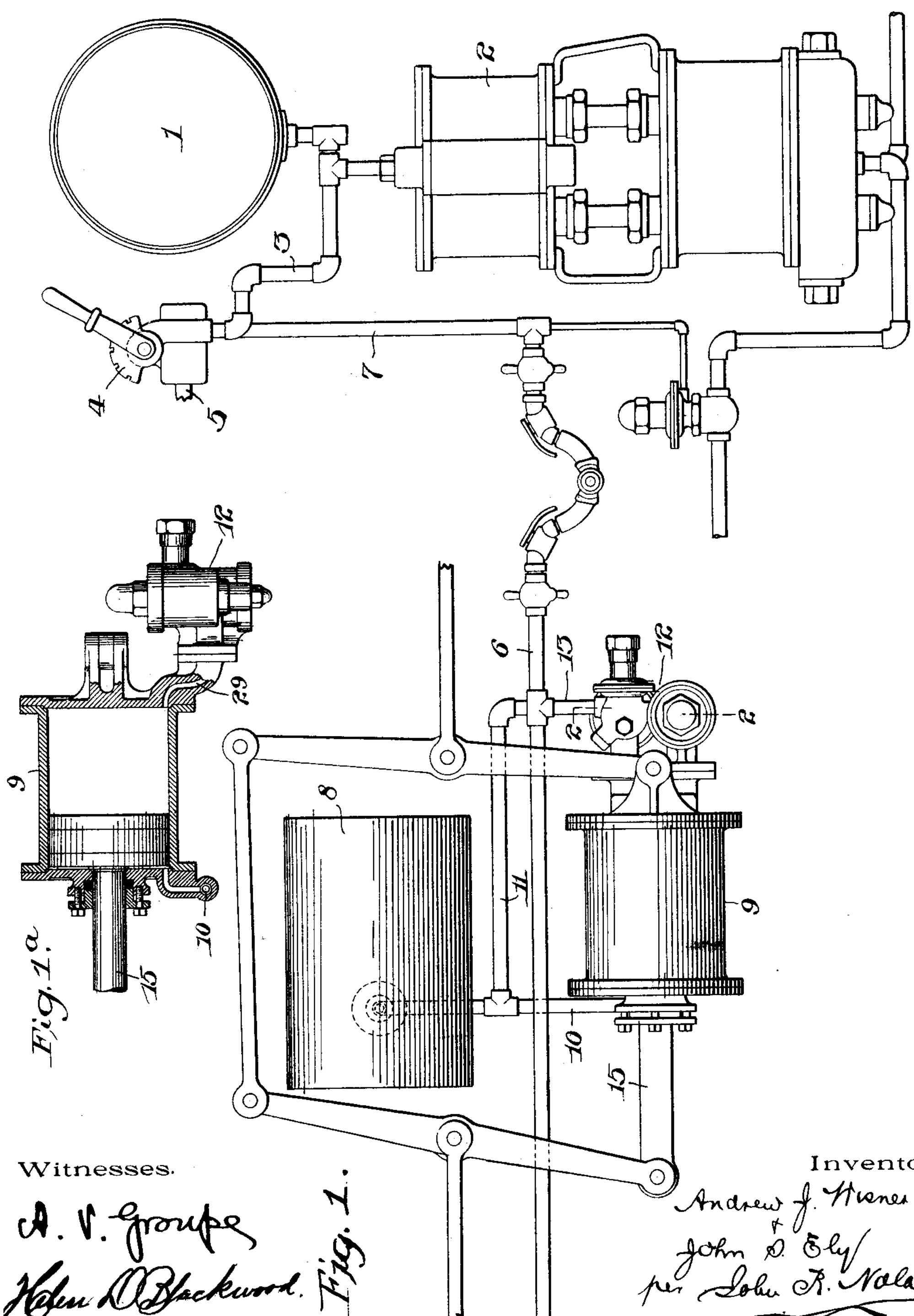

Fig. 1a.

Fig. 1.

Witnesses.

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Fig. 2.

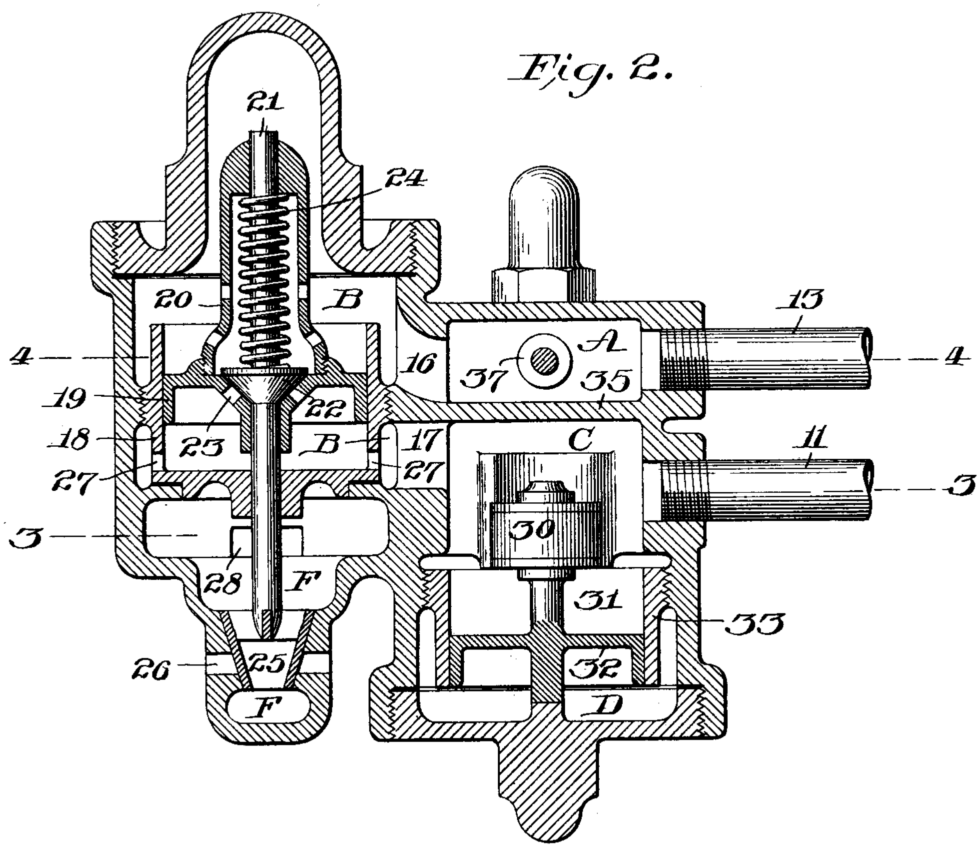

Fig. 3.

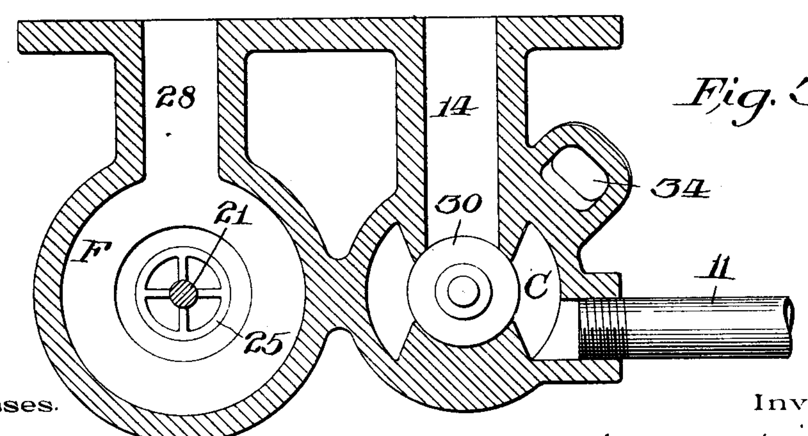

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Fig. 4.

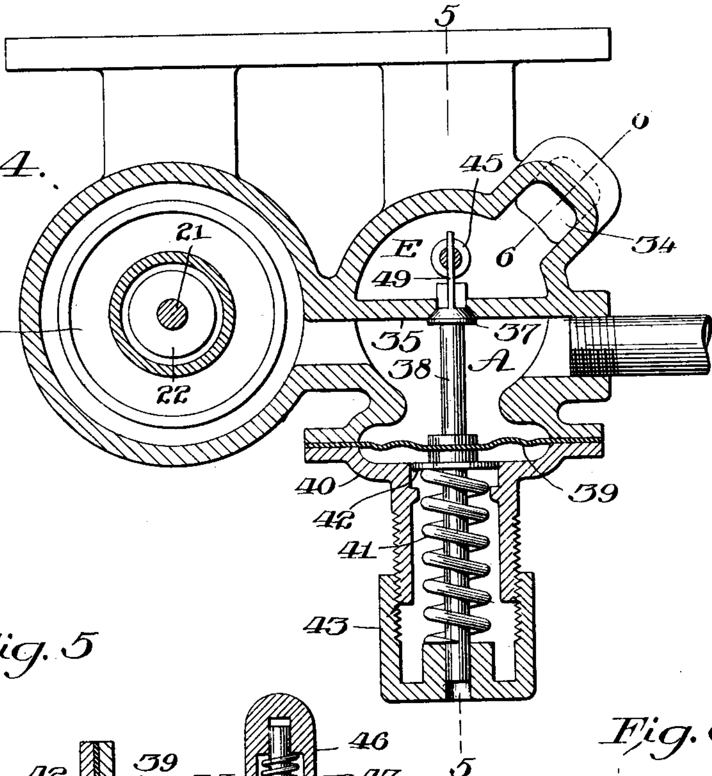


Fig. 5

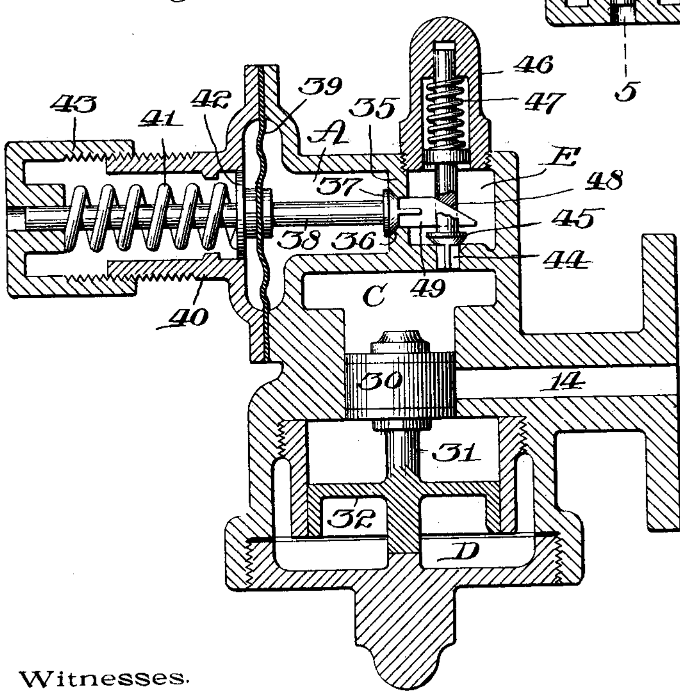
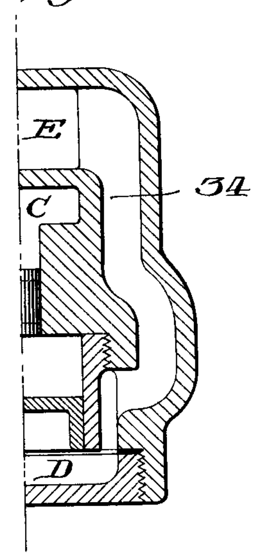


Fig. 6.



Witnesses.

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UNITED STATES PATENT OFFICE.

ANDREW J. WISNER, OF PHILADELPHIA, AND JOHN S. ELY, OF BRIDGEWATER, PENNSYLVANIA, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO WILLIAM F. ANDERSON, OF PHILADELPHIA, PENNSYLVANIA.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 676,019, dated June 11, 1901.

Application filed October 4, 1899. Serial No. 732,481. (No model.)

To all whom it may concern:

Be it known that we, ANDREW J. WISNER, residing in the city and county of Philadelphia, and JOHN S. ELY, residing in Bridgewater, in the county of Bucks, State of Pennsylvania, have invented certain new and useful Improvements in Air-Brakes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to that class of double-acting air-brakes in which compressed air is used to effect the application or the release of the brakes, as desired, our object primarily being to provide a simple and efficient construction and organization of mechanism whereby the charging of the auxiliary reservoir to braking pressure must be attained before the release of the brakes can be effected and which pressure shall be retained in the reservoir in readiness for instant application after the brakes have been released.

To this end our invention consists in the combination, with the train-pipe, the auxiliary reservoir, and the brake-cylinder communicating therewith, of improved valve mechanism operatively connected with the said pipe, the reservoir, and the cylinder, as will be hereinafter particularly described and claimed.

In the annexed drawings, Figure 1 is a diagram, partially in plan and partially in elevation, of an air-brake system embodying our invention. Fig. 1ª is a vertical section through the brake-cylinder, showing the controller-valve in elevation. Fig. 2 is a vertical section, enlarged, through the controller-valve as on the line 2 2 of Fig. 1. Fig. 3 is a horizontal section through said valve as on the line 3 3 of Fig. 2. Fig. 4 is a similar section as on the line 4 4 of Fig. 2. Fig. 5 is a vertical section as on the line 5 5 of Fig. 4. Fig. 6 is a sectional detail as on the line 6 6 of Fig. 4.

1 is the main air-reservoir, and 2 the supply-pump therefor. 3 is the air-pipe leading from the reservoir, 4 the engineer's controlling-valve on said pipe, and 5 the discharge-pipe from such valve to the open air. These parts are of any well-known or approved construction and are located upon the locomotive, as usual.

The main or train pipe 6 is coupled with a supply-pipe 7, leading from the valve 4, so that by proper manipulation of the latter the air may be directed from the reservoir to the pipe 6 or be discharged from this pipe to the open air in the usual manner. Arranged upon each of the cars comprising the train are the auxiliary air-reservoir 8 and the brake-cylinder 9. These are operatively connected with each other and with the train-pipe through a system of pipe and valve connections which constitute the novel and essential feature of our present invention and which we shall now proceed to describe in detail.

The rearward end of the brake-cylinder is connected with the auxiliary reservoir by a pipe 10, which is connected, by means of a branch pipe 11, with a controller-valve 12, arranged at the forward end of said cylinder. This valve is connected with the train-pipe by a branch pipe 13, between which and the pipe 11 communication may be secured through the medium of the controller-valve, whereby the pressure in the train-pipe may be directed to the auxiliary reservoir and the maximum pressure thus established in the latter. This valve is also connected with the forward end of the cylinder by port 14, whereby under certain conditions, hereinafter specified, communication between the train-pipe and the forward end of the cylinder may be had.

The rod 15 of the brake-piston extends through the rearward head of the cylinder and is connected, as usual, with the brake-actuating levers, as shown. Owing to the piston-rod the area of the rearward face of the piston is somewhat less than the forward face thereof, and therefore if the pressure in both portions of the cylinder be equal the excess of force on the front face of the piston will tend to maintain the latter at the rearward end of the cylinder. When the piston is in this position, the brakes are released. If, however, the pressure in the forward end of the cylinder be reduced below that in the rearward end thereof, the piston will be driven by the greater pressure toward the forward end of the cylinder, and thus effect the application of the brakes.

The construction of the controller-valve is such that the air in the auxiliary reservoir may be maintained at maximum pressure, that when the pressure is reduced in the train-pipe the air in the forward end of the cylinder will be allowed to escape preparatory to and during the application of the brakes, and that when the pressure is again increased in the train-pipe to effect an equal pressure in the train-pipe and the auxiliary reservoir the release of the brakes will be accomplished. The piston is therefore double-acting—that is, the full force of the air-pressure is at the command of the operator to drive the piston in either direction as may be desired.

Within the casing of the controller-valve 12 are formed relatively-arranged chambers A, B, C, D, E, and F, connected by ports and passages controlled by suitable valves. The branch pipe 13 from the train-pipe opens into the chamber A, and the branch pipe 11 leads from the chamber C. The chambers A and C communicate with the upper and lower parts of the chamber B by ports 16 and 17, respectively.

Secured or formed in the chamber B is a shell 18, which separates said chamber and the chamber F. In this shell is fitted a piston 19, from which rises a laterally-perforated sleeve 20, that is fitted at its upper end to a valve-stem 21, which extends freely through the piston and down into the chamber F. On the body of this stem is formed a valve-head 22, which is seated in the piston, the latter being provided with suitable ports 23, which are controlled by the head 22. This head is normally seated at a determinate pressure by the action of a spring 24, which, encircling the valve-stem, bears against said head and a shoulder at the upper end of the sleeve. On the lower extremity of this stem is another valve-head 25, which is seated at the bottom of the chamber F and is adapted to control lateral ports 26, leading from this chamber to the open air. The lower portion of this shell 18 is provided with orifices 27, which communicate with the lower portion of the chamber B. The upper portion of chamber F is provided with a port 28, that communicates with and forms, in effect, a continuation of a port 29, leading into the forward end of the brake-cylinder. Leading from the chamber C is the port 14, which, similarly to the port 28, communicates with port 29. The port 14 is controlled by a valve 30, the depending stem 31 of which carries at its lower end a piston 32, which separates the chambers C and D from each other. This piston is fitted in a suitably-located shell 33 in the casing. The chamber D is connected at a point below the piston 32 with the chamber E by a lateral duct or passage 34, formed in the valve-casing. This chamber E is disposed adjacent to the chamber A and is separated therefrom by a partition 35, provided with a port 36, in which is seated a valve 37. The stem 38 of this valve extends across the chamber A and is affixed to a diaphragm 39, which constitutes, in effect, the outer wall of the latter. The diaphragm is clamped to the valve-casing by a flanged sleeve 40, into which the valve-stem extends. In this sleeve is a spiral spring 41, which, encircling the extension of the stem, bears against a collar 42 on the latter and against a screw-cap 43 on the outer end of the sleeve, thereby holding the valve to its seat at a determinate pressure. The force of the spring may be nicely regulated by adjusting the screw-cap in respect to the end of the sleeve.

In the wall between chambers E and C is a port 44, in which is seated a valve 45, the stem of which extends into a cap 46 on the casing and is acted upon by a suitably-located spring 47, which tends to maintain the valve to its seat. In the valve-stem is a vertical slot 48, into which extends a beveled cam-plate 49 on the end of the valve 37 in such manner that when the latter valve is seated the valve 45 will be raised from its seat, and the converse.

The pressure from the train-pipe enters the chamber A, passes by way of port 16 into the upper part of chamber B, and acts upon the upper side of the piston-valve 19 in a manner to depress it against the force of the spring 24, thus opening the ports 23 in the piston-valve. The air passes through the lateral orifices in the sleeve 20 and through the ports 23 into the part of chamber B below the piston-valve, thence through the orifices 27 into the lower part of said chamber, thence through the port 17 into the chamber C, thence through the pipe 11 to the auxiliary reservoir. As the air from the train-pipe is thus directed to and compressed in the reservoir, the air accumulates under corresponding pressure in rear of the brake-piston and gradually moves it forward in a manner to effect the application of the brakes. As the air-pressure accumulates in the chamber A, it tends to force outwardly the diaphragm 39 against the pressure of the spring 41, the latter being so adjusted as to be overcome by a given pressure. When the spring has been overcome, the valve 37 is moved from its seat, thus opening the port 36 and permitting air to enter the chamber E and to pass thence through the passage 34 to the chamber D and therein act against the under side of the piston 32. When the valve 37 is unseated, the valve 45, being free from the action of the cam-plate 19, automatically closes the port between chambers E and C, and hence the pressure is constrained to enter the passage 34. Inasmuch as the pressure on the upper side of the piston 32 tending to hold it down is less than the initial train-pipe pressure by the force necessary to overcome the compression of the spring 41, the pressure below said piston will raise the same and therewith the valve 30, thus opening the port

14 and permitting the pressure in chamber C to enter the forward side of the brake-cylinder. Hence the air-pressure per square inch is equal on both sides of the brake-piston, and in virtue of the excess of force on the forward side of the piston the release of the brakes is effected, as above explained. As this operation is simultaneous throughout the entire train of cars, the train is now in complete control of the operator.

When it is desired to apply the brakes in service, the engineer's valve is manipulated to permit a part of the pressure in the train-pipe to escape to the outer air through the pipe 5, thereby reducing the pressure in the several chambers of the controller-valve 12 and effecting the following operation: The reduction of pressure in chamber B causes the piston 19 to rise and carry with it the valves 22 and 25, thus closing the ports 23 in the piston and opening the outlet-ports 26 at the lower end of chamber F. It will be obvious that the piston 19 must positively rise, as the full power of the air-pressure in the reservoir is below it and cannot return to the train-pipe. The air confined in the forward portion of the brake-cylinder escapes through the ports 26 to the open air, and in consequence the pressure on the rearward face of the brake-piston effects the application of the brakes, as above mentioned. As soon as the air-pressure in the auxiliary reservoir falls by expansion to train-pipe pressure the piston 19 and valves 22 and 25 resume their original position, and thus check the application of the brakes. It follows, therefore, that the greater the reduction of the train-pipe pressure the more severe will be the application of the brakes. Consequently, should an emergency occur and the engineer's valve be thrown entirely open or should the train part, the great fall in pressure in the train-pipe will cause instant application of all the brakes on the train. In case of emergency any of the train-hands can apply the brakes by opening the usual car-valve which is connected to the train-pipe for this purpose.

To release the brakes at any time, it is only necessary to open communication between the two ends of the brake-cylinder and effect thereby equalization of pressure in both ends of the piston. For this purpose the engineer by proper manipulation of his valve 4 effects an increase of pressure in the train-pipe, thereby closing the outlet-ports 26 and at the same time, by actuation of the diaphragm 39, effecting the opening of the port 36 between the chambers A and E and the closing of the port 44 between the latter chamber and the chamber C, the opening of the port 36 being attained by the retraction of the valve-stem 38 by the diaphragm and the closing of the port 44 by its spring 47 being permitted by the retraction of the cam-plate 49 in the slotted stem of the valve 45. The pressure thereupon enters chamber E through the open port and passes by way of the duct 34 to the under side of the piston 32 and lifts the same, with its valve 30, thus opening the port 14 to the rearward end of the cylinder. In this way the requisite communication is established between both ends of the brake-cylinder and the train-pipe.

As above indicated, the air-pressure received in the chamber A bears directly upon the diaphragm, but does not actuate the same unless and until a predetermined pressure has been attained, such pressure being determined by the resistance of the adjustable spring 41 and being sufficient to control the train on heavy grades. Therefore until the prescribed pressure has been reached the valve 30 on the piston 32 cannot be opened and the brakes, if applied, cannot be released.

From the foregoing it will be seen that the release of the brakes cannot be attained without first charging the auxiliary reservoir to braking-pressure and that therefore if at any time it be desirable to slightly release the brakes in descending a grade there is no danger in so doing, inasmuch as the operator can be certain of having sufficient pressure in the auxiliary reservoir for their instant re-application.

We claim—

1. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir having communication with one end of the cylinder, the train-pipe, a controller-valve comprising a series of relatively arranged chambers, a connection between one of said chambers and the train-pipe, a connection between another of said chambers and the auxiliary reservoir, a valve mechanism controlling communication between the latter chamber and the reverse end of the cylinder, and adapted to be actuated by train-pipe pressure to open the communication only when such pressure exceeds the normal braking-pressure, a valve mechanism controlling communication between the two chambers specified and adapted to be actuated by train-pipe and auxiliary pressure, and a valve controlling communication between such reverse end of the cylinder and the open air and operatively connected with the valve mechanism first named, substantially as described.

2. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir having communication with one end of the cylinder, the train-pipe, a controller-valve comprising a series of relatively arranged chambers, a connection between one of said chambers and the train-pipe, a connection between another of said chambers and the auxiliary reservoir, a valve mechanism controlling communication between the latter chamber and the reverse end of the cylinder and adapted to be actuated by train-pipe pressure to open the communication, a piston interposed between the two chambers specified and provided with a valved port that is adapted to be opened by train-pipe pres-

sure and closed by auxiliary pressure, and a valve controlling communication between such reverse end of the cylinder and the open air and operatively connected with the latter piston, substantially as described.

3. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir having communication with one end of the cylinder, the train-pipe communicative with said reservoir, valve mechanism controlling the communication between the train-pipe and the auxiliary reservoir, a connection between the train-pipe and the reverse end of the cylinder, a valve therefor adapted to be actuated by train-pipe pressure only when the same has exceeded the normal braking pressure, a passage from such reverse side of the cylinder communicative with the auxiliary reservoir, and an automatically-operating valve for controlling such communication, substantially as described.

4. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir having communication with one end of the cylinder, the train-pipe communicative with said reservoir, valve mechanism controlling communication between said pipe and the reservoir, an outlet-passage from the reverse end of the cylinder, a valve therefor operatively connected with said valve mechanism, a passage leading from such reverse end of the cylinder and communicative with the auxiliary reservoir, a valve controlling such communication and adapted to be governed by auxiliary and train-pipe pressures, and valve mechanism for determining the minimum amount of train-pipe pressure directed to the valve last named, substantially as described.

5. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir communicating with one end of said cylinder, the train-pipe communicative with said reservoir, valve mechanism for controlling such communication, a passage from the reverse end of the cylinder communicative with the open air, valve mechanism for controlling the communication of the passage with the open air, a passage affording communication between such reverse end of the cylinder and the auxiliary reservoir, a valve controlling said latter passage exposed on its upper face to auxiliary pressure, a passage leading to the under part of said valve, two valves arranged to control the communication of the last-named passage with the auxiliary reservoir and the train-pipe respectively, and means under the control of the train-pipe pressure whereby the valves last named may be actuated to open and close their respective ports in alternate succession, substantially as described.

6. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir communicating with one end of said cylinder, the train-pipe communicative with said reservoir, valve mechanism for controlling such communication, a passage from the reverse end of the cylinder communicative with the open air, valve mechanism for controlling the communication of the passage with the open air, a passage affording communication between such reverse end of the cylinder and the auxiliary reservoir, a valve controlling said latter passage exposed on its upper face to auxiliary pressure, a passage leading to the under part of said valve, two valves arranged to control the communication of the last-named passage with the auxiliary reservoir and the train-pipe respectively, a cam connection between the last-named valves, a diaphragm connected with one of said valves and constructed and arranged to be actuated by train-pipe pressure, and means acting upon the diaphragm in opposition to such pressure, substantially as described.

7. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir communicating with one end of said cylinder, the train-pipe communicative with said reservoir, valve mechanism for controlling such communication, a passage from the reverse end of the cylinder communicative with the open air, valve mechanism for controlling the communication of the passage with the open air, a passage affording communication between such reverse end of the cylinder and the auxiliary reservoir, a valve controlling said latter passage exposed on its upper face to auxiliary pressure, a passage leading to the under part of said valve, two valves arranged to control the communication of the last-named passage with the auxiliary reservoir and the train-pipe respectively, a cam connection between the last-named valves, a diaphragm connected with one of said valves and constructed and arranged to be actuated by train-pipe pressure, a spring acting upon the diaphragm in opposition to such pressure, and means for regulating the force of the spring, substantially as described.

8. In an air-brake system, the combination of the brake-cylinder, its piston, the auxiliary reservoir communicating with one end of said cylinder, the train-pipe, the controller-valve comprising the chambers A, B, C, D, E and F, whereof the chambers A and C are connected with the train-pipe and the auxiliary reservoir respectively, ports leading from said chambers A and C to the upper and lower portions of chamber B respectively, a piston fitted in chamber B between said ports, and provided on its upper side with a perforated valve-seat, a check-valve normally bearing on said seat, an outlet-port in chamber F, a valve therefor connected with the stem of the check-valve, ports or passages leading from chambers F and C respectively to the reverse end of the cylinder, a piston interposed between chambers C and D and provided with a valve seated in chamber C at the mouth of its port, a duct or passage connecting chambers D and E, ports connecting chamber E

with chambers A and C respectively, spring-actuated check-valves for said latter ports, a cam connection between said valves whereby when one of their ports is closed the other is open, and a diaphragm in chamber A connected with the stem of the valve controlling the port between said latter chamber and the chamber E, substantially as described.

In testimony whereof we have hereunto affixed our signatures in the presence of two subscribing witnesses.

ANDREW J. WISNER.
JOHN S. ELY.

Witnesses:
ANDREW V. GROUPE,
JOHN R. NOLAN.