No. 785,537. PATENTED MAR. 21, 1905.

C. E. BARRY.

TRIPLE VALVE.

APPLICATION FILED SEPT. 8, 1903.

Fig. 1.

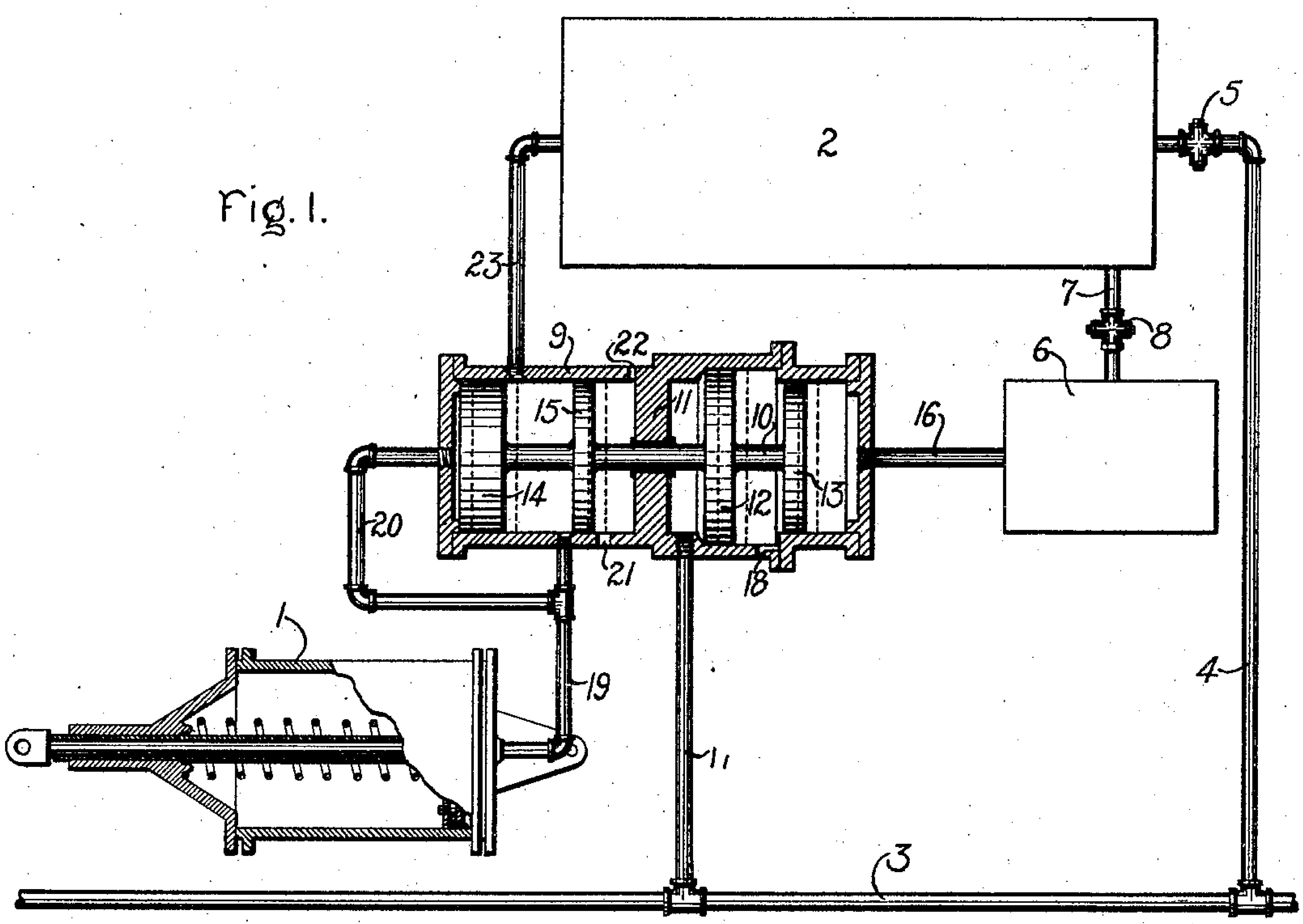


Fig. 2.

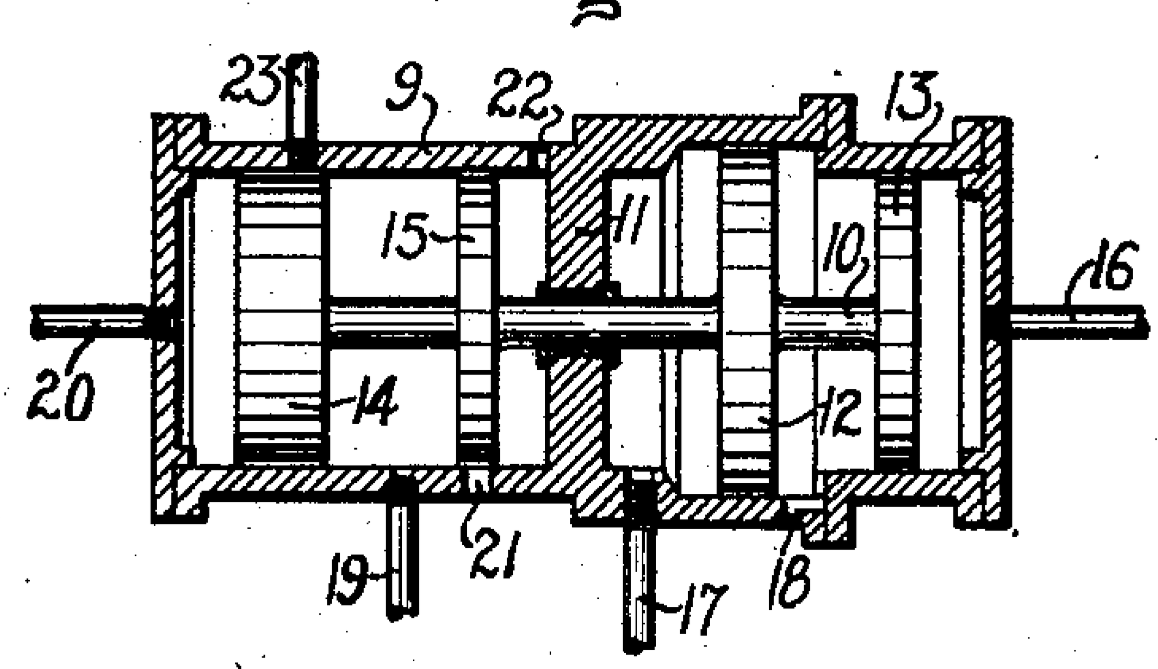
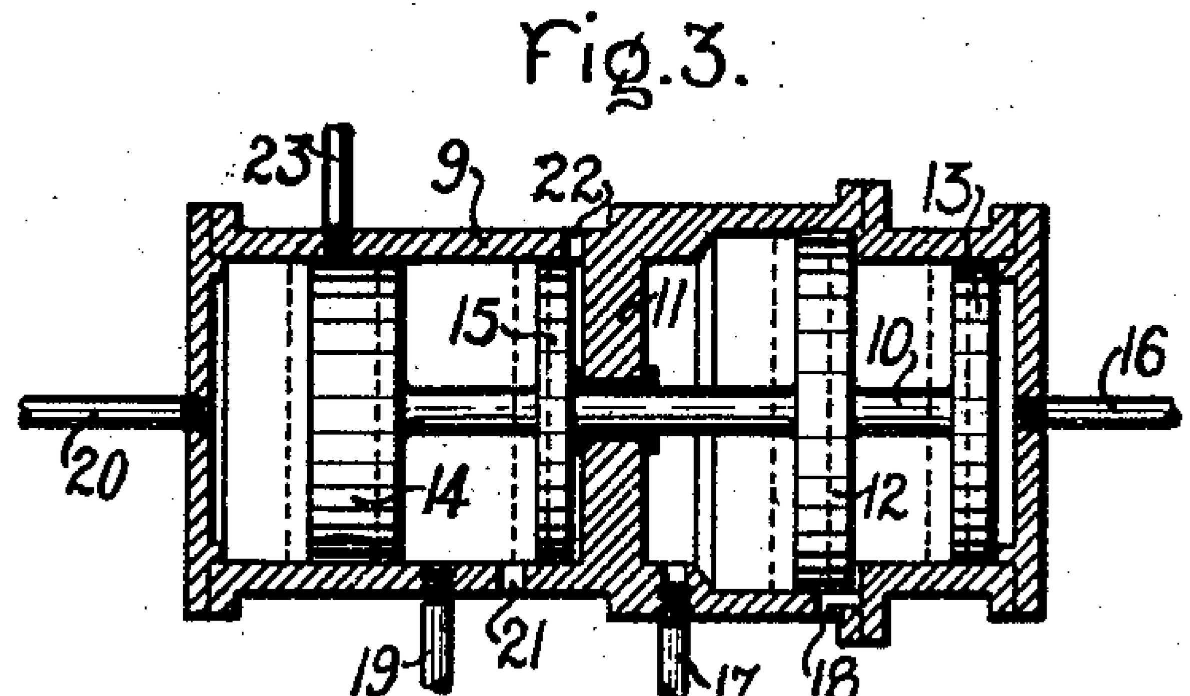


Fig. 3.



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No. 785,537. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

CHARLES E. BARRY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TRIPLE VALVE.

SPECIFICATION forming part of Letters Patent No. 785,537, dated March 21, 1905.

Application filed September 8, 1903. Serial No. 172,272.

To all whom it may concern:

Be it known that I, CHARLES E. BARRY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Triple Valves, of which the following is a specification.

My invention relates to "automatic" air-brake systems—that is, systems in which the brakes are applied by a reduction in the pressure of air in the train-pipe—in contradistinction to "straight" air systems, in which the brakes are applied by an increase in such pressure. In systems of this type each car is provided with a brake-cylinder, an auxiliary reservoir which is supplied with compressed air from a train-pipe, and a so-called "triple valve," which operates upon a reduction of pressure in the train-pipe to admit air from the auxiliary reservoir to the brake-cylinder to apply the brakes and upon an increase of train-pipe pressure to cut off the supply connection with the auxiliary reservoir and to exhaust the brake-cylinder to release the brakes. My invention has particular reference to the triple valve; and one of its objects is to provide a novel form of valve by which the engineer may control the release of the brakes, so as to maintain any desired braking pressure in the brake-cylinder—in other words, to provide an improved means for gradually releasing the brakes and stopping the releasing operation at any desired point. In the case of systems now in common use serious difficulties often arise in the handling of long trains because of the inability of the engineer to partially release the brakes. In such systems the brakes on each car are fully released at a single operation, and the releasing action also takes place on the different cars in succession, so that often when the brakes are released while the train is running at a considerable speed thé head of the train, having the check to its speed suddenly removed in advance of the rear, moves forward with such force as to break the train into two or more parts. By the employment of my invention this difficulty is overcome.

Another object of my invention is to provide a valve mechanism which shall be economical in operation and by which large variations in brake-cylinder pressure may be produced by small variations in train-pipe pressure, so that a maximum brake application may be obtained with a relatively small reduction of pressure in the train-pipe, and, conversely, a great restoration of pressure in the brake-cylinder with a small restoration of train-pipe pressure.

Other objects and advantages of my invention will appear from the following detailed description, taken in connection with the accompanying drawings, in which—

Figure 1 is a view illustrating, partly in diagram, one embodiment of my invention and showing the triple valve with its piston in "application" position; and Figs. 2 and 3 are similar views of said valve with the piston in "lap" and "release" positions, respectively.

Referring in detail to the drawings, 1, 2, and 3 designate the usual brake-cylinder, auxiliary reservoir, and train-pipe, respectively, with which the triple valve is associated. The train-pipe and the auxiliary reservoir are connected by a pipe 4, which permits a flow of air from the train-pipe to the auxiliary reservoir and through the agency of a check-valve 5 prevents a flow in the opposite direction. A supplemental reservoir 6 is connected with the reservoir 2 by a pipe 7, which is provided with a check-valve 8, arranged to permit a flow of air only toward the supplemental reservoir. The triple valve comprises a casing 9, provided with suitable ports and connections, and a piston 10 for controlling said ports. A transverse partition 11 within the casing divides its interior into two compartments, in which are located the heads 12, 13, 14, and 15 of the piston 10, the heads 12 and 13 occupying the upper compartment and the heads 14 and 15 the lower. A pipe 16, leading from the supplemental reservoir 6 to the upper end of the casing 9, supplies air to the upper face of the head 13, and this air by reason of the small displacement of the head 13 relative to the volume of the supplemental reservoir exerts a practically constant pressure which tends to move the piston toward the lower end of the casing 9. A pipe 17, leading from the train-pipe 3 to the upper compartment, supplies train-pipe air to the lower side of the head 12, and a port 18 maintains the air in the space between the heads 12 and 13 at atmospheric pressure. Brake-cylinder air is supplied to the lower side of the head 15 and both sides of the head 14 through the pipes 19 and 20. The pressures on the lower side of head 15 and the upper side of the head 14 balance each other, so that they have substantially no influence upon the movement of the piston, the only pressure tending to move the piston being on the lower side of the head 14, reacting against the lower head of the valve-casing. This pressure, in conjunction with the train-pipe pressure acting on the lower face of the head 12, opposes the supplemental-reservoir pressure acting upon the upper face of the head 13. An exhaust-port 21 communicates with the lower compartment and when the parts have moved to the position shown in Fig. 3 provides an escape-opening for the brake-cylinder air. Another port, 22, communicates with the lower compartment at a point adjacent to the partition 11, so as to maintain the air on the upper side of the head 15 always at atmospheric pressure. A pipe 23 connects the auxiliary reservoir 2 with the lower compartment of the casing 9 at a point somewhat below the brake-cylinder port, the distances between the heads 14 and 15 and between the auxiliary-reservoir, brake-cylinder, and exhaust ports being so proportioned that communication may be established between the brake-cylinder and the auxiliary reservoir or between the brake-cylinder and atmosphere, or both auxiliary-reservoir and exhaust ports may be closed, as illustrated in Fig. 2.

In operation the piston 10 is balanced between supplemental-reservoir pressure on the one hand and combined brake-cylinder and train-pipe pressures on the other, and when the train-pipe pressure falls off the brake-cylinder is charged from the auxiliary reservoir to restore the balance, and when the train-pipe pressure increases the brake-cylinder is exhausted sufficiently to make up the difference and again restore the balance.

Considering the operation more in detail, as soon as the engineer's valve is moved to admit air from the main reservoir to the train-pipe compressed air will flow from the train-pipe through the pipe 4 to the auxiliary reservoir and thence by way of the pipe 7, supplemental reservoir 6, and pipe 16 to the upper side of the piston-head 13 in the casing 9 and from the train-pipe through the pipe 17 to the lower side of the head 12. If the auxiliary-reservoir port is uncovered by the head 14, air will also flow into the brake-cylinder from the auxiliary reservoir; but if said port be closed the brake-cylinder will remain uncharged, and atmospheric pressure only will act on the lower face of the head 14. In either event the piston 10 will be moved to the position illustrated in Fig. 3, since the force on the lower side of the head 12 will overcome the opposing force on the upper side of the head 13 whether the pressure in the brake-cylinder be at that of atmosphere or greater, since the area of the head 12 is greater than that of the head 13 and the intensities of the pressures in the supplemental reservoir and train-pipe are equal. When this, the release or running, position of the piston is attained, any air that may have been fed to the brake-cylinder before such movement will be exhausted therefrom by way of the pipe 19 and the port 21. With the parts thus charged, if it is desired to apply the brakes for an ordinary service stop the train-pipe pressure is reduced until the pressure acting on the lower side of the head 12 becomes less than that acting on the upper side of the head 13. This difference will cause the piston to move toward the left until the head 14 partially uncovers the auxiliary-reservoir port. Air will then flow from the auxiliary reservoir to the brake-cylinder and continue to flow until the pressure on the lower side of the head 14 has increased sufficiently to neutralize the effect of reduction of pressure on the lower face of the head 12 and move the piston upward sufficiently to cut off the auxiliary-reservoir supply. This will bring the piston to the lap position. (Illustrated in Fig. 2.) When air flows from the auxiliary reservoir into the brake-cylinder, it will force the brake-cylinder piston toward the left to apply the brakes. If an increased brake application is desired, a further reduction in train-pipe pressure is made. This will again cause the piston to move toward the left, so as to partially uncover the auxiliary-reservoir port, and thereby admit air to the brake-cylinder until the brake-cylinder pressure has risen suffcently to counteract the effect of the train-pipe-pressure reduction, and thereby again force the parts to lap position, as before. When it is desired to release the brakes, the operation is substantially the same as that which takes place when charging the system, as previously described—that is, the train-pipe pressure is increased and the piston is moved toward the right, so as to wholly or partially uncover the exhaust-port 21 and cover the auxiliary-reservoir port, and thereby allow air to escape from the brake-cylinder to atmosphere. The amount of air that may escape from the brake-cylinder, and therefore the degree of brake-cylinder reduction, will depend directly upon the increase of train-pipe pressure. For instance, if the train-pipe pressure increase is small, the necessary change in brake-cylinder pressure will also be small. On the other hand, if a considerable increase of train-pipe pressure is made it can only be neutralized by a considerable reduction in brake-cylinder pressure. It will also be apparent that in applying or releasing the brakes more or less of the auxiliary-reservoir port or the exhaust-port 21 will be uncovered, according to the amount of train-pipe variation. Such intermediate positions of the piston are shown by the dotted lines in Figs. 1 and 3. Where the reduction in train-pipe pressure is large, the parts will be thrown to the position shown in Fig. 1 and the brake-cylinder will be charged rapidly, and where the train-pipe pressure is increased suddenly the parts will be thrown to the position shown in Fig. 3, and the brake-cylinder will exhaust rapidly.

As to the proportioning of the various parts of the valve, it should be noted that the heads 14 and 15 are, in effect, a single head with a deep annular port whose depth may be varied as desired and that the size of the head 13 determines the effective pressure of the entrapped supplemental-reservoir air in that end of the casing, and variations of the size of said head will only correspondingly vary said pressure. On the other hand, variations of the areas of the heads 12 and 14 will produce different brake-cylinder-pressure variations corresponding to any given train-pipe-pressure variations. In the preferred form of the invention the head 12 is made somewhat larger than the head 14, so that slight variations of pressure in the train-pipe will produce considerable variations of pressure in the brake-cylinder. This will be apparent upon consideration of a specific case. For this purpose let it be assumed that the area of the head 12 is two square inches, that of the head 14 one square inch, and that the maximum train-pipe pressure is seventy pounds per square inch. Under such conditions it will be apparent that with seventy pounds pressure in the auxiliary and supplemental reservoirs and in the train-pipe the parts would assume the position illustrated in Fig. 3 and that a five-pound reduction in train-pipe pressure would reduce by ten pounds the effective pressure exerted upon the lower side of the head 12, and in order to neutralize this loss of pressure and bring the piston to the lap position (illustrated in Fig. 2) a brake-cylinder-pressure variation slightly greater than ten pounds acting upon the one-square-inch area of the head 14 would be required. Similarly a train-pipe reduction of ten pounds would be followed by a brake-cylinder increase slightly greater than twenty pounds, and so on, each train-pipe reduction causing a corresponding increase of substantially twice the value. This action would continue until the train-pipe pressure had fallen to substantially thirty-five pounds, when the brake-cylinder pressure would be a maximum, or slightly less than seventy pounds. Similarly in releasing the brakes train-pipe-pressure variations between the limits thirty-five and seventy pounds would produce corresponding brake-cylinder-pressure variations substantially between the limits naught and seventy. It will of course be apparent that since the brake-cylinder can only be charged by the expansion of the air in the auxiliary reservoir it can never be charged to the full seventy pounds pressure; but the maximum pressure will be slightly less than seventy pounds, and this will be balanced by a train-pipe pressure slightly less than thirty-five pounds, so that the limits thirty-five and seventy are approximate only.

I do not wish to be limited to the particular construction herein disclosed, since it is apparent that many alterations and modifications may be made without departing from the spirit of my invention, and I aim to cover by the terms of the appended claims all such alterations and modifications.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an air-brake system, the combination of a train-pipe, a brake-cylinder, an auxiliary reservoir, a valve adapted to connect brake-cylinder to auxiliary reservoir or to atmosphere, a piston controlling said valve and comprising two heads of unequal areas subjected to train-pipe pressure and to brake-cylinder pressure respectively, and means for impressing on said piston a constant force opposing said pressures.

2. In an air-brake system, the combination of a train-pipe, a brake-cylinder, a piston comprising two heads of unequal areas subjected to train-pipe pressure and to brake-cylinder pressure respectively, means for impressing on said piston a constant force opposing said pressures, and means operatively connected to said piston for varying the pressure of the air in the brake-cylinder.

3. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder and mechanism connected therewith, comprising a movable member having abutments of unequal areas subjected, the larger to train-pipe pressure and the smaller to brake-cylinder pressure, and means coöperating therewith for varying the pressure of the air in the brake-cylinder.

4. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder and valve mechanism comprising a casing connected therewith and provided with an exhaust-port and a piston having a plurality of heads, means for entrapping compressed air in a portion of said casing adjacent to one of said heads, other heads being subjected to brake-cylinder and train-pipe pressures, and means coöperating therewith for controlling the flow of air from the auxiliary reservoir to the brake-cylinder and from the brake-cylinder to atmosphere.

5. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-

cylinder, and valve mechanism for controlling the flow of air to and from the brake-cylinder, comprising means normally cutting off the brake-cylinder supply and exhaust-passages under the equal opposing effects of a constant pressure on one side and combined train-pipe and brake-cylinder pressures on the other and operating upon an increase or decrease of train-pipe pressure to establish a communication to produce a decrease or an increase respectively of the brake-cylinder pressure to restore the equality.

6. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder, and a triple valve for controlling the flow of air to and from the brake-cylinder, comprising a movable member subjected to a practically constant pressure tending to move it in one direction and brake-cylinder and train-pipe pressures tending to move it in the opposite direction, the member being so constructed and arranged that a variation of one kind in the train-pipe pressure will establish a connection to bring about a variation of the opposite kind in the brake-cylinder.

7. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder, a valve-casing, a piston therein having an upper and a lower head, means for entrapping compressed air in said casing at the upper side of the upper head, a port for supplying train-pipe air to said casing at the lower side of the upper head, a port for supplying brake-cylinder air to said casing at the lower side of the lower head, an exhaust-port in said casing adjacent to the brake-cylinder port and adapted to be closed by the lower head when the combined train-pipe and brake-cylinder pressures equal the pressure of the entrapped air and to be opened to establish communication with the brake-cylinder port when the train-pipe pressure is increased, a port for supplying auxiliary-reservoir air to said casing at a point below said brake-cylinder port, and means for closing said auxiliary-reservoir port when the combined train-pipe and brake-cylinder pressures equal the pressure of the entrapped air and for opening it to establish communication with the brake-cylinder port when the train-pipe pressure is reduced.

8. In an air-brake system, the combination of a train-pipe, an auxiliary reservoir, a brake-cylinder, a cylindrical valve-casing comprising an upper and a lower compartment, a piston therein having a head in each compartment, means for entrapping compressed air at the upper side of the upper head, a port for supplying train-pipe air to the upper compartment at the lower side of the upper head, a port for supplying brake-cylinder air to the lower compartment at the lower side of the lower head, an exhaust-port leading from the lower compartment adjacent to the brake-cylinder port and adapted to be closed by the lower head when the combined train-pipe and brake-cylinder pressures equal the pressure of the entrapped air and to be opened to establish communication with the brake-cylinder port when the train-pipe pressure is increased, a port for supplying auxiliary-reservoir air to said lower compartment at a point above the brake-cylinder port, and means moved by said piston to close said auxiliary-reservoir port when the combined train-pipe and brake-cylinder pressures equal the pressure of the entrapped air and to open said port to establish communication with the brake-cylinder port when the train-pipe pressure is decreased.

In witness whereof I have hereunto set my hand this 4th day of September, 1903.

CHARLES E. BARRY.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.