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F. B. COREY.

AIR BRAKE SYSTEM AND AUTOMATIC VALVE.

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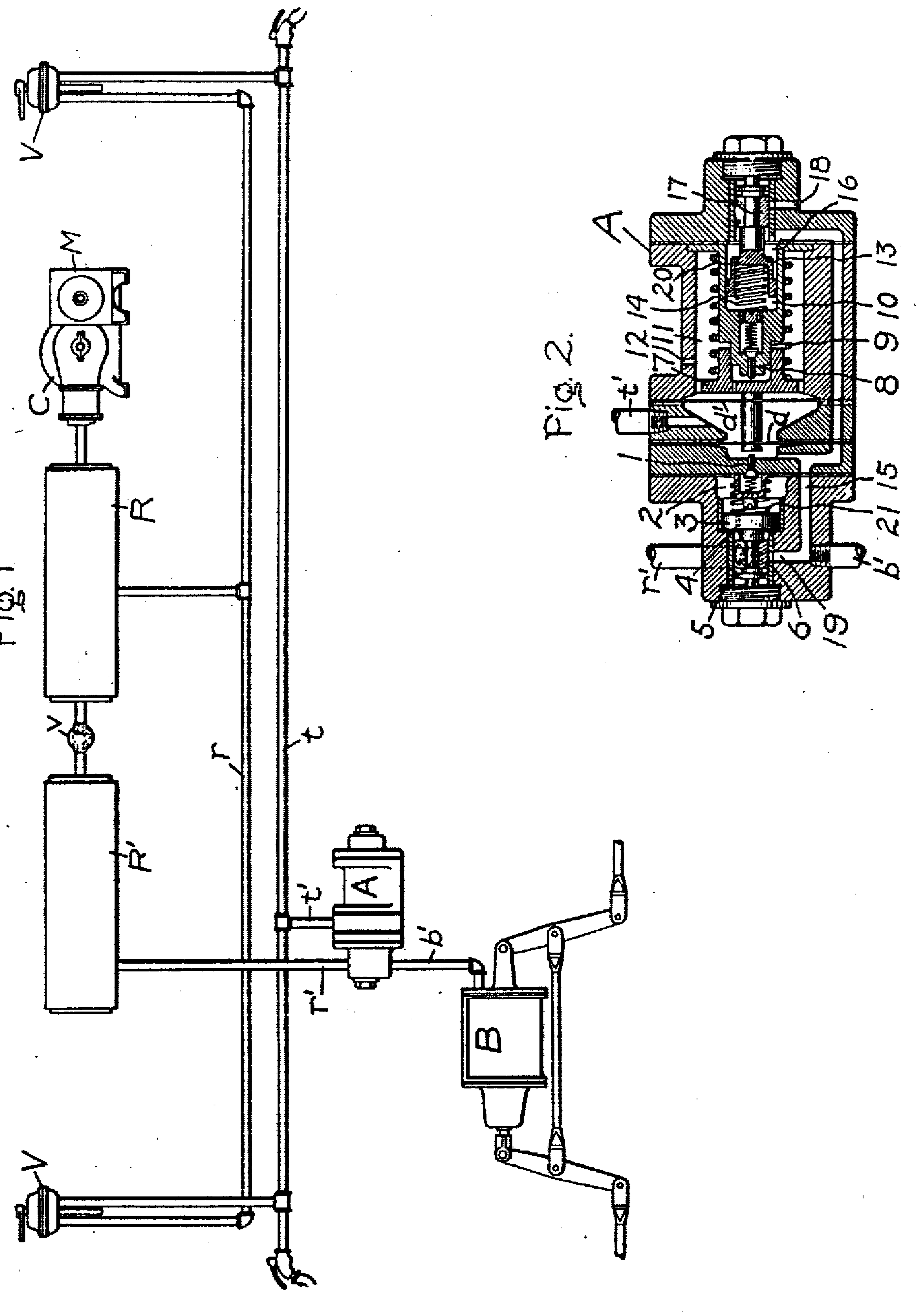

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UNITED STATES PATENT OFFICE.

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AIR-BRAKE SYSTEM AND AUTOMATIC VALVE.

No. 811,765. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed September 16, 1904. Serial No. 224,651.

To all whom it may concern:

Be it known that I, FRED B. COREY, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have inventd certain new and useful Improvements in Air-Brake Systems and Automatic Valves, of which the following is a specification.

My invention relates to air-brake systems; and its object is to provide a novel system which possesses all the characteristic advantages of the automatic air-brake system and in addition certain other advantages not heretofore obtained, including means for obtaining a graduated application of the brakes and an operation of the brakes with a very small amount of air.

In the automatic system as ordinarily employed, in which the main reservoir is carried at one end of the train and air for the brakes is transmitted from the main reservoir through the train-pipe to the several auxiliary reservoirs, the train-pipe for long trains must be of considerable size, and consequently a great amount of air is wasted in raising and lowering the train-pipe pressure in the operation of the brakes. On the other hand, when each car is provided with its own source of compressed air, the reservoirs on the several cars being connected to a common train-pipe, it is necessary to provide more or less complicated means for synchronizing the governors for the several compressors in order to distribute the work properly among the compressors. By my invention I provide each car with its own source of compressed air, but maintain the braking systems of the several cars independent of each other, so that no synchronizing means for the governors is required, and I provide a control-pipe extending through the train by means of which an automatic valve on each car is controlled, so as to apply and release the brakes. Since this control-pipe does not carry air for the brakes, but merely operates an automatic or relay valve on each car, it may be made very small as compared with the usual train-pipe, and consequently a great economy of air in braking results. Furthermore, I so arrange the automatic valves that they return automatically to lap position whenever the pressure in the brake-cylinder bears a certain relation to that in the train-pipe. Consequently by reducing the pressure in the train-pipe step by step the pressure in the brake-cylinder is raised step by step, so as to obtain a graduated series of increases and reductions of braking force without an intermediate total release, as is required in an automatic system.

My invention, then, in one aspect consists in the combination with a train of cars of a source of compressed air on each car, a control-pipe extending through the train, and an automatic valve on each car responsive to variations of pressure in the control-pipe and arranged to connect the brake-cylinder on the car to reservoir to apply the brakes or to atmosphere to release the brakes, the valve being arranged to return automatically to lap position whenever the pressure in the brake-cylinder bears a certain relation to that in the control-pipe.

More specifically considered, my invention consists in a combination, as above stated, provided with automatic valves responding differentially to the pressures in the brake-cylinders and control-pipe.

Another feature of my invention consists in providing two reservoirs on each car charged from the same compressor, but separated from each other by a check-valve, one of the reservoirs being connected through the motorman's valve to the control-pipe and the other being connected to the automatic valve. With this arrangement it is evident that if the train breaks apart, exhausting the control-pipe, and if the motorman's valve has been left in release position—that is, with the reservoir connected to the control-pipe, so that the reservoir itself is exhausted—the check-valve between the two reservoirs will maintain the pressure in the second reservoir so that it will be available for applying the brakes.

Another feature of my invention consists in the novel construction and arrangement of the automatic valve whereby the desired differential action is obtained.

Other features of my invention will appear in the following specification and accompanying drawings, in which—

Figure 1 shows diagrammatically the air-brake system of one car of a train arranged in accordance with my invention, and Fig. 2 shows a sectional view of the automatic valve.

In Fig. 1, C represents the compressor driven by the electric motor M. The governor (not shown) for the compressor is arranged to respond to variations in the pressure of reservoir R, connected to the compressor, and to control the circuit of the motor M in the usual manner. No connection between the several governors on the train is required, as has been heretofore explained. The reservoir R is connected to a reservoir-pipe r, extending the length of the car and connected at each end to the usual motorman's valve V, to which is also connected the train-pipe t. The motorman's valves are arranged to connect the train-pipe t to reservoir R or to atmosphere, so as to raise and lower the pressure in the train-pipe t. Connected to the train-pipe t, through the connection t', is an automatic valve A, which is also connected through the pipe r' to the second reservoir R', which is connected to the first reservoir R through a check-valve v. This check-valve is so arranged as to permit a free flow of air from reservoir R to reservoir R', but prevents a flow in the opposite direction, the purpose being, as heretofore explained, to prevent the lowering of pressure in reservoir R' if reservoir R is exhausted by a breakage of the train-pipe. The automatic valve A controls the connection, as will be hereinafter explained, between the pipe r', leading to reservoir R', and the pipe b', leading to the brake B. The train-pipe is provided at each end with couplings, as shown, for connection with the other cars of the train, it being understood that the equipment of each car is a duplication of that shown in Fig. 1.

The construction of the automatic valve A is shown in Fig. 2. The connections to the reservoir-pipe, the control-pipe, and the brake-pipe are indicated by the letters r', t', and b'. The connection t' to the control-pipe opens into a chamber between two rigidly-connected diaphragms d and d', the latter being of greater effective area than the former. The smaller diaphragm d is subjected on its outer side to the brake-cylinder pressure, to which it is connected through the passage 15 and the pipe connection b'. The diaphragm d' is connected on its outer side to atmosphere through the chamber 11 and a port 12, but is subjected to the pressure of the piston 7, which is pressed against the diaphragm d' by the compression-spring 9. 1 and 8 represent two spring-pressed pilot-valves, which are normally held seated, as shown, by springs, but one of which is raised from its seat when diaphragms d and d' move in one direction or the other. When the diaphragms are moved toward the left, the raising of pilot-valve 1 connects chamber 2 to brake-cylinder through passage 15 and pipe b'. The chamber 2 is closed at the left-hand end by the piston 3, but is connected through a restricted passage 4 in this piston to chamber 5 on the left of the piston, into which opens the connection r' to the reservoir-pipe. The piston 3 carries a valve 6, which normally closes a port 19, leading to the brake-cylinder pipe connection b'. The other pilot-valve 8 when raised from its seat establishes a connection from chamber 10 to chamber 11 and thence through port 12 to atmosphere. Chamber 10 is closed at its right-hand end by the piston 13, which is pressed into the position shown by the spring 14. Chamber 10 is connected through a restricted passage 20 in piston 13 with the chamber 16, which is in connection with the brake-pipe connection b' through the passage 15. The piston 13 carries the valve 17, which when the piston is in the position shown closes the passage 18, leading to atmosphere. The several parts of the valve are thus shown in lap position.

The operation is then as follows: With the several parts of the auxiliary valve in the position shown if it is desired to apply the brakes the pressure in the control-pipe is reduced. The reduction of pressure between the diaphragms d and d' allows the spring 9 to move the diaphragms toward the left, so as to raise pilot-valve 1 from its seat. Chamber 2 is consequently connected to brake-cylinder through passages 15 and pipe connection b', and since the brake-cylinder is at atmospheric pressure, the brakes being released, the chamber 2 is exhausted. The restricted passage 4 in piston 3 is not sufficient to maintain an equality of pressure on its opposite sides, and consequently the reservoir-pressure in chamber 5 pushes piston 3 to the right against the pressure of spring 21, moving valve 6, so as to open port 19. This connects the reservoir-pipe connection r' to the brake-pipe connection b' through chamber 5, and consequently the pressure in the brake-cylinder is raised and an application of the brakes is secured. As the brake-pressure rises the pressure is raised on the outer side of diaphragm d until a point is reached at which a pressure of spring 9 on the outer side of diaphragm d' is balanced, so that the diaphragms are moved back to lap position, as shown, closing pilot-valve 1. When this valve is closed, the pressure in chamber 2 is quickly equalized with that of chamber 5 by means of the passage 4, so that spring 21 is allowed to push piston 3 back into position shown, breaking the connection between pipes r' and b'. If it is desired to increase the brake-pressure, the pressure in the control-pipe t' is further reduced, and the operation that has just been described is repeated. In this manner a graduated application of the brakes may be obtained. Now if it is desired partly to release the brakes the pressure in the control-pipe is raised a certain amount. This increase of pressure on the inner side of diaphragm d' overpowers spring 9 and moves the piston 7, so as to lift valve 8 from its seat. By this means chamber 10 is connected with chamber 11 and thence through port 12 to atmosphere. The piston 13 is thus subjected to atmospheric pressure on one side, while on the other side it is subjected to the brake-cylinder pressure, and the passage 20 is too restricted to allow of an equalization of the pressures. The brake-cylinder pressure consequently moves piston 13 to the left, compressing spring 14 and moving valve 17 to uncover passage 18. The brake-cylinder is consequently connected to atmosphere through pipe connection b', passage 15, chamber 16, and passage 18. The brake-cylinder pressure is consequently reduced until the pressure on the outer side of diaphragm d falls a sufficient amount to allow spring 9 to push the diaphragms back into position shown. The valve 8 is then seated, the pressures on opposite sides of piston 13 are quickly equalized by means of passage 20, and spring 14 pushes the piston back into the position shown, moving valve 17 to close passage 18. Further exhaust from the brake-cylinder is thus prevented. By further increasing the pressure in the control-pipe more air is released from the brake-cylinder, and thus a graduated release is obtained. It will be seen that the train-pipe pressure exerts a resultant force on the diaphragms equal to the pressure multiplied by the difference in area between the two diaphragms and that the brake-cylinder pressure exerts a force in the same direction equal to the brake-cylinder pressure multiplied by the area of the smaller diaphragm d. Furthermore, the valve automatically moves to the lap position whenever the sum of these two forces is equal to the constant opposing pressure exerted by the spring 9. If the difference in area between the two diaphragms were equal to the area of the smaller diaphragm, the train-pipe and brake-cylinder pressure would exert equal effective forces per pound of pressure, and the valve would move to the lap position whenever sum of the train-pipe pressure and the brake-cylinder pressure was equal to a constant, and a variation in the train-pipe pressure would produce an exactly equal variation in the brake-pipe pressure. By making the difference in area between the two diaphragms greater than the area of the smaller diaphragm it is evident that the train-pipe pressure exerts a greater effective force per pound than the brake-cylinder pressure and that a given variation in train-pipe pressure will produce a greater variation in the brake-cylinder pressure. Consequently in order to vary the brake-cylinder pressure from zero to full-reservoir pressure it is not necessary to reduce the train-pipe pressure to zero; but a reduction over a much smaller range is sufficient. Thus the amount of air required for raising and lowering the train-pipe pressure is reduced and the efficiency of the system still further increased.

Obviously other arrangements of diaphragms may be employed, the only requisite being that the sum of the train-pipe pressure multiplied by a constant quantity and the brake-pipe pressure multiplied by a constant quantity be opposed by a substantially constant force, which may be a spring or any other suitable source of pressure.

Obviously a breaking apart of the train, which would suddenly exhaust the control-pipe, would produce an effective application of the brakes on all the train.

Since the control-pipe must carry only the necessary amount of air for raising and lowering the pressure between the two diaphragms d and d', it is evident that it may be made much smaller than in systems in which it must carry air for the brake-cylinders. Consequently the amount of air required to raise and lower the pressure of the control-pipe is very small. All the cars are entirely independent of each other as regards their air-brake systems, except for the automatic valves, so that no synchronizing apparatus is required for the governors of the several reservoirs.

The connection and arrangement of parts may be greatly altered and other forms of automatic valves may be employed, if desired, and I aim in the appended claims to cover all modifications which are within the scope of my invention.

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

1. In combination with a train of cars, an independent source of compressed air on each car, a control-pipe extending through the train, and an automatic valve on each car responsive to variations in the pressures both in the control-pipe and in the brake-cylinder, and adapted to connect the brake-cylinder to the source of pressure or to atmosphere.

2. In combination with a train of cars, an independent source of compressed air on each car, a control-pipe extending through the train, and an automatic valve on each car connected to said control-pipe and adapted to connect brake-cylinder to the source of pressure or to atmosphere, said valve being arranged to return to lap position when the pressures in control-pipe and brake-cylinder bear a predetermined relation to each other.

3. In a train of cars, an independent source of compressed air on each car, a control-pipe extending through the train, an automatic valve on each car responsive to variations of the pressures in both the control-pipe and the brake-cylinder and adapted to establish connections for applying and releasing the brakes, and means for raising and lowering the pressure in the control-pipe.

4. In a train of cars, an independent source of compressed air on each car, a control-pipe extending through the train, an automatic valve on each car comprising a movable member and a valve controlled thereby adapted

to establish connections for applying and releasing the brakes, means for impressing on said member two forces tending to move it in the same direction and proportional respectively to the pressures in the control-pipe and in the brake-cylinder, means for impressing on said member a substantially constant opposing force, and means for raising and lowering the pressure in the control-pipe.

5. In a train of cars, an independent source of compressed air on each car comprising two reservoirs, a control-pipe extending through the train, a manually-controlled valve connecting one of said reservoirs to said control-pipe, an automatic valve connected to the control-pipe and adapted to connect brake-cylinder to the second reservoir or to atmosphere, and means for preventing a flow of air from the second to the first reservoir.

6. In a train of cars, an independent source of compressed air on each car comprising two reservoirs, a control-pipe extending through the train, a manually-controlled valve connecting one of said reservoirs to said control-pipe, an automatic valve connected to the control-pipe and adapted to connect brake-cylinder to the second reservoir or to atmosphere, and a check-valve inserted in the connection between the two reservoirs.

7. In a train of cars, a control-pipe extending through the train, a movable member responsive to variations in pressure in both the control-pipe and the brake-cylinder, two relay-valves arranged to be operated respectively by the movement of said member in one direction or the other, and two valves controlled by said relays and adapted and arranged to establish connections respectively for applying and for releasing the brakes.

8. In an air-brake system, a control-pipe extending through the train, two rigidly-connected diaphragms, connections from the brake-cylinder to one side of one diaphragm, connections from the control-pipe to the corresponding side of the other diaphragm, means for impressing a substantially constant opposing force on said diaphragms, two relays arranged to be operated respectively by the movement of said diaphragms in one direction or the other, and two valves controlled by said relays and adapted and arranged respectively to establish connections for applying and for releasing the brakes.

9. In an air-brake system, an independent source of compressed air on each car, a control-pipe extending through the train, two rigidly-connected diaphragms, connections from brake-cylinder to one side of one of said diaphragms from said control-pipe to the corresponding side of the other diaphragm, means for impressing a substantially constant opposing force on said diaphragms, two relay-valves arranged to be operated respectively by the movement of said diaphragms in one direction or the other, and two valves controlled by said relays and arranged respectively to connect brake-cylinder to said source of pressure and to atmosphere.

In witness whereof I have hereunto set my hand this 14th day of September, 1904.

FRED B. COREY.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.