W. V. TURNER & J. S. CUSTER.

FLUID PRESSURE BRAKE.

APPLICATION FILED FEB. 13, 1904.

937,392. **Patented Oct. 19, 1909.**

2 SHEETS—SHEET 1.

Fig. 1

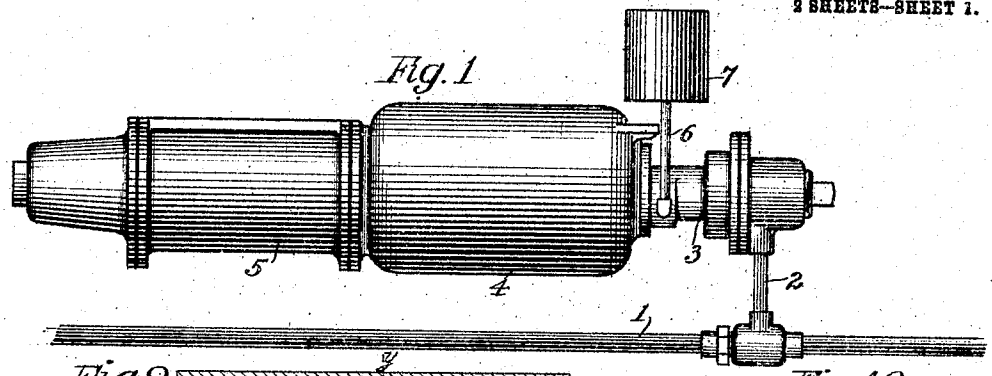

Fig. 9

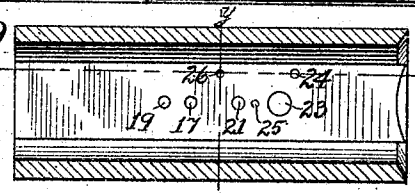

Fig. 10

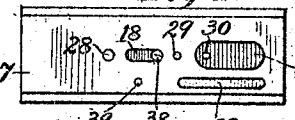

Fig. 2

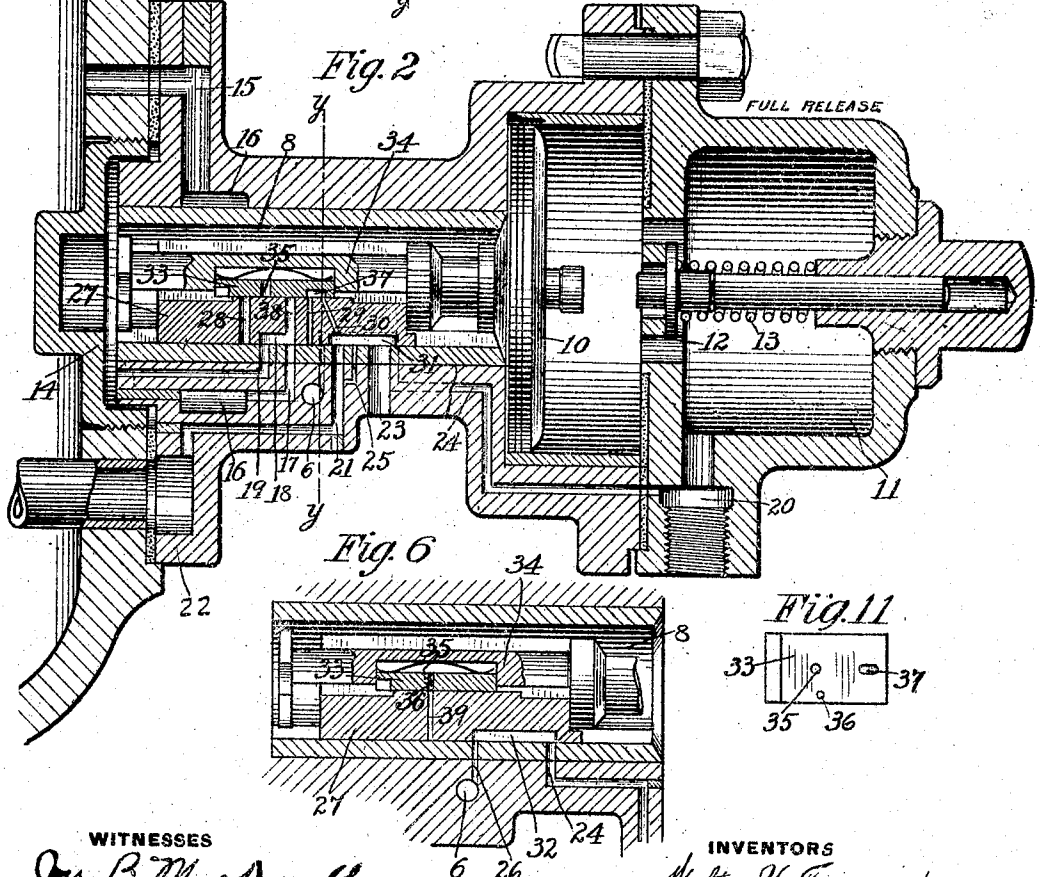

Fig. 6

Fig. 11

WITNESSES

Jas. B. MacDonald.

Marion L. Clark

INVENTORS

Walter V. Turner

John S. Custer

By E. Wright Att'y.

W. V. TURNER & J. S. CUSTER.

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2 SHEETS—SHEET 2.

Fig 3

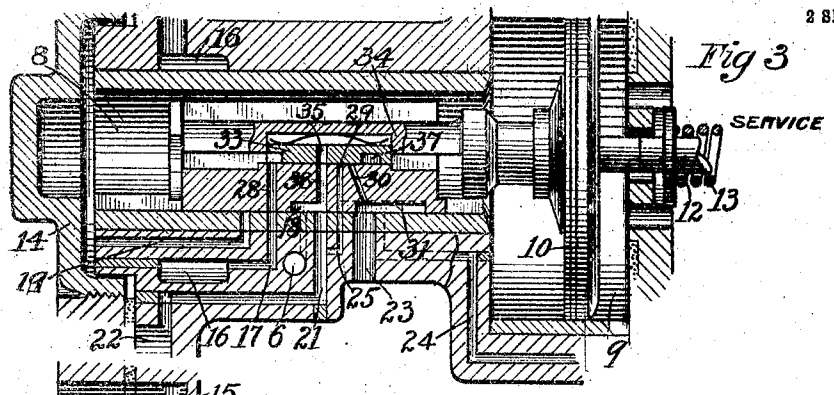

Fig. 4

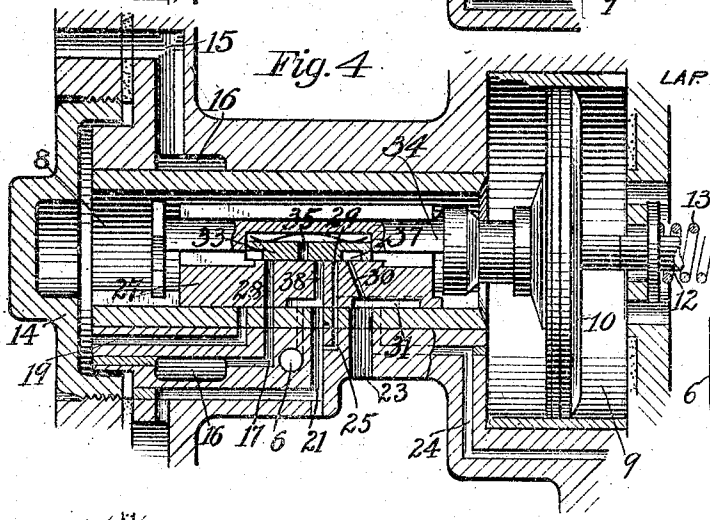

Fig 8

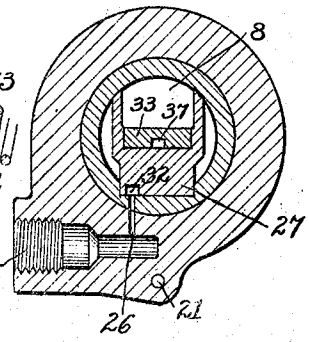

Fig. 5

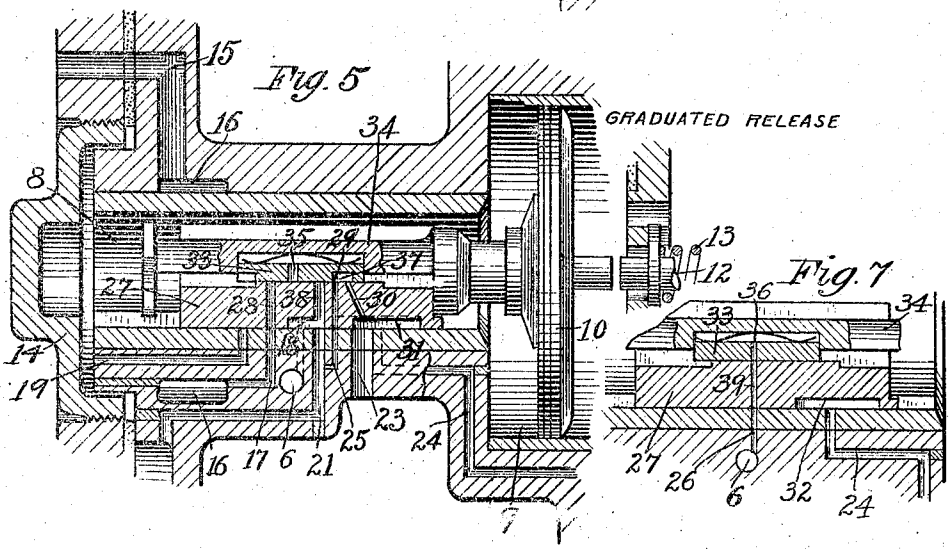

Fig. 7

WITNESSES

Jas. B. MacDonald.

Francis L. Clark

INVENTORS

Walter V Turner,

John S Custer

By E. Wright Att'y.

UNITED STATES PATENT OFFICE.

WALTER V. TURNER, OF WILKINSBURG, AND JOHN S. CUSTER, OF PITTSBURG, PENNSYLVANIA, ASSIGNORS TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

FLUID-PRESSURE BRAKE.

937,392. Specification of Letters Patent. Patented Oct. 19, 1909.

Application filed February 13, 1904. Serial No. 193,377.

To all whom it may concern:

Be it known that we, WALTER V. TURNER and JOHN S. CUSTER, citizens of the United States, residing, respectively, at Wilkinsburg and Pittsburg, both in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Fluid-Pressure Brakes, of which the following is a specification.

This invention relates to automatic fluid pressure brakes, and has for its object to provide an improved triple valve device combined with the auxiliary reservoir and a supplemental reservoir or other source of fluid pressure and adapted to be operated by one or more slight increases of train pipe pressure to grade down the brake cylinder pressure to any point desired after an application, thereby securing what may be termed a graduated release of the brakes.

It has heretofore been proposed to use a supplemental reservoir, in which air at normal standard pressure is stored and retained while the brakes are applied, for discharging into the triple valve chamber and auxiliary reservoir when the triple valve is returned from service or lap position to a position giving a partial or full exhaust to the brake cylinder, the object being to thereby raise the pressure in the auxiliary reservoir and upon the triple valve piston sufficiently to cause the same to move back and close the exhaust and the inlet port from the supplemental reservoir. With these prior devices, however, it has been necessary to provide a supplemental reservoir of considerable storage capacity, in order to raise the pressure of the entire auxiliary reservoir sufficiently to cause the triple piston to move back to close the exhaust. It is also found in the operation of these devices, that when a slight increase in train pipe pressure is made after an application, the triple valve is liable to go all the way over to full release position, thereby fully opening the exhaust ports and releasing a considerable amount of air from the brake cylinder before the piston is moved back to close the exhaust.

This improvement is designed to give a much finer grading down of the brake cylinder pressure than is possible with the prior devices, and to this end comprises means for cutting off the triple valve chamber and piston chamber from the auxiliary reservoir in the position of the valve device giving a partial exhaust to the brake cylinder, so that when the inlet port from the supplemental reservoir or other source of fluid pressure is opened to the valve chamber in this position, the piston and valve are immediately moved back to close these ports owing to the small volume of the chamber in which it is necessary to momentarily increase the air pressure. By this means a much smaller supplemental reservoir may be employed than those used for this purpose heretofore.

Another important feature of this invention comprises a main valve having ports which may be controlled by the movement of an auxiliary or graduating valve operated directly by the piston, so that after the valve device has moved to service position for applying the brakes, the valve may be lapped by a slight return movement of the piston, thereby cutting off the auxiliary reservoir from the valve chamber, and then by a small further movement of the piston and graduating valve the inlet port from the supplemental reservoir and the partial exhaust ports from the brake cylinder may be opened without moving the main valve, thereby securing a very sensitive device which may be operated to grade down the brake cylinder by very small amounts, at will. The invention also comprises certain other important features, all of which will now be more fully described and set forth.

In the accompanying drawings; Figure 1 is a diagrammatic elevation of a car air brake equipment embodying this improvement; Fig. 2 a central sectional view of the triple valve device indicated in Fig. 1, the parts being shown in full release position; Fig. 3 a similar sectional view of the main portion of the triple valve with the parts in service position; Fig. 4 a similar view showing the parts in lap position; Fig. 5 a similar view with the parts in what is known as "graduated" or "partial" release position; Fig. 6 a fragmentary longitudinal section of the valves and valve seat taken on the line

x—*x* of Fig. 9; Fig. 7 a similar view showing the position of the ports in "graduated" release position; Fig. 8 a transverse section of the triple valve device taken on the line *y*—*y* of Figs. 2 and 9; Fig. 9 a plan view of the main valve seat showing arrangement of ports; Fig. 10 a face view of the main slide valve; and Fig. 11 a face view of the small auxiliary or graduating slide valve.

According to this construction the car air brake equipment comprises train pipe 1, branch pipe 2, triple valve device 3, connected to auxiliary reservoir 4 and brake cylinder 5, and also by pipe 6 with supplemental reservoir 7. The triple valve device comprises the usual valve chamber 8, piston chamber 9, containing piston 10 and cap chamber 11, communicating with the train pipe passage 20 and containing the graduating stem 12 and spring 13. According to our improvement, the usual opening from the valve chamber to the auxiliary reservoir is closed by a cap 14 and the auxiliary reservoir normally communicates with the valve chamber in full release position, (Fig. 2) through ports 15, 16, 17, cavity 18 in the main slide valve, and port 19. The main slide valve seat is also provided with the brake cylinder port 21 leading to brake cylinder passage 22, exhaust port 23, train pipe port 24, partial exhaust port 25 from the brake cylinder port, and supplemental reservoir port 26 leading to pipe 6 and the supplemental reservoir 7. On the valve seat is located the main slide valve 27 having port 28 and cavity 18 for establishing communication between the valve chamber and the auxiliary reservoir, service port 38, partial exhaust ports 29 and 30, main exhaust cavity 31, communicating with the exhaust port 23, supplemental reservoir port 39, and cavity 32 for establishing communication from the train pipe to the supplemental reservoir in full release position. On the main slide valve is mounted the auxiliary or graduating slide valve 33 operating with the stem 34 of the main piston and having a certain amount of lost motion or independent movement with respect to the main slide valve. The graduating valve is provided with the service port 35, supplemental reservoir port 36, and a cavity 37 for controlling the partial exhaust ports in the main slide valve.

The operation of our improvement is as follows:—Compressed air being supplied from the main reservoir to the train pipe the triple valve piston is moved to full release position, as shown in Fig. 2, and the air flows through the usual feed groove around the piston to the valve chamber 8 and from thence through port 19, cavity 18, ports 17, 16 and 15 to the auxiliary reservoir, charging the same to normal standard pressure. At the same time the supplemental reservoir is charged to normal pressure through port 24, cavity 32, port 26, and pipe 6, see Fig. 6. When a reduction in train pipe pressure is made for a service application the piston and slide valves are moved back under the preponderating auxiliary reservoir pressure to what is known as "service" position, as shown in Fig 3, in which the brake cylinder exhaust is closed and the graduating stem 12 and spring 13 are also slightly compressed by the piston stem, as indicated. The graduating valve 33 has now moved to uncover service port 28 in the main slide valve and to register port 35 with service port 38, so that the auxiliary reservoir communicates with the valve chamber through ports 15, 16, 17 and 28, and with the brake cylinder through ports 35, 38, 21 and 22. In this position also communication from the train pipe to the supplemental reservoir through port 24 is cut off by the main slide valve, while partial exhaust port 29 registers with port 25 leading to the brake cylinder and port 39 registers with supplemental reservoir port 26, but these ports are closed by the auxiliary valve 33. The air then flows from the auxiliary reservoir to the brake cylinder until the pressure in the valve chamber upon the piston is reduced to substantially equal that of the train pipe when the graduating spring returns the piston and graduating slide valve 33 to lap position, indicated in Fig. 4, in which both ports 28 and 38 of the main slide valve are covered, thereby cutting off communication from the valve chamber to the brake cylinder, and from the auxiliary reservoir to the valve chamber. During this time the supplemental reservoir port 26 registers with port 39 in the main slide valve, which port is closed by the auxiliary slide valve, so that the normal standard pressure has been retained in the supplemental reservoir. If now it be desired to grade down the brake cylinder pressure, or, in other words, to produce a graduated release of the brakes, a very slight increase is made in train pipe pressure, which is sufficient to move the piston and graduating slide valve until the shoulder on the piston stem engages the main slide valve, the additional resistance of which tends to check the movement and stop the piston at this point, which is termed the "graduated" release position, see Fig. 5. In this position, it will be noticed the small or partial exhaust ports 25, 29 and 30 have been connected through the cavity 37 in the graduating valve and a slow reduction of pressure from the brake cylinder to the atmosphere is begun; but at the same time that the cavity 37 connects ports 29 and 30, the port 36 registers with the supplemental reservoir ports 39 and 26, thereby opening communication from the supplemental reservoir to the valve chamber. As the sup-

plemental reservoir contains air stored at the normal standard pressure, a puff of air from the supplemental reservoir flows through ports 26, 39 and 36 into the valve chamber, which contains air at a lower pressure, and owing to the comparatively small capacity of the valve chamber this puff of air is sufficient to move the piston and graduating valve back to lap position, and thereby close the partial exhaust ports from the brake cylinder, and the inlet port from the supplemental reservoir to the valve chamber. Further slight increases in train pipe pressure may be made for causing the valve to be operated in a similar manner to make further reductions in the brake cylinder pressure to any point desired. It will be observed that in the movement of the piston from lap to graduated release position and return the small graduating valve only is moved, the main slide valve remaining stationary in its intermediate service or lap positions and forming an abutment for defining the graduated release position, and preventing the piston from going to full release position upon a slight rise in train pipe pressure.

As the small graduating valve creates very little friction, and moves easily upon a slight variation of pressure upon the piston, it will be seen that the device is very sensitive in its movements and especially so as the valve chamber is cut off from the auxiliary reservoir in these positions of the piston, thereby requiring only a slight discharge of air from the supplemental reservoir into the valve chamber to insure the movement of the piston back into contact with the graduating stem, which, according to our improved construction, is defined as lap position. Whenever it is desired to produce a full and complete release of the brakes a considerable increase in train pipe pressure is made in the usual way, which causes the piston to move both the graduating valve and main slide valve back to full release position, as shown in Fig. 2.

While we have described our improvement as applied to a triple valve device of the so-called "plain" type, it will be apparent that the same may be applied equally well to a valve of the quick-action type, in which an emergency application of the brakes is produced by a sudden reduction in train pipe pressure and a local venting of the train pipe.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir and brake cylinder, of a valve for controlling the exhaust from the brake cylinder, a movable abutment subject to the opposing pressures of the train pipe and a chamber for operating said valve, means for closing communication from the auxiliary reservoir to said chamber, and means operated by a slight increase of train pipe pressure for supplying fluid to said chamber and for opening a partial exhaust from the brake cylinder.

2. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir and brake cylinder, of a valve mechanism for controlling the supply of air from the auxiliary reservoir to the brake cylinder and from the brake cylinder to the atmosphere, a movable abutment subject to the opposing pressures of the train pipe and a chamber for operating said valve mechanism, means for cutting off communication from the auxiliary reservoir to said chamber at an intermediate position of the valve giving a partial exhaust to the brake cylinder, and means for increasing the pressure in said chamber when the auxiliary reservoir is cut off.

3. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir, of a valve mechanism controlling communication from the auxiliary reservoir to the valve chamber, from the valve chamber to the brake cylinder, from the supplemental reservoir to the valve chamber and from the brake cylinder to the atmosphere, and a movable abutment subject to the opposing pressures of the train pipe and valve chamber for operating said valve mechanism.

4. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir, of a valve device and piston operated by the opposing pressures of the train pipe and a chamber for controlling communication from the said chamber to the auxiliary reservoir and to the supplemental reservoir, and from the brake cylinder to the atmosphere.

5. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a valve mechanism for controlling communication from the valve chamber to the auxiliary reservoir and to the brake cylinder, from the supplemental reservoir to the valve chamber, and from the brake cylinder to the atmosphere, and a movable abutment subject to the opposing pressures of the train pipe and the valve chamber for operating said valve mechanism.

6. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a triple valve device comprising a main valve having ports for controlling communication from the auxiliary reservoir and the supplemental reservoir to the valve chamber and the exhaust from the brake cylinder, and a graduating valve movable with the piston and having a certain movement in-

dependent of the main valve for controlling the ports therein.

7. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a valve device having a movable abutment operated by variations in train pipe pressure, a main valve actuated by said abutment for controlling communication from the valve chamber to the auxiliary reservoir, the brake cylinder and the supplemental reservoir, and from the brake cylinder to the atmosphere, and an auxiliary or graduating valve having an independent movement relative to the main valve for controlling the supply of air from the supplemental reservoir to the valve chamber and from the brake cylinder to the atmosphere.

8. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a valve device having a movable abutment operated by variations in fluid pressure and controlling communication between the auxiliary reservoir and one side of said abutment, and an auxiliary valve having a movement relative to the main valve for controlling communication from the supplemental reservoir to the same side of the abutment.

9. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a valve device having a movable abutment subject to the opposing pressures of the train pipe and a chamber and controlling communication between the auxiliary reservoir and said chamber, and an auxiliary valve having a movement relative to the main valve for controlling communication from the supplemental reservoir to said chamber and the release from the brake cylinder.

10. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a triple valve device comprising a movable abutment subject to the opposing pressures of the train pipe and a chamber, a main valve actuated by said abutment and having a small exhaust port for establishing communication from the brake cylinder to the atmosphere in an intermediate or lap position of the valve, and an auxiliary valve having a movement relative to the main valve for controlling said exhaust port.

11. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a triple valve device comprising a movable abutment subject to the opposing pressures of the train pipe and a chamber, a main valve actuated by said abutment for controlling communication from the auxiliary reservoir to said chamber and having ports for opening communication from the supplemental reservoir to said chamber and from the brake cylinder to the atmosphere in an intermediate or lap position of the valve, and an auxiliary valve having a movement relative to the main valve for controlling said ports.

12. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder and supplemental reservoir of a triple valve device comprising a movable abutment subject to the opposing pressures of the train pipe and chamber, a main valve actuated by said abutment and having ports for opening communication from the supplemental reservoir to said chamber and from the brake cylinder to the atmosphere in an intermediate or lap position of the valve, and an auxiliary valve having a movement relative to the main valve for controlling said ports.

13. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a triple valve device comprising a movable abutment subject to variations in train pipe pressure, a main valve operated by said abutment and having a port adapted to open an exhaust from the brake cylinder in an intermediate or lap position of the valve, and an auxiliary valve having a movement relative to the main valve for controlling said exhaust port.

14. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and a supplemental reservoir or additional source of pressure, of a triple valve device comprising a movable abutment subject to the opposing pressures of the train pipe and auxiliary reservoir, a main valve actuated by said abutment and having ports for opening communication from the additional source of pressure to the auxiliary reservoir side of the abutment, and from the brake cylinder to the exhaust in an intermediate or lap position of the valve, and an auxiliary valve having a movement relative to the main valve for controlling said ports.

15. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and a supplemental source of fluid pressure, of a valve device having a chamber and operated by variations in train pipe pressure for controlling communication from the auxiliary reservoir and from said supplemental source to said chamber and from the brake cylinder to the exhaust.

16. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and a supplemental source of fluid pressure, of a valve device comprising a piston subject on one side to train pipe pressure, and a valve operated by said piston for controlling communication from the auxiliary reservoir and from the supplemental source to the other side of said piston, and from the brake cylinder to the exhaust.

17. In a fluid pressure brake, the combina-

tion with a train pipe, auxiliary reservoir, and brake cylinder, of a triple valve device having a chamber and comprising a piston subject to train pipe pressure and valve means contained in said chamber for controlling communication from the auxiliary reservoir to the chamber and from said chamber to the brake cylinder.

In testimony whereof we have hereunto set our hands.

WALTER V. TURNER.
JOHN S. CUSTER.

Witnesses:
R. F. EMERY,
JAS. B. MACDONALD.