W. M. AUSTIN.
AIR BRAKE TRIPLE VALVE.
APPLICATION FILED OCT. 24, 1903.

915,723. Patented Mar. 23, 1909.

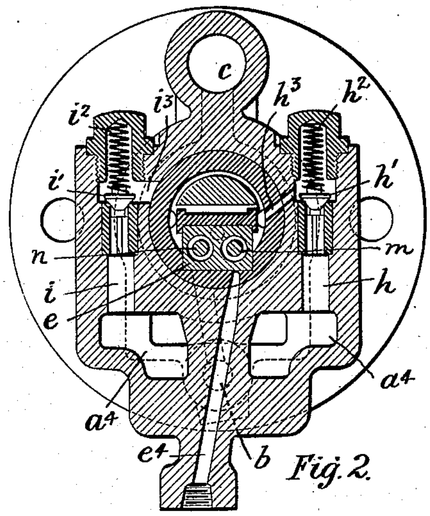

Fig. 2.

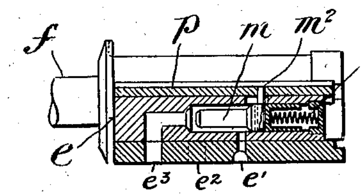

Fig. 4.

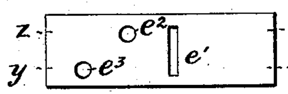

Fig. 3.

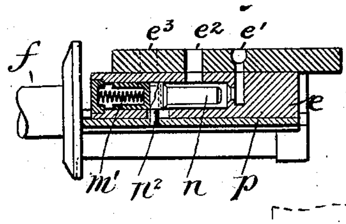

Fig. 5.

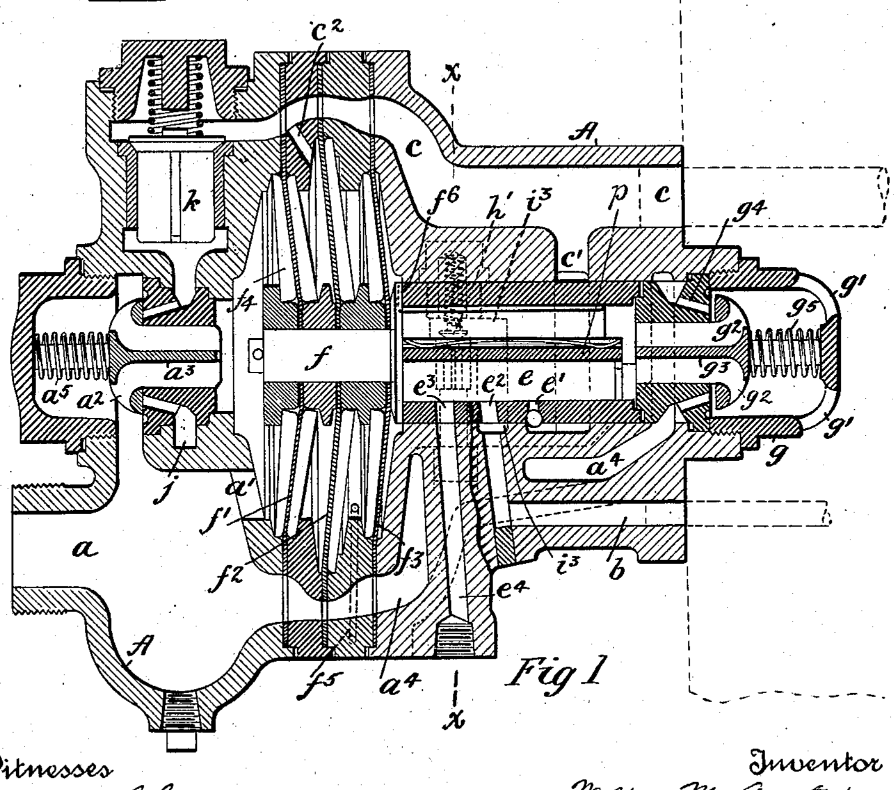

Fig 1

Witnesses
Frank S. Ober
Waldo M. Chapin

Inventor
Walter M. Austin
By his Attorney Wm. A. Rosenbaum

UNITED STATES PATENT OFFICE.

WALTER MERVILLE AUSTIN, OF SWISSVALE, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

AIR-BRAKE TRIPLE VALVE.

No. 915,723. Specification of Letters Patent. Patented March 23, 1909.

Application filed October 24, 1903. Serial No. 178,339.

To all whom it may concern:

Be it known that I, WALTER M. AUSTIN, a citizen of the United States, residing at Swissvale, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air-Brake Triple Valves, of which the following is a full, clear, and exact description.

This invention relates to fluid pressure train brakes, the object primarily being to devise a construction of triple valve whereby pressure which may leak away from the brake cylinder while the brakes are applied, will be automatically restored regardless of the extent or duration of the leakage, thus overcoming at once the defect commonly observed in the operation of brakes on long grades, where, by reason of leakage from the brake cylinders, the train often increases headway to such an extent that the engineer must continually reduce train line pressure and often recharge auxiliaries in order to hold the train at a safe speed.

Secondarily, my object is to devise a construction whereby the brakes can be partially reduced when desirable in order to keep the train at the proper speed when the grade changes or make a stop at the exact point desired.

In accomplishing the object of my invention, I balance train pipe and brake cylinder pressures against a constant pressure applied from a supplemental reservoir upon a controlling valve in such a manner that when a reduction in the brake cylinder pressure occurs, by reason of leakage, the supplemental pressure moves the valve to recharge the brake cylinder from the auxiliary reservoir.

The train pipe pressure and brake cylinder pressure which act together against the supplemental pressure, are respectively applied to differential pistons or diaphragms, of such construction that when the pressure admitted to the brake cylinder on application of brakes arrives at the working pressure, the main valve is moved to the lap position and there held until release of brakes takes place.

Another feature of my invention is a construction whereby in case the auxiliary reservoir pressure in charging the brake cylinder to compensate for leakage, is reduced below train pipe pressure, the auxiliary reservoir is automatically charged from the train pipe.

My invention will be described in detail with reference to the accompanying drawing, in which:

Figure 1 is a longitudinal section of my improved triple valve, one portion of the section being in a slightly different plane from the other; Fig. 2 is a section on line *x*—*x* of Fig. 1; Fig. 3 is a plan of the main slide valve seat; Fig. 4 is a section of the slide valve and seat on the plane of the line *y*—*y* of Fig. 3, and Fig. 5 is a section of the same parts on line *z*—*z* of Fig. 3, the view being as if the valve were tilted downward.

In the following description stress will be laid only on those parts of the construction and operation which concern the present invention, it being understood that several features of ordinary triple valves will be used in conjunction with the novel devices.

Referring to the drawing by letter, A indicates the main frame or case castings of the triple valve, *a* being the connection for the train pipe, *b* the connection for the auxiliary reservoir and *c* the connection for the brake cylinder. The main valve *e* contains a graduating release valve *m* normally held closed by spring m' (Fig. 4) but shown held open by pin m^2 in slide *p*, also a graduating application valve *n* normally held closed by spring n' (Fig. 5) but shown held open by pin n^2 in slide *p*. The slide valve seat contains a port e' connecting with a passage c' leading to the brake cylinder. In the seat there is also a port e^2 connecting with the auxiliary reservoir passage *b*, and a port e^3 connecting with a passage e^4 leading to the atmosphere.

On the main valve stem *f*, there are three diaphragms, f', f^2 and f^3, respectively, concentrically arranged in succession with slight spaces or chambers between them and clamped at their edges between sections of the main casing, as shown. The diaphragms are backed up or reinforced, by stiff segments f^4 loosely set in place and preventing the diaphragms from being strained by the pressures exerted thereon. The outside of diaphragm f' is constantly exposed to train pipe pressure through the openings a' and a^2, the latter opening being in a valve a^3 which is held closed by spring a^5 and placed in line with the valve stem and upon which the latter limits on service applications.

The space between diaphragms f' and f^2 communicates through passage c^2 with the brake cylinder passage c, while the space between diaphragms f^2 and f^3 is always open to the atmosphere through a passage f^5, shown in dotted lines in Fig. 1.

At the right hand end of the valve there is arranged a cap g having openings g' which lead into what I have termed a supplemental reservoir, indicated in dotted lines, the pressure from which leads through the cap g, thence through passages g^2 into a valve g^3, thence into the main valve chamber and finally reaches the outer side of diaphragm f^3 through a feeding groove f^6. Thus the outer diaphragms f' and f^3, which are of equal or nearly equal areas, are acted upon in opposite directions, respectively, by train pipe pressure and supplemental reservoir pressure. The intermediate diaphragm f^2, is, during the application of the brakes, acted upon by brake cylinder pressure in a manner to coöperate with the pressure on the outside of diaphragm f' to move the valve to the right. But this intermediate diaphragm is of greater area than either of the others, so that when a certain pressure from the brake cylinder has arrived in the space between diaphragms f' and f^2, the excess area of diaphragm f^2 will enable it along with train pipe pressure on f' to overcome the pressure of the supplemental auxiliary upon diaphragm f^3 and move the valve to the right.

Train pipe pressure leads from the connection a to the passage a^4 which divides and passes each side of that portion of the casing containing the passages b and e^4. Passage a^4 opens into the supplemental reservoir through passages g^4, which are normally closed by the head of valve g^3 acted upon by the spring g^5. Branch passages h and i (Fig. 2) lead upward from the train pipe passage a^4 on each side of the main valve chamber and each passage contains an upwardly opening check-valve i' and h' held in place by springs i^2 and h^2. From each chamber above the check-valve h', a passage h^3 leads into the main valve chamber. From the chamber above check-valve i', a passage i^3, shown in dotted lines in Fig. 1, leads to the auxiliary reservoir port b. The valve a^3 normally closes a passage j leading to the brake cylinder passage c through a check-valve k.

The operation is as follows: Fig. 1 and Fig. 4 are shown in quick release position, the valve g^3 being held open by the main valve stem at its extreme position to the right by a sudden increase in train pipe pressure (made by the operator). Supplemental reservoir pressure is thus allowed to flow into the train pipe causing the sudden increase in train pipe pressure to be communicated to the next car, etc. throughout the train. And pressure is allowed to flow from brake cylinder through port e', valve m, port e^3 and passage e^4 to atmosphere. When pressure is exhausted from brake cylinder, spring g^5 closes valve g^3, pushing valve stem f and slide p into running position, communication between ports e' and e^3 being maintained because valve m has not moved far enough to seat. In making a service application of the brakes, a gradual reduction of train pipe pressure on diaphragm f' allows supplemental reservoir pressure acting on diaphragm f^3 to move valve stem f and valve e to the left until stem f strikes valve a^3 when it is arrested by spring a^5. Slide p has been moved to the left on valve e, allowing spring m' to close valve m, and pin n^2 to open valve n, thus opening a passage from auxiliary reservoir through port e^2, valve n, port e' to brake cylinder. When pressure in brake cylinder has increased so that the remaining train pipe pressure on f' plus the excess brake cylinder pressure on f^2 over f'', are able to overcome supplemental reservoir pressure on f^3, stem f moves to the right pushing slide p along valve e and allowing valve n to close under spring n', thus closing passage between brake cylinder and auxiliary reservoir. I call this lap position. As no further pressure can then enter the brake cylinder, the parts will remain in this position unless leakage or some unintentional exhaustion of brake cylinder takes place. If leakage from brake cylinder does occur, supplemental reservoir pressure will overcome the remaining brake cylinder and train pipe pressures, stem f and slide p will move to the left and open valve n to reconnect the auxiliary reservoir with the brake cylinder, recharging the latter to compensate for the leakage. This takes place automatically and the recharging will continue, intermittently if the conditions so require, so long as the brakes are held applied. And if during the application, the auxiliary reservoir is robbed of so much of its pressure that it falls below the pressure of the train pipe, the latter will lift check-valve i' and recharge the auxiliary reservoir through the passage i^3. Hence if air pressure can be maintained in the train pipe, the pressure in the brake cylinder during an application of brakes will be correspondingly and automatically maintained. To partially release the brakes, a gradual increase in train pipe pressure will disturb the balance between train pipe and brake cylinder pressures on the one side, and supplemental reservoir pressure on the other side causing stem f, valve e and slide p to move to the right until stem f strikes valve g^3 when it is arrested by spring g^5. Communication is now open from brake cylinder through port e', valve m and port e^3 to atmosphere. When brake cylinder pressure is reduced sufficiently to allow supplemental pressure on f^3 to overcome remaining excess brake cylinder pressure on f^2 over f' and new train pipe pressure on f', stem f, slide p and pin m^2 will move to the left, allowing valve m to close under spring m', thus preventing further release of brake cylinder pressure. When making a partial release of brakes, train pipe pressure may increase above auxiliary reservoir pressure, then auxiliary reservoir will be recharged, as previously described in connection with the falling of auxiliary reservoir pressure below train pipe pressure. To make a complete but gradual release of the brakes, the action is the same as for a partial release, except that the parts do not return to lap position after the release, but remain in release or running position, and the auxiliary reservoir is recharged to full running train pipe pressure through passages a and a^4, valve i', passage i^3 and passage b. In an emergency application of the brakes the sudden reduction of train pipe pressure causes the valve stem to move to the left under the same forces as before described, and to unseat the valve a^3, thus permitting the train pipe pressure to enter the passage j, lift the check-valve k and enter directly into the brake cylinder. Thus the impulse of sudden reduction of train pipe pressure is extended rapidly from car to car throughout the train. If from any cause the supplemental reservoir pressure has been lowered below full running train pipe pressure (*e. g.* by leakage or by using the pressure in supplemental reservoir to partially recharge the train pipe for quick release of the brakes) when the train pipe is recharged, pressure will flow through passages a, a^4 and h, valve h', passage h^3 to main valve chamber and so recharge the supplemental reservoir. It is important that the pressure in the supplemental reservoir be maintained as nearly constant as possible, since it represents a constant force acting upon the valve stem in one direction, against the variable pressure of the train pipe and brake cylinder. The ability of the valve to maintain the pressure in the brake cylinder, depends upon the constancy of the pressure in the supplemental reservoir.

It will be seen that with my improved valve the engineer has perfect control of his train through variations which it is possible for him to make in the train pipe pressure. After applying brakes to any extent, it is possible to either partially release or further increase the brake cylinder pressure and thus allow the train to continue more freely under its momentum or further check its progress. With such command of the train, an engineer can make an accurate stop at stations without straining the rigging or lifting the car bodies from the trucks, as often occurs in present practice. In running long grades, it often happens that the gradient changes makes it desirable to change the pressure of the brake shoes upon the wheels; this can be readily done with my invention without the necessity of first making a full release, as would be required with the apparatus now in use. Furthermore by my method of operation there is evidently a saving of air, since complete exhaustion of the brake cylinder pressure is not necessary in order to obtain a fractional decrease of any given pressure at the brake shoes.

Under certain conditions, the auxiliary reservoir and supplemental reservoir may be combined into one large reservoir, but owing to the variability of ordinary auxiliary reservoir pressure, it is desirable to separate them. It will be understood that my invention includes the use of slide pistons as a substitute for the diaphragms described; in fact, for the broadest conception of my invention, it is not limited as to the nature of the mechanism used upon which to exert the various pressures utilized to move the valve, or valves; or, the mechanism of the valve or valves used to admit pressure to the cylinder and to release pressure from the same. It is understood that I may dispense with either or both the quick action release and emergency features without departing from the invention. I may also in emergency, discharge train pipe pressure into atmosphere if desired. I may also find it desirable to use series check valves in order to prevent leakage which may be done without departing from the invention.

Having described my invention, I claim:—

1. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve governing the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for controlling the supply of air to the brake cylinder, and a movable abutment subject to the train pipe pressure and brake cylinder pressure opposing a constant force, for operating said valves.

2. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve controlling communication from the auxiliary reservoir to the brake cylinder, a graduating valve having a movement relative to the main valve for also controlling said communication, and a movable abutment subject in one direction to the train pipe pressure and the brake cylinder pressure and in the opposite direction to a substantially constant force, for operating said valves.

3. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve governing the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for controlling the supply of air to and its release from the brake cylinder, and a movable abutment subject to the train pipe pressure combined with the brake

cylinder pressure and opposing a substantially constant force, for operating said valve.

4. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve for controlling supply and exhaust ports to and from the brake cylinder, an auxiliary valve means having a movement relative to the main valve for also controlling said ports, and a movable abutment subject to train pipe and brake cylinder pressures for operating said valves.

5. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve for controlling the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for also controlling said exhaust, and a movable abutment subject to train pipe and brake cylinder pressure, for operating said valves.

6. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, and brake cylinder, of a main valve for controlling the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for also controlling said exhaust, and a movable abutment subject in one direction to the combined forces of the train pipe pressure and the brake cylinder pressure, and in the opposite direction to a substantially constant fluid pressure for operating said valves.

7. 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 main valve governing the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for controlling the supply of air to the brake cylinder, and a movable abutment subject in one direction to the train pipe and brake cylinder pressures, and in the opposite direction to the supplemental reservoir pressure for operating said valve.

8. 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 main valve governing the exhaust from the brake cylinder, an auxiliary valve having a movement relative to the main valve for also controlling said exhaust, and a movable abutment subject in one direction to the train pipe and brake cylinder pressures, and in the opposite direction to the supplemental reservoir pressure for operating said valve.

9. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and additional source of pressure or supplemental reservoir, of a main valve controlling communication from the auxiliary reservoir to the brake cylinder, an auxiliary valve having a movement relative to the main valve for also controlling said communication, and a movable abutment subject to the opposing forces of the train pipe and brake cylinder pressures in one direction and the supplemental reservoir pressure in the other for operating said valves

10. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir brake cylinder, and additional source of pressure or supplemental reservoir, of a valve device operated by the opposing pressures of the train pipe and supplemental reservoir for controlling the brake cylinder pressure, and means operating under an increase in train pipe pressure for opening communication to permit flow of air from the supplemental reservoir to the train pipe.

11. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and additional source of pressure or supplemental reservoir, of valve means for controlling the supply of air from the auxiliary reservoir to the brake cylinder, a movable abutment subject to the opposing pressures of the train pipe and the supplemental reservoir for operating said valve means, and a valve also operated by said abutment under an increase in train pipe pressure for opening communication from the supplemental reservoir to the train pipe.

12. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and additional source of pressure or supplemental reservoir, of a valve device operated in one direction by the combined pressures of the train pipe and the brake cylinder, and in the other direction by the supplemental reservoir pressure for controlling the brake cylinder pressure, and means operating under an increase in train pipe pressure for opening communication to supply air from the supplemental reservoir to the train pipe.

13. In a fluid pressure brake, the combination with a train pipe, auxiliary reservoir, brake cylinder, and additional source of pressure or supplemental reservoir, of valve means for controlling the brake cylinder pressure, a movable abutment subject in one direction to the combined forces of the train pipe pressure and the brake cylinder pressure, and in the opposite direction to the supplemental reservoir pressure for operating said valve means, and a valve also operated by said abutment under an increase in train pipe pressure for opening communication from the supplemental reservoir to the train pipe.

14. In a fluid pressure brake system, a triple valve comprising a valve adapted to control the passage from the auxiliary reservoir to the brake cylinder, three movable diaphragms attached to the main valve,

two of which are of substantially equal area, while the third and intermediate diaphragm is of larger area than either of the others, the said diaphragms of equal area being acted upon respectively in opposite directions by a constant pressure and train pipe pressure, and a port connecting the space between the intermediate diaphragm and the diaphragm acted upon by the train pipe pressure with the brake cylinder.

In witness whereof, I subscribe my signature, in presence of two witnesses.

WALTER MERVILLE AUSTIN.

Witnesses:

JOHN H. MATHIAS,

GEO. W. FIELDHOUSE.