No. 871,270. PATENTED NOV. 19, 1907.

M. GRIFFIN.

PRESSURE RETAINING AND QUICK RELEASE VALVE FOR AIR BRAKES.

APPLICATION FILED APR. 3, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

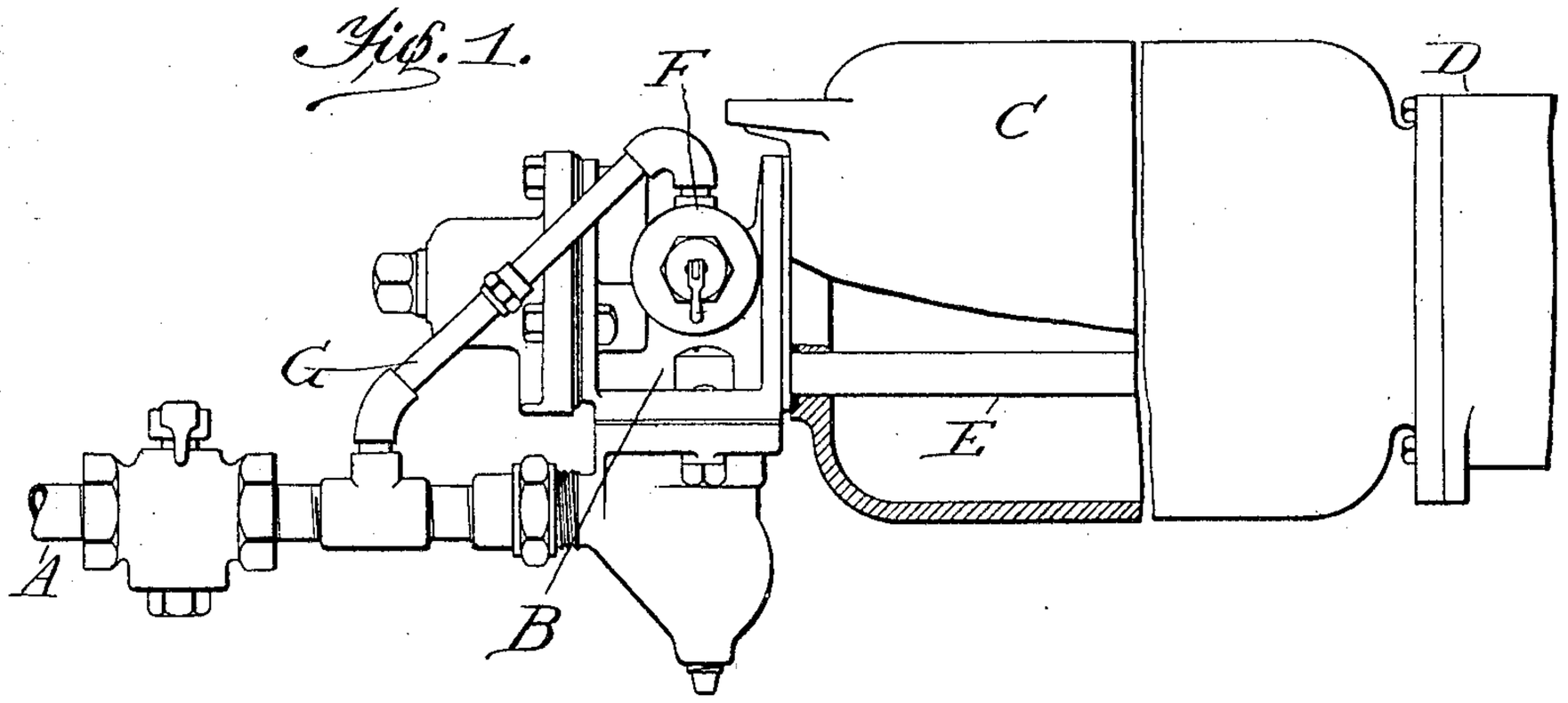
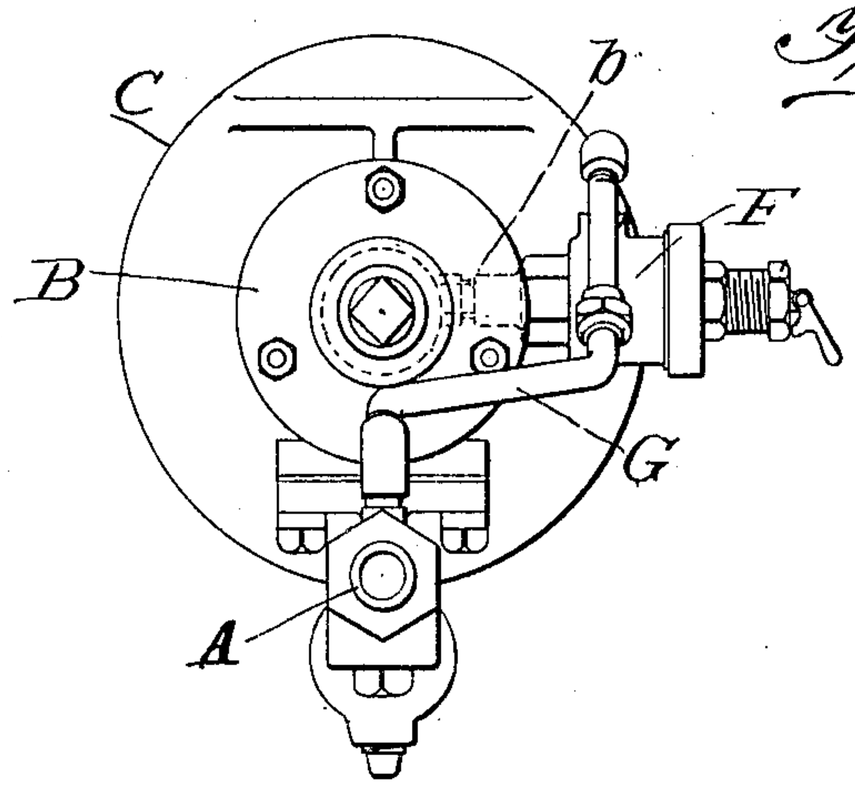


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

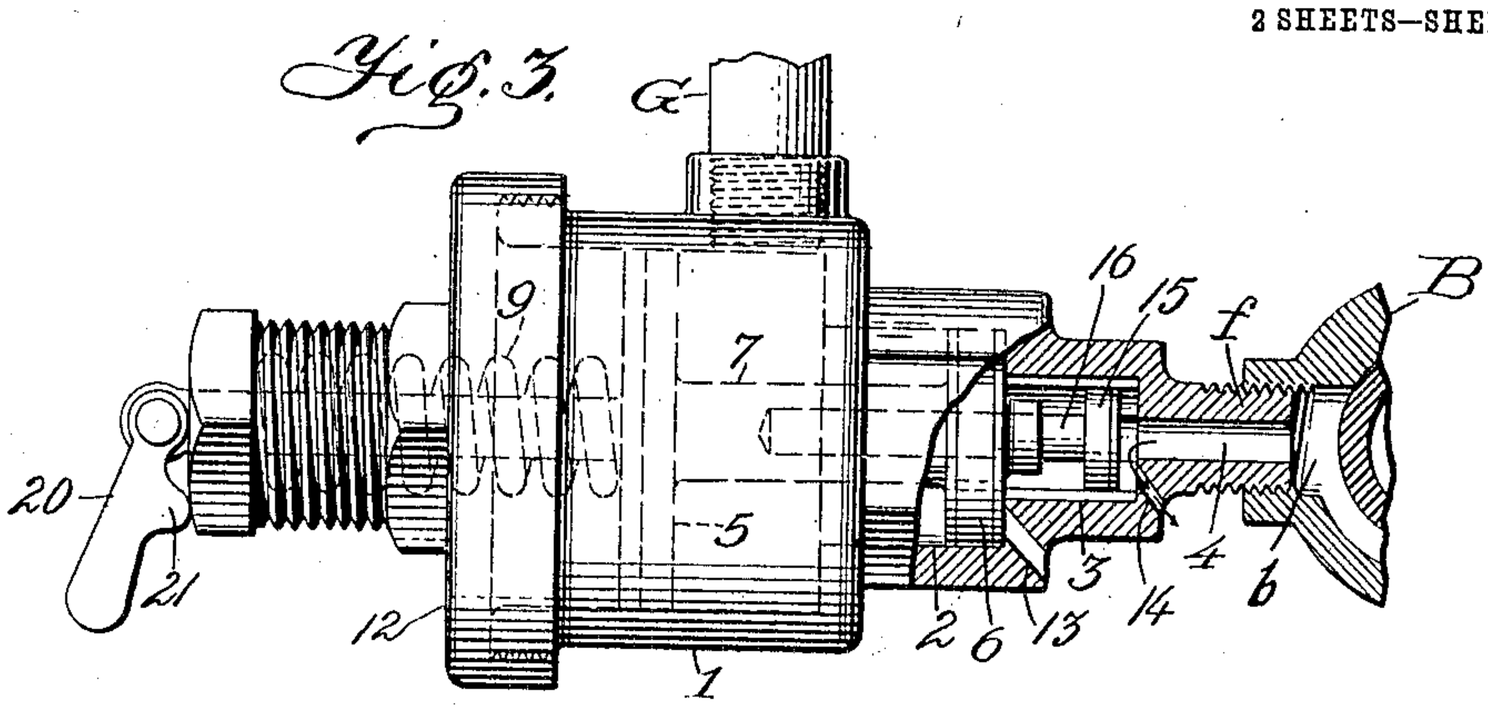


Fig. 4.

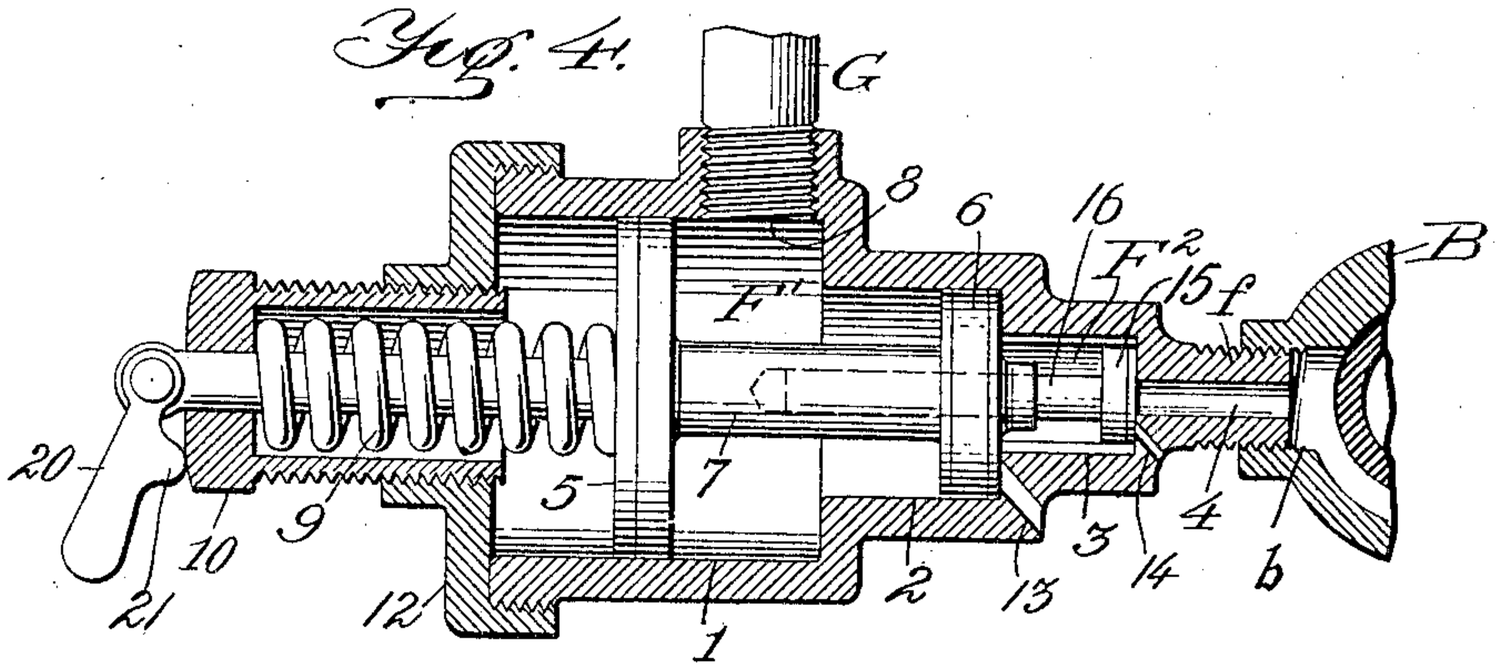
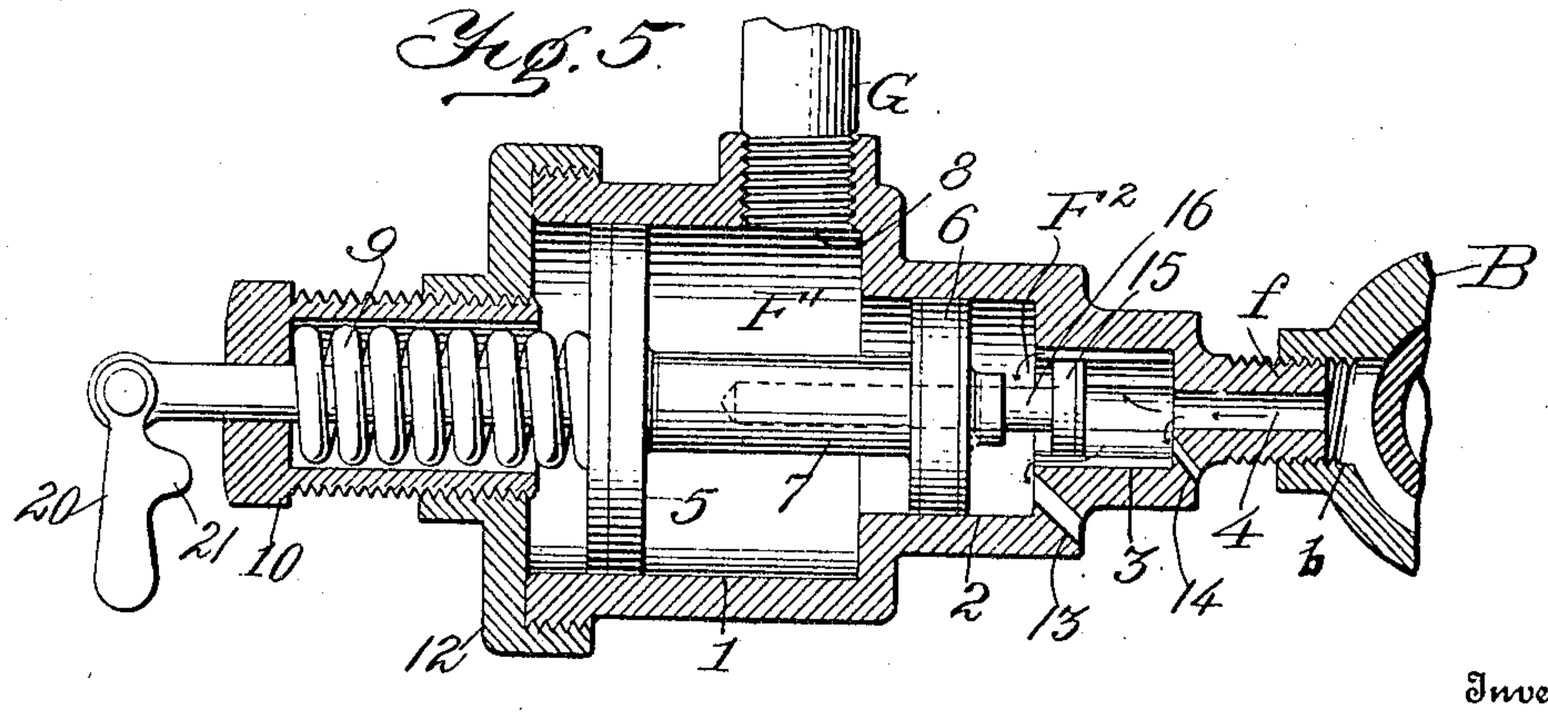


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PRESSURE-RETAINING AND QUICK-RELEASE VALVE FOR AIR-BRAKES.

No. 871,270. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed April 3, 1906. Serial No. 309,691.

To all whom it may concern:

Be it known that I, MARTIN GRIFFIN, a citizen of the United States, residing at St. Marys, in the county of Elk and State of Pennsylvania, have invented certain new and useful Improvements in Pressure-Retaining and Quick-Release Valves for Air-Brakes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the pressure-intercepting and controlling mechanism of automatic air-brakes, and particularly to pressure-retainers or retaining-valves which operate in connection with the triple valves for automatically controlling the exhaust from the brake-cylinders and retaining air-pressure therein after a release operation of the triples, the purpose of which is to insure control of the brakes through the engineer's controlling or brake-valve, and enable the engineer to recharge the auxiliary reservoirs without releasing the brakes, especially when running on long down grades.

The function and utility of such pressure-retaining valves, while well understood by those skilled in the art, may be made more readily apparent by a brief explanation of a standard air-brake system. Compressed air from a main reservoir on the locomotive or tender is led through the engineer's controlling valve or brake-valve to the train-pipe, which is connected with auxiliary reservoirs under the cars. These auxiliary reservoirs are connected with the respective brake-cylinders, which contain the spring-retracted pistons for operating the car-brakes. A triple valve intercepts and controls the flow of air from the train-pipe to each auxiliary reservoir, and from said reservoir to the brake-cylinder, and the exhaust from the brake-cylinder. This triple valve is so constructed and operative that when the train-pipe pressure is normal, usually at seventy pounds, the valve allows communication between the train-pipe and auxiliary reservoir, while closing the passage from the auxiliary reservoir to the brake-cylinder, the latter being opened to the atmosphere through an exhaust port in the triple valve. To apply the brakes, the engineer makes a reduction of pressure in the train-line, which causes the triple valve to cut off the auxiliary reservoir from the train-pipe, close the triple exhaust, and connect the auxiliary reservoir with the brake-cylinder, so that a part of the compressed air in the auxiliary reservoir is drawn into the brake-cylinder and operates on the brake-piston. To release the brake, the engineer restores or increases the train-line pressure, which causes the triple valve to open communication from the train-pipe to the auxiliary reservoir, cut off the latter from the brake-cylinder, and open the exhaust, permitting the air in the brake-cylinder to escape to the atmosphere as the brakes release. Thus each application of the brakes takes air-pressure from the auxiliary reservoir, which can be restored only by a fresh supply from the main reservoir, and this supply is essentially accompanied by an opening of the exhaust of the triple valve, permitting release of the brakes. It would therefore be impossible, without a pressure-retainer for holding the air in the brake-cylinder, to recharge the auxiliary reservoir while maintaining the brakes set; so that in the case of a constant application of the brakes, while running on a long down grade, the auxiliary pressure would be liable to fall so low by reduction and leakage as to be unable to hold the train. The function of the pressure-retainer, therefore, is to retain in the brake-cylinder the air-pressure which would otherwise escape through the triple exhaust on restoring or increasing the train-line pressure, whereby the brakes may be held continuously applied while the engineer recharges the auxiliary reservoir.

In automatic pressure-retainers, wherein the exhaust port of a triple valve is automatically controlled by air-pressure, as distinguished from hand-operated retainer-valves, the retainer usually closes the exhaust at or below the normal train-line pressure, and opens the same at a predetermined or abnormal train-line pressure, to permit release of the brakes, at the will of the engineer. Many of the automatic retainers heretofore devised have however been more or less objectionable, either from interference with the proper working of the triple valve, or interference with the auxiliary reservoir pressure, or by reason of retarding the release of the brakes, and from other causes. A more serious defect has been the closure or substantially plugging up of the triple valve

exhaust port during regular running of the train, while the brakes are off, the engineer's brake-valve being at "running position." The reason why this is objectionable may be explained as follows: As well known, in actual service there may be more or less leakage through the triple valve, either from the train-pipe or from the auxiliary reservoir. This leakage must escape through the triple valve exhaust port (where it is frequently observed to cause a blow), since otherwise it would pass into the brake-cylinder, and, if sufficiently profuse, would unexpectedly apply the brakes when not desired, especially should the small leakage groove in the brake-cylinder be clogged up or otherwise insufficient to permit the escape of the leakage past the piston. Hence should the triple valve exhaust port be stopped or plugged during the running of the train, there would be danger of unintentionally setting the brakes, particularly in the event of a defective equipment, or an accident in any part thereof. Furthermore, on the release of the brakes, all the air-pressure does not escape at once through the triple exhaust, and consequently, should the exhaust be suddenly closed, some pressure may remain in the brake-cylinder sufficient to maintain an undesirable light application of the brakes and thereby interfere with the running of the train. A practicable pressure-retainer should, therefore, operate without interference with the regular functions of the triple valve, especially without closure of the exhaust except at the will of the engineer for retaining pressure in the brake-cylinder. The retainer should thus be absolutely under control of the engineer's valve by which he manipulates the brakes, so as to automatically retain the pressure in the brake-cylinder and release the same at will. It should also operate without affecting the auxiliary reservoir pressure, and should permit a quick release, allowing a simultaneous release of all the brakes throughout the train. The chief object of my invention is to provide a simple, efficient and reliable automatic pressure-retainer having the desired characteristics mentioned.

One preferred embodiment of my invention is illustrated in the accompanying drawings, which form a part of this specification, it being understood however that the invention is susceptible of embodiment in other forms, or modification in details of construction and arrangement, and of incorporation in different kinds of brake equipment. Without restriction therefore to the particular construction illustrated, the invention will hereinafter be fully described with reference to said drawings and will then be more particularly pointed out and defined in the appended claims.

In said drawings, Figure 1 is a side elevation, with parts broken away, of a brake equipment embodying my invention, showing the brake-cylinder, auxiliary reservoir, adjacent train-pipe connections, interposed triple valve and the pressure-retaining and quick-release valve. Fig. 2 is an end elevation of the subject-matter of Fig. 1. Fig. 3 is an enlarged elevation, partly in section, of the pressure-retaining and quick-release valve, and with parts indicated by dotted lines, showing the device in normal operation to allow escape of leakage from the exhaust port of the triple valve while the train is running with the brakes off, the triple valve being of course in release position with its exhaust in communication with the brake cylinder. Fig. 4 is a central longitudinal section, showing the device in retaining position, for holding the air-pressure in the brake-cylinder when the triple valve has been brought to release position after an application of the brakes, so as to permit recharging the auxiliary reservoir without release of the brakes. Fig. 5 is a similar view showing the device in release position, the triple valve being still in its release position.

Referring to the drawings by symbols of reference, A denotes the branch pipe from the train-line, B the triple valve, C the auxiliary reservoir, and D the brake-cylinder, the latter being connected with the triple valve by the pipe E. The construction and relation of these parts may be the same as in the Westinghouse or other suitable brake system, and need not be described in detail.

It is understood that my invention is not limited to its application to any specific system, but may be embodied in any automatic fluid-pressure brake-apparatus having a distributing valve (the ordinary triple valve) intercepting and controlling the flow of motive fluid from the train-line to the auxiliary reservoir and from the latter to the brake-cylinder.

My improved pressure-retaining and quick-release valve, designated by the letter F, is shown in its preferred relation, that is interposed between the exhaust port *b* of the triple valve and the train-pipe A. It is shown attached directly to the triple valve, having a threaded nipple *f* tapped into the exhaust ports thereof, and connected by the pipe G with the train-pipe.

The internal construction of the device is shown in Figs. 3, 4 and 5. In this embodiment, the valve-case or shell has a differential bore, or cylinders 1 and 2 of different diameters, from the smaller one of which extends a bore or cylinder 3 of still smaller diameter, the latter terminating in a port or hole 4 in the nipple *f*. Said port 4 is therefore in communication with the exhaust port *b* of the triple valve, and permits inlet of compressed air from the brake-cylinder and

triple valve into the retainer-valve. Two connected pistons 5 and 6, of different sizes or areas, are arranged in differential relation in the cylinders 1 and 2 respectively, both pistons being shown fixed on the same rod or stem 7 and connected together thereby. In place of piston-heads, as shown, elastic diaphragms secured in the case or any equivalent members may be employed, it being understood that the word "piston" as used herein is intended to denote any suitable movable pressure abutment, such as piston-heads or diaphragms. The space or chamber F′ between the pistons has a port 8 connected with the train-line through the aforesaid pipe G, whereby said chamber is constantly exposed to train-line pressure, which pressure acts differentially upon said pistons. Opposing this differential piston-pressure is a spring 9, shown as a stout coiled spring, arranged on the rod 8 behind the larger piston, and acting between said piston and an adjusting nut 10. Said nut is tapped through the cap 12, which is screwed onto the back end of the valve-case. The smaller piston 6 divides the pressure-chamber F′ at one side from the exhaust-chamber F^2 at the opposite side. This latter chamber F^2 includes the cylinder 3, and also a part of the cylinder 2 when the connected pistons are moved backward in the release operation of the retainer, as hereinafter explained. It is herein termed the exhaust-chamber, because it is in communication with the exhaust port *b* of the triple valve, through the port 4, and because the air-pressure from the brake-cylinder is exhausted or released therefrom, as hereinafter explained. Said chamber F^2 has an exhaust or release port 13 controlled by a valve, which in this instance is the piston 6 itself; said piston 6 being normally forced by the spring 9 against its seat in the end of the cylinder 2, and the said port 13 being preferably formed in said seat or in the end of cylinder 2, though it may be formed in the side of said cylinder and closed by the periphery instead of the face of said piston. A supplementary or smaller exhaust port 14, hereinafter termed the leakage-port, is provided in the chamber F^2, preferably in the end of the cylinder 3, adjacent to the port 4. Said leakage-port 14 is controlled by a valve or valve-head 15 carried by the valve-stem 16. Said valve-stem is loosely fitted in a bore or socket in the piston-rod 7, said socket being of suitable length to provide an adequate guide for the valve-stem. The rear end of the valve-stem, by abutting against the extremity of said bore or socket, limits the backward movement of the valve-head, meaning the movement in a direction toward the piston 6. A relatively weak spring may be interposed between the piston 6 and valve-head 15, to force the latter yieldingly forward toward its seat, in the end of the cylinder 3. When seated, said valve-head 15 closes the ports 4 and 14. When unseated, it opens said ports and allows air to pass behind itself, the valve-head being of smaller diameter than the cylinder 3, or the latter having cored-out passages around the valve-head.

In operation, the retainer being connected between the train-line and triple valve exhaust, as hereinbefore explained, the pressure-spring 9 is set or adjusted to balance or overcome the differential piston-pressure in the chamber F′ except at a predetermined train-line pressure, preferably at a certain excess pressure, say two or three or more pounds above the normal train-line pressure, which may be either the usual seventy pounds per square inch or any suitable pressure which it may be desired to maintain normally in the auxiliary reservoir. Hence the spring will operate to hold the piston-valve 6 seated, thereby closing the exhaust or release port from the exhaust chamber F^2, except when said predetermined or excess train-line pressure causes a difference between the pressures on pistons 5 and 6 sufficient to overcome the resistance of said spring. The spring 9 does not however affect the supplementary valve 15, which is free to move loosely back and forth in the chamber F^2, or to and from its valve seat, within the limits allowed by the clearance between the extremity of the valve-stem 16 and the extremity of the socket in the piston-rod 7 in which said valve-stem is fitted. Now assume that the engineer's brake-valve is at "running position," the train-line pressure being normal, and the train running with the brakes off. Under these conditions, the triple valve, which is at normal or release position, allows communication between the train-pipe and auxiliary reservoir, cuts off the latter from the brake-cylinder, and maintains an open passage from the brake-cylinder to the exhaust port *b*, which port is connected with the exhaust chamber F^2 of the retainer-valve F. Said retainer-valve now operates, as shown in Fig. 3, to permit a normal escape from the triple exhaust. Any air-pressure in the brake-cylinder or passages leading thereto, or any leakage through the triple valve or from either the train-pipe or auxiliary reservoir, is allowed to escape by unseating the valve-head 15 and pass out through the leakage-port 14. There is no resistance to the unseating of the valve, unless a light spring be employed between the piston 6 and valve-head 15, in which case the valve would unseat when the accumulation of leakage would exert sufficient pressure to overcome said spring. In other words, the exhaust port *b* of the pressure valve is substantially open, instead of plugged or closed up by the retainer, as is usual with such devices.

Hence any leakage which may occur through the triple valve, or into any of the passages in communication with the brake-cylinder, may readily escape to the atmosphere. This avoids liability of accidental setting of the brakes.

To apply the brakes, the engineer moves his brake-valve to "service position," thereby making a reduction in the train-line pressure, causing the triple valve to move to service position, cutting off the train-pipe from the auxiliary reservoir, opening the passage from the latter to the brake-cylinder, and closing the exhaust from the brake-cylinder. This of course lets air from the auxiliary reservoir into the brake-cylinder, to apply the brakes. The exhaust port *b* of the triple valve now being closed by the operation of the triple valve itself, the retainer F is inoperative, that is it is not performing any function, and neither affects nor is affected by the triple valve, except that the reduction in the train-line pressure diminishes the opposition to the spring 9, which spring therefore holds the piston-valve 6 firmly seated. This condition exists so long as the triple valve is in service position, as well as while the engineer's brake-valve and triple valve are on lap, in making successive reductions for service stops, the triple exhaust being closed by the triple valve itself during these phases of operation. The same is true of course during an emergency application of the brakes.

To recharge the auxiliary reservoir without releasing the brakes, the engineer increases or restores the train-line pressure, first moving his brake-valve to "running position" in the usual way. This restoration of the normal train-line pressure operates the triple valve back to its release position, thereby closing the pasage from the auxiliary reservoir to the brake-cylinder, opening the passage from the train-pipe to the auxiliary reservoir, and opening the exhaust passage from the brake-cylinder. The brake-cylinder pressure being thus suddenly released by the triple valve, compressed air flashes forcibly past the valve-head 15 into the chamber F^2 behind the same and firmly seats said valve-head; the sudden inrush of compressed air being too great to escape through the small leakage-port 14, and the chamber F^2 having its exhaust or release port 13 closed by the piston-valve 6, which is held seated by the spring 9, the train-line pressure being yet insufficient to overcome said spring 9. The inlet-port 4 and leakage-port 14 are thus closed by the valve 15, retaining the pressure in the brake-cylinder, notwithstanding the release operation of the triple valve. The auxiliary reservoir can now be recharged to normal pressure, while the pressure is maintained in the brake-cylinder. Hence the engineer can charge up the brake-cylinder to whatever pressure is needed to control the train on a down grade, and then recharge the train-line and auxiliary reservoir, and move his brake-valve to "running position", while the retainer holds the pressure in the brake-cylinder.

To release the brakes, the engineer throws some excess pressure into the train-line, sufficient to cause a differential piston-pressure in the pressure chamber F′ high enough to overcome the resistance of the spring 9 and thereby unseat the piston-valve 6, thus opening the release port 12 and allowing the escape of compressed air from the exhaust chamber F^2 and from the exhaust port of the triple valve, the supplementary valve 15 being also unseated since the pressure behind the same is relieved. The brakes can be released in this manner either immediately after an application, or after the pressure has been retained for a while in the brake-cylinder, in the manner already described, independently of the release operation of the triple valve.

It will be observed that the piston 6, in the illustrated embodiment of the invention, constitutes a controlling valve for the exit or release port 13 from the exhaust chamber F^2, whose inlet port 4 is in communication with the triple exhaust; the said piston 6 being interposed between the train-line pressure in the chamber F′ and the brake-cylinder pressure in the chamber F^2, so that the brake-cylinder pressure on said piston 6 aids the differential piston pressure in the chamber F′ for operating the retainer to release position. As an alternative construction, the piston 6 or the connected pistons 5 and 6 may operate an independent or separate valve for controlling the release port 13, said release port being situated in a different position in that case. The described construction is preferred however. The supplementary valve 15 also operates to close or stop said inlet-port 4, as well as the leakage-port 14, during the pressure-retaining operation of the device, while said valve 15 opens said inlet and leakage ports under normal conditions. Both valves 6 and 15 open both the inlet and exit, as well as the leakage-port, during the release operation. Being interposed between the train-line and exhaust of the triple valve, the device is operated directly by the train-line pressure, without affecting the auxiliary reservoir pressure, and without interference with the regular operation of the triple valve. The port 8 of the device may of course be connected with the auxiliary reservoir, in which case the device would be operated at a predetermined or abnormal train-line pressure through the auxiliary reservoir pressure, the auxiliary reservoir being in connection with the train-line and fed therefrom; so that it will be understood that the invention is not limited in its application to

the manner of incorporating in the brake equipment shown and described, but for the reason stated the device is preferably connected with and operated by the train-line pressure direct.

One of the most useful features of this pressure-retaining valve is its quick release, due to recharge of the auxiliary reservoir and the release operation of the triple valve prior to actual release of the brakes by the retainer, thus permitting the release of the brakes on all the cars of the longest train simultaneously. Under the present practice, the brakes are released consecutively, and while the release is nearly simultaneous, yet on a long train, say of sixty cars, there is an interval of possibly three or four seconds between the time of the release of the cars in the front end of the train and the cars in the rear of the train; enough to necessitate a practice in air-braking of bringing a train to a full stop when the speed is reduced to ten miles per hour, or less, in order to avoid the rear portion breaking off from the front portion, on account of the brakes not releasing together. This difficulty is on account of the fact that in old style equipment the release of the brakes is immediately effected by the release operation of the triples, caused by an increase or restoration of previously reduced train-line pressure. Obviously the increased pressure necessary to release the brakes, being suddenly let into the train-line, has to fill up the whole train-line including the auxiliary reservoirs, the capacity of which is such as to require a perceptible time, although a slight time, before the whole train-line reaches the higher pressure. Consequently the action of the triples throughout a long train is of necessity slightly consecutive. Whereas, with my improved equipment herein set forth, the train-pipe pressure is restored to normal and the triples are released before the release of the brakes, thus fully charging the auxiliary reservoirs; and then an excess pressure let into the charged train-linewill act instantly throughout the entire line upon the several retainer-valves, thus instantly and simultaneously releasing all the brakes of the train.

By means of the adjusting nut 10, the pressure of the spring 9 can be regulated to graduate the pressure which is to be retained in the brake-cylinder. Said adjusting nut 10 is shown having a tubular portion tapped through the cap 12 and inclosing both the spring 9 and rod 7, which latter extends loosely through the rear end of the nut and is equipped with a hand-lever 20 having a cam-projection 21 adapted to bear as a fulcrum against the nut, whereby the rod 7 can be retracted to position to unseat the piston-valve 6 and allow unseating of the valve 15. Any suitable devices, such as eccentrics or set-screws, may be employed for this purpose, in order to provide for controlling the pressure-retainer for inspection or in case of any clogging of ports or other trouble. Both the adjusting nut 10 and cap 12 are shown formed with polygonal exterior portions for engagement by a wrench, and the valve-case itself is shown having a polygonal intermediate portion (the exterior of the intermediate cylinder 2), also for engagement by a wrench for attaching the device to the triple valve as well as for holding the device while screwing on its cap and while screwing the adjusting nut.

The device is herein shown embodied in a simple and practicable form, adapted for attachment to or incorporation in any of the standard brake systems without necessitating any alteration of the triple valve or other modification in the regular equipment.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an automatic air-brake system, the combination with the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve, of means maintaining an exhaust from the triple valve to the atmosphere during running operation of the triple valve or during an absence of braking-pressure in the brake-cylinder, means automatically operative below a predetermined abnormal train-line pressure for stopping said exhaust and maintaining pressure in the brake-cylinder upon a release operation of the triple valve occurring after admission of pressure to the brake-cylinder, and means operative at or above said predetermined train-line pressure for releasing said pressure from the brake-cylinder.

2. In an automatic air-brake system, the combination with the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve, of a retaining valve controlling the exhaust and automatically operative to close or stop the same upon a release operation of the triple valve occurring after admission of pressure to the brake-cylinder, means operative by an abnormal or excessive train-line pressure for releasing said valve or opening said exhaust, and means operative independent of train-line pressure for maintaining an open exhaust during running operation of the triple valve or in the absence of braking pressure in the brake-cylinder.

3. In an automatic air-brake system, the combination with the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve, of an automatic pressure-retainer having a chamber provided with an inlet-port, a release-port, and a leakage-port, said inlet-port being in communication with the exhaust from the brake-cylinder, a valve normally closing said release-port and operative to open the same only at an abnormal train-line pressure, and a supplementary valve controlling said leakage-port and adapted to close

the same only upon a release operation of the triple valve occurring after charging the brake-cylinder.

4. In an automatic air-brake system, the combination with the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve, of an automatic pressure-retainer having a chamber provided with an inlet-port, a release-port, and a leakage-port, said inlet-port being in communication with the exhaust from the brake-cylinder, a valve normally closing said release-port and operative to open the same only at an abnormal train-line pressure, and a supplementary controlling valve for said leakage-port operated to open said port by leakage exhaust while the brake-cylinder is uncharged and operated to close said port by exhaust from the brake-cylinder when charged.

5. A pressure-retaining and release device, comprising a valve-casing having a chamber arranged for communication with the exhaust port of a triple valve, said chamber being provided with an exhaust or release-port and a relatively smaller leakage-port, a retaining valve for said release-port normally closing the same and operative to open said port at a predetermined train-line pressure, and a valve for said leakage-port normally permitting an escape therethrough but operative to close the same when pressure is retained by said retaining valve.

6. A pressure-retaining and release device, comprising a valve-casing having a chamber provided with an inlet-port for communication with the exhaust of a triple valve and provided with an adjacent leakage-port and with a release or exhaust port, a retaining valve closing said release-port, means for operating said valve to open said port at a predetermined or abnormal train-line pressure, and a supplemental valve adapted to close said inlet and leakage-ports, said supplemental valve being movable under light pressure from the triple valve to uncover said ports, while the quick inrush of heavy pressure from the triple valve passes behind and operates said supplemental valve to close said ports.

7. A pressure-retaining and release device, comprising a valve-casing having a cylinder or chamber provided with an inlet-port at one end for communication with the exhaust-port of a triple valve and provided with an adjacent leakage-port, said cylinder having an outlet at its other end, a retaining valve normally closing said outlet and operative to open the same at a predetermined or abnormal train-line pressure, and a supplemental valve independently movable and guided in said cylinder and adapted when seated to close said inlet and leakage-ports and when unseated to open them, space or passages for air being provided in said cylinder around or past said supplemental valve, whereby leakage pressure from the triple valve unseats the supplemental valve to allow escape of such leakage, while release of brake-cylinder pressure passes behind and seats said valve, and means for releasing said retaining valve and thereby releasing said supplemental valve, said means being operative at a predetermined or abnormal train-line pressure, there being provision for passage of air behind said supplemental valve to said outlet during such release.

8. A pressure-retaining and release valve, comprising a valve-casing having a chamber for communication with train-line pressure, a movable piston or abutment therein subject to such pressure, an exhaust chamber arranged for communication with the exhaust of a triple valve and having an outlet or release-port, a retaining valve controlling said release-port, said valve being connected with and operable by said piston, a spring operating on said piston contrary to the air-pressure thereon and thereby normally holding said retaining valve closed, the spring being yieldable by pressure on the piston at a predetermined or abnormal train-line pressure to open said retaining valve, and a supplemental valve in said exhaust chamber which when seated closes the inlet from the triple exhaust as well as the leakage port and which opens said ports when unseated, there being space or passages for air around or past said supplemental valve to afford communication between the spaces at opposite sides thereof.

9. An automatic pressure-retaining and release valve, comprising a valve-casing having an exhaust chamber provided with an inlet-port for connection with a triple exhaust and an adjacent vent for communication with the atmosphere, a valve which when seated closes said inlet port and vent and when unseated opens said port and makes communication therefrom to said vent, there being passage for air around or past said valve between the spaces at its opposite sides, connected pistons or movable abutments of different areas differentially arranged in said valve-casing, thereby providing an intermediate pressure-chamber which has a port for communication with train-line pressure, whereby said pistons are exposed to such pressure, the smaller piston making a partition between said pressure-chamber and exhaust-chamber, an outlet or release-port from said exhaust-chamber controlled by said smaller piston, and a spring opposing the differential piston-pressure and maintaining said release-port normally closed, said spring being yieldable to allow movement of the pistons in a direction to open said release-port at a predetermined or abnormal train-line pressure.

10. An automatic pressure-retaining and release valve, comprising a valve-casing hav-

ing bores or cylinders of different diameters, the smaller cylinder having an extended bore or cylinder terminating in an inlet-port for connection with a triple exhaust, the said smallest bore having a vent to the atmosphere, pistons or movable abutments of different areas arranged in the first-mentioned bores, a rod connecting said pistons, there being a port between said pistons for communication with train-line pressure, a spring operating against the differential pressures on the piston and adapted to overbalance the same except at an abnormal train-line pressure, a valve-head in said smallest bore or cylinder adapted to cover and uncover said inlet-port and vent, a valve-stem therefor loosely fitted in a socket in the piston-rod, there being passage past or around said valve-head, and a release-port controlled by the smaller piston.

11. A pressure-retaining and release valve comprising a casing having a primary pressure-chamber arranged for connection with a train-pipe and an exhaust-chamber arranged for connection with the exhaust of a triple valve, and valve-mechanism therein arranged to operate below a predetermined pressure in said primary chamber to allow escape to the atmosphere of light pressure from the exhaust-chamber and to retain therein any heavy pressure or pressure released from a charged brake-cylinder, said valve-mechanism being operative to release all pressure from said exhaust-chamber when an excess of said predetermined pressure enters said primary chamber.

12. A pressure-retaining and release valve having a chamber provided with an inlet-port for connection with the exhaust of a triple valve and provided with an adjacent vent to the atmosphere, a valve working therein adapted to cover and uncover said port and vent, there being communication past or around said valve, and means operative by a predetermined or abnormal train-line pressure for releasing pressure from behind said valve.

13. A pressure-retaining and release valve, comprising a valve-casing having an inlet-port for connection with the triple exhaust and an adjacent vent for communication with the atmosphere, a valve which when seated closes said inlet-port and when unseated opens said inlet-port and connects it with said vent, connected pistons or movable abutments differentially arranged in said valve-casing, the valve-casing having a port between said pistons for connection with the train-line, whereby the chamber between said pistons is exposed to train-line pressure, and a spring operating against the differential pressure on said pistons, said pistons operating under predetermined or abnormal train-line pressure in a direction against resistance of said spring to allow backward movement of the valve, there being no positive connection between said pistons and the valve.

14. A pressure-retaining and release valve, comprising a casing having a differential bore and connected pistons differentially arranged therein, the space or chamber between said pistons being arranged for connection with the train-pipe, the space or chamber at the opposite side of the smaller piston being arranged for connection with the exhaust of a triple valve, a release-port to the atmosphere controlled by the smaller piston, and a spring normally holding said pistons in position to close said release-port and adapted to yield to allow opening of said port when an abnormal pressure enters the chamber between said pistons.

15. In a valve of the character described, the combination of a valve-case, movable rod therein, a valve controlled by said rod, a spring operating on said rod, the end of the rod extending backward through the valve-case, and a manually-operated device for retracting said rod against force of said spring and locking it in such retracted position, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MARTIN GRIFFIN.

Witnesses:
J. T. COLBERT,
D. J. DRISCOLL.