W. P. A. MACFARLANE.

FLUID PRESSURE BRAKE.

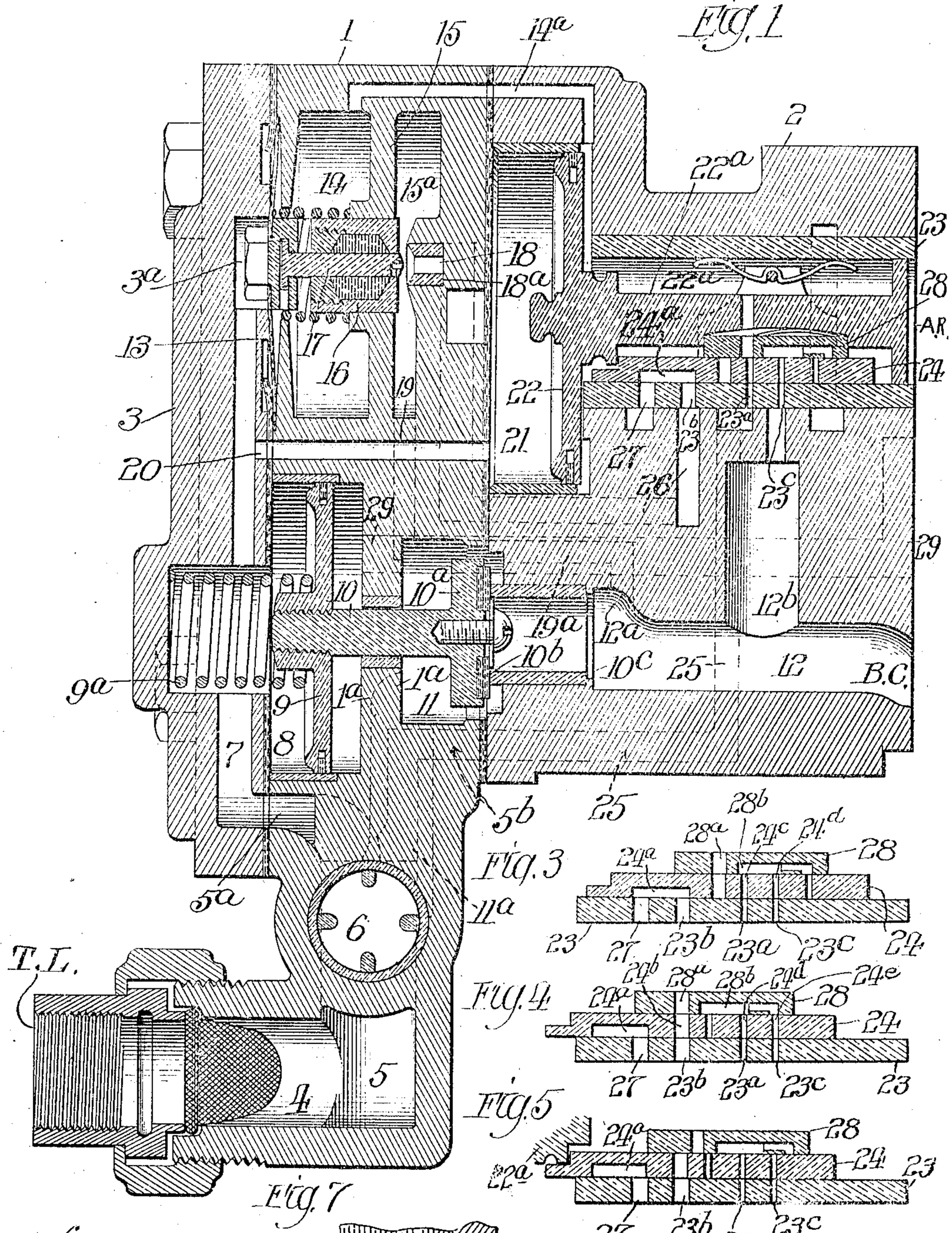
APPLICATION FILED JAN. 14, 1908.

926,068.

Patented June 22, 1909.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

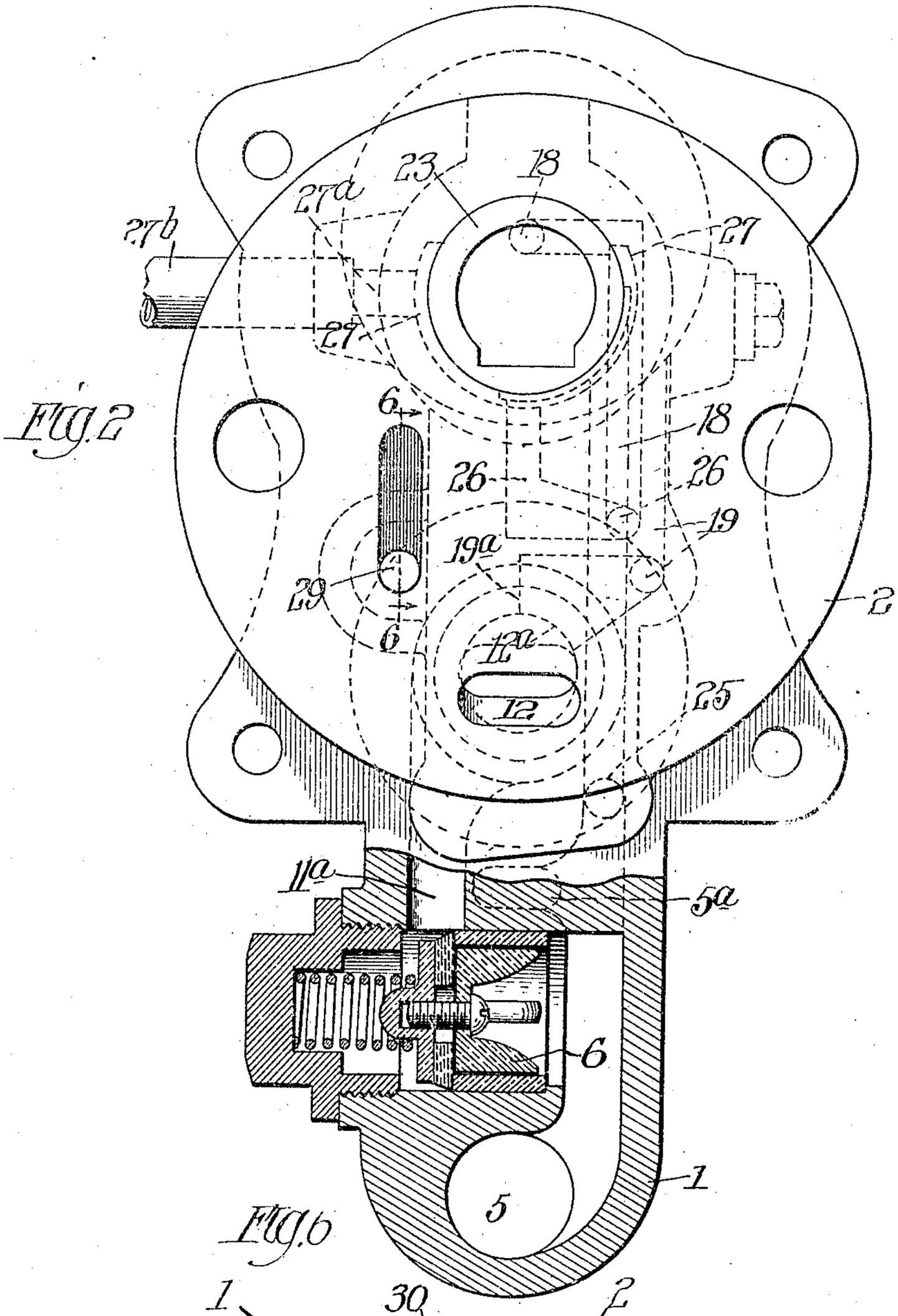
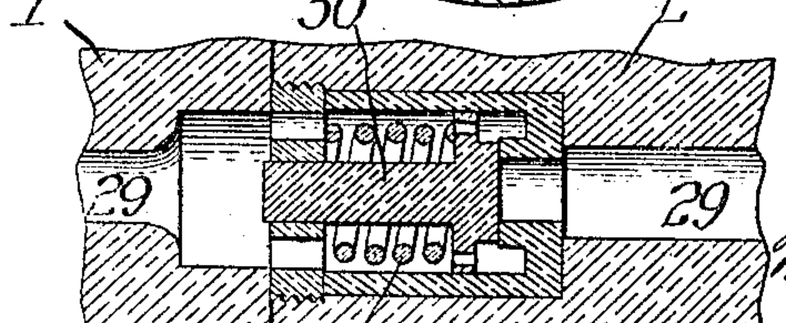


Fig. 2

Fig. 6



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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE BRAKE.

No. 926,068. Specification of Letters Patent. Patented June 22, 1909.

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To all whom it may concern:

Be it known that I, WILLIAM P. A. MACFARLANE, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Fluid-Pressure Brakes, of which the following is a specification.

This invention relates to a so called triple valve device for actuating railway brakes and the object thereof is to provide an efficient and reliable device of this character intended more especially for properly and efficiently braking the cars of long freight trains composed of more than fifty and upward of one hundred cars or so, with the result that the difficulties now encountered in braking trains of this length, particularly in the setting and releasing of the brakes, are overcome. As is well known to those skilled in the art, in service or graduated work of the brakes, the triple valves nearest the locomotive are the first to be applied, owing to the fact that the great length of the train line and the friction therein permits a comparatively prompt reduction of the train line pressure at the front end of the train and a slow reduction at the rear end or in the rear portion of the train. As a consequence, the front end brakes are set much sooner than the rear end brakes, so that the front end of the train will be retarded or braked, while the rearmost cars, which are not braked or retarded, will cause shock by bumping against the cars in front. So also a difficulty is presented in the releasing of the brakes and the same cause, that is, the length and friction of the train line, presents another difficulty, inasmuch as in the release of the brakes on a long train, the train line pressure will increase or build up faster in the front end of the train line than in the rear end, with the result that a so called "break away" is caused, that is, a pulling apart of the train. It is to remedy these difficulties that I have devised the triple valve hereinafter described, which is capable of producing a quicker train line reduction throughout the entire train line in the application of the brakes and in releasing the brakes for holding the pressure in the front end brakes until the rear end brakes are releasing.

In the drawings, Figure 1 is a central vertical section of my triple valve; Fig. 2 an elevation of the end of the triple valve which is clamped to the auxiliary reservoir as usual, with a portion of the same broken away; Figs. 3, 4 and 5 detail views of the main and graduating valves showing the same in different relative positions; Fig. 6 a detail view taken through a portion of the triple valve substantially on the line 6 of Fig. 2; and Fig. 7 a central section of the retarding valve or stem 17.

Referring to the present embodiment of my invention as illustrated in the drawings, I provide a casing 1 containing some of the operating parts and I also provide a second casing 2 which contains other working parts and is secured in suitable manner to the body or casing 1. In addition, the structure comprises a cap 3, which is bolted or otherwise secured to the outer side of the casing 1. The train line air enters the triple valve from the train line at the train line connection marked T L in Fig. 1 and after passing the usual strainer 4 enters the passage 5. The air then passes back and upwardly to the right of the check valve 6, said passage 5 turning to the left as shown in dotted lines in Fig. 1, and connecting with a passage 7 in the cap 3 at the point marked 5^a. This passage 5 divides at a point above the check valve, one portion turning to the left as stated and the other turning to the right and connecting with a passage (shown in dotted lines) in the body 2 at a point marked 5^b, as hereinafter described.

The air entering the passage 7, passing upwardly, enters a chamber 8, in which reciprocates the movable abutment or piston 9 of the emergency valve mechanism. This mechanism comprises, in addition to the piston 9, a stem 10 which passes through a wall 1^a in the casing 1 and carries at its outer end a head 10^a, whose outer or right hand face is provided with a rubber or other flexible seat 10^b. This head and seat constitute the emergency valve which normally seats upon the left hand end of a bushing 10^c and thereby governs a communication between the chamber 11 and the passage 12 that extends to the brake cylinder at the point marked B C. The emergency valve is, of course, designed to control the venting of train line air direct from the train line to the brake cylinder in the emergency application of the brakes, and for this purpose the chamber 11 is connected with the train line through a

passage 11ª shown in dotted lines in Fig. 1, and in full lines in Fig. 2. In the emergency application of the brakes the train line air passes through the passage 5 and, forcing open the check valve 6, passes upwardly through the passage 11ª, chamber 11, and thence through the passage 12 into the brake cylinder. As shown, a spring 9ª is arranged to press against the emergency valve piston 9 in a direction to hold the same seated. The passage 7 continues upwardly in the cap 3 to an opening 3ª, where it presses against the left hand side of a movable abutment or diaphragm 13, the other side of the diaphragm being exposed to auxiliary reservoir air from a chamber 14, which communicates with the auxiliary reservoir pressure in a manner hereinafter explained. This diaphragm constitutes a part of the mechanism for retarding the release of the brakes at the front end of the train so as to give the train line in the rearward portion of the train an opportunity to build up pressure. Describing this retarding mechanism, a wall or partition 15 is formed on or as a part of the casing 1, so as to thereby form a chamber 15ª between itself and the outer wall or surface of said casing. In this wall 15 is arranged a suitable packing or stuffing box 16 for packing a movable stem or rod 17 connected in suitable manner to the diaphragm 13. The right hand end of this rod forms a valve which is arranged to govern or restrict a passage 18 forming a part of the brake release passage. The end or head of this particular passage 18 is provided with a bushing 18ª which forms a seat for the stem or rod 17. The function of this stem is to restrict the carrying capacity of the brake release passage to thereby retard the release of the brakes, but it is not desired that the release or exhaust of the brake cylinder shall be entirely cut off by the retarding mechanism and to this end the rod 17 is provided at its right hand or valve end with a passage 17ª, as shown in Fig. 1 and more clearly in Fig. 7. It will be evident that when the stem 17 is in its full retarding position, the brake cylinder pressure can be released through the passage 17ª.

A passage 19 shown in dotted lines in Fig. 1 is formed in the casing 1, its upper end connecting with the chamber 15ª and its lower end turning to the right and connecting with the passage 19ª, such latter passage connecting with the passage 12 at a point 12ª. These passages 12, 12ª, 19ª, 18, together with the passage 26 with which the passage 18 connects, passage 23ᵇ in bushing 23, recess 24ª in the main valve and release port 27, constitute the route for the brake cylinder pressure in the releasing or exhausting thereof.

A passage 20 in the casing 1 leads from passage 7 to a chamber 21, in which is arranged a movable abutment or piston 22 for operating the main and graduating valves hereinafter described. This piston is provided with a stem 22ª extending into the bushing 23, on which is formed the seat for the main valve 24. The ports and passages for setting and releasing the brakes are located in this bushing and governed by the main valve.

A passage 25 shown in dotted lines in Fig. 1 leads direct from the train pipe to the valve seat in the bushing 23 and to the main valve, such passage communicating with said passage 5ᵇ at its lower end and communicating at its upper end with the passage 23ª in the bushing 23. The train pipe air is fed to the auxiliary reservoir through the passage 5, 5ᵇ, 25, 23ª, and thence through the port 24ᶜ and also through a port 28ª in the graduating valve 28 to the auxiliary reservoir which communicates at the point marked A R. From the reservoir or rather the space on the right hand side of the piston 22, the auxiliary reservoir pressure feeds through the passage 14ª to the chamber 14, so as to supply auxiliary reservoir air to the right hand side of the diaphragm 13.

A passage 12ᵇ is formed in the casing 2, the same communicating at its lower end with the passage 12 to the brake cylinder and extending upwardly where it terminates on the underside of the bushing 23, communicating with passage 23ᶜ therein.

A cavity 27 is formed in the casing 2 and runs partly around the bushing 23, as clearly shown in Fig. 2, the same connecting with the passage 27ª, which in turn connects with the retainer pipe 27ᵇ.

The main valve 24 which is actuated by the stem of the piston 22 is provided with the cavity or recess 24ª which, when in normal or released position, connects the passage 26 from the brake cylinder with the exhaust port or passage 27, leading to the atmosphere according to the relative position of the parts illustrated in Fig. 1. When the main piston 22 has made its full travel to the left, moving the main valve with it, the latter closes the port and passage 23ᵇ, and thereby holds the pressure in the brake cylinder. The main valve 24 is also provided with the port 24ᵇ, which connects with the port and passage 23ᵇ in the bushing 23 when the valve has made its full travel to the left, with the result that the auxiliary reservoir pressure will be admitted to the brake cylinder through passages 26, 18, 19, 19ª and 12. The main valve is also provided with the port 24ᶜ, which in normal position, connects with the passage 23ª, but which is closed off from the port 23ª on the first movement of the valve to the left. The main valve is further provided with a port and passage 24ᵈ, which connects with the passage 23ᶜ when the valve is in its normal position, and with the passage 23ª, when the valve has made its full travel to the left.

Referring in detail to the graduating

valve 28, hereinbefore referred to, this valve is of the same type as the main valve, inasmuch as it is a slide valve and is arranged to slide upon the upper side or face of the main valve. This valve is likewise under the control of the main piston and the construction and arrangement is such that while it will move in unison with the main valve, it will have a preliminary independent movement or travel upon the first movement of the piston 22. In other words, the first movement of the piston 22 and its stem 22[a] will cause the graduating valve 28 to make its full independent movement to the left, and the further movement of said piston and stem will carry both valves to their full travel to the left. The object of this independent movement of the graduating valve is to control certain ports and passages through the main valve, through which train line air is vented from the train line direct to the brake cylinder in the service application of the brakes. The graduating valve 28 also has a port 28[a] which connects with port 24[b] when the graduating valve has made its full travel to thereby admit auxiliary reservoir air to the brake cylinder. The graduating valve is further provided with a cavity or recess 28[b] formed on its underside adjacent the main valve and adapted to connect with ports 24[c] and 24[d] in the main valve, so as to form a complete passage from passage 23[a] to 23[c]. The arrangement is such that some train line air will be thus vented preliminarily to the movement of the main valve and consequently before the brake cylinder is at exhaust, such vented air escaping to the atmosphere, and the train line air subsequently vented will be admitted to the brake cylinder after the exhaust from the latter is closed by the main valve.

After the piston 22 has made its full travel to the left by reason of the usual train line reduction for the service application of the brakes and the air has vented from the auxiliary reservoir to a pressure slightly below the train line pressure, such slight preponderance of train line pressure will move the piston 22 to the right so as to move the graduating valve to the position shown in Fig. 5, closing the passages and ports, so that no further air will be admitted from the train pipe or auxiliary reservoir to the brake cylinder. The parts will remain in this lap position until a further train line reduction is made to give an increase of pressure in the brake cylinder, or an increase of train line pressure is made to move the piston 22 to its full extent to the right and open the release passage 27 and release the brakes.

A passage 29 shown in dotted lines in Fig. 1, extends through the casing 2, connecting at its right hand end with the auxiliary reservoir and at its left hand end with the chamber 8 on the right hand side of the emergency piston 9. Interposed in this passage 29 is a check valve 30 held to its seat with a predetermined pressure by means of a coiled spring 31. This valve, which is of the check valve type, seats in a direction toward the auxiliary reservoir, the purpose of the same being to prevent the flow of air to the reservoir in releasing the brakes, and thereby enabling the operation of the piston 9. This valve has a further object, in that it prevents the flow or admission of the auxiliary reservoir pressure against the right hand face of the piston 9 until a proper train line reduction for emergency action is made.

In the operation of setting and releasing the brakes for ordinary or service stops, a light train line reduction is made by the engineer with his brake valve in the usual manner. As a result, the piston 22 will be moved to the left, first bringing the graduating valve to the position illustrated in Fig. 3, at which time the train line pressure will pass from the train line through passages 25, 23[a], 24[c], cavity 28[b], passages 24[d], 23[c], and 12 to the brake cylinder, and by the release passage to the atmosphere until such time as the main valve has made its full travel, whereupon the passage 23[b] will be closed. The main and graduating valves will now be in the relative position shown in Fig. 4, whereupon the air will flow from the auxiliary reservoir to the brake cylinder through ports 28[a] and 24[b] and passages 23[b], 26, 19 and 12 to the brake cylinder. At the same time, the air from the train line will vent through passages 25, 23[a], 24[d], 28[b], 24[e], 23[c], 12[b] and 12 to the brake cylinder. It will be understood that the carrying capacity of the route or passages from the reservoir is proportioned to vent the reservoir air to the brake cylinder faster than the train line route vents the train line air thereto, so that the train line will soon become in excess over the reservoir air, which causes will move the valves to the lap position shown in Fig. 5, in which all the ports are lapped. On a further train line reduction the same process will occur until equalization is obtained. The local venting of the train line pressure for each triple valve affects the triple valve on the next car until the reduction quickly reaches the last car in the train.

In releasing the brakes a sudden increase in train line pressure will cause the power to pass from the train line into passage 7 and through passage 20 into the chamber 21 and move the piston 22 to the right to its full extent, opening the release ports in the main valve. This increase in train line pressure will pass to the left hand side of the diaphragm 13, there being reservoir pressure on the other side thereof. However, the train line pressure preponderating, will move the diaphragm to the right, seating the valve formed on the stem 17. This will cause a

restriction of the carrying capacity of the release passages and the release of the brake cylinder pressure will be prevented except for that amount of pressure that is enabled to pass through the small passage 17ª in the stem 17. At this time the feed ports are open and the reservoir is being fed. When the reservoir pressure is restored, such pressure acting on the right hand side of the diaphragm 13, will move such diaphragm to the left and open the release passage in full.

Inasmuch as in the releasing of the brakes, the train line pressure increases or builds up slowly on the rear end of long trains, the slow increase will not move the diaphragm 13 and consequently no obstruction or restriction of the release passage will occur and the release of the brakes will not be retarded in the rear portion of long trains, but will be released promptly. It will only be at the front end of the train or in those triples where the train line pressure has been considerably increased that such brake release retardation will take place.

In the emergency application of the brakes caused by sudden reduction of from eight to ten pounds in the train line pressure, the valve 30 will unseat and the full reservoir pressure will be admitted to the right hand side of the piston 9 and will move such piston to the left, inasmuch as the train line pressure on the other side has been so reduced. As a result, the emergency valve 10 will be unseated and the train line air will lift the valve 6 and flow through passage 11ª into chamber 11, and passage 12 to the brake cylinder. In order to obtain emergency action properly and at the right time the piston 9 and its spring-ring are fitted loosely in the piston chamber 8 in which they travel, with the result that a reduction of train line pressure will produce a reduction in the chamber 8 to the right of the piston 9. The excess of reservoir pressure will open the valve 30 upon an emergency reduction and the inrush of the reservoir air will move the piston 9 to the left to emergency position. The loose fit of the piston prevents an emergency action upon a service or graduated reduction. On a restoration of train line pressure the piston 9 will move to the right, seating the emergency valve and all the other parts will be restored to normal position, in the manner hereinbefore described. It will be understood, of course, that the main valve admits the auxiliary reservoir pressure to the brake cylinder, the train line pressure being vented, as described, to augment the auxiliary reservoir pressure in the brake cylinder.

I claim:

1. In a triple valve device for actuating railway brakes, the combination of a main valve mechanism for controlling the admission of auxiliary reservoir air to the brake cylinder, and a valve under the control of the main valve mechanism for venting train line air to the brake cylinder through a direct passage from the train line for a service or graduated stop in both the closed and exhaust conditions of the brake cylinder.

2. In a triple valve device for actuating railway brakes, the combination of a main valve mechanism for controlling the admission and exhaust of air to and from the brake cylinder, and a separate valve under the control of the main valve mechanism for preliminarily venting train line air to the brake cylinder before the closing of its exhaust and for subsequently venting train line air to the brake cylinder after the closing of the exhaust and during a service or graduated action of the brakes.

3. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, and a separate valve for preliminarily venting train line air to the brake cylinder before the closing of its exhaust and for subsequently venting train line air to the brake cylinder after the closing of the exhaust and during a service or graduated action of the brakes, said valves being slide valves and adapted to slide one upon the other.

4. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, and having a port and passage communicating with a direct passage from the train line when in position to exhaust the brake cylinder, and a second valve coöperating with said main valve and normally closing said port but arranged to move to open the same in advance of the main valve to thereby admit train line air to the brake cylinder while its exhaust is open.

5. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, and having a port and passage communicating with a direct passage from the train line when in position to exhaust the brake cylinder, and a second valve coöperating with said main valve and normally closing said port but arranged to move to open the same in advance of the main valve to thereby admit train line air to the brake cylinder while its exhaust is open, said port and passage in the main valve being restricted in carrying capacity.

6. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, said valve being of the slide type and having ports through it adapted to communicate respectively with the train line and the brake cylinder, and a second slide valve movable

on the main valve for governing said ports and arranged to vent train line pressure on its first movement.

7. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, said valve being of the slide type and having three ports, two of which communicate respectively with passages to the train line and to the brake cylinder during running position and the third of which is at that time blanked, and a second slide valve slidable on the main valve and arranged to connect said two ports in its first movement before the main valve has moved in order to reduce the train line air by admitting it to the brake cylinder from where it is exhausted, the movement of the main valve for service stop bringing one of said two ports and said third port into communication with said train line and brake cylinder passages.

8. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, a separate valve coöperating with the main valve and capable of moving in advance of the latter upon a train line reduction, and a direct passage from the train line to the auxiliary reservoir governed primarily by the second valve and secondarily by the main valve.

9. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, a separate valve coöperating with the main valve and capable of moving in advance of the latter upon a train line reduction, a direct passage from the train line to the auxiliary reservoir governed by said valves, and a special passage from said valves to the brake cylinders, said valves being arranged, during service action, to connect said passages for the admission of train line air to the brake cylinder.

10. In a triple valve device for actuating railway brakes, the combination of a main valve for controlling the admission and exhaust of air to and from the brake cylinder, said valve being of the slide type and having three ports, two of which communicate respectively with passages to the train line and to the brake cylinder during running position and the third of which is at that time blanked, and a second slide valve having a port through it normally registering with the one of the two ports in the main valve that normally registers with the passage from the train line, and also having a recess adapted to connect with other two of said ports in the main valve.

11. In a triple valve device for actuating railway brakes, the combination of a main valve for admitting and releasing air pressure to and from the brake cylinder, a direct passage from the train line and through the main valve for feeding the auxiliary reservoir, and means for disconnecting said passage from its communication with the auxiliary reservoir and connecting it with the brake cylinder.

12. In a triple valve device for actuating railway brakes, an emergency valve for venting train line air direct to the brake cylinder in emergency applications of the brakes, a movable abutment for operating the emergency valve, in combination with adjustable means governing the auxiliary reservoir pressure for preventing movement of the abutment until a predetermined train line reduction is made.

13. In a triple valve device for actuating railway brakes, an emergency valve for venting train line air direct to the brake cylinder in emergency applications of the brakes, a movable abutment for operating the emergency valve, in combination with a valve for controlling the pressure to one side of the abutment and arranged to prevent the passage of such pressure until a predetermined train line reduction is made.

14. In a triple valve device for actuating railway brakes, an emergency valve for venting train line air direct to the brake cylinder in emergency applications of the brakes, a movable abutment for operating the emergency valve, in combination with a valve governing a passage from the auxiliary reservoir to the side of the abutment and adapted to prevent the passage of auxiliary reservoir air therethrough until a predetermined train line reduction is made.

15. In a triple valve device for actuating railway brakes, an emergency valve for venting train line air direct to the brake cylinder, in emergency applications of the brakes, a movable abutment for operating the emergency valve, in combination with a check valve spring pressed to a predetermined degree and adapted to govern a passage from the auxiliary reservoir to one side of the abutment and prevent the passage of auxiliary reservoir air therethrough until a predetermined train line reduction is made.

16. In a triple valve device for actuating railway brakes, the combination with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a retarding device arranged in the brake release passage for retarding the release of the brakes on the front cars of the train.

17. In a triple valve device for actuating railway brakes the combination with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a retarding device arranged in the brake release passage for retarding the re-

lease of the brakes on the front cars of the train, said retarding device acting independently of the main valve.

18. In a triple valve device for actuating railway brakes, the combination with a main valve for governing the admission and release of pressure to and from the brake cylinder, of means arranged in the brake release passage for restricting said passage when the train line pressure at such triple valve is considerably increased after an application of the brakes.

19. In a triple valve device for actuating railway brakes, the combination with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a stem controlled by air pressure and arranged in the brake release passage, said stem normally not interfering with the carrying capacity of such passage, but arranged to be moved by variations between train line and auxiliary reservoir pressures to restrict such carrying capacity of said passage.

20. In a triple valve device for actuating railway brakes, the combination with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a stem controlled by air pressure and arranged in the brake release passage, said stem normally not interfering with the carrying capacity of such passage, but arranged to be moved by variations between train line and auxiliary reservoir pressures to restrict such carrying capacity of said passage, said stem being arranged to permit a limited amount of pressure to pass when the passage is restricted thereby to its fullest extent.

21. In a triple valve device for actuating railway brakes, the combination, with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a movable stem arranged in the brake release passage and adapted to restrict the carrying capacity thereof, and a movable abutment exposed on its opposite sides to train line and auxiliary reservoir pressure, respectively, and adapted to control said stem.

22. In a triple valve device for actuating railway brakes, the combination, with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a movable stem arranged in the brake release passage and adapted to restrict the carrying capacity thereof, and a movable abutment exposed on its opposite sides to train line and auxiliary reservoir pressure, respectively, and adapted to control said stem, the latter having through it a port through which the air from the brake cylinder may pass when the stem is in its position of greatest restriction and otherwise, closing said passage.

23. In a triple valve device for actuating railway brakes, the combination, with a main valve for governing the admission and release of pressure to and from the brake cylinder, of a movable stem arranged in the brake release passage and adapted to restrict the carrying capacity thereof, and a movable abutment exposed on its opposite sides to train line and auxiliary reservoir pressures, respectively, and adapted to control said stem, said passage having a seat on which the end of said stem seats and said stem having a port and passage through which the brake cylinder pressure may pass, when the stem is seated.

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