No. 836,682. PATENTED NOV. 27, 1906.

G. R. HENDERSON & W. V. TURNER.

AIR BRAKE SYSTEM.

APPLICATION FILED NOV. 13, 1902.

3 SHEETS—SHEET 1.

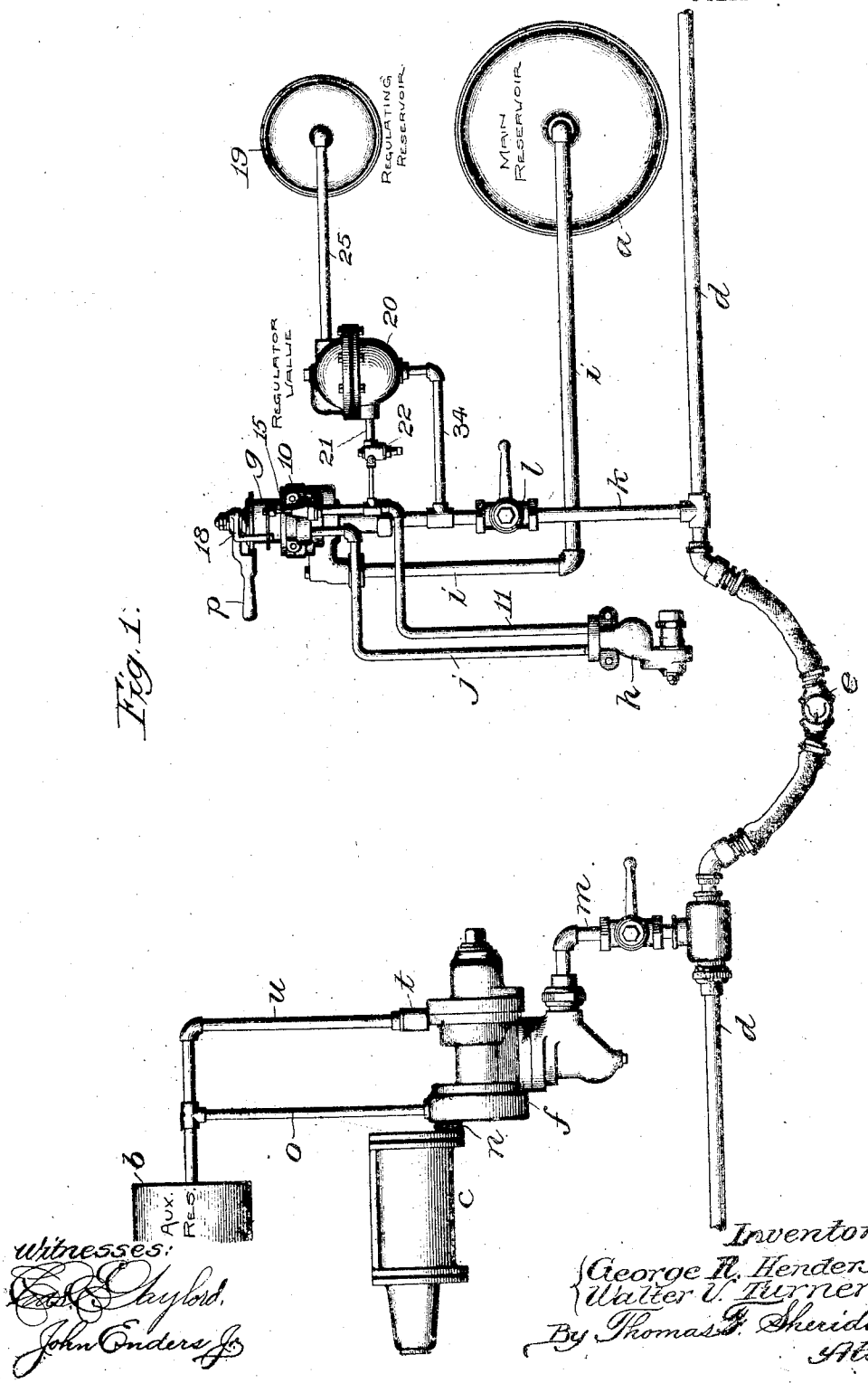

Fig. 1.

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3 SHEETS—SHEET 2

Fig. 4.

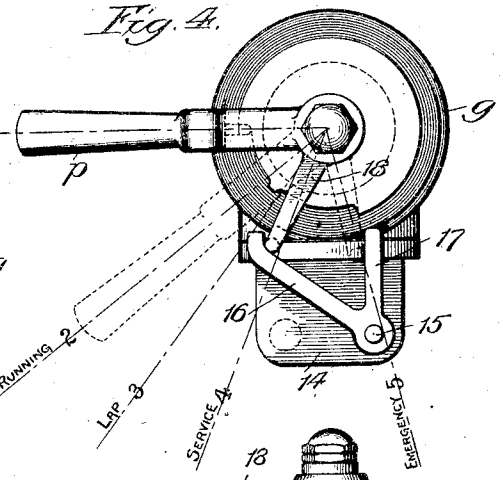


Fig. 5.

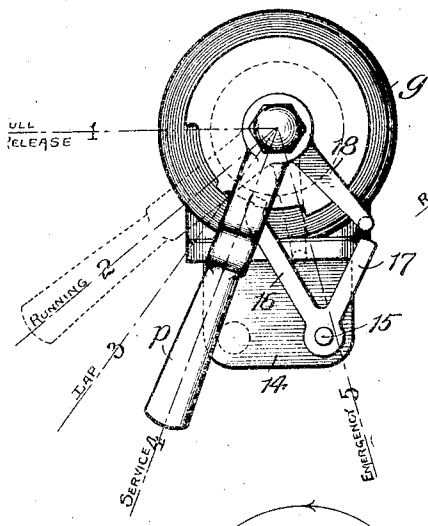


Fig. 2.

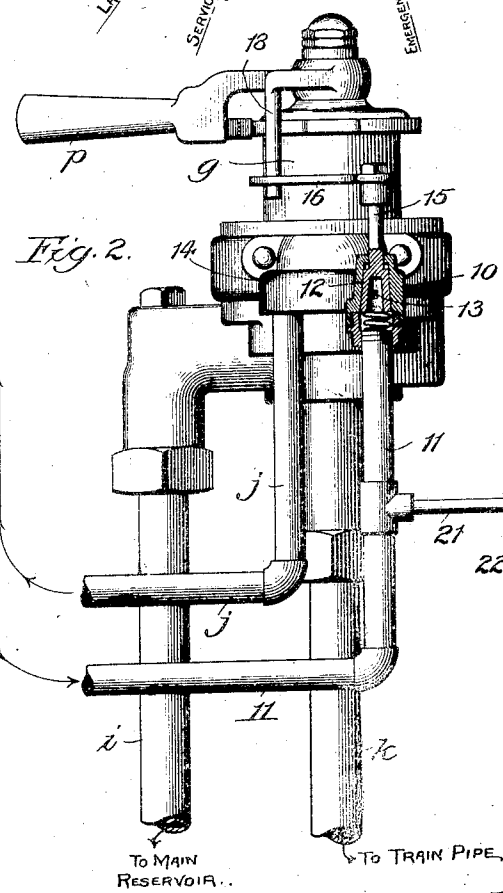
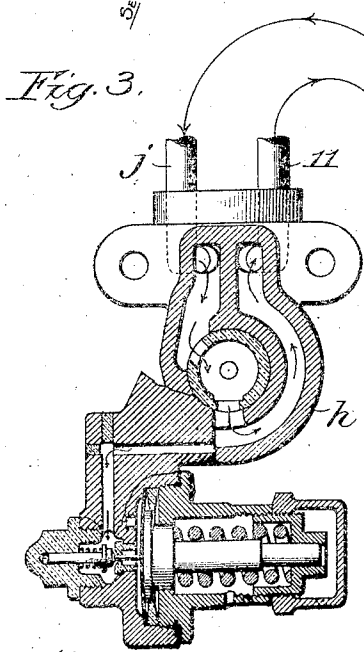


Fig. 3.



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AIR BRAKE SYSTEM.

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3 SHEETS—SHEET 3.

Fig. 8.

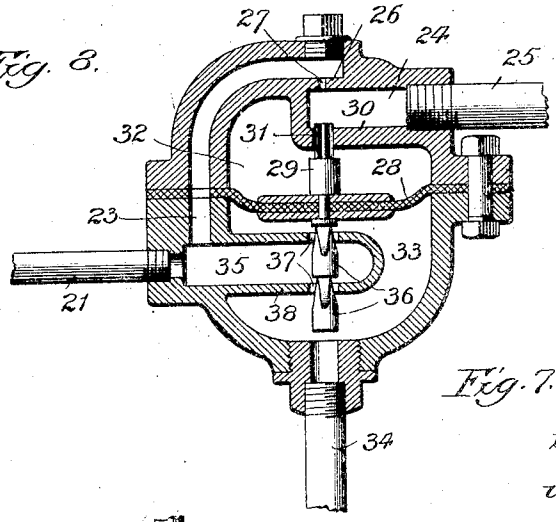


Fig. 7.

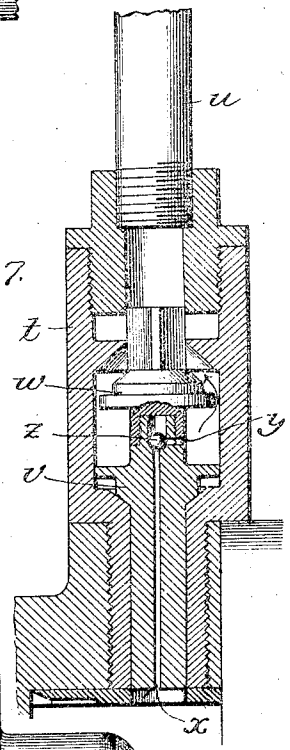
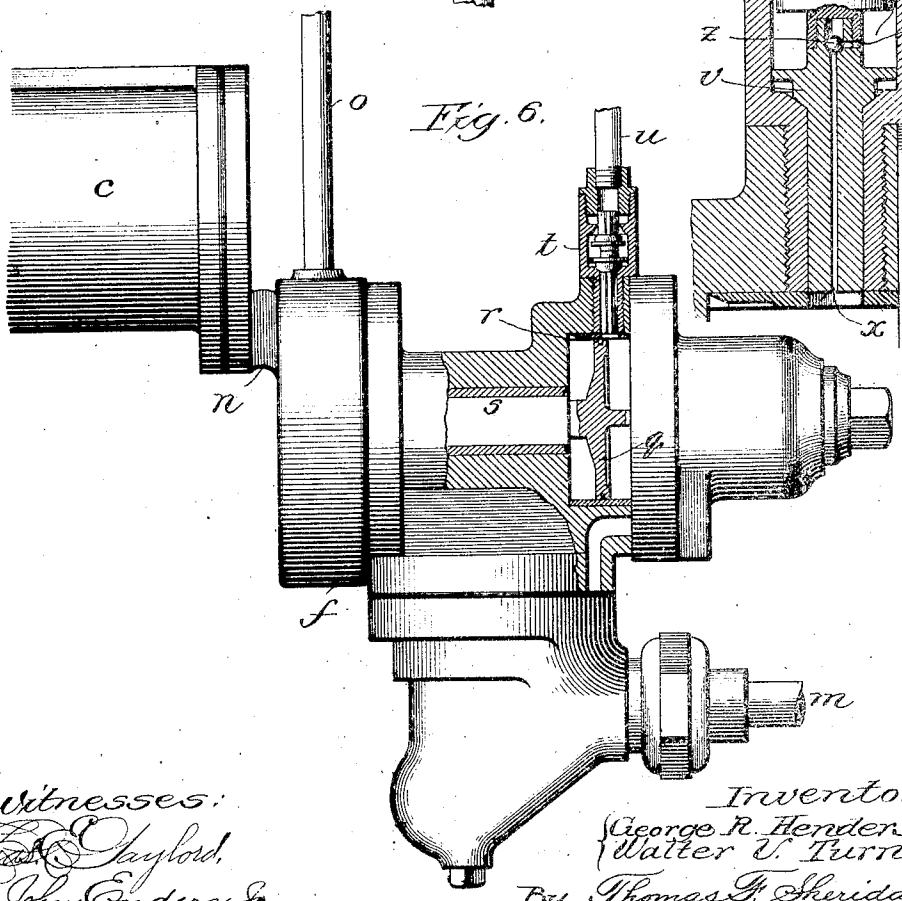


Fig. 6.



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UNITED STATES PATENT OFFICE.

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AIR-BRAKE SYSTEM.

No. 836,682. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed November 13, 1902. Serial No. 131,240½.

To all whom it may concern:

Be it known that we, GEORGE R. HENDERSON and WALTER V. TURNER, citizens of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Air-Brake Systems, of which the following is a specification.

This invention relates to automatic air-brakes, and has for its principal object to provide means for controlling the supply of air from the main reservoir to the train-pipe while the brakes are applied.

Another object of the invention is the provision of an improved recharging-valve device for opening communication from the train-pipe to the auxiliary reservoir around the triple-valve piston, whereby the auxiliary reservoir may be recharged from the train-pipe while the brakes remain applied and without moving the triple valve to release position.

Various devices for gradually raising the train-pipe pressure and recharging the train-pipe and auxiliary reservoirs while the brakes remain applied have heretofore been proposed; but these have been unsatisfactory, principally for the reason that the rate of feed or supply of air to the train-pipe was not properly regulated for varying conditions and different lengths of train, since, as will be readily seen, the rate of feed to the train-pipe, which might be made to recharge a long train successfully without releasing the brakes, would be sufficient upon a short train to cause the movement of the triple valves to release position, thereby rendering such a device objectionable.

By means of our improvement the supply of air to the train-line when it is desired to recharge while the brakes are applied is automatically regulated, so that the train-pipe pressure may be increased at substantially a predetermined rate regardless of the length and capacity of the train-pipe or the amount of leakage therefrom, which rate of increase will be less than that required to release the brakes.

Another important feature of our improvements comprises means operated by the usual movements of the engineer's brake-valve, whereby the feed-control-valve device for recharging the train-pipe and auxiliary reservoirs without releasing is brought into action by the movement of the brake-valve from service or lap position to running position and is cut out and the ordinary feed-valve device brought into action by the movement of the brake-valve from full release position to running position.

When a reduction in train-pipe pressure has been made for the purpose of applying the brakes, the ordinary feed-valve device naturally stands open on account of the reduced train-pipe pressure, so that when the brake-valve is returned to running position and the feed-port is thereby opened a strong puff of air from the main reservoir immediately flows through the feed-valve to the train-pipe, and unless this wave of increased pressure is checked before reaching the triple valves it will be sufficient to cause the release of some of the brakes. It is important, therefore, when it is desired to recharge the train-pipe without releasing that the supply of air from the main reservoir to the train-pipe should be started very gradually and that the feed-control valve should be opened slowly in order to prevent a sudden wave of increase in train-pipe pressure, and this comprises another important feature of our invention.

Our invention further comprises an improved form of recharging-valve device adapted to open communication from the train-pipe to the auxiliary reservoir around the triple-valve piston under a slow and gradual rise in train-pipe pressure without releasing the brake, but also adapted to close such communication upon a more sudden or positive increase in train-pipe pressure, such as is ordinarily made for causing the movement of the triple valves to release position.

In the accompanying drawings, Figure 1 is a diagrammatic view of an air-brake apparatus embodying our improvements; Fig. 2, a side elevation of the engineer's brake-valve with certain attachments, partly in section; Fig. 3, a transverse section of the standard slide-valve feed-valve device; Fig. 4, a plan view of the engineer's brake-valve, showing in full lines the handle and attachments in full-release position, the parts being indicated in dotted lines in running position; Fig. 5, a similar view showing the parts in full lines in service position and in dotted lines in run-

ning position; Fig. 6, a sectional elevation of the triple-valve device with the recharging-valve device secured thereto; Fig. 7, an enlarged sectional view of our improved recharging-valve device, and Fig. 8 a sectional view of the feed-control-valve mechanism.

In illustrating and describing these improvements we have only illustrated and described in detail that which we consider to be new, taken in connection with so much that is old as will properly disclose the invention to others and enable those skilled in the art to practice the same, leaving out of detailed consideration other and well-known mechanism which, if described and shown herein, would only tend to confusion, prolixity, and ambiguity.

In constructing an air-brake system in accordance with these improvements we use a main reservoir *a*, auxiliary reservoir *b*, brake-cylinder *c*, train-line pipes *d*, connections or couplings *e*, triple valve *f*, brake-valve *g*, and train-line governor *h*, all constructed and arranged substantially in any well-known or usual manner and all of which is fully understood by those skilled in the art.

The brake-valve is connected with the main reservoir through the usual channel or pipe *i* and with the train-line governor through a pipe *j* in substantially the usual manner and with the train-line through a pipe *k* in the usual manner, which pipe has the usual cut-off valve *l*. The triple valve is connected with the train-line pipe by the usual connecting-pipe and valve mechanism *m* with the brake-cylinder at *n*, as is usual in passenger equipment, and with the auxiliary reservoir by means of a pipe *o*, also usual in passenger equipment.

In the art to which this invention relates it is well known, as hereinabove suggested, that when the first application of brakes is made by the placing of the brake-valve lever *p* at "service" position, as shown in full lines in Fig. 5, the train-line pressure will be reduced a sufficient amount to permit the auxiliary-reservoir pressure to move the triple-valve piston *q* to the position shown in Fig. 6, making the usual connections between the auxiliary reservoir and the braking-cylinder. In the old constructions it would at the same time cut off the further introduction of air from the train-line to the auxiliary reservoir, so that a recharging of the reservoir could not take place until the triple-valve piston had been returned to its "release" position, where the air could flow around it through the usual feed-groove *s*, through the triple valve *s*, pipe *o*, and into the auxiliary reservoir. This, however, as above suggested, is objectionable, and in order to provide means by which the auxiliary reservoir may be recharged at any time when the brakes are applied, as well as by the usual means when the piston of the triple valve is in its usual release position, a supplementary recharging-valve *t* is provided and connected, by means of a pipe *u*, with the auxiliary reservoir. This supplementary recharging-valve is composed of a double-acting check-valve formed in two parts *v* and *w*, screw-threaded together, the lower part being kept by the force of gravity and some of the pressure in the auxiliary reservoir at its lowest position, so as to prevent free communication between the train-line and the auxiliary reservoir. To permit of a small volume of air passing therethrough, however, so as to recharge the auxiliary reservoir slowly when the parts are arranged as last set forth, the lower portion of the double-acting check-valve is preferably provided with an axial perforation *x* and an angular or radial perforation *y*, opened and closed by means of a ball-valve *z*. When there is a slight increase of pressure below the double-acting check-valve over that in the auxiliary reservoir, the ball-valve *z* will be raised and a small volume of air permitted to pass through the perforations *x* and *y* and around the upper valve *w* into the pipe *u* and thence into the auxiliary reservoir from the train supply-pipe, as shown particularly in Figs. 6 and 7. In Fig. 6 it will be seen that the connection of this supplementary recharging-valve *t* is on the train-line side of the triple-valve piston, so that when this piston is in its "lap" position a small volume of air from the train-line can still pass into the auxiliary reservoir, (maintaining in practical equilibrium pressure on both sides of triple piston,) providing there is no substantial increase of volume such as would act to move the triple-valve piston to release position. When the volume of air increases substantially so as to move the triple-valve piston to the release position, it will also act on the superior area of the lower check-valve *v* and raise the same with the upper check-valve against its seat, so as to completely shut off all communication through this supplementary recharging-valve with the auxiliary reservoir and permit such reservoir to take its charge through the ordinary feed-groove *r* and pipe *o*.

From the foregoing description of construction and operation it will be seen that the supplementary recharging-valve as attached to the triple valve and auxiliary reservoir is operated under certain conditions. It will also appear that should any excessive volume of air be admitted to the train-line side of the triple-valve piston *q* it might and probably would operate to move such piston to release position when it is not desirable to so move it. It is, therefore, necessary that some means be provided for obtaining and maintaining a desired feed or supply of air to each side of such piston, so as to prevent such a contingency. To accomplish this, a second supplementary or cut-off valve

10 is provided and connected with the train-line governor *h* by means of the pipe 11. This supplementary cut-off valve 10 has a plug 12 arranged therein, having a longitudinal and radial passage 13 therethrough arranged to be connected or disconnected with the usual train-line channel through the brake-valve. This valve and the pipe *j* are preferably secured to a bracket or lug 14, extending out from and forming an attachment to the brake-valve casting. The plug of the valve has a stem 15 extending upwardly, having a lever with two arms 16 and 17 connected therewith. These two arms of the lever are so arranged that a second arm or projection 18 on the brake-valve lever may contact the same and move it to the position shown in Fig. 4 by and during the movements of the brake-valve lever from running to "full-release" position, so as to open the passage 13 in the valve-plug 12 and connect the train-line governor with the train-line through the usual passage, thus making the train-line governor at such times the governing-valve for the pressure in the train-line system. The parts are also so arranged (see Fig. 5) that when the brake-valve lever is moved from "running" to service position the projection thereon strikes the arm 17 of the supplementary cut-off-valve lever and operates such valve so as to close the same. This closes the passage from the train-line governor to the train-line through the usual channel, so that other means must be supplied to provide a passage from the main reservoir to such train-line system and regulate the pressure and volume therein. In order to accomplish this last-mentioned result, a regulating-reservoir 19 is provided and a regulating-valve 20 connected therewith. This regulating-valve is shown particularly in Fig. 8 in sectional elevation and is provided with a branch-pipe connection 21, which connects it with the train-line-governor pipe 11. This pipe or passage 21 has an ordinary reducing or governing valve 22 therein set so as to govern or reduce the pressure to a predetermined amount—say, sixty-three pounds—that is, when the pressure in the regulating-reservoir equals or exceeds sixty-three pounds the valve 22 will close it against further supply of air under pressure. This regulating-valve 20 is provided with passages 23 and 24, the passage 23 being connected with the pipe 21 and the passage 24 with the pipe 25, which connects it with the regulating-reservoir. These two passages 23 and 24 are separated by means of a wall 26, through which a perforation 27 is made. This perforation practically governs the volume of air that flows from the main reservoir to the train-line pipe when this regulating-valve is in use, and it should be smaller than the passage or perforation *x* in the first-named supplementary recharging-valve, which is attached to the triple valve, as shown particularly in Figs. 6 and 7, so that the air as furnished the system when the regulating-valve is in use may pass up through one or more of such supplementary valves without any danger of moving the triple-valve piston *q* to release position. This regulating-valve is further supplied with a main diaphragm 28, having a stem 29 loosely arranged in division-wall 30, which acts as a guide. The upper part of the stem 31 is grooved so as to permit a quantity of air to flow from the passage 24 into the chamber 32 above the diaphragm. A chamber 33 is arranged below the diaphragm and connected with the train-line pipe *k* by means of a pipe 34. The valve-casing also has a chamber 35, the walls of which project into the chamber 33 and are perforated so as to form valve-seats in which balanced valves 36 play and operate to open and close. When the air-pressure as it feeds into regulating-reservoir and chamber 32 of the regulating-valve exceeds that of the train-line and chamber 33 of regulating-valve, the superior pressure acting on the upper side of the diaphragm 28 forces it downwardly, so as to open the perforations 37 in the walls 38 and permit air from the train-line governor to pass through the pipe 21, chamber 35, perforations 37, into the chamber 33 and out through the pipes 34 and *k* into the train-line until the pressure in the train-line slightly exceeds that contained in the regulating-reservoir, when the excess of pressure below the diaphragm 28 will be raised and close the valves 36.

When the supplementary cut-off valve has its parts moved to such position as to open the passage from the train-line governor to and through the usual passages in the brake-valve, so as to connect it with the train-line, the air under pressure moves along the lines of least resistance, and consequently the regulating-valve and reservoir are cut out from further action, all of which occurs as above described when the brake-valve handle is moved from running to full-release position, or at any point intermediate the same.

It will also be seen from the foregoing description of construction and operation that should the supplementary cut-off valve be closed in position the engineer has within his power the maintaining of desired and safe pressures in the train-line pipes and all of the auxiliary reservoirs without in any way disturbing or releasing the brakes, so that he can make an emergency or further application of brakes, as may be desired, all of which will be understood and appreciated by those skilled in the art.

With regard to the operation of the lever on the supplementary cut-off valve it will be seen that after the lever has been moved

from one position to another the brake-lever may be moved over a limited area without in any way disturbing such valve-arms. For instance, when the parts are arranged as shown in Fig. 4 the brake-lever may be moved from full-release to running position and back any number of times without moving the cut-off valve, and when the parts are in the position shown in Fig. 5 the brake-lever may be moved from service to emergency or running position and back any desired number of times without disturbing the cut-off valve. In fact, such cut-off valve cannot be moved except when it is essential so to move it.

With regard to Figs. 4 and 5 line 1 shows the central line which the handle occupies when the brake-valve is in full-release position, line 2 when it is in running position, line 3 when it is in lap position, line 4 when it is in service position, and line 5 when it is in emergency position.

We claim—

1. In an air-brake, the combination with a train-pipe and engineer's brake-valve, of a valve device for controlling the supply of air to the train-pipe while the brakes are applied, and means operated by the movement of the brake-valve from lap to running position for bringing said valve device into action.

2. In an air-brake, the combination with a train-pipe and engineer's brake-valve, of a valve device for controlling the supply of air to the train-pipe while the brakes are applied, and means operated by the movement of the brake-valve from lap to running position for bringing said valve device into action, and from full-release to running position for cutting the same out of action.

3. In an air-brake, the combination with a train-pipe and engineer's brake-valve, of a valve device for controlling the supply of air to the train-pipe while the brakes are applied, and a cut-off valve operated by the movements of the brake-valve for controlling the supply of air to said valve device.

4. In an air-brake, the combination with a train-pipe and engineer's brake-valve, of a valve device for controlling the supply of air to the train-pipe while the brakes are applied, a cut-off valve for controlling the supply of air to said valve device, and mechanism operated by the movement of the brake-valve from lap to running position for moving said cut-out cock to one position, and from full-release to running position for moving the cut-out cock to another position.

5. In an air-brake, the combination with a train-pipe and brake-valve, of a valve device for controlling the supply of air to the train-pipe while the brakes are applied, a cut-off mechanism operated by the movements of the brake-valve, for controlling the supply of air to said valve device, and a pressure-reducing valve for limiting the pressure to a predetermined degree.

6. In an air-brake, the combination with a train-pipe and brake-valve, of a valve device for controlling the supply of air to the train-pipe at a predetermined rate while the brakes are applied, and cut-off mechanism operated by the movements of the brake-valve for cutting said valve device into and out of action.

7. In an air-brake, the combination with a train-pipe and brake-valve, of a regulating-valve for controlling the supply of air to the train-pipe while the brakes are applied, a regulating-chamber, means subject to the opposing pressures of the train-pipe and regulating-chamber for operating said valve, means for increasing the pressure in said chamber at a predetermined rate, and mechanism operated by the brake-valve for cutting said regulating-valve into and out of action.

8. In an air-brake, the combination with a train-pipe and brake-valve, of a regulating-valve for controlling the supply of air to the train-pipe while the brakes are applied, a regulating-chamber having a restricted inlet-opening, a movable abutment or diaphragm subject to the opposing pressures of the train-pipe and regulating-chamber for operating said valve, and mechanism operated by the brake-valve for cutting said regulating-valve into and out of action.

9. In an air-brake, the combination with a train-pipe, auxiliary reservoir and triple valve, of a recharging-valve device connected to the piston-chamber of the triple valve and having means operated by a light increase in train-pipe pressure to open communication from the train-pipe to the auxiliary reservoir, but adapted under a greater increase to close such communication.

10. In a recharging-valve device for air-brakes, comprising a double-seated check-valve normally closing communication from the auxiliary reservoir to the train-pipe, and adapted under a positive increase in train-pipe pressure to move to its opposite seat to close communication from the train-pipe to the auxiliary reservoir, and a small valve acting under a slow and gradual rise in train-pipe pressure to recharge the auxiliary reservoir.

11. A recharging-valve device for air-brakes, comprising a valve adapted to be seated by a sudden increase in train-pipe pressure for closing communication from the train-pipe to the auxiliary reservoir, and a small valve mounted on said first-named valve and operated under a slow and gradual increase in train-pipe pressure for recharging the auxiliary reservoir.

12. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a brake-cylinder, a train-line

pipe, a triple valve connected with the braking-cylinder auxiliary reservoir and train-line, a supplementary recharging-valve connected with the triple valve on the train-line side of its piston intermediate it and the auxiliary reservoir with which it is also connected, a brake-valve, a train-line governor connected therewith, and second supplementary cut-off-valve mechanism arranged intermediate the train-line governor and the train-line and arranged to be operated by the movements of the brake-valve to maintain a desired pressure in the air-brake system, substantially as described.

13. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a train-line pipe, a braking-cylinder, a triple valve connected with the braking-cylinder, auxiliary reservoir and train-line pipe, a brake-valve, a train-line governor connected therewith, and a supplementary cut-off valve connected with the train-line governor and with the train-line intermediate the same and arranged to be operated by the movements of the brake-valve lever to cut off such governor from the usual train-line connection in one position and open such connection to the train-line in another position, substantially as described.

14. In an air-brake system of the class described the combination of main and auxiliary reservoirs, a train-line pipe, a braking-cylinder, a triple valve connected with the braking-cylinder, auxiliary reservoir and train-line pipe, a brake-valve, a train-line governor connected therewith, supplementary cut-off-valve mechanism arranged between the train-line and the train-line governor connected therewith and provided with lever mechanism arranged to be operated by the movements of the brake-valve lever to close same when the brake-line lever is in service position and open the same between running and full-release position, substantially as described.

15. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a train-line pipe, a braking-cylinder, a triple valve connected with such braking-cylinder, auxiliary reservoir and train-line pipe, a brake-valve connected with the main reservoir and train-line, a train-line governor connected with the brake-valve, a supplementary cut-off valve connected with the train-line governor and arranged between it and the train-line pipe with which it is also connected and operatable during the movements of the brake-valve lever, a regulating-reservoir, a regulating-valve connected with the train-line governor, regulating-reservoir and train-line arranged to be thrown into and out of action by the position of the supplementary valve to maintain a desired pressure in the train-line pipe, substantially as described.

16. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, an air-brake cylinder, a train-line pipe, a triple valve connected with the auxiliary reservoir, brake-cylinder and train-line pipe, a brake-valve connected with the main reservoir and train-line pipe, a train-line governor connected with the brake-valve, a supplementary cut-off valve connected with the train-line governor and with the usual train-line connections and arranged to be operated by the movements of the brake-valve lever to cut the train-line governor into or out of usual connection with the train-line, a regulating-reservoir, a regulating-valve connected therewith and with the train-line governor through a by passage or pipe and with the train-line pipe, and a reducing or governing valve in the connection between the regulating-valve and the train-line governor, substantially as described.

17. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a train-line pipe, a brake-cylinder, a triple valve connected with the auxiliary reservoir brake-cylinder and train-line pipe, a supplementary recharging-valve connected with the auxiliary reservoir and with the triple valve on the train-line side of its piston to entirely cut off the admission of air to the auxiliary reservoir therethrough when the volume of air in the train-pipe exceeds a predetermined amount and permit air to go through the same under desired conditions, brake-valve mechanism connected with the train-line pipe and with the main reservoir, a train-line governor connected with the brake-valve, supplementary cut-off-valve mechanism connected with the train-line governor and train-line operatable by and during the movements of the brake-valve lever to cut off and connect the train-line governor with the train-line through the usual channels, a regulating-reservoir, and a regulating-valve connected with the regulating-reservoir, train-line pipe and train-line governor, substantially as described.

18. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a train-line pipe, a brake-cylinder, a triple valve connected with the auxiliary reservoir, brake-cylinder and train-line pipe, a supplementary recharging-valve connected with the auxiliary reservoir and with the triple valve on the train-line side of its piston to cut off the admission of air to the auxiliary reservoir therethrough when the volume of air in the train-pipe exceeds certain conditions and permit air to go through the same under desired conditions, brake-valve mechanism connected with the train-line pipe and with the main reservoir, a train-line governor connected with the brake-valve, supplementary cut-off-valve mechanism connected with the train-line governor

and operatable by and during the movements of the brake-valve lever to cut off and connect the train-line governor with the train-line through the usual channels, a regulating-reservoir, a regulating-valve connected with the regulating-reservoir train-line pipe and train-line governor, and a reducing or second governing valve in the connection between the regulating-valve and train-line governor, substantially as described.

19. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a brake-cylinder, a train-line pipe, a triple valve connected with the auxiliary reservoir, brake-cylinder and train-line pipe, a supplementary recharging-valve connected with the auxiliary reservoir, and with the triple valve on the train-line side of its piston to permit a recharging of the auxiliary reservoir when the brakes are applied as well as when released, a brake-valve connected with the train-line pipe and with the main reservoir, a train-line governor connected with the brake-valve, a supplementary cut-off valve connected with the train-line governor and train-line and between the usual connections of such train-line governor and train-line, and a lever on such second supplementary valve arranged to be operated by and during the movements of the brake-valve lever when it approaches either extreme of its motion to close the same when movement is made from running to service positions and open the same when movement is made from running to full-release position and to remain inoperative during intermediate positions of such brake-valve lever, substantially as described.

20. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a brake-cylinder, a train-line pipe, a triple valve connected with the auxiliary reservoir, brake-cylinder and train-line pipe, a supplementary recharging-valve connected with the auxiliary reservoir and with the triple valve on the train-line side of its piston to permit a recharging of the auxiliary reservoir when the brakes are applied as well as when released, a brake-valve connected with the train-line pipe and with the main reservoir, a train-line governor connected with the brake-valve, a supplementary cut-off valve connected with the train-line governor and train-line and between the usual connections of such train-line governor and train-line, a lever on such supplementary cut-off valve arranged to be operated by and during the movements of the brake-valve lever when it approaches either extreme of its motion to close the same when movement is made from running to service position and open the same when movement is made from running to full-release position and to remain inoperative during intermediate steps of such brake-valve lever, a regulating-reservoir, and a regulating-valve connected therewith and with the train-line pipe and train-line governor, substantially as described.

21. In an air-brake system of the class described, the combination of main and auxiliary reservoirs, a brake-cylinder, a train-line pipe, a triple valve connected with the auxiliary reservoir, brake-cylinder and train-line pipe, a supplementary recharging-valve connected with the auxiliary reservoir and with the triple valve on the train-line side of its piston to permit a recharging of the auxiliary reservoir when the brakes are applied as well as when released, a brake-valve connected with the train-line pipe and with the main reservoir, a train-line governor connected with the brake-valve, a supplementary cut-off valve connected with the train-line governor and train-line and arranged between the usual connections of such train-line governor and train-line, a lever on such supplementary cut-off valve arranged to be operated by and during the movements of the brake-valve lever when it approaches either extreme of its motion to close the same when movement is made from running to service position and open the same when movement is made from running to full-release position and to remain inoperative during intermediate steps of such brake-valve lever, a regulating-reservoir, a regulating-valve connected therewith and with the train-line pipe and train-line governor, and a reducing or second governor valve arranged in the connection between the regulating-valve and train-line governor, substantially as described.

22. In an air-brake system of the class described, a triple valve provided with the usual connections, a supplementary recharging-valve connected with the auxiliary reservoir and with the triple valve on the train-line side of its piston composed of a double check-valve having an axial perforation through a portion of the same normally closed by a small ball-valve to prevent return of air to the train-line but to permit a small volume of air to pass up therethrough, the whole arranged to be raised to the upper limit of its motion and entirely close communication between the train-line and auxiliary reservoir when an excessive volume of air is reached below the valve, substantially as described.

23. In an air-brake system of the class described, the combination of a brake-valve having the usual connections, a train-line governor connected therewith, a supplementary cut-off valve arranged between the train-line governor and the train-line to open and close the usual connections therewith and arranged to be operated during the movements of the brake-valve lever, a regulating-reservoir, and a regulating-valve connected

therewith and with the train-line governor and train-line formed of a casing having a main piston or diaphragm therein, a passage around the same from the train-line governor to the regulating-reservoir of predetermined size to admit a predetermined volume of air, and valve mechanism connected with the main piston or diaphragm to open and close a passage through the regulating-valve.

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