No. 791,605. PATENTED JUNE 6, 1905.

L. T. BLOCK.

SLACK ADJUSTING DEVICE FOR AIR BRAKES.

APPLICATION FILED DEC. 5, 1903.

Fig. I.

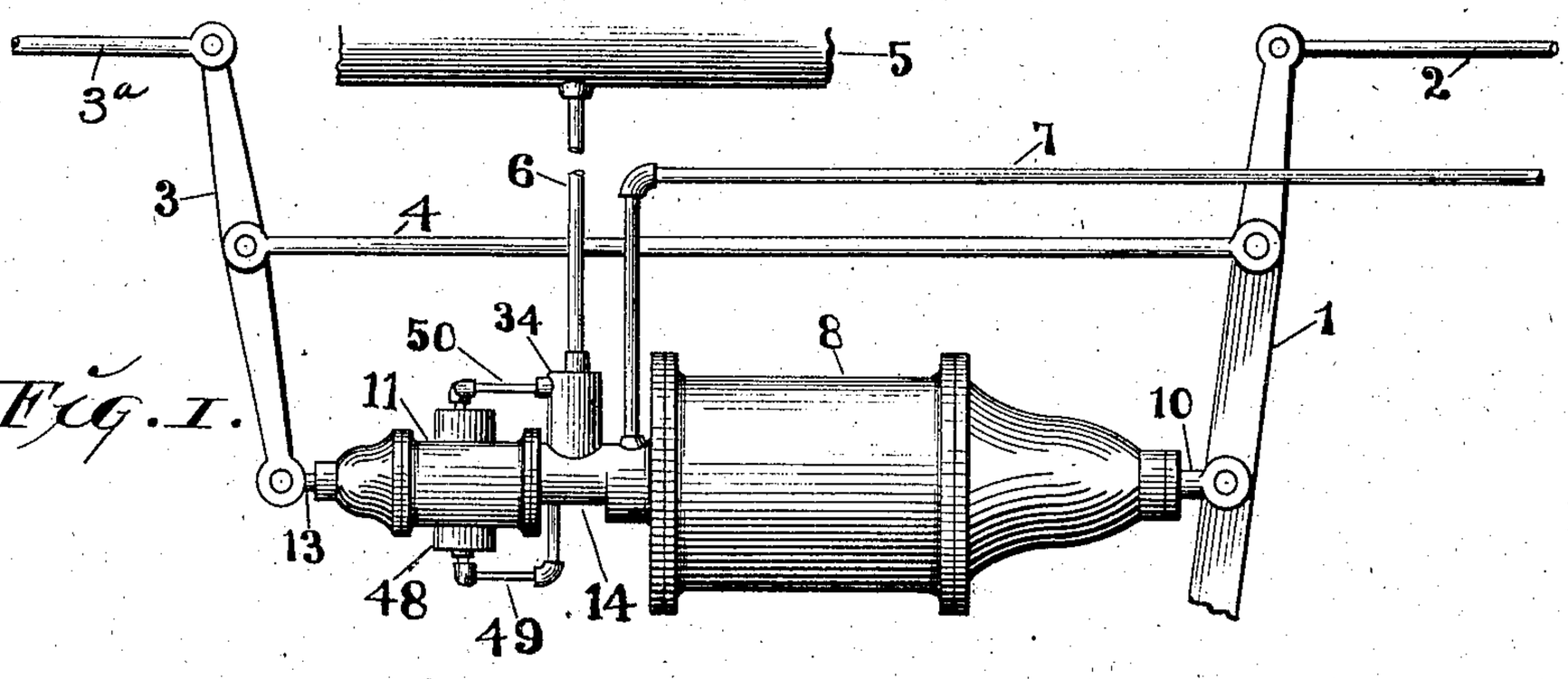

Fig. II.

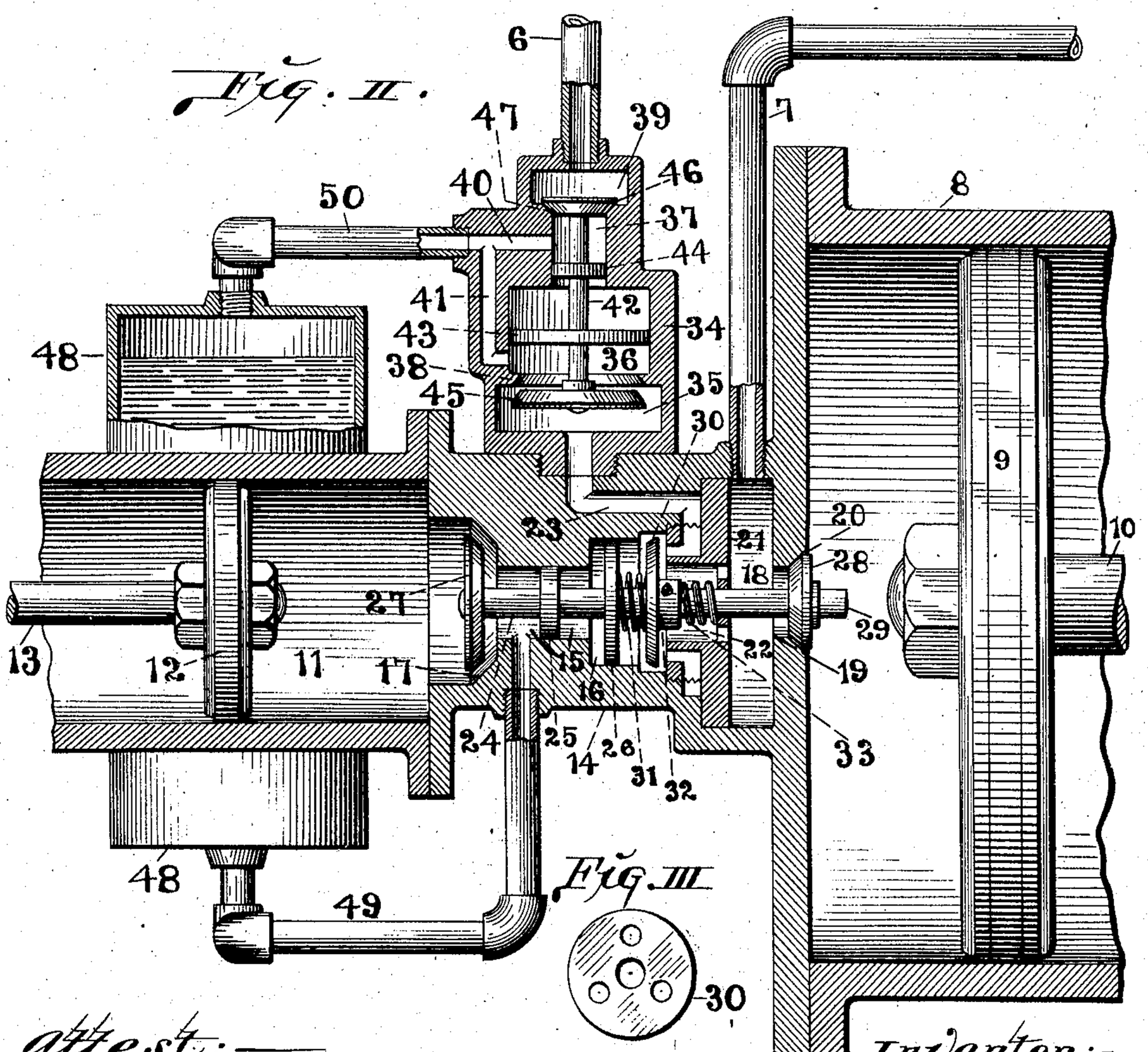

Fig. III.

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UNITED STATES PATENT OFFICE.

LYNTON T. BLOCK, OF ST. LOUIS, MISSOURI.

SLACK-ADJUSTING DEVICE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 791,605, dated June 6, 1905.

Application filed December 5, 1903. Serial No. 183,987.

To all whom it may concern:

Be it known that I, LYNTON T. BLOCK, a citizen of the United States, residing in the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Slack-Adjusting Devices for Air-Brakes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to a device for taking up the slack in the brake-leverage mechanism of an air-brake previous to the action of the main air-brake mechanism.

The invention consists in features of novelty hereinafter fully described, and pointed out in the claims.

Figure I is a top or plan view of an air-brake-operating mechanism with my slack-adjuster applied thereto. Fig. II is an enlarged horizontal section taken through the main brake-cylinder and my slack-adjusting device. Fig. III is a face view of the perforated check-disk in the slack-adjusting device.

1 designates the main brake-lever, to which is connected the brake-rod 2, and 3 is a slack-adjusting lever that is united to the main brake-lever by a connecting-rod 4 and has united to it a second brake-rod 3ª.

5 is the air-storage reservoir, from which the conducting-pipe 6 leads, and 7 is the triple-valve connecting-pipe. These pipes 6 and 7 will hereinafter be referred to as the "reservoir-pipe" and "triple-valve" pipe.

8 is the main air-brake cylinder, in which the main brake-piston 9 operates.

10 is the piston-rod of the piston 9, which leads to the exterior of the main cylinder 8 and is connected to the main brake-lever 1.

11 designates an auxiliary cylinder. In this auxiliary cylinder is a piston 12, that carries a piston-rod 13, which leads to the exterior of said cylinder and is connected to the slack-adjusting lever 3, and through the medium of which said slack-adjusting lever is moved to effect movement of the connecting-rod 4 and occasion a pull upon the main brake-lever 1 for the purpose of adjusting the slack in the brake mechanism united to the brake-rods 2 and 3ª, as usual.

14 designates a connecting-head that unites the main brake-cylinder 8 and the auxiliary cylinder 11. This connecting-head contains a cylinder-passage 15 and a cylinder-passage 16. The cylinder-passage 15 has communication with the interior of the auxiliary cylinder, and at the end of said cylinder-passage leading to said auxiliary cylinder is a valve-seat 17. At the end of the connecting-head adjoining the main brake-cylinder is a chamber 18, that has communication with the main brake-cylinder through a port 19, that is tapered outwardly within the brake-cylinder to form a valve-seat 20.

21 is a cap fitted to the connecting-head within its end adjoining the main brake-cylinder and forming a part of said head. Extending centrally through the cap 21 is a passage-way 22, that furnishes communication between the chamber and the cylinder-passage 16. In the cap 21 is one or more ducts 23, that are continued through the connecting-head to a point to be hereinafter noted.

24 designates a shaft extending longitudinally through the connecting-head 14. On this shaft are fixed a piston 25, that operates in the cylinder-passage 15, and a piston 26, that operates in the cylinder-passage 16. On the end of the shaft 24 that faces the auxiliary cylinder 11 is a valve 27, that is adapted to seat against the valve-seat 17 and close communication between the cylinder-passage 15 and the auxiliary cylinder or to be moved away from said valve-seat to furnish communication between said cylinder-passage and auxiliary cylinder. The valve 27 is so mounted on the shaft 24 with respect to the valve-seat 17 that it can move only sufficiently to provide a restricted passage-way around the valve in furnishing communication between the cylinder-passage 15 and the auxiliary cylinder. As a consequence when flow of fluid from the cylinder-passage to the auxiliary cylinder occurs there is a pronounced pressure exerted thereby against said valve 27 to the restriction of its flow. On the end of the shaft 24 that extends to the main brake-cylinder 8 is a valve 28, that is adapted to control communication between the chamber 18 in the connecting-head 14 to the main brake-

cylinder by contact with the valve-seat 20 or separation from said valve-seat. The end of the shaft 24 preferably extends beyond the valve 28 into the main brake-cylinder, as seen at 29.

30 designates a perforated disk loosely fitted to the shaft 24 adjacent to the cylinder-passage 16. This perforated disk is yieldingly held separated from the piston 26 by a spring 31 interposed between said members, and the disk is designed to contact with the inner end of the cap 21 to close the duct 23 in the connecting-head 14.

32 is a collar fixed to the shaft 24 forward of the perforated disk 30, and 33 is a spring surrounding the shaft 24 and acting to exert pressure against said collar 32 to normally force the shaft in an outward direction, so that the valve 27 will be unseated and the valve 28 seated.

34 is a housing surmounting the connecting-head 14 and into which the duct 23 in the connecting-head leads. The duct 23 communicates with a chamber 35 in the inner end of the housing 34, and 37 is a small cylinder-space beyond the space 36. Communication is provided for between the chamber 35 and the cylinder-space 36, and at the junction of said chamber and space is a valve-seat 38. Beyond the cylinder-space 37 is a chamber 39, that has communication with the reservoir-pipe 6.

40 is a duct that has communication with the cylinder-space, and 41 is a duct that furnishes communication between the duct 40 and the cylinder-space 36.

42 is a shaft extending horizontally through the housing 34. Fixed to this shaft is a large piston 43, that operates in the cylinder-space 36, and a small piston 44, that operates in the cylinder-space 37.

45 is a valve fixed to the inner end of the shaft 42, which controls communication between the chamber 35 and the cylinder-space 36 and which is adapted for movement to and from the valve-seat 38.

46 is a valve fixed to the outer end of the shaft 42 and which controls communication between the chamber 39 and the cylinder-space 37 by movement to or from the adjacent valve-seat 47.

48 designates an oil-tank into which is introduced a quantity of oil or other heavy fluid. This tank is connected at one end to the connecting-head 14 by means of a pipe 49 to furnish communication between the tank and the cylinder-passage 15 in said connecting-head. The opposite end of the tank is connected to the housing 34 by a pipe 50, that leads to the duct 40.

The operation of my slack-adjuster is as follows: The reservoir-pipe 6, communicating, as it does, with the air-supply reservoir 5, carries the full reservoir-pressure, and this pressure acts on the outer face of the valve 46 in the housing 34 to hold said valve to its seat and prevent communication from the chamber 39 in the valve-housing to the cylinder-space 37, and communication between the chamber 35 and the cylinder-space 36 will be provided, owing to the valve 45 being unseated. As hereinbefore stated, the spring 33 on the shaft 24 constantly presses said shaft in the direction of the auxiliary cylinder 11, thereby causing the valve 28 to close the port 19 in the main brake-cylinder and holding the valve 27 unseated to furnish communication between the cylinder-passage 15 and the auxiliary cylinder 11. When the shaft 24 is in the position stated, the perforated disk 30 is held separated from the duct 23 in the connecting-head 14, owing to the collar 32 pressing thereagainst. When air flows from the triple valve through the triple-valve pipe 7, it enters the chamber 18 and passes through the cap 21 and the perforations in the disk 30 to fill the space between said disk and the adjacent piston 26, fixed to the shaft 24. The air-receiving surface of the piston 26 is greater than that of the valve 28, and hence pressure of air against said piston acts to maintain the shaft 24 in the outpressed position shown in the drawings. After the air enters the chamber 18 and the space between the perforated disk and the piston 26 it continues to flow through the duct 23 and therefrom into the housing-chamber 35, from which last-named chamber the air passes into the cylinder-space 36 to act upon the piston 43 therein. The piston 43 being of greater diameter than the valve 46, against which pressure from the reservoir-pipe 6 is delivered, is moved outwardly, thereby carrying the shaft 42 in a corresponding direction to seat the valve 45 and unseat the valve 46. When this action occurs, the full reservoir-pressure is permitted to enter the cylinder-space 37 from the chamber 39, and the air then passes from said cylinder-space through the duct 40 to the oil-tank 48. Owing to the piston 43 being of larger diameter than the valve 45, the shaft 42 continues to be carried in an outward direction as long as there is any pressure in the housing-chamber 35 to offset the pressure on the piston 44. The full reservoir-pressure having been communicated in the manner stated into the oil-tank 48, the oil therein is forced through the pipe 49 into the cylinder-passage 15 and from said passage into the auxiliary cylinder 11 to force the piston 12 therein outwardly. It is now to be noted in connection with the shaft 24 that the diameter of the piston 26 is greater than that of the valve 28, and the diameter of the valve 27 is greater than that of the piston 25; but the sum of the diameters of the piston 25 and valve 28 is, however, enough greater than the diameter of the piston 26 to overcome said piston and the spring 33 when pressure exists in the cylinder-passage 15 and chamber 18. The auxiliary cylinder 11 is of

such diameter that something less than the reservoir-pressure of the brake system will act to force the piston 12 therein outwardly to reciprocate the piston-rod and actuate the slack-adjusting lever 3 to take up the slack in the brake-rod mechanism. Such being the case, the pressure in the cylinder-passage 15, being the full reservoir-pressure which is communicated thereto by the forcing of oil from the tank 48, is greater than the pressure in the auxiliary cylinder, and as a result of this difference the valve 27, controlling communication between said cylinder-space and auxiliary cylinder, is constantly, when the coincident parts are under the influence of pressure, pressed toward the auxiliary cylinder, notwithstanding the tendency of the piston 25 to push the shaft 24 in the opposite direction. This is due to the fact of the valve 27 being enough greater in diameter than the piston 25 to overcome said piston with the pressures differentiated, as stated. In this connection attention is called to the statement hereinbefore made that the passage-way around the valve 27 is a restricted one and that as a result the flow of fluid around said valve to gain admission to the auxiliary cylinder 11 from the cylinder-passage 15 is restricted. It will therefore be seen that, due to the restriction of the fluid-flow and the greater area in the auxiliary cylinder and the constantly-increasing fluid-receiving space in the auxiliary cylinder while the piston 12 therein is moving away from the valve 27, there is no opportunity for the pressures at the two sides of the valve 27 to become equal. Therefore there is maintained under these conditions sufficient pressure in the cylinder-passage 15 to hold the valve 27 from its seat during flow of fluid to the auxiliary cylinder. When, however, the brake-shoes of the brake mechanism came in contact with the car-wheels, the piston 25 meets with resistance, and the degree of pressure in the auxiliary cylinder increases to the degree of pressure in the cylinder-passage 15. The result is that the valve 27 is balanced and has no effect on the shaft 24, and the only forces acting are the tank-pressure against the piston 25 and the triple-valve-pipe pressure in the chamber 18 against the piston 26 and valve 28. Now, as the combined pressure-receiving faces of the piston 25 and valve 28 are greater than the pressure-receiving face of the piston 26, the force exerted against the piston 25 and valve 28 is greater than the force exerted against the piston 26 and the force of the spring 33, the shaft 24 is forced in an inwardly direction. As a consequence the valve 27 is caused to be seated and the valve 28 is unseated, thereby permitting the flow of air from the chamber 18 as it is delivered thereto from the triple-valve pipe and delivering the air into the main brake-cylinder 8 through the port 19. It will be noted in this connection that at the time the valve 27 is moved to its seat, as stated, the pressure in the auxiliary cylinder is approximately the same as the pressure in the pipe 49 and in the chamber 18, and therefore the several pressures are on a balance and the valve 27 is readily carried to its seat, due to the variation in the areas of the piston 26, valve 28, piston 25, and valve 27, as previously explained. The piston 9 in said brake-cylinder is thereby forced outwardly to actuate the brake mechanism, from which the slack has been previously removed. When the parts are in the positions stated, the auxiliary piston 12 in the auxiliary cylinder assumes a fixed position after having taken up the slack in the brake mechanism, and thereafter the entire office of setting the brakes is borne by the piston in the main brake-cylinder. Upon releasing the brake the air is allowed to escape at the triple valve by passing from the slack-adjuster to the triple-valve pipe 7, and the port 19 in the main brake-cylinder being open the air in said cylinder finds ready egress into the triple-valve pipe after entering the chamber 18. The function of the perforated check-disk 30 will next be set forth. This disk, as hereinbefore stated, is reciprocally positioned on the shaft 24 and is held against the collar 32 on said shaft by the spring 31 when the shaft is in the position illustrated in the drawings. When, however, the shaft has been moved inwardly, as in setting the brakes, the perforated disk is moved to the duct 23 and closes it, being held thereto by the spring 31 and also by the pressure of air between the disk and the piston 26. Should, however, the pressure in the duct 23 be greater than that in the space between the disk and piston 26, the spring 31 is weak enough to permit the air in said duct to act against the disk and move it away from the entrance to the duct 23 to permit the escape of the air into the chamber 18. The check-disk is of service in preventing the passage of air under pressure from the chamber 18 to interior of the housing 34 through the duct 23 when the piston has moved outwardly in taking up the slack in the brake system. The check-disk is only operative after all the slack has been taken up and the air in the chambers 18 and 35, cylinder-spaces 36 and 37, and duct 23 has escaped and a new supply has been forced into the chamber 18 without the oil or heavy fluid having escaped from the auxiliary cylinder 11. Under such condition the check-disk acts as a guard to prevent the passage of air to the interior of the housing 34, involving unnecessary consumption of air, while the auxiliary cylinder remains full of oil. It will be remembered that, as described, the shaft 42 has been moved outwardly, and at this time it remains in such position so that the valve 45 is seated and the valve 46 unseated. The pistons 44 and 43 and the valves 46 and 45 are of such diameters that the diameter of the piston 44 plus

the diameter of the valve 45 is slightly greater than the diameter of the piston 43, and the pressure of air in the chamber 35, acting on the valve 45, added to the pressure in the cylinder-space 36, acting on the piston 43, overbalances the pressure in the cylinder-space 37 on the piston 44 plus the pressure in the cylinder-space 36, acting on the valve 45, which holds the shaft 42 pressed outwardly. When, however, the pressure in the chamber 35 is reduced sufficiently by the escape of air to the triple-valve pipe in the manner stated, the pressure in the cylinder-space 37 on the piston therein (the valve 46 being balanced by equal pressures in cylinder-space 37 and chamber 39, and therefore eliminated) plus pressure in cylinder-space 36 on valve 45 overbalances the pressure in the cylinder-space 36 on the piston therein, and the shaft 42 is therefore shifted inwardly into the position shown in the drawings, thereby seating the valve 46 and unseating the valve 45. When this movement of the parts has occurred, the air is permitted to escape from the cylinder-spaces 36 and 37, oil-tank 48, and ducts 40 and 41 into the chamber 35 and find egress from said chamber by the duct 23 and chamber 18. As a result of such escape of the air the pressure on the oil in the tank 48 and in the pipe 49 and cylinder-space 37 is relieved. As long as there is any pressure in the main brake-cylinder 8 the leverage arrangement of the brake mechanism is such that a higher degree of pressure will be maintained in the auxiliary cylinder 11, owing to said last-named cylinder being of smaller diameter than the first named. Therefore until the air entirely escapes from the main cylinder and atmospheric pressure in the main cylinder is reached the degree of pressure in the auxiliary cylinder will always maintain the valve 27, controlling the entrance thereinto, closed. When, however, the pressure in the main brake-cylinder is entirely relieved, the pressure in the auxiliary cylinder will become practically *nil*, and the spring 33 will act to move the shaft 24 outwardly to close the port 19, leading to the main brake-cylinder, by seating the valve 28 and opening communication between the auxiliary cylinder and the cylinder-passage 15 by unseating the valve 27. When this movement has occurred, the oil in the auxiliary cylinder is permitted to return to the tank 48 via the cylinder-passage 15 and the pipe 49. Should the pressure in the auxiliary cylinder remain great enough to hold the valve 27 seated, even after all pressure has ceased in the main brake-cylinder, the piston 9 in said brake-cylinder comes in contact with the projecting end of the shaft 24, thereby shifting said shaft outwardly and positively seating the valve 28 and unseating the valve 27 to permit escape of oil from the auxiliary cylinder in the course before mentioned.

I have herein referred to the pipe 7 as a "triple-valve" pipe; but I do not limit myself to a construction of system in which a triple-valve pipe is used, as said pipe and its appurtenances are in nature clearly a controller and will be so claimed herein.

I claim as my invention—

1. The combination with the main cylinder and operating mechanism, of an air-brake and means for conducting air to said cylinder, of an auxiliary fluid-cylinder, a piston operating in said auxiliary cylinder, slack-adjusting connection between said piston and said main brake-operating mechanism, and means for delivering a heavy fluid to said auxiliary cylinder under air-pressure, substantially as set forth.

2. The combination with the reservoir, main cylinder and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said auxiliary cylinder having slack-adjusting connection with said leverage mechanism, and means through which heavy fluid is first delivered to said auxiliary cylinder to actuate the piston therein to operate the said slack-adjusting connection and leverage mechanism previous to the main actuation thereof, substantially as set forth.

3. The combination with the main reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said auxiliary cylinder having slack-adjusting connection with said leverage mechanism, means for delivering a heavy fluid to said auxiliary cylinder, and fluid-operated valves for controlling the ingress of heavy fluid first into said auxiliary cylinder and the ingress of air subsequently into said main cylinder, substantially as set forth.

4. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said auxiliary cylinder having connection with said leverage mechanism, means through which fluid is conducted to said auxiliary cylinder, a shaft, pistons on said shaft and valves carried by said shaft for controlling the ingress of fluid first into said auxiliary cylinder and subsequently to said main cylinder, substantially as set forth.

5. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said auxiliary cylinder having connection with said leverage mechanism, means for delivering fluid to said auxiliary cylinder, a shaft, pistons on said shaft, valves for controlling the ingress of fluid into said main cylinder and auxiliary cylinder, and a spring for moving said shaft to seat the valve controlling ingress to said main cylinder and unseat the valve controlling ingress into the auxiliary cylinder, substantially as set forth.

6. The combination with the reservoir, main cylinder, controller and leverage mechanism

of an air-brake, of an auxiliary cylinder having connection with said leverage mechanism, means for conducting pressure medium to said main cylinder, means for conducting fluid to said auxiliary cylinder, a pressure-actuated shaft, valves carried by said shaft for controlling the ingress of fluid to said main and auxiliary cylinders, and a disk on said shaft to control communication between said controller and the means for conducting fluid to said auxiliary cylinder, substantially as set forth.

7. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said cylinder having connection with said leverage mechanism, a heavy-fluid tank having communication with said auxiliary cylinder and said reservoir, and valves for controlling the ingress of air from said controller to said main cylinder and from said heavy-fluid tank to said auxiliary cylinder, substantially as set forth.

8. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said cylinder having connection with said leverage mechanism, a heavy-fluid tank having communication with said auxiliary cylinder and said reservoir, and fluid-operated valves for controlling the ingress of air from said controller to said main cylinder and from said heavy-fluid tank to said auxiliary cylinder, substantially as set forth.

9. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said cylinder having connection with said leverage mechanism, a heavy-fluid tank having communication with said auxiliary cylinder and said reservoir, a shaft, pistons on said shaft, a valve carried by said shaft to control the ingress of air from said controller to said main cylinder, and a valve carried by said shaft to control the ingress of fluid from said tank to said auxiliary cylinder, substantially as set forth.

10. The combination with the reservoir, main cylinder, controller and leverage mechanism of an air-brake, of an auxiliary cylinder, a piston in said cylinder having connection with said leverage mechanism, a connecting-head joining said main and auxiliary cylinders, a heavy-fluid tank having communication with said auxiliary cylinder, a housing having communication with said connecting-head, reservoir and heavy-fluid tank, fluid-operated valves actuated by pressure admitted to said connecting-head and controlling the ingress of air and fluid to said main and auxiliary cylinders, and fluid-operated valves in said housing for controlling the passage of fluid from said reservoir to said heavy-fluid tank, substantially as set forth.

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In presence of—
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