No. 847,936. PATENTED MAR. 19, 1907.

A. L. GOODKNIGHT.

AIR BRAKE MECHANISM.

APPLICATION FILED NOV. 21, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

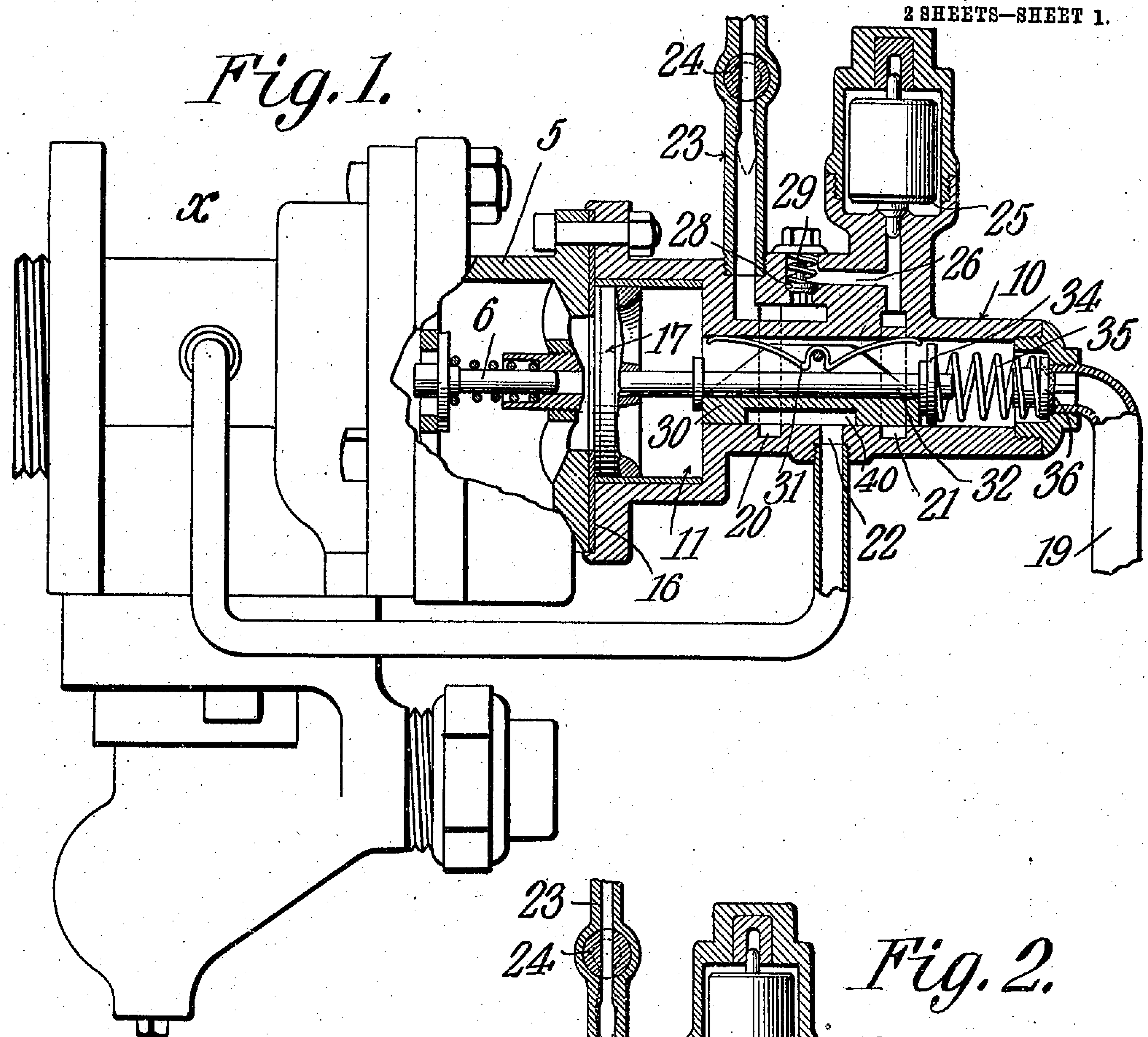
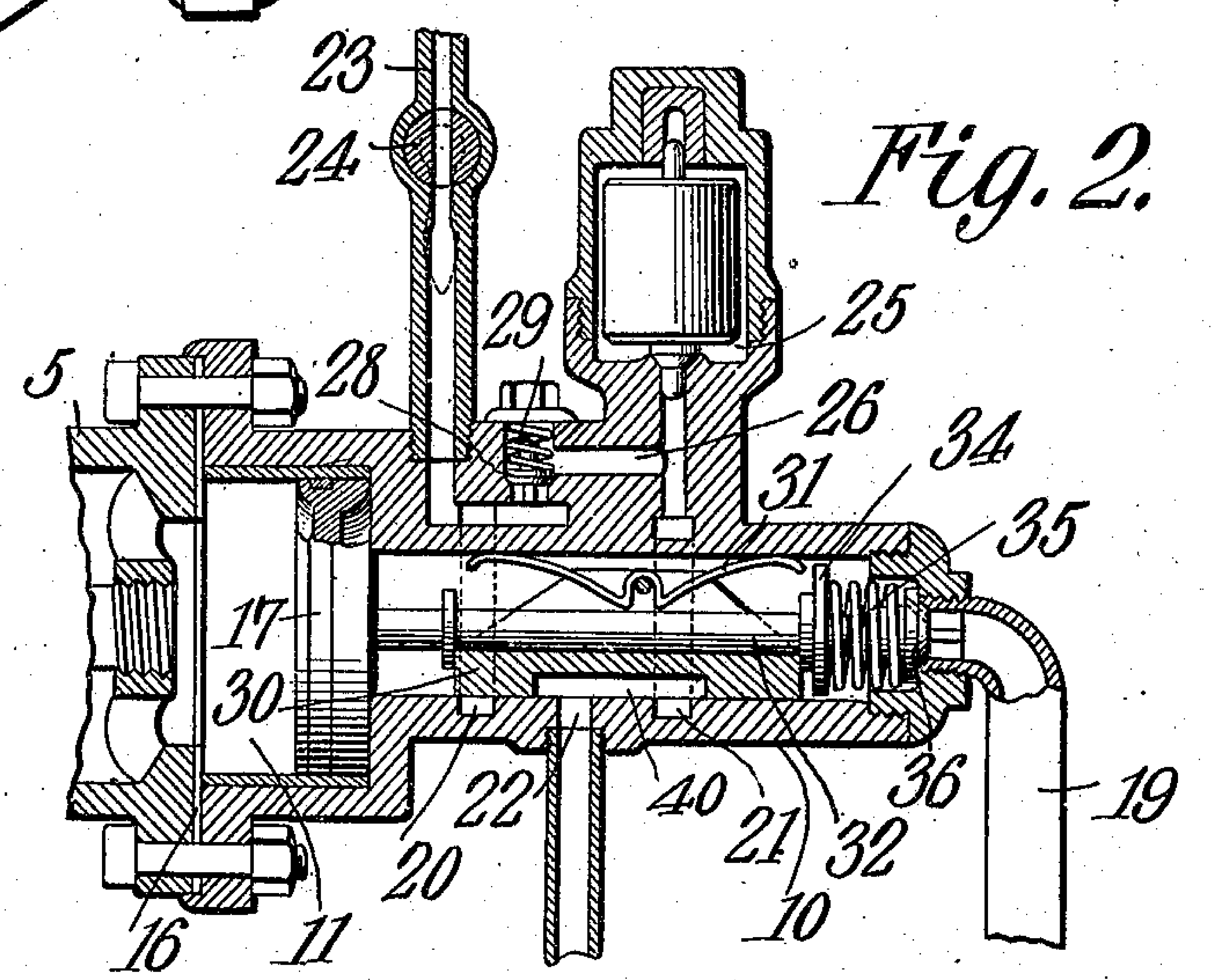


Fig. 2.



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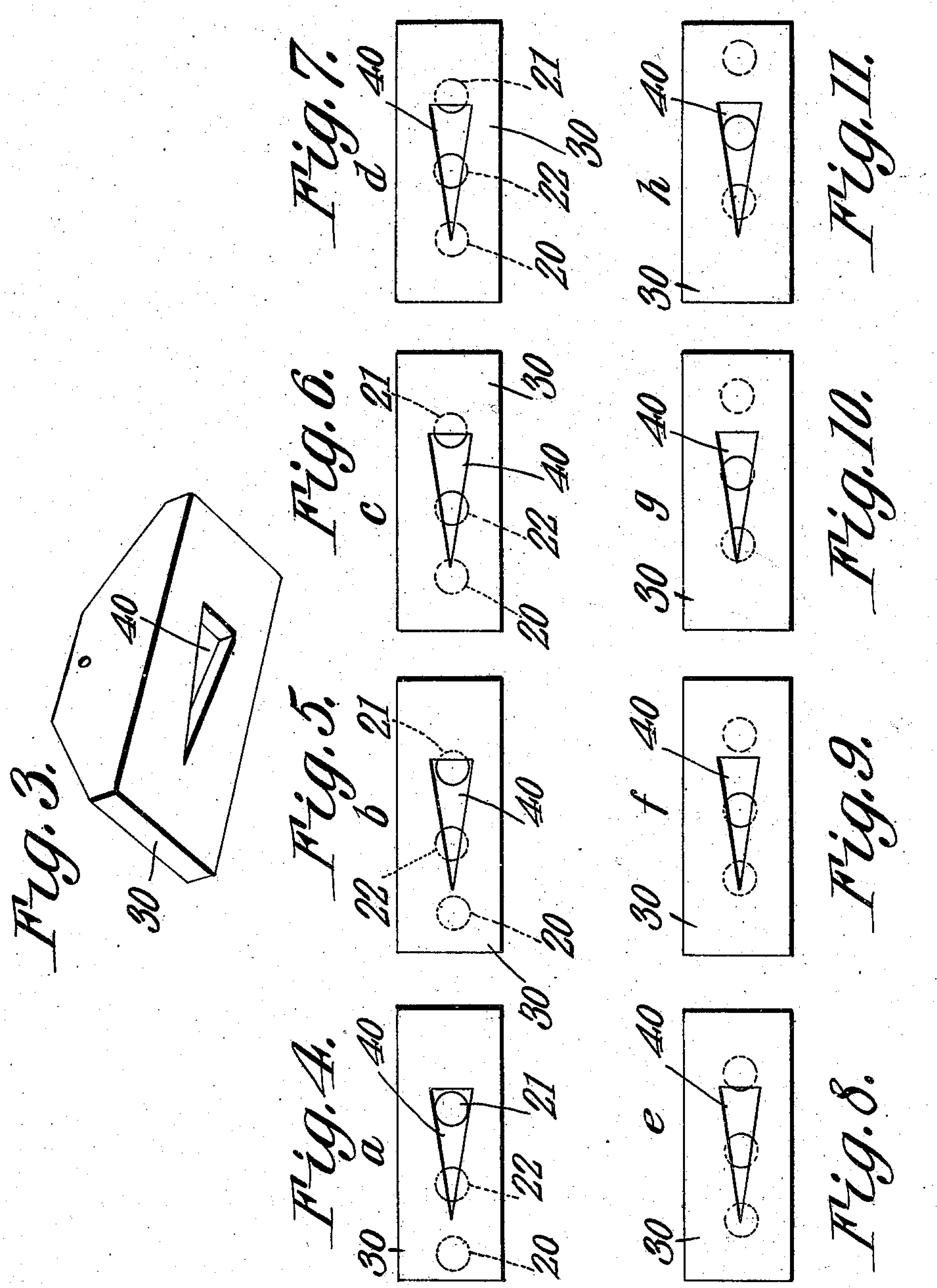

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AIR-BRAKE MECHANISM.

No. 847,936. Specification of Letters Patent. Patented March 19, 1907.

Application filed November 21, 1906. Serial No. 344,495.

To all whom it may concern:

Be it known that I, ALVA L. GOODKNIGHT, a citizen of the United States, residing at Council Bluffs, in the county of Pottawattamie and State of Iowa, have invented a new and useful Air-Brake Mechanism, of which the following is a specification.

This invention relates to air-brake mechanism, and has for its principal object to improve the efficiency of the ordinary Westinghouse or New York air-brake mechanisms now in use.

It is well known that where the ordinary equipment is used on a long train it is impossible to secure uniform release of the brakes throughout the whole length of the train, owing to the fact that the pressure in the train-pipe is not evenly distributed, but is necessarily greater at the head of the train than at the rear end thereof, and when the engineer's brake-valve is moved to full-release position the current of air sent through the pipe will immediately release the brakes at the head of the train long before the brakes at the rear are released, and it frequently happens that trains break in two from this cause. Many attempts have been made to secure "retarded" release, as it is commonly termed, and to maintain some pressure on the brakes at the head of the train while releasing those at the rear of the train.

One of the principal objects of the present invention is to secure a graduated release throughout the entire length of the train and to provide means whereby when full-release pressure is turned on by the engineer's brake-valve the brake on the rearmost car of the train will be fully released while the brake on the head car will be only partly released, and the pressure on the brakes at about the center of the length of the train will be about one-half that on the head-brakes, and so on, the pressure gradually reducing from the head-brakes to the rear brakes.

A further object of the invention is to provide an improved means for retaining a portion of the pressure in the brake-cylinder in order to secure retarded release and to provide means whereby the controlling mechanism shall be automatically moved from pressure-retaining position to full-release position, the movement being accomplished gradually, so that the brakes will be gradually released.

A still further object of the invention is to provide a release-valve having a port of gradually-decreasing width or area from end to end, so that as the valve is moved different distances in response to different pressures throughout the length of the train-pipe more or less of the effective area of the valve will be brought into play for the purpose of securing gradual release of the brakes.

A still further object of the invention is to so construct and arrange the releasing mechanism as to provide for the retention of any desired amount of pressure in the brake-cylinders where trains are descending heavy mountain grades, provision being made for utilizing an additional pressure-retaining valve which is placed under the control of the train crew.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings, Figure 1 is an elevation of a Westinghouse triple valve, showing the application thereto of a release-valve constructed in accordance with the invention, the valve being shown in normal or full-release position. Fig. 2 is a sectional view of the valve moved to pressure-retaining position. Fig. 3 is a perspective view of the valve inverted. Figs. 4 to 11, inclusive, are diagrams showing the different positions to which the valves are moved at different points in the length of a train.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

In carrying out the invention the cap-piece, which carries the graduating stem of the ordinary triple valve x, is removed and a new cap is placed in position thereon and a new section 5 is bolted on this section, carrying a graduating stem 6 and being provided with a bolting-flange at one end, by which it may be secured to the casing 10 of the device forming the subject of the present invention. The end of the section 5 is open, so that it may communicate with a cylinder 11, that is formed at one end of said casing 10, and train-pipe pressure entering the section 5 will act on the main piston of the triple valve in the usual manner and will also enter the cylinder. At the juncture of the section 5 and the cylinder 11 is arranged a gasket 16, forming a seat for a piston 17 when the latter is in normal or full-release position, and the train-pipe pressure is constantly exerted against the outer face of this piston. The opposite end of the casing is connected by a pipe 19 to the auxiliary reservoir, so that the opposite face of the piston 17 will be subjected to auxiliary-reservoir pressure and tending to hold said piston in the position shown in Fig. 1.

The lower portion of the casing is faced to form a valve-seat in which are arranged three ports 20, 21, and 22, of which the port 22 is connected to the exhaust-port of the triple valve, while the port 20 leads to a pipe 23, in which is arranged a valve 24, the latter being disposed usually at the top of the car and being similar to the valve which is used ordinarily in connection with the weighted retaining-valve. On level roads the valve is moved to the position shown in Figs. 1 and 2 in order to permit free passage of the exhaust, and where the train is descending heavy grades the valve is turned to closed position and prevents the escape of air through the pipe 23.

The port 21 leads to a retaining-valve 25, which is preferably of the weighted type commonly used at the top of the car and usually serves to hold fifteen pounds pressure in the brake-cylinder when the train is descending a heavy grade. The valve in the present instance, however, is designed to be constantly in use, and if the ports 21 and 22 are placed in communication with each other a portion of the air under pressure will be retained in the brake-cylinder, and the brakes will be held under light pressure—usually about fifteen pounds. The lower portion of the retaining-valve casing is in communication with the port 20 through a passage 26, in which is arranged a one-way check-valve 28, held to its seat by a spring 29, that will exert a pressure of approximately fifteen pounds, and when the valve 24 is turned to closed position any air which may be allowed to pass to the port 20 from the main port 22 will be compelled to pass the valve 28 and thence pass through the retaining-valve 25, and as the valve 28 is held to its seat by a spring exerting approximately fifteen pounds pressure there will be no possibility of the escape of all of the air from the brake-cylinder, such as frequently occurs through the rocking of the ordinary weighted retaining-valve.

Mounted on the valve-seat is a slide-valve 30, that is held down by a leaf-spring 31 of the ordinary construction, and this valve is connected by a stem 32 to the piston 17. The piston-stem carries a disk 34, against which bears a spring 35, that tends normally to maintain the valve and piston in the position shown in Fig. 1, this being the normal release position while the train is running. The opposite end of the spring bears against a one-way check-valve 36, that controls communication with the auxiliary-reservoir pipe 19, the spring tending to hold the valve closed and acting to prevent the return of any air-pressure from the casing to the auxiliary reservoir.

In the operation of the device, the parts being normally in the position shown in Fig. 1, the turning of the engineer's brake-valve to full-release position allows air under full pressure to enter the pipe 18 and force the piston 16 to the position shown in Fig. 2, this being accomplished against auxiliary-reservoir pressure which may be within the casing and against the resistance offered by the spring. The parts move to the position shown in Fig. 2, and in this position the air exhausting through the triple valve to pipe 22 will pass through the valve-port to the port 21 and thence to the retaining-valve; but as the latter is a weighted valve fixed to retain a certain portion of the pressure all of the air in the brake-cylinder will not be exhausted; but a sufficient quantity—say fifteen pounds—will be retained in the brake-cylinder for the purpose of holding the head-brake set while recharging and releasing the rear brakes first. When the engineer's brake-valve is turned to lap position, the spring and the auxiliary-reservoir pressure will gradually force the piston to the position shown in Fig. 1, and in so doing the exhaust-port 22 will be placed in communication with the port 20, which leads to the discharge-pipe 23, and all of the air in the brake-cylinder will be allowed to pass to the atmosphere.

It will be observed that the spring 35 acts to keep the main piston-valve in full-release position and at the same time serve to close the one-way check-valve in the auxiliary-reservoir connection, and as the piston moves toward the position shown in Fig. 2 under train-pipe pressure the spring will become more and more compressed and will exert gradually-increased force, thus preventing the passage of any air from the auxiliary reservoir into the casing.

Under ordinary circumstances the valve 24 will be in the open position shown in Figs. 1 and 2, so that the exhaust which is allowed to pass to the port 20 may escape freely to the atmosphere; but on heavy grades the valve 24 is closed and the air passing to the port 20 must first pass the pressure-retaining check-valve 28 and then pass the retaining-valve 25, the spring-held check-valve afford-an additional margin of safety in that there will be no danger of its rocking from its seat and allowing the gradual escape of air from the brake-cylinder, such as frequently happens where trains are running at a comparatively rapid rate on mountain grades. A further advantage resulting from this arrangement of the retaining-valves is that while the check-valve 28 is held to its seat under a spring-pressure of five pounds there is also an air-pressure of fifteen pounds, tending to keep it seated, and this results in the maintenance of twenty pounds pressure in the brake-cylinder, this being sufficient to insure the safety of the train on heavy grades.

The distance to which the valve and piston move is of course determined by the train-pipe pressure, and as this pressure varies at different points in the length of the train it necessarily follows that the valve at the head of the train will be moved fully over, while the valve at the rear end of the train will be moved to a much smaller extent, the distance of valve movement gradually decreasing from the head to the rear end of the train. Advantage is taken of this fact to secure a gradual release throughout the length of the train. This is accomplished by making the port 40 of the slide-valve of gradually-decreasing width, as shown in Fig. 3, the largest end of the port being opened first and under the lightest pressure, while as the pressure increases, especially at the head of the train, the valve will be moved a greater distance, and the effective port area will be diminished, so that at the head of the train the escape of the air is retarded, while at the rear end of the train the escape is comparatively free, and at the center of the train the retardation is about one-half that at the head of the train.

The position of the valves and the ports on a train of fifty cars is shown in Figs. 4 to 11, inclusive. It will be observed that on the head car *a* the exhaust from the port 22 to the port 21, which leads to the pressure-retaining valve, is approximately the same as that on car *b*, which may be the sixth or seventh car of the train, while in car *c* partial communication will be established through the port 20, and there will be greater freedom of escape of the air than on cars *a* and *b*. On car *d*, which may be the twenty-fifth or twenty-sixth car of the train, the free exhaust 20 is open to a greater extent, and the available area of the free exhaust gradually increases throughout cars *e*, *f*, *g*, and *h*, the latter car being the last car of the train. In this manner the brakes are released gradually and the braking pressure gradually increases from the head to the rear of the train.

I claim—

1. In air-brake mechanism, an auxiliary valve-casing having ports communicating with the triple-valve exhaust, the outer air and a pressure-retaining device, and a valve arranged within the casing and movable under full-release pressure in the train-pipe to place the brake-cylinder exhaust in communication with the pressure-retaining device.

2. In air-brake mechanism, an auxiliary valve-casing having ports connected to the triple-valve exhaust, to the outer air, and to a pressure-retaining device, and a valve arranged in the casing and controlling the port, the valve being movable under full-release pressure from the train-pipe to place the triple-valve exhaust in communication with the pressure-retaining device and under auxiliary-reservoir pressure to place the triple-valve exhaust in communication with the port leading to the outer air.

3. In air-brake mechanism, an auxiliary valve-casing having ports connected to the triple-valve exhaust, the outer air and to a pressure-retaining device, a ported valve arranged within the casing, a piston connected to the valve and exposed on one side to train-pipe pressure, and on the other side to auxiliary-reservoir pressure, and a spring acting on the valve and tending to assist the auxiliary-reservoir pressure in moving said valve to free-exhaust position.

4. In air-brake mechanism, an auxiliary valve-casing, a valve arranged therein and movable under train-pipe pressure to secure retarded exhaust from the brake-cylinder, and under auxiliary-reservoir pressure to secure free exhaust from the brake-cylinder, and a spring acting to assist movement of the valve to free-exhaust position.

5. In air-brake mechanism, an auxiliary valve-casing, a valve arranged therein and controlling the exhaust from the triple-valve casing, the casing being provided with two ports, one leading to the outer air, and the other to a pressure-retaining device, and the valve being provided with a port, whereby the brake-cylinder exhaust may be directed through the port leading to the outer air or to the pressure-retaining port, or both, the valve being movable under full-release pressure to the retaining or retarding position, and under auxiliary-reservoir pressure to free-exhaust position, and a spring tending to assist the movement to free-exhaust position, the springs of all of the valves in a train being compressed to different extents at different portions of the length of the train, thereby graduating the braking pressure from end to end thereof.

6. In air-brake mechanism, a valve controlling the brake-cylinder exhaust, and movable under full-release pressure, and a spring tending to resist such movement, said valve

being provided with a port of graduated width or area, and the valves being arranged to assume different positions at different points in the length of the train in accordance with variations in train-pipe pressure, whereby the braking pressure throughout the train may be gradually increased from full-release position at the rear of the train toward the head of the train.

7. In air-brake mechanism, an auxiliary valve-casing having a port connected to the triple-valve exhaust and having two escape-ports, one leading to the air and the other to a pressure-retaining device, a valve arranged within the casing and movable under full-release pressure to place the brake-cylinder exhaust in communication with the pressure-retaining device, and a spring tending to resist the movement of the valve, said valve having a port tapering in width, so that its effective area will vary with variations in the train-pipe pressure to which said valve is responsive.

8. In air-brake mechanism, an auxiliary casing having a port in communication with the brake-cylinder exhaust and two escape-ports one leading to the outer air and the other to a pressure-retaining device, a valve arranged in said casing and controlling the ports, a piston connected to the valve and exposed on one side to train-pipe pressure, and on the opposite side to auxiliary-reservoir pressure, a check-valve controlling communication between the auxiliary reservoir and the casing, and a spring arranged between the two valves.

9. In air-brake mechanism, the combination with an auxiliary valve-casing having ported communication with the brake-cylinder exhaust and provided with two ports, one leading to the outer air, a pressure-retaining valve with which the second port communicates, a valve arranged in the port which leads to the outer air, said valve being adjustable to open or close the port, a spring-pressed check-valve by which said ports may be placed in communication with each other, a piston arranged within the casing and exposed on one side to train-pipe pressure, and on the other side to auxiliary-reservoir pressure, a valve controlling the ports, and a spring tending to assist the movement of the valve under auxiliary-reservoir pressure.

10. In air-brake mechanism, an auxiliary valve-casing, a valve arranged therein and movable under train-pipe pressure to secure retarded exhaust from the brake-cylinder and under auxiliary-reservoir pressure to secure free exhaust from the brake-cylinder, and springs exerting variable force at different points in the length of the train for assisting movement of the valve to free-exhaust position.

11. In air-brake mechanism, an auxiliary valve-casing having a port connected to the exhaust-port of the triple valve and provided with two ports, one of which leads to the retaining-valve and the other to a valved discharge, the valved discharge being in communication with said retaining-valve, an auxiliary retaining-valve arranged in the connection, a slide-valve controlling the ports, said slide-valve being exposed on one side to train-pipe pressure, and on the opposite side to auxiliary-reservoir pressure.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ALVA L. GOODKNIGHT.

Witnesses:

E. HUME TALBERT

JNO. E. PARKER.