No. 768,538. PATENTED AUG. 23, 1904.

J. F. McELROY.

AIR BRAKE.

APPLICATION FILED JAN. 3, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

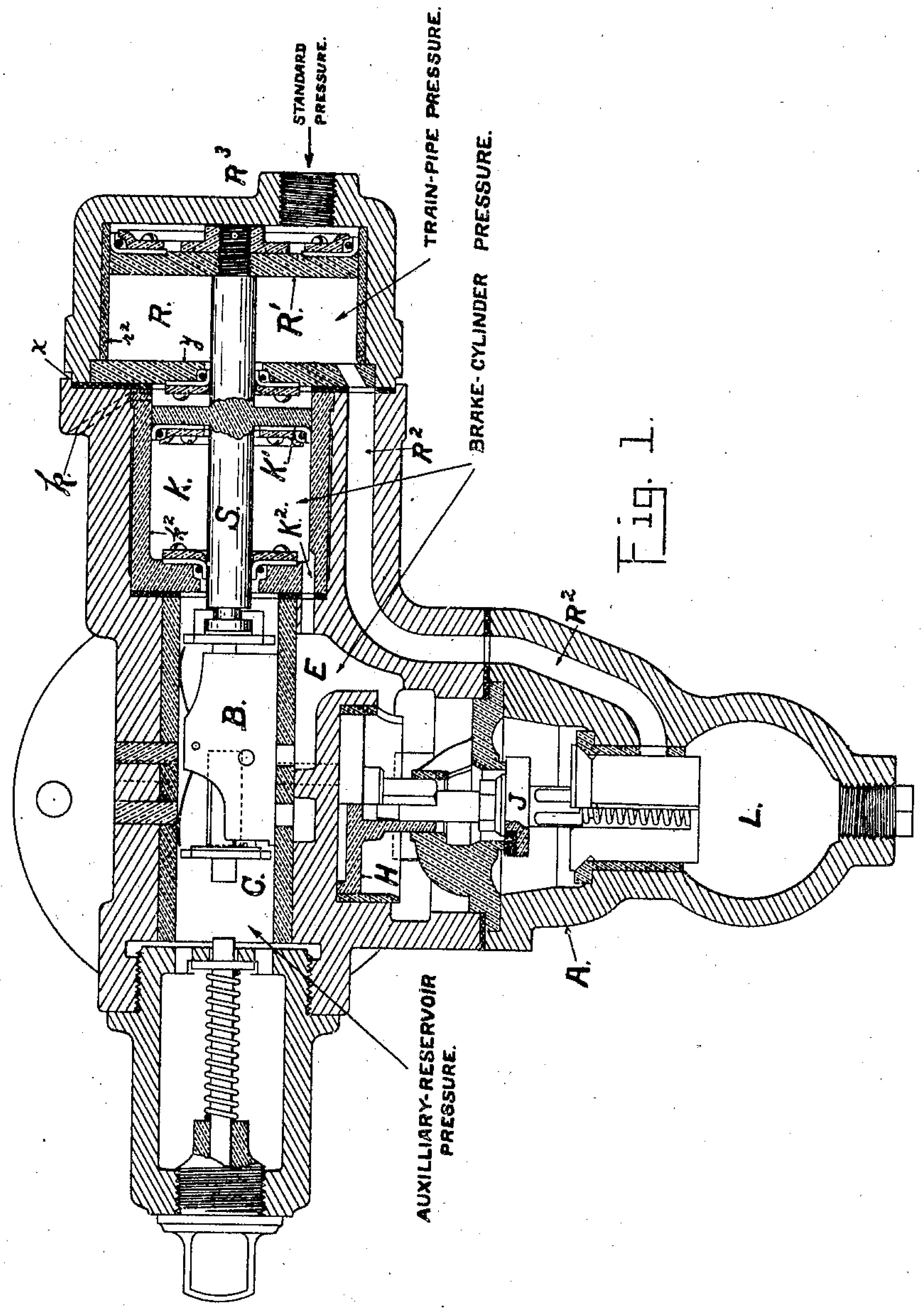

Fig. 1

Witnesses

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NO MODEL. 3 SHEETS—SHEET 2.

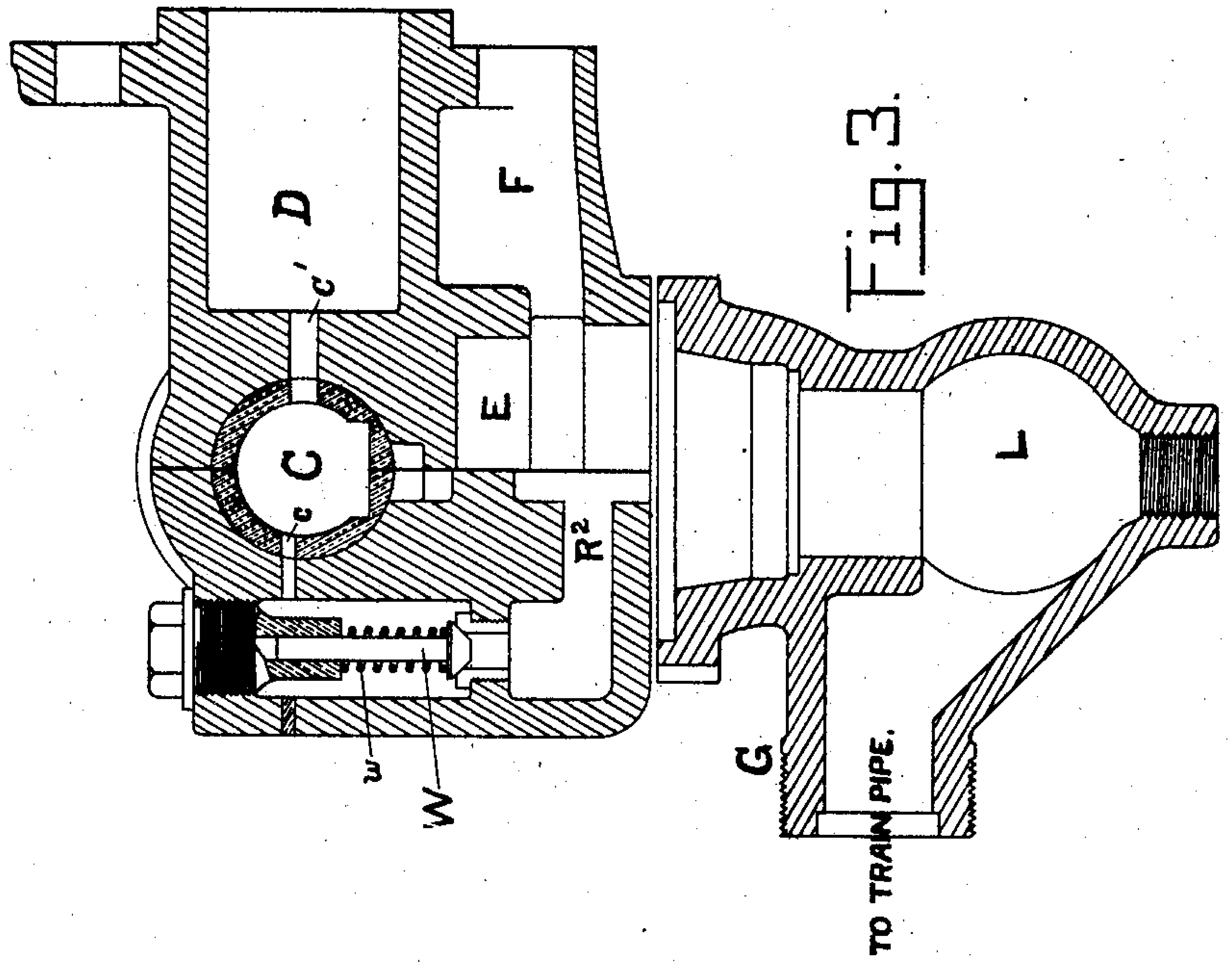

Fig. 3.

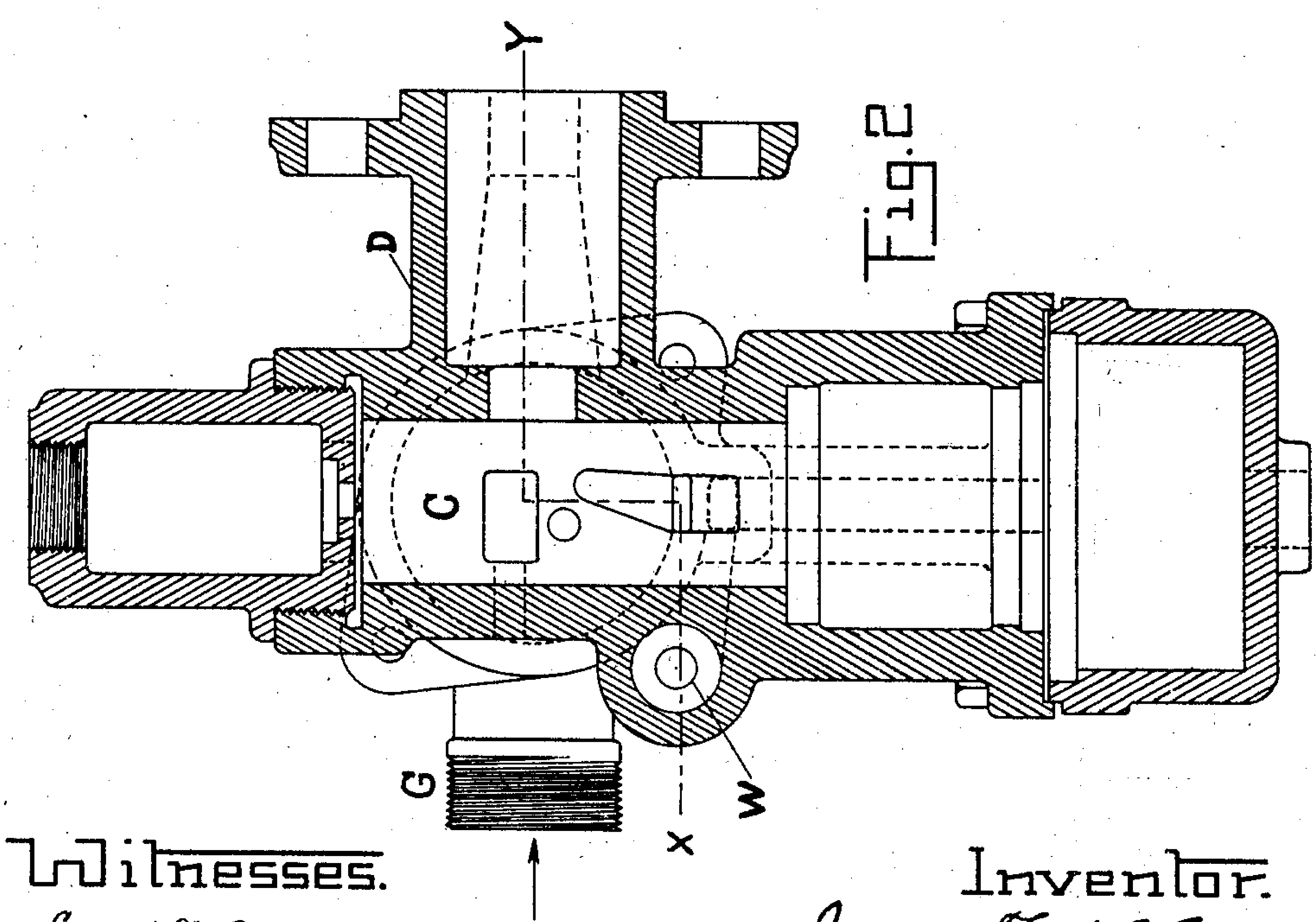

Fig. 2.

Witnesses.

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NO MODEL. 3 SHEETS—SHEET 3.

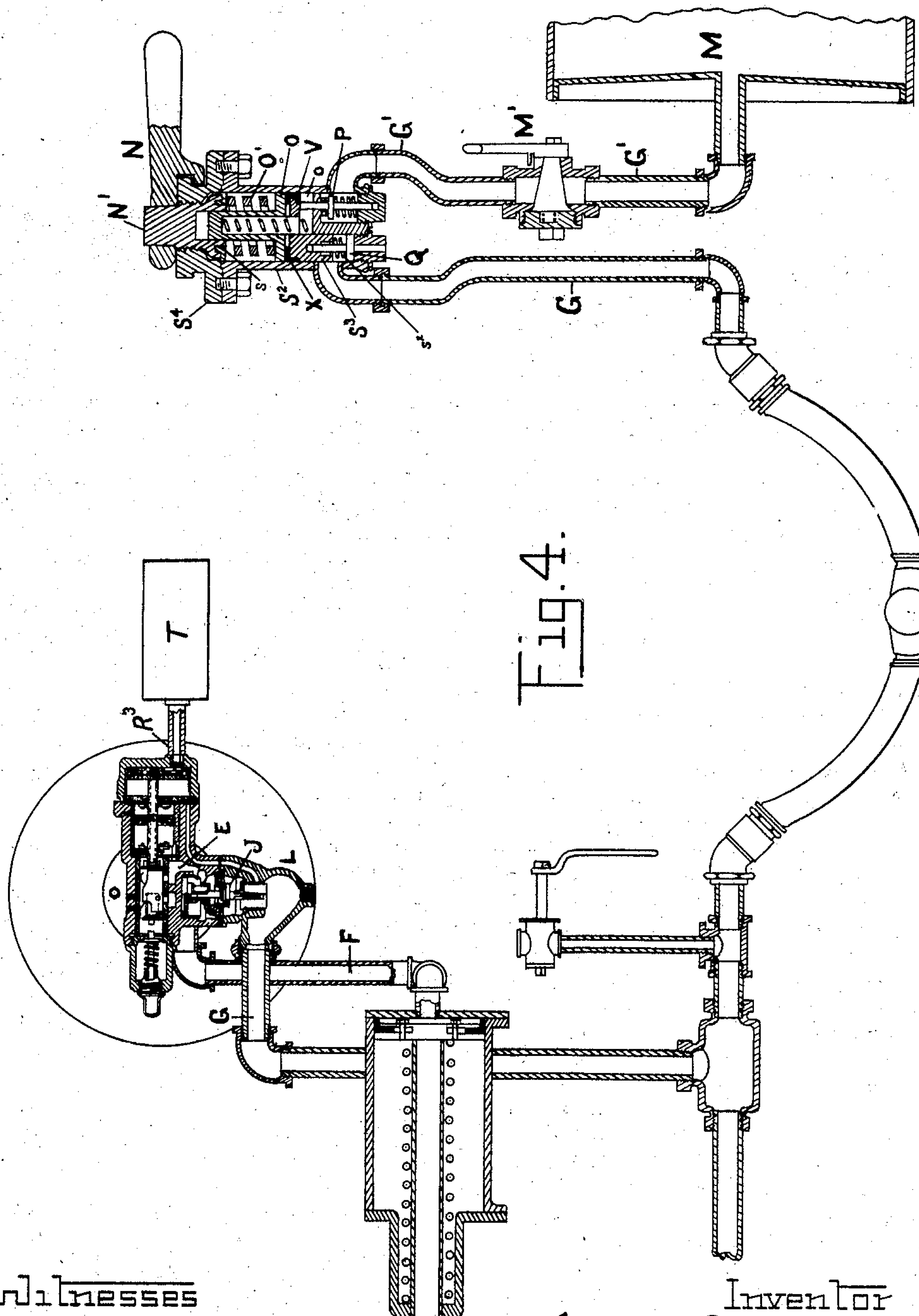

Fig. 4.

Witnesses
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James F. McElroy.
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No. 768,538. Patented August 23, 1904.

UNITED STATES PATENT OFFICE.

JAMES F. McELROY, OF ALBANY, NEW YORK, ASSIGNOR TO CONSOLIDATED CAR-HEATING COMPANY, OF ALBANY, NEW YORK.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 768,538, dated August 23, 1904.

Application filed January 3, 1903. Serial No. 137,661. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. McELROY, a citizen of the United States, residing at Albany, county of Albany, and State of New York, have invented certain new and useful Improvements in Air-Brakes, of which the following specification and accompanying drawings disclose as an illustration one embodiment thereof, which I now regard as the best out of the various forms in which the principles of the invention may be applied.

In the drawings, Figure 1 is a vertical longitudinal section of a triple valve. Fig. 2 is a horizontal longitudinal section of the valve-casing. Fig. 3 is a vertical transverse section on the offset line $x\,y$ of Fig. 2; and Fig. 4 is an assemblage view showing the valve in its relation to the train-pipe, engineer's-valve, and other parts of the system.

In an air-brake system heretofore devised by me and shown in an application for patent filed February 19, 1902, Serial No. 94,708, I have provided an arrangement wherein the pressure in the brake-cylinder is automatically adjusted and held to any desired standard. To this end I employ a pressure-governor for the cylinder, in which I balance the cylinder-pressure against a fixed or standard pressure and operate the inlet and outlet valves of the cylinder by the resultant of these two pressures. Thus if the cylinder-pressure exceeds the standard the outlet-valve is opened, and if it is below the standard the inlet-valve is opened and the cylinder-pressure thereby decreased or increased till it just balances the standard, when the valves are again closed automatically. If now the engineer of a train can change at will the standard on all of the cars simultaneously, he will have complete control of the brake-cylinder pressure on each car, and by setting the standard high or low such pressure will rise or fall, following in each case the standard which he sets. This I accomplish by opposing the train-pipe pressure to the aforesaid standard on each car, so that the standard will be decreased as the train-pipe pressure is increased, and vice versa. Then by providing an engineer's valve, which will permit him to give any desired pressure in the train-pipe, I give him the desired control of the standard on each car of the train.

My present invention relates to an improvement on the system just described whereby the apparatus conforms to the special arrangement of details now familiar to the art in brakes of the Westinghouse type. In particular I adapt to my system such inlet and outlet valves for the brake-cylinder as are already in general use, likewise the emergency features of the ordinary Westinghouse brake, while in shape, dimensions, and relative location of parts I have made my devices conform as closely as possible to accepted and well-known forms now in use, it being my purpose to employ my system interchangeably and in conjunction with such well-known forms. In such conjoint use of my apparatus with others several distinct advantages are gained, although the full benefit of my invention is only realized when all of the apparatus on a train is of my type.

Referring to Fig. 1 of the drawings, A represents the casing of the triple valve, which, it will be seen, bears a general resemblance to those already in use, the exception being that the casing is elongated at the part which ordinarily contains the main piston, balanced between the train-line pressure on the one hand and auxiliary-reservoir pressure on the other. The purpose of this elongation is to receive the two pistons which in my device operate on the stem of the valves.

B is the main valve-slide traveling in a slideway C, which communicates with the auxiliary reservoir through pipe D, Figs. 2 and 3. As usual, this valve-slide normally stands (the brakes being released) in a position to exhaust the brake-cylinder by connecting it with the atmosphere. A short traverse of the slide to the left, Fig. 1, will admit the auxiliary-reservoir pressure to the brake-cylinder by connecting slideway C with space E, which in turn communicates with the brake-cylinder through pipe F, Fig. 3. A longer traverse of the valve-slide (emergency) will admit auxiliary-reservoir pressure to the space above piston H, which will act to force down valve J, and thereby admit train-pipe pressure from train-pipe G, Fig. 3, through the drip-bulb L to space E, communicating, as aforesaid, with the brake-cylinder. A return of the slide to its normal position will shut off the brake-cylinder from the auxiliary reservoir and connect it with the atmosphere to allow it to exhaust. The actions just described are well-known and need not be referred to in detail, it being noted that the main valve-slide B serves as the moving element of both the inlet and outlet valves of the brake-cylinder. In the ordinary Westinghouse system this slide moves to the left only when the force of the train-pipe pressure acting on one side of the operating-piston of the slide becomes less than the force of the auxiliary-reservoir pressure acting on the opposite side of the said piston. Such reduction of train-pipe pressure is made by the engineer, who exhausts the train-pipe more or less by his valve at the engine. The slide will subsequently return sufficiently to close the port connecting the brake-cylinder with the auxiliary reservoir after the flow from said reservoir to said cylinder has reduced the reservoir-pressure to meet the reduction in train-pipe pressure, so that equilibrium is again restored between the reduced train-pipe pressure and the reduced reservoir-pressure. A certain pressure will have thus been established in the brake-cylinder. This pressure will be maintained therein, (unless the brake-cylinder is exhausted by a restoration of full train-pipe pressure;) but if a still higher brake-pressure is desired a further reduction of train-pipe pressure will again disturb the equilibrium, produce by a second operation of the valve-slide a further flow from reservoir to brake-cylinder, which will continue till a second condition of equilibrium is established between the further reduced train-pipe pressure and the further reduced reservoir-pressure. If, however, a lower instead of a higher brake-pressure is desired, it cannot be had in the ordinary Westinghouse system now being described except by first exhausting the brake-cylinder completely by a restoration of full-train-pipe pressure to wholly release the brakes and then reapplying the brakes with the desired lesser degree of pressure by a lesser degree of train-pipe reduction. This requires, moreover, that a sufficient time must elapse to permit the reservoir-pressure, which had been reduced by the previous flow into the brake-cylinder, to be restored by a flow thereto from the train-pipe. This is a long-recognized defect which it is the purpose of my system to avoid. The principle of such system has been already described, and the result of it is that the engineer can pass directly from any intermediate pressure to either a higher or lower pressure, while by means of the engineer's valve forming part of my system he can do this by a simple to-and-fro movement of his lever, such lever position corresponding to a definite pressure at all of the brakes on the train. An equality of brake-pressure throughout the train is also secured, since there is not, as in the previous systems, a definite volume of air delivered to each brake-cylinder, but the amount delivered to each is dependent upon the attained brake-pressure therein and a greater or less amount, sufficient to produce the desired pressure in each case, is supplied.

Referring again to the drawings, the means provided for the operation of the valve-slide B (which means constitute the difference between the construction of the prior art and my present invention) will be described. The slide B is connected, preferably, by a flexible joint directly to a stem S, to which are attached two pistons K′ and R′ of different areas, the former moving in a cylinder K and the latter in a cylinder R. The cylinder K is preferably provided with a brass lining k^2 and the cylinder R with a similar lining r^2, and there is a packing-ring x between the two cylinders, shown at the left of the brass disk y, which separates them. The lining k^2 can be removed, together with the valve, the stem S, and the two pistons, by removing the cylinder R. This is for cleaning and for renewals. The train-pipe pressure is admitted to cylinder R in front of piston R′ by the passage R^2 from the drop-bulb L, while the brake-cylinder pressure is admitted to the cylinder K in front of the piston K′ by the passage K^2 from the space E, which, as above described, communicates with the brake-cylinder. The cylinder K to the rear of piston K′ is connected with the atmosphere by the passage k. The cylinder R in the rear of piston R′ is connected by the pipe R^3 with a source of standard or fixed pressure, which in this case is a small tank or reservoir T, (see Fig. 4,) which may be designated for convenience as the "equalizing-reservoir." This equalizing-reservoir is filled and maintained full by the leakage of air from the cylinder R, the packing which surrounds the piston R′ being for this purpose turned over at its edge in a direction pointing away from the front face of the piston, so that air can leak past it into the equalizing-reservoir, but cannot leak in the opposite direction.

It is manifest that the cylinder R, with the piston R′ and the valve-slide B, operated thereby, constitutes an automatic pressure-regulator for the brake-cylinder which will maintain such pressure at a point corresponding to the standard pressure maintained in reservoir T. Thus if the brake-pressure falls below the standard it will allow the slide B to move to the left to admit air to the brake-cylinder to increase its pressure, while if it exceeds the standard the slide will move to the right and open the exhaust-port of the brake-cylinder to reduce its pressure. Therefore whatever pressure may be taken as the standard will be automatically maintained in the brake-cylinder so long as its source of air-supply—to wit, the auxiliary reservoir—remains available. To keep up the supply in the auxiliary reservoir, there is provided a check-valve W, (see Figs. 2 and 3,) located in a passage leading from the passage R^2 (which communicates, as aforesaid, with the train-pipe) to the auxiliary reservoir via the slideway C, the ducts c c', and the pipe D. By this device the train-pipe pressure, which whenever it exceeds the pressure in the auxiliary reservoir will lift the check-valve W, is communicated to the auxiliary reservoir and will first pass through the slideway C, containing the valve-slide B, and if the port to the brake-cylinder is open will pass directly to the brake-cylinder without previously passing through the auxiliary reservoir.

As thus far described my system comprises an automatic pressure-adjuster for the brake-cylinder which will cause the brake-cylinder pressure to conform to the standard or governing pressure, and it now remains to describe the means for enabling the engineer to control such standard or governing pressure so that by making it high or low he can cause the brake-pressure which follows the standard to be high or low. For this purpose I provide a connection which will admit the train-pipe pressure to cylinder R on the left side of piston R′, so as to oppose the standard pressure acting on the right side of piston R′. If then the standard pressure is of a given or fixed value, as it will be in the arrangement above described, it will be adjusted up or down exactly in reverse ratio to the train-pipe pressure. If the latter is at its maximum, the standard will be reduced to zero, which corresponds to a release of the brakes, while for every pound of train-pipe pressure below the maximum there will be a corresponding standard pressure to which the brake-pressure will conform. It being assumed that the engineer can make the train-pressure what he pleases, it is manifest that he can consequently make the brake-pressure what he pleases and can pass from low to high or from high to low at will without the necessity of completely releasing the brakes in the transaction. Instead of the equalizing-reservoir T a spring may be used, if desired; but I prefer the reservoir, since the pressure will be maintained therein automatically and will be automatically fixed at the right degree with respect to the train-pipe pressure on any train in which the car may be, whereas a spring might have to be specially adjusted to work with different train-pipe pressures.

It will be understood that the apparatus thus far described may be used on an ordinary Westinghouse system, with the advantage of a delivery to brake-cylinder of an amount of air needful for the brake-pressure desired regardless of the extent of travel of the piston in the brake-cylinder, which travel depends upon the amount of wear on the brake-shoes and the adjustment thereof. If, however, a sufficient number of cars in a train are equipped with my brake, they can be used on my principle and with my engineer's valve—that is, the brake-pressure may be adjusted merely by an increase or decrease in the train-pipe pressure without the need of releasing the brakes entirely or waiting for the auxiliary reservoir to be filled and the main reservoir to be pumped up. This would be a material advantage even without a complete installation of my system. In such cases—viz., when used with Westinghouse type of equipments—it will be understood that the engineer will adjust his train-pipe pressure by the type of engineer's valve now in use, which only permits him to admit more or less air to the train-pipe or to exhaust more or less air therefrom until the pressure as indicated by the gage is at the desired point. The system, however, is incomplete without my form of engineer's valve, which is so constructed that by a definite degree of movement of the handle the engineer can impress a definite degree of pressure on the train-pipe without the necessity of watching his gage and opening or closing the valve, as the gage may indicate. I will describe this valve to complete the exposition of my system, though it is to be understood that I do not make claim thereto in the present application, since it is the ruling of the Patent Office that the said valve constitutes a separate and distinct invention that cannot be claimed in the present case.

Remembering that my system is one in which the brake-pressure follows uninterrupted the variations in train-pipe pressure, its best embodiment requires that such variations be produced by definite handle positions of the controller rather than by a series of handle movements of greater or less duration, which are quite suitable for the ordinary Westinghouse system, (which only calls for maximum train-pipe pressure or for a greater or less exhaustion of the train-pipe pressure,) but are unsuitable for passing through a range of increasing or decreasing pressures such as are required in my system.

Turning to Fig. 4, M is the main reservoir on the locomotive, which will be kept supplied with air under pressure in the well-known way. G is a pipe leading therefrom to the engineer's valve and provided with a shut-off cock M′. S^2 is the cylindrical casing of the engineer's valve, or, as I prefer to call it in this description, the "controller." Within the cylinder S^2 is a piston O, provided with the ordinary packing X, secured between the under side of the piston and a disk V, the disk having at one side a downward projection S^3 with a hole in its end for the reception of the stem of the exhaust-valve Q, which is attached to the projection S^3 through a small coiled spring S^2, (secured at its lower end to the valve and at its upper end to the projection,) so that the valve may be lifted by the projection, yet have a slight amount of play with relation thereto. The piston O has on its upper side a hollow stem containing a small supporting-spring which just balances the weight of the piston. Around the stem is a heavy spring O′, which at its lower end bears against the upper side of piston O and at its upper end against the under side of a disk *s*, which in turn bears on the under side of a screw-shaft N′. The shaft N′ receives the operating-handle N and is screwed through the cap S^4, which closes the upper end of cylinder S^2. The cap is also hollowed out to receive and guide the upper end of the stem of piston O. P is the inlet-valve, which when open admits the air from pipe G′ to the interior space *o* of the cylinder S^2, which space also communicates with train-pipe G. The piston O in descending will strike the stem of valve P and open it, while its ascent will allow the valve P to close and the exhaust-valve Q to open, it being remembered that the projection S^3 is connected, as aforesaid, to valve Q through the spring S^2, so as to both lift and depress the valve with a slight yielding action. The piston therefore plays up and down between the pressure of spring O′ above and the pressure of the train-pipe air below and works one valve or the other, according to the preponderance of one pressure or the other, but leaves both valves closed when the pressures are balanced. If now the pressure of spring O′ is adjustable, it may be made to require for balancing it a greater or less train-pipe pressure. Such adjustment is afforded by the screw-shaft N′ bearing against the upper end of the spring through the intermediate disk *s* and turned by the handle N. So by giving the handle a greater or less turn a greater or less train-pipe pressure will be automatically maintained. For example, if there is a low pressure in the train-pipe balancing a low tension on spring O′ a movement of the handle N in a direction to screw down the shaft, will cause the spring-pressure to predominate over the train-pipe pressure. This will allow piston O to descend and open inlet-valve P, whereupon air will flow from the pipe G′ into the train-pipe until the pressure in the latter rises to a point where it will balance the increased tension on spring O′. In the same way a mere turn of the handle N to right or left will insure a corresponding greater or lesser pressure in the train-pipe with a corresponding brake-pressure following in the manner already described. The value and necessity of this controller in my system may perhaps be more clearly realized by remembering that the said system relies upon an adequate supply of air in the auxiliary reservoir to meet all the demands caused by repeated application and changes of brake-pressure which are not, as in the ordinary Westinghouse, limited by the necessity of letting off the brakes in order to change the auxiliary reservoir or of allowing the auxiliary-reservoir pressure to equal the train-pipe pressure in order to shut off the flow into the brake-cylinder. In other words, the function of the train-pipe of charging the auxiliary reservoirs in my system, separated from its other function of determining the degree of brake-pressure, and in consequence a controller must be provided for the engineer which will permit the separate performance of this reservoir-changing function. For example, a given brake-pressure (corresponding to a given train-pipe pressure) may make such a draft on the reservoir that its pressure falls below that of the train-pipe. The reservoir then makes a draft on the train-pipe and the train-pipe pressure would drop were it not for the presence of my automatic controller, which maintains the train-pipe pressure at the point necessary for a desired brake-pressure in spite of any drafts which the reservoir may at the same time make on the train-pipe.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a brake and a source of air-pressure, of an inlet-valve between said source and the brake-cylinder, an exhaust-valve for the cylinder, an operating-stem for the said valves, two pistons secured to the said stem at succeeding points, two cylinders in tandem inclosing the said pistons respectively and three additional sources of pressure acting upon the said pistons and controlling the said valves, one source being the brake-cylinder, the second being a standard source of pressure acting in opposition to the brake-cylinder pressure and the third being the train-pipe acting in opposition to the constant pressure and in conjunction with the brake-cylinder pressure.

2. The combination with a brake and an auxiliary reservoir of an inlet-valve between said reservoir and the brake-cylinder, an exhaust-valve for the cylinder, an operating-stem for the said valves, two pistons secured to the said stem at succeeding points, two cylinders in tandem inclosing the said pistons respectively and three sources of pressure additional to the auxiliary reservoir and acting upon said pistons to control the said valve, one source being the brake-cylinder, the second being a source of standard pressure acting in opposition to the brake-cylinder pressure and the third being the train-pipe, its pressure acting in opposition to the constant pressure and in conjunction with the brake-cylinder pressure.

3. The combination in a brake system, with an auxiliary reservoir of a triple valve containing a slideway communicating with the said reservoir, a valve-slide therein, a cylinder disconnected from said slideway, but communicating at one end with the brake-

cylinder and at the other end with the atmosphere, a piston in said cylinder mechanically connected with the valve-slide, a second cylinder also out of communication with the said slideway, but connected at one end with the train-pipe and at the other end with a source of constant pressure and a second piston also connected mechanically with the valve-slide.

4. The combination in an air-brake system of an auxiliary reservoir and a triple valve containing the following elements, to wit: a slideway communicating with the auxiliary reservoir, a valve-slide therein controlling the communication between it and the brake-cylinder, a valve-stem extending through the wall of said slideway into an adjacent cylinder and provided with packing to seal the opening through which it passes, a piston in said cylinder subjected on one side to the brake-cylinder pressure, a second cylinder into which the said stem also extends, with a surrounding packing, a piston in said second cylinder subjected on one side to the train-pipe pressure, and a source of standard pressure acting upon the opposite side of the said second piston.

5. The combination in an air-brake system, of an auxiliary reservoir and a triple valve communicating with the auxiliary reservoir, the train-pipe and the brake-cylinder, and containing a slideway for the main valve, a valve-stem extending through the wall of said slideway, a packing for sealing the opening through which it passes and operating-pistons for the said valve subjected to the differential pressure of the train-pipe and brake-cylinder acting together in opposition to the standard pressure.

6. The combination in a brake system of a triple valve, an auxiliary reservoir, a brake-cylinder and a train-pipe, the said triple valve containing a slideway for the main valve-slide, two cylinders with valve-operating pistons therein respectively, one cylinder communicating at one end with the brake-cylinder and at the other with the atmosphere, and the other cylinder communicating at one end with the train-pipe and provided at the other end with a source of standard pressure independent of the pressure in the auxiliary reservoir.

7. A triple valve containing a slideway, a valve-slide B therein, a cylinder separated from said slideway by an intervening wall and a piston in said cylinder subjected to the differential effect of the brake-cylinder pressure and a standard pressure independent of the pressure in the auxiliary reservoir.

8. A triple valve containing a slideway, a duct connecting said slideway with an auxiliary reservoir, an additional duct connecting the auxiliary reservoir with the train-pipe, a check-valve in said last-mentioned duct, a valve-slide in said slideway and an operating device for said valve-slide subject to the differential effect of the brake-cylinder pressure and a standard pressure.

9. A triple valve containing inlet and outlet ducts for the brake-cylinder, opening and closing devices for said ducts, a pressure-governor controlling said devices in accordance with the differential effect of the brake-cylinder pressure acting in opposition to a standard pressure, an emergency device differentiating the service traverse from the emergency traverse of the apparatus and means for adjusting the said standard pressure by the train-pressure.

10. A triple valve containing a valve-slide controlling the inlet and outlet passages of the brake-cylinder, an emergency-spring having a tension less than the force of the emergency movement of the valve-slide, an emergency-valve, and an operating device for the said valve-slide controlled by the differential effect of the brake-cylinder pressure acting in opposition to a standard pressure.

11. A triple valve containing an outlet-duct for the brake-cylinder, an inlet-duct leading to said cylinder from the auxiliary reservoir, opening and closing devices for said ducts, operating-pistons for said devices subject to the brake-cylinder pressure, the train-pipe pressure and a standard pressure, an emergency-spring differentiating the service traverse from the emergency traverse of the apparatus, an emergency-valve for the train-pipe and means for adjusting the said standard pressure by the train-pipe pressure.

12. A triple valve containing a slideway communicating with an auxiliary reservoir, a valve-slide thereon, inlet and outlet ducts for the brake-cylinder controlled by said slide, a piston secured to said slide, a cylinder surrounding said piston and communicating at one end with the brake-cylinder and at the other end with the atmosphere, a second piston also secured to said slide, a cylinder surrounding said second piston and communicating at one end with the train-pipe and at the other end with a standard pressure, an emergency-spring having its tension independent of the variable air-pressures and a duct connecting the auxiliary reservoir with the said train-pipe and containing a check-valve permitting air-flow in one direction only.

13. The combination in an air-brake system of a main source of compressed air, a train-pipe, an intervening controller containing (*a*) inlet and exhaust valves, (*b*) operating devices for said valves controlled by the differential effect of the train-pipe pressure acting in opposition to a standard pressure and (*c*) means for manually controlling the said standard pressure, a local auxiliary reservoir, a brake-cylinder, a source of standard pressure and a triple valve containing (*a*) a feed-duct between the said train-pipe and the auxiliary reservoir, (*b*) a check-valve in said duct, permitting the flow of air in one direction only, (*c*) inlet and exhaust valves for the brake-cylinder, operating devices for said valves vibrating between the opposing brake-cylinder and

standard pressures and means for adjusting the said standard pressure by the train-pipe pressure.

14. The combination in an air-brake system of a main source of compressed air, a train-pipe, an intermediate controller containing an automatic pressure-governor having its standard manually adjustable, an auxiliary reservoir and a triple valve containing (*a*) inlet and exhaust ducts for the brake-cylinder, (*b*) opening and closing devices for said ducts, (*c*) an automatic governor for said devices controlled by a source of standard pressure, (*d*) means for adjusting said standard pressure by the train-pipe pressure, (*e*) an emergency-spring having a tension less than the force of the emergency movement of the apparatus and (*f*) an emergency-valve for the train-pipe operated by said emergency movement.

15. A triple valve containing a slideway, a valve-slide B therein controlling the inlet and exhaust ports of the brake-cylinder, an operating-stem for said valve-slide passing through a permanently-tight opening in the wall of the slideway, and operating devices for said stem controlled by the differential effect of the brake-cylinder pressure balanced against a standard pressure.

16. A triple valve containing a slideway, a valve-slide therein controlling the inlet and exhaust ports of the brake-cylinder, a cylinder adjoining said slideway, a piston therein, a stem joining said piston to the valve-slide and passing into the slideway through a permanently-tight opening, a second cylinder, a piston therein also acting on the valve-slide, a source of standard pressure and ducts delivering to the said pistons in opposition both the brake-cylinder pressure and the standard pressure.

17. A triple valve containing a slideway, a valve-slide therein, a spring between said valve-slide and one wall of its slideway, a stem for said valve, two pistons in separate cylinders secured to said stem and a yielding joint for permitting the free movement of the pistons and valve-slide.

18. A triple valve containing a slideway, a valve-slide therein, an operating valve-stem passing through a tight opening into said slideway, and secured to the valve-stem by a yielding joint.

19. A triple valve containing a slideway, a valve-slide therein, an operating-stem for said slide passing into the slideway through a permanently-tight opening, an operating device therefor governed by the resultant effect of the brake-cylinder pressure balanced against a standard pressure, a feed-duct from the train-pipe leading to the auxiliary reservoir and a check-valve in said duct permitting air-flow in one direction only.

20. A triple valve containing a slideway and a valve-slide therein controlling the inlet and exhaust ports of the brake-cylinder, the said slideway having a normally open communication with the auxiliary reservoir and a permanently-tight opening containing the operating-stem of said valve-slide.

21. In an air-brake system, the combination with a train-pipe, of a brake having its degrees of pressure determined thereby, an auxiliary reservoir charged from the said train-pipe simultaneously with such determination of the degree of brake-pressure, and an automatic supply-valve for the train-pipe acting to maintain the pressure desired on train-pipe and brake, in spite of the simultaneous draft by the auxiliary reservoir.

22. In an air-brake system the combination with a train-pipe of an auxiliary reservoir, a brake-cylinder, valves for said cylinder held closed by the train-pipe pressure acting in opposition to an adverse pressure, a connection between the said train-pipe and auxiliary reservoir acting simultaneously to charge the reservoir and an automatic supply-valve for simultaneously charging the train-pipe.

In witness whereof I have hereunto set my hand, this 30th day of December, 1902, before two subscribing witnesses.

JAMES F. McELROY.

Witnesses:
ERNEST D. JANSEN,
BEULAH CARLE.