(No Model.) 4 Sheets—Sheet 1.

A. M. WILLETS.

AIR BRAKE.

No. 561,301. Patented June 2, 1896.

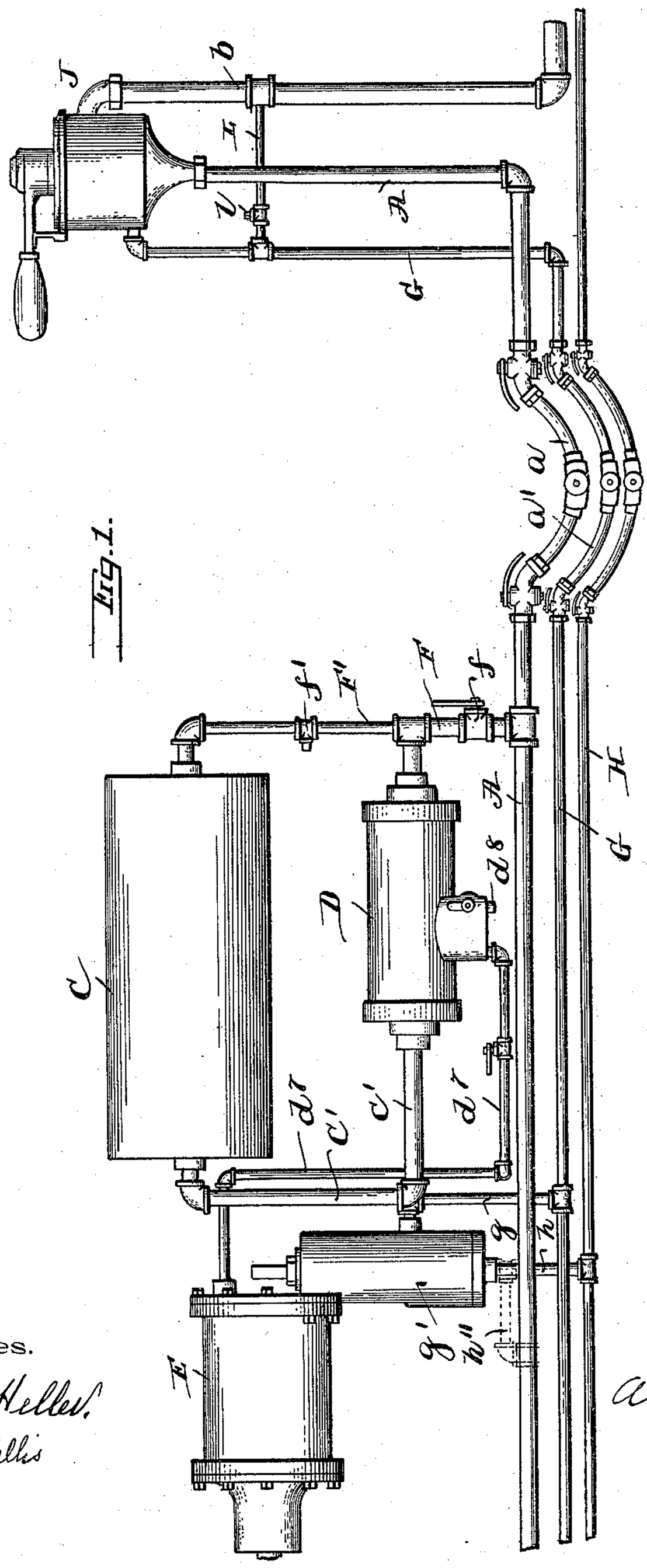


Fig. 1.

Witnesses.

Jesse B. Keller.

Minnie F. Ellis

Inventor.

Albert M. Willets

by G. J. Harding

Attorney.

(No Model.) 4 Sheets—Sheet 2.

A. M. WILLETS.

AIR BRAKE.

No. 561,301. Patented June 2, 1896.

Fig. 2.

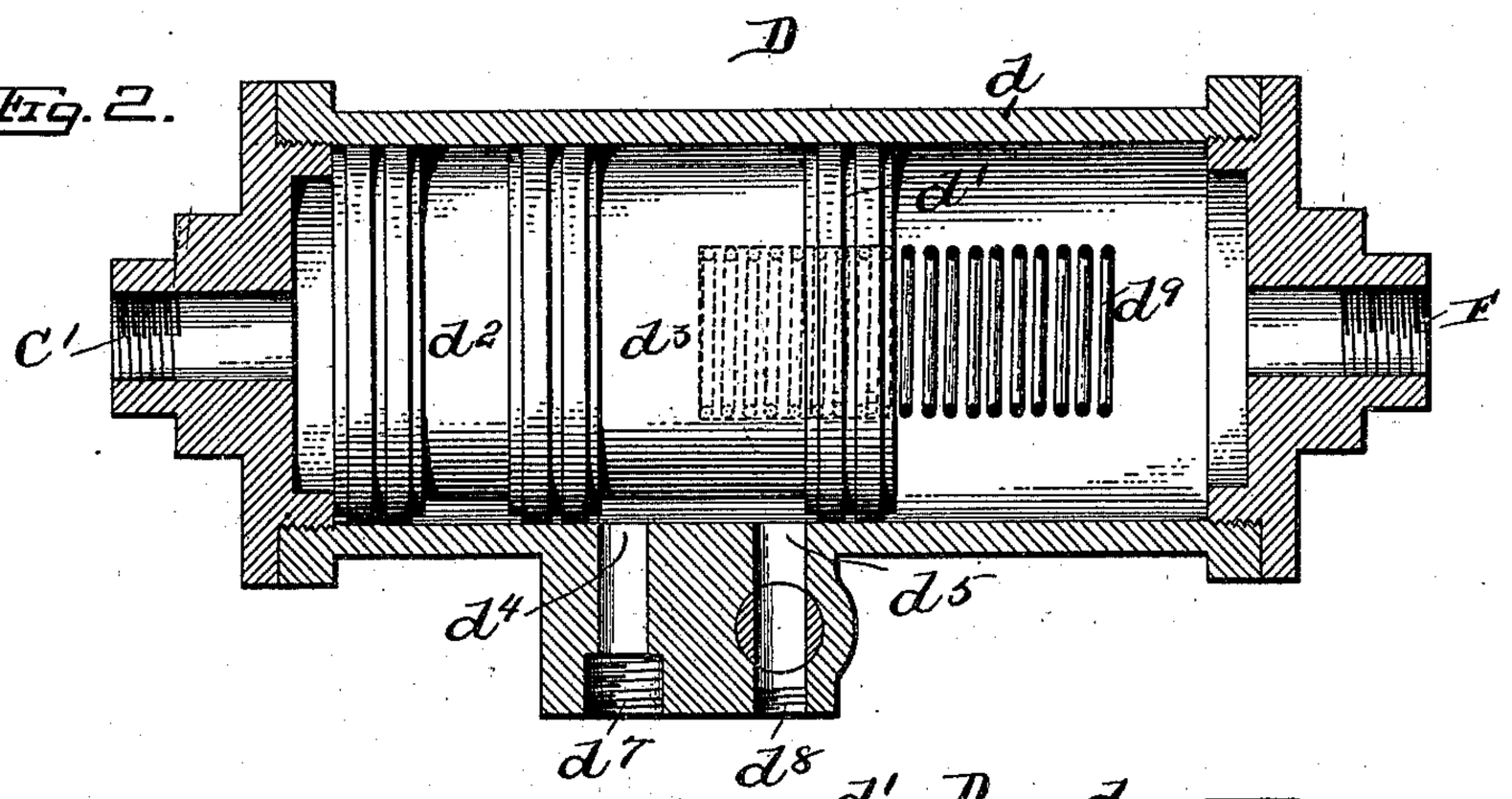


Fig. 3.

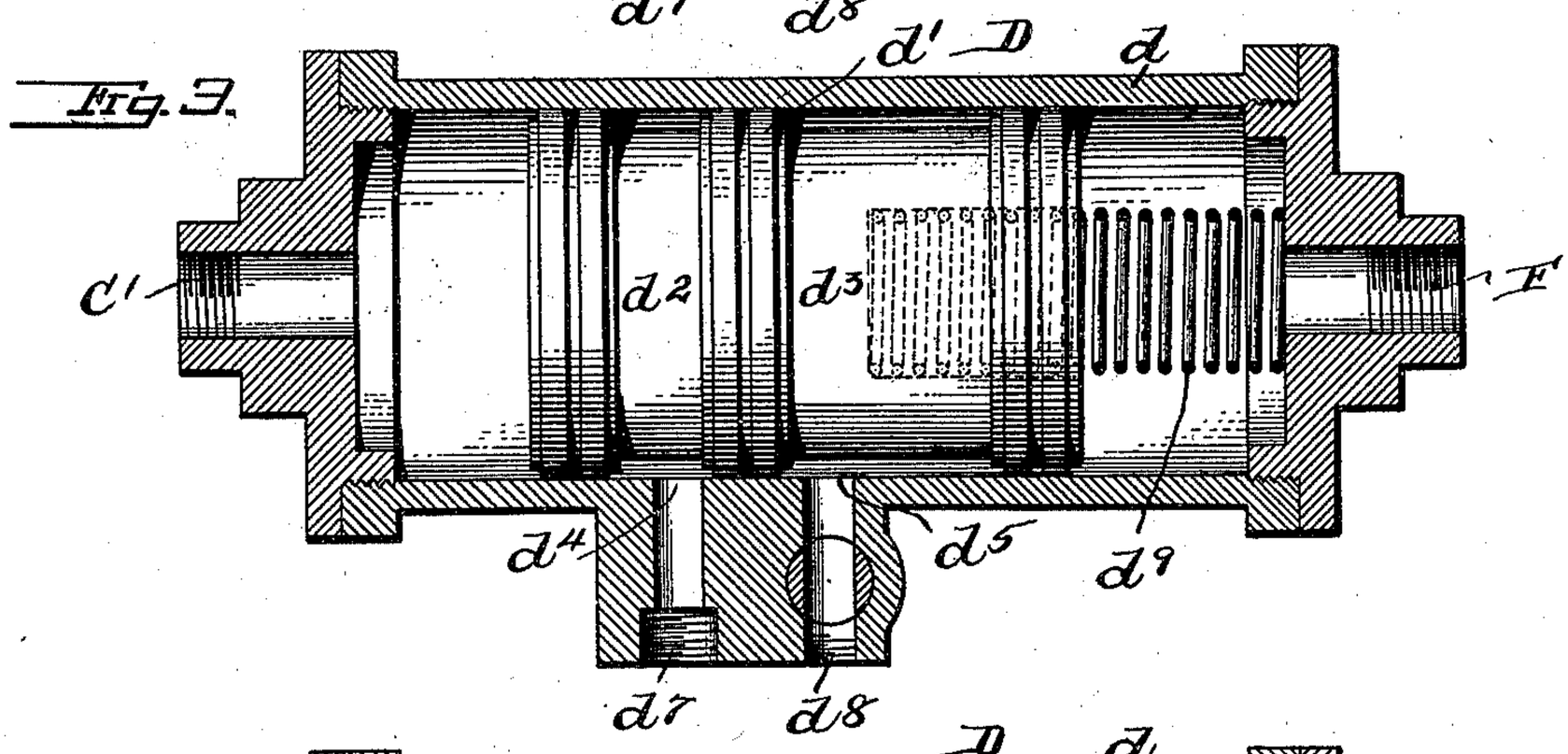
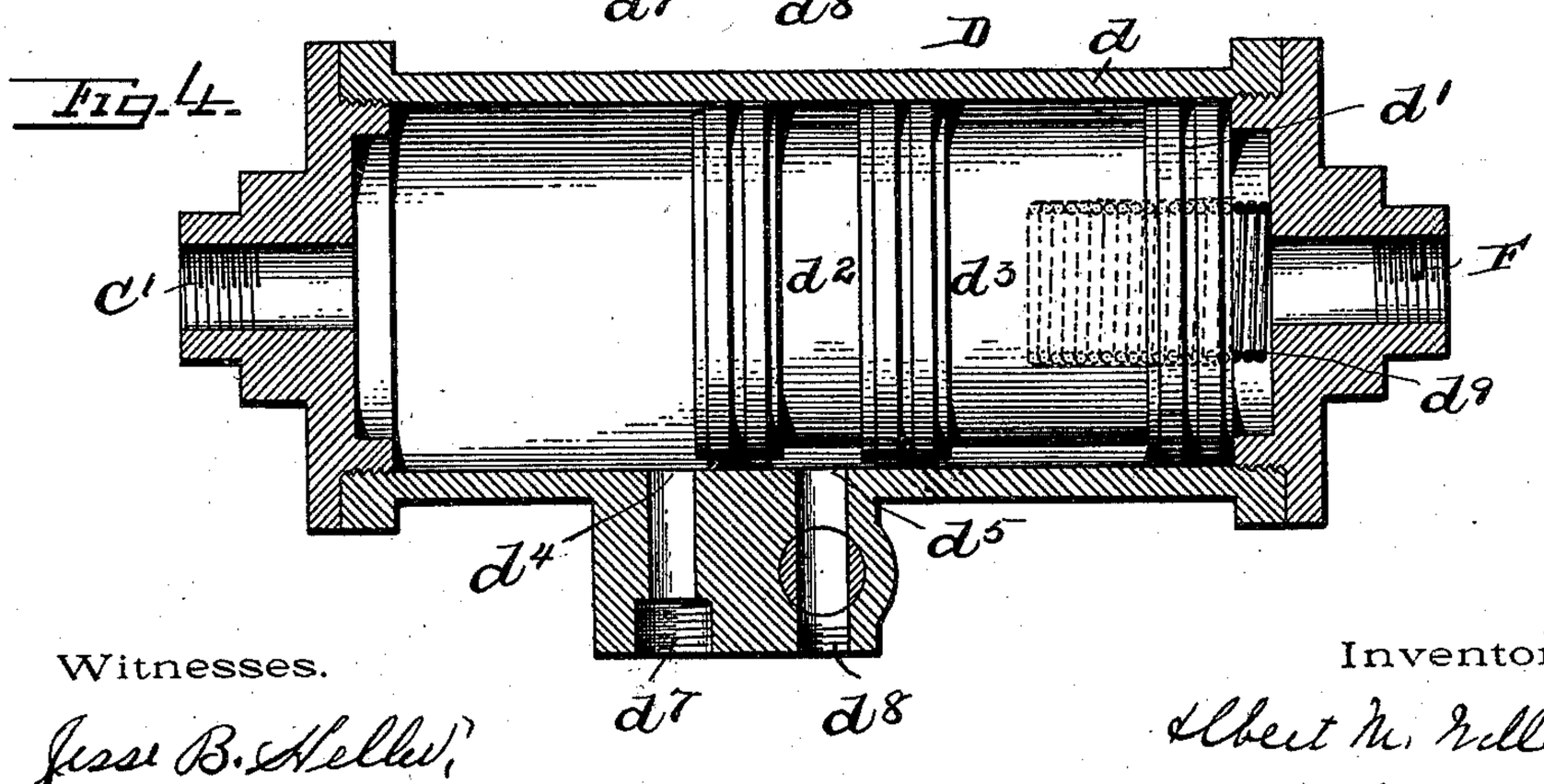


Fig. 4.



Witnesses.

Jesse B. Kellett,

Minnie F. Ellis

Inventor.

Albert M. Willets

by S. D. Harding

Attorney.

(No Model.) 4 Sheets—Sheet 3.

A. M. WILLETS.

AIR BRAKE.

No. 561,301. Patented June 2, 1896.

Fig. 5.

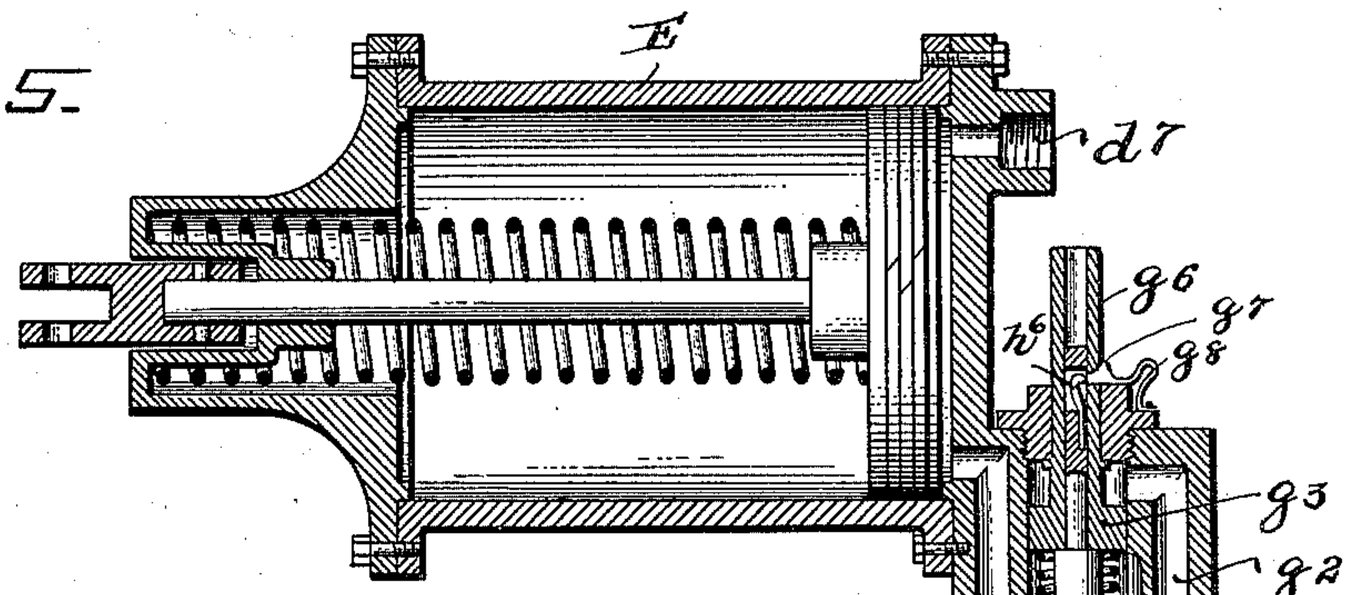


Fig. 6.

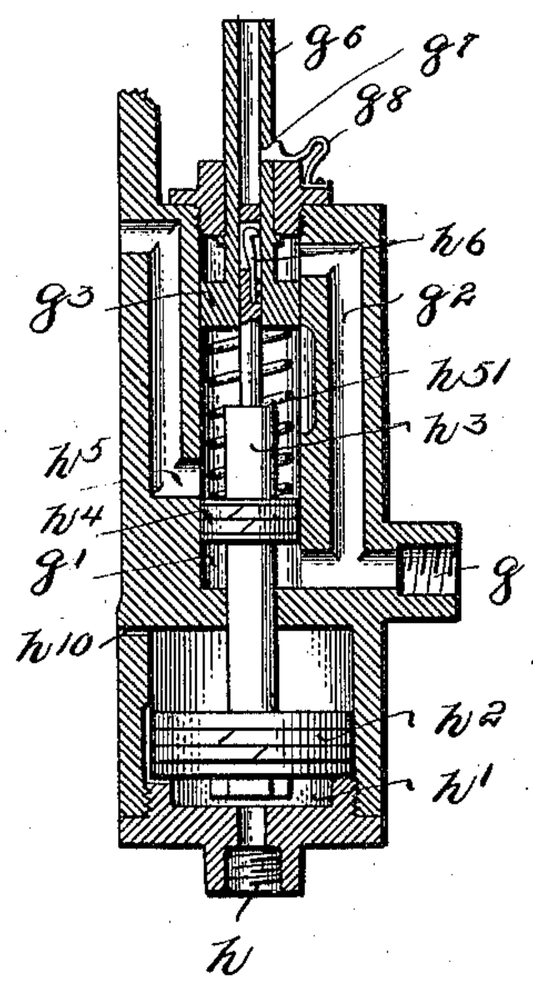
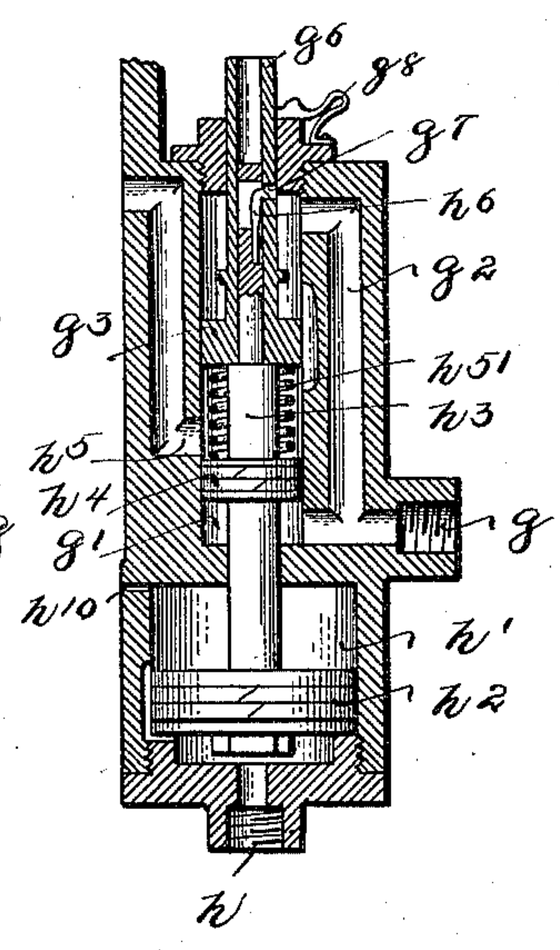


Fig. 7.



Witnesses.

Jesse B. Hellers

Minnie F. Ellis

Inventor.

Albert M. Willets

by J. Harding

Attorney.

(No Model.) 4 Sheets—Sheet 4.

A. M. WILLETS.

AIR BRAKE.

No. 561,301. Patented June 2, 1896.

Fig. 8.

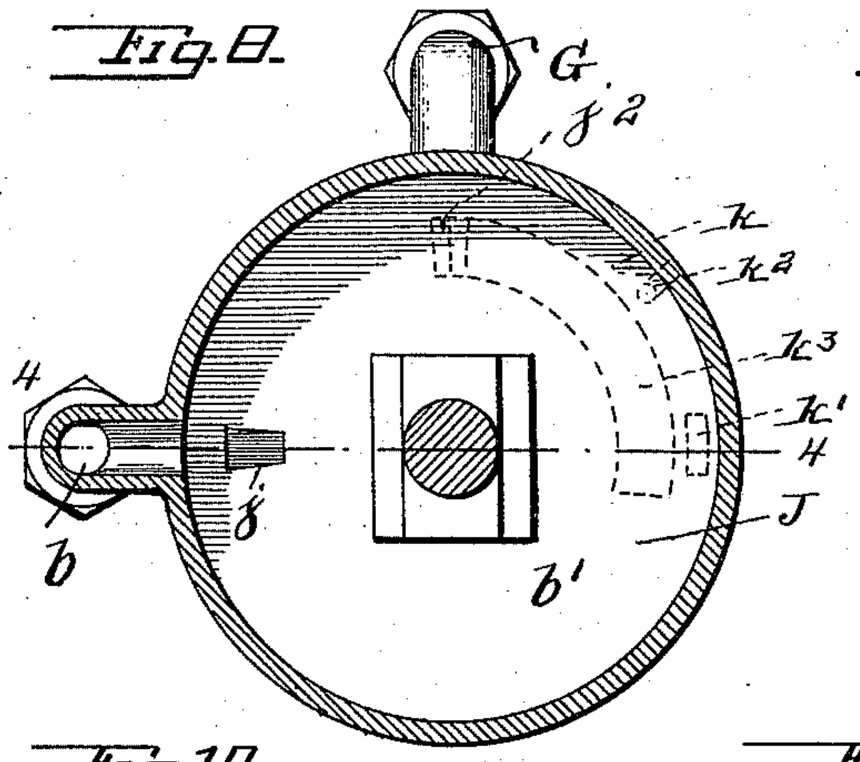


Fig. 9.

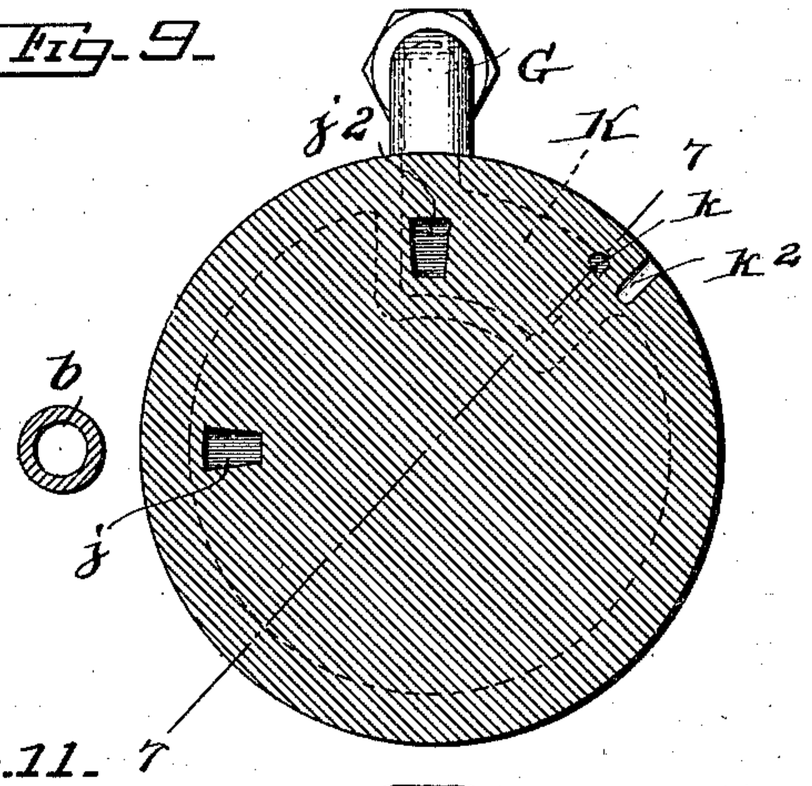


Fig. 10.

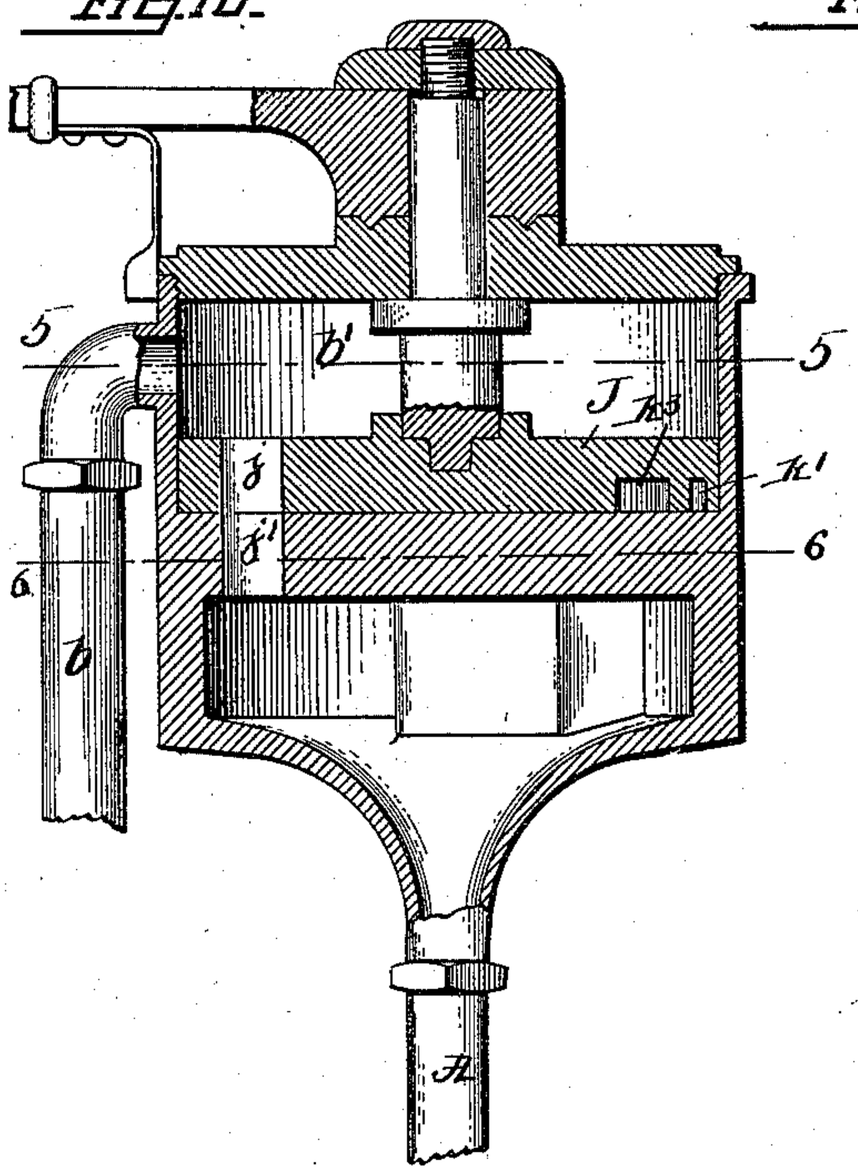
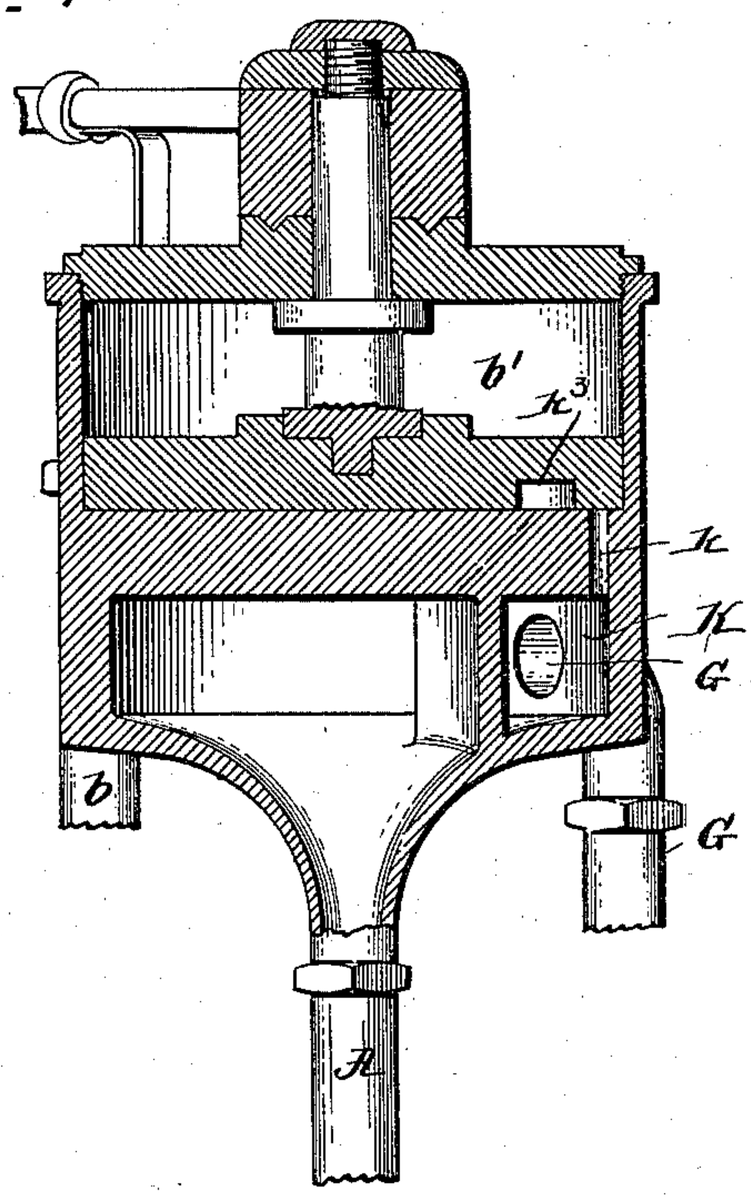


Fig. 11.



Witnesses.
Jesse B. Keller,
Minnie F. Ellis.

Inventor.
Albert M. Willets
by J. J. Harding
Attorney.

UNITED STATES PATENT OFFICE.

ALBERT M. WILLETS, OF CAMDEN, NEW JERSEY.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 561,301, dated June 2, 1896.

Application filed January 30, 1896. Serial No. 577,421. (No model.)

To all whom it may concern:

Be it known that I, ALBERT M. WILLETS, a citizen of the United States, residing at Camden, county of Camden, and State of New Jersey, have invented a new and useful Improvement in Air-Brakes for Trains, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to certain changes in and additions to the present air-brake system; and, broadly considered, it consists in, first, providing for the admission of train-pipe air from the train-pipe to the auxiliary reservoir independent of the valve mechanism on the cars; second, providing that the car-valve mechanism shall control only ports or openings from the auxiliary reservoir to the brake-cylinder and from the brake-cylinder to the atmosphere; third, providing an independent auxiliary train-pipe connecting directly with the brake-cylinder of each of the cars, and by means of the engineer's valve the auxiliary train-pipe may be connected either with the main train-pipe or the atmosphere; fourth, constructing the car-valve mechanism so that when the pressure is equalized on both sides of said valve the valve will be forced to its dead-point.

I will first describe the embodiment of my invention illustrated in the accompanying drawings and then set out the invention in the claims, although I desire it to be distinctly understood that I do not intend to limit myself to the specific embodiment of my invention shown in the drawings, except wherein the same may be specifically claimed.

In the drawings, Figure 1 is a diagrammatic side elevation of the connections of the engineer's valve and one car. Fig. 2 is a vertical longitudinal section from the valve D, showing it in the release position. Fig. 3 is a similar view showing it at the dead-point. Fig. 4 is also a similar view showing it in the position in admitting air to the brake-cylinder from the auxiliary reservoir. Fig. 5 is a vertical transverse section through the brake-cylinder and the valves g^3 and h^4, showing the valves in their normal position. Fig. 6 is a similar view of the valves when both are closed. Fig. 7 is also a similar view with the valve g^3 open. Fig. 8 is a horizontal section of the engineer's valve, line 5 5 of Fig. 10. Fig. 9 is a similar view on line 6 6 of Fig. 10. Fig. 10 is a vertical transverse section on the line 4 4 of Fig. 8. Fig. 11 is a similar view on the line 7 7 of Fig. 9.

A is the main train-pipe of the air-brake system; *b*, a pipe leading from the main pressure-reservoir; C, the auxiliary reservoir which is carried by each of the cars; D, a valve mechanism carried by each of the cars; E, the brake-cylinder, also carried by each of the cars.

The train-pipe A extends from the engine to the end of the train of cars, being connected by flexible hose-couplings *a*, of the ordinary construction, where it passes from car to car.

F is a branch pipe at each car connecting the train-pipe A with one side of the valve mechanism D corresponding to the car.

f is a cock of ordinary construction to enable the pipe F to be cut off from connection with the train-pipe A. From the pipe F, between the train-pipe and valve mechanism, a pipe F′ of smaller diameter than pipe F leads directly to the auxiliary pressure-reservoir C corresponding to said car. Upon this pipe F′ is the check-valve *f′*, which is adapted to open in one direction only—to wit, toward the reservoir C. From the reservoir C a pipe C′ leads to the valve mechanism D on the side opposite to that of pipe F. The valve mechanism D consists, essentially, of a cylinder *d*, a piston *d′*, which substantially fills the cylinder, except at portions d^2 d^3. In the chamber are two ports d^4 d^5, port d^4 leading directly to a pipe d^7, passing to the brake-cylinder E.

d^5 is a port connected with pipe d^8, leading to the atmosphere. Upon the pipes d^7 and d^8 are cocks adapted to close said pipes independent of the valve.

When the piston *d* is in one position, (see Fig. 3,) it is at its dead-point and no connections are open. In the position shown in Fig. 4 connection is made between the pipe C′ and pipe d^7, and when in the position shown in Fig. 2 connection is made between ports d^4 and d^5.

There is connected with the piston *d′* a spring d^9, which in one position is compressed

against the end wall of the cylinder d, for a purpose hereinafter described.

In addition to the train-pipe A, I provide a second pipe G, extending from the engine to the end of the train. This pipe I call a "compound and reducing pipe," for reasons which will hereinafter appear. This pipe has also at each car a flexible hose connection a', as in the main train-pipe connections hereinbefore described. This pipe G has a connection, by means of a pipe g, at each car directly with the brake-cylinder E. This pipe g passes through a valve g', the construction and purpose of which will hereinafter be described, and has a by-passage g^2 around said valve g', controlled by a valve g^3. (See Figs. 5, 6, and 7.)

H is the train-signal pipe passing from the engine and connected with the main pressure-reservoir and controlling a pneumatic signal in the well-known manner. Connection is made between this pipe H and each of the valves g' through the pipe h, entering a cylinder h'. In this cylinder is a port h^{10} to the atmosphere, and a piston h^2, which in its elevated position covers said port and in its depressed position leaves it open. Connected to this piston h^2 is the rod h^3, which is connected with the valve h^4, having the passage h^5 in the elevated position of piston h^2. The passage h^5 registers with the pipe g. Coiled around the piston-rod h^3, above the valve h^4, is a spring h^{51}.

The valve g^3 is an ordinary piston-valve with the passage g^5, which in one position registers with the by-passage g^2 and in the other position the solid portion of the piston-valve g^3 closes said passage. The piston-rod g^6 projects upward in alinement with and surrounds the piston-rod h^3, the piston-rod g^6 being above the piston-head h^4. The coil-spring h^{51}, which is around the piston-rod h^3, rests one end against the piston head or valve h^4 and the other end against the piston head or valve g^3. When the valve g^3 is closed, the piston-rod g^6 is above it.

Connected to the piston-rod h^3 is the leaf-spring h^6. In the piston-rod g^6 is a slot g^7, in which, when the piston-rod g^6 is pressed downward—that is, when the valve is opened—the spring h^6 rests and makes connection between the piston-rods h^3 and g^6. When the piston-rod h^3 is elevated, both the piston-rod h^3 and the piston-rod g^6 are elevated until the spring g^8, attached to the casing, enters the slot g^7. The spring g^8 being stronger than the spring h^6 forces said spring out of the slot, releasing connection between piston-rods h^3 and g^6.

In Fig. 6 I have shown the arrangement in which both the valve h^4 and the valve g^3 are closed. In Fig. 7 I have shown the condition which exists when the valve h^4 is closed and the valve g^3 open. In this case, as may be seen and as before described, when the valve h^4 is moved to open it closes the valve g^3 and releases connection between the valve connections of valves g^3 and h^4 and brings the valve into the position shown in Fig. 5. From this it may be seen that under ordinary conditions the valve h^4 is kept open by means of the pressure from the train-signal pipe, and thus if for any cause the train should part the valve will close connection from the brake-cylinder. If for any reason the valve should fail to be operated by the train-signal pipe—*i. e.*, the valve should become stuck—the port h^{10} would be open and air would exhaust from the train-signal pipe around the piston h^2 and operate the pneumatic signal, so that the engineer could come and fix the valve.

If by any chance the train-signal-pipe air should give out or the valve h^4 should permanently cease to work, then the engineer operates the valve g^3, so as to open said valve and allow connection through the by-passage g^2. When the valve is again repaired, so that the valve h^4 will be operated by the pressure from the train-signal pipe, the valve g^3 will be automatically closed.

In cases where there is no train-signal-pipe equipment I connect the chamber of cylinder h', by means of the pipe h^{11}, with the main train-pipe A. (See Fig. 1.)

From the main pressure-reservoir a pipe b leads to the chamber b' of the engineer's valve J, which is a rotary valve and seat. In the valve is through-port j, connecting with chamber b', which can be brought to register with the port j', connecting with the train-pipe A.

The auxiliary pipe G terminates in the chamber K in the engineer's valve, which chamber is in connection with the port k through the valve-seat, and by turning the valve the port k may be brought into connection with a port k', which is a bridge-port connecting in that position the port k with the port k^2, leading to the atmosphere. The bridge-port k^3 can be brought into position to connect port j' and port j^2, the latter port leading to the auxiliary train-pipe chamber K.

L is a pipe leading from the pipe b directly to the compound and reducing pipe G, independent of the engineer's valve J. This pipe is controlled by a cock l, normally closed. (See Fig. 1.)

The operation is as follows: In initial charging the engineer's valve is turned so that the reservoir-pipe b is brought into connection with the train-pipe A, in which case the reservoir-air is pumped directly into the auxiliary reservoir. The pipe F being larger than the pipe F', the air first rushes into the cylinder D against the valve or piston d, forcing it to the left, bringing it into the position shown in Fig. 2, in which the connection between the ports d^4 and d^5 are connected, and whatever air is in the brake-cylinder is exhausted. The reservoir then receives air directly from the train-pipe and continues to receive it, the air passing into the reservoir and out by the pipe C' to the opposite side of the cylinder d, creating a balance-pressure on both sides of the piston d'. Now in order to make a brake-

application I connect the train-pipe A and the pipe G by means of the engineer's valve, as hereinbefore described, which causes a reduction of pressure on the piston d' at the side of the pipe F, and the piston d' moves so as to make connection between the pipe C' and the pipe d^7. The auxiliary-reservoir air then passes into the brake-cylinder. Also, as the reduction is made by connecting the train-pipe A with the pipe G, the latter being in direct connection, as before described, with the brake-cylinders of each car, the train-pipe air also passes into the brake-cylinder of each car, adding its pressure to the pressure of the auxiliary reservoir. The movement of the piston d', after the spring d^9 has come in contact with the end of the cylinder d, is made against the spring, compressing the spring, and the moment the pressure on each side of the piston d' becomes equal the spring acts and moves the piston back to a position which will be a dead position—that is to say, will cover and close the ports. (See Fig. 3.) When for any cause too great pressure has been applied to the brake-cylinder and the train is being brought to a stop too quickly on approaching a station and it is necessary to prevent this too-rapid stopping of the train, under the system now in use it would be necessary to exhaust the air from the brake-cylinder through the car-valve, to recharge the reservoir, make another reduction, and apply the brakes a second time, when the same trouble might again occur. Again, between the first application and the second application the momentum of the train might be sufficient to carry it too far. By my arrangement, under such conditions, I can simply, by turning the engineer's valve so that the pipe G is connected with the atmosphere, reduce the pressure in the brake-cylinder to any desired point, and thus allow the train to assume any desired momentum sufficient to carry it to the desired stopping-point without, in many cases, adding any additional pressure. Again, by this arrangement, instead of making a reduction to apply the brakes and losing the air-pressure, as in the ordinary case where the reduction is made to the atmosphere, by making the reduction, as in my invention, to the compound and reducing pipe G, train-pipe air becomes effective in applying the brakes, and thus, so far as applying the brakes is concerned, I can do so without losing any of the effective train-pipe pressure. By this construction also, which differs from the air-brake systems now in use, the auxiliary reservoir is charged independent of the valve on the cars, and as a consequence can be charged much more quickly. This becomes very important where successive stops have to be made, or where the auxiliary pressure is constantly becoming reduced and it is necessary to recharge it. I can also by this construction, as may be seen, charge the reservoir without in any way being controlled by the movement of the valve. In the ordinary construction it is necessary in order to charge the reservoir to exhaust the air from the brake-cylinder, which is not necessary in my case, and it is very advisable in some cases to be able to charge the auxiliary reservoir without exhausting the air from the brake-cylinder—such, for instance, where long and steep grades are encountered. In this case the cock upon the pipe d^8 may be closed, in which case, even when the engineer's valve is operated to connect the pressure-supply with the train-pipe, no loss of pressure will occur in the brake-cylinder, and yet the auxiliary reservoir can be recharged. This is not feasible with the ordinary air-brake constructions now in use, for the reason that the exhaust from the brake-cylinder through the valve is the only means for regulating or clearing the brake-cylinder of air, while in my case I can absolutely regulate the pressure in the brake-cylinder by connecting the compound and reducing pipe with the atmosphere.

In case the valve mechanism should become defective, in my construction I can cut it off by closing the cock f and the cock on the pipe d^7, eliminating the valve and auxiliary reservoir of that car, and use the auxiliary reservoir in the other cars and the train-pipe to charge the brake-cylinder in the car where the valve is defective. If for any reason the train-pipe itself should become defective, I can, by admitting pressure directly from the reservoir through the pipe L and cock l to the pipe G, operate the brake-cylinders on the direct-pressure system.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir, and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, an engineer's valve adapted when operated to connect the train-pipe and the main pressure-reservoir and train-pipe and said second pipe.

2. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-

cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, a normally open connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, an engineer's valve adapted when operated to connect the train-pipe and main pressure-reservoir, and said second pipe and the atmosphere, and means to reduce the pressure in the train-pipe.

3. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir, and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of the valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between last-mentioned pipe and the brake-cylinder, independent of the car-valve, an engineer's valve adapted when operated to connect the train-pipe and main pressure-reservoir and train-pipe and said second pipe, and means to connect the second pipe directly with the pressure-supply.

4. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir, and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, an engineer's valve adapted when operated to connect the train-pipe and main pressure-reservoir and train-pipe and said second pipe and connect the second pipe with the atmosphere.

5. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir, brake-cylinder, and valve carried by the car, connection between one side of said valve and the train-pipe, connection between the other side of said valve and the auxiliary reservoir, said valve controlling the connection between the auxiliary reservoir and the brake-cylinder and adapted when the train-pipe pressure is reduced to open connection between the auxiliary reservoir and brake-cylinder, a spring on the piston of said valve adapted to be compressed against the end of said valve-chamber, the arrangement being such that when the pressure on opposite sides of the valve is equal and the spring in compression, the spring will force the valve to close, connection between the auxiliary reservoir and brake-cylinder, connection between said train-pipe and the auxiliary reservoir, means to connect the train-pipe with the source of pressure supply, and means to reduce the pressure in the train-pipe.

6. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir, brake-cylinder, and valve carried by the car, connection between one side of said valve and the train-pipe, connection between the other side of said valve and the auxiliary reservoir, said valve controlling a connection between the auxiliary reservoir and the brake-cylinder, and between the brake-cylinder and the atmosphere, the valve being adapted, when the pressure in the train-pipe side exceeds the pressure on the auxiliary-reservoir side of the valve, to open connection between the brake-cylinder and the atmosphere, and when vice versa to open connection between the auxiliary reservoir and brake-cylinder, a spring on the piston of said valve adapted to be compressed against the end of said valve-chamber, the arrangement being such that when the pressure on opposite sides of the valve is equal and the spring in compression, the spring will force the valve to close connection between the auxiliary reservoir and brake-cylinder, and between the brake-cylinder and atmosphere, connection between said train-pipe and the auxiliary reservoir, means to connect the train-pipe with the source of pressure supply, and means to reduce the pressure in the train-pipe.

7. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, a valve on said last-mentioned connection controlling said connection, and connection between said valve and the source of pressure supply, the pressure holding said valve open, said valve being adapted to close said connection when said pressure is cut off, an engineer's valve adapted when operated to connect the train-pipe and main pressure-reservoir and train-pipe and said second pipe.

8. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection

between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, a valve on said last-mentioned connection controlling said connection, connection between the piston of said valve and the source of pressure supply, the pressure holding said valve open, said valve being adapted to close said connection when said pressure is cut off, the piston opening a connection between said pressure-supply connection and the atmosphere when the valve is in the closed position, an engineer's valve adapted when operated to connect the train-pipe and main pressure-reservoir and train-pipe and said second pipe.

9. In an air-brake system, in combination, a source of pressure supply, a train-pipe, an auxiliary reservoir and brake-cylinder carried by the car, connection between said train-pipe and auxiliary reservoir, a valve carried by the car, connection between one side of said valve and the train-pipe, and between the auxiliary reservoir and the other side of said valve, said valve controlling connection between the auxiliary reservoir and the brake-cylinder, and adapted when the train-pipe pressure is reduced to move to open said connection, a second pipe, connection between said last-mentioned pipe and the brake-cylinder independent of the car-valve, a valve on said last-mentioned connection controlling said connection, and connection between said valve and the source of pressure supply, the pressure holding said valve open, said valve being adapted to close said connection when said pressure is cut off, a passage around said last-mentioned valve, a supplemental valve in said passage, said valve being held from opening by the second pipe brake-cylinder-connection valve, when said valve is open and when said supplemental valve is open is moved to close when said second pipe brake-cylinder-connection valve is moved to open.

In testimony of which invention I have hereunto set my hand.

ALBERT M. WILLETS.

Witnesses:

CAROL H. DESHONG,

FRANCES ELLIS.