(No Model.) 2 Sheets—Sheet 1.

# W. H. CLARKE.

## AIR BRAKE.

No. 549,703. Patented Nov. 12, 1895.

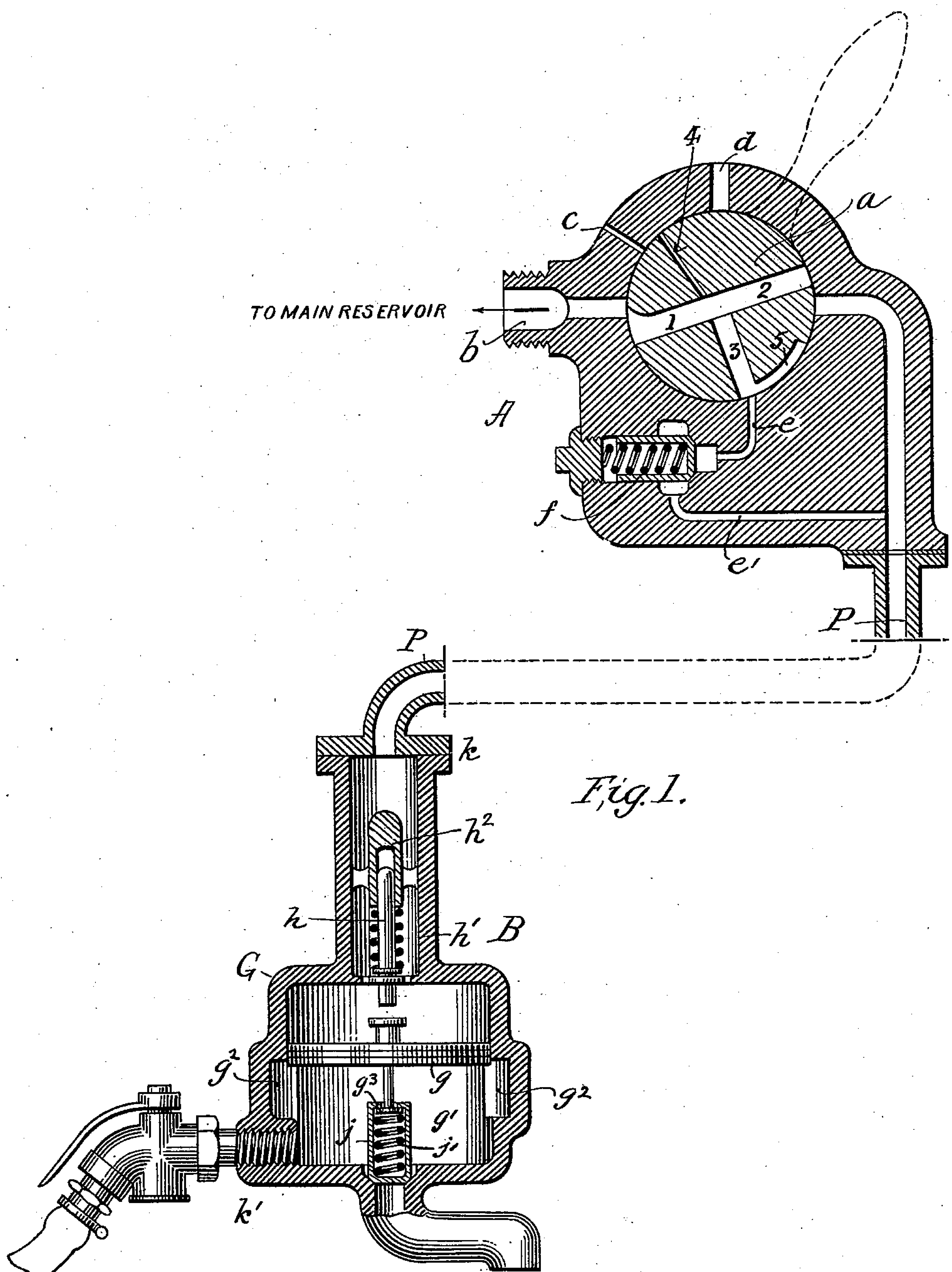


Fig. 1.

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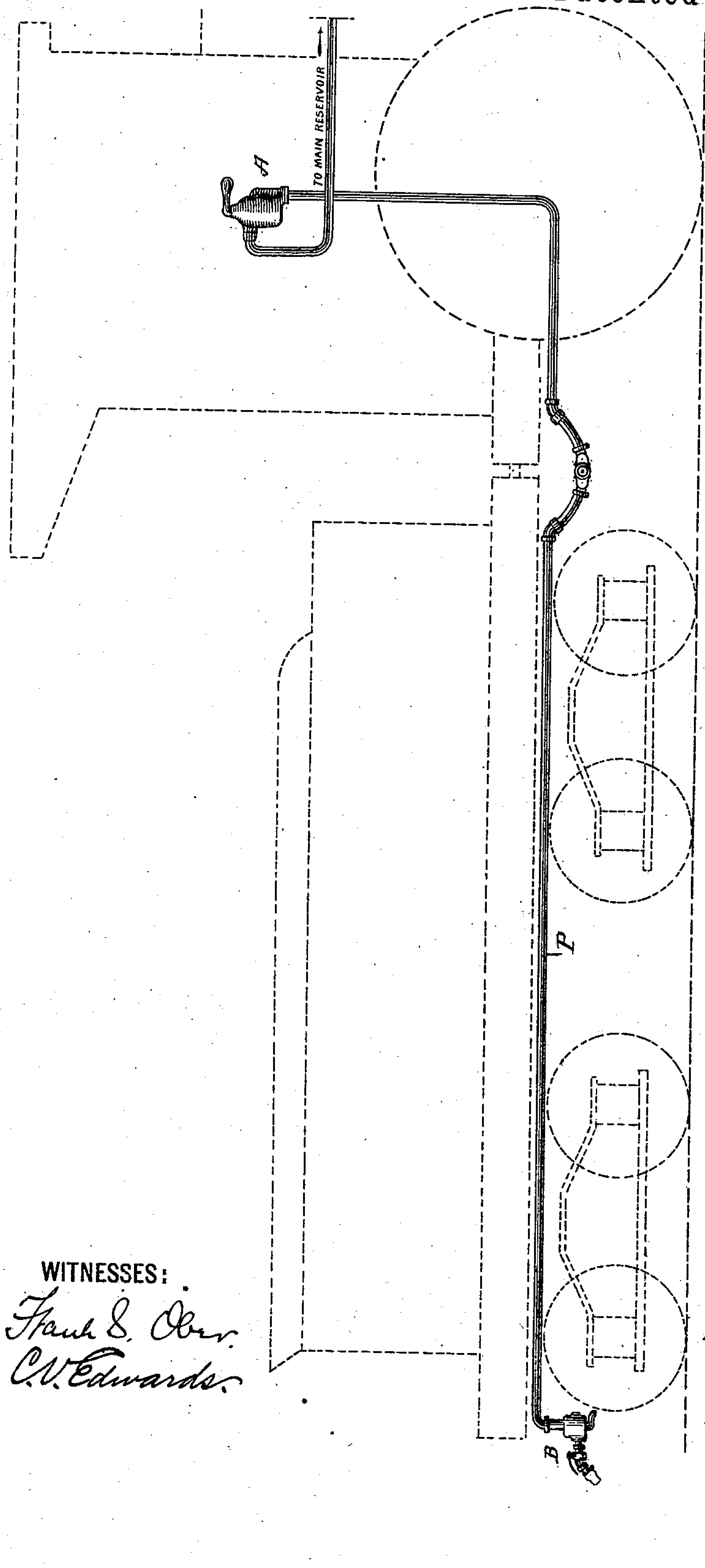


*Fig. 2.*

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# UNITED STATES PATENT OFFICE.

WILLIAM H. CLARKE, OF BROOKLYN, NEW YORK.

## AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 549,703, dated November 12, 1895.

Application filed February 13, 1895. Serial No. 538,179. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM H. CLARKE, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Air-Brakes, of which the following is a full, clear, and exact description.

This invention relates to air-brakes for railway-trains, the object being to improve certain features of the system now commonly used.

In the Westinghouse air-brake system, which is the one most generally in use, there is provided upon the locomotive a mechanism known as the "engineer's valve" to be manipulated by the engineer for the purpose of applying and releasing the brakes. The modern engineer's valve contains, in addition to the valve moved directly by the engineer, a so-called "equalizing-valve," which acts automatically to control the movement of air in the train-pipe. In conjunction with this modern engineer's valve it is customary to use a so-called "small reservoir," the main function of which is to act as a cushion on one side of the equalizing-valve to prevent a sudden movement which would create an unequal pressure in the train-pipe and sometimes cause a forward wave of air to bank up and "kick off" the brakes at the forward end of the train. The small reservoir merely increases the size of the chamber above the equalizing-valve, thereby making the air therein more responsive to pressure beneath the valve and insuring a gradual movement of the equalizing-valve.

My invention comprehends the separation of the two parts of the engineer's valve, locating the manually-operated portion in the cab, as usual, and the equalizing portion at a point in the train-pipe somewhat to the rear of the cab, preferably at the rear end of the locomotive-tender, and utilizing that portion of the train-pipe between the two separated parts of the valve as the small reservoir. In carrying out this idea I incidentally modify the form of the equalizing portion of the valve and derive advantages from this modification and from the change in location of the parts which materially improve the system.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 gives sectional views of the manually-operated and equalizing valves, the connecting portion of train-pipe being removed. Fig. 2 shows in broken lines the rear portion of a locomotive and its tender and in full lines the train-pipe and the two valves.

In Fig. 1 the manually-operated valve A is somewhat conventionally illustrated, the ported plug *a* being shown in a plane at right angles to its position in practice. The plug *a* is provided with five ports, and when in the position shown establishes communication between the passage *b* (from the main reservoir) and the train-pipe P through ports *e* and *e'*. When port 4 is in line with the small exhaust-port *c*, communication is established between the train-pipe and atmosphere through passages 5, 3, and 4, the main reservoir being cut off. When port 2 is in line with the large exhaust-port *d*, the train-pipe also connects with the atmosphere through passages 3 and 2, while the main reservoir is cut off. In the line of ports *e* and *e'* is a valve *f*, known commonly as the "excess-pressure valve." It is held to its seat by a spring of sufficient tension to maintain the pressure in the main reservoir at about twenty pounds more than in the train-pipe under normal conditions.

The train-pipe, which ordinarily extends from the engineer's valve on the locomotive throughout the train, is represented by P. At some point in this pipe to the rear of and distant from the engineer's valve and preferably at the rear end of the locomotive-tender is placed an equalizing-valve B. This is directly in the line of piping. It consists of a valve-casing G, provided with a piston *g*, moving in a chamber *g'*. The normal position of this piston is that shown in the drawings, where the air ahead and to the rear of it is entirely separated. A movement of the piston in a rearward direction establishes communication between the two sides of the piston through the side passages $g^2$, which are of about the capacity or cross-section of the train-pipe. Ahead of the piston is placed a plunger *h*, resting against a spring *h'* and acting as a buffer against which the piston strikes when making an upward movement, quite similar in every respect to the construction and action of the service-piston in the ordinary triple valve. In service-applications of the brakes the piston merely strikes without materially moving the buffer; but in emergency-applications it strikes the buffer and forces it against the stop $h^2$. The chamber below or back of the piston communicates with the atmosphere through the exhaust-port $i$, which port is controlled by a valve $j$. This valve is a hollow cylinder containing a spring $j'$, against the end of which rests a small plunger $g^3$, attached to and passing loosely through the end of the cylindrical valve. The valve-seat is at the bottom of a cup-shaped socket the diameter of which is slightly greater than the external diameter of the cylindrical valve. When the valve is against its seat, the exhaust-passage is entirely closed. When lifted slightly off its seat, a restricted passage is opened, and when the valve is entirely withdrawn from the socket a comparatively large and free exhaust-passage is opened. The plunger $g^3$ acts as a cross-head inside of the cylindrical valve to abut against the head of the valve and lift it from its seat when the piston makes an upward movement. The section of train-pipe leading from the locomotive connects with this valve at the point $k$, ahead of the piston, and the train-pipe leading from the valve throughout the train connects with the valve $k'$, behind the piston. When the pressures on each side are balanced, spring $j'$ forces the piston to the point shown in the drawings.

The operation is as follows: Assuming the ports of valves A and B to be in the "position while running," as shown in the drawings, there will then be a regular normal train-pipe pressure in the section of pipe between the valves A and B and throughout the train. To make a service-stop the engineer moves ported plug $a$ to connect passage 4 with the restricted exhaust-passage $c$. The reduction of pressure which immediately follows in the train-pipe between the valves A and B allows the excess of pressure below piston $g$ to lift said piston slightly, thereby opening a restricted passage to the atmosphere beneath and around valve $j$. This exhausts the train-pipe correspondingly and the brakes are gently applied in the usual manner. If the plug $a$ is moved to the "on-lap" position, the valve $j$ will remain open until the pressures on each side of the piston $g$ balance, at which time the valve will close. This operation is repeated, if necessary, until the train comes to a stop. In making an emergency-stop the engineer throws plug $a$ to the position where passage 2 coincides with the large exhaust-port $d$. This gives a sudden and great reduction of pressure in the train-pipe between valves A and B, which permits the comparatively great pressure beneath piston $g'$ to force it an extraordinary distance or to the point where it is stopped by the plunger striking the stop $h^2$, the spring $h'$ being thereby compressed. Such an extraordinary movement of piston $g$ moves valve $j$ entirely out of the socketed valve-seat and provides a large unrestricted exhaust-passage for the air from the train-pipe. Such an exhaust causes a quick action at the triple valves throughout the train and retards the train suddenly. To release the brakes and restore pressure throughout the train-pipe, plug $a$ is moved to connect passage 1 2 with the main reservoir-passage $b$ and the train-pipe. The full main-reservoir pressure then enters the train-pipe and forces piston $g$ rearward beyond its normal position, meanwhile compressing spring $j$ and allowing the air to pass from the forward side of the piston through passages $g^2$ to the train-pipe, thus restoring pressure throughout the train-line. As soon as the pressures balance, piston $g$ is forced by the spring $j'$ to its normal position.

It will be observed that the location of that portion of the train-pipe between the two valves with respect to the piston $g$ is the same as the location of the so-called "small reservoir" with respect to the equalizing-valve piston of the modern form of engineer's valve—that is to say, both the train-pipe and the small reservoir serve to enlarge the cavity or chamber above or ahead of the piston, thus making the air in said chamber very sensitive or responsive to pressures beneath the piston.

It is possible that the capacity of that portion of the train-pipe between the two valves is less than the capacity of the small reservoir referred to; but if the difference is a material one the portion of pipe between the valves may be made of larger cross-section, and thus make its capacity as nearly equal to that of the small reservoir as desired.

An advantage derived from the elimination of the small reservoir is the lessening of the number of pipe connections, all of which are subject to leakage and stricture by dust or other foreign matter.

Again, the combined engineer's and equalizing valve now in use requires a packing between the two parts, which being subjected to the heat of the boiler becomes dry and creates leaks. By removing the equalizing-valve from the neighborhood of the boiler, as proposed by me, this difficulty is overcome.

Some advantage may be gained from the location of the valve $j$ in the extreme lower portion of the valve-case. Water frequently gathers in the train-pipe and valves, which it is desirable to remove, and every time this valve $j$ opens the water is blown off.

One of the faults of the modern engineer's valve is the so-called "blow" which takes place upon restoration of pressure for release of brakes. This is caused by the fact that the pressure from the main reservoir is admitted directly into the train-pipe and beneath the equalizing-valve piston through larger ports than such pressure is admitted to the chamber above the said valve-piston. This causes the valve to lift and open and thus permit of an escape of air or blow through the regular exhaust from the brake-pipe. Besides the loss of air which this causes, it also interferes with the complete release of the brakes. By my invention this blow is prevented because in releasing brakes the pressure from the main reservoir is against the upper side of the equalizing-valve piston only and not against the lower side. Instead of a blow I get a tighter closing of the exhaust-passage.

It is pointed out that the piston $g$ acts as a diaphragm across the train-pipe, thus dividing it into sections. Hence the farther to the rear the valve is located the better, for its location determines the distance the "wave" of air has to travel and the shorter the distance the less pronounced is the wave.

Having thus described my invention, I claim—

1. In an air brake system, the combination of a train pipe, an engineer's train pipe discharge valve and an equalizing train pipe discharge valve, the said equalizing valve being separated from the engineer's valve by a length of train pipe and on its forward side subject to air pressures only and in the application of brakes adapted always to release air from that portion of the train pipe to its rear, in direct proportion to the release of air from the train pipe at the engineer's valve while always maintaining the separation of the air in the train pipe on each side of the equalizing valve.

2. In an air brake system, the combination of a train pipe, an engineer's train pipe discharge valve, a piston or movable abutment and a connected train pipe discharge valve, said piston or abutment being located in the train pipe but distant from the engineer's valve, and on its forward side subject to air pressures only and adapted, in the application of brakes, to always open the discharge valve while always maintaining the separation of the air in the train pipe on each side of the piston or abutment, substantially as set forth.

In testimony whereof I subscribe my signature in presence of two witnesses.

WILLIAM H. CLARKE.

Witnesses:
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C. V. EDWARDS.