(No Model.) 3 Sheets—Sheet 1.

A. B. MURRAY.

ATMOSPHERIC BRAKE.

No. 369,805. Patented Sept. 13, 1887.

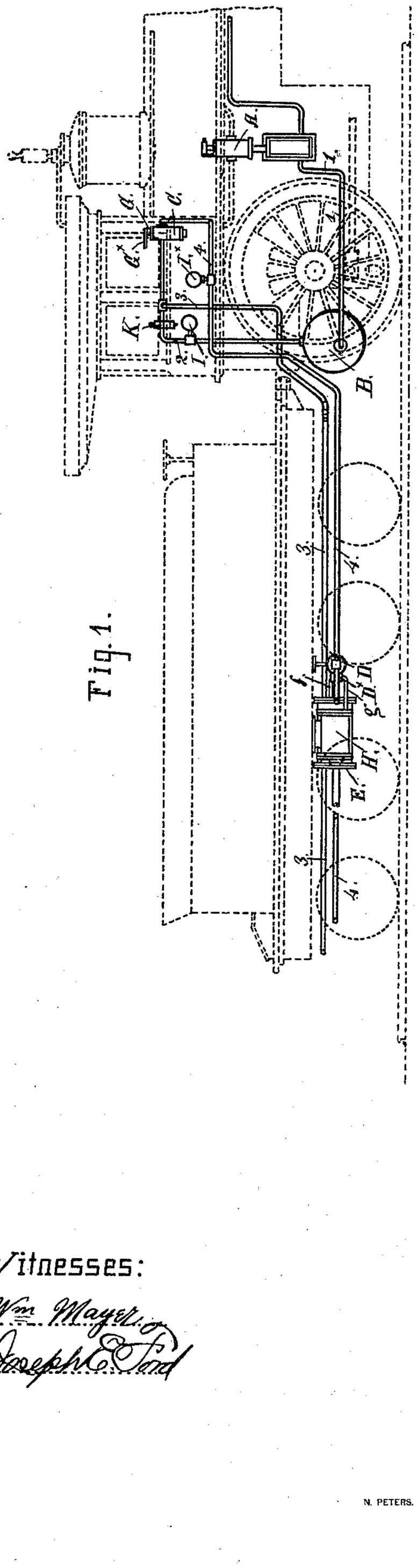

Fig. 1.

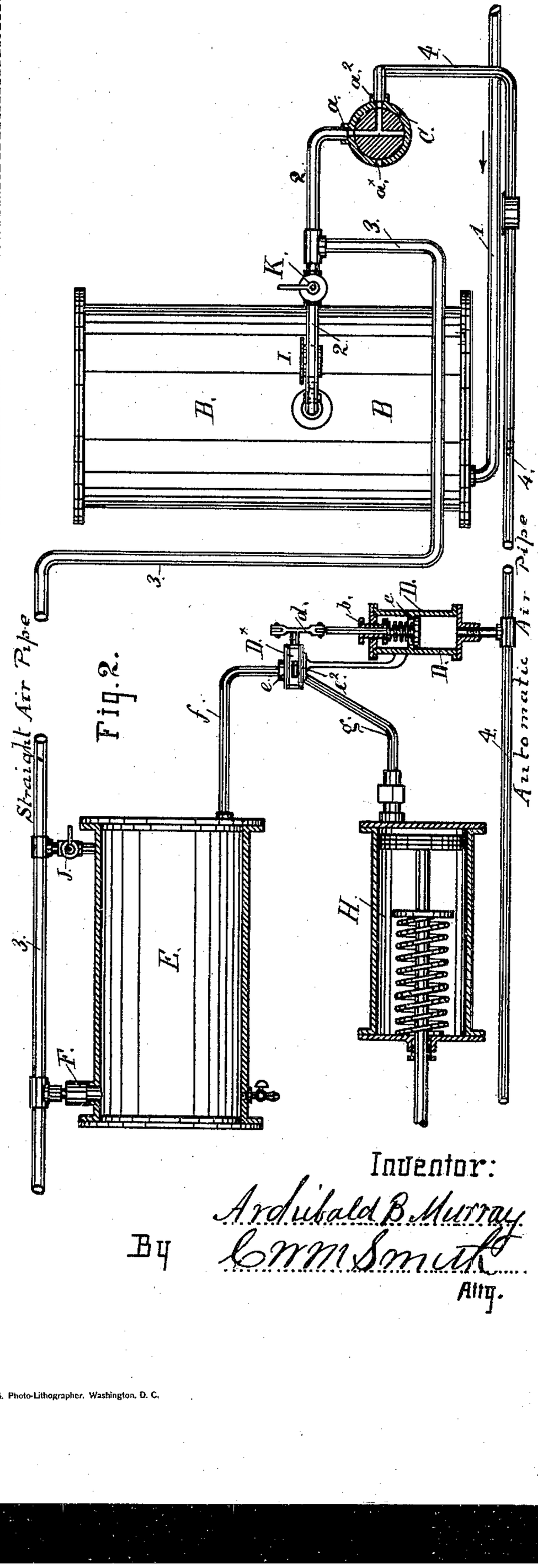

Fig. 2.

Witnesses:

Wm. Mayer.

Joseph C. Ford

Inventor:

Archibald B. Murray.

By Wm Smith

Atty.

(No Model.) 3 Sheets—Sheet 2.

A. B. MURRAY.

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Fig. 3.

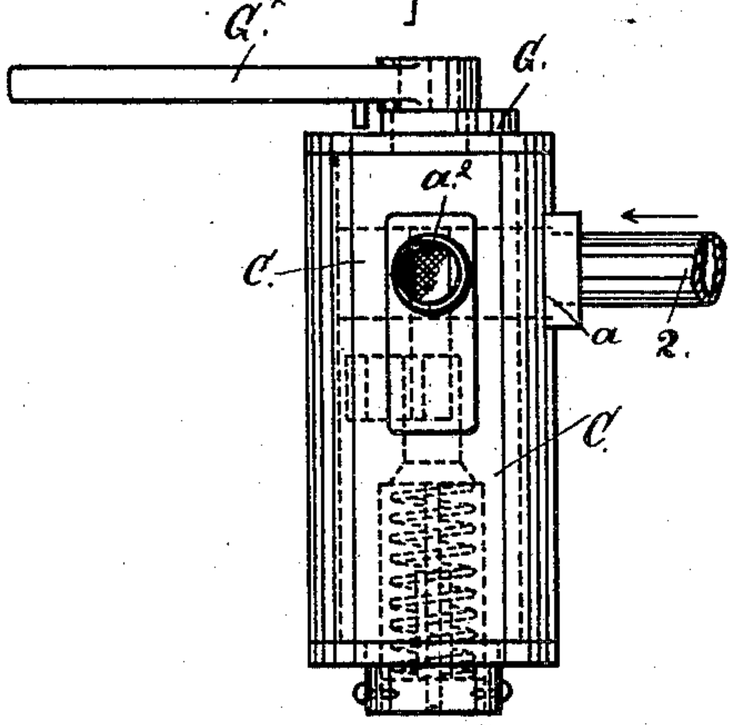


Fig. 5.

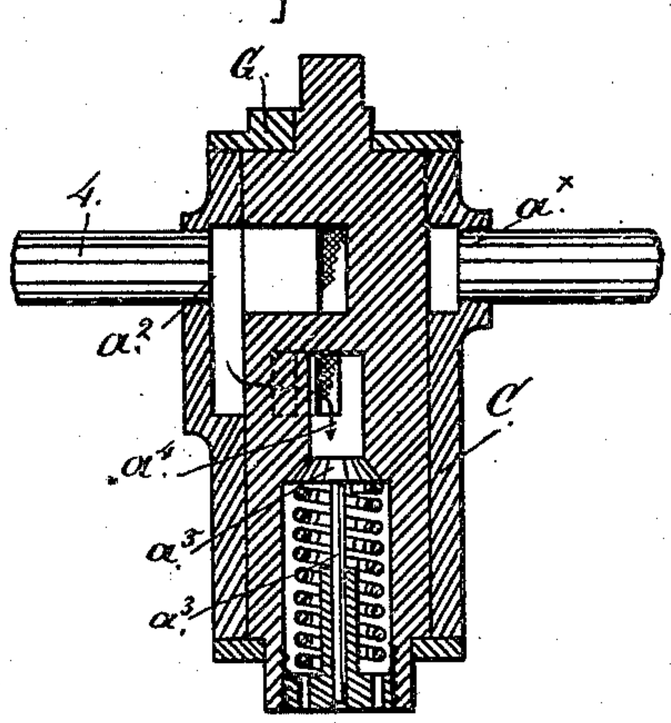


Fig. 4

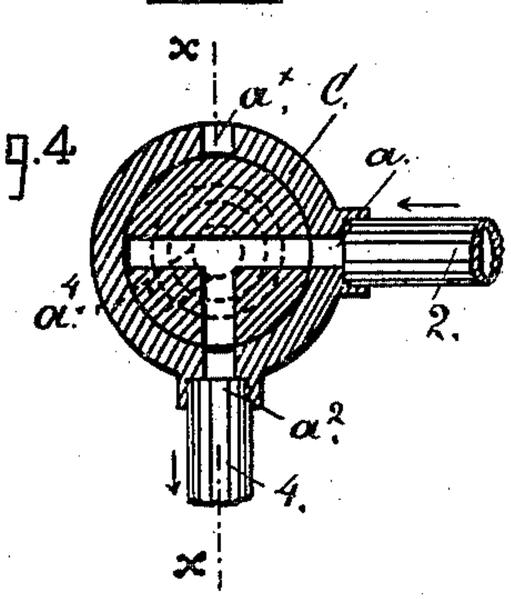


Fig. 6.

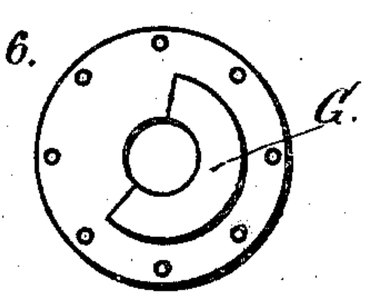


Fig. 7.

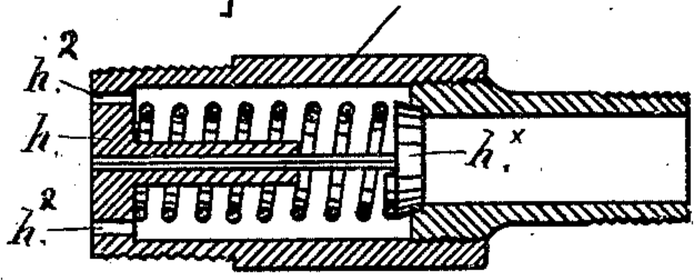
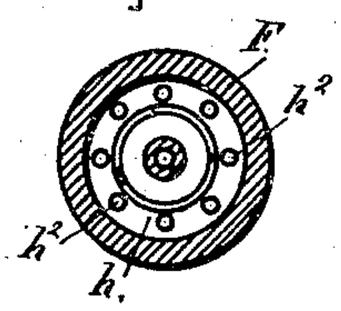


Fig. 8.



Witnesses:

Wm Mayer

Joseph E. Ford

Inventor:

Archibald B. Murray

By Wm Smith

Atty.

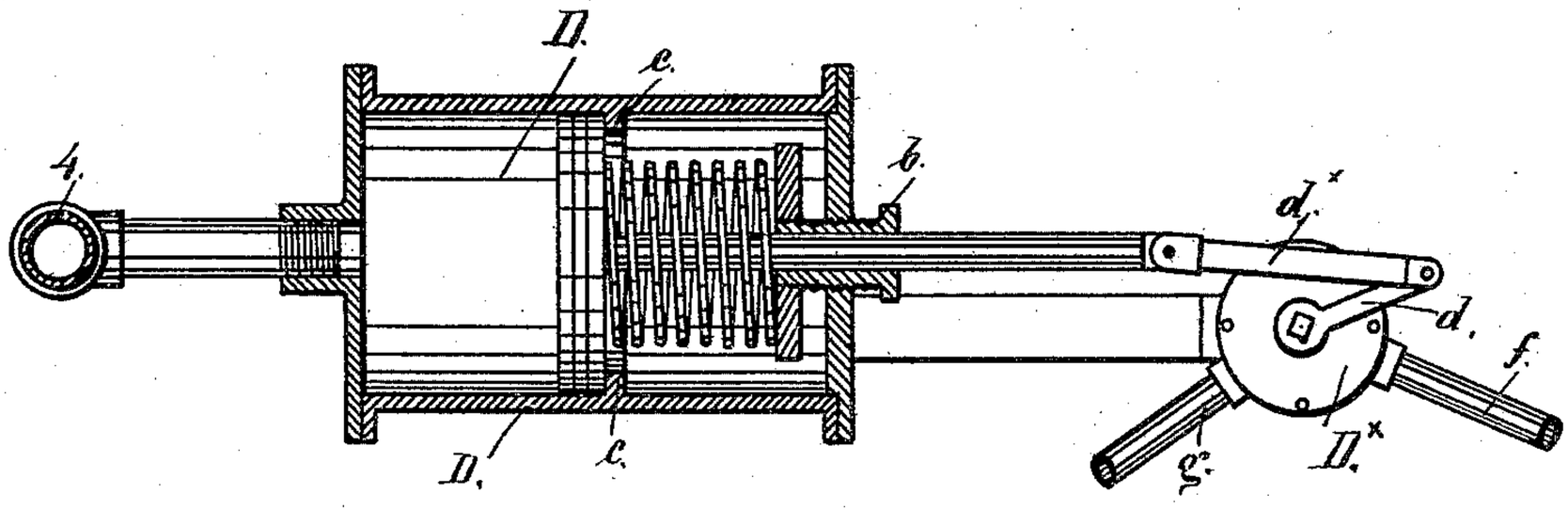
(No Model.) 3 Sheets—Sheet 3.

A. B. MURRAY.

ATMOSPHERIC BRAKE.

No. 369,805. Patented Sept. 13, 1887.

Fig. 9.



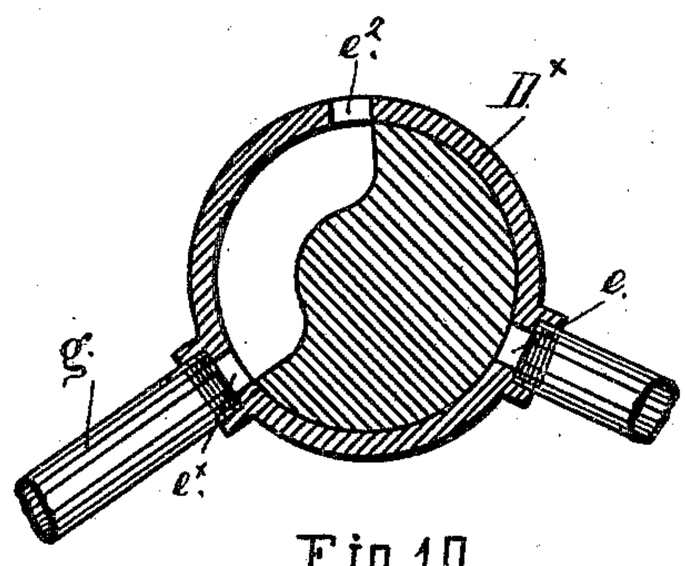


Fig. 10.

Witnesses:

Wm. Mayer

Joseph E. Ford

By

Inventor:

Archibald B. Murray

Chas. M. Smith

Atty.

UNITED STATES PATENT OFFICE.

ARCHIBALD B. MURRAY, OF SAN RAFAEL, CALIFORNIA.

ATMOSPHERIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 369,805, dated September 13, 1887.

Application filed September 1, 1886. Serial No. 212,433. (No model.)

To all whom it may concern:

Be it known that I, ARCHIBALD B. MURRAY, a citizen of the United States, residing at San Rafael, in the county of Marin and State of California, have invented certain new and useful Improvements in Atmospheric Brakes, of which the following is a specification, reference being had to the accompanying drawings, in three sheets.

My invention relates to that class of steam-power air-brakes known as "automatic" or "safety" brakes, and in which an air-compressor compresses air to the desired density into a main reservoir on the locomotive or car, and an auxiliary reservoir and brake-cylinder and interposed valve device are employed on each car, with pipe-connections from one to the other; and my invention consists in the employment of an air compressor and reservoir, an auxiliary reservoir, a brake-cylinder, two lines of train-pipe, a straight air-valve attached to the reservoir to prevent the backward escape of air from the reservoir, an automatic valve for controlling air from the receiver to the brake-cylinder, an engineer's quadruple valve provided with a spring-retaining piston in the lower end of the shell or case thereof as an escape-valve, and two air-pressure gages, one of which indicates the straight air-pressure and the other shows the automatic operating-pressure, and to the other details of construction and operation, whereby the straight air and automatic brakes are combined.

The nature of these improvements and the manner in which I proceed to construct, combine, and apply and use the same to accomplish the desired end and object are fully set forth and explained in the following description, the said drawings being referred to by figures and letters.

Figure 1 is a view in elevation of the brake-operating mechanism as attached to a locomotive and tender. Fig. 2 is a plan view, partly in section, of my atmospheric brake mechanism. (Air-pump not shown.) Fig. 3 is a view in elevation of the quadruple valve. Fig. 4 is a cross-section of the quadruple valve through ports or air-passages. Fig. 5 is a vertical transverse section of quadruple valve through line *x x*, Fig. 4, showing a pipe connecting with air-release opening. Fig. 6 is a top view of cap of quadruple valve. Fig. 7 is a horizontal section of air-retaining valve of air-reservoir. Fig. 8 is a cross-section through the same. Fig. 9 represents in section and elevation the automatic valve-operating mechanism connecting with the brake-valve and cylinder. Fig. 10 is a transverse section through the ports of the automatic supply-valve.

A represents an air-pump of suitable construction, which is secured upon the locomotive, and is arranged to be operated by steam from the boiler in a suitable manner and by suitable mechanism. (Not herein shown or described.) From the pump A leads a pipe, 1, which enters the reservoir B and conveys air to said reservoir.

Within the locomotive-cab is situated a quadruple operating-valve, C, with which is connected a pipe, 2, that extends between said valve and the reservoir B. At a suitable point in the length of the pipe 2 a branch pipe, 3, passes therefrom and leads downward into an auxiliary reservoir, to be hereinafter fully described. The pipe 3, I denominate the "straight" air-pipe. From the valve C there extends a pipe, 4, which I call the "automatic" air-pipe, and whose function it is to supply air for operating the automatic mechanism of the brake.

The quadruple valve C is provided with a supply-port, *a*, where the pipe 2 enters the valve-casing, and with a release-port, $a^{\times}$, and a brake-port, a^2, where the pipe 4 enters the valve-casing. These ports are simply openings made in the valve-casing, and corresponding with them are openings or passages made in the valve-plug located within said casing. The location and arrangement of this plug are best shown in Figs. 4 and 5. The lower end of the plug is made hollow, and contains a spring escape-valve, a^3, which is operative in connection with the air coming through a port, a^4, in the plug, which communicates at the proper time, through the port a^2, with the automatic air-pipe 4. The port a^2 is longer than the ports *a* and $a^{\times}$, although it is covered, excepting where the pipe 4 enters it, as shown in Fig. 5, and the port a^4 is situated in the plug below the openings that correspond with the ports and out of line with either of them; hence when the plug is rotated the opening

a^4 will at one time be opposite the port a^2 and at another time another opening will be opposite said port, the handle of the valve-plug being properly adjusted to cause these openings to come into the proper coincidence. At one time, therefore, the pipe 4 will be in communication with the air-supply, and at another time the air-supply will be cut off and the pipe 4 will be in communication with the port a^4. When the port a^2 is closed as respects pipe 4, the air-supply will be shut off from entering the pipe 4, the port a^4 will be brought into coincidence with the port a^2, and there being no further pressure from the air-supply upon the air in pipe 4 this air will expand into port a^4 and depress the piston a^5 or remove it from its seat, so as to permit the excess of air to escape into the atmosphere through suitable holes drilled in the lower portion of the cap, as shown in Fig. 5. The cap, which is screwed into the lower end of the valve-plug, and which carries the piston-stem and spring of this spring escape-valve, is simply a screw-cap, arranged so that the spring may be compressed to any desired degree of resiliency by adjusting the cap-piece. (See Fig. 5.)

The automatic air-pipe 4 connects with a cylinder, D, by means of a suitable branch pipe, as shown in Fig. 2, said branch pipe being arranged to admit air to the end of the cylinder. Within the cylinder is located an automatic device arranged as follows: Into the end of cylinder D, opposite to where the above-mentioned air-pipe enters, is screwed the cap *b*, through which passes a rod that carries a piston, and around which rod is coiled a spring which can be depressed to any degree of resiliency by adjusting the cap-piece *b*. Within the cylinder is formed an annular flange or stop, *c*, which prevents the piston from passing beyond a certain point.

The piston-rod within the cylinder D connects with a valve, $D^\times$, through the medium of a crank-arm, *d*, and jointed arm $d^\times$. A portion of the plug within the casing of this valve $D^\times$ is cut away, as shown in cross-section at Fig. 10, and the casing itself is provided with three ports, $e\ e^\times\ e^2$. The pipe *f* enters the casing at the port *e*, and connects valve $D^\times$ with the reservoir E, while a pipe, *g*, enters the valve-casing at the port $e^\times$ and connects said casing with the brake-cylinder H. The port e^2 serves as an escape-port.

Into the outer wall of the reservoir E is screwed a valve, F, in the position shown in Fig. 2, and constructed, as illustrated in Figs. 7 and 8, with a piston, $h^\times$, a stem therefor, and a spring surrounding the stem. The stem is guided in its movements by a sleeve on the screw-cap *h*, which cap is perforated at $h^2\ h^2$, to permit the air to pass through. The valve F is located between the pipe 3 and the reservoir E, and when the air in the pipe 3 attains a sufficient pressure the piston $h^\times$ will be driven inward and the air will pass into the reservoir E through the drilled holes $h^2\ h^2$. Upon the cap of the quadruple valve C, above described, is formed a curved stop or lug, G, (see Figs. 3 and 5,) against the ends of which the operating lever or crank $G^\times$ strikes in its movements, which are thereby limited in either direction, so as to secure an accurate adjustment of the plug within said valve C.

Suitable pressure-gages, I and $I^\times$, are provided upon the straight air-pipe 3 and the automatic air-pipe 4.

Upon a short connecting-pipe, between the pipe 3 and the reservoir E, is a shut-off cock, J, which is usually to be kept closed, and, when the train has become disconnected or broken in two, by coupling the two hose of the separated cars and opening this cock J the pressure from the reservoir E will release the brakes of all cars that are detached from the engine, for the air will thus be driven through the pipe 3, the hose-couplings, and the pipe 4 to the automatic-valve cylinder D, thus opening the port $e^\times$ and escape-port e^2 of the valve $D^\times$, and thus releasing the brakes.

In operating my improved atmospheric brake I preferably provide shut-off cocks upon the hose-couplings of each car, said couplings on the rear car being kept connected, and should these cocks on the rear car become opened by mistake or design the compressed air would pass from one pipe to the other—*i. e.*, from pipe 3 to pipe 4—and into the automatic valve, in which condition of things the brakes could not be set without allowing the air to escape from main reservoir. To guard against this contingency, I employ a cock, K, which is located in the pipe 2 within easy reach of the engineer in the cab. Ordinarily this cock is kept open; but in case the cocks in the rear end of the train should become disarranged, as above explained, the engineer will close the cock K, which will shut off the air-supply from the reservoir B, thus allowing the air to be discharged from the straight air-pipe and the automatic air-pipe, whereupon the automatic valve $D^\times$ will be actuated and the brakes will be set, notwithstanding the fact that the cocks are open at the rear end of the train.

The quadruple valve C is operated by a suitable handle, as $G^\times$, and when the brakes are off or released the said valve will be in the position shown in Fig. 4, the ports $a^\times$ and a^4 being closed and the ports *a* and a^2 open and the piston of the cylinder D down the full distance, thus forcing the connecting arm and valve $D^\times$ backward its full stroke, so as to open the ports $e^\times$ and e^2 and close port *e* of valve $D^\times$, which results in releasing the pressure from the brake-cylinder H, and at the same time shuts off the pressure from the reservoir E and relieves the brakes. In order to set the brakes, the lever or crank $G^\times$ of the valve is moved around until it comes in contact with the stop G. By this means the position of the plug in said valve is so changed that the ports $a^\times$ and a^2 will be opened and the ports *a* and a^4 will be closed, thus simultaneously shutting off the air-supply from the reservoir B and re-

leasing the pressure in the automatic air-pipe 4 and cylinder D, so that the reaction of the spring in the cylinder D will move the piston of said cylinder, thus actuating the valve $D^{\times}$, so as to cause the ports *e* and $e^{\times}$ to be opened and the port e^{2} to be closed. In this manner the compressed air will be allowed to pass from the reservoir E to the brake-cylinder H, where it will act on the contained piston and cause the brakes to be set.

It is evident that the amount of air which is to be admitted at any one time to the cylinder H for the purpose of setting the brakes may be regulated by the movement of the handle $G^{\times}$, which operates the valve C; hence the engineer has the brakes completely under his control at all times. When the brakes are to be released, the handle $G^{\times}$ will be moved in the opposite direction to what it was before, so that the ports $a^{\times}$ and a^{2} will be closed and the ports *a* and a^{4} will be opened.

The relief-valve a^{3} in the bottom of the casing of the valve C, which is constructed and arranged in the manner already described, may be set at any desired pressure which in practice is found to be most convenient—at five to seven pounds, more or less.

Should the pressure be too great in the cylinder D, or of such force and in such a direction as to tend to release the air in the brake-cylinder H, the piston in this cylinder may be easily moved slightly by simply moving the lever $G^{\times}$ quickly from one end of its movement to the other, or from end to end of the stop G, so that the ports *a* and a^{2} will be momentarily opened. In this way enough air will be admitted to cylinder D to force its piston downward about half-way in the cylinder, or in a direction opposite to that in which the pressure may be, thus counterbalancing such pressure, and that movement will also close ports *e* and e^{2} of valve $D^{\times}$ and prevent any of the air contained in the brake-cylinder H from escaping. If in making this movement too much air should pass into the cylinder D, the relief-valve a^{3} will allow the excess to escape through port a^{4} and the piston in cylinder D will fall back to its central position, which movement closes ports *e* and e^{2} of valve $D^{\times}$.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the air-pump A, the reservoir B, connecting-pipe 1, valve C, having openings *a*, $a^{\times}$, and a^{2}, the lever $G^{\times}$ for operating said valve, the straight air-pipe 3, the automatic air-pipe 4, the pipe 2, and the mechanism for setting the brakes, all arranged and operated substantially as shown and described.

2. The combination of the reservoir B, valve C, having ports *a*, $a^{\times}$, and a^{2}, and containing a plug having a relief-valve, a^{3}, and a port, a^{4}, the air-supply pipe 2, the straight air-pipe 3, the automatic air-pipe 4, the cylinder D, the valve $D^{\times}$, reservoir E, and brake-cylinder H, all arranged, connected, and operated as set forth.

3. The combination, with the air-reservoir, connecting-pipes, and operating-valve C, of the cylinder D, containing a piston whose rod passes through cap *b* in the end of said cylinder, and around which rod is coiled a spring, the valve $D^{\times}$, connecting with said piston-rod by a crank-arm, *d*, and jointed arm $d^{\times}$, and constructed as specified, the reservoir E, and brake-cylinder H, all constructed and arranged substantially as described.

4. In combination with the straight air-pipe 3 and automatic pressure-pipe 4, the combined engineer's brake-valve C, which consists of ports *a* $a^{\times}$ a^{2}, relief-valve a^{3}, with its screw-plug or piston-guide and drilled holes, and relief-valve operating port a^{4}, constructed, arranged, and operating in the manner and for the purpose herein set forth and specified.

5. The combination of an air-pump, reservoir, operating-valve, supply-pipe 2, straight air-pipe 3, automatic air-pipe 4, cylinder D, valve $D^{\times}$, having ports *e* $e^{\times}$ e^{2}, reservoir E, connecting with valve $D^{\times}$ by pipe *f* entering it at *e*, and brake-cylinder H, connecting with valve $D^{\times}$ by pipe *g* entering it at $e^{\times}$, all substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand and seal.

ARCHIBALD B. MURRAY. [L. S.]

Witnesses:
C. W. M. SMITH,
CHAS. E. KELLY.