(No Model.)

3 Sheets—Sheet 1.

F. W. EAMES.

Ejector for Vacuum Brakes.

No. 241,635. Patented May 17, 1881.

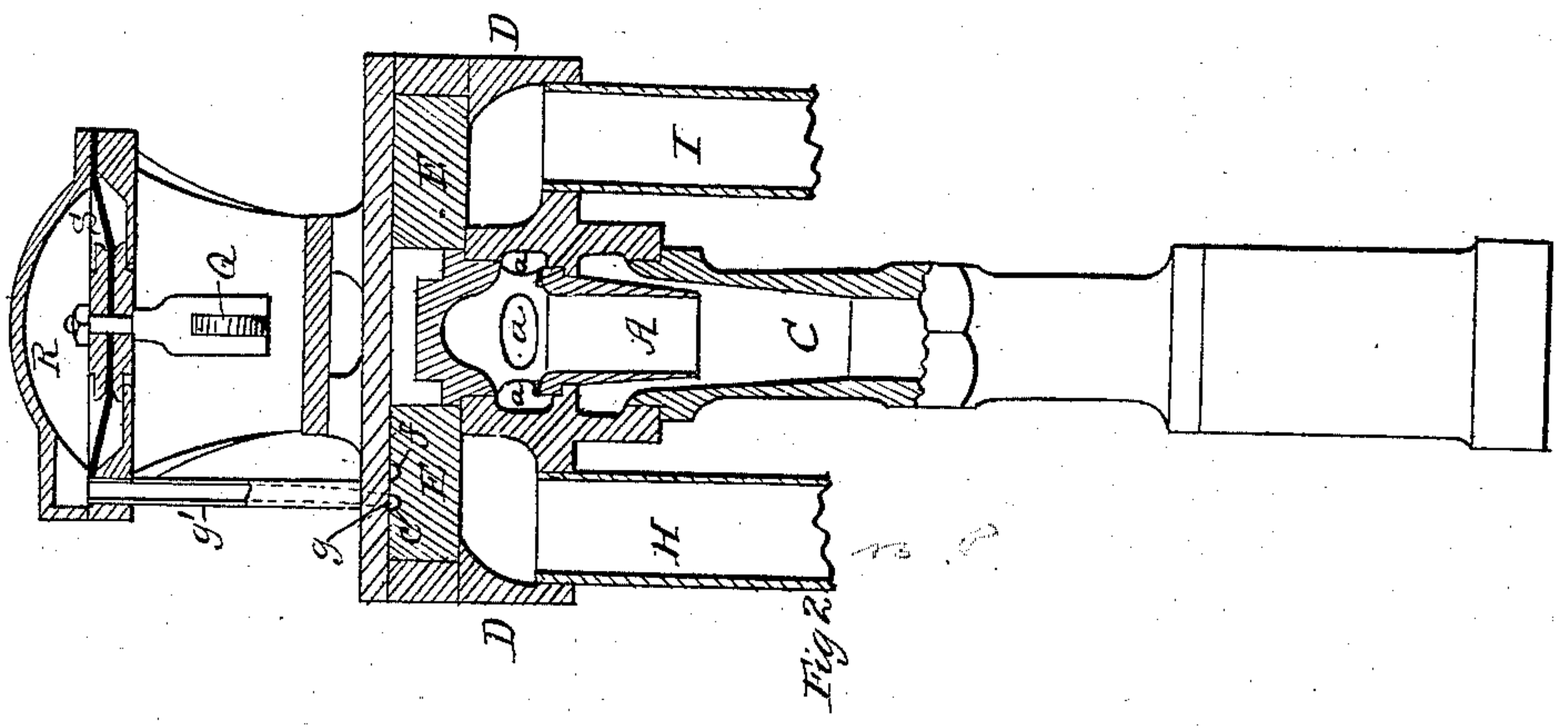

Fig 2.

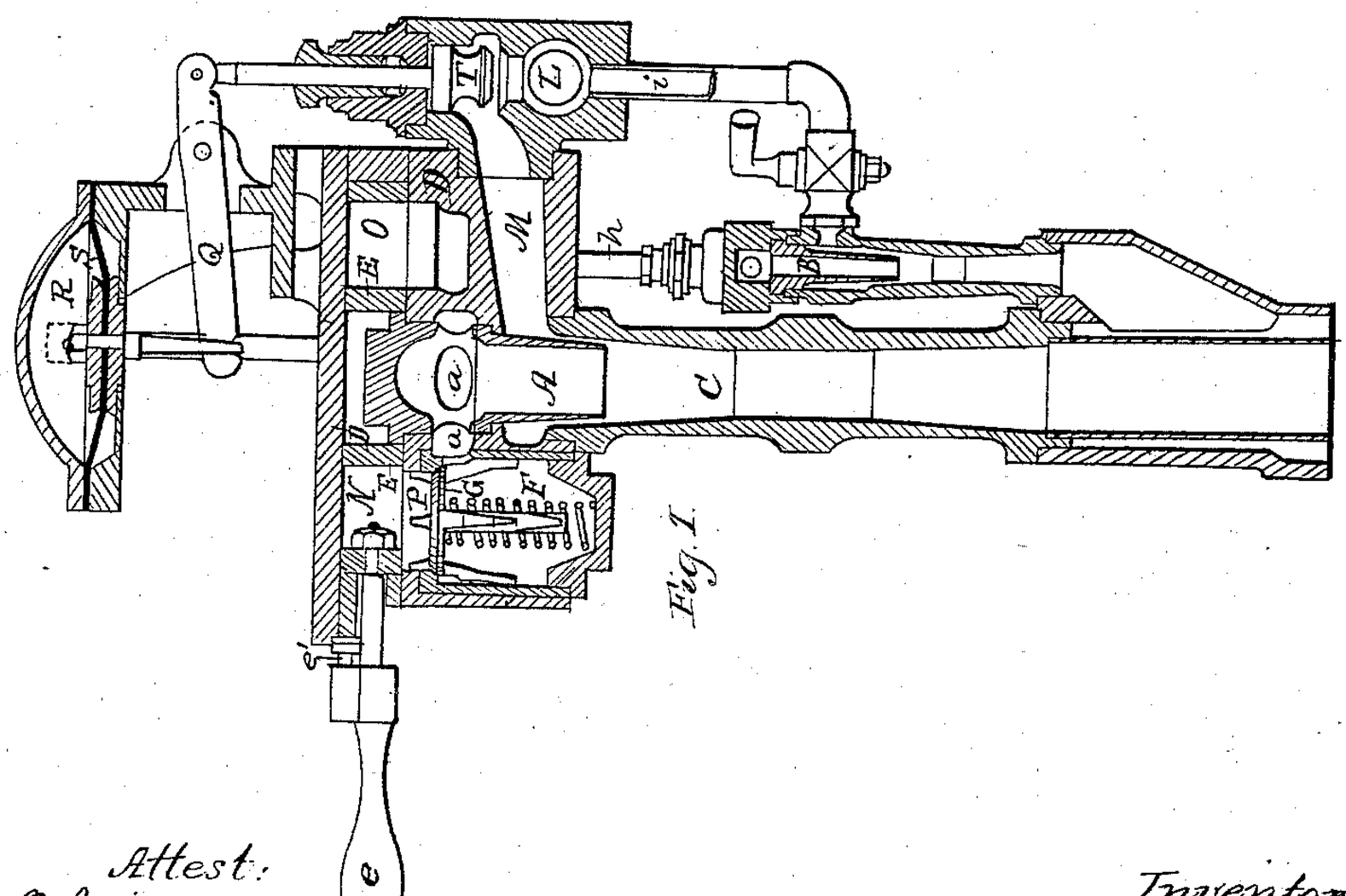

Fig. 1.

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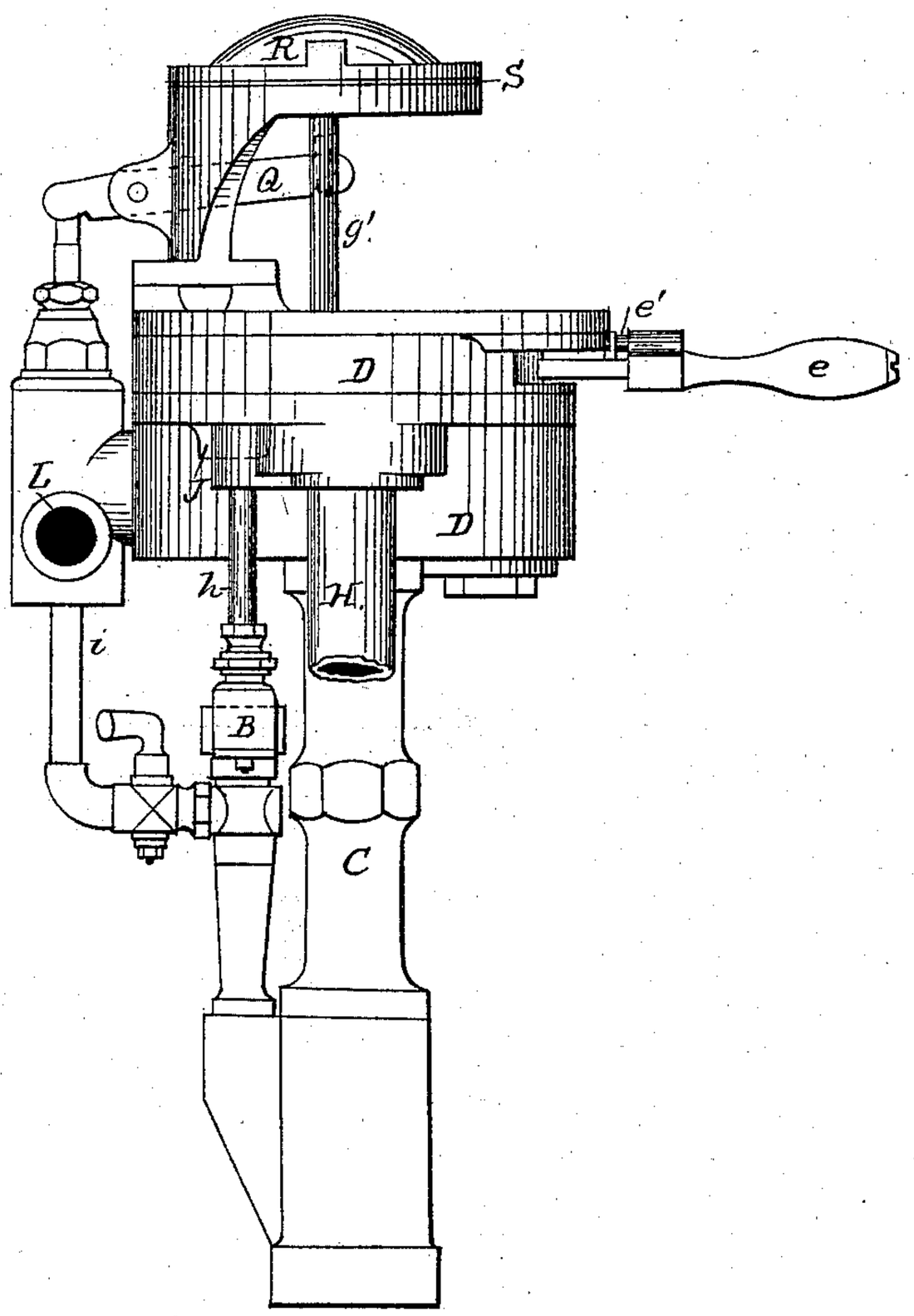
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

F. W. EAMES.

Ejector for Vacuum Brakes.

No. 241,635. **Patented May 17, 1881.**

Fig. 7.

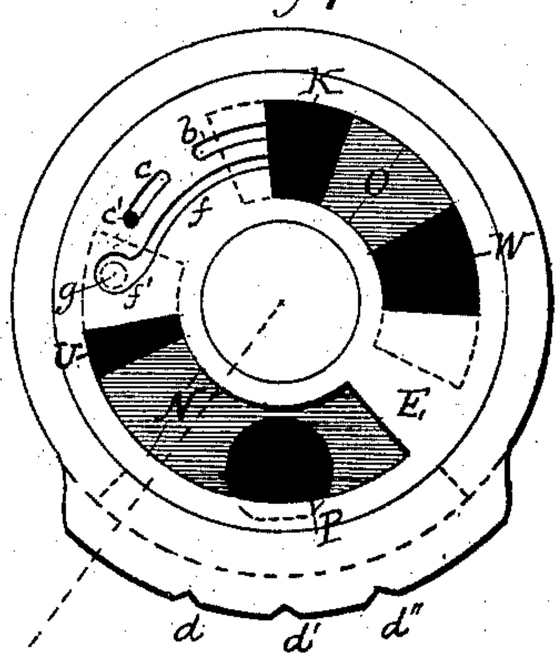


Fig. 8.

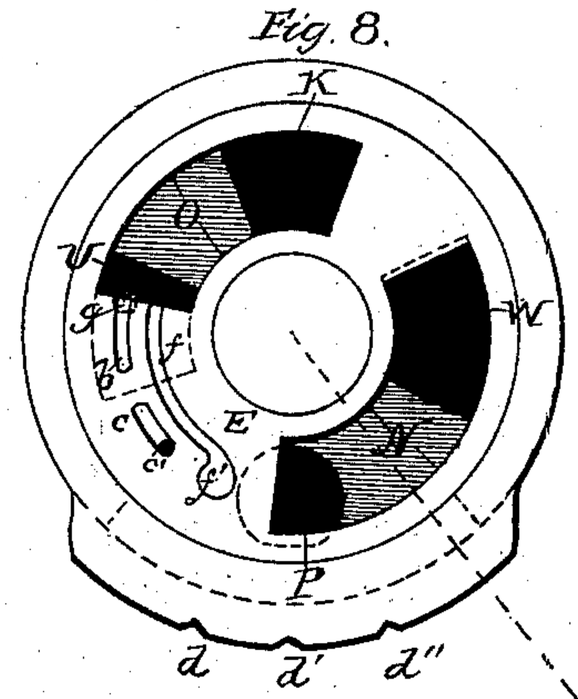


Fig. 4.

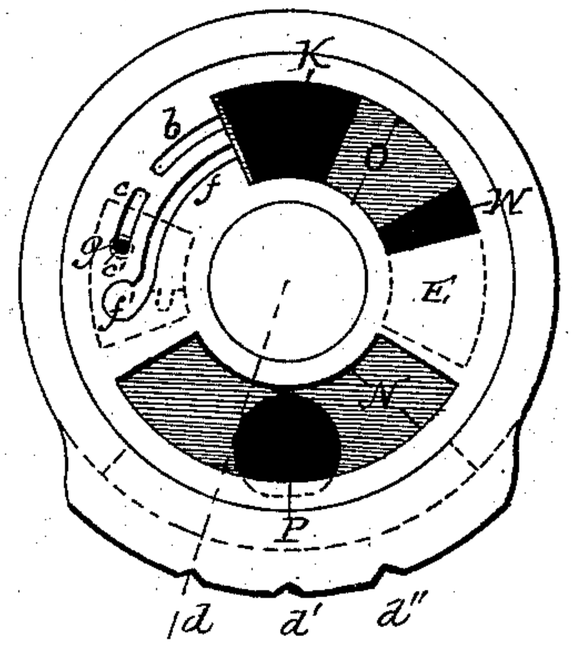


Fig. 5.

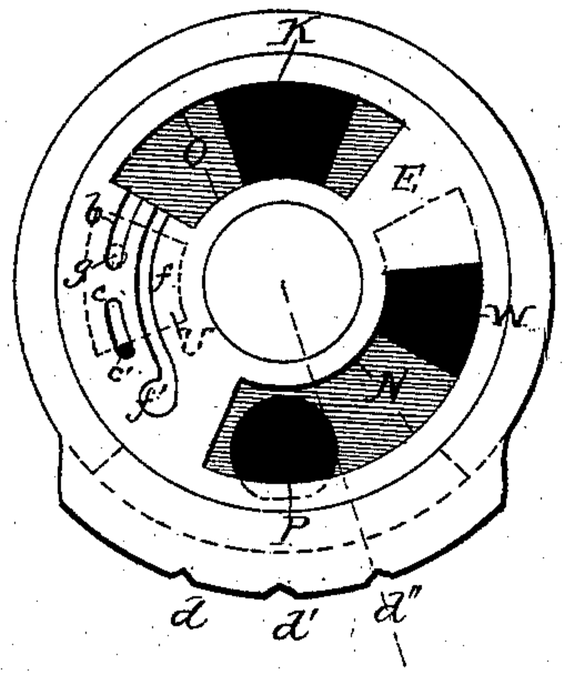
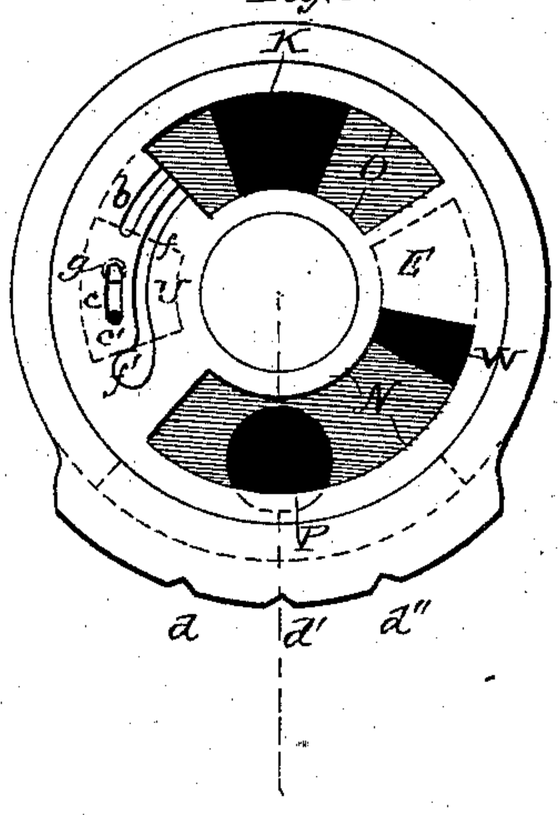


Fig. 6.



Attest:

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Inventor:

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Attys

UNITED STATES PATENT OFFICE.

FREDERICK W. EAMES, OF WATERTOWN, NEW YORK.

EJECTOR FOR VACUUM-BRAKES.

SPECIFICATION forming part of Letters Patent No. 241,635, dated May 17, 1881.

Application filed March 24, 1881. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. EAMES, a citizen of the United States, of Watertown, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Ejectors for Vacuum-Brakes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My present invention relates to air-ejectors for vacuum-brakes.

Heretofore the employment of air-ejectors for exhausting a double line of brake-pipes has been attended by serious difficulties. Whether automatic in their action or not, it was necessary, in order to properly operate them, that they be provided with several valves and valve-handles, besides other contrivances dependent for their action upon the attendant engineer, and the risk of his not properly adjusting them was considerable.

To remedy these defects are the objects of my present invention; and it consists in the following construction and arrangement, whereby a duplex line of brake-pipes and their necessary connections with the operative chambers and reservoirs may be held under perfect control by a single valve operated by the engineer.

Figure 1 represents a central vertical longitudinal section of a device embodying my invention. Fig. 2 represents a central longitudinal vertical section of the same, taken in a line transverse to the line of section in Fig. 1. Fig. 3 represents a side elevation of my improved device. Figs. 4, 5, 6, 7, and 8 represent the controlling-valve in its five different operative positions, they being respectively top-plan views of the same.

To enable others skilled in the art to make and use the same, I will proceed to describe it in detail, here premising that I wish it understood that I do not confine myself to the exact proportions or arrangement of the apparatus, as they obviously may be varied and yet be the same in principle; or one or more parts of the device might have substituted for it a mere equivalent.

In the accompanying drawings, in which the same letters of reference indicate the same parts, A represents the ejector-nozzle of the larger ejector, the action of which, as well as the smaller ejector B, is downward instead of upward, as in my former patents. This construction I consider preferable in this case, for the reason that any water of condensation that may get into the passages of the apparatus will gravitate downward into and pass off through the steam and air casing C, thereby preventing water from entering the brake-pipes and their connections, to their consequent injury.

The inner end of the ejector-nozzle A terminates in a valve-box, D, and forms a spindle, on which a flat-faced slide-valve, E, is mounted loosely, so as to turn freely thereon. Said inner end of nozzle A is closed; but lateral openings *a* open up a communication with chamber F below valve G, which valve normally closes a passage leading to valve E and its box, as hereinafter set forth. The bottom of valve-box D is provided for the reception of vacuum-brake pipes H and I, (see Fig. 2;) and it is one of the purposes of valve E to bring these pipes alternately into communication with ejector-nozzle A.

Standing out from the periphery of the valve E is a handle, *e*, which projects through the valve-box D, and suitable means are provided for preventing the admission of air into the valve-box therethrough. The handle *e* is also provided with a spring-stop, *e'*, which may enter notched recesses *d* in a projecting lip formed on the valve-box. This stop *e'* has only a limited bearing movement, and may be moved in either direction against its friction to the full limit of the throw of the valve E.

In the valve-box D is an opening, J, cored out through said box, preferably from side to side, to the outer air. Its inner end forms port K for the admission of air to the apparatus, which port is cut off by valve E from connection with the vacuum-pipes when they are required to be sealed. The center of the main ejector A is always in communication by passages *a* with the valve-box D, (valve G, opening downward, merely serving as a check-valve to prevent the back-pressure and the destruction of any vacuum which may be desired to be held.)

The annular steam-jet of the ejector receives steam from a pipe, L, leading from the boiler into a passage, M, cored out through the valve-box.

N and O are openings made in valve E, of the configuration shown in the top-plan views of the valve. They serve to bring either of the vacuum-pipes H or I into communication with port K, leading to the outer atmosphere, and also to bring either of said pipes H or I in connection with port P, leading to the main ejector, as before stated.

Leading from port O of valve E is a short segment-shaped channel, *b*, cut in the upper face of the valve, and of the depth shown in cross-section, Fig. 2. The length and arrangement of channel *b* are shown by Figs. 4, 5, 6, 7, and 8. Beyond channel *b*, and within the same radius, is another channel, *c*, illustrated in the same figures, and at its end farthest from port O and nearest port N is formed a small port, *c'*, cut vertically through valve E.

Leading from port O, also, is another channel, *f*, cut in the line of a different radius from channels *b* and *c*, but whose other end, *f'*, is curved, so as to end within the same radius as said channels *b* and *c*. In the line of these three channels is a small port, *g*, cut through the valve-box cover, the position of which is indicated by dotted lines in each of the top-plan views of valve E. This port *g* connects with tube *g'*, which communicates with the air-box R of a pneumatic lever, Q. This lever Q is operated through its connection with diaphragm S, the other end of which is attached to the spindle of the steam-supply valve T in such a manner as to insure of the valve T remaining shut while a vacuum is maintained in air box or chamber R, and to admit of its opening when air is admitted to chamber R.

The small ejector B is constantly blowing, and its air-nozzle is in direct connection with pipe H by means of connecting-tube *h*, and said ejector receives its steam from pipe L through pipe *i*, independently of any action of valve T, and it discharges steam and air into the main-ejector casing C below or beyond the annular jet thereof.

Pipe H ends in the apparatus by port U, and vacuum-pipe I by port W.

The operation of my invention is as follows: It will be understood, in connection with the description of the operation of my invention, that in the continuous brake-pipe H a vacuum is constantly maintained and held, excepting in cases of emergency, where a more effective and instantaneous application of the brakes is required than is necessary for the ordinary stoppage of trains, in which case the vacuum is destroyed in pipe H, which acts through automatic valvular apparatus under each car of the train, opens up communication with their respective operating-chambers of reserve vacuum-reservoirs, and the brakes are instantly set in action with great power, as before set forth. This constantly-maintained vacuum in pipe H is secured by the constantly blowing small ejector B in direct connection therewith. In ordinary usage, however, the brakes are applied by creating a vacuum in pipe I.

In the normal position of the apparatus the position of controlling-valve D is that shown by Fig. 4, and the brakes are off. In this position the handle *e* of the valve D lies in the direction of the dotted radial line in the figure, and the spring *e'* would be in notch *d*. Small port *c'* of steam-channel *c* being directly over port U of pipe H, which, it will be remembered, is kept constantly exhausted by ejector B, and said port *c'* also being in conjunction with port *g*, which connects with air-chamber R through pipe *g'*, it is evident that a vacuum will be produced in said chamber R. This will have the effect of raising diaphragm S and operating lever Q, thereby forcing the steam-supply valve T onto its seat and shutting off the steam, and no action of the ejector will take place. At the same time port W has been uncovered by air-passage O of the valve E, and connection is made therewith with the open air through port K and passage J.

When, however, it is desired to apply the brakes in ordinary cases, the valve is shifted to the position shown in Fig. 5, the valve-lever *e* lying in the direction of the dotted radial line which passes through notch *d''*. In this position channels *c* and *c'* have passed beyond port *g*, and channel *b*, communicating with passage O and the outer air, now registers with said port *g*. Air through said channel and port now enters chamber R, thrusting out the diaphragm S, and through lever Q opens the steam-valve T. At the same time valve-passage N has brought port W of pipe I and port P of ejector A into communication, and the valve T being opened, as above, the rapid exhaustion of pipe I will ensue, the valve G opening by the exhaustion behind it against the pressure of its closing-spring. The exhaustion in pipe I sets the brakes, and when it is desired to hold the brakes set the valve E is shifted to the position shown in Fig. 6, the valve-lever being in notch *d'*. In this case the channel *b* is moved to the right out of register with port *g*, and an end of channel *c*, which has port *c'*, is brought in conjunction with port *g*, whereby chamber R is again exhausted and the steam-valve T held shut. Ejector A will then have no further action, but the vacuum in pipe I will still be held, as it has no outlet except when the brakes are released. (Fig. 4.)

In cases of emergency, as an approaching danger, where a more instantaneous and effective application of the brakes than is necessary in ordinary usage is desired, the valve-lever is shifted to the right to the limit of its throw, which is the position shown by the dotted radial line, Fig. 7. This movement brings port U of pipe H into connection with port K, leading to the outer air, thereby destroying the vacuum therein. This destruction of the vacuum will have the effect of opening up reserve

vacuum-reservoirs under the several cars of the train with the operating-chambers by automatic valvular apparatus. Port *g* also communicates with the outer air, which will have the effect of raising valve T, as before explained, and the ejector A will be set in action to exhaust pipe I at the same time, thereby adding to the effective power and completeness of the vacuum. In order to take the brakes off when applied in this way, and also to reenforce the action of the small ejector B, and thereby exhaust the reservoirs rapidly, (after the crisis has passed,) the valve E is thrown to the left-hand limit of its movement. By this movement the end *f'* of channel *f* is made to register with port *g*, and as this channel opens into valve-passage O, and thence to the outer air, it is evident the steam-valve T will still be open. Valve-passage N has also brought port U of pipe H and port P of ejector A into connection, when it is obvious both ejectors A and B will exhaust pipe H, and which will be effected very rapidly. Pipe I at the same time is in communication with the outer air. Thus it will be seen the apparatus is again ready for action in setting the brakes.

I may find it convenient to fit onto the valve-box a free reed, which will serve to indicate to the engineer when exhaustion is taking place in the pipe I through leakage of the steam-valve, or when air has been withdrawn from such pipe by the train-men in order to apply the brakes. This reed will also allow of the admission of air into pipe I and destroy all tendency of the brakes to creep into action.

I am aware that ejectors have been constructed having communication with a double line of brake-pipes controlled by a single valve-lever; but in such apparatus it was necessary to provide an independent valve and lever operated by hand for the admission of steam to the ejector for the purpose of exhausting it when desired.

Having described my invention, what I claim is—

1. An air-ejector apparatus provided with an automatic steam-valve, and having connection with a double line of brake-pipes, and controlled by a single valve and its lever, substantially as and for the purpose set forth.

2. An air-ejector apparatus provided with an automatic steam-valve, and having connection with a duplex line of brake-pipes, in one line of which a vacuum is automatically maintained and controlled by a single valve and its lever, substantially as and for the purpose set forth.

3. An automatically-operating brake apparatus provided with an automatic steam-valve, and an air-ejector having connection with a duplex line of brake-pipes and controlled by a single valve and its lever, substantially as and for the purpose set forth.

4. An air-ejector having connection with a duplex line of brake-pipes controlled by a single valve and its lever, and the ports so constructed and arranged as to adapt it to exhaust either one or both lines of pipes at the same time, substantially as and for the purpose set forth.

5. An air-ejector apparatus having connection with a duplex line of brake-pipes and operated by a single valve and valve-lever, and the ports so constructed and arranged as to adapt it to continuously maintain a vacuum in one line of pipe as a reserve power, and to create a vacuum in the other line of pipe when it is ordinarily desired to apply the brakes.

6. An air-ejector apparatus provided with an automatic steam-valve, and having connection with a double line of brake-pipes, consisting of two ejectors controlled by a single valve and valve-lever, as set forth.

7. An air-ejector apparatus having connection with a double line of brake-pipes, consisting of two ejectors of different comparative sizes and capacities, controlled by a single valve and its lever, substantially as specified.

8. An air-ejector apparatus controlled by a single valve and its lever, consisting of two ejectors, one of which has communication with but one line of pipe, and the other ejector of which has communication under certain conditions with one or both lines of pipes at the same time, substantially as set forth.

9. An air-ejector apparatus having connection with a double line of brake-pipes and controlled by a single valve, consisting of two ejectors of comparatively different sizes and capacities, one of which has connection with but one line of pipe, and the other ejector of which has connection under certain conditions with one or both lines of pipe.

10. An air-ejector controlled by a single valve operated by hand or otherwise, and provided with an automatically-operating steam-supply valve, and having connection with a duplex line of brake-pipes, in one line of which a vacuum is automatically maintained, as specified.

11. An air-ejector controlled by a single valve operated by hand or otherwise, having connection with a double line of brake-pipes, and provided with an automatically-operating steam-supply valve, whereby a vacuum is automatically and continuously maintained in one line of pipe as a reserve power, and a vacuum created in the other line of pipe when it is ordinarily desired to apply the brakes.

12. An air-ejector apparatus consisting of two ejectors controlled by a single valve operated by hand or otherwise, and having an automatically-operating steam-supply valve, substantially as set forth.

13. An air-ejector apparatus consisting of two ejectors of different comparative sizes and capacities, controlled by a single valve operated by hand or otherwise, and having an automatically-operating steam-supply valve, substantially as set forth.

14. The controlling-valve of an air-ejector, so constructed and arranged as to provide for

the automatic action of the steam-supply valve, in the manner set forth.

15. The controlling-valve of an air-ejector, so constructed and arranged as to provide for the automatic action of the steam-supply valve, and having ports for establishing communication from either of the brake-pipes with the ejector or with the outer air, in the manner set forth.

16. The valve D, having ports N and O, in combination with ports K, U, W, and P, arranged in the manner and for the purpose set forth.

17. The valve D, having ports N and O and channels *b*, *c c'*, and *f*, adapted to register with port *g*, for the purpose described, in combination with ports K, U, W, and P, all arranged in the manner set forth.

18. The valve D, having ports N and O and channels *b* and *c c'*, in combination with ports K, W, and P, arranged in the manner and for the purpose set forth.

19. The combination of valve D, substantially as described, and valve T, connected by the pneumatic lever Q, for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 28th day of July, 1879.

FREDERICK W. EAMES.

Witnesses:
F. W. SPICER,
CHAS. D. BINGHAM.