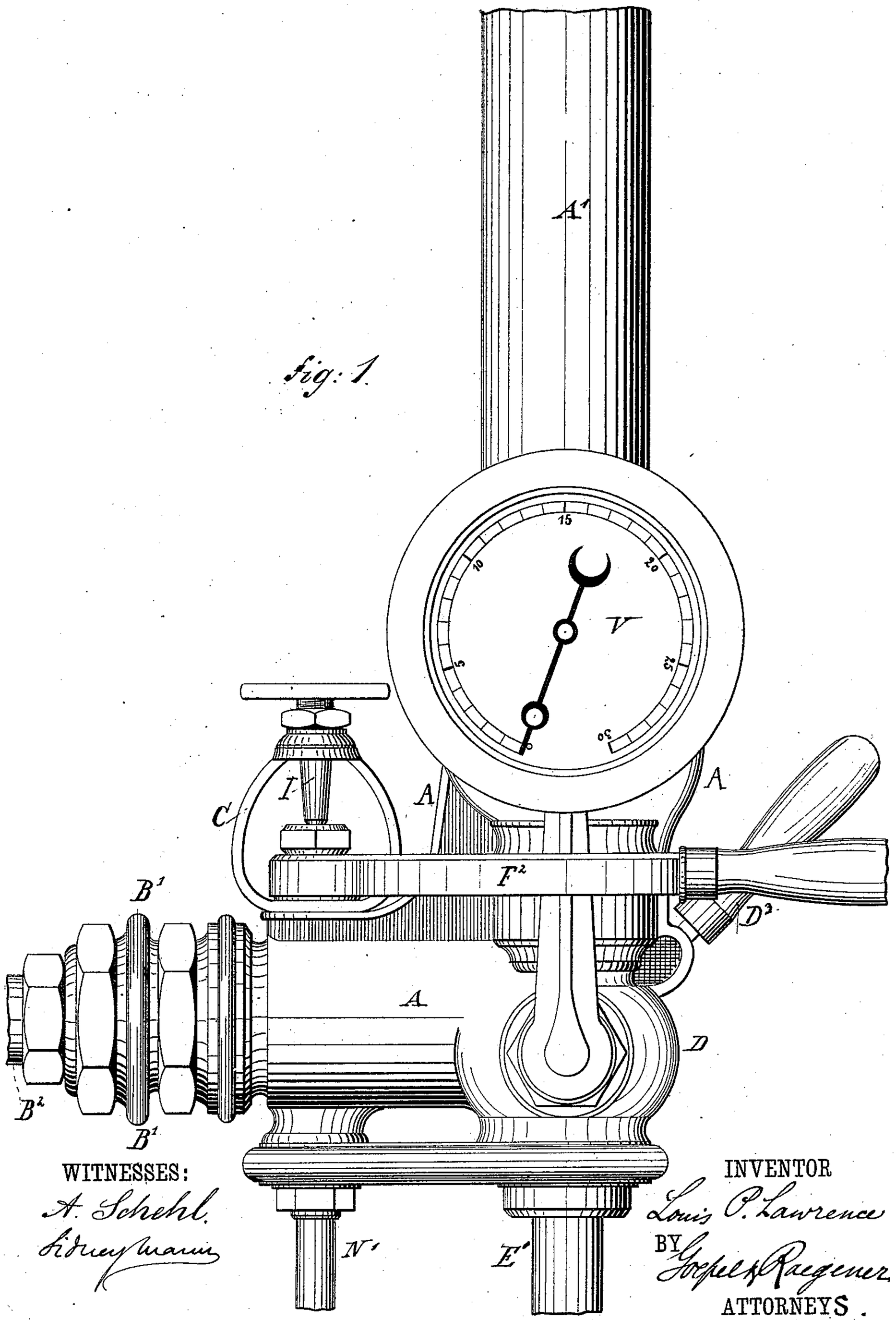
(No Model.) 3 Sheets—Sheet 1.

L. P. LAWRENCE.

AIR EJECTOR FOR VACUUM BRAKES.

No. 300,876. Patented June 24, 1884.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig: 2.

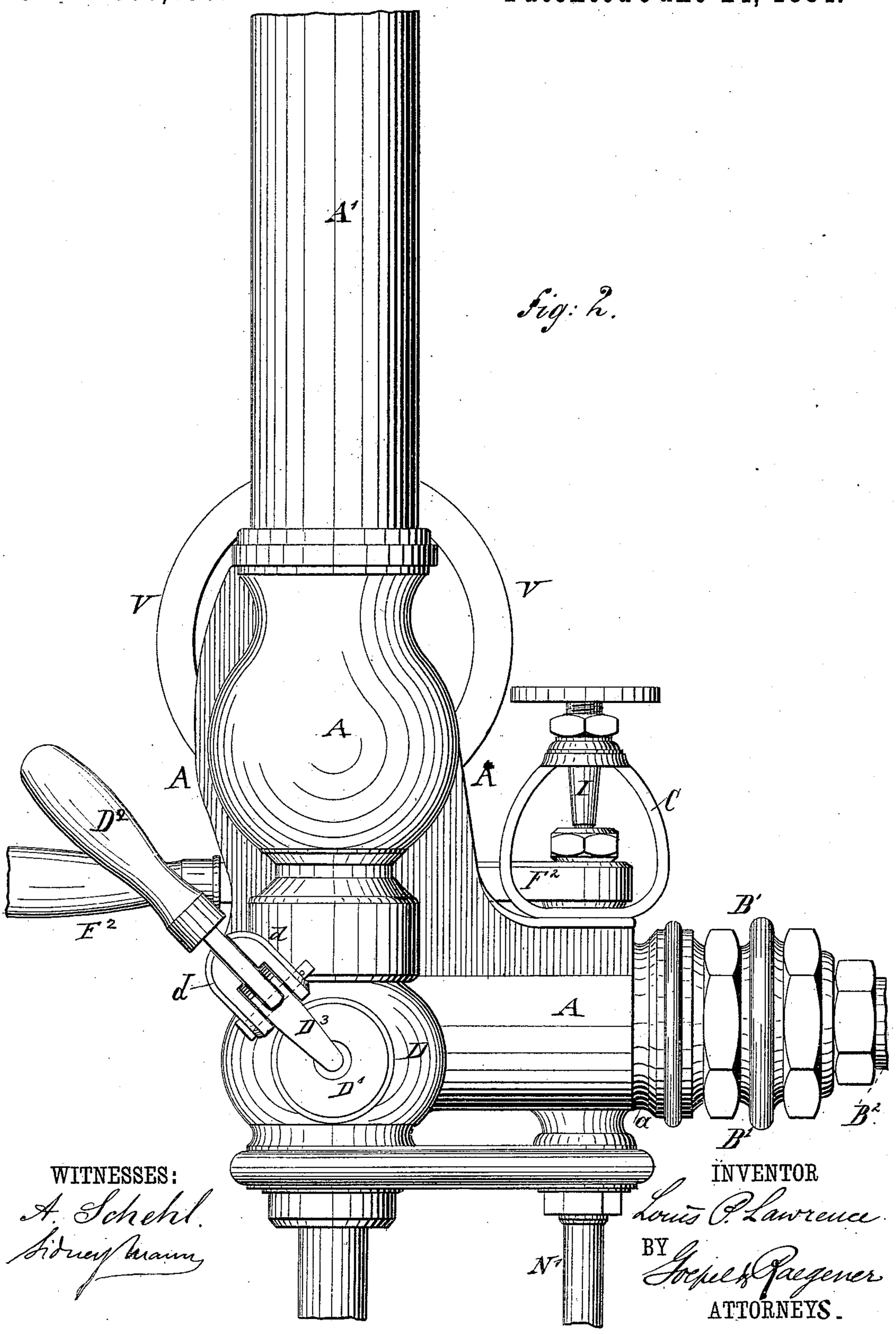

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Fig. 5.

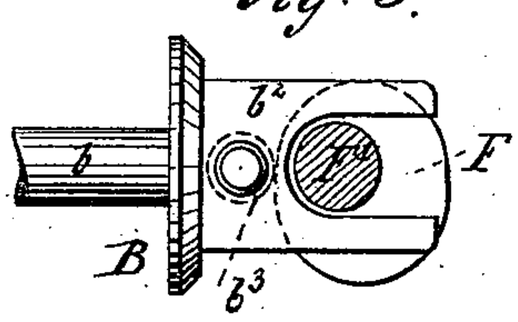


Fig. 4.

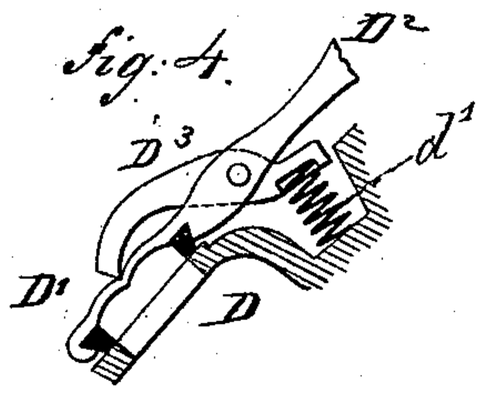
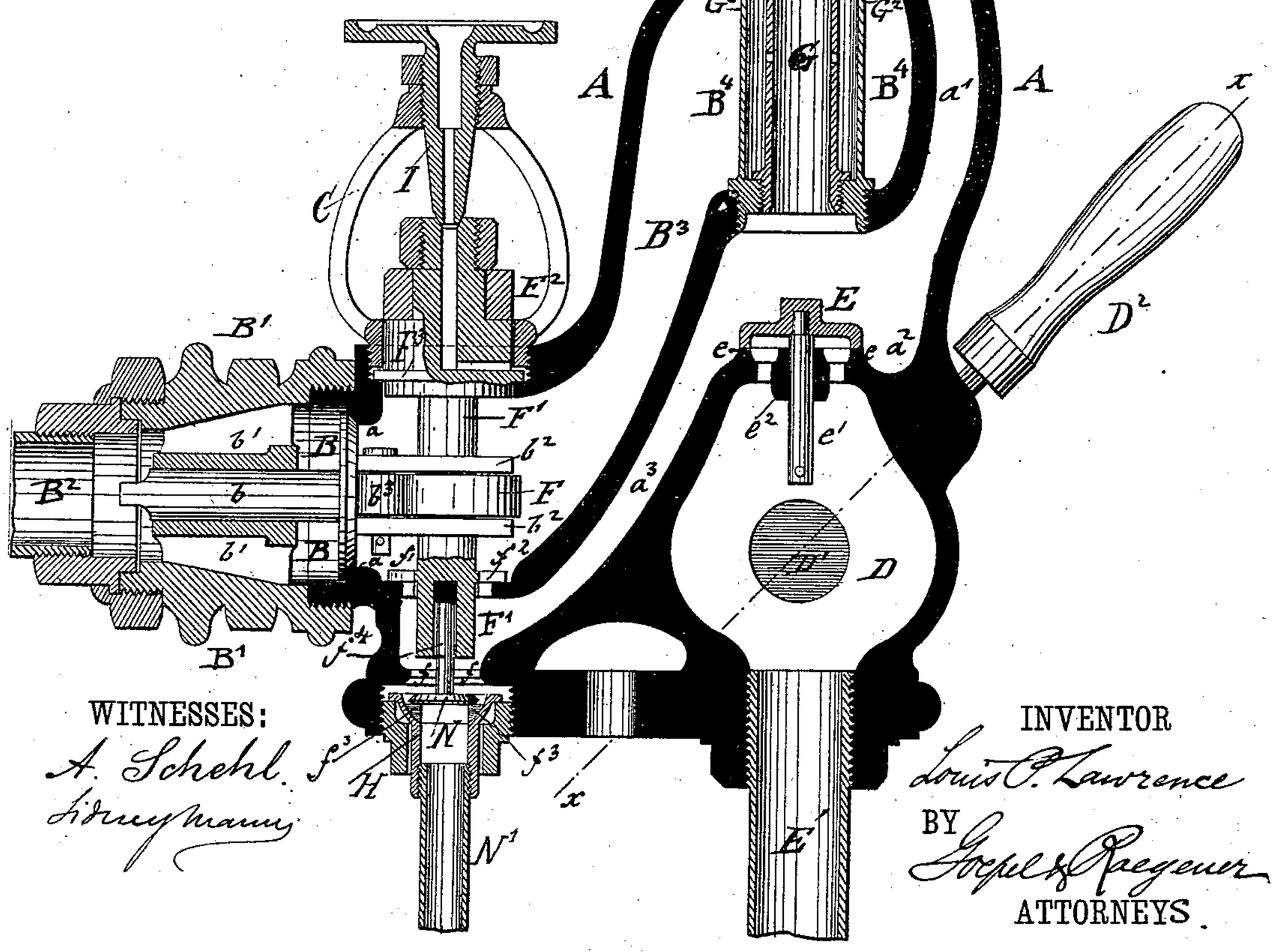


Fig. 3.



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UNITED STATES PATENT OFFICE.

LOUIS P. LAWRENCE, OF PASSAIC, NEW JERSEY, ASSIGNOR OF ONE-FOURTH TO LOUIS C. RAEGENER, OF BROOKLYN, NEW YORK.

AIR-EJECTOR FOR VACUUM-BRAKES.

SPECIFICATION forming part of Letters Patent No. 300,876, dated June 24, 1884.

Application filed February 27, 1884. (No model.)

To all whom it may concern:

Be it known that I, LOUIS P. LAWRENCE, of the city of Passaic, county of Passaic, and State of New Jersey, have invented certain new and useful Improvements in Air-Ejectors for Vacuum-Brakes, of which the following is a specification.

This invention has reference to an improved air-ejector for vacuum-brakes, which has the advantage that a high degree of vacuum is obtained in the cylinder connected thereto, and that the water of condensation is conducted from all parts of the ejector by its natural gravity to the drip-valve, and the discharge-pipe arranged at the lower part of the ejector, whereby it is prevented from entering the air-passage and exhaust-pipe.

The invention consists of an air-ejector for vacuum-brakes, the body of which is cast in one piece with an interior steam-induction channel, steam-expansion chamber, and air-chamber, and with channels for conducting off the water of condensation. The live steam enters through a supply-valve at one side of the ejector-body, and is then conducted by the upwardly-slanting induction-channel into the expansion-chamber arranged around the central air-exhaust pipe. The steam-supply valve is operated by an eccentric, which bears upon an anti-friction roller of a forked extension of the steam-supply valve. A drip-valve for the water of condensation is arranged at the lowermost part of the ejector, and connected with a discharge-pipe and by interior channels with the steam-exhaust pipe, and by a valve on the stem of the eccentric with the induction-channel, so as to drain the ejector as soon as the steam-supply valve is closed. An air-chamber having an air-exhaust valve is arranged vertically below the central air-pipe of the ejector, the air-exhaust valve being seated on a raised seat, and of inverted cup shape, so as to shed the water of condensation into the channels arranged for the same. An equilibrium-valve is arranged at the rear of the air-chamber below the air-valve, so as to reestablish the pressure in the brake-cylinder. The equilibrium-valve is held in closed position by means of a spring-actuated lever, which is fulcrumed to the handle of the equilibrium-valve, and adapted to press upon the center of the valve, so as to keep the same tightly closed on its seat. A peculiar construction of the air-exhaust pipe enables the establishment of a high degree of vacuum in the vacuum-cylinders connected to the ejector.

In the accompanying drawings, Figures 1 and 2 represent, respectively, a front and a rear view of my improved air-ejector for vacuum-brakes. Fig. 3 is a vertical longitudinal section of the same. Fig. 4 is a detail section of the equilibrium-valve on line *x x*, Fig. 3; and Fig. 5 is a detail of the forked extension of the steam-admission valve.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the body of my improved air-ejector for vacuum-brakes. The body A is provided at the lower part with a seat, *a*, and a conical steam-supply valve, B, the valve-chamber B′ of which is screwed or otherwise connected to the lower part of the body A, and connected by a suitable coupling with the steam-supply pipe B^2. The stem *b* of the steam-valve B is guided in central bearings, *b′*, of the valve-chamber B′, while the inner end of the valve B is provided with a forked extension, b^2, carrying an intermediate anti-friction roller, b^3. The forked extension b^2 passes alongside of the shank F′, over an eccentric, F, on said shank, which eccentric bears upon the anti-friction roller b^3, and moves the steam-supply valve B either away from the seat *a* into open position, or into closed position against the same, according as the shank F′ is turned by a lever, F^2, applied to its outer end in one or the opposite direction. The forked extension b^2 prevents the steam-supply valve B from turning on its axis in either direction, and secures the contact of the anti-friction roller b^3 with the face of the eccentric F. The steam-induction channel B^3 extends from the supply-valve B in an upwardly-slanting direction to an annular steam-expansion chamber, B^4, which is arranged around the air-exhaust pipe G, that is screwed into an opening at the bottom of the steam-expansion chamber B^4.

To the upper part of the expansion-chamber B^4 is screwed the steam-pipe B^5, and to the upper end of the ejector-body A the exte-

rior exhaust-pipe A′, which are both arranged concentrically to the air-exhaust pipe G. The annular space formed between the exterior exhaust-pipe A′ and the steam-pipe B^5 is connected by a channel, a', extending along the outside of the expansion-chamber B^4 to an annular gutter, a^2, arranged around the raised and beveled seat e of the air-valve E. The gutter a^2 is connected by a steam-channel, a^3, arranged below the steam-induction pipe B^3 to a drip-valve, N, which is arranged at the lowermost part of the ejector-body below the shank of the eccentric F and the seat f. The water of condensation passes from the exterior exhaust-pipe A′ through the channel a' to the gutter a^2, and from the same through the channel a^3 to the drip-valve N, where it is collected and discharged through the pipe N′ below the drip-valve N.

The steam-induction channel B^3, the steam-expansion chamber B^4, the channels a' and a^2 for conducting off the water of condensation, the enlarged air-chamber D, together with the valve-seats a, e, and f of the steam-supply valve B, the air-valve E, and the drip-valve N, are made in one casting, and form all integral parts of the ejector-body, as shown clearly in longitudinal section in Fig. 3. By casting the ejector-body in the manner described it is adapted for attaching the different parts of the ejector conveniently thereon, so that my improved ejector can be manufactured at a considerably lower price than the air-ejectors for vacuum-brakes heretofore in use.

The steam-pipe B^2, valve-chamber B′, the valve-seat a for the steam-valve B, and the lower part of the induction-channel B^3 are arranged in line with each other, so that the steam is conducted in a natural and unobstructed manner from the steam-supply pipe B^2 to the induction-channel B^3, and by the upwardly-slanting portion of the latter into the expansion-chamber B^4. The shank F′ of the eccentric F is guided in bearings of the ejector-body A near the seat for the steam-valve, the upper part of the shank being enlarged, so as to form a guide-cylinder, F^3, which is packed by a gland to the body of the ejector. Above the gland an arch, C, is formed, which supports the adjustable set-screw I, that presses upon the upper end of the shank F′, for the purpose of holding the lower part of the cylinder F^3 tightly on its seat of the body A. The guide-cylinder F^3 is lubricated by means of oil-passages that extend through the set-screw I and cylinder F^3 to the seat of the same on the body A, as shown in Figs. 1 and 3. The operating-lever handle F^2 of the eccentric F is secured to the square exterior end of the shank F′, and retained securely thereon by a screw-nut. The handle F^2 is curved and extended across the front part of the ejector towards the right-hand end of the same below the vacuum-gage V, shown in Fig. 1. The shank F′ of the eccentric F is provided at its lower part with a disk, f', which rests on a seat at the lower end of the steam-induction channel B^3 of the body A, said seat being provided with recesses at its inner edge. The disk f' has at one point of its circumference a recess, f^2, through which the water of condensation collected at the lower part of the steam-induction channel B^3 is drained off into the channel a^3, and thence to the discharge-pipe N′. The stem f^4 of the drip-valve N is guided in a central perforation of the lower end of the shank F′ of the eccentric F. The discharge-pipe N′ is secured to the body of the ejector by a gland, H, which is provided with interior projections, f^3, that form rests for the drip-valve N, when the latter is not drawn up against the seat f at the end of the channel a^3 by the operation of the ejector.

The air-valve E is made of inverted-cup shape, and guided by a stem, e', in a central bearing, e^2, below its raised seat e, as shown clearly in Fig. 3. The convex upper surface of the air-valve E sheds the water of condensation into the gutter a^2 and channel a^3.

At the rear of the air-chamber D is arranged an equilibrium-valve, D′, through which air is admitted to the different vacuum-cylinders below the cars of the train after they have been exhausted by the ejector whenever the ordinary atmospheric pressure is to be re-established therein. The equilibrium-valve D′ is provided with a lever, D^2, that is fulcrumed to projecting ears d on the body of the ejector and securely retained in closed position when not in use by means of a locking-lever, D^3, which is fulcrumed to the lever of the equilibrium-valve D′, and acted upon by a spiral spring, d', at its rear end, so that its pointed front end is firmly pressed on the concave center portion of the equilibrium-valve D′, as shown in Fig. 4. The pressure of the spring-actuated lever D^3 upon the equilibrium-valve D′ retains the same tightly in proper position on its seat, so as to close the air-chamber perfectly air-tight until the equilibrium-valve is opened and the air admitted into the air-chamber and the vacuum-cylinders connected therewith.

The air-exhaust pipe G is arranged with a number of suction-cones, G′, the lowest cone being a part of a pipe, G^2, that incloses the lower part of the air-pipe, as shown clearly in Fig. 3. The air-pipe G communicates by openings g with the annular spaces between the cones. The upper end of the air-pipe G is enlarged by an outwardly-flaring conical part, G^3, and then contracted by an inwardly-flaring cone, G^4, the opening of which is considerably smaller than the opening of the air-exhaust pipe G at its base. By means of the suction-cones a more effective action of the ejector and a higher degree of vacuum are obtained, while the contracted end of the air-exhaust pipe prevents the steam from entering at the exit end of the air-pipe and exerting a so-called "back action" thereon.

By admitting steam to the steam-valve B the same passes through the induction-channel B^3 into the expansion-chamber B^4, where it encircles entirely the air-pipe G, and passes

upward in the form of a tubular column through the annular space between the air-pipe G and the steam-pipe G′. As the steam is passed into the end of the steam-pipe G at nearly its initial velocity, it lifts the air-inlet valve E and produces a vacuum in the air-pipe E′ and the vacuum-cylinders connected therewith.

The drip-valve N is closed, so that the atmospheric air is prevented from entering into the ejector at any point. The air is consequently exhausted steadily from all the pipes and vacuum-cylinders to the ejector, and drawn in upward and outward direction through the exhaust-pipe until the required degree of vacuum that is required for applying the brakes is obtained. As the steam enters the body of the ejector at a considerable distance below the lower end of the air-pipe, and is then conducted in an upwardly-curved induction-channel into the expansion-chamber, where it obtains a direction parallel to the air-pipe, it encircles the air-pipe entirely, and passes in an unbroken column through the annular space between the air-pipe and the steam-pipe, so as to exert its full effect in the most natural manner, and produce almost instantly a very high degree of evacuation in the vacuum-cylinders and a quick and effective application of the brakes. When the brakes are to be released, the steam-valve is closed by the handle of the eccentric, and the equilibrium-valve D′ opened, so that the atmospheric pressure is re-established in the entire brake system.

The drip-valve N is dropped in the seats of its gland, and the valve of condensation dropped by its own gravity and connected off through the discharge-pipe N′. No part of the water of condensation can be carried along by the air when the ejector is exhausting, owing to the raised seat of the air-valve and to the shape of the channels that connect it downward to the drip-valve at the lowermost part of the ejector, as stated. By this natural and simple arrangement the water of condensation is drained off after each operation of the ejector, so that it can accumulate neither at the interior of the injector-body nor be carried off through the exhaust-pipe, so as to soil the adjoining part of the locomotive.

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

1. In an air-ejector for vacuum-brakes, the body A, having an upwardly-slanting steam-induction channel, B^3, an interior steam-expansion chamber, B^4, drip-channels a' a^3, and an enlarged air-chamber, D, all made integral in one casting, substantially as set forth.

2. In an air-ejector for vacuum-brakes, an ejector-body, A, having a slanting steam-induction channel, B^3, a steam-expansion chamber, B^4, drip-channels a' a^3, an air-chamber, D, and valve-seats a, e, and f, all cast integral in one piece, substantially as described.

3. In an air-ejector for vacuum-brakes, the combination of an ejector-body, A, having a slanting steam-induction channel, B^3, and a steam-expansion chamber, B^4, with an air-exhaust pipe, G, and a steam-pipe, B^5, secured to the expansion-chamber, and a steam-supply valve arranged at one end of the ejector-body and at some distance below the air-exhaust pipe, substantially as set forth.

4. In an air-ejector for vacuum-brakes, the combination of the ejector-body A, having an exhaust-pipe, A′, and interior drip-channels a' a^3, and a gutter, a^2, around the raised seat of the air-valve, with a drip-valve, N, and discharge-pipe N′ at the lower part of the ejector-body, substantially as set forth.

5. In an air-ejector for vacuum-brakes, the combination of the ejector-body A, having a seat, a, a steam-supply valve, B, having a forked extension, b^2, and an anti-friction roller, b^3, and an eccentric, F, having an exterior lever, F^2, for opening or closing the steam-supply valve, substantially as described.

6. In an air-ejector for vacuum-brakes, the combination of an ejector-body, A, having a valve-seat, a, a steam-supply valve, B, having a forked extension, b^2, and an anti-friction roller, b^3, an eccentric, F, having a shank, F′, guide-cylinder F^3, and lever F^2, yoke C, and set-screw I, substantially as set forth.

7. In an air-ejector for vacuum-brakes, the combination of the ejector-body A, having a steam-induction channel, B^3, steam-supply valve B, an eccentric, F, for actuating said valve, and a recessed valve-disk, f', secured to the shank of said eccentric and fitted to a recessed seat at the lower part of the induction-channel B^3, substantially as described.

8. In an air-ejector for vacuum-brakes, the combination of the ejector-body A, having a drip-channel, a^3, and a valve-seat, f, at the lower end of the same, a drip-valve, N, having a stem, f^4, guided in the lower end of the shank F′, and discharge-pipe N′, provided with a gland, H, having rests f^3, substantially as specified.

9. The combination of an ejector-body, A, having a steam-supply valve, B, a steam-induction channel, B^3, and a drip-channel, a^3, an eccentric, F, actuating the steam-valve B, a recessed drip-valve, f', secured to the shank of the eccentric, a drip-valve, N, guided by said shank, and a discharge-pipe, N′, at the lower part of the ejector-body, substantially as specified.

10. In an air-ejector for vacuum-brakes, the combination of an ejector-body, A, having an enlarged air-chamber, D, with an equilibrium valve, D′, having a lever, D^2, and a spring-actuating locking-lever, D^3, fulcrumed on the lever D^2, and pressing upon the center of the valve, substantially as set forth.

11. In an air-ejector for vacuum-brakes, the combination of an ejector-body, A, having a slanting steam-induction channel, B^3, and an annular steam-expansion chamber, B^4, a steam-supply valve, B, at the lower end of the induction-channel B^3, a steam-pipe, B^5, at the upper end of the expansion-chamber, an ex-

haust-pipe, A′, at the upper end of the ejector-body, an air-exhaust pipe secured to the lower end of the expansion-chamber and passing through the same, and the steam-pipe, and an air-chamber, D, having an exhaust-valve, E, and an equilibrium-valve, D′, substantially as set forth.

12. The combination of the ejector-body A, having a steam-induction channel, B^3, and an expansion-chamber, B^4, a steam-pipe, B^5, an air-exhaust pipe, G, having openings *g g*, a series of suction-cones, G′, attached to the air-exhaust pipe, and a pipe, G^2, surrounding the lower part of the air-exhaust pipe, substantially as specified.

13. The combination of an ejector-body, A, having a steam-induction channel, B^3, and an expansion-chamber, B^4, a steam-pipe, B^5, and an air-exhaust pipe, G, the latter having openings *g g*, suction-cones G′, and a conically enlarged and contracted end portion, G^3 G^4, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

LOUIS P. LAWRENCE.

Witnesses:
WM. C. CLIFFORD,
SIDNEY MANN.