

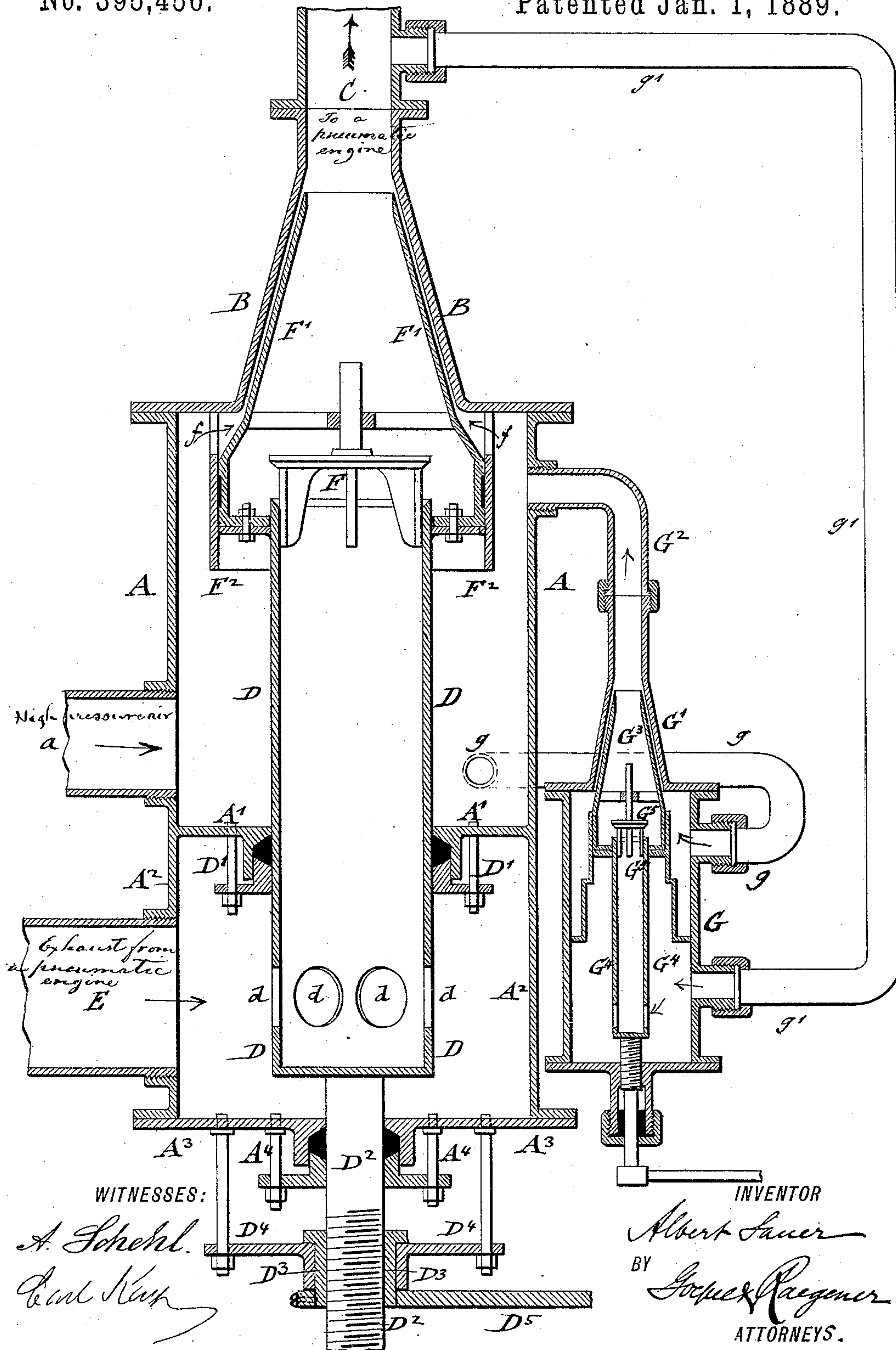
(No Model.)

A. SAUER.

ATTACHMENT FOR COMPRESSED AIR ENGINES.

No. 395,456.

Patented Jan. 1, 1889.





# UNITED STATES PATENT OFFICE.

ALBERT SAUER, OF PITTSBURG, PENNSYLVANIA.

## ATTACHMENT FOR COMPRESSED-AIR ENGINES.

SPECIFICATION forming part of Letters Patent No. 395,456, dated January 1, 1889.

Application filed March 19, 1888. Serial No. 267,621. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT SAUER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Attachments to Compressed-Air Engines, of which the following is a specification.

This invention relates to an improved attachment to compressed-air engines, by which the air exhausted from a pneumatic motor-engine instead of being emitted to the atmosphere is utilized by being mixed with air of high pressure, the attachment also serving for the purpose of regulating the pressure required for working the motor-engine.

The invention consists of an attachment to compressed-air engines, which consists of a partitioned high-pressure cylinder that is connected with the induction-pipe of a pneumatic motor-engine, an interior cylinder connected to the eduction end of said motor-engine, a check-valve at the inner end of the interior cylinder, a nozzle applied to the end of the interior cylinder, an exterior nozzle attached to the end of the high-pressure cylinder and concentric to the interior nozzle, and means for adjusting the interior cylinder in stuffing-boxes of the high-pressure cylinder.

The invention consists, further, of an auxiliary injector connected with the high-pressure cylinder and with the pipe connecting the same with the motor, and means for adjusting the interior nozzle of the auxiliary injector, as will be fully described hereinafter, and finally be pointed out in the claims.

The accompanying drawing represents a vertical central section of my improved attachment to compressed-air engines.

Referring to the drawing, A represents a high-pressure cylinder which is supplied by a pipe, *a*, with air at high pressure from a suitable storage-reservoir. The end of the high-pressure cylinder A is made in the shape of a conical nozzle, B, which is connected by a conducting-pipe, C, with the induction end of a pneumatic motor-engine. At the interior of the high-pressure cylinder A is arranged a cylinder, D, of smaller diameter than the high-pressure cylinder A, the interior cylinder, D, being guided in a stuffing-box, D', of a partition, A', of the high-pressure cylinder. The cylinder D communicates by open-

ings *d d* in the end outside of the partition A' with the partitioned end A<sup>2</sup> of the cylinder A, which end is connected by a pipe, E, with the exhaust or eduction pipe of the motor-engine. The partitioned end A<sup>2</sup> of the high-pressure cylinder A is closed by a head, A<sup>3</sup>, which is provided with a stuffing-box, A<sup>4</sup>, for guiding a threaded rod, D<sup>2</sup>, attached to the end of the interior cylinder, D. The threaded rod D<sup>2</sup> is engaged by a screw-nut, D<sup>3</sup>, which is operated by a suitable lever or hand-wheel, D<sup>5</sup>, said screw-nut being supported by a suitable guide-frame, D<sup>4</sup>, as shown clearly in the drawing.

The opposite or inner end of the interior cylinder, D, is provided with a check-valve, F, and with a conical nozzle, F', that is attached to the inner end of the cylinder D and guided in a guide-cylinder, F<sup>2</sup>, attached to the head of the high-pressure cylinder A, said guide-cylinder being provided with openings *f* for the free passage of the air to the annular space between the nozzles *f'* and *b*. The base of the nozzle F', or that part which is guided in the cylinder F<sup>2</sup>, is provided with a suitable packing for producing the tight connection between it and the guide-cylinder F<sup>2</sup>.

The nozzle F is located concentric to and adapted to be adjusted relatively to the nozzle B of the high-pressure cylinder A by the operating-lever D<sup>5</sup>, screw-nut D<sup>3</sup>, and screw-rod D<sup>2</sup>, so that a greater or smaller quantity of air may be permitted to pass to the annular space formed by the nozzles B and F', or the supply of air be entirely shut off.

When the pneumatic motor-engine is started and the inner nozzle moved away from the outer nozzle, B, a vacuum is produced at the interior of the nozzle F' and the exhaust-air is drawn from the pneumatic motor through the connecting-pipe E into the interior cylinder, D, by the action of the high-pressure air on the injector formed by the nozzles B and F'. The suction exerted by the injector on the interior cylinder, D, lifts the check-valve F and sucks in the spent air, which is mixed with the air of high pressure and reconducted to the motor, supplying thereby air at a lower pressure than that contained in the high-pressure cylinder E, but relieving the piston of the motor-engine of any back-pressure caused by



the air exhausted from the same. Whenever a surplus quantity of exhaust-air is drawn by the injector B F' into the conducting-pipe C, the proper equilibrium between the same and the interior of the high-pressure cylinder A is established by an auxiliary injector, G, the interior partitioned casing of which is connected with the high-pressure cylinder by a pipe, g, while its fixed exterior nozzle, G', is connected by a pipe, G<sup>2</sup>, with the high-pressure cylinder A.

The outlet-pipe C is connected by a pipe, g', with the partitioned-off end of the casing and with the interior cylinder, G<sup>4</sup>, having a check-valve, G<sup>5</sup>, and interior nozzle, G<sup>3</sup>. The interior nozzle, G<sup>3</sup>, is adjusted toward the exterior nozzle, G', by a screw-rod, screw-nut, lever, and stuffing-box in a manner similar to the adjustment of the inner nozzle, F<sup>2</sup>, of the high-pressure cylinder A. The auxiliary injector relieves the main injector of any surplus pressure and produces the proper equilibrium in the regulating attachment, so as to prevent back-pressure on the piston of the motor-engine by the exhaust-air.

The attachment serves for regulating the pressure of the air conducted to the motor-engine and the pressure still remaining in the air exhausted from the same, so as to produce the easier running of the engine.

By adjusting the interior nozzle, F', of the high-pressure cylinder the required speed of the pneumatic engine is regulated at will, as the working of the main and auxiliary injectors is fully within control, while by the closing of the main injector, by means of the interior adjustable nozzle, the engine is instantly stopped.

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

1. The combination of a high-pressure air-cylinder, an injector communicating with said cylinder and the induction end of a pneumatic engine, an interior cylinder communi-

cating with the eduction-pipe of said engine, and a check-valve at that end of the interior cylinder communicating with the injector, substantially as set forth.

2. The combination, with a high-pressure cylinder provided with the injector-nozzle connected with the induction end of a pneumatic engine, of an interior cylinder connected to the eduction end of said engine, a nozzle at the inner end of the interior cylinder, a check-valve in said cylinder, and means for adjusting the interior cylinder and its nozzle to the exterior nozzle of the high-pressure cylinder, substantially as set forth.

3. The combination of a high-pressure air-cylinder, an injector communicating with said cylinder and the induction end of a pneumatic engine, an interior cylinder communicating with the eduction end of said engine and at the opposite or inner end with said injector, and an auxiliary injector communicating with the high-pressure cylinder and the outlet-pipe of the same, so as to establish an equilibrium of pressure in the high-pressure cylinder and the outlet-pipe, substantially as set forth.

4. The combination of a high-pressure cylinder provided with an injector-nozzle connected to the induction end of a pneumatic engine, an interior cylinder connected to the eduction end of said engine, the inner end of the interior cylinder being provided with a nozzle and a check-valve, means for adjusting the interior cylinder and its nozzle, an auxiliary injector connected to the high-pressure cylinder and to the outlet-pipe of the same, and means for adjusting the auxiliary injector, substantially as set forth.

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

ALBERT SAUER.

Witnesses:

PAUL GOEPEL,  
JOHN A. STRALEY.