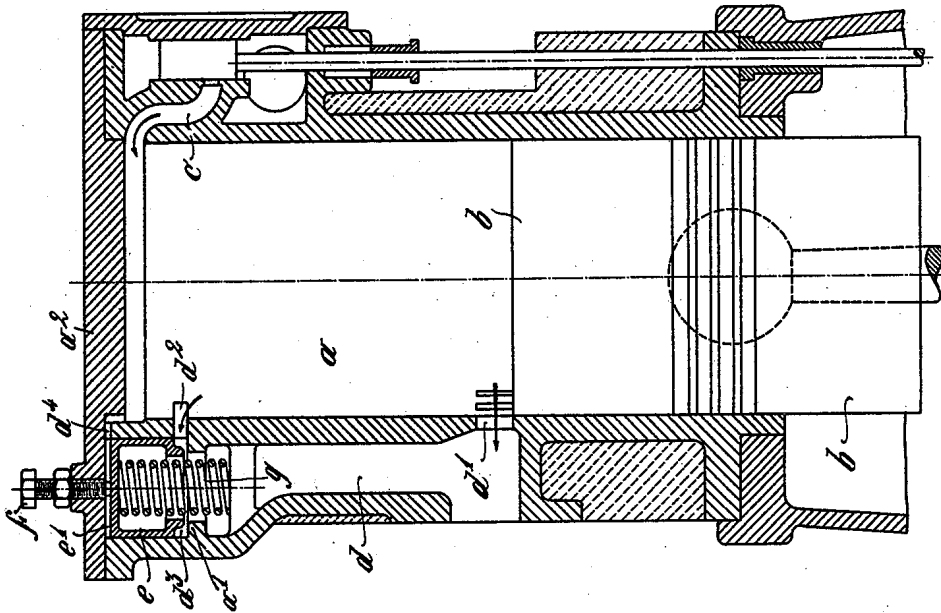


(No Model.)

W. SCHMIDT.  
OUTLET VALVE FOR STEAM ENGINES.

No. 562,039.

Patented June 16, 1896.



Witnesses:  
Carl Pfaffbach  
Emil Kayser.

Inventor:  
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Attorney.

# UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF WILHELMSHÖHE, GERMANY.

## OUTLET-VALVE FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 562,039, dated June 16, 1896.

Application filed September 28, 1894. Serial No. 524,386. (No model.) Patented in Germany February 15, 1894, No. 78,809; in France March 3, 1894, No. 236,887; in Belgium March 12, 1894, No. 108,975; in Norway March 20, 1894, No. 3,691; in Italy March 26, 1894, No. 36,034; in Switzerland April 4, 1894, No. 8,158; in England April 7, 1894, No. 6,981; in Hungary July 2, 1894, No. 722; in Austria July 8, 1894, No. 44/3,039, and in Denmark June 14, 1895, No. 81.

*To all whom it may concern:*

Be it known that I, WILHELM SCHMIDT, a subject of the King of Prussia, German Emperor, and a resident of Wilhelmsöhe, near Cassel, in the Province of Hesse-Nassau, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Outlet-Valves of Steam-Engines and Similar Motors, (for which patents have been obtained or filed in Germany, No. 78,809, filed February 15, 1894; in Austria, No. 3,039/44, dated July 8, 1894; in Hungary, No. 722, dated July 2, 1894; in France, No. 236,887, dated March 3, 1894; in Belgium, No. 108,975, dated March 12, 1894; in Italy, No. 36,034, dated March 26, 1894; in Sweden, application filed March 21, 1894; in Switzerland, No. 8,158, dated April 4, 1894; in Russia, application filed March 15, 1894; in Norway, No. 3,691, dated March 20, 1894; in Denmark, No. 81, dated June 14, 1895, and in Great Britain, No. 6,981, dated April 7, 1894,) of which the following is an exact specification.

This invention refers to steam-engines and similar motors in which the outlet valve or valves is or are operated automatically; and my improvements in such engines or motors relate to the combination of the outlet proper or main outlet with an auxiliary outlet-valve combined with a spring or equivalent part tending to keep said valve constantly open, the latter being so arranged and operating in such a manner that the waste steam remaining within the cylinder after the main outlet has been opened and again closed can yet escape wholly or nearly wholly, while the fresh steam is prevented from flowing through the channel affording the said escape. The drawbacks resulting from the compression of the said remaining part of the waste steam are avoided by my improved outlet-valve, and a very exact and regular working of the motor is obtained thereby, as the said valve at the same time is capable to act as a regulator.

In order to make my invention more clear, I refer to the accompanying drawing, which shows a vertical longitudinal section through the cylinder of a single-acting engine provided with my improved valve.

Referring to the figure represented in said

drawing, *a* is the cylinder of the engine; *b*, the piston; *c*, the inlet-channel, and *d* the outlet-channel. This channel extends parallel to the working cylinder and communicates with the latter by the main outlet *d'* and the auxiliary outlet *d''*. This latter terminates into an annular channel or groove *d'''*, the lower projecting rim *a'* forming the seat for the auxiliary outlet-valve *e*. Valve *e* is shaped in this mode of construction as a casing, the bottom *e'* of which is kept at a certain distance from the cylinder-cover *a''* by an adjusting-screw *f*. The space thus formed communicates by a channel *d''* with the working cylinder *a*. A spring *g*, tending to keep valve *e* constantly open, extends into the inner space of the latter, thus pressing bottom *e'* against the adjusting-screw *f*.

This device operates as follows: As soon as piston *b* has reached the end of its forward stroke, Fig. 1, and the expanded steam escapes as waste steam through the main outlet *d'* the remainder of the steam, after outlet *d'* is closed by the returning piston, will be driven out by the latter through the auxiliary outlet *d''* *d'''* into the channel *d*. There is consequently no compression within cylinder *a* so long as the auxiliary outlet *d''* remains open. As soon, however, as this channel is closed by the returning piston the small quantity of steam now remaining in the rear part of the cylinder is compressed, thus exerting a corresponding pressure on the rear side of bottom *e'* of valve *e*. The strength of spring *g* is such a one that the tension of the latter is overcome by the pressure exerted on valve-bottom *e'* by the said compressed steam. Valve *e* therefore is pressed down on its seat *a'*, so that the communication between the auxiliary outlet *d''* and the channel *d* is interrupted thereby. Piston *b* is at this time in its dead-point and fresh steam is entering now the cylinder. This steam keeps, as a matter of course, valve *e* closed, and the latter will remain closed until the piston on its downstroke has cleared the main outlet *d'*, when the pressures on both sides of valve-bottom *e* *e'* will become like, so that the valve is then raised by spring *g* and the remaining steam can again escape through the auxiliary

channel  $d^2$ . Suppose now the speed of the engine increases, and the piston thus makes its path with a greater velocity, (the same being the greatest in the middle part of the path,) the waste steam escaping through the annular space between the lower edge of valve  $e$  and the seat  $a'$  of the latter will be throttled, the degree of throttling being dependent on the degree of velocity of the piston and also on the adjustment of screw  $f$ , as will be clear without further explanation. There arises thus, in such case, a difference of pressure between the spaces of channel  $d$  and cylinder  $a$ —*i. e.*, an overpressure arises within the latter before the auxiliary outlet  $d^2$  is closed by the returning piston. As soon as this overpressure has become as great as to be capable of overcoming the tension of spring  $g$  the valve  $e$  will be pressed down on its seat, so that the further escape of waste steam through channel  $d^2$  is instantly interrupted. This channel will be closed the earlier the quicker the velocity of the piston, and the greater, consequently, the overpressure created by the increased throttling action of valve  $e$ . In either case the steam kept back within the cylinder will be more or less compressed, according to its quantity, so that the speed of the returning piston, and consequently that of the whole engine, is correspondingly lessened thereby.

Having thus fully described the nature of this invention, what I desire to secure by Letters Patent of the United States is—

1. In a steam-engine, the combination with a main exhaust-port situated so as to become uncovered by the piston at one end of its stroke, of an auxiliary exhaust-port situated so as to become covered by said piston near the other end of its stroke; a valve adapted to close the outer end of said auxiliary port, and to be operated by the steam remaining within the cylinder, and compressed by the said piston after the latter has covered the inner end of the said auxiliary port; and a spring tending to keep said valve constantly open, for the purpose as described.

2. In a steam-engine, the combination with a main exhaust-port situated so as to become uncovered by the piston at one end of its stroke, of an auxiliary exhaust-port situated so as to become covered by said piston near the other end of its stroke; a piston-like valve adapted to close the outer end of said auxiliary port, and to be operated by the steam remaining within the cylinder, and compressed by the said piston after the latter has covered the inner end of the said auxiliary port; and a spring tending to keep said valve constantly open, for the purpose as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILHELM SCHMIDT.

Witnesses:

R. HERPICH,  
E. SCHULTZE.