W. J. STEVENS.

VARIABLE EXHAUST.

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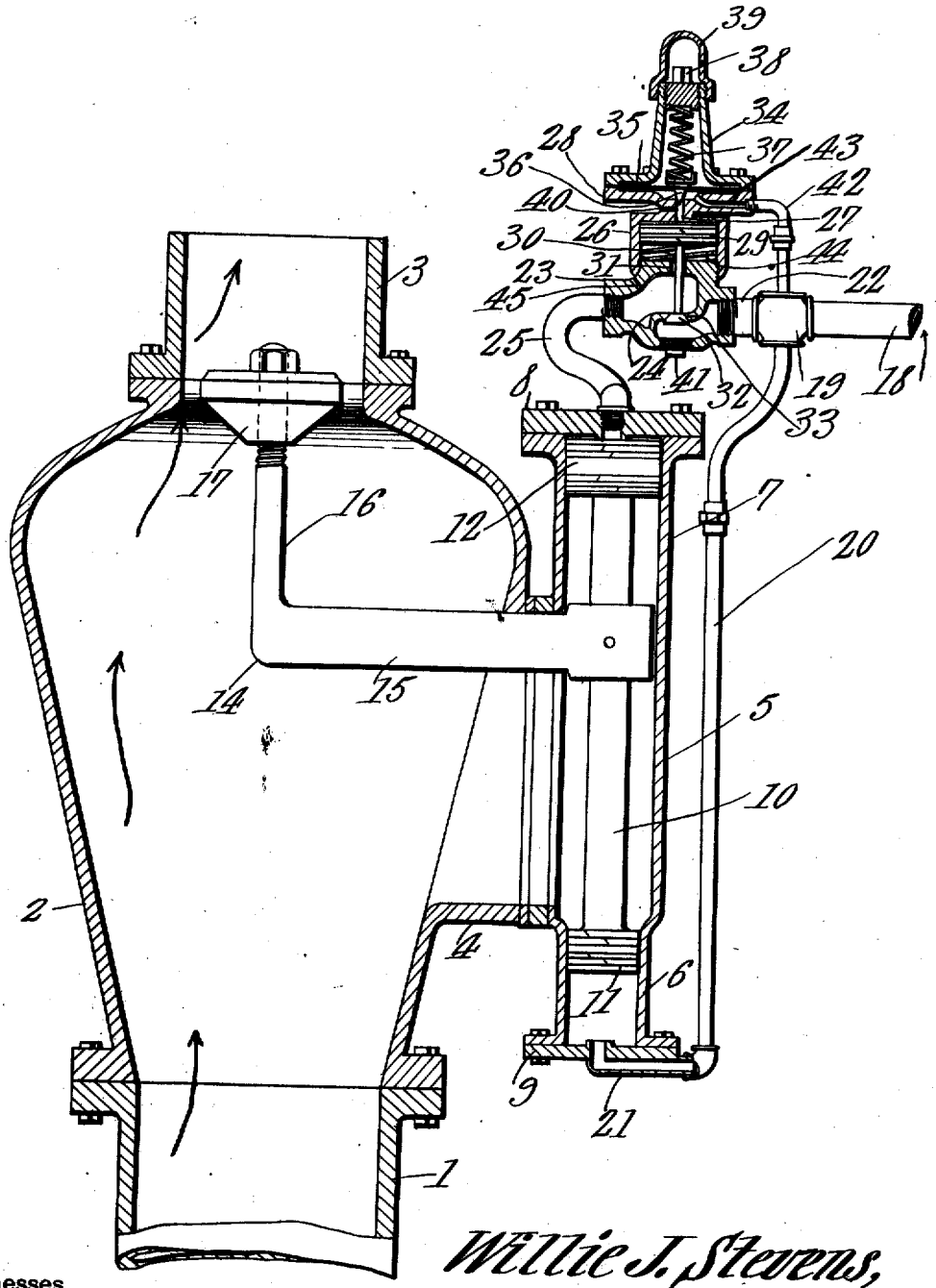
1,006,803.

Patented Oct. 24, 1911.



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VARIABLE EXHAUST.

1,006,803. Specification of Letters Patent. **Patented Oct. 24, 1911.**

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To all whom it may concern:

Be it known that I, WILLIE JUDSON STEVENS, a citizen of the United States, residing at South Poland, in the county of Androscoggin and State of Maine, have invented a new and useful Variable Exhaust, of which the following is a specification.

It is the object of this invention to provide a variable exhaust mechanism whereby the outflow of the exhaust of a steam engine into the stack may be automatically controlled by pressure in the boiler.

Another object of the invention is to provide movable mechanism for throttling the exhaust flow; and to provide novel mechanism, responsive to boiler pressure, to operate said mechanism.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

The device is depicted in a single figure, the same being a longitudinal section, wherein sundry details are shown in elevation.

Referring, then, to this figure, the numeral 1 denotes a saddle which, in a locomotive engine, is located directly in the center line of the smoke stack, the exhaust steam passing from the cylinders of the engine into this saddle 1, and thence upwardly into the smoke stack of the locomotive.

To the cylinder saddle 1 the exhaust stand 2 is secured, the exhaust stand being provided at its upper end with a tip 3, the exhaust, of course, passing through the stand 2 and the tip 3 to enter the smoke stack of the locomotive.

The exhaust stand 2 is provided at one side with an outwardly projecting tubular neck 4, and to this neck 4 is secured, in any desired manner, a cylinder 5, the axis of which is approximately parallel to the axis of the exhaust stand 2. It is to be noted that, for a purpose to be described hereinafter, the diameter of the neck 4 is large.

The lower end of the cylinder 5 is reduced in diameter as shown at 6, while the upper end of the cylinder is, as shown at 7, maintained of the same diameter as the body of the cylinder. To the upper end of the cylinder 5, an upper cylinder head 8 is secured, a lower cylinder head 9 being secured to the opposite end of the cylinder 5, to serve as a closure for the reduced portion 6 of the cylinder.

A piston structure reciprocates in the cylinder 5. This piston structure embraces a piston rod 10, to the lower end of which is secured a head 11, adapted to reciprocate in the portion 6 of the cylinder 5. To the upper end of the piston rod 10, a head 12 is secured, this head 12 being adapted to reciprocate in the portion 7 of the cylinder. The head 12 is of greater diameter than the head 11 and consequently presents a greater area subject to fluid pressure.

To the piston rod 10, intermediate the heads 11 and 12, an arm 14 is secured. The arm 14 comprises angularly disposed segments 15 and 16. The segment 15 of the arm 16 is secured directly to the piston rod 10 and extends through the neck 4 into the exhaust stand 2. The segment 16 of the arm 14 is disposed upright in the exhaust stand 2, and is preferably located in the vertical axis of the exhaust stand. To the upper end of the segment 16 of the arm 14 a cone shaped head or exhaust damper 17 is attached. This head 17, together with the mechanism whereby it is upheld, is adapted to be reciprocated vertically, so that the head 17 alternately may be brought into the tip 3, and withdrawn therefrom.

The head 17, the arm 14 and the piston rod 10 will be referred to hereinafter as the steam-engine-exhaust regulating-means.

In the drawings, a pipe 18 is shown, this pipe communicating with the boiler, and serving as a source of boiler pressure supply. A cross 19 is mounted upon the pipe 18, and from this cross 19 a pipe 20 extends downwardly, this pipe 20 communicating with the portion 6 of the cylinder 5 below the piston head 11. This pipe 20, preferably, as shown at 21, although not of necessity, enters the lower head 9 of the cylinder 5.

A stub pipe 22, alined axially, under ordinary circumstances, with the pipe 18, unites the cross 19 with one end of a casing 23. In the bottom of this casing there is a removable plug 41 whereby the casing may be cleaned out. Formed within the casing 23 is a transverse seat 24. The boiler pressure from the pipe 18 is supplied to the casing 23 upon one side of the seat 24, there being a pipe 25 uniting the opposite end of the casing with the head 8 of the cylinder, whereby boiler pressure may be communicated to the cylinder 5 on top of the piston head 12.

Located above the casing 23, and preferably secured thereto, is a cylinder 26, closed at the top saving for an inlet port 27. This cylinder 26 includes an outstanding table 28.

A piston head 29 is adapted to reciprocate in the cylinder 26, this piston head 29 being secured to a piston rod 30, extending downwardly through an opening 31 in the top of the casing 23. The lower end of the piston rod 30 carries a valve 32, located below the seat 24, and adapted to register in an opening 33 in the seat. When this valve 32 is disposed in the opening 33, steam from the boiler supply pipe 18 cannot pass through the casing 23 into the pipe 25; while, upon the other hand, if the valve 32 be depressed, so that it no longer registers in the opening 33, fluid pressure from the boiler supply pipe 18 will pass through the casing 23 into the pipe 25 and thence into the cylinder 5 upon top of the piston head 12.

Secured to the table 28 of the cylinder 26 is a casing 34. A diaphragm 35 is interposed between the casing 34 and the table 28, the diaphragm being thus bound in place at its periphery, the table 28 and the casing 33 being in contact at their outer edges only. Extended through this diaphragm 35 is a needle valve 36, a compression spring 37, located in the casing 34, pressing upon the needle valve 36, the spring serving to maintain the needle valve 36 seated in the upper end of the inlet port 27.

The pressure which the spring 37 exerts upon the needle valve 36 may be regulated by means of a screw plug 38 threaded into the upper end of the casing 36, the screw plug 38 being, if desired, housed beneath a cap 39, threaded or otherwise secured to the casing 34. Located in the cylinder structure, preferably between the cylinder proper 26 and the table portion 28 of the cylinder, is a minute bleed port 40, communicating at its outer end with the atmosphere, and communicating at its inner end with the inlet port 27. Another minute bleed port 45 is positioned in the casing 23 upon the opposite side of the seat 24 from the boiler supply pipe 18. When the function of this bleed port 45 is pointed out, it will readily be seen that the position thereof may be varied without jeopardizing the working of the device. The valve 32 is maintained seated in the opening 33 by means of a compression spring 44, bearing at its upper end against the piston head 29, and at its lower end against the top of the casing 23. From the cross 19, a pipe 42 leads into a port 43 formed in the table 28, this port 43 discharging below the diaphragm 35.

The operation of the device is as follows, and, referring to the drawing, it may be stated that the figure shows the parts of the device in the positions which they will assume when it is desired to have the exhaust from the cylinders of the engine exert a maximum effort to secure a draft through the smoke stack; the head 17, in such case, being positioned well up into the tip 3, so as to reduce the area of the exhaust discharge, and thus to increase the velocity thereof, with a corresponding increase of draft. In the drawings, the steam from the boiler, entering the boiler pressure supply pipe 18, will pass through the pipe 20 into the portion 6 of the cylinder 5, expanding against the head 11 and raising the piston rod 10 and the arm 14 to hold the conical head 17 in the position shown. The pressure from the boiler cannot pass through the casing 23 into the pipe 25 and thus into the cylinder 5 to expand against the head 12, by reason of the fact that the valve 32 is seated in the opening 33 by the effort of the spring 44 which bears against the piston head 29. Moreover, the steam which is in the pipe 42 and the port 43 cannot pass into the inlet port 27 to actuate the piston head 29, by reason of the fact that the needle valve 36 is maintained seated in the port 27 by the effort of the spring 37. At this point it may be stated that by manipulating the plug 38, the pressure of the spring 37 may be regulated, so that the diaphragm 35 will lift, opening the inlet port 27, under a boiler pressure a few pounds less than pop-off pressure. Supposing, now, that, with the parts positioned as shown in Fig. 1, the exhaust escaping through the tip 3 has created sufficient draft so that the boiler pressure has raised to the point at which the boiler pressure will lift the diaphragm 35. The operation in such case is as follows. The steam, entering the boiler pressure supply pipe 18, will flow through the pipe 42 and through the port 43 beneath the diaphragm 35, lifting the diaphragm and compressing the spring 37, the needle valve 36 being lifted out of the inlet port 27 in the top of the cylinder 26. Steam will therefore flow through the inlet port 27 into the cylinder 26 on top of the piston head 29,

forcing the same downwardly, and compressing the spring 44, the valve 32 moving downwardly, and out of the opening 33 in the seat 24 of the casing 23. Steam from the boiler supply pipe 18 will now pass into the casing 23, through the opening 33, into the pipe 25, and thence into the portion 7 of the cylinder 5 on top of the piston head 12. This piston head 12, being of greater area than the piston head 11 will, together with the piston rod 10, move downwardly, depressing the arm 14 and withdrawing the conical head 17 from the tip 3 of the exhaust stand. The tip 3 will thus be left open throughout its entire cross sectional area, and the exhaust steam from the cylinders of the engine will pass outwardly into the stack, without exerting any appreciable draft. Suppose, now, that the boiler pressure again falls. The operation in such case will be as follows. When the excessive boiler pressure is relieved from the under side of the diaphragm 35, the spring 37 will force the needle valve 36 downwardly, to close the inlet port 27. The steam which is between the upper face of the piston head 29 and the top of the cylinder 26 will ebb away slowly through the port 27 and the minute bleed port 40 thus relieving the pressure on the top of the cylinder 29. The spring 44 will then act against the piston 29, lifting the same, and causing the valve 32, to close the opening 33 in the seat 24. Consequently, steam can no longer pass through the opening 33 into the pipe 25 and thence into the portion 7 of the cylinder on top of the piston head 12. The pressure which is stored in the portion 7 of the cylinder above the head 12, in the pipe 25, and in the casing 23 above the seat 24, will slowly ebb away through the minute bleed port 45, thus relieving the fluid pressure on top of the relatively large piston head 12, whereupon the pressure upon the lower, smaller piston head 11 will cause the piston rod 10 to rise, carrying with it the arm 14, and positioning the conical head 17 again at the place indicated in the drawing.

It is of course to be understood that the bleed ports 40 and 45 are very small, so as not to cut down the working pressures; these bleed ports being merely large enough to allow the pressure to leak away very slowly, under the conditions hereinbefore pointed out.

From the foregoing description it will be seen that the device automatically controls the exhaust and consequently regulates the draft through the stack.

When an engine is equipped with the device of my invention, it is not necessary, in order to regulate the draft, to open the fire box door; an operation which allows cold air to pass into the fire box and through the boiler tubes, to the damage thereof.

Having thus described the invention, what is claimed is:—

1. In a device of the class described, a casing; a valve normally seated in the casing to prevent the passage of fluid therethrough; a cylinder mounted upon the casing and provided with an inlet port; a piston operating in the cylinder and connected with the valve; means for maintaining the valve seated; a diaphragm carried by the cylinder and having means for normally closing the port; a boiler pressure supply discharging into the casing upon one side of the valve, and discharging upon the diaphragm to open the port; steam-engine-exhaust regulating-means reciprocating under fluid pressure; and means for delivering boiler pressure from both sides of the valve to opposite sides of the regulating means.

2. In a device of the class described, a casing; a cylinder thereon, provided with an inlet port; a piston operating in the cylinder; a valve connected with the piston and adapted to seat in the casing; means for maintaining the valve seated; a diaphragm upon the cylinder having adjustably spring pressed means for closing the port; steam-engine-exhaust controlling-means reciprocating under fluid pressure; a boiler pressure supply discharging into the casing upon one side of the valve; and means for delivering boiler pressure from both sides of the valve to opposite sides of the controlling means; there being a bleed port in the device located between the diaphragm and the piston, and a bleed port in the device located between the other side of the valve and the regulating means.

3. In a device of the class described, an exhaust stand; a cylinder secured thereto and opening laterally thereinto; a piston structure reciprocating in the cylinder; a rigid arm projecting laterally from the piston structure and extended into the stand; means upon the arm for throttling the exhaust flow through the stand; and means for delivering fluid pressure to the cylinder to secure a reciprocation of the piston structure.

4. In a device of the class described, an exhaust stand; a cylinder secured to the stand parallel thereto; a piston rod reciprocating in the cylinder; heads of different diameters upon the piston rod; a rigid arm projecting laterally from the piston rod and extended into the exhaust stand; means upon the arm for throttling the exhaust flow through the stand; means for supplying boiler pressure to both heads; and means

responsive to rising boiler pressure to cut off the supply to the larger head.

5. In a device of the class described, an exhaust stand; a cylinder secured to the stand parallel thereto; a piston rod located in the cylinder; heads upon the piston rod adjacent the ends thereof; a rigid angular arm projecting laterally from the piston rod and extended into the exhaust stand; means upon the arm for throttling the exhaust flow through the stand; means for supplying boiler pressure to both heads; and means for cutting off the supply to one head.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

WILLIE JUDSON STEVENS.

Witnesses:
HARRY F. HILTON,
HERMAN E. LEWIS.