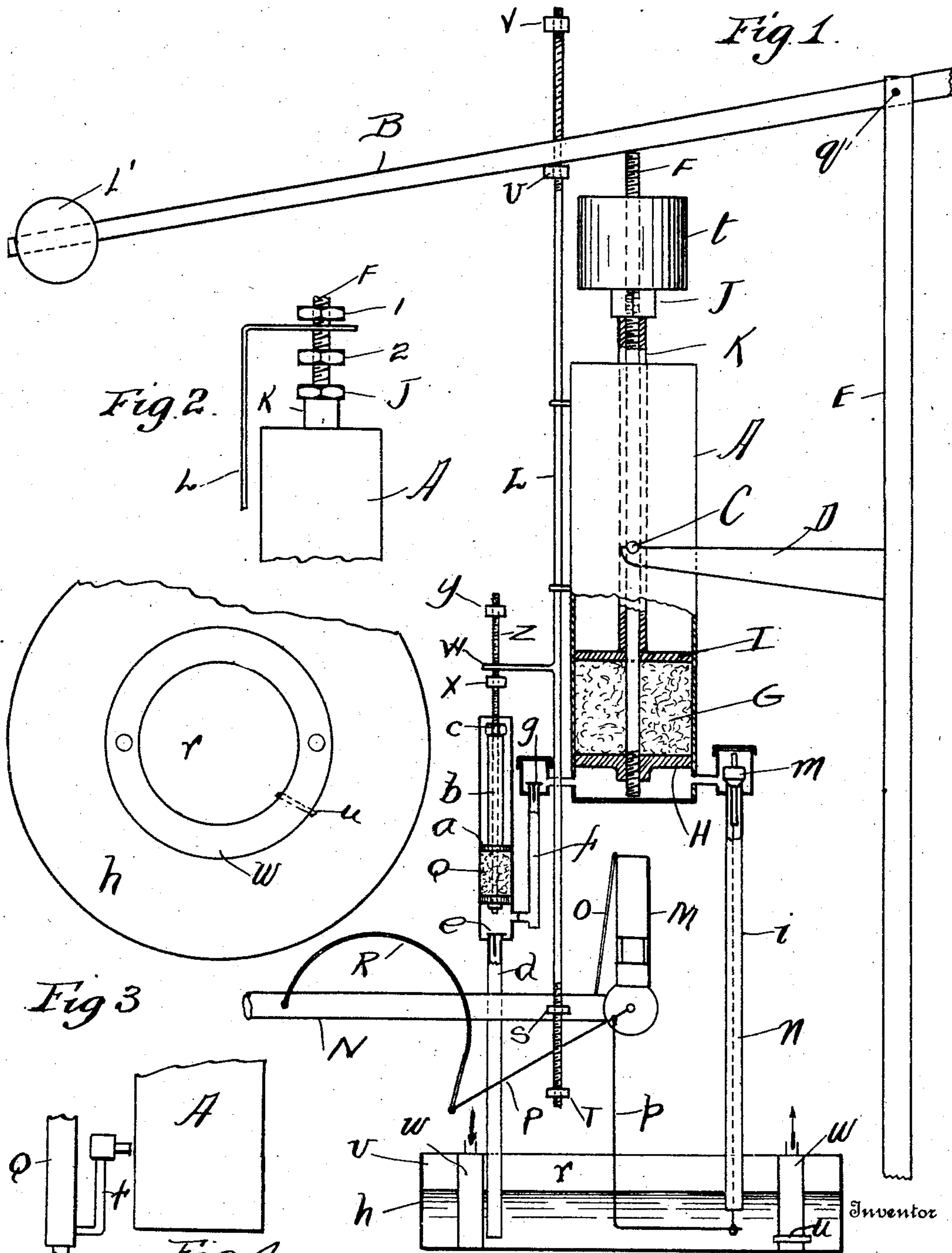


No. 786,321.

PATENTED APR. 4, 1905.

D. M. SMALL.  
COMBINED ENGINE AND BOILER.

APPLICATION FILED OCT. 12, 1903.



Witnesses

Fig. 4.

H. E. Barlow

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Dexter M. Small

# UNITED STATES PATENT OFFICE.

DEXTER M. SMALL, OF PROVIDENCE, RHODE ISLAND.

## COMBINED ENGINE AND BOILER.

SPECIFICATION forming part of Letters Patent No. 786,321, dated April 4, 1905.

Application filed October 12, 1903. Serial No. 176,736.

*To all whom it may concern:*

Be it known that I, DEXTER M. SMALL, of Providence, in the county of Providence and State of Rhode Island, have invented a Combined Engine and Boiler, of which the following is a specification.

Figure 1 of the accompanying drawings, which forms a part of this specification, is a side view, partly in section, showing my device complete. Fig. 2 is a slight modification thereof, and Fig. 3 a plan view of water-supply tank with air-chamber. Fig. 4 is also a slight modification.

The object of my invention is a cheap and simple device for automatically pumping air into gas-generators and also for pumping water and for other uses where a rapid movement of piston is not required.

A represents the cylinder of my engine, to the bottom of which heat is automatically applied at intervals for generating therein the necessary steam to force up the piston, with its load, either directly or through intermediate lever B, with fulcrum at *g*. With lever a slight oscillating motion of cylinder is required and is provided for by bearings C, (one on each side), free to turn on arms D, secured to upright support E.

For convenience in adjusting the packing G without removing piston from cylinder I squeeze down the loose-fitting disk I upon the packing by means of a nut J and intermediate tube or sleeve K. To automatically apply and remove heat from cylinder, I use a rod L, which can be connected with piston-rod F, but preferably with its load or with lever B, as shown, and also with the heating device, so as to remove the heat when the piston or its load has reached its upper limit and to instantly apply it again when load has returned to its starting-point. This can be done with any kind of burner or fuel, either by turning on and shutting off the blaze or by turning burner to one side and then back or by both turning it to one side and shutting off the gas at the same time, all of which I have done; but the device shown is both simple and practical and will sufficiently illustrate this part of my invention.

M is a common atmospheric-gas burner, supported by gas-pipe N.

O is a pilot-light, connected with gas-supply back of shut-off, the arm P of which is raised and lowered by rod L nearly to point where the spring R takes it and instantly opens or closes gas-cock, as the case may be. This is important to insure proper lighting of the burner and for another reason, to be explained farther on, the nuts S and T on rod L being far enough apart so as not to interfere with the quick movement of arm P when the spring comes into action.

The length of the piston-stroke is regulated by position of the adjustable nuts U and V on the rod L, with which the lever B engages to operate rod L, as stated, with the arm W, connected with the injector, the stroke of which I also make adjustable by means of nuts X and Y on stem Z in cylinder Q, the packing of which is also adjustable at top of cylinder by means of disk *a*, sleeve *b*, and nut *c*.

*d* is a suction-pipe extending down into water-supply tank *h*.

*e* is a valve; *f*, pipe leading from injector to cylinder A, with valve *g* as near cylinder as practical.

*i* is the exhaust-steam pipe, also extending down into supply-tank.

*m* is a valve operated by rod *n*, connected with arm P so as to be instantly and simultaneously opened and closed with the opening and closing of the gas-cock, the rod *n* being short enough so as not to touch the stem of valve *m* until raised far enough for the spring R to come into action.

The object of extending exhaust-pipe into supply-tank is threefold—to heat the water-supply, to condense the steam, and to serve as a suction-pipe to supply cylinder A with water in case injector gives out or is omitted altogether, as it can be with a very slow downward movement of piston, giving time for the steam in cylinder A to condense, and thus automatically suck up a fresh supply of water. This requires about half a minute, and with an air blower or pump can be provided for by reducing size of discharge-pipe, so that rod L will not descend too quickly. In either



case, but especially with an air-blower for gas-  
generators, where the descent depends on the  
rate of consumption, it is important to have  
piston forced down (or back to starting-point  
5 where engine is used in a horizontal position)  
by a weight *t* or other device independent of  
and without waiting for the descent of load,  
as the piston must be forced down while the  
cylinder is hot.

10 By utilizing exhaust-pipe for feed-pipe I  
have found that the valve *m* is washed, and  
thus kept clean by the inflowing water, so as  
not to give any trouble whatever even after  
long-continued use, so that this advantage is  
15 thus gained, besides saving expense and care  
of another feed-pump or injector.

To increase rapidity of piston-stroke with-  
out using injector to force water into the cyl-  
inder, (which serves as boiler,) I have ex-  
20 tended the discharge - pipe therefrom up  
against outside of cylinder, as shown in Fig.  
4, to cool it off and have also used air in same  
manner, to either of which methods my device  
is adapted, as also to slow service, without  
25 either an exhaust or an automatic injector, a  
fresh supply of water being occasionally in-  
troduced by hand.

The water-tank, a plan view of which is

shown in Fig. 3, is preferably constructed  
with a small inner chamber *r*, connected by a 30  
small tube *u* with larger chamber *h*, through  
an intervening air space or chamber *w*, and  
preferably with inlet and outlet, through  
which air can be forced to be heated for any  
purpose desired. This air-space is also im- 35  
portant for separating the walls of the inner  
chamber from large water-tank, so as to pre-  
serve the heat of the immediate water-sup-  
ply, and thus save time and fuel in generating  
steam for each stroke of piston. 40

That part of my invention relating to inter-  
mittent application of heat to cylinder is  
practical for hot-air as well as steam engines.

I claim as my invention—

In an engine of the class described, the com- 45  
bination with cylinder A, of a heating device  
thereunder, the heat from which is automatic-  
ally applied thereto when piston is down and  
then removed when piston has been raised to  
its adjusted limit, all substantially as and for 50  
the purpose set forth.

DEXTER M. SMALL.

Witnesses:

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HOWARD E. BARLOW.