

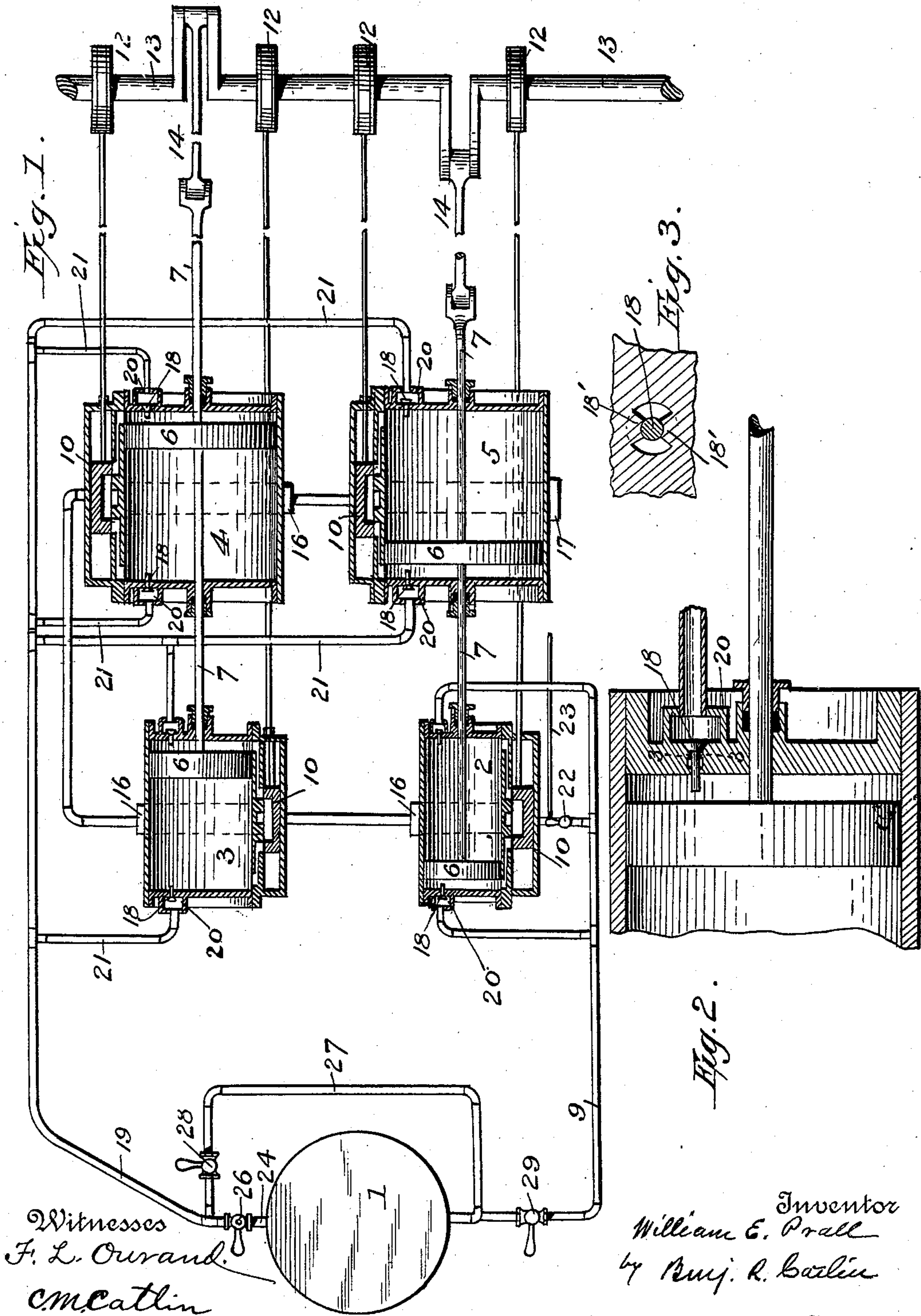
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Patented Nov. 8, 1898.

W. E. PRALL.  
ENGINE.

(Application filed Nov. 22, 1895.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## ENGINE.

SPECIFICATION forming part of Letters Patent No. 613,939, dated November 8, 1898.

Application filed November 22, 1895. Serial No. 589,755. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM EDGAR PRALL, a resident of Washington, in the District of Columbia, have invented certain new and  
5 useful Improvements in Apparatus for Con-  
verting Heat into Power; and I do hereby  
declare the following to be a full, clear, and  
exact description of the invention, such as will  
enable others skilled in the art to which it per-  
10 tains to make and use the same.

The improvement relates to converting  
heat into power, and has for its object to  
make improvements in apparatus therefor,  
and more particularly in means for introduc-  
15 ing and utilizing hot water in the cylinder or  
cylinders in manner to increase the effective  
pressure; and the invention consists in the  
construction hereinafter described and par-  
ticularly pointed out.

20 In the accompanying drawings, Figure 1 is  
a plan, partly in section, of an apparatus suit-  
able for practicing the improvement. Fig. 2  
is an enlarged section of a detail, and Fig. 3  
is a section on line 3 3 of Fig. 2.

25 Referring to Fig. 1, numeral 1 indicates a  
tank adapted to hold superheated water un-  
der a high pressure.

Numerals 2, 3, 4, and 5 denote the cylinders  
of a compound engine. Superheated water  
30 under high pressure is admitted from the  
tank to cylinder 2 and passed from it in the  
form of water and vapor or steam through  
cylinders 2, 3, 4, and 5 in series to drive the  
several pistons by quadruple expansion. A  
35 part of the invention, however, is independ-  
ent of multiplied expansion, being applicable  
to a single cylinder.

6 indicates pistons, and 7 piston-rods.

8 denotes a pipe leading from the bottom  
40 of the water-tank to cylinder 2.

9 denotes valve-chests, and 10 slide-valves  
of usual form.

11 indicates valve-rods, 12 the operating-  
eccentrics, and 13 a crank-shaft.

45 14 are connecting-rods.

16 denotes exhaust-conduits whereby the  
valve-chests of the several cylinders 2, 3, 4,  
and 5 communicate each with the valve-chest  
of the succeeding cylinder, and 17 denotes a  
50 final exhaust.

Water heated to about 400° Fahrenheit can  
be admitted to cylinder 2 through valve-  
chests 9 and exhausted from it through the

several cylinders with the effect to start the  
engine and move it with the power developed 55  
by the vaporization of the water and the con-  
sequent expansion, but such means is im-  
practicable for general use and is only em-  
ployed to start the engine or to utilize a more  
than average of power for special occasions. 60  
The constant use in such an apparatus of a  
sliding valve with water heated to anything  
approaching the temperature named soon de-  
stroys the usefulness of the valve, and it also  
involves an unnecessary waste of the hot 65  
water—that is, of power.

It has been found necessary to provide  
means for introducing hot water into cylin-  
ders in small and measured quantities to  
avoid the waste; but heretofore no means 70  
has been provided for obviating the destruc-  
tive or wearing effect of very high heat and  
pressure upon the valves. To overcome this  
difficulty, I provide pop-valves situated in  
the path of the piston and adapted to be 75  
opened by it very near the end of its stroke.  
18 indicates such valves, and 18' guides for  
their stems. (See Fig. 3.)

19 is a pipe conveying water from the tank  
to the valve-chamber 20 through a branch or 80  
branches 21. The valve-chamber 20 being  
in free communication with the water-space  
of the tank, the valves 18 are normally held  
closed by pressure from the tank and opened  
by the piston at the close of its forward stroke. 85

As it is important that but a small quantity  
of water be admitted at each stroke, the tap-  
pet-valve extends but a small distance through  
the cylinder-wall and the valve is not opened  
until the piston has nearly reached the end of 90  
the cylinder. The valve is moved slightly  
and is open but an instant, the proper effect  
being produced by a momentary contact with  
the piston. At such time the piston-rod, the  
pitman, and the crank should be at or nearly 95  
approaching the dead-center and not far  
enough behind to effect a reversal of the en-  
gine.

As a very small amount of water suffices  
for working the engine, an instantaneous 100  
opening and closing of the valve is required,  
and such an effect cannot be secured when  
valve-gear is interposed with the effect to  
consume time in its movement and hold the  
valve open longer than by the instantaneous 105  
action of the piston upon a puppet-valve,



as herein represented and described. Such speedy and brief opening of the valve is characteristic of the invention, and the direct contact of the piston with a puppet-valve is the most simple and convenient means of effecting it known to me, though others are not excluded, provided they instantaneously open and close the valve with substantially the same effect. By use of the puppet or pop valve wear and cutting, such as are incidental to slide-valves, are avoided.

Obviously the engine cannot be started by the sole use of pop-valves constructed and arranged as set forth. The slide-valve 10 of cylinder 2 can be operated to admit water for this purpose, or other means may be employed. The highly-heated medium admitted to cylinders will tend to maintain initial heat. Said valve and similar valves for controlling the utilization of exhaust in the several cylinders in case of multiple expansion can be used temporarily for ascending steep grades or other purposes requiring an exceptional amount of power, and a cock or valve 22, controlled in any usual way, as by a rod 23, can be provided.

24 denotes a steam-pipe continuous with pipe 19, whereby the steam-space of tank 1 may communicate with each valve box or chamber 20 of cylinders 3, 4, and 5. 26 is a cock or valve back of its connection with pipe 27 to close said pipe 24. 27 is a pipe whereby the lower or water space of tank 1 may communicate with the steam-pipe 24, and 28 is a valve or cock to close such pipe. By suitable manipulation of these valves either hot water or steam or both may be admitted to the valve-boxes and immediately to the cylinders. The several cylinders may be protected from loss by radiation in any usual manner. No special provision for maintaining the heat of the hot-water cylinder 2 is required on account of its small size and the very high heat of water supplied to the entire engine through it.

The amount of steam or water admitted to a cylinder can be regulated by the length of the valve-stem or the manipulation of the main exhaust-valve or by throttling the supply-pipe.

Referring to the drawings, it will be understood that the pistons are represented near the end of the path and that the exhaust-port is in communication with the space about the valve to be opened. The continuance of the piston's travel will open the valve as described and simultaneously the eccentrics will close the said exhaust and open an exhaust-port at the opposite end of the cylinder.

Having described my invention, what I claim is—

1. In an engine the combination of a holder for superheated water under pressure, an engine-cylinder, a charging-conduit whereby the holder and cylinder may communicate, a piston for the cylinder, a valve, means for momentarily opening said valve to admit water to reverse the piston, said valve be-

ing closed by pressure from the superheated water-charging conduit immediately upon the reversal of the piston, and exhausting devices, substantially as described.

2. In a compound engine, the combination of a holder for superheated water under pressure, a charging-conduit, engine-cylinders having valves and valve-casings inclosing chambers in free communication with the holder and in communication with the cylinders when the valves are open, exhausting devices comprising conduits whereby the cylinders communicate to exhaust from one to another and finally from the engine, and pistons for said cylinders, the valves being situated in the path of a moving part of the engine and adapted to admit sufficient water to drive the engine by instantaneous contact at suitable intervals with said moving part, said valves being closed by pressure from the holder immediately upon the reversal of the pistons, substantially as described.

3. In a compound engine, the combination of a holder for superheated water under pressure, engine-cylinders having valves and valve-casings inclosing chambers in free communication with the holder and in communication with the cylinders when the valves are open, conduits whereby the cylinders communicate to exhaust from one to another and finally from the engine, pistons for said cylinders, the valves being situated in the path of the moving part of the engine and adapted to admit sufficient superheated water to drive the engine by instantaneous contact at suitable intervals with said part and closed by pressure from the holder immediately upon the reversal of the pistons, and supplementary devices for starting the engine, substantially as described.

4. In a compound engine, the combination of a holder for superheated water under pressure, engine-cylinders having valves and valve-casings inclosing chambers in free communication with the holder and in communication with the cylinders when the valves are open, the valves being adapted to be closed by pressure from the holder immediately upon the reversal of the pistons, conduits whereby the cylinders communicate to exhaust from one to another and finally from the engine, pistons for said cylinders, said valves being situated in the path of the moving part of the engine and adapted to admit sufficient superheated water to drive the engine by instantaneous contact at suitable intervals with said part, and supplementary devices for starting the engine, said devices comprising a distinct valve and separate superheated water-supply pipe, substantially as described.

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

WILLIAM EDGAR PRALL.

Witnesses:

GEORGE STOLL,  
OTTO MARKUSKE.