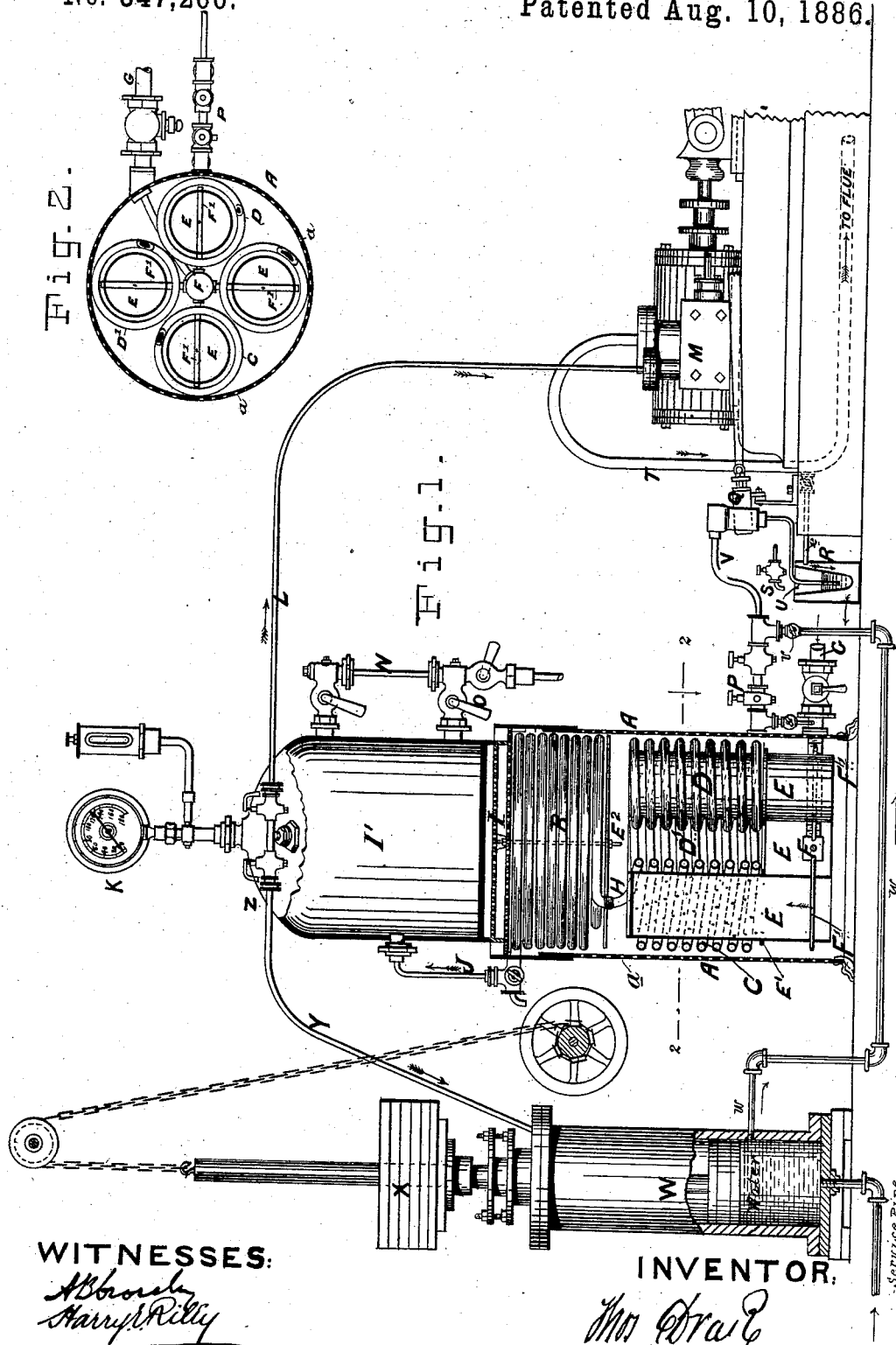


T. DRAKE.
STEAM GENERATOR.

Patented Aug. 10, 1886.



UNITED STATES PATENT OFFICE.

THOMAS DRAKE, OF HUDDERSFIELD, ENGLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 347,266, dated August 10, 1886.

Application filed April 14, 1886. Serial No. 198,845. (No model.) Patented in England July 2, 1885, No. 8,027.

To all whom it may concern:

Be it known that I, THOMAS DRAKE, a subject of the Queen of Great Britain, residing in Huddersfield, England, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to apparatus for generating steam in large volumes and at high pressures by means of heat derived from the burning of gas. I provide a water-heater which consists of an outer casing or shell, within which are placed two or more vertical cylinders or gas-bells, consisting of tubes having their upper ends closed and their lower ends open. Entering the lower portions of these cylinders is a gas-pipe having a burner branching therefrom about the center of each cylinder. The burner has a solid concave cap which projects slightly so as to form a rim, and a series of holes are made in the burner at an angle of forty-five degrees, so that the gas, as it escapes from the perforations in the side of the burner, is thrown up against the inner sides of the two cylinders at the said angle of forty-five degrees. Around each of the vertical cylinders is a coil of metal piping connected together and communicating with a coil of larger dimensions placed in the upper portion of the casing. The water in the coiled pipes is heated by means of jets of gas which issue from a series of holes formed spirally around the two upright cylinders or gas-bells. This form of boiler, combined with other mechanism, I now propose to employ for actuating steam-engines, pumps, and other purposes requiring steam, and in order to carry out my invention with regard to the steam-engine, I place on the top (or other convenient position) of the said water-heater, a vessel, spherical, cylindrical, or of other suitable shape, and made of copper, brass, iron, or other suitable metal. This vessel is connected to one end of the coiled pipes, and forms a steam-dome to receive the steam generated in the pipes, and not for the reception of water, the said steam-dome being provided with a steam and water gage and blow-off valve, in the same manner as an ordinary steam-boiler.

The steam-dome is connected by one or more pipes to the valves of the engine, and is continuously supplied with steam from the coiled pipes. The arrangement and manner of heating forms a rapid and continuous steam-generator.

Such being the nature and object of my invention, I will now proceed to describe the same more fully, and for that purpose have annexed the accompanying sheet of drawings, wherein—

Figure 1 is a sectional elevation of the apparatus I employ for carrying out my invention; and Fig. 2 is a transverse section of part thereof, taken in the plane of the line 2 2 in Fig. 1.

The casing A, which may be of sheet-iron or other material, is open at the bottom and covered at the top by perforated plates I, and by steam-dome I'. Coiled pipes B, C, D, and D', are employed, the lower pipes being supported by flange E', projecting from cylinders E, while the larger coiled pipe, B, is supported by plate and bolt E". The gas-cylinders E are closed at the top and open at the bottom, and have a series of perforations arranged spirally around the portions of the cylinders above the flanges E'. Gas is supplied to the box F from the pipe G, and distributed from box F through pipes running through the cylinders E E E, having an inlet at the center of each cylinder by one or more perforations. The gas thus introduced escapes through the spirally-arranged perforations, and is ignited by means of a taper or other means passed through the hole a.

The several coiled pipes herein enumerated contain water, and in order that there may be through communication between the lower and upper pipes they are connected by branch pipe H to the coil B, by which means a direct and continuous circulation of water takes place from end to end of the coils.

On the top of the water-heater, or in any other convenient place, I fix the dome or vessel I', which is in communication with the water-heater by pipe J, so that as steam is generated in the pipes it passes into and fills the dome, which is practically a receiver of

steam, and is employed for purposes herein-
after explained. This dome is provided with
an ordinary steam-gage, K, and by pipe L is
connected to the valves M of a steam-engine,
in exactly the same manner as the pipe from
a steam-boiler. The said dome is also pro-
vided with a water-gage, N, so that the quan-
tity of condensed water which may get therein
can be seen and let out by tap O.

For the purpose of starting the engine, wa-
ter can be supplied to the heater from the
main service-pipe by tap P, after which it can
be pumped in by the engine-pump Q, and if
necessary the feed-water may be heated before
being pumped into the coiled pipes, and this
I accomplish by the employment of the vessel
R, which, it will be observed, is made in the
form of a jacket, or one vessel within another,
leaving an annular space all around. The
inner vessel is supplied with a small contin-
uous stream of water from tap S, the stream
being equal to the quantity of water required
to keep up a continuous feed. The exhaust-
steam from the engine-cylinder, or a portion
thereof, is then conducted by pipe T to the
jacketed vessel, whereby the water is heated,
as will be well understood, and is pumped by
the engine up the pipe U, and through the
conducting-pipe V. The several taps shown
are necessary for supplying water to start the
engine either by pressure from the main or
by means of the hydraulic cylinder W, as oc-
casion may require, as hereinafter explained.

In places where the pressure of water in the
main is not sufficient I employ apparatus to
increase the pressure, consisting of the hy-
draulic cylinder W, above referred to, the pis-
ton of which is forced down upon the water
within the cylinder by the adjustable weights
X, whereby the water is forced out under
pressure through the pipe *w* to the valve *v*,
which, being opened, admits it to the coils. The
weights X may represent any number of
pounds per square inch; but the pressure can
be further increased by blowing steam upon
the upper surface of the piston, conveyed
thereto by pipe Y from the dome, whereby I
am enabled to equalize the number of pounds
pressure gained in the dome I' by the back-
pressure which operates against the weights
X. Consequently I always obtain and maintain
the same flow of water equal to the pressure
of the weights X.

A stop-tap is shown at Z.

The employment of water from the main
service-pipes or from the cylinder W is only
necessary for the purpose of starting the en-
gine; but immediately the engine is set in mo-
tion the taps communicating with the main
service-pipes or with the cylinder W are at
once closed, and the tap S (which is provided
with a quadrant) is opened, which allows a
stream of water to flow into the jacketed ves-
sel R at a rate equal to the consumption re-
quired by the engine, such said stream of

water being supplied either from the main or
from a cistern or other convenient source.

The jacketed vessel R is heated by the ex-
haust-steam issuing from a small pipe, *e*, so
that the stream of water flowing therein be-
comes heated, which is rendered serviceable
as feed-water, as will be well understood, and
from this time the engine becomes self-main-
taining.

By the employment of steam-boilers in the
manner herein set forth for driving steam-en-
gines many advantages will be found over the
ordinary steam-boiler, such as a saving of
fuel, the more rapid generation of steam, and
the abatement of smoke. Long chimneys are
also rendered unnecessary, and the starting of
the engine is effected in a few minutes. Should
the pipes be overheated and cold water be
quickly introduced, no serious explosion en-
dangering either life or property would take
place, as is the case with the present shell
steam-boilers, because the pipes employed in
the coils of the boiler or water-heater will
rarely, if ever, exceed one and one-half inch
in diameter, and the pressure to burst them
would have to be equal to five hundred pounds
per square inch. As the coils contain only
enough water to generate steam before it has
passed through them, the bursting of a pipe
at any given point of the coil would only dis-
charge a jet of steam of the pressure above
named, and certainly not sufficient water to
destroy life, besides which the peculiar forma-
tion of the boiler, being a coil, prohibits a
possibility of any section being blown out
when the explosion takes place, as is the case
with other boilers of large internal area. As
the domes I' are of small capacity, it is possi-
ble to have them made at a very little cost to
withstand a pressure equal to five hundred
pounds per square inch. The boilers or water-
heaters as herein shown and described may
have as many cylinders E and coiled pipes
connected to them, according to size, as may
be found most compatible with economy, and
according to horse-power required, and sev-
eral such boilers may be combined and de-
tached as is desirable. These forms of steam-
boilers also occupy less room, are less costly,
more powerful, much safer, and take less at-
tention; the pressure of the steam can also be
quickly raised or lowered at once by instan-
taneously extinguishing the gas.

I claim as my invention—

1. The combination, to form a steam genera-
tor, of perforated gas cylinders or bells, gas-
supply pipes delivering thereinto, water-coils
surrounding said cylinders, and a steam dome
or receiver above said cylinders and communi-
cating with said coils, substantially as set
forth.

2. The combination, to form a steam-genera-
tor, of a chamber, A, steam-dome I', coil B,
coils C D beneath, perforated gas bells or cyl-
inders E E within said lower coils, and gas-

pipes delivering gas into said cylinders, with a force-pump, Q, for feeding water through said coils, substantially as set forth.

3. The combination, with a steam-engine and steam-generator, of a hydraulic cylinder, W, for increasing the pressure of water in order to start the engine, substantially as set forth.

In witness whereof I have hereunto signed

my name in the presence of two subscribing witnesses.

THOS. DRAKE.

Witnesses:

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