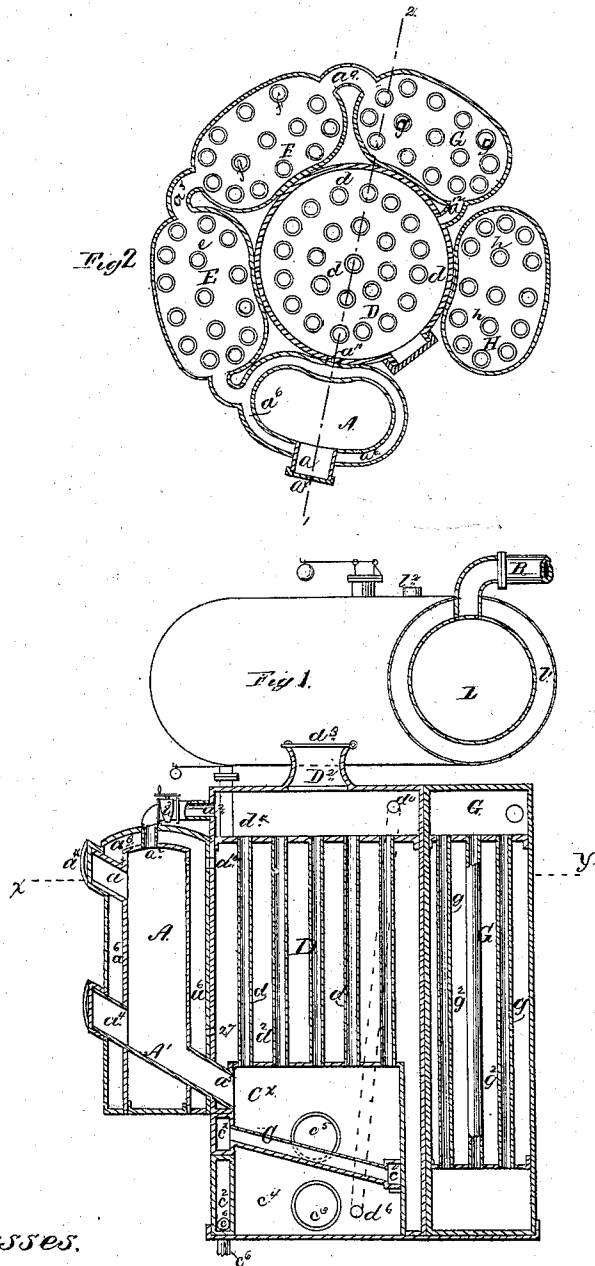


D. PARSELL.
Steam Generators.

No. 137,953.

Patented April 15, 1873.



Witnesses.
Harris C. Clark
Columbus Choate

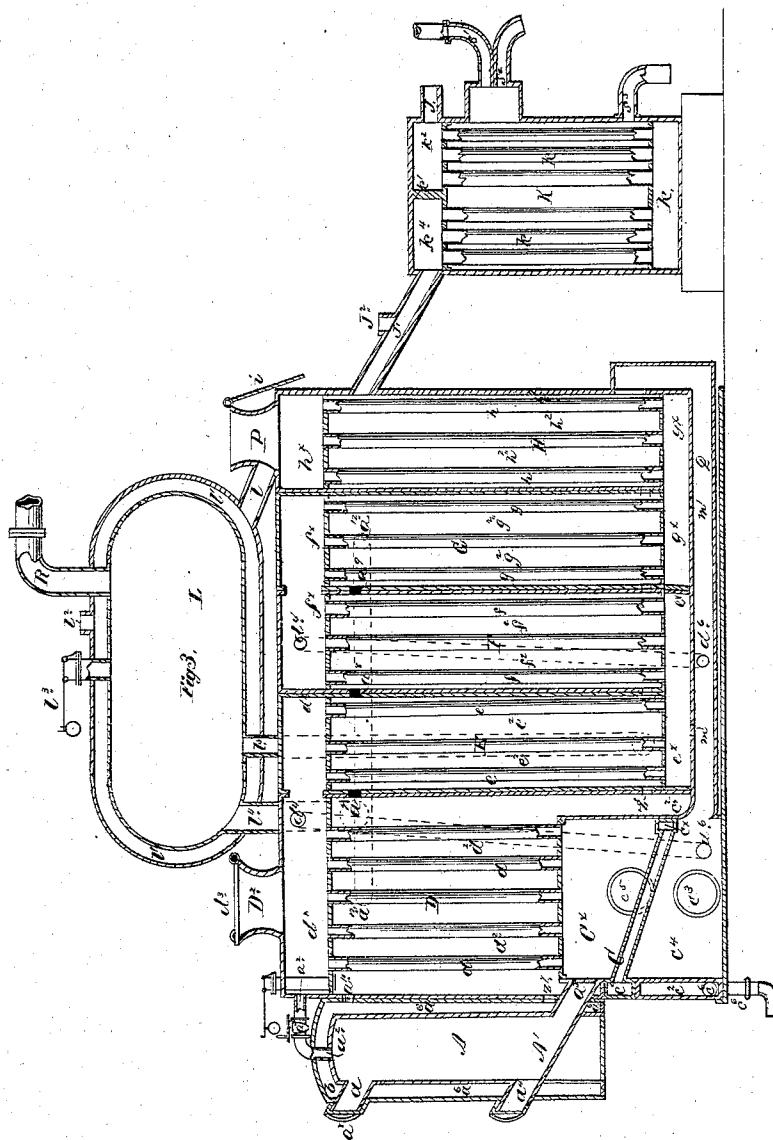
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Fig. 3.



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UNITED STATES PATENT OFFICE.

DAVID PARSELL, OF SAUNDERSFOOT, WALES.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **137,953**, dated April 15, 1873; application filed October 11, 1872.

To all whom it may concern:

Be it known that I, DAVID PARSELL, of Saundersfoot, in the county of Pembroke, Wales, engineer, have invented Improvements in Steam-Engines and Boilers, of which the following is a specification:

The main object of my invention is to utilize waste steam and heat of engines and boilers and prevent noise and discharge of thick vapor and steam.

I use currents or blasts of air for condensing the waste or exhaust steam, and currents or blasts of heated air are injected or introduced into the furnace or fire-place of the boiler to urge the fire and promote combustion. The hot products of combustion rising from the fire are carried through two or more boilers—that is, up through one boiler and down through another, and so on, and thence into a heater to which the air from the condenser passes, and taking up heat from the escaping aeriform products of combustion is injected or blown into the furnace or fire-place through the ash-pit or the fire-bars, or elsewhere to urge the fire.

The aeriform products from the fire may ascend and descend in and through one and the same boiler, and thence pass into the heater. Hollow fire-bars are used by preference, through which air or water is driven, blown, or injected.

I combine with the boiler-furnace a chamber, into which the coal or fuel is fed prior to its reaching the fire-bars, so that while the fuel is in such chamber it shall be subjected to a certain amount of heat, and be thereby heated or partially annealed before it is allowed to pass to the fire-bars.

A series of tubular boilers are arranged side by side around the chief boiler, or otherwise, their interiors being so connected with each other that the heat shall pass up one boiler, down the next, up a third, down a fourth, and so on, until the heat passes into a heater or heating-chamber, and thence into a jacket surrounding a steam-chest, or elsewhere. Into this heater I convey from the condenser the air used to condense the waste steam. The

said air takes up heat from the products of combustion led into the heater from the boilers. This air is then led into the furnace.

The accompanying drawing represents apparatus constructed according to my invention for carrying the same into practical effect.

Figure 1 is a sectional elevation of apparatus constructed according to my improvements; Fig. 2, horizontal section of same. Fig. 1 is taken on the line 1 2 of Fig. 3. Fig. 2 is on the line *xy* of Fig. 1. Fig. 3 is a sectional elevation of apparatus arranged in an extended form for better explaining the invention.

Similar letters of reference indicate similar parts in all the figures.

A is a chamber, into which the coal or fuel is first fed. This chamber is placed next the boiler, and it is charged through an opening, *a*, closed by a door, *a'*, provided with a handle. The fuel in this chamber is subjected to heat derived from the fire and thus annealed. The gases or hot vapors distilled from the fuel pass from the upper part of the chamber through a passage, *a''*, into a space, *d'*, at the upper part of the boiler D. In this passage *a''* is a stop-cock or valve, *a'''*. *a''''* is the door of the chamber A. *A'* is a sloping plate on which the fuel rests, and whence it falls through the passage *a''* on to the fire-bars C; *a''''*, water-space or water-jacket surrounding the chamber A; *a''''''*, aperture or pipe for passage of steam from water-jacket *a''''* into boiler D; *a''''''''*, opening through which water passes into the jacket *a''''* from boiler D into which it is fed by the water-feed pipe *e''*. C^x, furnace, in which is a grate, C, consisting of a set of tubular or hollow fire-bars which fit into square hollow frame-bars *c''* at each end of the grate; *c''*, water-space; *c''''*, door of ash-pit *c''''*; *c''''''*, fire-door; *e''*, water-feed pipe. D E F G are a series of four adjacent tubular boilers, communicating with each other. They may be arranged by placing the boilers E F G round the central or main boiler D, as shown in Figs. 1 and 2; or they may be parallel to each other, as in Fig. 3; or they may be otherwise disposed with regard to each other as convenience may dictate, but always in such

manner that the hot products of combustion may pass up one boiler and down the next, up the third and down the fourth, and also so that the feed-water may pass into all the boilers when fed into one of them. The first or main tubular boiler, steam-generator, or chamber D is directly over the furnace C^x. $a^1 a^2 a^3$ are steam-tubes, through which communication is effected between the boilers so that steam may pass from one to the other. These tubes increase in sectional area in a direct ratio as they are distant from the furnace, as shown in Fig. 3. $d d$ are the fire or smoke tubes in the boiler D; D², mouth, opened by cover or register d^3 to prime the boiler or start the fire; d^4 , mouth of pipe d^5 , leading from the passage Q, hereinafter mentioned, or, rather, from the ash-pit c^4 , into which the passage Q opens. This pipe leads into the space d^x , to admit therein a supply of hot air in order to burn unspent gases proceeding from boiler D and annealing-chamber A. d^4 also marks the opening of another pipe, d^6 , hereinafter described, and leading direct from the passage Q into the space f^x . The hot gases or aeriform products of combustion generated by the incandescent fuel on the fire-bars C pass up through the tubes d into the space d^x , and thence descend through the flues or tubes e of a boiler or generator, E, into the space e^x , whence they ascend through the tubes or flues f of a third boiler, F, into a fourth boiler, G, and descend through its tubes or flues g into a passage or chamber, g^x , whence they pass into a heater or heating-chamber, H, furnished with tubes h , at the top of which is a space or chamber, h^x , having an opening, P, opened and closed by a register or cover, h^1 , which is opened when the aeriform products of combustion are to escape into the atmosphere. When this cover is closed the hot products pass through passages l into jacket l' surrounding steam-chest L. K is a tubular condenser or chamber provided with a number of tubes, $k k^x$, into which the waste steam of the engine is led through an opening, s^1 ; s^2 , opening through which air may be admitted with the steam; J, pipe through which cold atmospheric air passes into the condenser. The pipe J opens into a chamber, k^2 , divided by a partition, k^1 , so that the air is forced to descend one set of tubes, k , into the chamber or space k^3 , into which the tubes open at bottom, and thence the air rises through the other set of tubes, k^x , into the space k^4 , and thence, through pipe J', into heater H.

The steam and air admitted through the pipes $s^1 s^2$ into the condenser K surround the tubes $k k^x$, and are condensed by fresh atmospheric air flowing through these tubes. The water of condensation is discharged through a tube, s^3 , connected with the boilers, so that such water may be conveyed to them and used therein. When air is mixed with

this steam it is discharged through this opening. The air used for condensing the steam passes through tube J' into heater H, carrying with it heat which it extracts from the steam. Most of the air passes down heater H and through passage Q into the ash-pit c^4 , but a portion of the air passes up, through the tubes d^6 , through openings d^4 , at the top of the tubes, into the chambers $d^x f^x$, and passes through openings m into the chambers $e^x g^x$, in order that the unconsumed gases may be kept ignited or in flame.

Sight-holes in convenient position, protected by thick glass disks, allow of inspection of the interior of the boilers.

J², passage for allowing air to escape from passage J¹ when not required to be passed into the heater or the fire. It is closed and opened by a register or damper. L, steam-chest, which is over the boilers D E F G. It receives steam therefrom through the passage l^4 , which may communicate direct with first boiler D or with last boiler G. From the steam-chest L the steam passes to the engine through a passage, R; l^3 , safety-valve on steam-chest L. There should be a safety-valve on each of the boilers D E F G. a^{12} , steam-pipe between G and D. l^5 , passage for carrying priming-water from steam-chest L into boilers. It opens into boiler E near the bottom. l^4 , air-jacket which surrounds steam-chest L and is fed with heated air through passage l from space h^x ; l^2 , opening for allowing the heated air to escape. It is opened and closed by a lid.

The frame of locomotive-engines carrying the apparatus for condensing the steam by air is advantageously constructed, especially for engines intended to travel through tunnels, with a conical or bell-mouth-shaped opening at front, so that air may pass readily into the condenser.

A fan or other contrivance for producing a blast may be placed in a convenient position to blow air through the condenser and thence to the heater and thence to the fire.

Instead of using a series of tubular boilers, as above described, and causing the hot products of combustion to pass up one such boiler, down the next, and so on, I sometimes use one or a single tubular boiler and connect its tubes by branch pipes or partitions in such manner that the hot products of combustion shall pass up one set of tubes and down another set of tubes, or up one tube, down another, up a third, and so on in the same boiler. Also, instead of a tubular condenser, a condenser may be used in which the steam is made to pass through compartments formed by thin plates or partitions, which also divide it from the air used for condensing such steam, parallel compartments being thus formed for the passage of the steam to be condensed and others for the air for condensing it.

d^2 e^2 f^2 g^2 indicate the water-spaces of the boilers D E F G, respectively; h^2 , air-spaces of heater H.

Having now described the nature of the said invention, I declare that I claim—

1. The combination of the main boiler D with the series E F G and fuel-chamber A, as described.

2. In combination with the elements of the first claim, the heater H.

3. The generator described, consisting of

furnace C, fuel-chamber A, the boilers D E F G, heater H, and condenser K, all combined and arranged as described, for the purpose set forth.

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Witnesses:

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