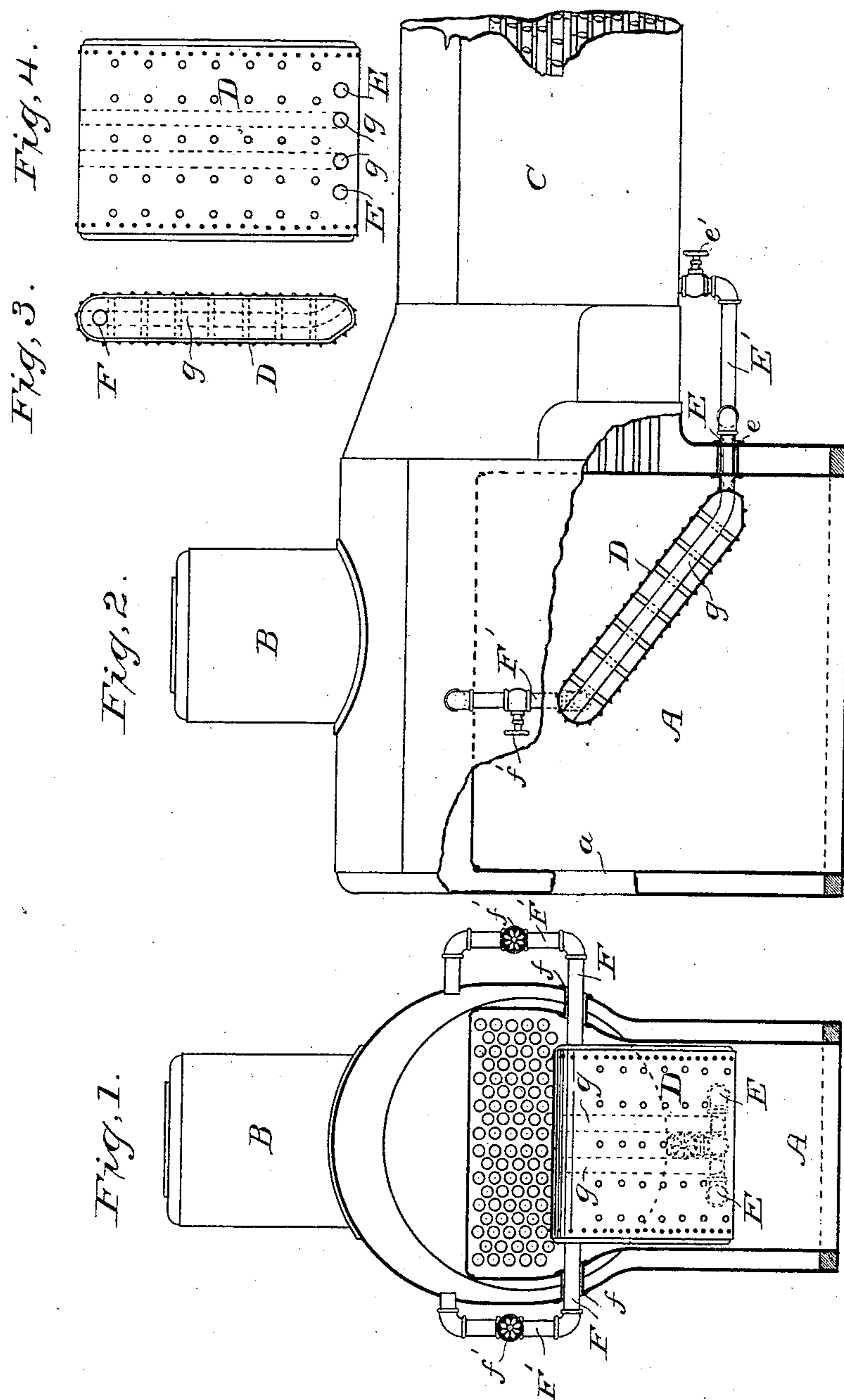


(No Model.)

W. H. LEWIS.
STEAM GENERATOR.

No. 326,510.

Patented Sept. 15, 1885.



WITNESSES
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WILLIAM H. LEWIS, OF GRAND CROSSING, ILLINOIS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 326,510, dated September 15, 1885.

Application filed June 8, 1885. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENRY LEWIS, a citizen of the United States, residing at Grand Crossing, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

It has heretofore been proposed to introduce water-bridges into the fire-boxes of steam-generators, through which circulation is established from the bottom of the boiler-barrel to the water-space over the crown-sheet as it is heated by the impinging flames, and over the top of which the incandescent gases and products of combustion are drawn on their way to the smoke-stack.

The object of my invention is to provide a water-bridge of such nature, which may be readily detached and removed from the fire-box without leaving a water inlet or leak by the removal of any of the fastenings or connecting devices; to promote and increase the circulation of the water therethrough, so that it may rise rapidly by the laws of ebullition to the space above the crown-sheet, and to increase and make more perfect the consumption of the products of combustion by the introduction of heated air currents or jets from the exterior along the top of said bridge to mingle with the incandescent gases and other products drawn over its top at that point; and it consists in suspending an inclined water-diaphragm within the fire-box by means of pipes at bottom and top passing through timbles or flues permanently formed in the side walls of said box, so as to hermetically close the water-space between the inner and outer sheets of said walls, and leading to connections, respectively, with the water-space below the boiler-barrel and that above the crown-sheet; in coupling said pipes first to the diaphragm to lead to and from the water-space therein, and next to other or secondary pipes or pipe-sections exterior to the fire-box, and forming the immediate connections with the two water-spaces mentioned, whereby the bridge or diaphragm may be removed by uncoupling the first or primary sections; in providing said secondary pipes or pipe-sections with stop-cocks, whereby the flow of wa-

ter may be shut off and the supporting-pipes uncoupled therefrom to remove the water-bridge; in admitting exterior air for circulation through flues in the water-bridge, whereby the temperature of the water at the foot and top of the bridge is relatively more changed; in providing said water-bridge with flues extending from a connection with the external air at the foot thereof to the top, and opening along said top, that the currents of air heated during their passage through said flues may enter the incandescent gases and products of combustion drawn thereover on their way to the smoke-stack and renew the supply of oxygen, and in various other combinations and details of construction hereinafter set forth and claimed.

In the drawings, Figure 1 is a rear elevation in section of a steam-boiler embodying my invention. Fig. 2 is a side elevation thereof with the wall of the fire-box broken away to better expose the parts relating to the invention; and Figs. 3 and 4 are respectively a side elevation and a plan of the water bridge or diaphragm detached.

A represents the fire-box or fuel-chamber, having the usual door, *a*, through which it is fed.

B is the steam-dome, and C the rear end of the barrel, of an ordinary locomotive steam-generator, which I have chosen for the purpose of explaining my invention, without, however, intending thereby to be limited to its application to generators of such construction alone.

D is a water bridge or diaphragm, consisting, essentially, of a hollow box constructed of steel plates or other suitable metal, and securely stayed, extending from side to side of the fire-box, but not attached to the walls thereof, and admitting a sheet or blanket of water of about six inches in diameter or other suitable thickness. This bridge or diaphragm is to be suspended in the fire-box diagonally from a point below the flues, thence backward and upward at an angle of about forty-five degrees to a point, say, about sixteen inches from the crown-sheet; and for the purpose of avoiding leaky joints, and in order to readily remove the bridge, if desired to use the generator

without, I intend that it shall, as just stated, be entirely disconnected from the side sheets of the fire-box. It is suspended by means of pipes passing through thimbles set in the water-space between the fire-box sheets and the shell of the boiler, and hermetically secured to both.

Said pipes are arranged as follows: Two pipes, E, coupled to and discharging within the lower extremity of the deflector, and of, say, two inches diameter, pass through the thimbles *e*, set in the water-space between the flue-sheet and connection-sheet of the boiler, and are then coupled to another pipe or pipes, E', of corresponding capacity, provided with a stop-cock, *e'*, and entering the barrel of the boiler at its bottom. Pipes F extend horizontally from both sides of the deflector at the top and pass through thimbles *f* in the side water-spaces, then are coupled to vertical pipes F', provided with stop-cocks *f'*, and leading to the water-space in the boiler immediately above the top of the crown sheet and at the sides thereof.

Should it be desired to remove the bridge or diaphragm, the stop-cocks will be closed and the pipe-sections extending immediately from the diaphragm will be uncoupled therefrom and from the others, allowing the diaphragm to be taken out, when the thimbles or flues will serve for the introduction of exterior air to promote combustion. The stop-cocks will also be used in case of leakage in the bridge or in the intermediate pipes.

The water introduced into the bridge or diaphragm at its lower end, being drawn from the bottom of the boiler-barrel, will be relatively cooler than that above the crown-sheet, and will therefore rise within the diaphragm, according to well-known laws, passing through the upper pipes under the space above the crown-sheet, keeping up a constant circulation, and greatly increasing the steam-producing capacity. To promote the circulation, however, I introduce air-flues *g*, extending from the bottom to the top of the diaphragm, and at their foot passing through flues or thimbles similar to the foregoing in the water-space between the flue-sheets and boiler-connection sheets to the external air. This, as it enters, will be of a lower temperature than the water in the box, and may slightly reduce it, but as it ascends will be heated to an equal temperature, thus increasing the circulation through ebullition.

For the further purpose of promoting the entire consumption of the incandescent matters, thus economizing fuel and suppressing smoke, these just-mentioned air-flues open at the top of the diaphragm into the fire-box, that the incandescent gases and other unconsumed products of combustion drawn thereover may receive the jets of heated air therefrom and be further enkindled by the fresh supply of oxygen.

In removing the diaphragm the air-flues will afford no obstruction after the water-pipes

are uncoupled, as they simply extend to, or part way to, the exterior of their respective thimbles, and are readily withdrawn therefrom.

One effect of my improvement, additional to those already enumerated, is that the expense and trouble caused by the deposit of sediment and incrustation of boilers are reduced to a minimum, and, as to the barrel of the boiler, wholly prevented. The feed-water being introduced into the latter, precipitation of all impurities at once takes place, and the current passing through the diaphragm immediately sweeps this sediment off and discharges it above the crown-sheet, at each side of the same, whence it sinks into the boiler-leg vertically beneath, the natural receptacle, and from this it will be removed by the ordinary process of blowing off and washing.

So far as relates, broadly, to the employment of air-flues passing through the water-bridge either to promote the circulation of the water therein or to conduct heated air to the top of the bridge and discharge it into the gases passing thereover I do not intend to limit myself to their use in connection with a bridge detachably suspended, or suspended by the specific connecting devices herein described. Nor do I intend to limit myself to the use of these connecting devices with a water-bridge provided with air-flues; but

What I claim, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinbefore set forth, in a steam-generator, of an inclined water-diaphragm suspended within the fire-box by means of pipes at bottom and top, thimbles or flues permanently formed in the side walls of said box, through which the pipes pass, and induction and eduction passages, respectively, from the water-space at the bottom of the boiler-barrel and above the crown-sheet of the fire-box for said pipes.

2. The combination, substantially as hereinbefore set forth, in a steam-generator, of an inclined water bridge or diaphragm suspended within the fire-box, pipes coupled to the bottom and the top of the diaphragm to lead to and from the water-space therein, thimbles or flues permanently formed in the side walls of the fire-box, through which the pipes pass, and exterior pipes connecting with the water-spaces, respectively, at the bottom of the boiler-barrel and at the top of the crown-sheet, to which said primary pipes are coupled, whereby the bridge or diaphragm may be removed by uncoupling the first or primary pipes.

3. The combination, substantially as hereinbefore set forth, in a steam-generator, of a water bridge or diaphragm suspended therein at about the inclination mentioned, so as to leave a space between its top and the crown-sheet for the incandescent gases to be drawn through, induction-pipes coupled to said diaphragm at the bottom, eduction-pipes coupled to said diaphragm at the top, thimbles permanently connecting the fire-box sheets with

the shell of the boiler, through which said pipes pass, secondary pipes leading, respectively, from the bottom of the boiler-barrel to the pipes at the bottom of the diaphragm and from the pipes at the top of the diaphragm to the water-space above the crown-sheet, and stop-cocks set in said secondary pipes.

4. The combination, substantially as hereinbefore set forth, with an inclined water-diaphragm in the fire-box, of induction-pipes leading from the bottom of the boiler to the foot of the diaphragm, and eduction-pipes leading from the top of the diaphragm to a discharge-point near the crown-sheet and over the water-space in the leg of said boiler, whereby sediment will be drawn from the barrel and deposited in the leg.

5. The combination, substantially as hereinbefore set forth, in a steam-generator, of the inclined water bridge or diaphragm in the fire-box, the thimbles connecting the front sheet of the fire-box or flue-sheet with the connection-sheet of the boiler, induction-pipes passing through said thimbles, entering the bottom of the diaphragm, and fed from the bottom of the boiler-barrel, eduction-pipes passing horizontally from each side of the diaphragm at its top through thimbles connecting the side sheets of the fire-box with the side shell of the boiler, vertical pipes to which said eduction-pipes are coupled, and induction-passages from said vertical pipes into the water-space immediately above the crown-sheet.

6. The combination, substantially as hereinbefore set forth, with a water-diaphragm set in the fire-box, of flues or passages therethrough connecting with the external air at the bottom of the fire-box, whereby the circulation of water through the diaphragm is promoted.

7. The combination, substantially as hereinbefore set forth, with a water-diaphragm set in the fire-box, of flues or passages passing therethrough from bottom to top, at the bottom opening into the external air, and at the top opening into the fire-box beneath the crown-sheet, whereby the incandescent gases drawn between the top of the diaphragm and the crown-sheet are given a fresh supply of oxygen without reducing their temperature.

8. The combination, substantially as hereinbefore set forth, in a steam-generator, of a water-diaphragm suspended within the fire-box and inclining upwardly and rearwardly from the front wall thereof, thimbles connecting the inner sheet of the front wall with the outer sheet or connection-sheet of the boiler-barrel, and air-flues extending from bottom to top of said diaphragm and passing into or through said thimbles to receive the external air.

9. The combination, substantially as hereinbefore set forth, in a steam-generator, of a water bridge or diaphragm suspended therein and inclined upwardly from front to rear, induction-pipes leading from the bottom of the boiler-barrel to the bottom of the diaphragm and having removable sections, eduction-pipes leading from the top of the diaphragm to the water-space above the crown-sheet, and also having removable sections, and air-flues passing through the diaphragm from bottom to top and into or through thimbles in the front wall of the box to receive external air, whereby said diaphragm may be detached by uncoupling the removable section in its induction and eduction pipes.

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Witnesses:

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