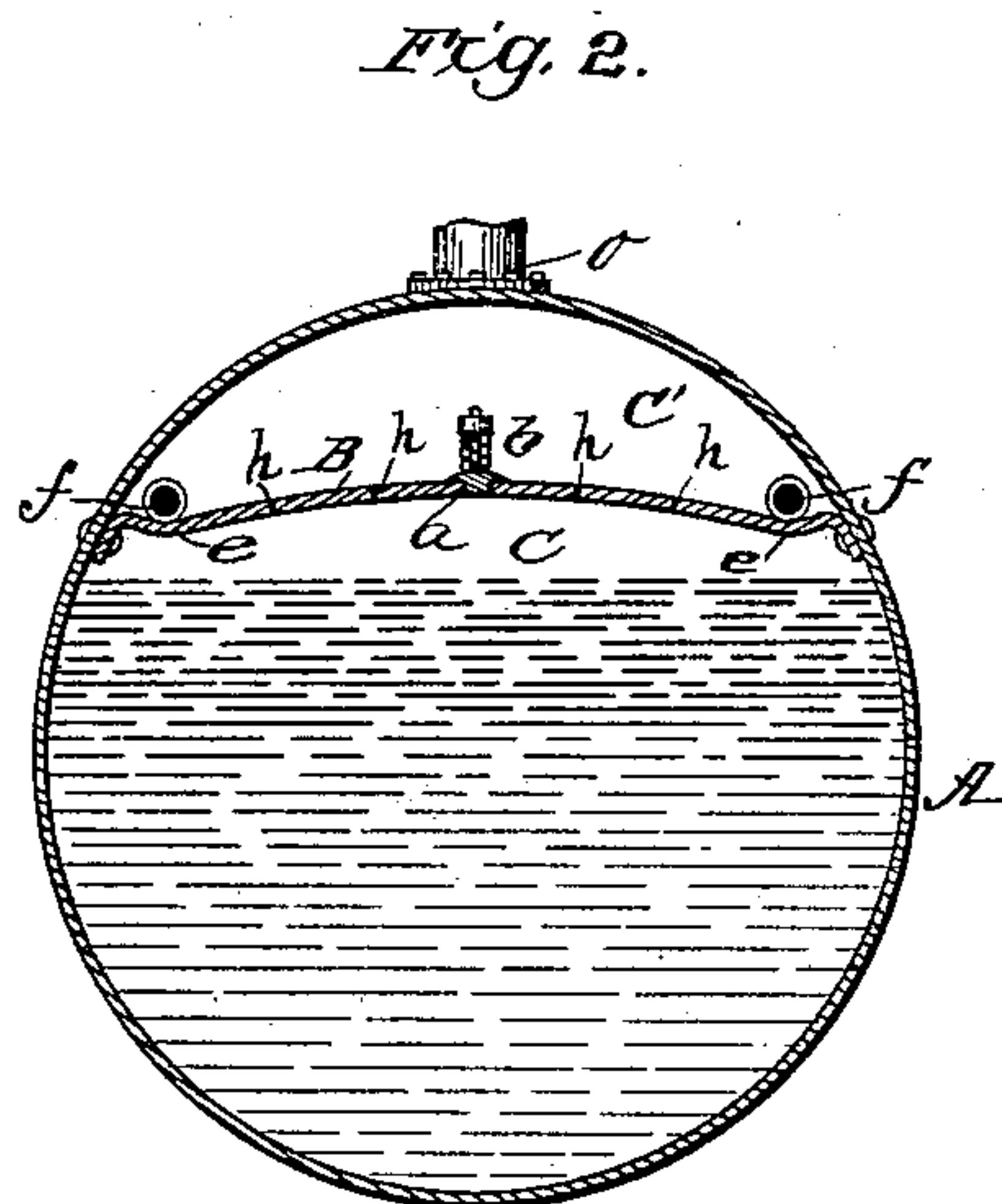
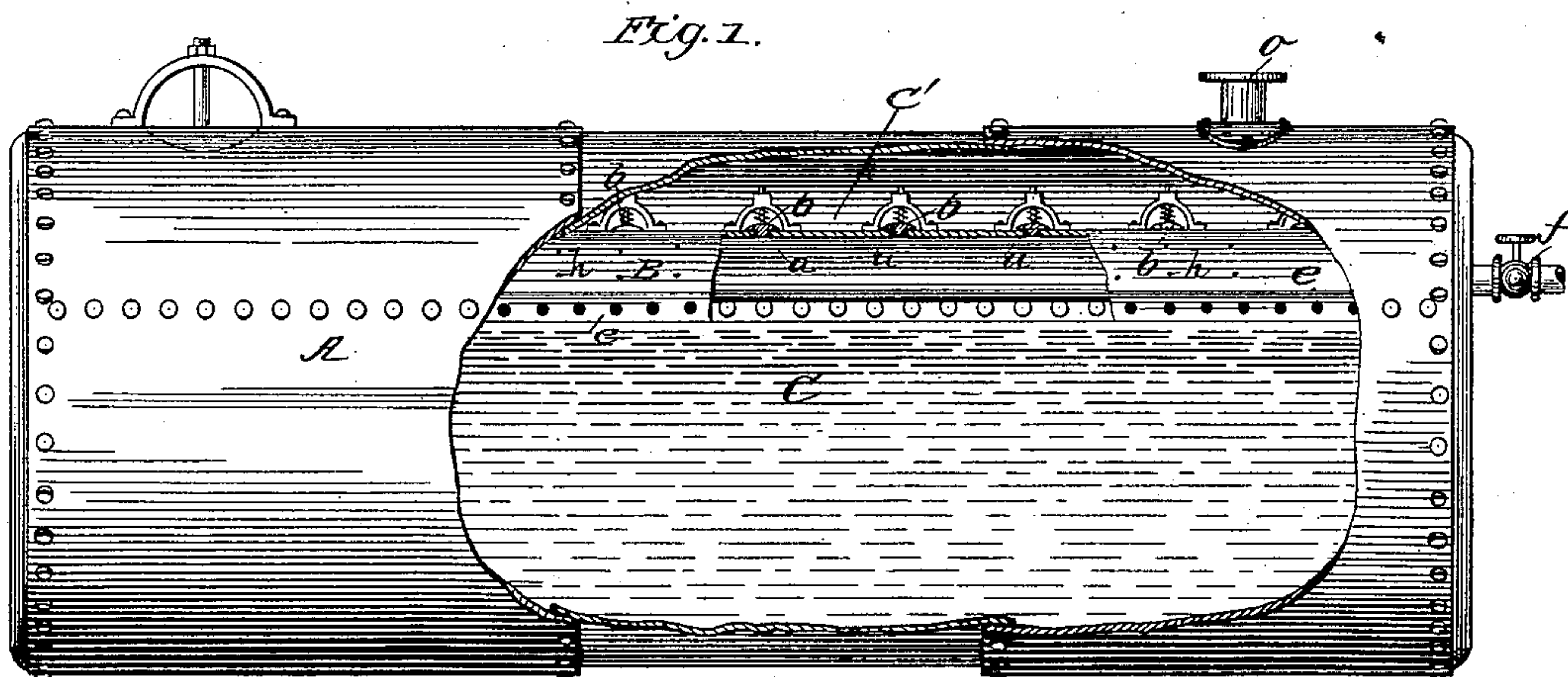


(No Model.)

D. T. LAWSON.
STEAM BOILER.

No. 407,538.

Patented July 23, 1889.



WITNESSES:

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DANIEL T. LAWSON, OF WELLSVILLE, OHIO.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 407,538, dated July 23, 1889.

Application filed February 13, 1889. Serial No. 299,787. (No model.)

To all whom it may concern:

Be it known that I, DANIEL T. LAWSON, of Wellsville, in the county of Columbiana and State of Ohio, have invented a new and useful
5 Improvement in Steam-Boilers, of which the following is a specification.

My invention comprehends certain improvements upon the steam-boiler patented by me April 27, 1880, No. 227,024. In that patent I
10 described and claimed a process of preventing steam-boiler explosions by retarding or prolonging the flow of steam from the water-space to the steam-space by means of a diaphragm or partition having a valved opening
15 of less size than the outlet from the steam-space, whereby the sudden conversion of water into steam (due to the abstraction of steam from the steam-space) is prevented and its concussive effect upon the boiler is avoided.
20 In accordance with my theory as expressed in that patent and subsequently confirmed by the report of United States engineers upon the subject it has been demonstrated that steam-boiler explosions are mainly due to a
25 sudden reduction of steam-pressure and the immediate conversion of hot water into steam with explosive energy, which, having no relief, bursts the boiler. The causes which produce this sudden reduction of steam-pressure
30 upon the water are, first, the sudden opening of the throttle-valve and rush of steam into the cylinder, being instantly followed by the closure of the steam-port, as in starting the engine, and, secondly, the injection of cold water into the steam-space in starting the feed-pumps, which causes an instantaneous condensation of steam, this being liable to occur
35 when the inlet end of the feed-water pipe terminates too high in the boiler, or when the feed-pipe is uncovered by the lowering of the water in the boiler by the careening of the boiler on shipboard. It will thus appear that a risk of explosion is always involved when steam is allowed to escape from the boiler and
40 its escape suddenly arrested, or the pressure upon the heated water in the boiler is suddenly reduced without adequate vent to carry off the concussive strain produced by the bursting of the heretofore quiescent hot water into steam.
50

In the patent before referred to I employed a slide-valve attached to a stem and extend-

ing through the shell of the boiler, which valve could be adjusted at will over the opening in the diaphragm separating the
55 steam from the water space. As the adjustment of the size of this opening to the escape of steam required nice judgment on the part of the engineer, only the most expert engineers could make available the full advantages of
60 my invention, while the other class of unskilled engineers are the very ones who need it most.

My present invention is intended to render the boiler automatic in its action in accordance with my theory, so that all may profit by
65 its advantages without the exercise of judgment, and whereby also the firing-surface of the boiler is rendered free from incrustation and self-cleaning to a certain extent.
70

Figure 1 is a side elevation of the boiler with a portion of the shell and also a portion of the diaphragm broken away to show the internal construction, and Fig. 2 a transverse
75 section of my improved boiler.

A is the shell of the boiler.

B is the horizontal diaphragm, running lengthwise the boiler and separating the water-space C from the steam-space C'. This boiler may be of any desired size or shape,
80 and may be provided with return-flues or fire-tubes.

In the diaphragm B are formed several openings *a*, and over each of these openings is arranged a check-valve *b*, opening upwardly
85 and held down by a weight or spring. The aggregate size of these openings is considerably less than the size of the steam-outlet *o* from the steam-space, so that steam will pass from the lower space C to the upper space C'
90 somewhat slower than it will escape from the upper space through the steam-outlet, so that no matter how impulsive or intermittent the escape of steam from the steam-space may be the passage of the steam from the lower space
95 C to the upper space C' is more or less constant or prolonged through a greater space of time, thus avoiding a sudden removal of pressure from the water and the resultant concussive strain. These automatic valves open
100 whenever the steam-pressure is reduced by discharge from the upper space C', and they serve another very important function, which I will now proceed to explain.

I have found in the operation of my boiler that all the sedimentary matters which produce scale or incrustation are thrown up on the diaphragm, and if they can be held there
5 and eliminated before they are allowed to wash back into the water-compartment by overflow of the diaphragm (which may under certain conditions occur, and cause them to settle upon the bottom plates and flues, where
10 they may be burned into adherence to the iron) my boiler can be made self-cleaning and free from scale. Ordinarily, when the boiler is in action, the sedimentary matters when first eliminated do not adhere to the
15 boiler; but when the boiler is at rest they settle down upon the fire-surface of the boiler, and when the boiler is fired up they become burned into an adhering incrustation, which in a short time seriously interferes with the
20 steaming capacity of the boiler, involving a great waste of fuel, as well as injury to the iron. With my diaphragm these sedimentary matters pass to the upper side of the diaphragm when the boiler is in action, and are
25 there retained by the automatic check-valves on a surface out of contact with the fire, where they cannot become incrustated, but may be blown off in the form of a slush or semi-fluid mass. To facilitate this action, the
30 diaphragm is formed with trough-like grooves *ee* on its opposite sides, and at the lower ends of these troughs there are blow-off pipes *ff*, by which the troughs may be cleaned of their load of impurities. By this means the firing-
35 surface of the boiler as well as flues is always

kept clean and free from incrustation and capable of a maximum steaming effect.

In connection with the valved openings in the diaphragm, I may use a number of small holes *h* through the diaphragm of about a
40 quarter of an inch in diameter, which act in conjunction with the valved openings, but which always remain open and effect the liberation of perfectly dry steam. These open-
45 ings should, however, be computed in with the valved openings in determining the aggregate area of the openings in the diaphragm, which should always be kept considerably below the area of the discharge-openings from
50 the steam-space.

Having thus described my invention, what I claim as new is—

1. A steam-boiler having its steam-space separated from the water-space by a horizontal diaphragm provided with openings in the
55 same, and combined with upwardly-opening check-valves arranged upon the diaphragm, substantially as and for the purpose described.

2. The combination, with a steam-boiler, of a horizontal diaphragm separating the steam-
60 space from the water-space and provided with upwardly-opening check-valves and gathering-troughs for sediment, and blow-out pipes extending through the boiler from the level of the troughs, substantially as and for the
65 purpose described.

DANIEL T. LAWSON.

Witnesses:

A. B. JENKINS,
A. G. SMITH.