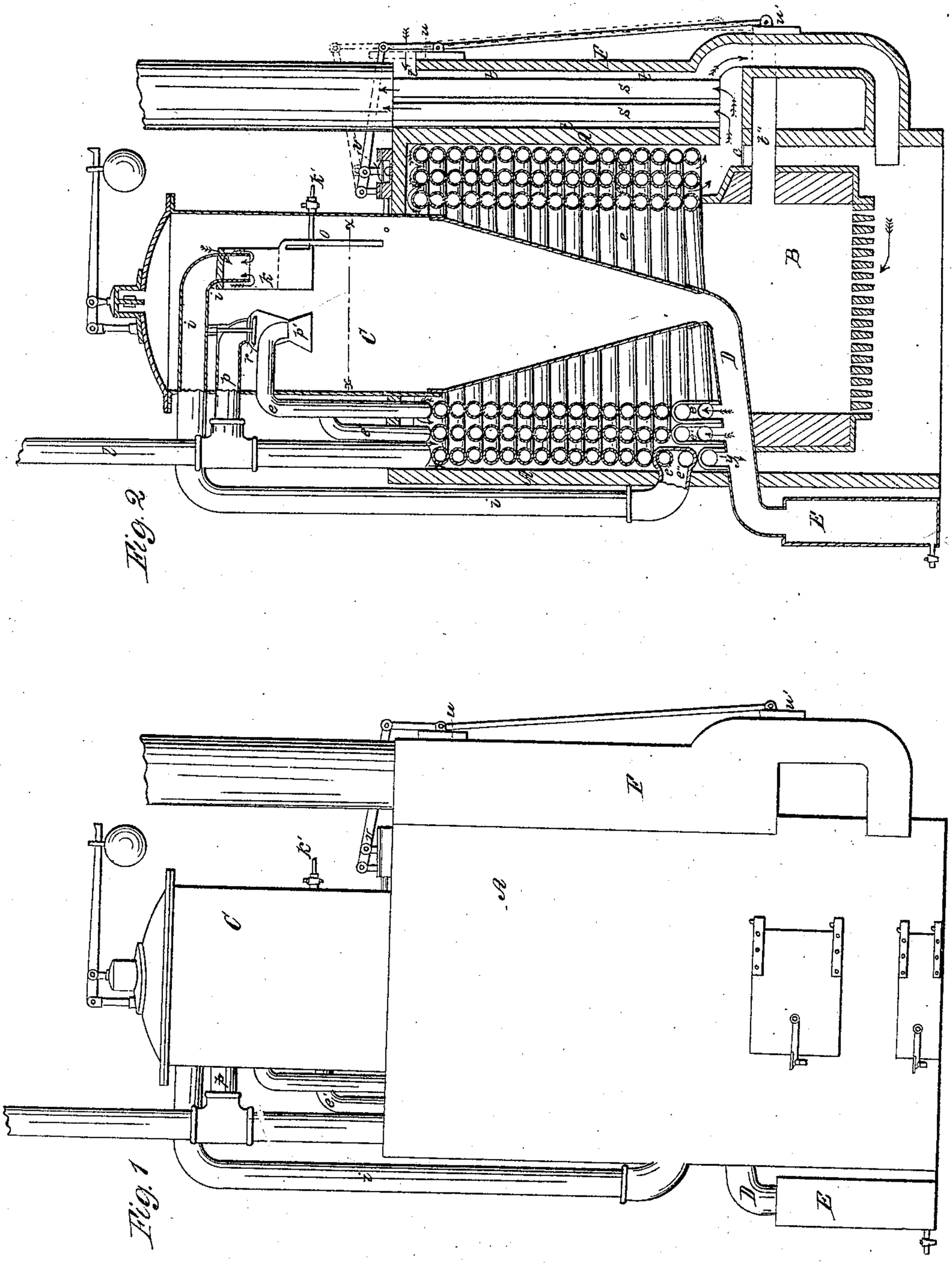
O. M. Stillman & S. Wilcox, Jr.,

Steam-Boiler Water-Tube.

No. 14,523. Patented Mar. 25, 1856.



UNITED STATES PATENT OFFICE.

O. M. STILLMAN AND STEPHEN WILCOX, JR., OF WESTERLY, RHODE ISLAND.

STEAM-BOILER.

Specification of Letters Patent No. 14,523, dated March 25, 1856.

To all whom it may concern:

Be it known that we, O. M. STILLMAN and STEPHEN WILCOX, Jr., of Westerly, county of Washington and State of Rhode Island, have invented certain new and useful Improvements in Steam-Boilers; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawing, making a part of this specification, in which—

Figure I is a side view or elevation of our improved boiler; Fig. II is a transverse vertical section, and

Similar letters indicate similar parts throughout.

Our invention consists in certain improvements in spiral tubular boilers, said improvements being chiefly as follows.—Firstly in the manner of arranging the spiral coils; and secondly, in the placing of the water and steam reservoir, or boiler proper.

The construction and operation is as follows. The form of said boiler is vertically cylindrical; the spiral coils, fire chamber, and a portion of the steam and water reservoir, are embraced within a shell or casing of some nonconducting material, as fire-brick, plaster &c. which casing is shown at A. The fire chamber is constructed so as to be detached from said casing and leave a space all around its sides as well as at the bottom for a certain distance below the grate-bars as shown at B. This space is cut off below the coils by a diaphragm which runs around on a level, a portion being seen at (C). The spiral tubes are arranged in a series of vertical coils placed one within the other, the diameter of each successive coil being so diminished as to leave annular spaces between each, and inasmuch as the coils are rolled so as to touch, they form solid walls, the spaces between these walls being designed to operate as flues. In the drawings but three series of coils are represented (*e e e*) the innermost coil (*e*) being of the same diameter as the top of the furnace and resting upon it. The course of the heat is first up through the center coil until intercepted by the top of the casing where it turns over and descends into the annular spaces formed between the coils to the place of discharge at their bases, as shown by the direction of the arrows.

At C, is the water and steam reservoir; this is a vessel tapering from a point just within the shell and terminating on a level with the bottom of the coils, the remainder of it being cylindrical. This reservoir is placed within the inside coil and is of such diameter at the largest part as to leave only a free space all around for the escape of the gases from the fire. From the bottom a pipe extends across through the shell or case A, to the outside as seen at D, and there terminating in a sediment vessel E, fitted with a blow off cock.

The manner of combining the coils with the steam reservoir will now be described. The coils (*e*) and (*e'*) are for water, while the outermost one (*e''*) is for steam, and it is intended to pass the steam through this before allowing it to go to the engine. In this particular there is nothing new, but there is a feature in maintaining the circulation of steam through this coil, while the engine is at rest, which will be described hereinafter. The coils (*e*) and (*e'*) connect with the reservoir C both at the bottom and at the top, while the coil (*e''*) terminates both of its ends only at the top of C. The bottom connections of (*e*) and (*e'*) are in the pipe D, and at the upper ends they terminate as shown by their respective letters. The super-heating coil is so connected with the reservoir C as to take in steam at the bottom of the coil and discharge it from the top, either into the engine or back again to the reservoir by a branch (*p*). At the end of this branch there are fixtures for maintaining a circulation when the engine is at rest; and at the commencement of the pipe (*i*) there is a fixture for separating the water from the steam as before mentioned. This pipe (*i*) which conveys the steam to the bottom of the coil passes out from the top or side of the reservoir and down to the base of the coil where it enters the shell A, and receives the end of the tubes as shown. The coil (*e''*) is formed of two spirals similar to a double threaded screw; hence there are two termini at each end of the coil, as shown.

Upon the mouth of (*i*) in the reservoir there is a vessel attached; this is of such diameter as to leave a space all around the

nozzle of the pipe and is shown at (*k*). The nozzle projects into it a short distance from the mouth of (*k*) around which there is a number of spiral passages as represented at (*i'*,) and at (*k'*) may be a pipe passing from the bottom to the outside for blowing off sediment.

At (*o*) is seen a pipe placed part of the way up the side, terminating below the water level in the reservoir, and is to prevent the vessel (*k*) from filling up higher than the dotted line. The steam which enters the pipe (*i*) must pass through the spiral passages (*i'*) whereby a rapid whirling motion is imparted to it, and then a sudden turn into the pipe in a reverse direction but the heavy particles unable to overcome both the centrifugal force and the force of gravity are separated by their momentum and deposited in (*k*) while the steam passes off as "dry" as possible before entering the super-heating coil. The upper end of the coils (*e''*) terminate in the pipe (*l*) which conducts the steam off to the engine and a branch (*p*) from it terminates within the reservoir by a nozzle curving downward and here the apparatus is attached for causing a circulation of the steam through the coil (*e''*) when the engine is at rest. This consists of a vessel having a trumpet shaped mouth pointing downward, as shown at (*p'*), into which vessel the inner coil (*e*) also terminates with a direction given it pointing out of the trumpet mouth as shown. Above this, and fitting so as to cover the end of the pipe (*p*) there is a valve (*r*), opening downward, the use of which is to close (*p*) when the engine is acting.

At F is an arrangement for heating the air before entering the draft box. (*s s*) are small flues placed within an air trunk, the interior space of which is divided by diaphragms (*t*) projecting part of the way across on alternate sides, the use of which is to cause the currents of cold air to be broken up and impinge upon the flues (*s*).

At the top of the trunk F there is an air opening (*t'*) to which a slide valve (*u*) is fitted; the air enters this place to be heated and after passing down through the trunk is conveyed under the grate. As shown there is at the foot of the trunk another air passage (*t''*); this crosses and terminates within the fire box above the grate, and it has also a valve (*u'*); these valves (*u*) and (*u'*) are coupled by a rod of such length that both valves cannot be open at one time; thus while the passage (*t'*) is open (*t''*) is closed. These valves are intended to be opened by the pressure of the steam acting upon a piston or diaphragm shown at (*v*,) and from which a lever extends to and couples with the valve rod. When the steam rises above a certain pressure the lever is lifted, and in being so, close the hot air passage and opens the cold air passage (*u'*) which at once cools down the fire and lowers the pressure of steam.

The operation will now be thus, the reservoir being filled with water to the line *x* the coils (*e*) and (*e'*) will also be filled to their tops; fire being kindled the draft ascends between the reservoir and inner coil and passes down the annular spaces between the coils (as shown by the arrows) on its way to the outlets (*s s*). As the water in the coils (*e*) and (*e'*) receives heat and begins to throw off bubbles of steam the latter rise and pass into the steam space of the reservoir above the water line *x* forming when in full action powerful jets, the supply of water being kept up through the pipe D by gravity and thus the circulation is easily maintained. As before remarked, a powerful jet of steam, or rather a mixture of steam and water, is driven out of the coils (*e*) and (*e'*); one of these coils (*e*) is made to terminate so as to discharge through the expanded mouth of (*p*) and in doing so forms a partial vacuum behind in a manner well known, the consequence of which will be that (*p*) is exhausted and thereby draws the steam through the coil (*e''*) thus maintaining a circulation therein. When however the engine is at work the steam will pass off with such velocity that it will seek to escape by the shortest passage being then through the pipe (*p*). At this time therefore the valve (*r*) comes into play and by closing against the pressure compels all to pass through the coil. In order that the full effect of the super-heating may be obtained it is of advantage that the steam should enter the coil freed as much as possible from water yet unresolved; this is accomplished by the separating vessel (*k*), the steam with particles of water commingled with it entering through the spiral passages (*i'*) and thus acquiring a violent gyratory motion in its passage to the mouth of the pipe (*i*) the momentum imparted together with the centrifugal force being such as to cause the water to separate measurably from the steam, as before described and the accumulation of water in (*k*) flowing out by the pipe (*o*).

As steam is known to bring some of the impurities in the water over with it to the engine the vessel (*k*) also forms a sediment collector and the blow off pipe (*k'*) is accordingly attached for discharging it as shown. The feed is sent in through the pipe D as shown, and the vessel E is placed in such position as to be out of reach of currents and accordingly allows all the impurities to subside therein and be drawn off in like manner.

We claim,

1. Such arrangement of a series of vertical coils of different diameters, that when

placed one within the other, spaces shall be left between, thereby forming flues which allow the fire to act upon each of the said coils as described.

2. The arrangement in combination with the coils, of a reservoir or boiler placed within the inner coil, in such manner that the greatest effect of the heat upon both will be obtained as set forth.

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Witnesses:
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