(No Model.)

3 Sheets—Sheet 1.

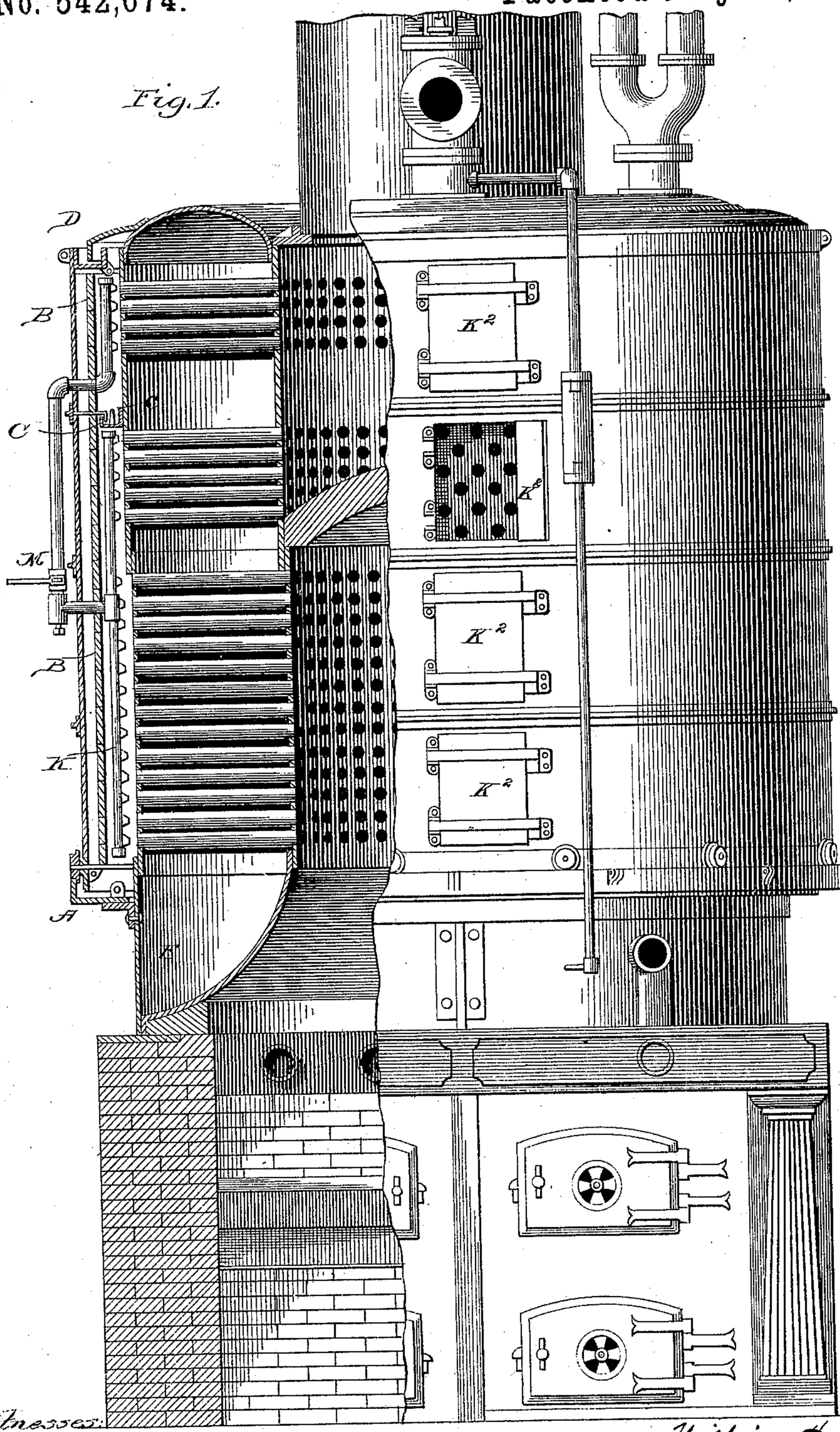
W. H. BERRY

STEAM BOILER.

No. 542,674.

Patented July 16, 1895.

Fig. 1.



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STEAM BOILER.

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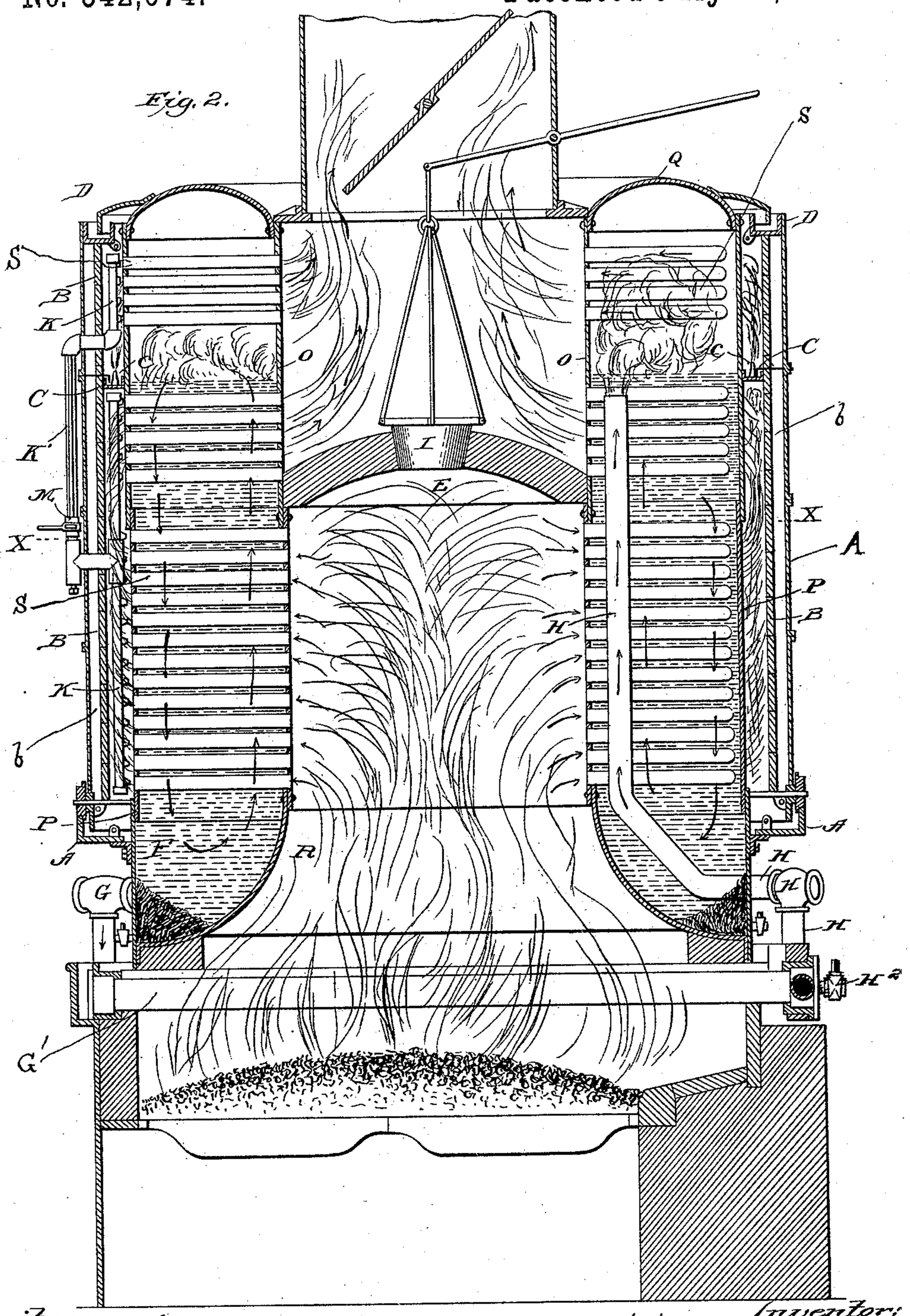
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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STEAM BOILER.

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Fig. 3.

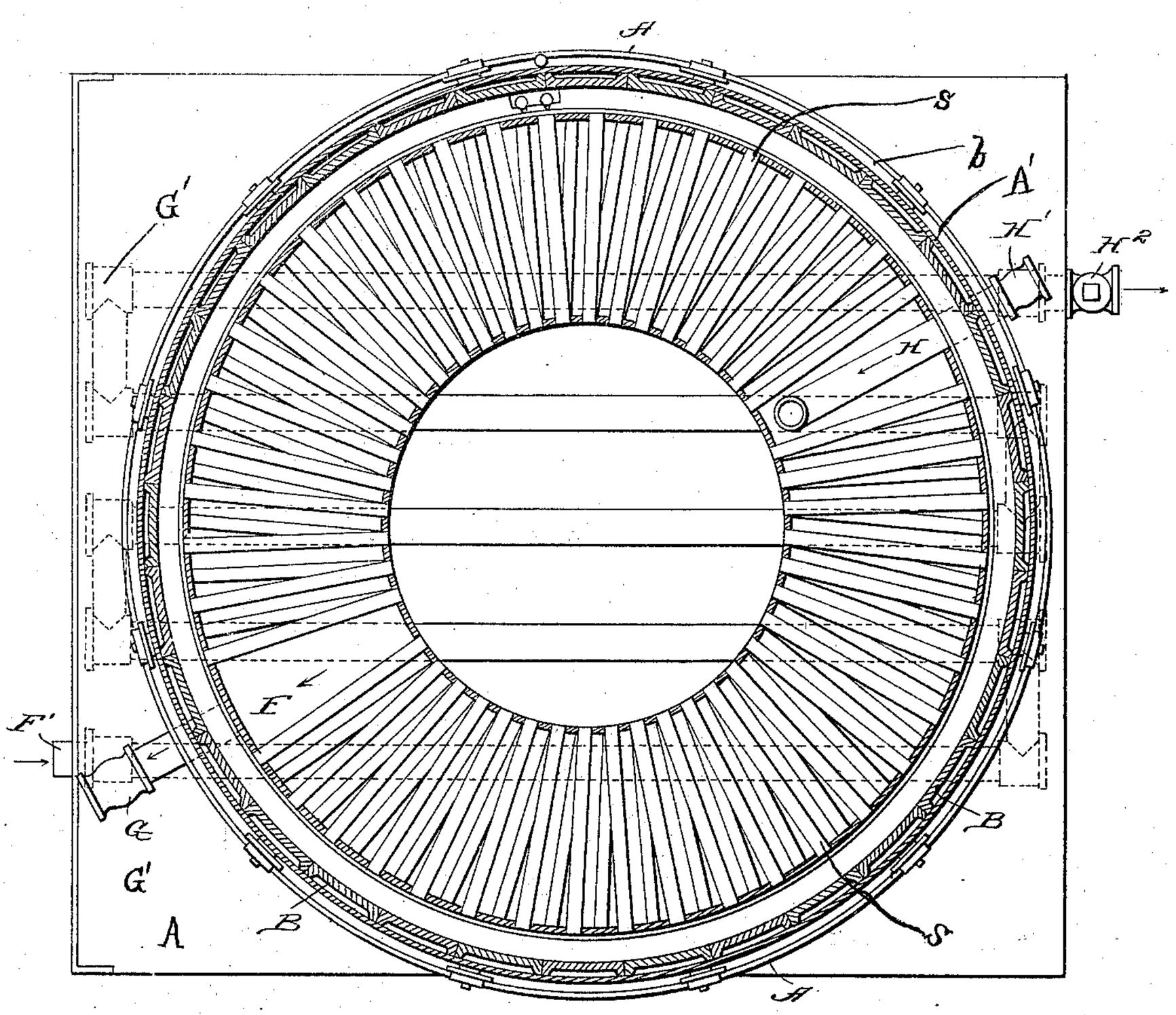
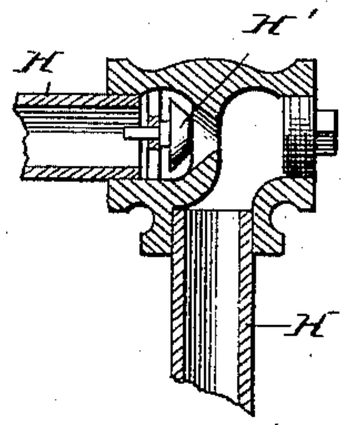


Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM H. BERRY, OF HOOSICK FALLS, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 542,674, dated July 16, 1895.

Application filed April 16, 1894. Serial No. 507,701. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BERRY, of Hoosick Falls, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature and objects of my invention will be fully set forth in the specification and claims.

In the drawings, Figure 1 is an elevation, partly in section, of my improved boiler. Fig. 2 is a vertical section. Fig. 3 is a horizontal section taken on the line X X of Fig. 2, and Fig. 4 is a detached detail.

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

The boiler consists of two vertical cylindrical shells O and P, one within the other, united at the top by a crowned ring Q and at the bottom by a cone-shaped ring or crown-sheet R. Since these heads cover a comparatively narrow space they are of thin steel and do not require bracing, and are therefore sufficiently flexible to accommodate any inequality of expansion in the two shells. Tubes S S, of small diameter, (the probable greatest size being two inches outside diameter,) radiate from the inner to the outer shell, forming braces for each. These tubes are placed in vertical rows in the inner shell O, and alternately diverged or "staggered" in the outer one P, so as to form two rows in the former to one in the latter. (See Fig. 3.) By this arrangement the rapid circulation of the water and steam upward near the inner shell is not obstructed (fifty per cent. of the entire area being preserved) and the downward movement of the cooler water near the outer shell afforded the same facility, while the strength of the outer shell is not reduced below the percentage of that of the seams. The result is therefore an enormously strong construction, every ounce of the metal in which is available for heating-surface.

The lower end of the outer shell P is of sufficiently heavy material to carry the weight of the boiler without bracing and forms a rigid base for the boiler, while a roomy and entirely unobstructed space is provided under the tubes for cleaning and inspection. A manhole is employed for entrance to this space.

Secured to the heavy base-sheet of the boiler is a circular ring or trough A, Figs. 1 and 2, adapted to be partly filled with sand, and the outer rim of which ring or trough forms a track upon which a casing or smoke-jacket A′ is supported, so that it may be revolved around the boiler. The lower edge of the casing A′ projects into the sand, and prevents the passage of air, while it allows the casing to be freely revolved. This casing is lined throughout with fire-clay tile B, Figs. 2 and 3, in such manner as to form an insulating air-space *b* inside the casing.

At or a little below the water-line a draft-check C, Fig. 2, is provided similar in construction to the one below. Through this check a limited number of openings *c*, Fig. 2, are provided, the area of which may be controlled. The object of these openings *c* is to permit a portion of the products of combustion to pass above the draft-check C and through the tubes S, extending across the steam-space for the purpose of drying the steam. A third check D, of the same construction, is placed at the top of the casing, Fig. 2. At a point covering about three-fourths of the submerged tubes an arch or dome of fire-brick E, Fig. 2, is inserted in the inner shell O, and from the top of this shell the stack or flue connection rises.

Between the fire-clay lining and the shell P a flue-cleaning device is secured, consisting of two pipes K K, one above and the other below the draft-check C. The pipes K are each connected to a pipe K′ outside the casing, the latter pipe being furnished with a three-way cock M, which is supplied with steam from the boiler through a flexible pipe. (Not shown.) Each pipe K has a series of nozzles arranged to stand opposite the centers of the tubes in one of the vertical rows. By revolving the casing the nozzles are made to register successively with each row of tubes, and a blast may be sent alternately through the upper and lower sections of tubes to clean them of soot. To aid in this effect a gate I is provided in the arch E, which may be opened to change the course of the draft directly up the chimney. A series of doors K^2 are also

placed in the casing, of sufficient width to allow of the cleaning of any of the tubes with a brush or scraper or to replace or repair any of the tubes or seams. The revolution of the casing brings these doors opposite every part of the external surface of the shell P, making the inspection of every part possible without trouble.

The furnace is preferably of the simplest possible construction, square in form, and lined throughout with fire-brick, and having ample and efficient grate area.

Doors of convenient height and arranged to the best advantage for hand-firing are employed; but any of the shaking grates or automatic stokers may be easily applied.

To avoid arches and other unsatisfactory brick-work in the furnace, I use a continuous coil of four-inch tubing G′ to carry the furnace covering. Through this coil all the feed-water passes, as well as all the blow-off water, in addition to which a rapid continuous circulation of the water in the boiler is maintained by the following means. One end of the coil is connected to the outside shell of the boiler at F, so as to take water from the descending column. A check-valve G is here placed, opening outward to insure the passage of the water at all times in one direction. At this end of the coil the feed-water is also introduced through the pipe F′ below the check-valve G. The coil extends back and forth under the boiler and over the fire, and at its other end connects with a pipe H, having a check-valve H′ opening inward. The pipe H passes through the outside shell into the boiler and across the water-space to close proximity to the inner shell, where it is extended up to a point near the water-line. Just below the check-valve H′ is placed the blow-cock H^2.

In operation, and assuming the boiler to contain the proper quantity of cold water and the fire to have been started, the products of combustion will pass through the tubes below the arch E into the space between the shell P and the outer casing A. The check C will cause the greater portion of the products of combustion to pass back into the shell O through the tubes between said check C and the arch E. A certain proportion of the products of combustion will, however, pass through the openings *c* in the check C and be deflected by the check D through the tubes above the water-line into the shell O, whence they will pass to the smoke-stack. It is obvious that the products of combustion expend the greater part of their heat upon the coil G′, the inner shell O below the dome E, and the fire-tubes located in this portion of the boiler. The water near the inner shell O will therefore be hotter than that near the outer shell P, and there will consequently be a tendency of the former to ascend and of the latter to descend. There is, therefore, a column of water constantly pressing with full gravity upon the end opening F of the coil. As soon as heat is applied to the coil G′, the water rises in the vertical internal extension of the pipe H, and, being lighter than the water near the outer shell of the boiler, the circulation will begin, and when steam is generated in the coil the resistance in the vertical extension of the pipe H will be so slight that a rapid circulation will be kept up.

The feed-water is introduced into the end of the coil G′, which receives the water from the boiler, and is, in consequence, mingled with many times its volume of hot water which is moving rapidly through the coil. Therefore, in its passage through the coil, the feed-water becomes highly heated and any floating sediment or mineral substance held in solution made ready for precipitation. No precipitation occurs, however, in the coil or pipe H, owing to the rapid movement of the water therein. When the water is delivered from the pipe H at the water-line, it passes outward to the slowly-descending column at the outer shell and the settlement then occurs. The sediment is thus deposited in a portion of the boiler protected from the fire and whence it may be readily removed, and the water while in contact with the heating-surfaces will deposit no sediment, thus preventing scale.

Having described my invention, I claim—

1. The combination, substantially as set forth, with a boiler having vertical cylindrical inner and outer shells, and horizontal fire tubes connecting them, of a fire chamber, a heating coil, between the fire chamber and the boiler, opening at one end into the lower end of the boiler through the outer shell, and a pipe leading from the other end of the coil and extending through the outer shell of the boiler across the water space and upwardly, near the inner shell, to a point near the water line, whereby the highly heated feed water is prevented from mixing with the boiler water until near the water line, and then allowed to mix with the slowly descending current, before coming in contact with the highly heated surfaces of the boiler, thus preventing scale by depositing the sediment in a part of the boiler protected from the fire.

2. The combination with a boiler having vertical cylindrical inner and outer shells, and horizontal fire tubes connecting them, of a heating coil opening at one end into the lower end of the boiler through the outer shell and exposed to the direct heat of the furnace, and a pipe leading from the other end of the coil and extending through the outer shell of the the boiler, across the water space and upwardly, near the inner shell, to a point near the water line, substantially as and for the purpose specified.

3. The combination with a boiler having vertical, cylindrical, inner and outer shells, and horizontal fire tubes connecting them, of a heating coil opening at one end into the lower end of the boiler through the outer shell, a check valve in said coil near the point of connection, opening outwardly, a feed water

supply pipe connected to the coil beyond the check valve, a pipe leading from the other end of the coil and extending through the outer shell, across the water space and upwardly, near the inner shell, to a point near the water line, a check valve opening inwardly in said pipe or coil near their connection, and a blow-off cock in the coil in front of the check valve, substantially as and for the purposes described.

4. The combination with a boiler having vertical, cylindrical, inner and outer shells, and horizontal fire tubes connecting them, of a smoke jacket surrounding the outer casing, a draft check supported between the smoke jacket and the outer shell of the boiler near the water line, an arch or dome supported within the inner shell below said draft check whereby the products of combustion are deflected through the fire tubes, and a gate in said dome to permit their escape direct to the smoke stack, substantially as described.

5. The combination with a boiler having vertical, cylindrical, inner and outer shells, and a series of horizontal fire tubes connecting them through the water and steam spaces, a smoke jacket surrounding the outer shell, and a draft check supported between the smoke jacket and the outer shell of the boiler near the water line, said draft check having openings, substantially as and for the purpose specified.

6. The combination with a vertical cylindrical boiler having horizontal fire tubes, of a revoluble smoke jacket surrounding said boiler, a draft check supported between the boiler and the revoluble casing near the water line, two pipes supported by the revoluble casing one above and the other below the draft check, and each provided with nozzles adapted to register with the fire tubes, a pipe outside the casing to which the other two pipes are connected, and a three-way cock in said outer pipe which receives steam from the boiler, substantially as and for the purpose specified.

7. The combination with a vertical boiler and its furnace, of a continuous coil of tubing through which the feed water and the water in the boiler circulate, said coil supporting the furnace covering, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand and seal.

WILLIAM H. BERRY. [L. S.]

Witnesses:

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