(No Model.)

G. SEWELL.
Steam Boiler.

No. 239,348. **Patented March 29, 1881.**

Fig. 1

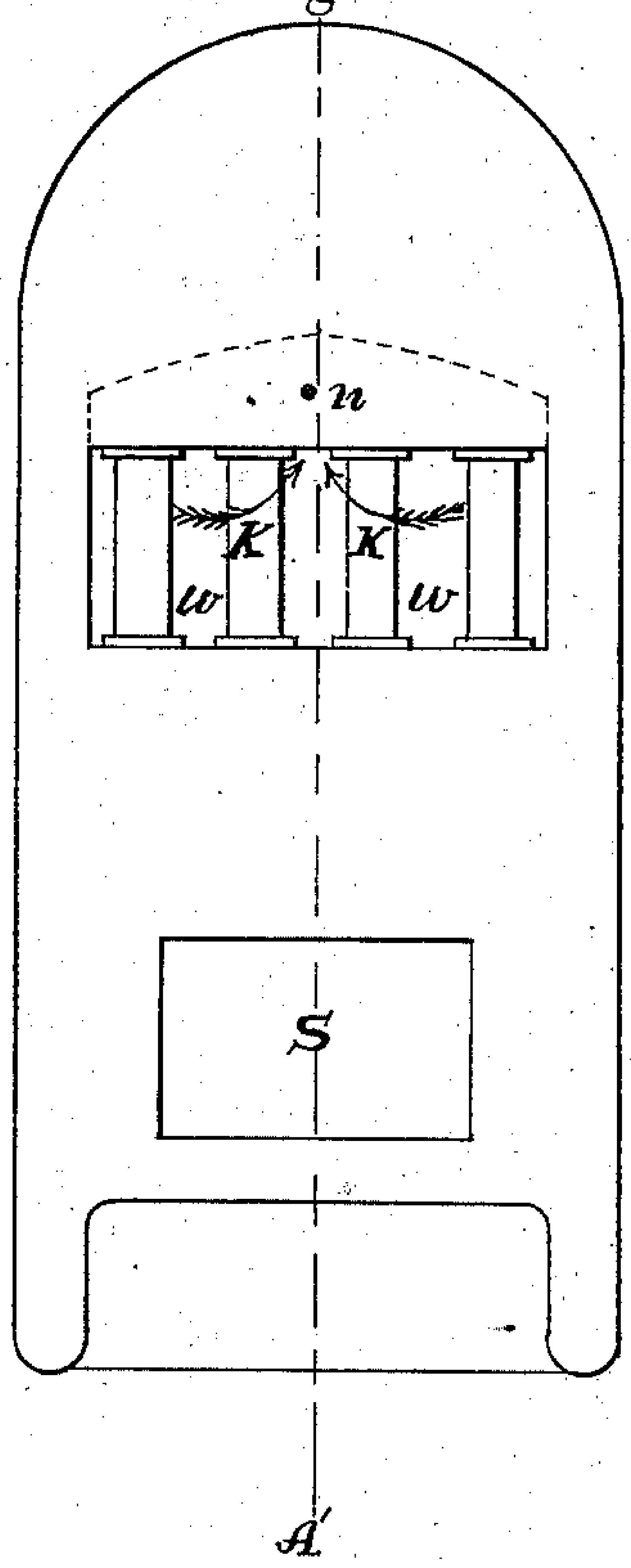


Fig. 2

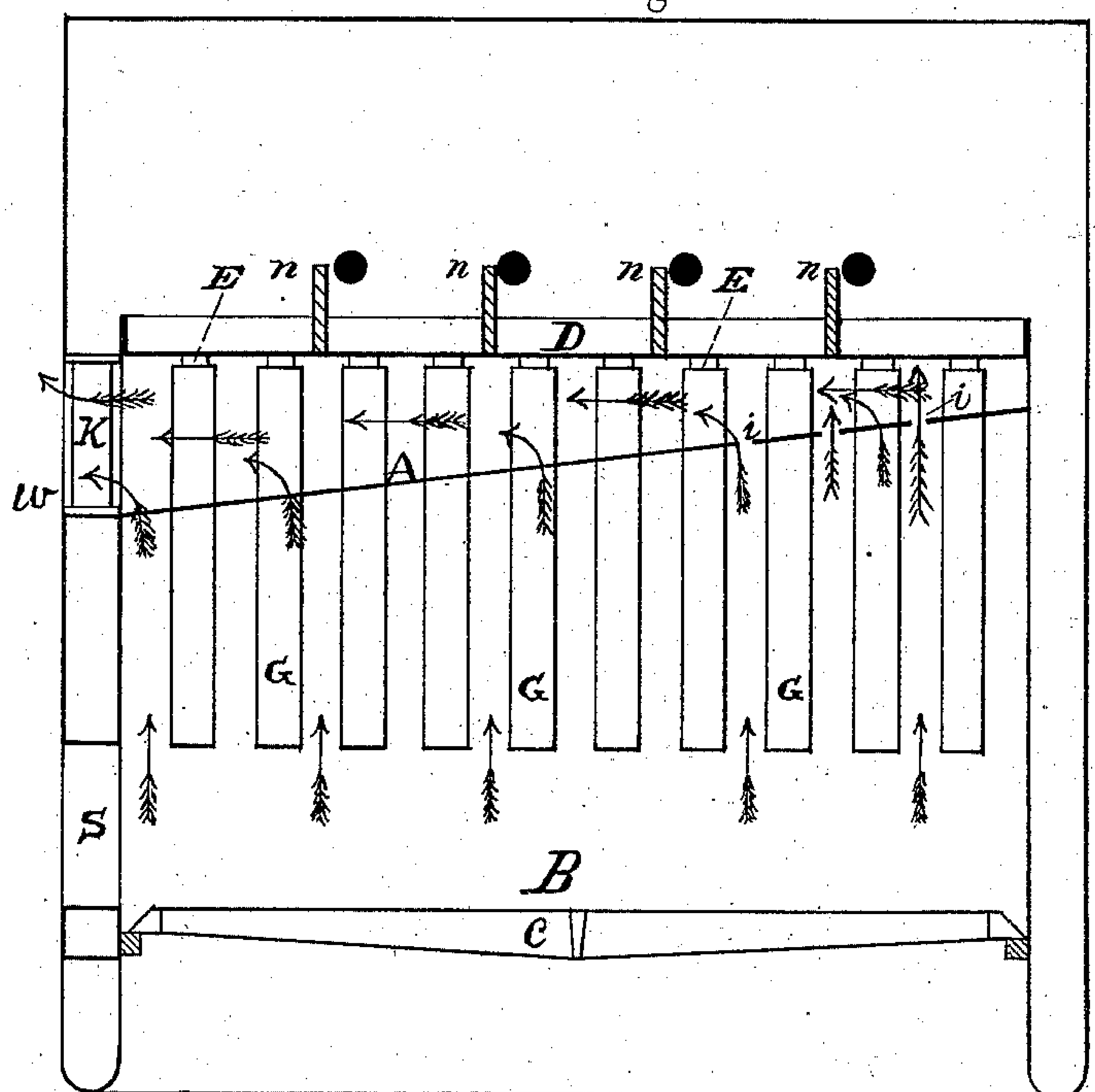


Fig. 3

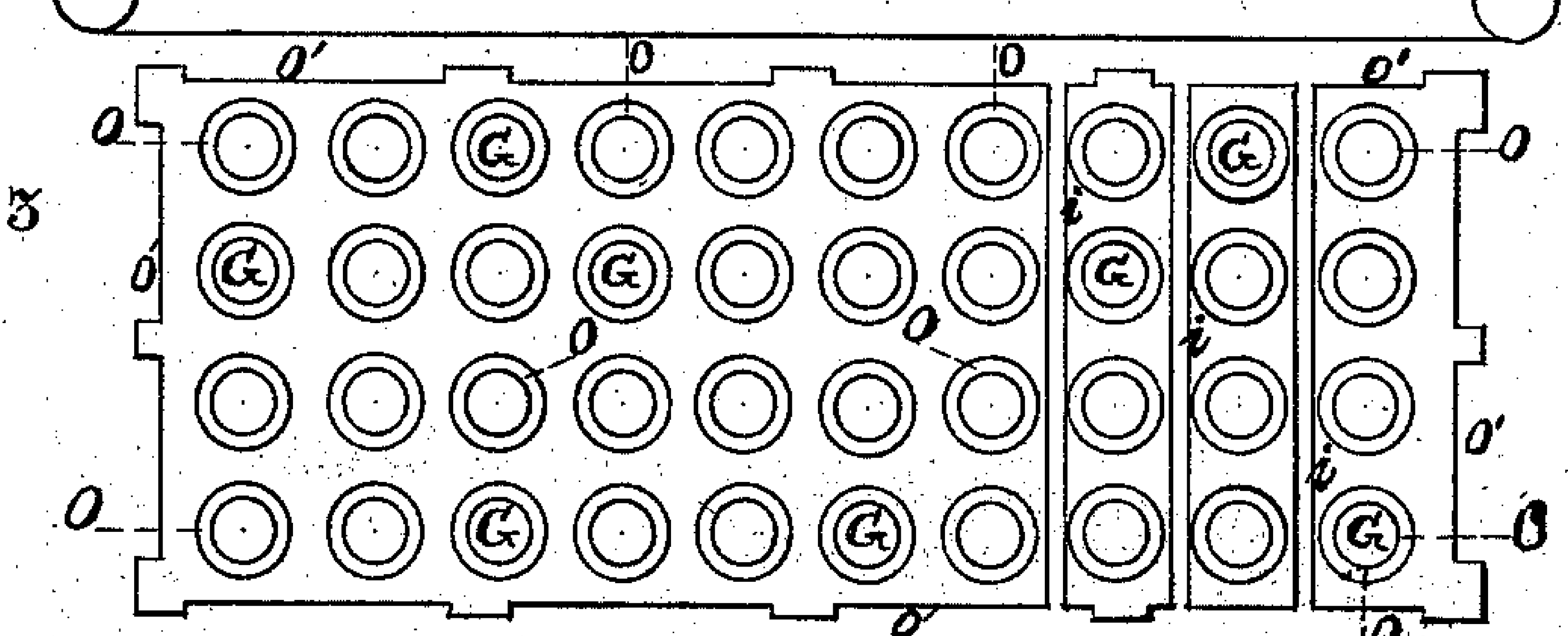
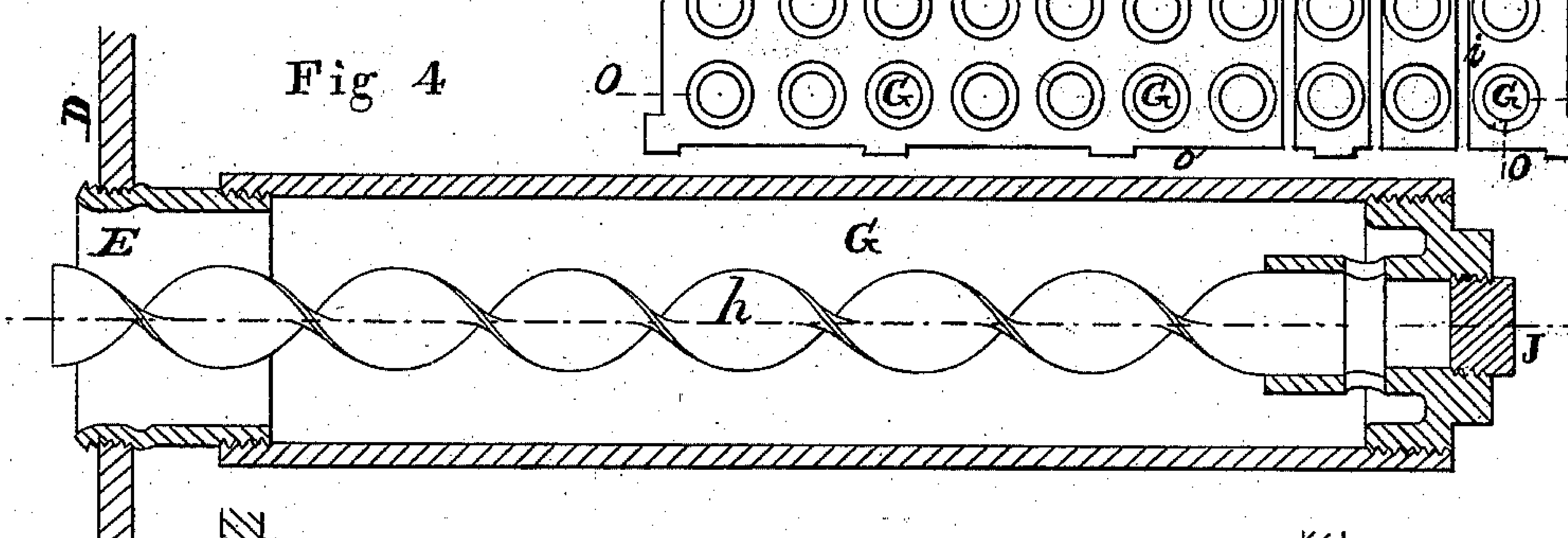


Fig 4



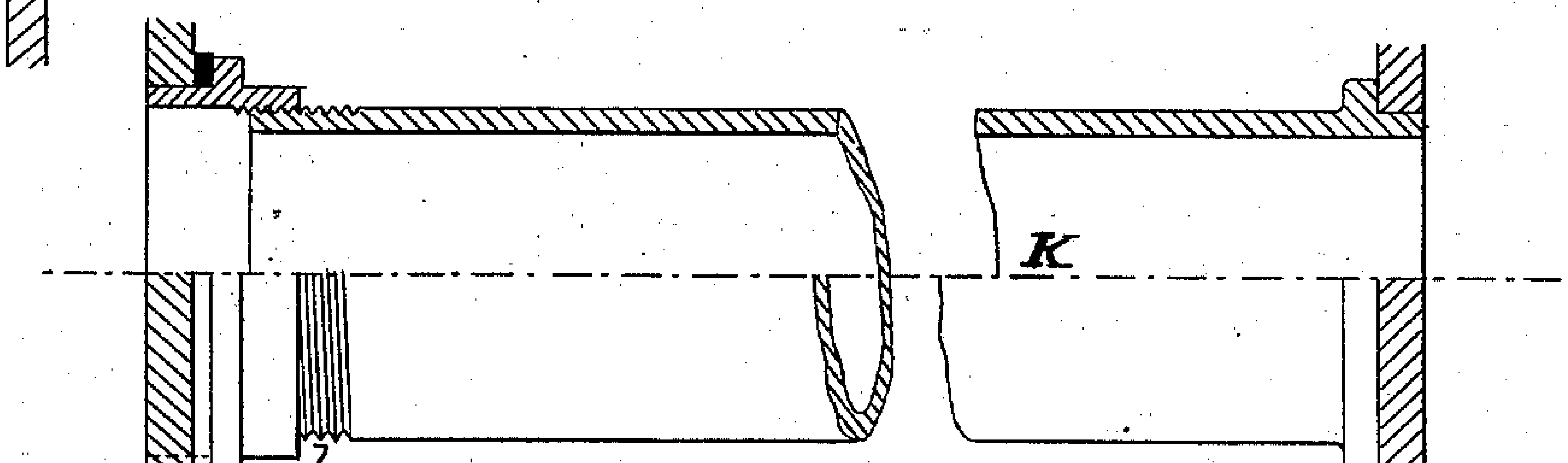


Fig 5

WITNESSES.

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STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 239,348, dated March 29, 1881.

Application filed June 24, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SEWELL, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Boilers or Steam-Generators, which improvement is fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to simplify the construction of boilers and steam-generators, and to so arrange their steam-generating surfaces that a maximum of such surface of the most efficient character may be obtained within any given exterior lines or parallelopipedon circumscribing such surface.

With this end in view the invention consists of a calorimeter plate or plates introduced into the furnace, in combination with vertical water-tubes depending therein, said plate thus practically dividing the tube-space into two flues or compartments.

The invention further consists in a certain method of securing said tubes to their tube-sheet, whereby a thinner and consequently better heat-transmitting sheet is caused to sustain in a durable and perfectly-tight condition the necessary number of tubes inserted therein.

In the accompanying drawings, Figure 1 illustrates, in front elevation, a boiler provided with my improvements, as shown in the remaining figures. Fig. 2 is a median longitudinal vertical section through Fig. 1. Fig. 3 is a plan of the calorimeter-plate, shown in part as an entire sheet, and in part as constructed in divisions or sections. Fig. 4 is an enlarged longitudinal section through one of the tubes of the boiler, showing the method of connecting the tube, or an interposed nipple or socket, to the tube-sheet. Fig. 5 is an enlarged section through one of the shorter tubes of the boiler, showing a method by which said tubes may be secured within the small length of space necessarily allotted to them.

The following is a description, in detail, of the construction and operation of my invention, like letters of reference in the several figures of the drawings indicating the same parts.

To the tube-sheet D, corresponding to the ordinary crown of the furnace and forming the top of the furnace, are secured, in the manner hereinafter described, the vertical water-tubes G. Within the space W, forming the exit for the gases of combustion, or entrance for the same into the uptake of the boiler, are placed the shorter tubes K.

The calorimeter-plate A is introduced within the furnace B, preferably at an inclination, as shown in the drawings, transversely to the length of the tubes G. The said plate, forming a perforated diaphragm surrounding said tubes, is so cut around the tubes, as shown at O, and at its sides, as shown at O′, that a sufficient area of discharge is allowed for the products of combustion to pass through the intervals O and O′, and through said intervals or spaces only. The velocity of the draft, the consequent rate of combustion, and the "calorimeter" suited to the attainment of these results under the most economic conditions, can by this means be very accurately regulated.

The calorimeter-plate A, instead of being made in one sheet, may be cut into divisions or sections, as shown in Figs. 2 and 3, at the points indicated by the letters *i i*.

The tubes G are secured to the tube-sheet D preferably by means of the interposed nipple E. This arrangement allows of a comparatively thin tube-sheet being used, thus securing a better heat-transmitting sheet than if of thicker metal, while at the same time permitting the tube to be unscrewed from the nipple and removed or renewed, the nipple remaining in tight-fitting junction with the sheet. The nipple E is first screwed into the tube-sheet D by means of screw-threads cut into both tube and sheet, and then the nipple is expanded and shouldered or beaded respectively within and around the sheet D.

I am aware that it has been proposed to expand non-threaded smooth cylindrical tubes into helical-threaded holes in a tube-sheet; but I am not aware that either tubes or nipples, previously threaded, have been both screwed and expanded into and around a corresponding previously-threaded tube-sheet, as herein described and claimed. If the hole in the tube-sheet be threaded, and the attempt be made to expand a non-threaded tube into said hole, unless the tube-sheet be of considerable and undesirable thickness, the attempt will fail as a practical and useful operation, and in any case the practicability of properly

expanding a non-threaded tube into a helical-threaded hole would be a very uncertain and fortuitous operation at best, and the expanding-tool necessary for the operation, if a practical device at all, would at least require to be of exceptional accuracy and precision in construction and mode of application. I therefore confine my claim to this part of my invention solely to the invention set forth and embraced within the narrow scope of claim 3.

Within the tube G is shown a strip of metal twisted into a helicoid and resting upon a plug screwed into the end of the tube G. The object of this device is to create a comparatively quiescent center within the tube G, in order that, as the currents of heated water or steam bubbles ascend in the tube most vigorously near its sides, there may be an axial return-current of cooler water to the bottom of the tube, by which means total expulsion of the water from the tube is prevented, as might otherwise happen under an excessively high temperature of furnace, particularly in tubes of small diameter. Instead of this helicoidal strip of metal, a simple internal tube of lesser diameter than the tube G may be substituted. Said tube will be as efficient in function as the helicoid *h*. But these circulating devices I do not claim as of my invention, and have only introduced them herein as explanatory of the complete adaptation of my improvements to such constructions as perform those functions in practice desired in all good steam-generators.

As the great object of this invention is to obtain a maximum of heating-surface within given limits, and as the space W in the drawings is valuable for conversion into steam-generating surface, and for such purpose is commonly unutilized, and therefore almost lost, I have introduced therein the short tubes K, which largely utilize such space as a steam-generating medium. As some ingenuity of construction is required to properly insert said tubes into said space, I have shown in enlarged section in Fig. 5 a good method, and the best known to me, of applying the tubes K to the desired purpose.

By means of the screw-threads *l* on the end of the tube, and the coupling nut or socket shown thereon, and the shoulder or flange formed at the upper end of the tube, all clearly illustrated in Fig. 5, it is quite obvious that by first screwing said socket upon the tube, then placing the tube in position opposite its holes in the sheets, and then unscrewing or backing off the socket a certain distance, the tube will be practically elongated, and firmly pressed and held within and against both its top and bottom tube-sheet, any suitable cement, washer, or joint being interposed between the sheets and the flanges, respectively, of the tube and socket; but to this method of securing the tubes K, for the reasons above given, I make no claim.

The other portions of the boiler illustrated are those commonly used, the letter S indicating the furnace-door; J, a plug for emptying or cleaning the interior of the tubes G; *c*, the grate-bars, and *n* bars or girders which brace or strengthen the tube-sheet D.

The arrows shown in Fig. 2 clearly indicate the courses of the currents of the gases of combustion, and, with the explanations hereinabove given, no further description of the complete operation of the devices constituting my said improvement in boilers is deemed necessary.

As of my invention I claim—

1. In a boiler or steam-generator, a calorimeter-plate, A, constructed as described, in combination with vertical water-tubes G, depending from and secured to the top of the furnace, substantially as and for the purposes set forth.

2. In a boiler or steam-generator, a calorimeter-plate, A, divided into sections, in combination with vertical water-tubes G, depending from and secured to the top of the furnace, substantially as and for the purposes set forth.

3. In combination with the tube-sheet of a boiler or steam-generator, a tube or nipple screwed into said sheet by means of corresponding screw-threads cut into both tube and sheet, said tube or nipple having also a circumferential bead or shoulder expanded thereon from within outwardly and closely abutting the inner side of the sheet, substantially as and for the purposes set forth.

GEORGE SEWELL.

Witnesses:
RICHARD E. SHAW,
JOHN L. BROOME, Jr.