(No Model.) 3 Sheets—Sheet 1.

J. JUNGBLUT & S. A. EKEHORN.

SECTIONAL STEAM GENERATOR.

No. 547,352. Patented Oct. 1, 1895.

Fig. 1.

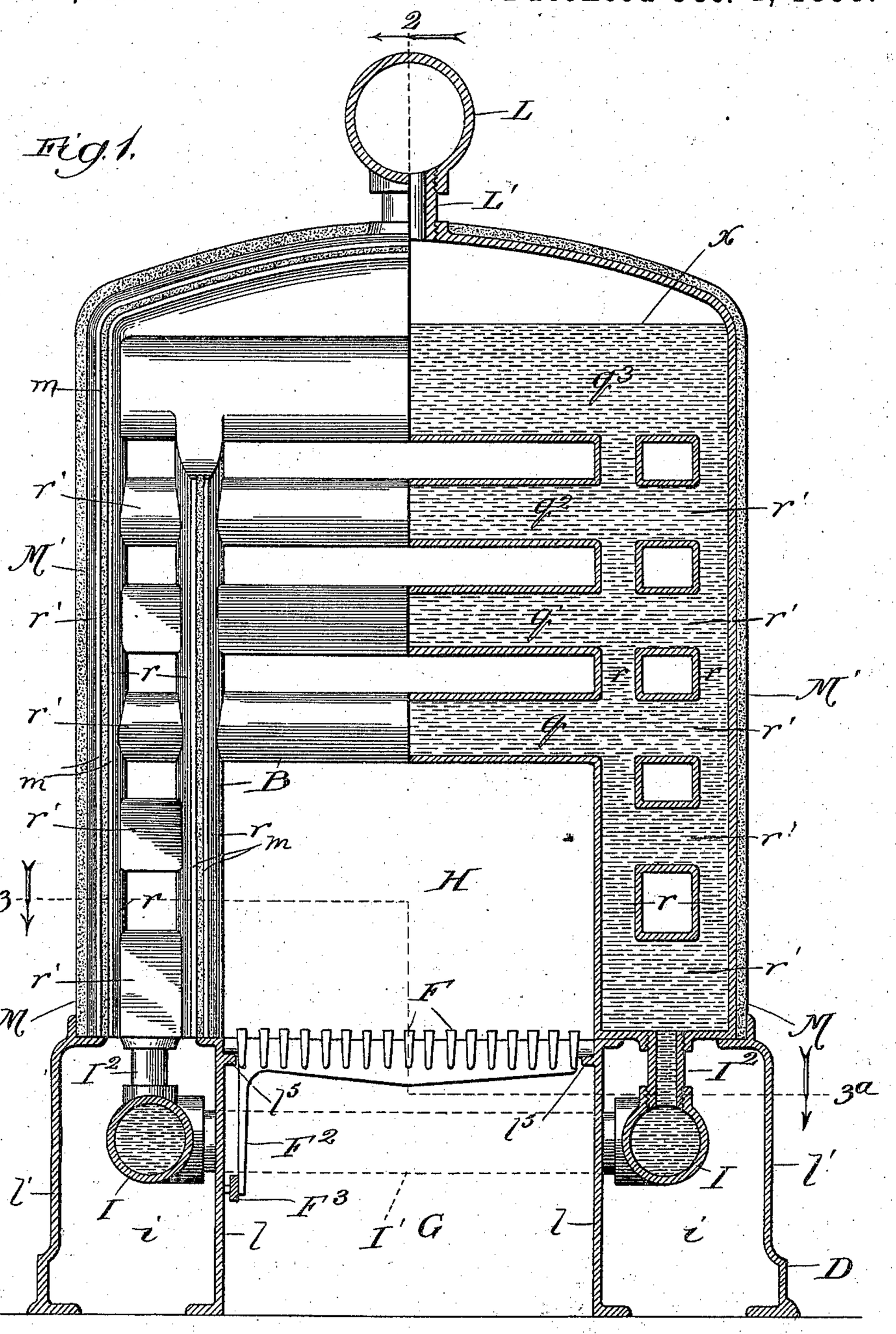

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Fig. 2.

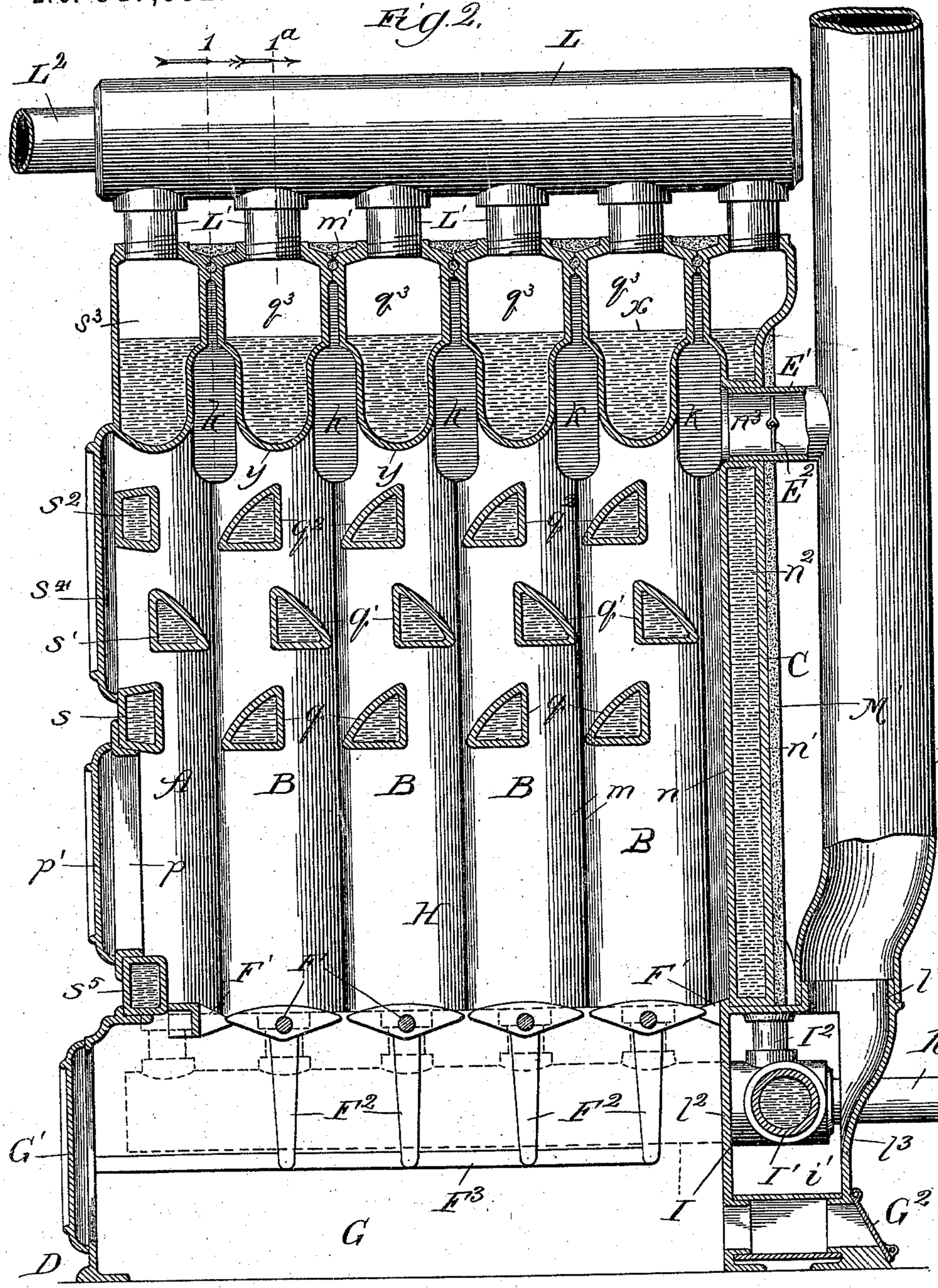

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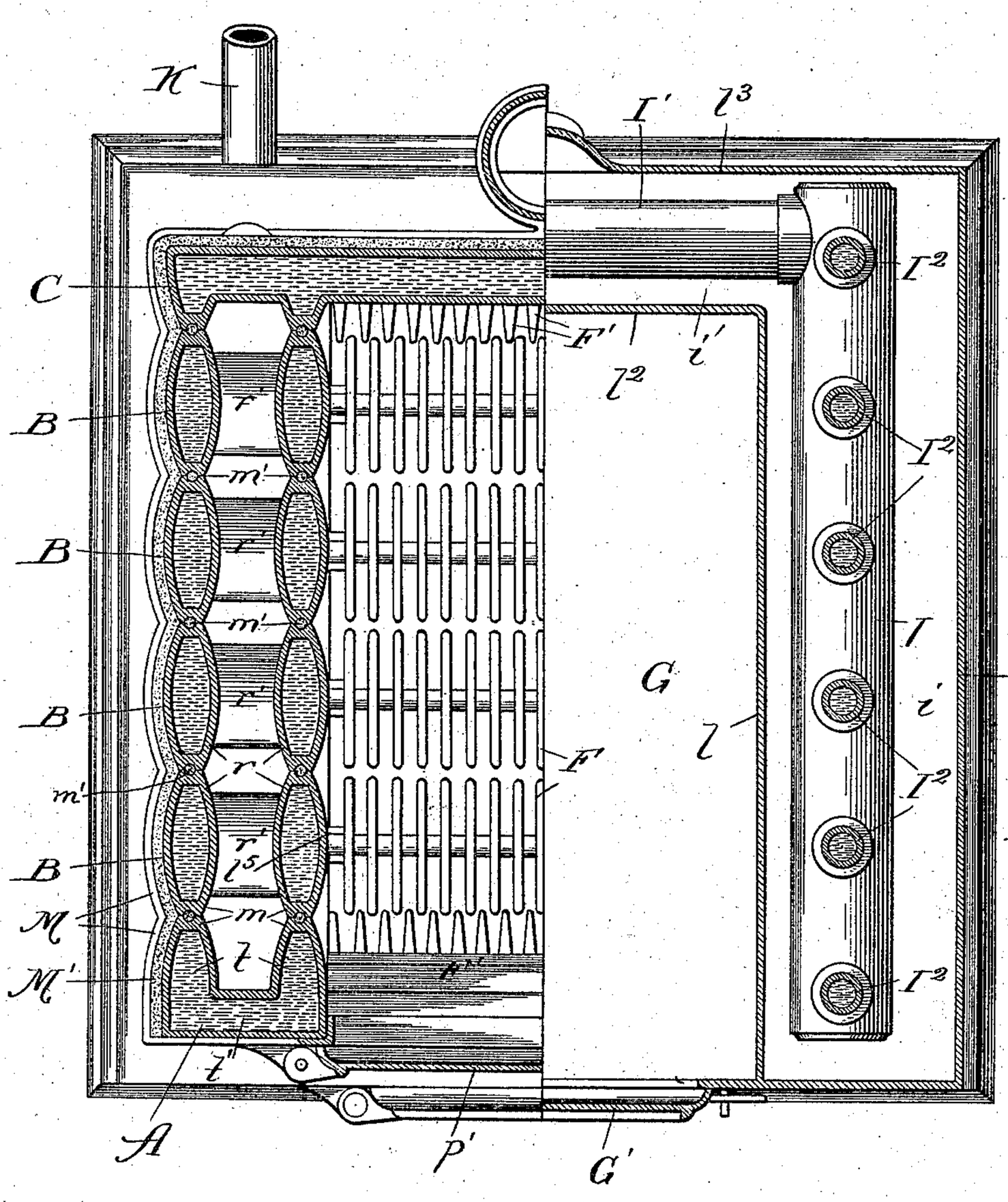
Fig 3.



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UNITED STATES PATENT OFFICE.

JULIUS JUNGBLUT AND SVEN A. EKEHORN, OF MILWAUKEE, WISCONSIN.

SECTIONAL STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 547,352, dated October 1, 1895.

Application filed October 29, 1894. Serial No. 527,117. (No model.)

To all whom it may concern:

Be it known that we, JULIUS JUNGBLUT and SVEN A. EKEHORN, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Sectional Steam-Generators, of which the following is a specification.

Our invention relates to improvements in steam-generators of the class known as "sectional-flue boilers;" and our object is to provide certain improvements in the construction thereof to the end of adapting the boiler more perfectly to its purpose in the sense of generating steam quickly and in large quantity at the minimum expense of fuel.

Our invention consists in the general construction of our improved boiler, and also in details of construction and combinations of parts, all as hereinafter set forth and claimed.

In the drawings, Figure 1 is a vertical cross-section of our improved sectional-flue boiler, one half of the view at the left-hand side being taken on line 1 of Fig. 2 and the other half on line 1^a of Fig. 2, both in the direction of the arrows; Fig. 2, a vertical longitudinal section taken on line 2 of Fig. 1 and viewed in the direction of the arrow; and Fig. 3 a plan sectional view, one half, to the left, being on line 3 of Fig. 1 and the other half, to the right, being on line 3^a of Fig. 1.

The body portion of the structure consists of a front section A, intermediate sections B, and a rear section C. The front section A is formed on each side with two upright tubes t t, joined by a lower cross-tube t', of less width than the upright tubes shown in Fig. 3, and by other cross-tubes of substantially the same width as the tubes t', corresponding in position with those of the sections B, hereinafter described. The pairs of upright tubes t t of the section A at opposite sides of the structure are joined by circulating-tubes s s' s^2 and an upper tube or chamber s^3 in the relative positions shown most plainly in Fig. 2. The sections B are each formed on opposite sides of the structure with pairs of vertical tubes r, the members of each pair being joined by cross tubes or passages r', and the opposite columns, consisting each of a pair of tubes r, being joined by cross-tubes q q' q^2 and a tube or chamber q^3, having a rounded under surface y. On the front section A, and formed, preferably, integral therewith, is a front plate s^4, which extends from the lower tube s to the chamber s^3 and closes the upper part of the front of the structure. Set into the opening bounded on opposite sides by the columns t, at the top by the tubes s, and at the bottom by a tube s^5, corresponding with the tube s, is a frame p for a door p'. The rear section C is formed of two parallel walls n n', which constitute the closed back of the furnace. The chamber n^2 between the walls is a continuous space broken only by the smoke-flue n^3, passing through its center and upper part. The rear face of the front section A, the front face of the rear section C, and the opposite faces of the intermediate sections B are formed with meeting edges m, having central longitudinally-extending concavities, which when the sections are put together form tubes in which are placed strips of asbestos rope m'. The joints between the sections are thus rendered sufficiently tight.

The sections placed together as described fit at opposite sides into a base structure D, formed on each side with an inner wall l and an outer wall l', and formed at the back with an inner wall l^2 and an outer wall l^3. At its center the outer back wall l^3 is formed with a tubular projection l^4, from which extends the smoke-outlet flue E. From the flue E extends a thimble E′ through the passage n^3 in the back section C, and in the thimble E′ is a damper E^2, which may be turned from outside the furnace. On the walls l, registering with the centers of the sections B, are shelf-pockets l^5, forming bearings for sectional rocking grate-bars F. Below the front section A and rear section C are stationary grate-bars F′. The rocking grate-bars F are each provided with a downwardly-extending arm F^2, pivotally connected at their lower ends to an operating-bar F^3.

The space between the walls l and below the grate constitutes the ash-pit G. The space above the grate below the cross-tubes s q is the fire-chamber H, closed at the front by the door p', at the sides by the columns t r, and at the back by the wall n of the rear section. The front section A on its rear side near the top, the rear section C on its front

side near the top, and the intermediate sections B on both sides near the top are recessed coincidently to produce flues or passages *k*, which extend through the wall formed by the inner tubes *t r* to the spaces between the inner and outer tubes *t r* on each side. The cross-tubes *s s′ s²* are staggered in the sense that while the tubes *s s²* are toward the front of the section A the tubes *s′* are toward the rear of said section. The cross-tubes *q q′ q²* of the intermediate sections B are also staggered, as indicated.

In the opposite sides of the base D, between the walls *l l′*, are chambers *i i* and between the front wall *l²* and rear wall *l³* of the base is a cross-chamber *i′*. In the chambers *i i* are drums I I, connected by a cross-drum I′ in the chamber *i′*. The three drums communicate with a water-pipe K. The drums or pipes I extend below the lower ends of the sections A B C and communicate with the latter through pipes I², which extend into the lower cross-tubes *t′* of the section A, lower cross-tubes *r′* of the sections B, and lower part of the chamber *n²* of the rear section C. Above the sections is a steam-drum L, which connects by means of pipes L′ with the upper ends of all the sections—namely, the chamber *s³* of the front section A, the chambers *q³* of the intermediate sections, and the top of the chamber *n²* of the rear section. From the drum L extends the steam-pipe L².

In practice the products of combustion from the fire-chamber H rise between the staggered tubes *q q′ q²* of the intermediate sections and also between the staggered tubes *s s′ s²* of the front section, and if the damper E² is open they will pass directly to the smoke-flue E. When the damper E² is closed, the products of combustion pass through the flues *k* and descend between the upright tubes of the columns and cross-tubes *r′* to the chambers *i* in the base. The chambers *i* are in open communication with the opposite ends of the rear chamber *i′*, and the products of combustion pass to the latter and through the tubular extension *l⁴* to the smoke-flue E. The air to support combustion may enter the ash-pit G through the usual damper in the ash-pit door G′ and through a rear damper G².

The water to be converted into steam enters through the pipe K to the drums I′ I I and rises thence through the pipes I² to the sections A B C, rising in the flues *t t r r* of the columns and filling the tubes *t′ s⁵ r′ s s′ s² q q′ q²*, rear chamber *n²*, and upper chambers *s³ q³* to the water-level, which is indicated by the dotted line *x* in Figs. 1 and 2. The hot products of combustion rising between the staggered tubes and playing against the chambers *q³* heat those parts very rapidly and to a high degree, while the products of combustion passing down between the tubular walls of the columns then heat the lower flues *r′* and lastly the drums I I′. The effect is that the products of combustion pass first against the tubes and chambers in which the steam is generated—that is to say, they exert their greatest heat directly at or near the surface of the water. Passing thence down between the lower flues and against the drums, the products of combustion exert themselves finally against the latter. In this way the greatest heat is exerted at the parts where the greatest heat is required, and as the products of combustion become cooler they come in contact with the pipes which feed the water to the boiler.

The structure may, if desired, be set in masonry or, and preferably, it may be provided with a sheathing M over the sides, back, and top, with an intervening space filled with an asbestos or other refractory lining M′.

Constructed as described our improved furnace is especially durable, for the reason that the sides, back, and top of the fire-chamber are water-lined. The staggered arrangement of the cross-flues above the chamber causes the currents of the products of combustion to be broken up and to contact with all parts of the said flues. The rounded under surfaces of the upper chambers *s³ q³* present large areas to the products of combustion, the latter while still almost at their highest temperature striking the said under surfaces and remaining in contact therewith an extended time while flowing to and escaping through the flues *k*. Owing to the prolonged time that the products of combustion are caused to remain in contact with the surfaces *y* of the upper or steam-generating chamber *q³*, the greatest heat absorption takes place at said chambers, which, being at the water-level, are the parts where for purposes of economy the greatest heat should be exerted.

The aim of improvement in steam-generators is naturally in the direction of complete heat-absorption from the products of combustion, whereby the greatest amount of steam may be generated at the least expense of fuel. Our improved furnace, owing to its construction, causes the water to absorb heat from the products of combustion to a degree, we believe, not before accomplished in other furnaces. The structure is very compact and takes up less space than any other furnace of the same capacity for steam generation of which we are aware, and the construction is simple, whereby the furnace may be erected at a comparatively small cost.

What we claim as new, and desire to secure by Letters Patent, is—

A sectional flue boiler comprising, in combination, a base D having the side chambers *i* and rear chamber *i′* communicating with each other and central ash-pit G, a grate-covering for the ash-pit G, a body-portion consisting of a front section A, intermediate sections B and rear section C, the front section A being formed with vertical side columns consisting of upright tubes *t* and narrower cross tubes *t′*, an upper cross chamber *s³* and staggered tubes *s s′ s²*, all connecting the columns together, the intermediate sec-

tions B being formed of side columns, comprising each a pair of vertical parallel tubes r connected by cross tubes r' and upper chambers q^3, staggered flues q q' q^2 connecting the columns, and the rear section C comprising a front wall n and a rear wall n' with an intermediate chamber n^2, and the sections forming when placed together on the base a fire chamber H, flues k and outer flues extending between the vertical tubes r from the flues k to the chambers i, water-supply drums I in the chambers i connected with the lower ends of the sections, a drum I′ in the chamber i' connecting the drums I, a steam drum L above the sections and communicating with the upper chambers thereof through connecting pipes L′, a smoke flue E extending from the chamber i' and a flue E′ extending through the section C from the smoke flue E to the upper rear part of the fire chamber, and a damper E^2 in the flue E′, the parts being constructed and arranged to operate as and for the purpose set forth.

JULIUS JUNGBLUT.
SVEN A. EKEHORN.

In presence of—
S. G. RICHTER,
FERDINAND RICHTER.