(No Model.) 3 Sheets—Sheet 1.

T. L. & T. J. STURTEVANT.

STEAM GENERATOR.

No. 487,792. Patented Dec. 13, 1892.

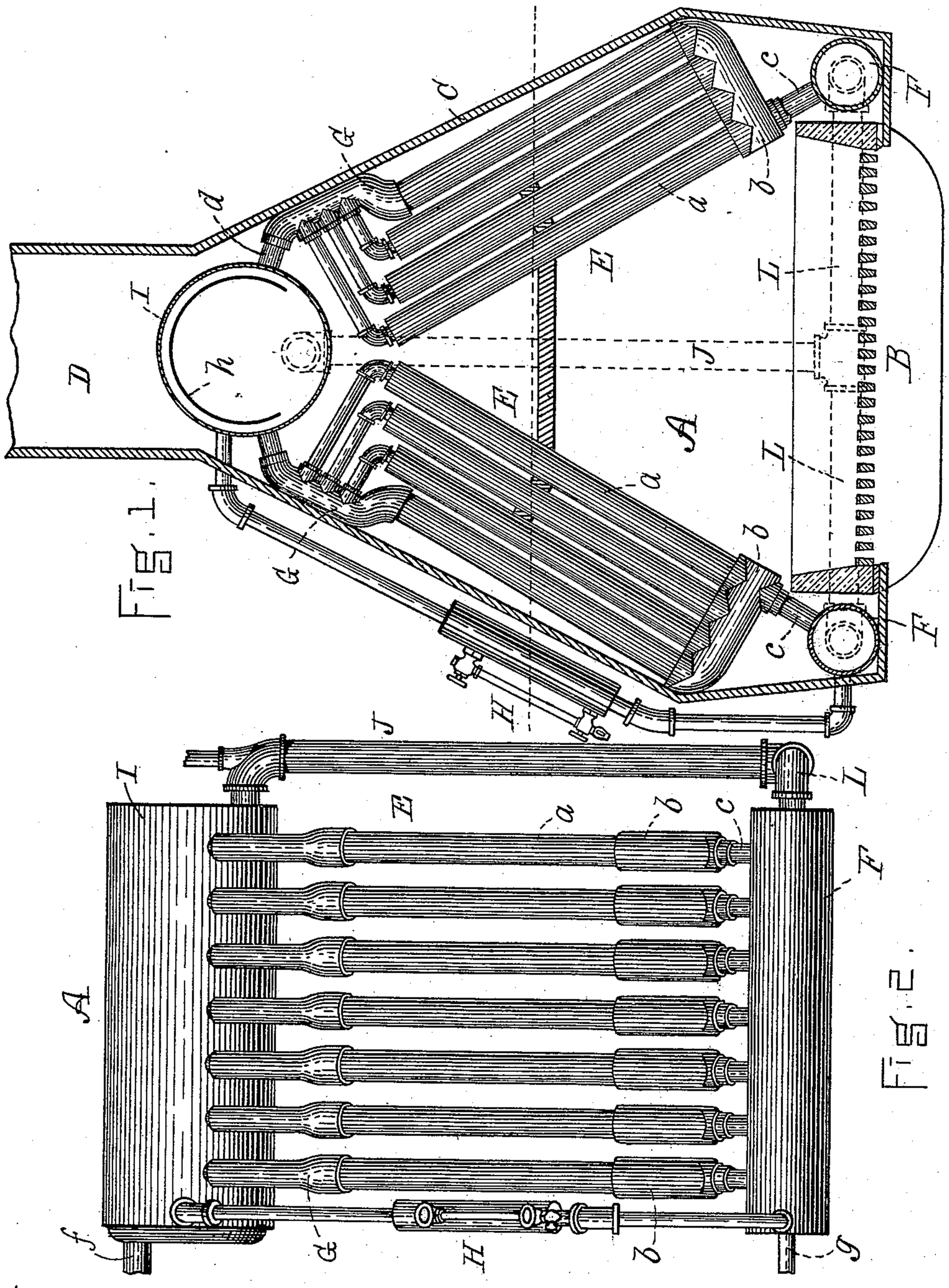


FIG. 1.

FIG. 2.

WITNESSES:

R. Henry Marsh.

Francis E. Stanwood

INVENTORS:

Tho's. T. Sturtevant.
Tho's. J. Sturtevant.
by H. C. Lodge Atty.

(No Model.) 3 Sheets—Sheet 2.

T. L. & T. J. STURTEVANT.

STEAM GENERATOR.

No. 487,792. Patented Dec. 13, 1892.

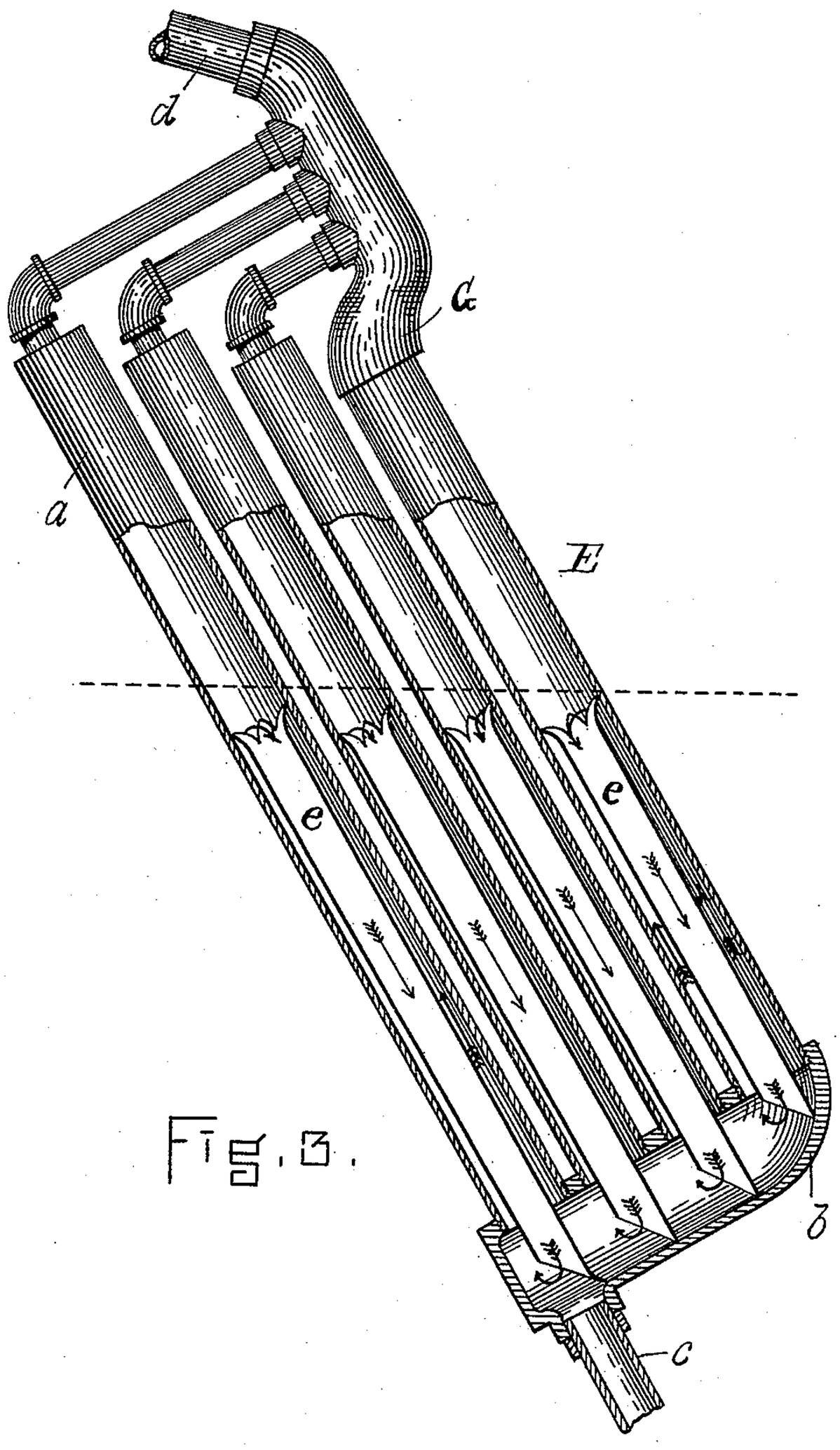


Fig. 3.

WITNESSES:

L. Henry Marsh.

Francis C. Stanwood

INVENTORS:

Thos. L. Sturtevant.
Thos. J. Sturtevant.
by H. C. Lodge Atty.

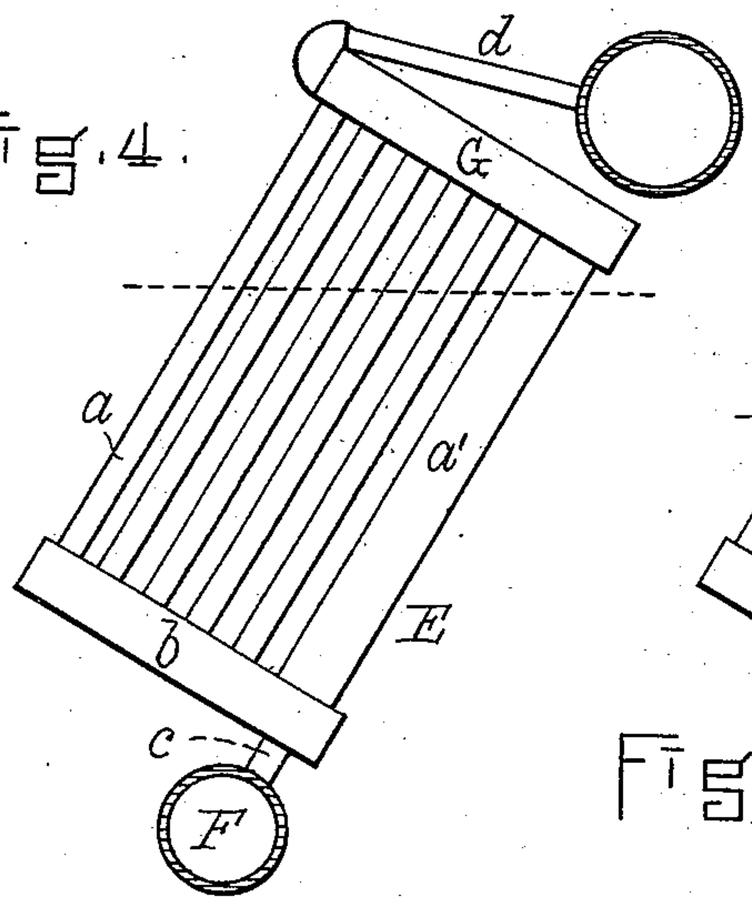
(No Model.) 3 Sheets—Sheet 3.

T. L. & T. J. STURTEVANT.

STEAM GENERATOR.

No. 487,792. Patented Dec. 13, 1892.

Fig. 4.



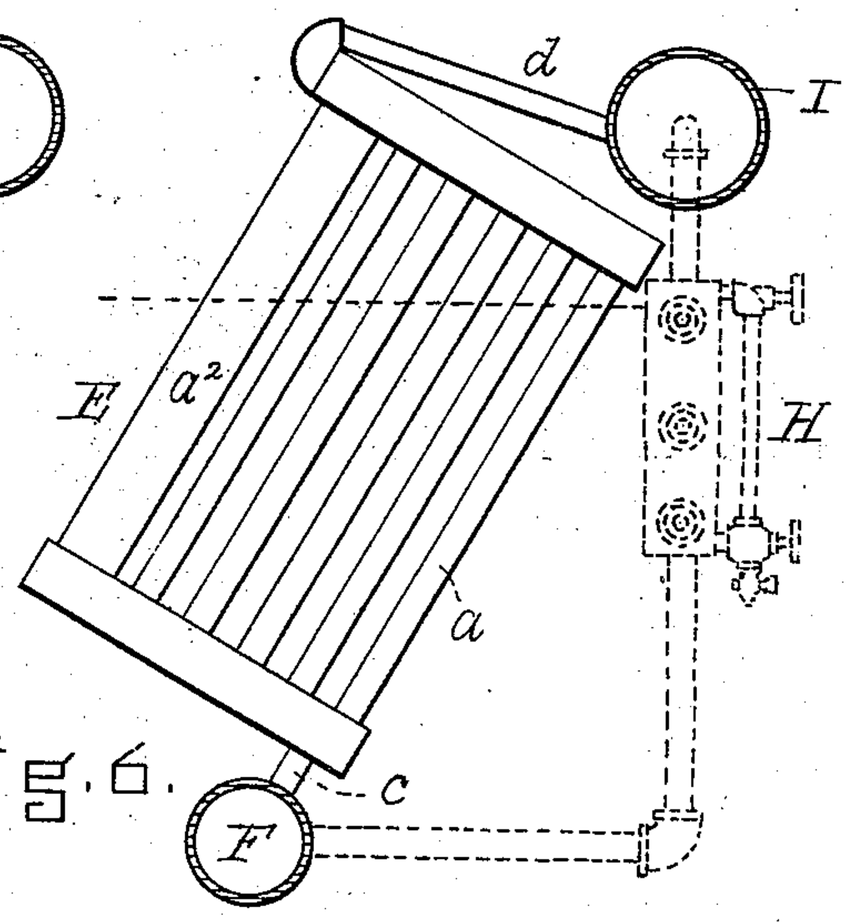
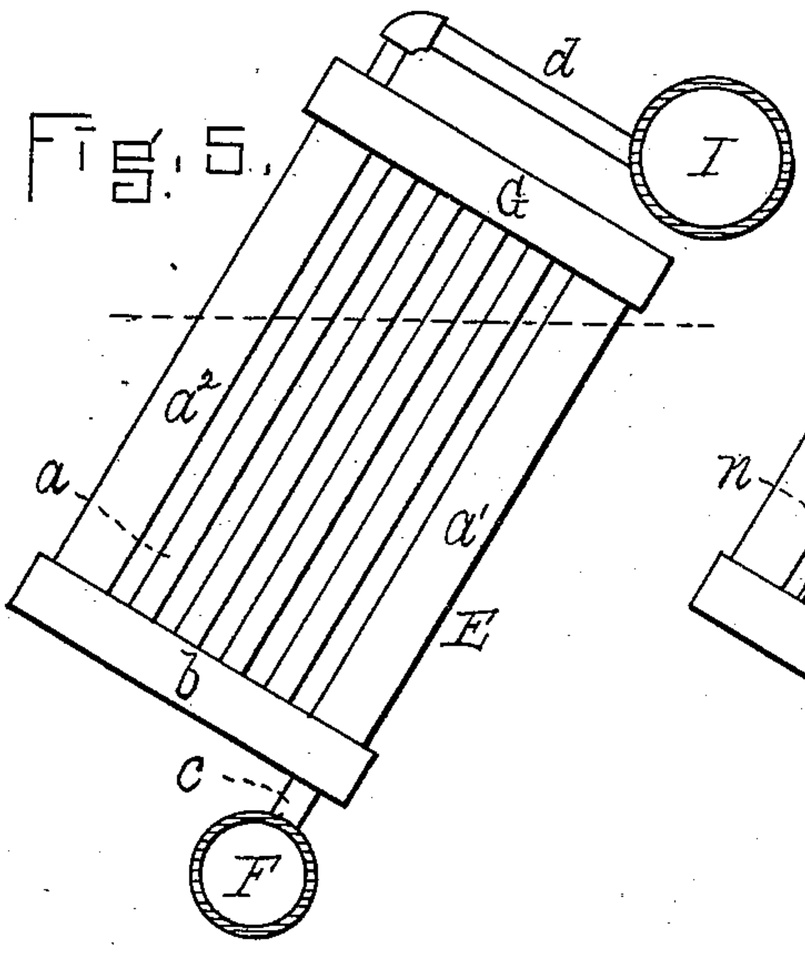


Fig. 6.

Fig. 5.



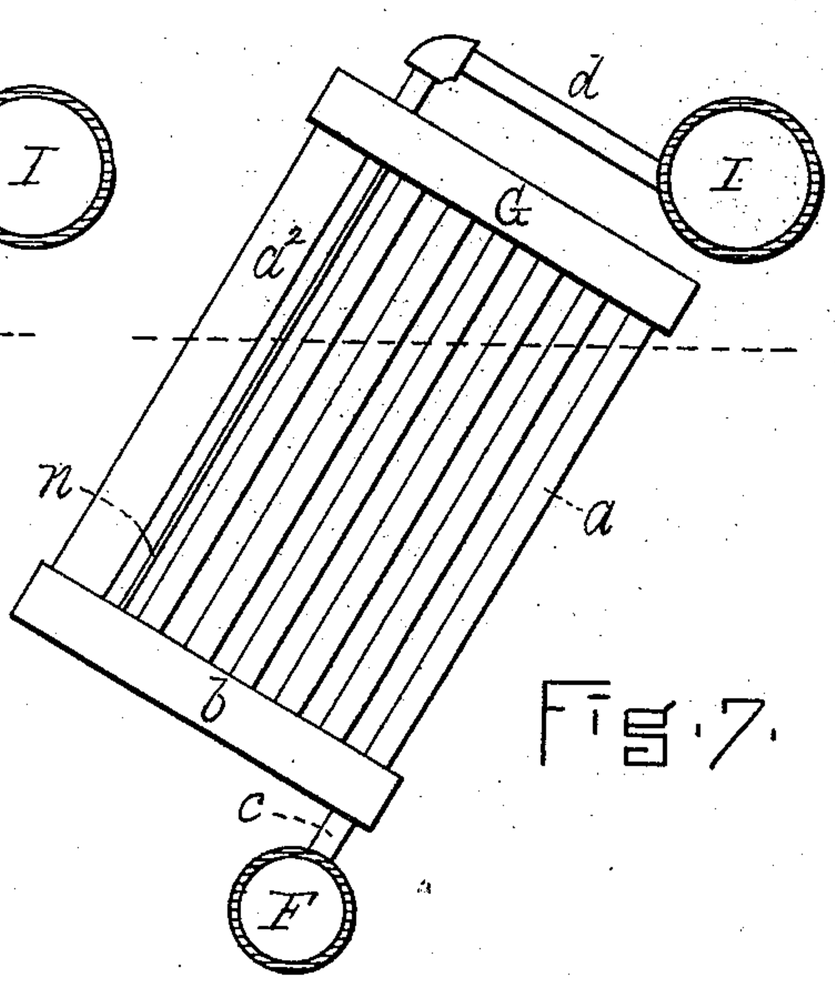


Fig. 7.

WITNESSES.

R. Henry Marsh.

Francis C. Stanwood

INVENTORS:

Tho's. L. Sturtevant.

Tho's J. Sturtevant.

by H. C. Longe Atty.

UNITED STATES PATENT OFFICE.

THOMAS L. STURTEVANT AND THOMAS J. STURTEVANT, OF FRAMINGHAM, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 487,792, dated December 13, 1892.

Application filed November 3, 1891. Serial No. 410,779. (No model.)

To all whom it may concern:

Be it known that we, THOMAS L. STURTEVANT and THOMAS J. STURTEVANT, citizens of the United States, residing at Framingham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Steam-Generators; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to boilers, more particularly that class termed "sectional" water-tube steam-generators.

The object of our improvements is to enable a boiler of large steam capacity to be placed in small steam-launches and other steam-propelled vessels and economize space; but these peculiar advantages are equally applicable to ocean-going craft.

The prominent features in our invention, which is an improvement over that shown and described in United States Letters Patent No. 430,445, of June 17, 1890, consist in the general shape of the boiler, which is an inverted V, in its independent sections, which are in multiple, and the inclined position of the steam-making pipes. The gist of our invention is, however, embodied in the construction of each section, which when grouped and properly connected form the boiler as an entirety. These sections are composed of individual steam-generating pipes provided with a common water-supply and terminating at the top in a common steam and water receiver, which in its turn connects with the steam-drum proper. The water-level is carried below the upper ends of the steam-making tubes of the sections and preferably midway of the length of said tubes. When in active use, any water carried over by way of said steam-making pipe is delivered into the receiver and passed back by way of some of the other pipes of the section. Each pipe consequently serves as a separator for the other pipes in the section, and steam alone passes into the drum adapted for its reception. A drum, however, is not a necessity, especially when interior circulating-tubes are used, and in such instances the steam-making tubes may connect directly with any steam-delivery pipe.

The drawings represent in Figure 1 a transverse sectional elevation of a marine boiler embodying our invention. Fig. 2 is a side elevation. Fig. 3 is an enlarged view of a section showing the pipes partly in section to display the circulating-tubes when such are employed. Figs. 4, 5, 6, and 7 are modified forms in the construction of the individual sections shown in elevation, the peculiar features of which will be hereinafter alluded to in detail.

In the accompanying drawings a sectional marine boiler is indicated at A, with grate-bars at B, its inclosing casing at C, and smoke-stack at D. The cross-section of this boiler is in general shape an inverted V, as it is found to be of importance, since ample room is afforded for passage-ways by it even in small boats. Further, the center of gravity is low. As before premised, this boiler is made up of sections E, composed of a series of steam-generating pipes *a*, obliquely positioned. (See Fig. 1.) Said pipes are united at the bottom with a common water-leg *b*, which is supplied from a water-drum F by the pipe *c*. The upper extremities of said pipes *a* enter a common receiver G for steam and water, while a single pipe *d* therefrom unites it with the steam-drum I in the top of the boiler, as shown. This sectional character offers exceptional facilities for repairs or in case of an accident, since one or more sections can be removed, the holes where the pipes *c d* respectively enter the water-drum and the receiver being plugged, and the boiler can then be operated as well as before, with the exception that its steam-generating surface is reduced, dependent upon the number of sections removed.

The arrangement of the steam-making tubes in each section is a very important matter. Those next the fire are exposed to intense heat, while those farther from the furnace are more moderately heated. The first often carry water over with the steam unless they are of large size and contain circulating-pipes, which are shown at *e* in Fig. 3; but the

steam and water conducted over through the hottest pipes are carried forward in the upper part of the section and the water runs back to the base by way of some of the back pipes that have no strong upward currents. As a result, the general water-level is maintained, as shown. The steam alone goes up into the steam-drum. Thus the tubes act as separators for each other, (an important function,) and the water is carried back to the base as fast as raised without going over into the steam-drum. It will be noticed that in all forms of this steam-generator the water-level is carried in the steam-making sections, and consequently a water-gage H must be attached accordingly and below the steam-drum, as shown.

The steam-generating pipes inclined over the fire form a large part of the inclosing walls and receive a great proportion of the furnace heat by direct radiation This great heat causes a rapid circulation of the water in the steam-making tubes, and when they are large enough circulating-pipes are introduced, whereby the movement of the water is still further increased.

Reference to Fig. 4 shows a section constructed to enable wood to be used as fuel. Hence a large steam-making pipe a' is placed next the fire in each section. This pipe, being large, is strong and is not liable to be bent or injured by blows due to contact with sticks of wood when such are thrown into the fire. Small pipes under such usage would soon become bent and useless.

Fig. 5 is the construction deemed preferable when a forced draft is used, since more water is carried over by the steam-making pipes, which do not contain interior circulating-tubes. This is frequently the case when the pipes are of small diameter. Hence we insert a large pipe a^2 in the section farthest from the fire. This insures ample return-space for the water. In general, however, only the rear steam-making tube or tubes a^2 are made large, those next the fire being of small size, as indicated in Fig. 6.

The construction shown in Fig. 7 is provided in case the position of the generator is such that there is no room for deep sections containing a large number of steam-making tubes. A partition n is placed between the steam-making tubes nearest the fire and the others, so that the back tubes are protected from the fire, and thus making little or no steam are used as return-pipes for those making steam and carrying over water.

The steam-drum I, with which the boiler is equipped in the present instance, is intended to contain only steam; but in case of condensation a return-pipe J at one end connects it with the water-drum F by a branch-pipe L. The steam-delivery is at f, the blow-off at g, and the water-gage at H.

In Fig. 1 the steam-drum is seen to be furnished with a deflector-plate h in order to separate any water which may enter from the sections or water of condensation formed in the drum from the general body of the steam, which is thus rendered very dry.

The inclined steam-generating pipes are more effective than vertical pipes, since they present their surface more directly to the upwardly-escaping heat and gases emanating from the fire. When said pipes are of large size, they may contain circulating-pipes e, whereby the movements of the water are more rapid, while the steam generated escapes more readily. Each steam-generating pipe when it contains a circulating-pipe is a complete boiler, having a water-feed inlet, a steam-discharge, water-level, and steam-room. Hence the steam-drum F may be omitted and steam drawn directly from the sections.

The operation of this steam-generator is as follows: After being filled to the proper level with water and fire being made in the space under the steam-generating tubes, (which is the fire-box of the boiler,) the tubes heated by the fire soon begin to make steam, which, rising in the usual manner, passes up through the various passages provided for it into the steam-drum. Any water traveling with it at first drops back by gravity to the base through the easiest passage it finds on its way. The water gathered in the drum is forced out by gravity through the return-pipe J to the base. The feed-water is forced in through the same pipe, as circumstances require. Sediment is deposited in the water-drum F, from whence it is occasionally blown off through the blow-off pipe shown. When circulating-pipes are used, the arrows in the drawings indicate the direction taken by the water-currents.

What we claim is—

1. In a steam-generator, the combination, with a water-drum extending on one or more sides of the furnace and water-legs connected therewith, of a steam-drum having steam and water receivers connected thereto and a series of inclined steam-generating tubes connecting said water-legs and steam and water receivers, substantially as set forth.

2. In a steam-generator, the combination, with a water-drum extending on one or more sides of the furnace and water-legs connected therewith, of a steam-drum located centrally of the furnace and having steam and water receivers connected thereto, and a series of steam-generating tubes of different lengths connecting said water-legs and steam-receivers, the outer tubes of each series being connected directly to said steam-receivers and serving as water-return pipes, substantially as set forth.

3. In a steam-generator, the combination, with a water-drum and water-legs connected therewith, of a steam-drum having steam and water receivers connected thereto, and a series of steam-generating tubes of different lengths connecting said water-legs and steam-receivers, each of said generating-tubes being provided with an interior circulating-pipe, substantially as set forth.

4. A sectional water-tube boiler having a steam-discharge, the water or mud drum below, and multiple sections connected with and rising therefrom, an intermediate water-leg which connects the individual steam-generating pipes at the bottom with the water-drum, and a steam and water receiver whereby the steam-generating pipes nearest the fire are connected at the top with the corresponding pipes farthest from the fire, so that each pipe of a section shall act as a separator for the other pipes in that section to retain water and deliver steam, and an indicator to show the water-level in said steam-generating pipes, substantially as explained.

5. A sectional water-tube steam-generator consisting of two rows of water-tube sections, substantially as shown, placed upon opposite sides of the fire-chamber and inclined toward each other above the fire, as described, with steam-discharge, a water-supply, and an indicator to show the general water-level existing in the steam-generating pipes of said sections, for purposes specified and explained.

6. In a steam-generator, the combination, with a steam-drum arranged at the upper part thereof and a water-drum arranged at the base thereof, of a water-leg connected with said water-drum, a steam-receiver connected with the said steam-drum, and a series of inclined independent sections communicating at their lower ends with the said water-leg and connected at their upper ends with the said steam-receiver, the said steam-receiver, inclined sections, and water-leg forming a connection between the said water-drum and steam-drum.

In testimony whereof we affix our signatures in presence of two witnesses.

THOS. L. STURTEVANT.
THOMAS J. STURTEVANT.

Witnesses:
H. E. LODGE,
FRANCIS C. STANWOOD.