No. 862,872. PATENTED AUG. 13, 1907.

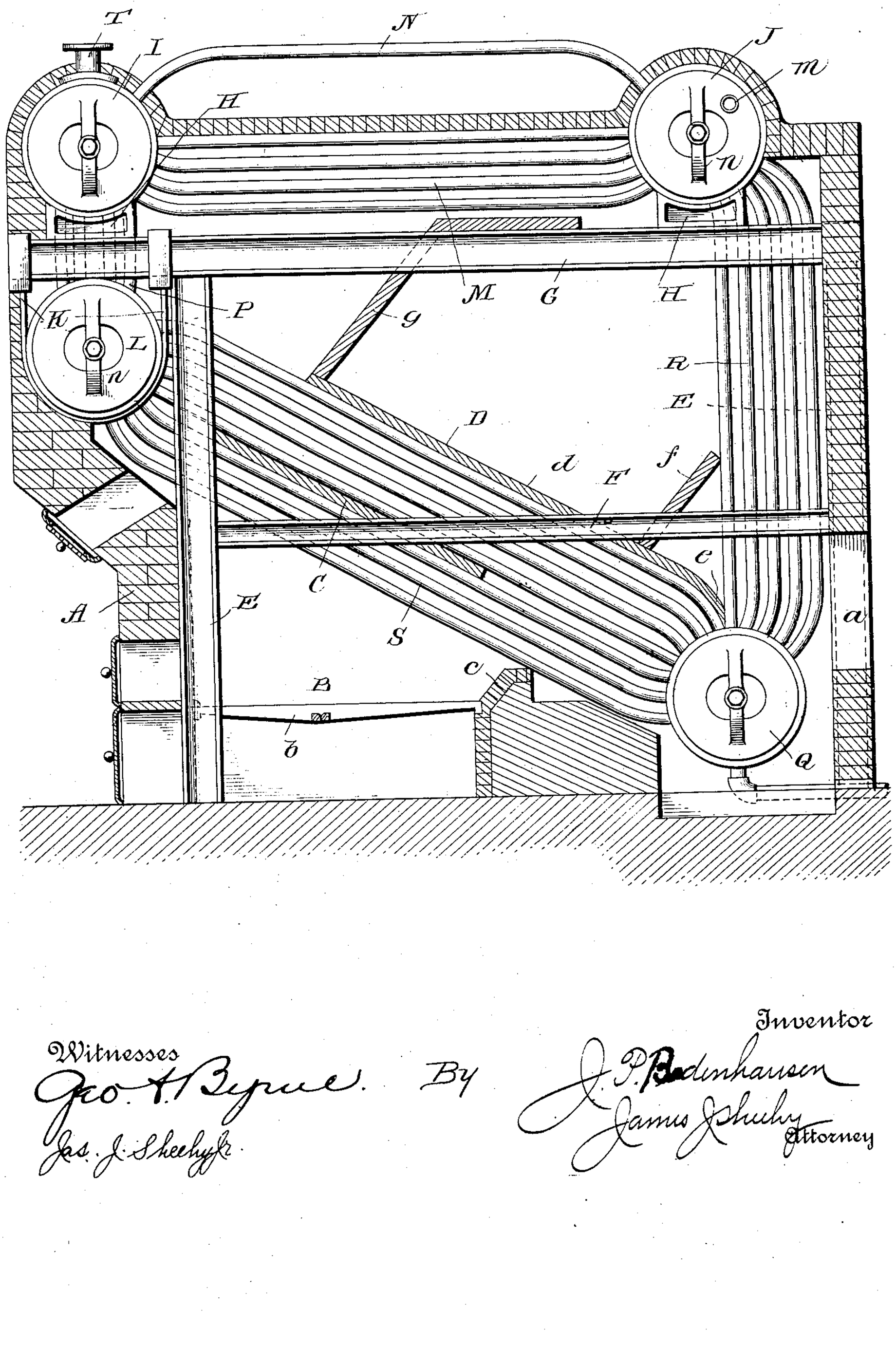
J. P. BADENHAUSEN.

WATER TUBE BOILER.

APPLICATION FILED JAN. 22, 1907.

2 SHEETS—SHEET 1.

Fig. 1.



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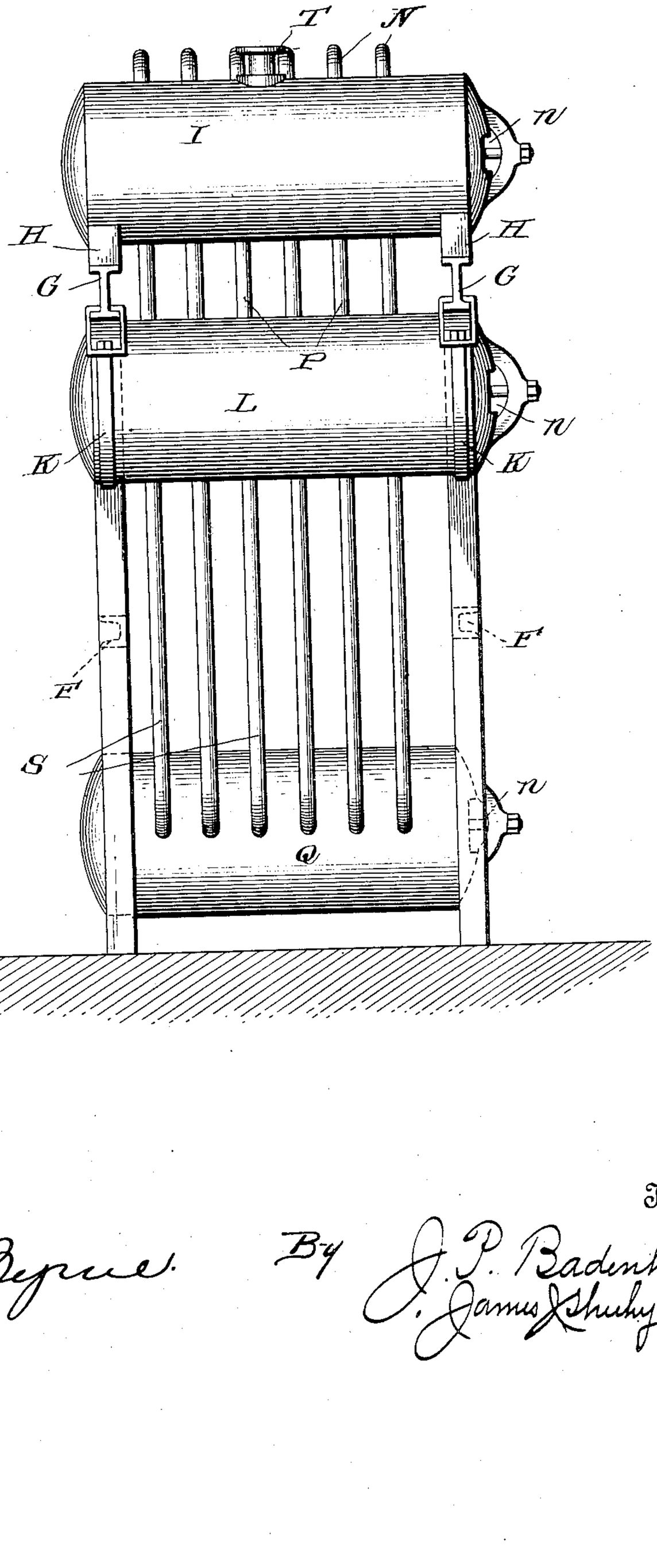
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN P. BADENHAUSEN, OF SEATTLE, WASHINGTON.

WATER-TUBE BOILER.

No. 862,872. Specification of Letters Patent. Patented Aug. 13, 1907.

Application filed January 22, 1907. Serial No. 353,520.

To all whom it may concern:

Be it known that I, JOHN P. BADENHAUSEN, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented new and useful Improvements in Water-Tube Boilers, of which the following is a specification.

My invention pertains to steam generators; and it contemplates the provision of a steam generator of the water tube type having a large amount of heating surface in proportion to its size and also having an arrangement of water holders that will assure positive and rapid circulation according to the known laws of physics, with a view of contributing to its steam generating capacity, and one in which the mud drum is free to move in any direction necessary to accommodate itself to expansion and contraction due to changes in temperature, and in which all of the parts are so shaped that they are not liable to be distorted when subjected to pressure.

Other objects and advantageous features of my invention will be fully appreciated from the following description and claims when the same are read in connection with the accompanying drawings, forming a part of this specification, in which:

Figure 1 is a vertical section of a water-tube steam generator constructed in accordance with my invention. Fig. 2 is a detail view taken at a right angle to Fig. 1 and illustrating the arrangement of the several drums relative to the supporting frame therefor.

Similar letters of reference designate corresponding parts in both views of the drawings.

The casing A of my generator may be of the construction illustrated or of any other construction compatible with the purposes of my invention, and need not therefore be described in detail except to say that it is provided at *a* with an outlet for products of combustion. In the lower front portion of the said casing A is provided a furnace B having the usual grate *b* and bridge wall *c*, while above the furnace are suitably supported lower and upper baffles C and D, of fire-clay or other suitable refractory material; the lower baffle C being inclined downwardly and rearwardly from the forward portion of the casing, and the upper baffle D being made up of a portion *d* arranged parallel to the baffle C and having a depending curvilinear tail-piece *e*, a rear portion *f* extending upward and rearward at an angle to the portion *d*, and a forward portion *g* extending upward and rearward at an angle to the portion *d* and then rearward horizontally, all as shown in Fig. 1.

E E are steel uprights, preferably of I-form in cross-section, arranged in the casing A.

F F are longitudinal steel bars connecting the fore and aft uprights E.

G G are longitudinally disposed, horizontal steel beams, preferably of I-form in cross-section, arranged on and connected to the uprights E, and H H are cradles, preferably of steel, positioned on and supported by the said I-beams G. In these cradles H are arranged upper, fore and aft drums I and J designed to contain steam and water, while arranged in hangers K connected to the beams G is a forward drum L designed to contain water. The upper fore and aft drums I and J are connected through water tubes M arranged in the casing A, and also through steam equalizing tubes N located above the said casing A, while the drum L is connected with the forward drum I above it through water tubes P.

Q is a mud drum located in the lower, rear portion of the casing A. This latter drum is connected through upright water tubes R with the upper, rear drum J, and through oblique water tubes S with the forward, lower drum L; and it is supported by said water tubes R and S alone, this being advantageous since it leaves the mud drum free to move in any direction that may be necessary to compensate for expansion and contraction due to changes in temperature without in any way impairing the connection between said drum and the tubes R and S.

In the practical operation of my novel generator, the products of combustion take the course indicated by arrows from the furnace B to the outlet *a*, and the feed water that is introduced into the upper rear drum J through a suitably located port *m*, passes from said drum J through the tubes R, mud drum Q, tubes S, lower forward drum L, tubes H, upper forward drum I and tubes M, in the order named, when it again takes the same course. From this it will be apparent that the circulation in the water holders of my generator is positive and very rapid, and is maintained in strict accordance with the known laws of physics with the result that it contributes materially to the capacity of the generator; also, that throughout its course the water is subject to the heat of the products of combustion until it is converted into steam and occupies the upper fore and aft drums I and J.

Steam is taken off the upper fore and aft drums I and J through the steam outlet T of the former; steam passing from the drum J to drum I through the equalizing tubes N.

As will be gathered from the foregoing, the steel frame described sustains the weight of the several drums and tubes and the water contained therein.

By reference to Fig. 2, it will be seen that each of the several drums is composed of a cylinder and sections of spheres, shapes which will not distort when subjected to pressure; also, that each drum is provided at one end with a manhole, and by removing all of the manhole plates *n* the whole generator is made fit for inspection. The form of the drums renders it unnecessary to employ stay bolts and the like, and the use of the manhole plates obviates the necessity of employing joints and gaskets which are likely to leak after a short period of use.

In addition to the advantages hereinbefore ascribed

to my novel generator, it will be noted that the generator is simple and compact in construction, and in proportion to its size is possessed of high steam generating capacity; and it will also be noted that the size of the boiler may be increased either by increasing the number of sections or by increasing the lengths of the different sets of water tubes.

Having described my invention, what I claim and desire to secure by Letters-Patent, is:

1. A steam generator comprising cross steam and water drums, tubes connecting the same, a water drum located below one of the steam and water drums, tubes connecting the water drum and said steam and water drum, a mud drum located under the other steam and water drum, tubes connecting the mud drum and said steam and water drum, and tubes connecting the water drum and the mud drum.

2. A steam generator comprising cross steam and water drums, water tubes connecting said drums, a frame supporting the steam and water drums, a water drum hung from the frame and positioned under one of the steam and water drums and connected therewith by interposed water tubes, a mud drum positioned under the other steam drum and located in a horizontal plane below that of the water drum, upright water tubes suspending the mud drum from the last mentioned steam and water drum, and oblique water tubes suspending the mud drum from the water drum.

3. A steam generator comprising a frame, steam and water drums supported on the said frame, a water drum positioned under and connected by water tubes with one of the first mentioned drums, and a mud drum suspended by water tubes from the other of the first mentioned drums and from the water drum.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN P. BADENHAUSEN.

Witnesses:
J. D. HULL,
J. C. MOORE.