

(No Model.)

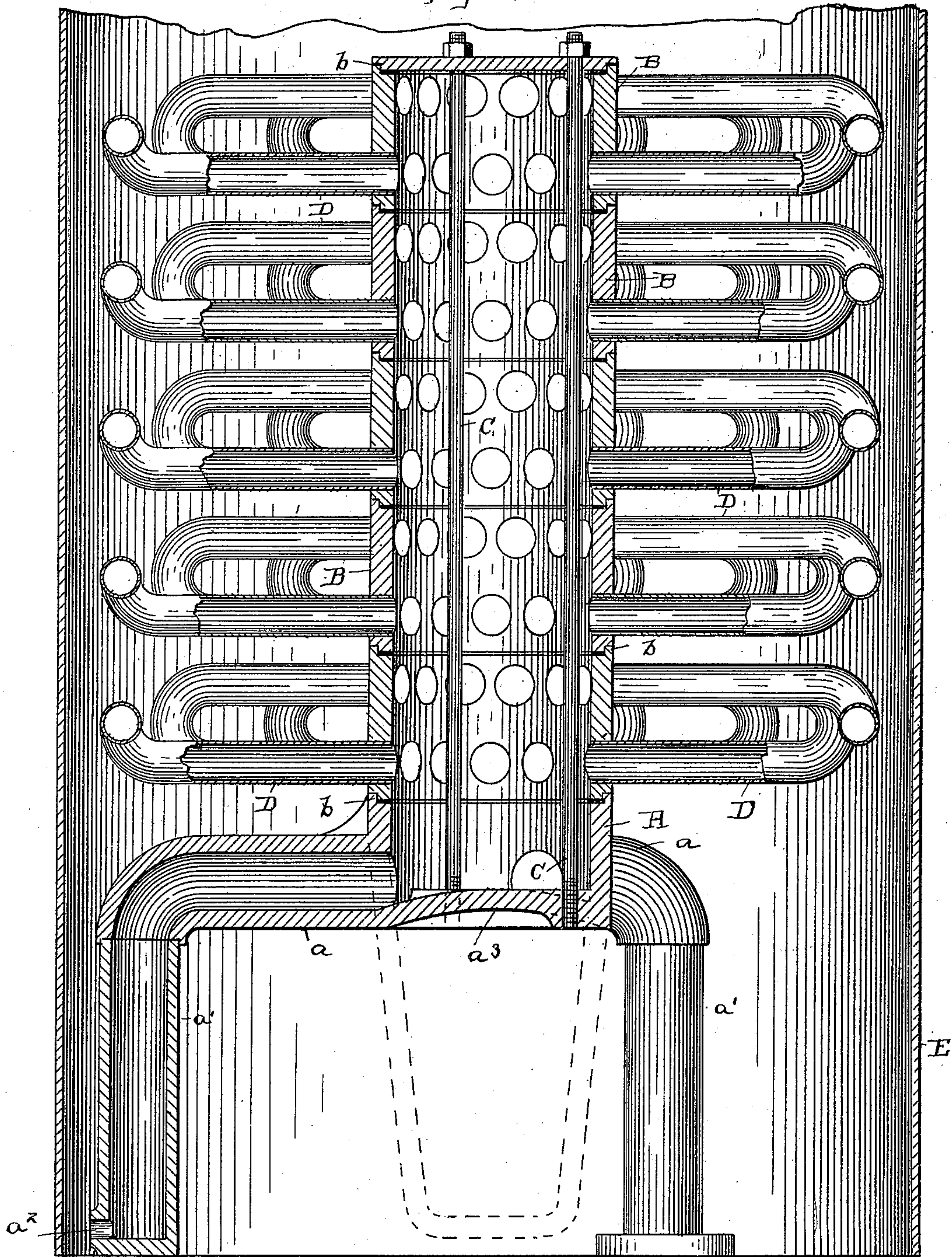
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G. A. CRANE.  
STEAM BOILER.

No. 492,936.

Patented Mar. 7, 1893.

Fig 1.



ATTEST.

R. B. Moser.  
N. L. McLane  
J. H. Fisher  
ATTORNEY.

INVENTOR  
George A. Crane.



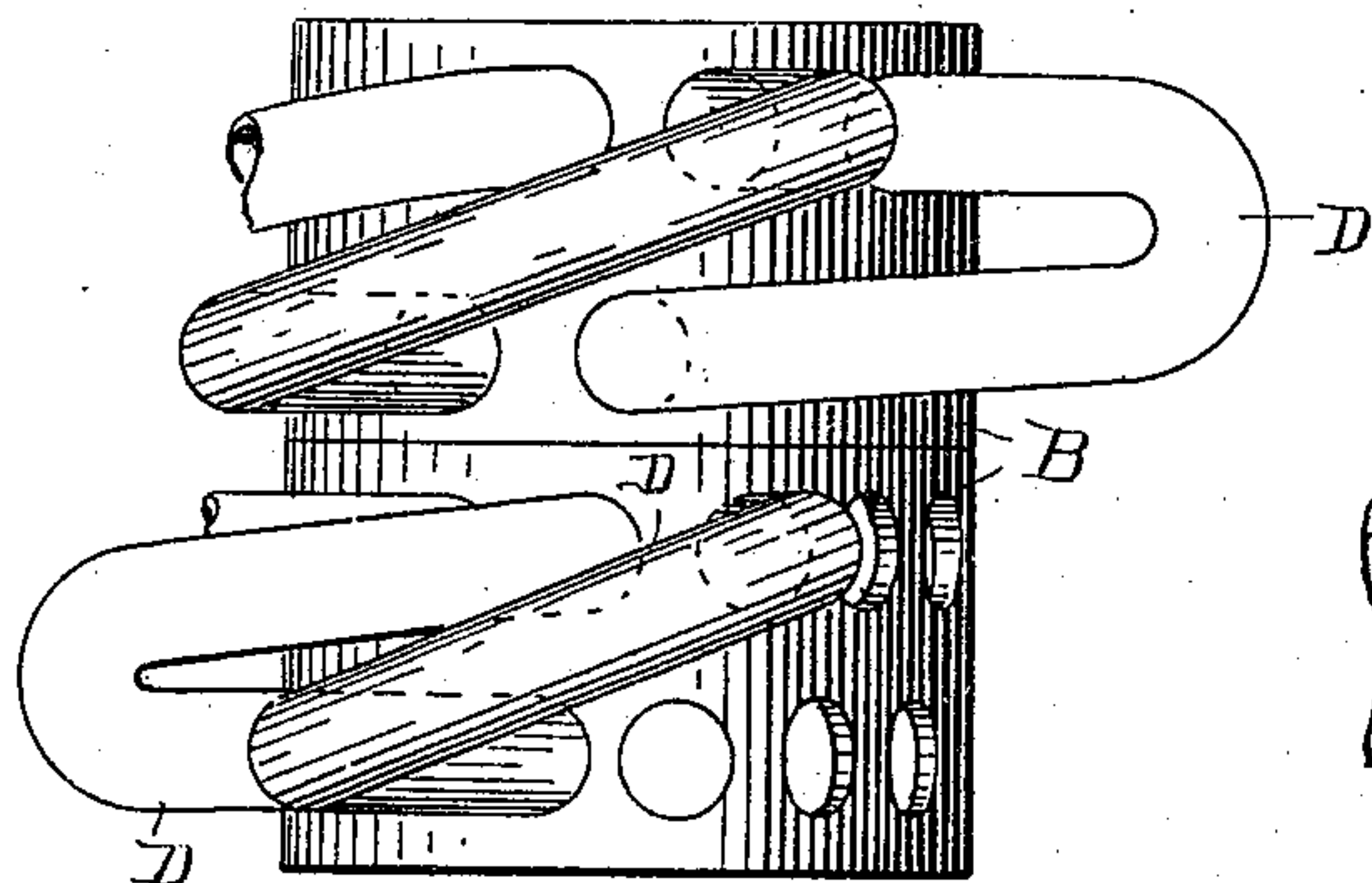
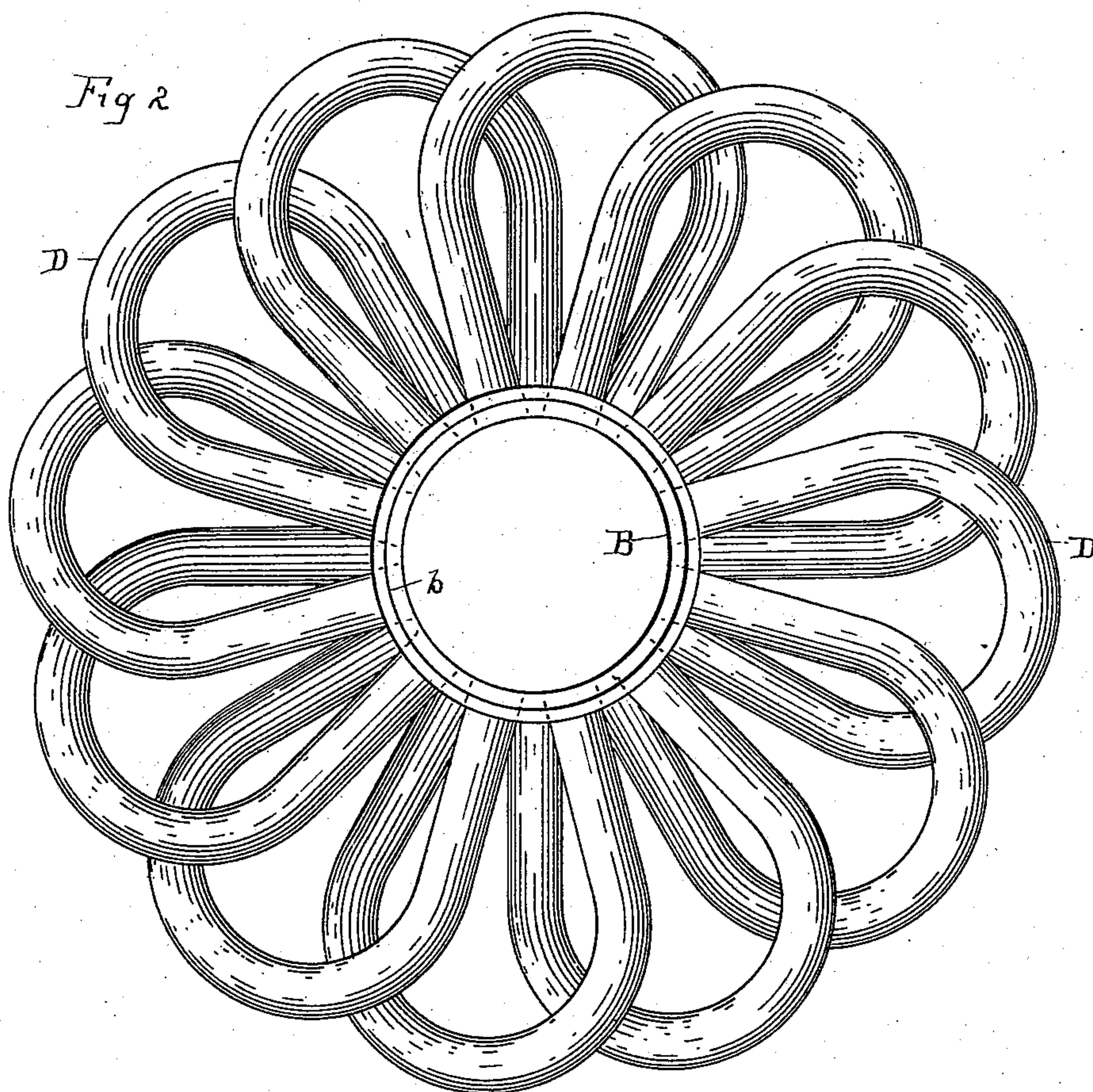
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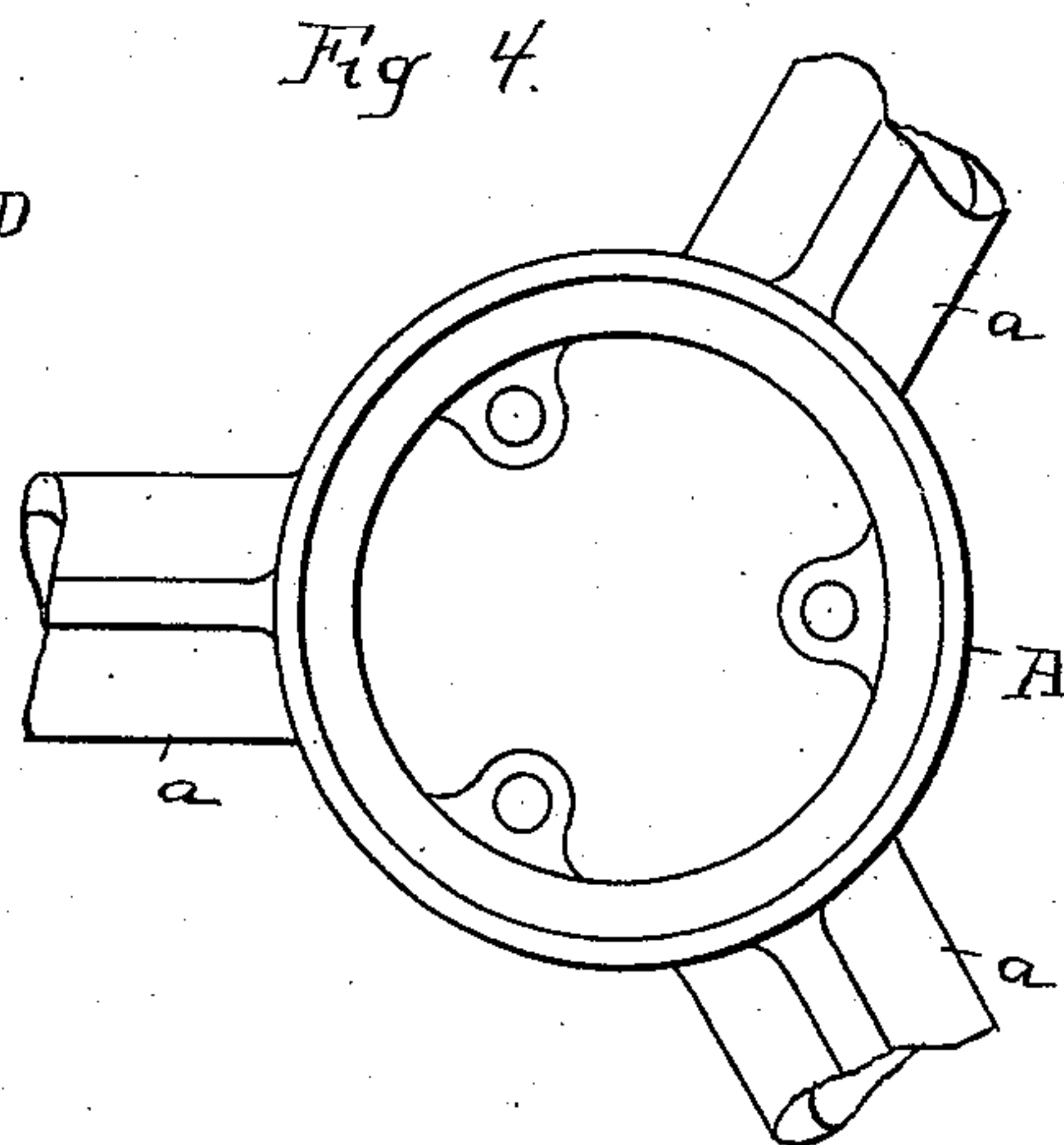
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*Fig 3.*



INVENTOR.

George A. Crane

ATTEST

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N. L. McLane.

By H. T. Fisher.

ATTORNEY



# UNITED STATES PATENT OFFICE.

GEORGE A. CRANE, OF CLEVELAND, OHIO.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 492,936, dated March 7, 1893.

Application filed April 14, 1892. Serial No. 429,120. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE A. CRANE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Steam Boilers; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention has reference to steam boilers, and the invention consists in a boiler built in sections resting, preferably, horizontally one upon another, and each section provided with a series of expanding tubes about its outside, all substantially as shown and described and particularly pointed out in the claim.

In the accompanying drawings Figure 1 is a vertical central section of a boiler constructed according to my invention. Fig. 2 is a plan view thereof, omitting the outside inclosing case, shell, or wall. Fig. 3 is a side elevation of one of the boiler sections in which is shown the arrangement of the expanding tubes to one another and to the central body portion of the section. Fig. 4 is a plan view of the base section or portion of the boiler.

In the construction of boiler as herein shown we have a base portion A with three tubular arms *a*, preferably formed integral therewith, and three tubular supporting legs *a'*, the whole forming a tripod upon which the boiler structure rests. The legs *a'* have suitable flanges at their bottom through which the boiler is bolted to its foundation. In each leg, and below the grates, is a blow-off-outlet *a<sup>2</sup>*, for removing any sediment or deposit that may accumulate in the boiler. By the construction herein shown the sediment or deposit referred to will gravitate to the bottom of the water space, and inasmuch as these legs open into the bottom of the boiler, the sediment will gravitate or deposit in the legs below the boiling point and below the point where it would be riled up and carried up by the boiling water, so that thereby the boiler will be kept clean of sediment and a material advantage be gained in its operation.

The portion of the base A with which the arms *a* are immediately connected forms the bottom section of the boiler, and the several

sections, when united, constitute a vertical column and may be made of wrought or cast iron, or other suitable metal, as desired. The superposed sections B are all constructed alike, and there may be as many of these as the size and character of the boiler may demand. Each of these sections is cylindrical in form, and one is supported immediately upon the other throughout the structure. Each section or ring of the column has a rabbet formed about its lower and outer seating edge, and a lip *b* about its upper and outer edge adapted to engage in the rabbet of the section immediately above it. Between these sections and inside of the lips referred to, I place a light copper ring, or other suitable packing, to make a tight joint and prevent leakage, and the said several sections are held together by bolts or rods C, extending through the several rings from top to bottom, so that all said parts are firmly united and make a water and steam tight structure throughout.

Each section A, is provided with two series of holes of suitable size, one series being above the other, and the said series preferably parallel to one another. In these holes are secured the expanding tubes D. These tubes are, preferably, of about the shape of a horse shoe, having their bent portion made in a common circle, and their ends fitted closely in the upper and lower series of holes respectively, in the section B, the arrangement of these tubes being clearly shown in Figs. 1 and 3. For convenience, the bend of each tube is made an exact semi-circle. This makes all the tubes alike, and gives a graceful and easy bend to the tubes.

It will be noticed in Fig. 2 that,—viewed from a vertical point,—the said tubes stand in a staggered relation to one another instead of being one immediately above the other in the successive superposed sections. When viewed in side elevation, with all the tubes arranged as shown, the series of tubes run on spiral lines. By this arrangement all the tubes are exposed to the heat and none are especially sheltered by the others beneath, so that the heat is made effective on the successive tubes from bottom to top. This gives a very large heating surface to the water contained in the boiler, and by reason of the exposure of the water in tubes thus arranged,



it requires but a few moments to heat the boiler to a steam producing condition, and much less time than would be required if an equal surface were not thus exposed.

5 Among the advantages of this construction we have the following:

First. Safety. This boiler being a water tight boiler, having no steam drums or receivers, makes an explosion impossible, and  
10 as all parts are cylindrical and of similar diameter, the greatest strength possible is obtained.

Second. Weight. All parts of this boiler being of small diameter, and all presenting effective heating surface, very little water is  
15 carried in the boiler column, and as the heating surface is most effective by reason of this construction, as well as being unusually large, less diameter and height is required to evaporate a given quantity of water in a given time.

Third. Ease in repairing. The boiler being built up in independent sections, the matter of repairing in cost of time and incidental expense is materially reduced. If any one section becomes impaired, it can easily be removed for repairs or replaced by a new section, and as all the sections are made interchangeable, any one thereof may be removed entirely, if desired, or replaced by a new one  
25 by any unskilled person. This enables me to dispense with the necessity of taking the boiler to a shop or of sending it to a boiler maker for repairs, or of calling in an expert mechanic to make the necessary changes or repairs.

Fourth. Cleanliness and durability. This boiler is practically self cleaning, because all surfaces where sediment would tend to deposit are made convex, the bottom of the boiler being shown convex at  $\alpha^3$ , and the tubes being  
40 bent and set in the column at an angle to a vertical plane, and with one end higher than the other, the sediment naturally precipitates or gravitates to the lowest parts of the boiler or water space, which is below the grates.  
45 The valves in the legs enable an easy way for removal of sediment, and the boiler may be cleansed daily if desired, and its cleanliness be thus assuredly maintained.

Fifth. Economy. The tubes in this boiler

are set alternately, one above the other, in a diagonal or spiral line, as before described, and this causes the flame and heat from the fire to impinge with greatest intensity upon the tubes, thereby transferring the greatest amount of heat to the water within the tube. The effective surface again in this way compensates for the difference in size for a given horsepower over the ordinary shell boiler, and the fuel required being decreased in the same proportion and being another item in the economy of operating the boiler constructed after the manner herein described.

E represents a wall, jacket, or casing about the outside of the boiler, and between which and the boiler and its tubes is the heating space or chamber. Any suitable wall or jacket E may be employed for this purpose. If a portable engine be made, and this style of boiler is especially adapted to portable use, the wall or jacket will be of metal plate of any suitable kind. If the boiler be exclusively for stationary purposes it may have a bottom extension, as shown in dotted lines beneath the center of the column and legs. In that case the legs would be omitted and the sediment would deposit in the base of the boiler as thus shown.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A steam generator consisting of a series of sections seated one upon the other, each section having two concentric rows of holes, the holes in one row being out of line vertically with the holes of the other row, and expanding tubes having one end secured in the upper and one end in the lower row of holes of the same section of the boiler and out of line vertically, thereby throwing said tube at an angle to a horizontal plane, substantially as described.

Witness my hand to the foregoing specification.

GEORGE A. CRANE.

Witnesses:

H. T. FISHER,  
NELLIE L. McLANE.