3 Sheets-Sheet 2.

J. Harrison, Jr.,

Sectional Steam Boiler.

No 25,640. Patented Oct. 4, 1859.

Fig. 1.

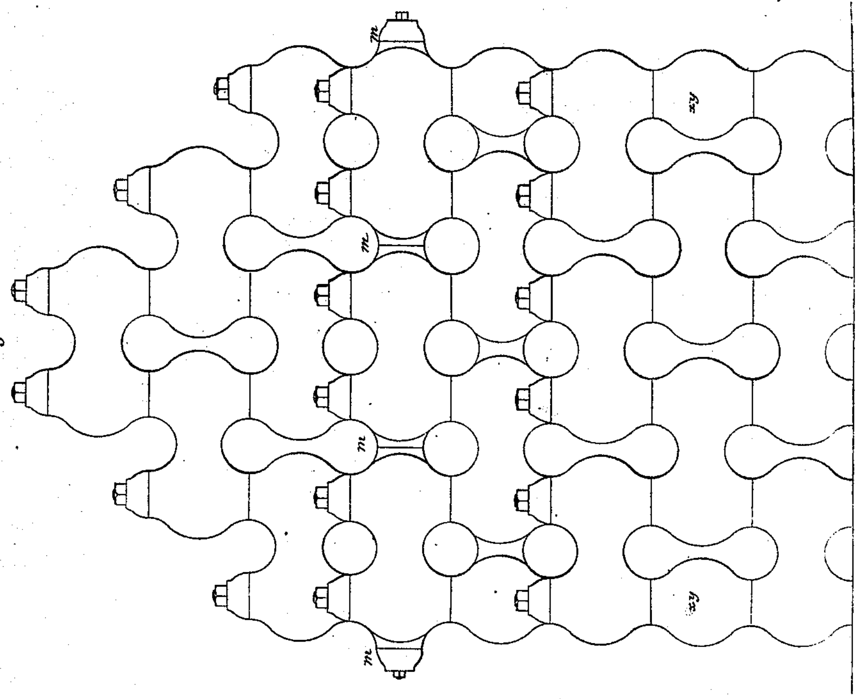
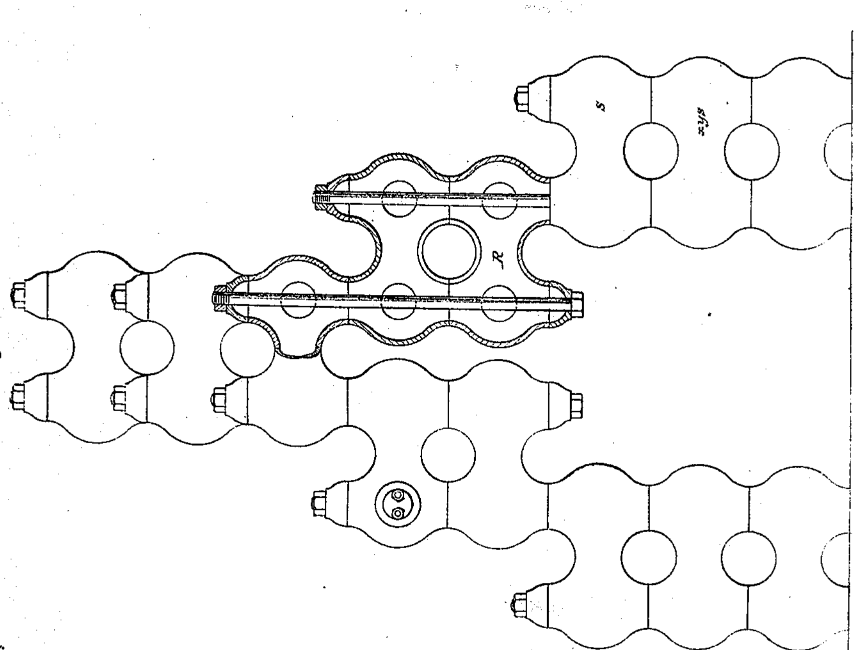


Fig. 2.



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3 Sheets-Sheet 1.

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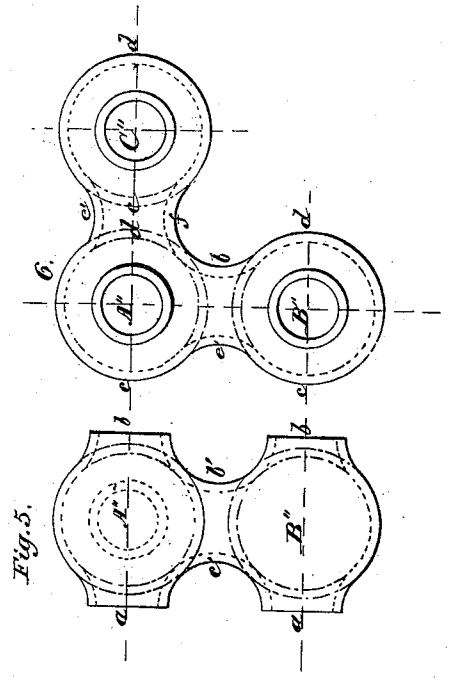

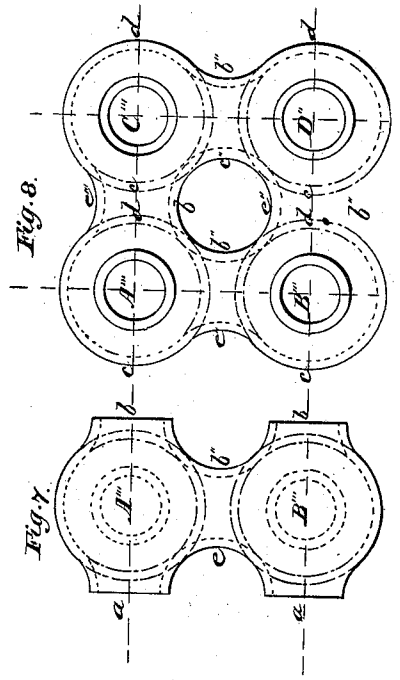

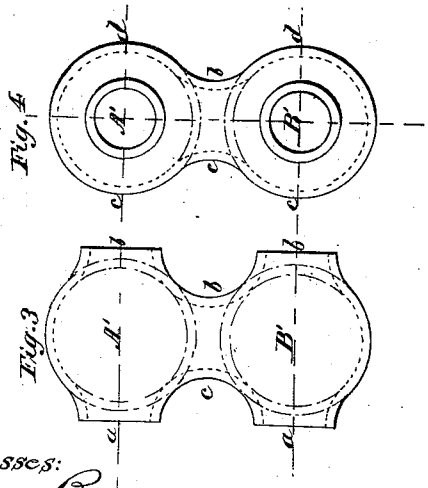

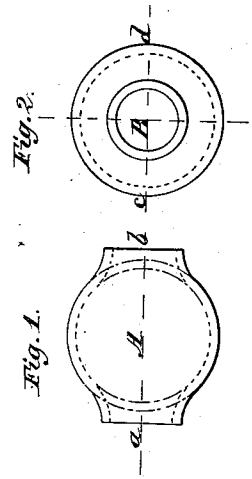

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3 Sheets—Sheet 3.

J. Harrison, Jr.,

Sectional Steam Boiler.

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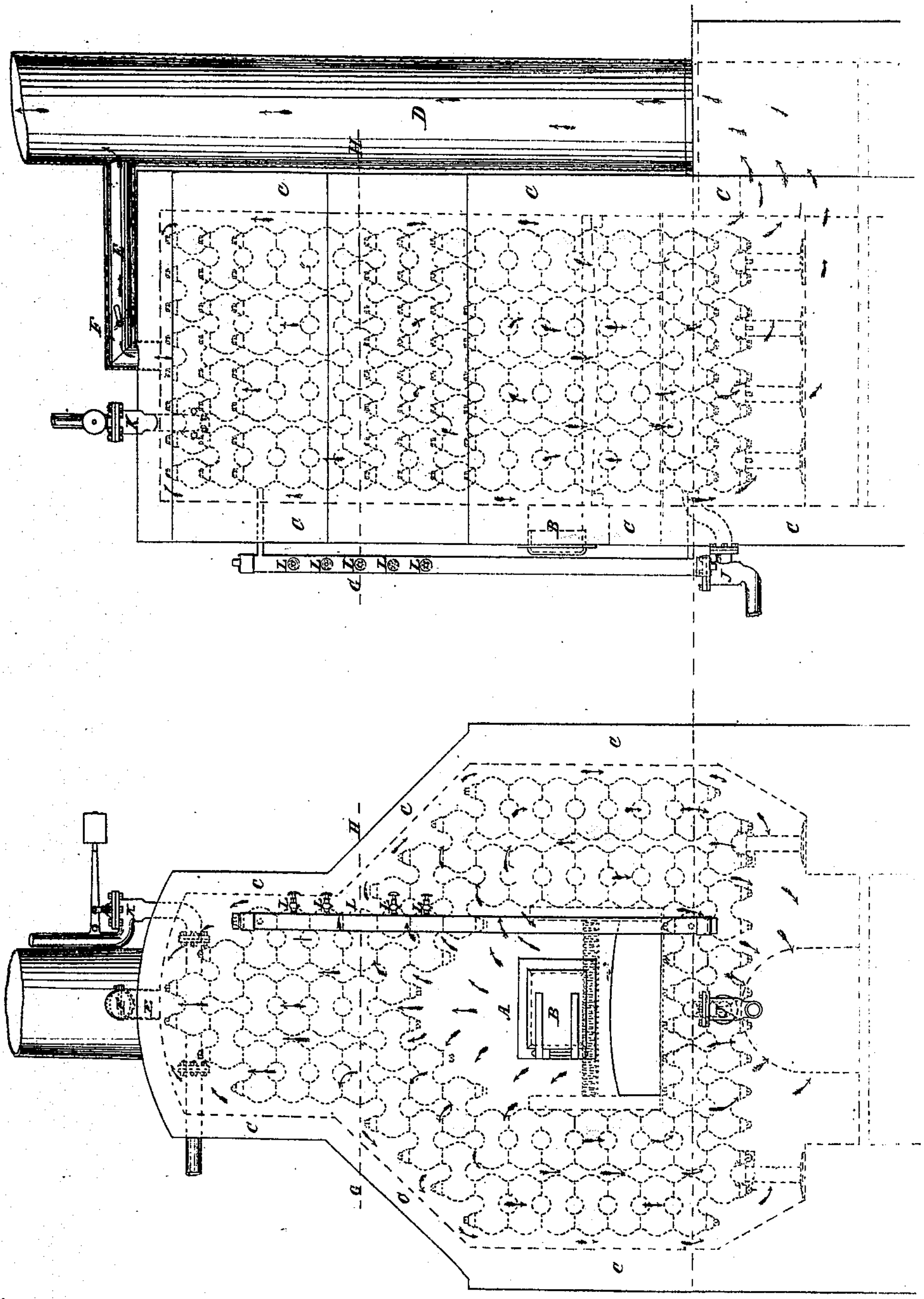
Fig. 2.

Fig. 1



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UNITED STATES PATENT OFFICE.

JOSEPH HARRISON, JR., OF PHILADELPHIA, PENNSYLVANIA.

IMPROVED STEAM-BOILER.

Specification forming part of Letters Patent No. **25,640**, dated October 4, 1859.

To all whom it may concern:

Be it known that I, JOSEPH HARRISON, Jr., of the city of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in the Construction of Steam-Boilers; and I do hereby declare that the following is a full, true, and exact description thereof.

It is unnecessary to describe the various plans of boilers heretofore devised, used, thrown aside, and taken up again. They all resolve themselves into two classes—the first, where the water in mass is sought to be converted into steam by the application of heat to the outside of the vessel containing it; the other, where, for the purpose of increasing the surface in contact with the water upon which the heat operates, the mass of water is divided by flues, tubes, chambers, and the like. Sometimes the water occupies the tubes, the heat circulating around them, as in the Nott boiler. Sometimes the tubes are only so many smaller flues, through which the heat is made to act upon the water in contact with them, as in the common locomotive-boiler. Sometimes, instead of tubes, flat parallel chambers are used, as in the Hancock boiler; but whatever may be the plan of construction, whether the most simple or the most complicated, the boiler, when completed and in use, is a mechanical structure made, in the first instance, on a given plan, and whose materials, whether consisting of simple sheets of metal only or including flues, tubes, chambers, and the like, are permanently fastened together, forming a united whole, while its peculiar and distinguishing characteristics, and even where, as has been the case, boilers have been planned in sections, yet in these cases such sections have been incapable of any general application, as in Gold's improved apparatus for heating buildings, patented on the 15th day of June, 1859, where, while the boiler can be elongated by multiplying the inner sections, the outer ones are shaped to accommodate the fire-box and the smoke-stack, and where, too, the inner sections are of a shape admitting of but one position in the boiler, and can only be used in the class of boiler for which they were originally prepared.

It is to be further remarked, too, in view of the more thorough understanding of my invention, that, generally speaking, the increase of the dimensions of boilers or a complication of their parts involves a loss of strength to be compensated by thickening the plates or by mechanical contrivances—such as stay-bolts and the like—thus increasing cost and weight in a greater ratio than the mere increase of size, and not always preserving the relative capacity of the boiler to resist explosions.

Now, the object, among others, which I have in view is to simplify, facilitate, strengthen, and cheapen the construction of boilers, resolving them into what I call "units of construction," presently to be described, each of which has a maximum of strength, and any number of which may be united to form a boiler of any given shape or dimensions, whose strength, being the strength of the sum of its units, will be as strong for all practical purposes as any one of them, and which units shall be so arranged and united that they may be separated for cleaning or renewal or repairs, or to be used in the making of other boilers of different size and shape. The objects thus stated I accomplish as follows: It is well known that a hollow globe is the strongest form that can be adopted in order to dispose of a given quantity of metal of a given thickness to resist either external or internal forces to compress it in the one case or to burst it in the other. Thus a hollow globe of good cast-iron three-eighths of an inch in thickness and six and a quarter inches in diameter, taking a very low figure as the breaking strength, will not burst under an explosive pressure of much less than two thousand pounds to the square inch. A boiler having no part of less strength than a globe of the dimensions above stated would be many times stronger, therefore, than is aimed at in any boiler now used to propel ordinary steam machinery. If a boiler, say, for a hundred-horse-power engine could be constructed of a sufficient number of such globes to furnish the required heating-surface, each globe being independent of the others so far as strength was concerned, such a boiler would be practically as strong throughout as the single globe. The construction, therefore, of such a boiler out of globes of the above dimensions, retaining each their independent individual strength, is the problem to which I have ad-

dressed myself and in the solution of which I have attained the object above proposed and others. Imagine four such globes resting on a plane surface within a parallelogram and connected by tubular openings in their adjacent sides as one casting, each globe having an opening with half a connecting-tube at top and bottom. Imagine now a pile of such castings, the lower half-tubes of one corresponding with the upper half-tubes of the one below it, and the whole pile bound together by four screw-bolts passing through the vertical connecting-tubes, with washers closing the openings of the upper and lower castings of the pile, respectively. There would thus be formed a vertical or a horizontal boiler, according to the position in which the column of castings was laid, to which the usual connections could be attached and to which heat might be applied by surrounding it with a proper casing of masonry or metal in many well-known ways.

I have described the globes as cast in fours, because I have found that, while all desirable strength may be obtained in this way, a unit of construction is obtained which may be more cheaply and advantageously made and more conveniently used than any other; but the globes may be cast singly or in pairs or triplets as well as sixtuplets, &c., and where certain forms of boilers are desired such castings may be found useful.

The annexed drawings, which are to be taken as a part of my specification, will show in more detail the nature of my invention and furnish full information to those desiring to use it.

Figure 1, Plate I, is a single globe in profile, the red line indicating the globular form, the dotted line the thickness of the casting, and the projections at *a* and *b* the tubular openings above referred to, and which it is seen are formed with reversed curved surfaces running into those of the globe, their edges being planed, or otherwise prepared, so as to form when drawn tight by the screw-bolts against the like openings in other globes a steam-tight joint. Fig. 2, Plate I, is a plan of the same globe. Figs. 3 and 4, Plate I, are globes cast in pairs. Figs. 5 and 6, Plate I, the same cast in triplets. Figs. 7 and 8, Plate I, the same cast in fours, and forming what I call the "unit of construction."

In all these figures the red lines indicate the globular forms which I prefer to use, and from which it will be seen that there is no more departure than is required for the tubular connections—a departure which, owing to the curved surfaces preserved throughout, does not affect practically the strength of the unit of construction aforesaid or its fractions, represented in Plate I.

Plate II represents various combinations of the unit of construction. Fig. 1, Plate II, shows at *x y* the use that is made of the globes in pairs or half of a unit, the full castings of fours or units in adjacent rows or courses being thus made to break joints with each other in the same way that a half-brick is used in breaking joints in courses of masonry, by beginning the course at a corner with a half-brick. Fig. 2, Plate II, shows a pyramidal form of boiler, and at *m n* the globes are shown in section for the purpose of illustrating the manner of using the screw-bolts. The washers here represented are in the shape of a cup whose lines correspond with the curved surfaces of the globes, increasing to the extent indicated the amount of fire-surface. The drawings of Plate II show also the direction of the circulation of the water in the boiler, where the units of construction, in lieu of being placed vertically one above the other, so as to form a column, are placed diagonally, as exhibited in the drawings, Plate II, Fig. 2, at R. S.

It will be seen that the water and steam connections, as above described and referred to in the drawings, are made with vertical channels and horizontal joints. In addition to such channels it might be desirable in some cases to have the globes drawn together with bolts in a lateral as well as in a vertical direction, thereby connecting the globes by vertical as well as horizontal joints, as shown at M M M, Plate II, Fig. 1; but it is unnecessary to multiply illustrations as to the changes that may be made in the form of the boiler. It is apparent from the inspection of the drawings that the units taken from one boiler may be used in another of a totally different form; that in the event of an explosion the explosion of a single unit affords an escape for the steam, making it impossible that explosions destroying buildings and vessels by the sudden disengagement of large volumes of water and vapor, thereby scattering great masses of boiler material in every direction, should occur where my improvement is used; that by unscrewing a few nuts and removing the bolts the whole structure may be taken down, or any unit may be removed for cleaning, repairing, or replacing or altering the face exposed to the direct action of the fire. Thus in a sea steamer, or, indeed, wherever else sediment may be deposited, the whole range of units at the bottom may be removed in succession and replaced with clean ones while the others are prepared for replacing at leisure, or the entire boiler may be removed and a new one reconstructed from entire new pieces without serious loss of time, if it is considered desirable to keep the units on hand for such purpose; that the boiler may be set up on land in places to which it would be difficult to transport one of ordinary construction, or in a vessel, without the necessity of having great openings to introduce it into its place or requiring expensive machinery to place it in position; that the parts of a boiler may be kept on hand without great cost by manufacturers to be used as wanted on the instant, or sold by dealers in units or fractions of units; that a boiler may be sent in separate pack-

ages to a distance with or without the screw-bolts, which any common smith is competent to make, while a common bricklayer or sheet-iron worker may surround it with the necessary casing, all which advantages, in addition to those referred to when stating the object of my invention, are due to the adoption by me of what I have called a "unit of construction" and the fractions thereof.

In my plan the steam-chamber is made in the same way as the rest of the boiler, and by a judicious arrangement and adjustment of the draft the steam therein may be dried or surcharged at the discretion of the engineer.

There are many ways in which my boiler may be advantageously constructed or arranged at the fancy of the parties using it; but I have shown in Plate III, Figs. 1 and 2, a form which I have adopted successfully.

Fig. 1 represents a front elevation and Fig. 2 a side elevation, similar letters in each referring to similar parts. By reference to this drawing it will be seen that the units represented by the dotted lines surround a fire-chamber or furnace, A, the fire being fed through the door B, the whole incased in brick-work C C.

D represents the chimney at the back of the furnace, and the current of the draft, as well as its direction in passing to the chimney, are shown by the arrows. At the top of the casing is a small flue, E, with a damper, F. When this damper is opened, a portion of the heated gas from the furnace will pass upward, and thus on its way to the chimney will dry or superheat the steam in that portion of the boiler above the water-line which is represented by the blue line G H; J, check-valve and supply-pipe for water; K, safety-valve, and L gage-cock are all readily understood.

While I prefer the globular form above described, yet the principle of construction involved in my invention is not dependent upon it. Other forms may be given to the unit of construction which, while they are uniform and capable of being used in the construction of boilers of different dimensions and shape, as above described, would, though in a less valuable way, accomplish the object I have in view. Neither do I insist upon the brick casing I have described. The casing may be of cast or plate iron; but this unimportant feature will depend in a great degree upon the uses to which the boiler is to be put and the fancy or judgment of those erecting it.

With the dimensions heretofore given I have obtained good results; but the globes may be made larger or smaller and their thickness may vary with their size and the metal employed and their position in the boiler. The smaller they are the stronger they will be. In the size used by me there is more than ample strength for all ordinary steam purposes, and it has the advantage of easy handling, facility of casting and fitting, and general adaptation. So, too, as regards the distance between the globes. That represented in the drawings I have found to answer well; but it may be varied without affecting my invention.

I have described my invention as an improvement in the manner of constructing steam-boilers; but the same form of construction will answer in a condenser, and it may be applied to the heating of water and as a radiator for the warming of buildings.

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

1. The construction of a boiler of distinct globular or spherical parts, single or in groups, substantially as above described, united in the manner hereinbefore specified, or any other analogous thereto, and wherein the strength of the globular form of such parts is common to the entire structure, this claim being intended to include not true spheres only, but elliptical, conical, polyhedral, or any other analogous forms also, where the results, looking to strength and construction of the boiler, are substantially the same as those herein enumerated.

2. The employment as units of construction, as hereinbefore explained, of separate chambers of cast-iron or other metal of uniform size and shape, substantially as described, to be used as wanted, wherewith boilers of different forms and dimensions may be built up, being united together in the manner hereinbefore specified or any other analogous thereto.

Both of the above claims involve an outside casing for the particular construction with furnace or furnaces, substantially as hereinbefore described. It is not, however, my intention to confine myself to any special form of boiler or mode of casing the same.

JOSEPH HARRISON, JR.

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COLEMAN SELLERS.