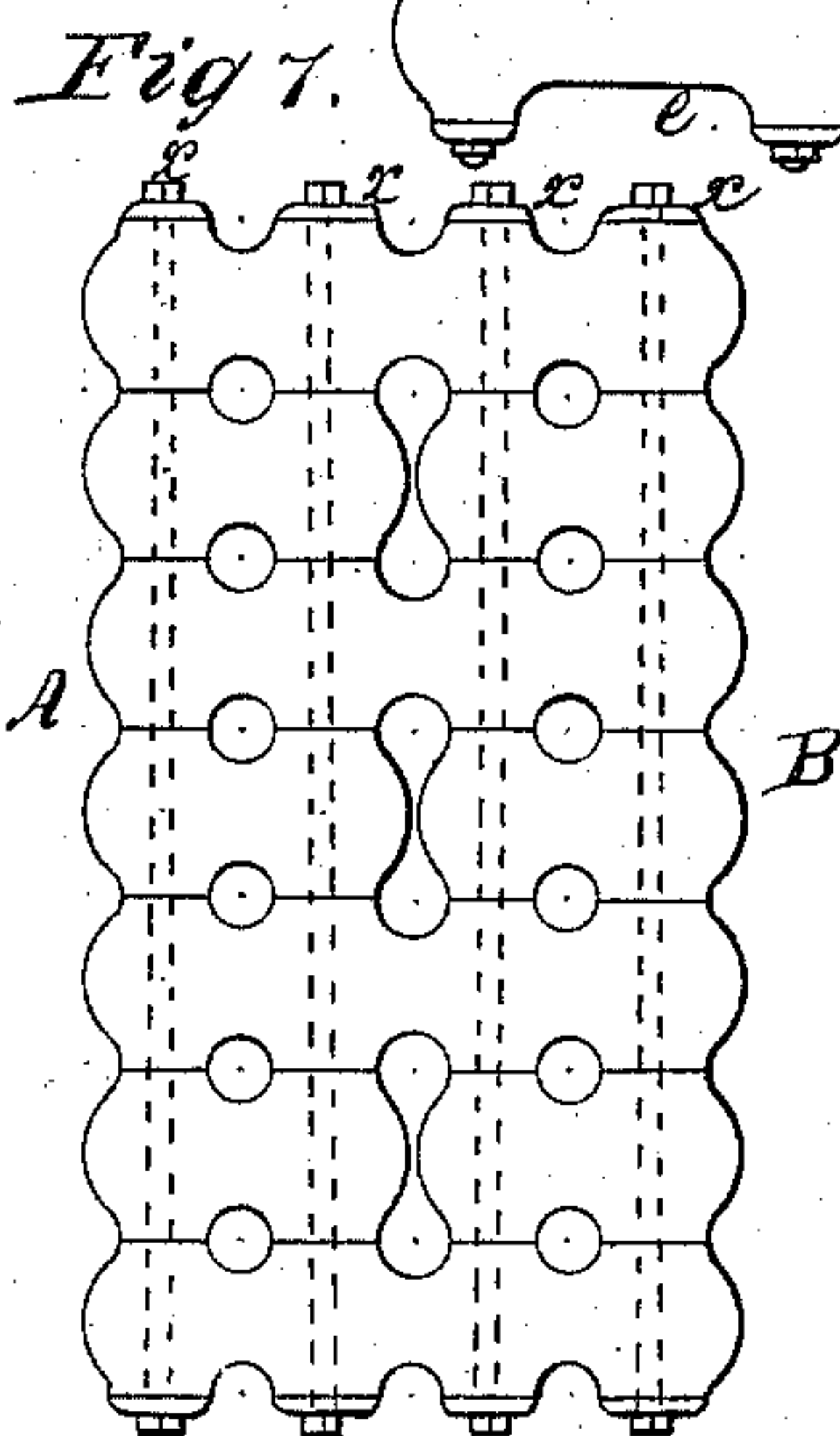
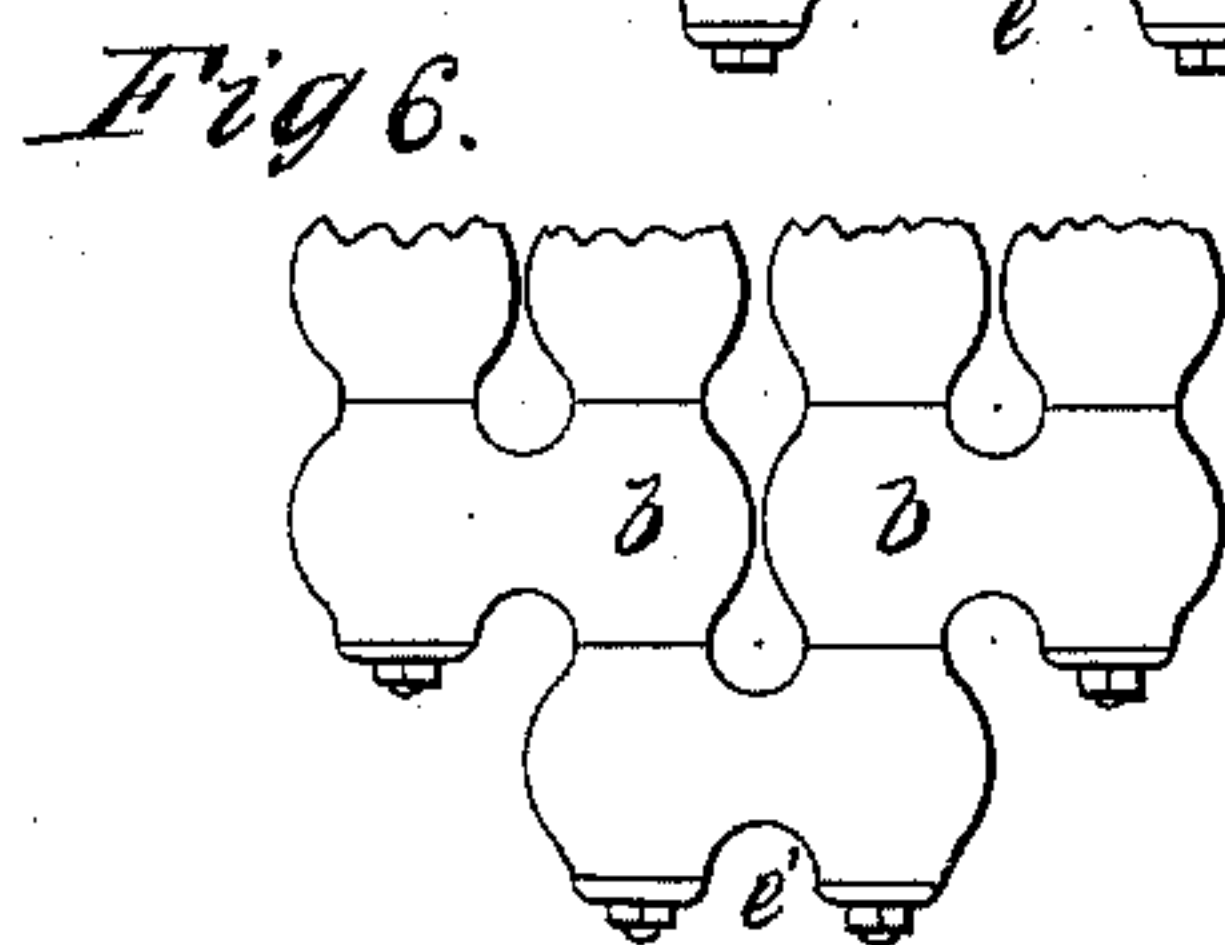
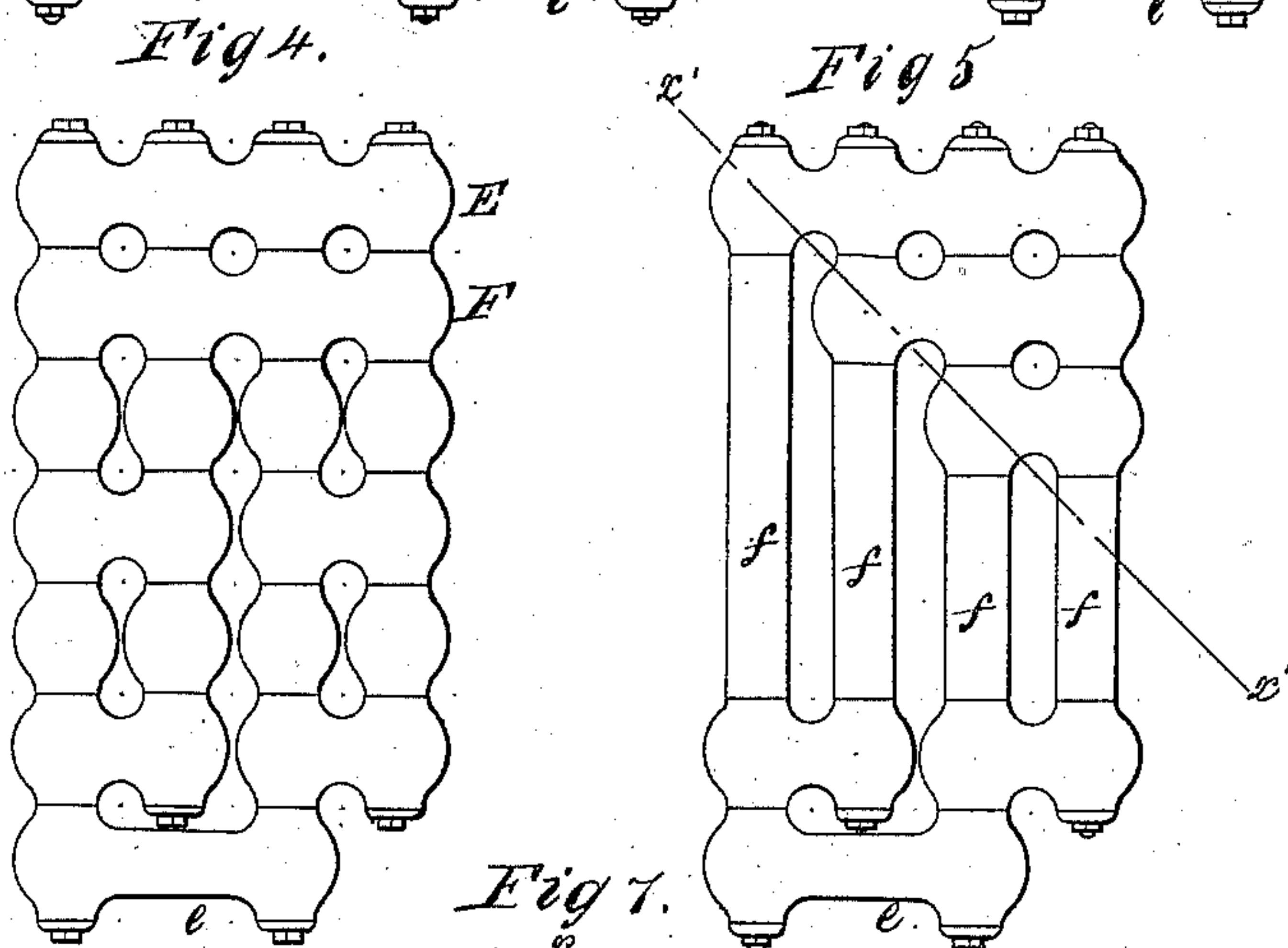
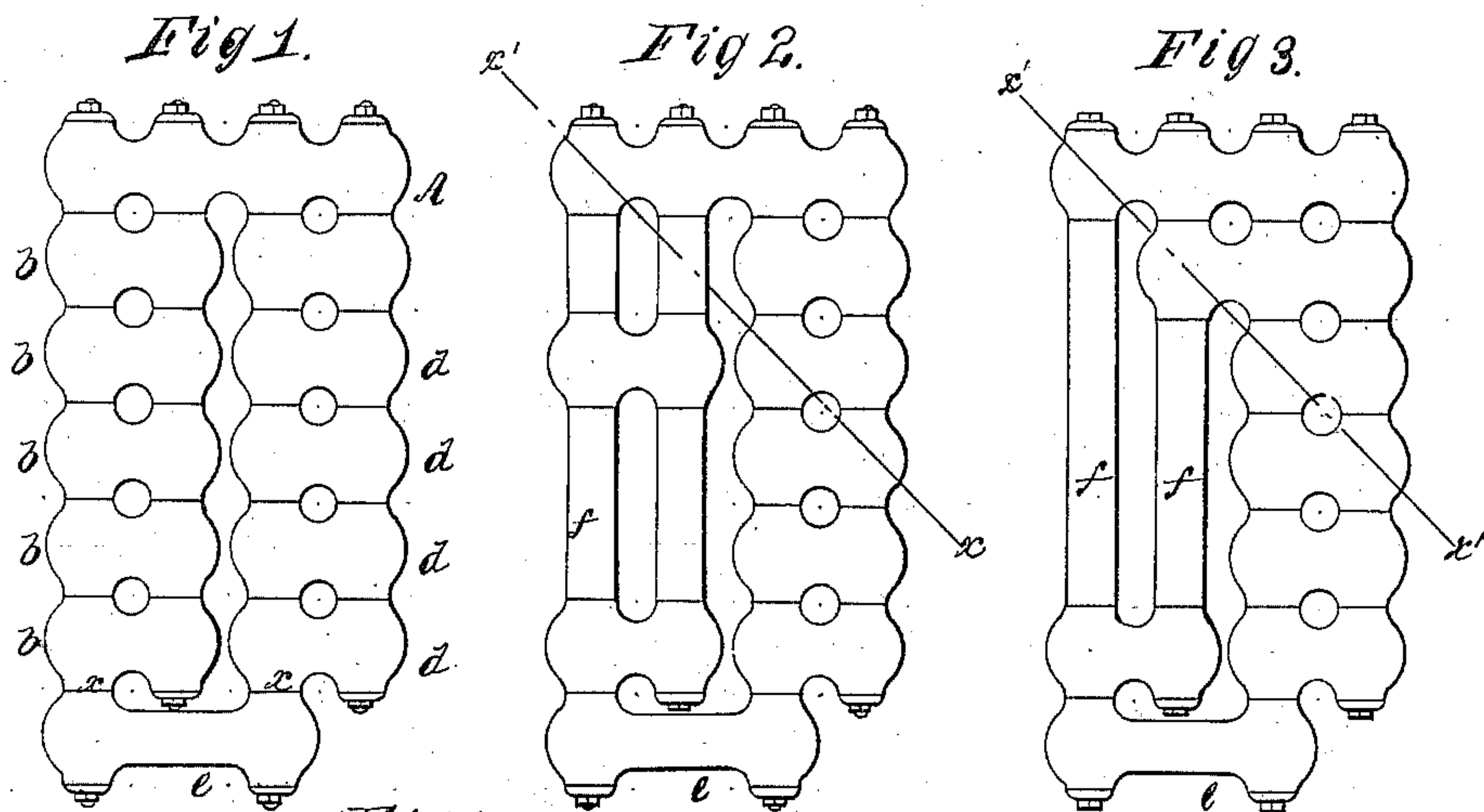


2 Sheets-Sheet 1.

J. Harrison, Jr.,
Sectional Steam Boiler.
No 80,543. Patented Aug. 4, 1868.



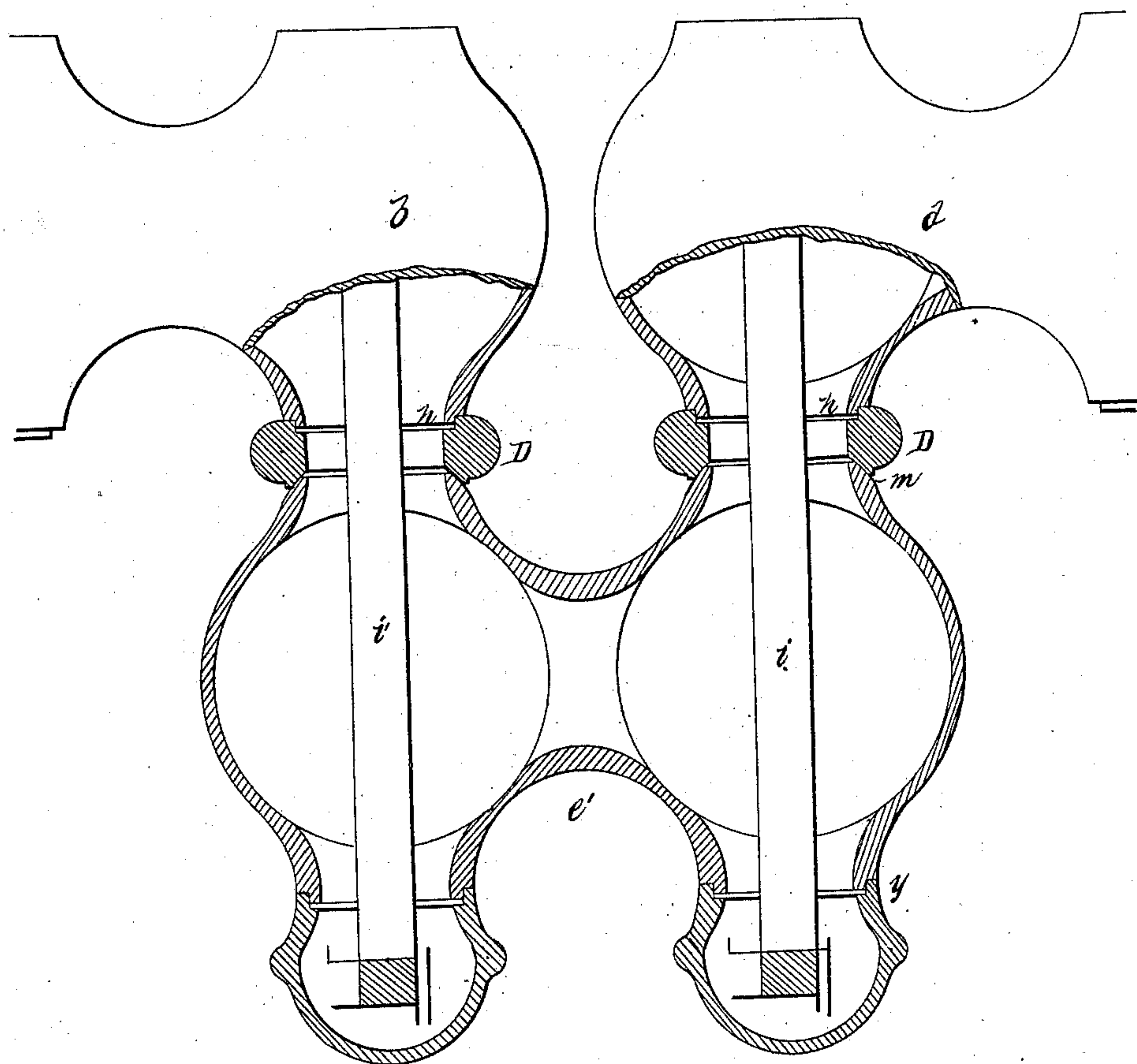
Witnesses.
Wm. A. Slut
John Parker.

Inventor.
J. Harrison, Jr.
By his Atty
H. Holman
M.S.P.

2 Sheets-Sheet 2.

J. Harrison, Jr.,
Sectional Steam Boiler,
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Fig 8.



Witnesses.

Wm. A. Steel
John Parker

Inventor
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W.S.P.

United States Patent Office.

JOSEPH HARRISON, JR., OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 80,543, dated August 4, 1868.

IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, JOSEPH HARRISON, Jr., of Philadelphia, Pennsylvania, have invented certain Improvements in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in the steam-boiler for which Letters Patent were granted to me on the 4th day of October, 1859, and my improvements consist—

Firstly, in the application, to the said boiler, of compensating units, by which other units, of which the boiler is composed, are relieved from undue strains and consequent liability to become fractured. My invention has also for its object the ready removal and replacing of any of the units in the boiler.

Secondly, my invention consists in combining plain wrought or cast-iron pipes with the cast-iron units, as described hereafter, so as to reduce the boiler in weight, without any decrease of steam-space.

In order to enable others skilled in the art to make and use my invention, I will now proceed to describe the manner of carrying the same into effect, reference being had to the accompanying drawing, which forms a part of this specification, and in which—

Figures 1, 2, 3, 4, 5, and 6 represent sections of my patented steam-boiler, with the improvements.

Figure 7, a diagram, illustrating one of the usual plans heretofore adopted of arranging the units, and

Figure 8, Drawing No. 2, a section of part of fig. 6, drawn to an enlarged scale.

Prior to the present improvements, it has been the practice to construct my patented boiler by fitting and securing together what I have termed, in my aforesaid patent, units of construction, each unit consisting of hollow globes or spheres, united by curved necks, single spheres being occasionally used, but two or more being generally cast together so as to form one unit. A number of these units have been heretofore so arranged and connected together by internal bolts as to form a section, of any desired length or breadth, and any desired number of these sections, united at the top by connecting steam-pipes, constitute the boiler.

A section, such as it has been my practice, among other plans, to construct prior to my present improvements, is illustrated in fig. 7, on reference to which it will be observed that some units of construction consist of four hollow spheres cast in one piece, others being composed of two spheres only, cast together, the latter units being arranged between the former, and ordinary rebated joints being used. When the whole of the units have been secured together by internal bolts, indicated by dotted lines, the section may be considered equivalent to one unjointed mass of cast iron.

As one portion of each section of the boiler is frequently subjected to a greater heat than other portions, an unequal expansion takes place, which subjects some of the units to undue strains, and, in some instances, to fracture at the necks. For instance, in fig. 7, if the two vertical rows of spheres, A, are subjected to a greater heat than the similar rows B, the expansion of the portion A will exceed that of the portion B, and, consequently, the necks of those units which have four spheres will be subjected to undue strains.

My invention obviates this evil in a manner which I will now proceed to describe.

The section illustrated in fig. 1 consists of one unit, A, composed of four hollow spheres, cast in one piece, the remaining units, *b b b b*, *d d d d*, and *e*, consisting each of two spheres; in other words, two legs—one composed of the units *b*, and the other of the units *d*—are connected to the upper unit A, and connected together at the bottom by the unit *e*.

All the units of the section are connected together by plain rebated joints.

It will be observed that the neck of the unit *e* is much longer than that of the other units, and, consequently, that it must have more elasticity, so that, if one leg of the section composed of the units *b* expands, through excess of heat, more than the leg composed of the units *d*, the former leg can expand independently of the latter, owing to the slight elasticity of the neck of the unit *e*, which I have, therefore, termed the compensating unit, as a protection of the other units from undue strains. I prefer, however, to make the joints, *x x*, of this unit *e*, where one portion is connected to one leg of the section, and the other to the other leg of the same, in

the manner illustrated at *m*, fig. 8, a rounded exterior of a portion of one unit being adapted to the concave interior edge of another unit; in other words, the joints *x x* are ball-and-socket joints, which will permit the free and independent contraction and expansion of the two legs.

It will be evident, on examining the figs. 2, 3, 4, and 5, that the compensating unit may be applied to sections composed of units arranged in a manner differing from that shown in fig. 1, or to a section having some units composed of spheres and others of plain cylindrical tubes, for, when a light boiler is required, I frequently use plain tubes with the units, as shown in figs. 2, 3, and 5, a combination which forms another feature of my invention.

What I have termed the legs of the section may be connected together by a short compensating unit, *e'*, as shown in figs. 6 and 8. In the latter figure, rings, *D*, intervene between the compensating unit *e'* and the units *b* and *d*, the union of the rings with the units *b* and *d* being by a plain rebated joint, *h*, while the union of the compensating unit and the ring is with a joint capable of yielding, or a ball-and-socket joint, as described above.

These rings are not indispensable, but are used as convenient expedients in fitting up the boiler.

Independently of the advantages presented by the compensating units, as a medium for presenting the evil results of variable expansion, it possesses the further advantage of permitting the ready removal and replacing of those units which are nearest to the fire, and, consequently, are most likely to require renewal occasionally, without disturbing the entire section. Thus, in fig. 8, should it become necessary to remove the section *d*, all that is necessary is to withdraw the bolt *i*, turn the compensating unit *e'* on one side, while it is still attached to the other portion of the section by the bolt *i'*, and, after the section *d* has been removed and a new one adjusted in its place, the compensating unit may be returned to its original position and secured by the bolt *i*.

It is only the lower portion of the sections, or those exposed to the direct action of the fire, which are most liable to variable expansion and contraction; hence, the upper parts of each section, that is, the portion devoted to steam-space, may consist of two sections, *E F*, fig. 4, each section being cast in one piece, or even three such upper sections may be used.

I have found, by repeated tests, that when a light boiler is required, plain cast-iron pipes or lap-welded tubes may be used, with good results, in combination with the cast units. When this plan is adopted, I take care that the plain pipes are so arranged as to be more exposed to the fire, and below the water-line, and thus act as generators, while the upper cast-iron units, enclosing more space, serve as reservoirs for the steam.

Sections, consisting of cast-iron units, combined with plain pipes, are illustrated in figs. 2, 3, and 5, in which figures the diagonal lines, *x' x'* represent the water-lines, as the sections, when fitted to their places, are adjusted in an inclined position.

I claim as my invention, and desire to secure by Letters Patent—

1. Compensating units *e*, combined substantially in the manner and for the purpose described, with a steam-boiler constructed in accordance with that described in the patent granted to me, October 4, 1859.

2. The combination of plain cast or wrought-iron pipes with the cast-iron units, in the manner and for the purpose specified.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH HARRISON, JR.

Witnesses:

H. HOWSON,
HARRY SMITH.