

(No Model.)

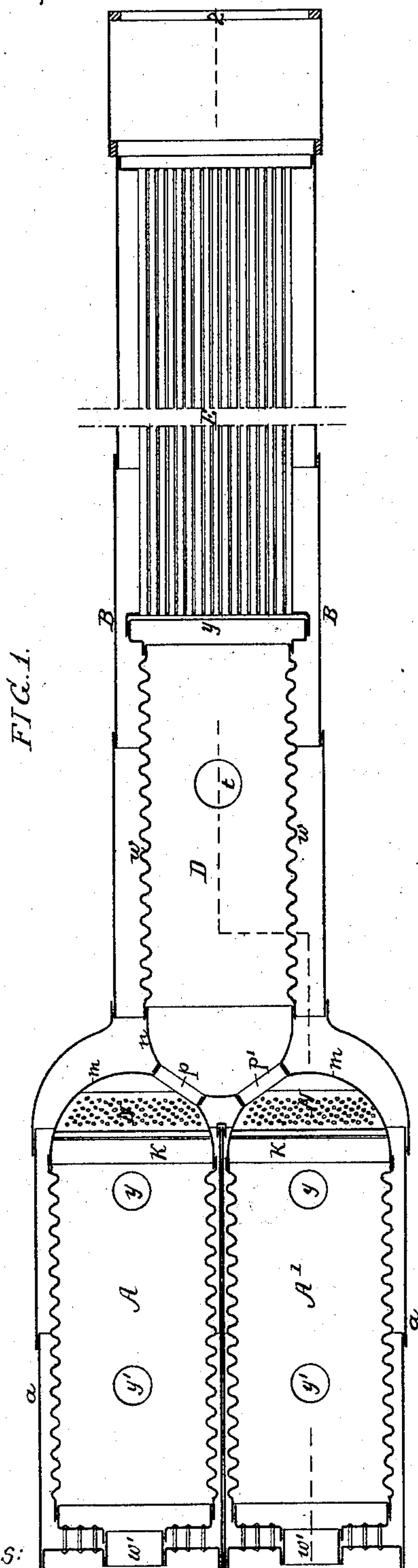
3 Sheets—Sheet 1.

G. S. STRONG.

## STEAM BOILER.

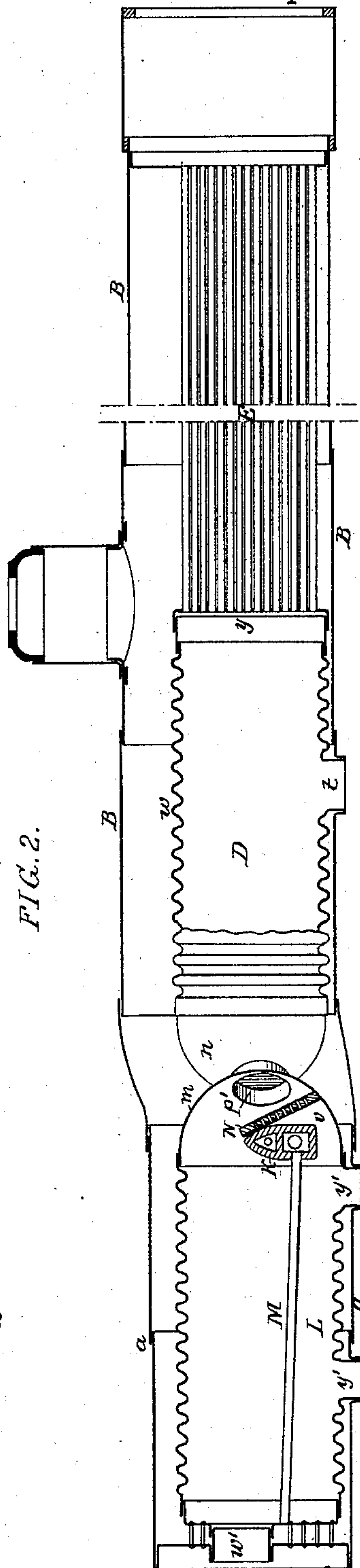
No. 304,973.

Patented Sept. 9, 1884.



**WITNESSES:**

John C. Parker  
James J. Tobins



*INVENTOR:*

George S Strong  
by his Attf  
Houston and Claus

(No Model.)

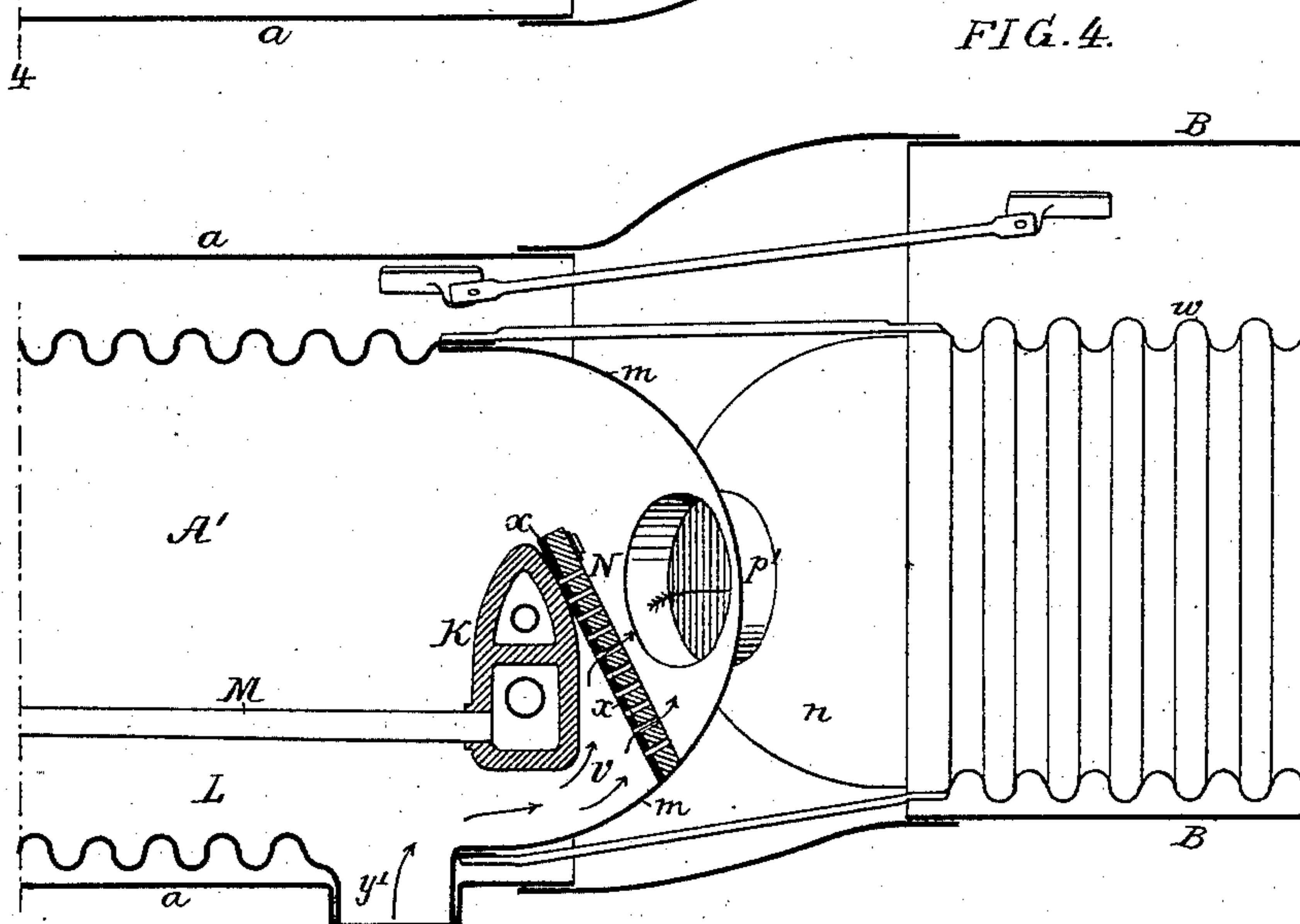
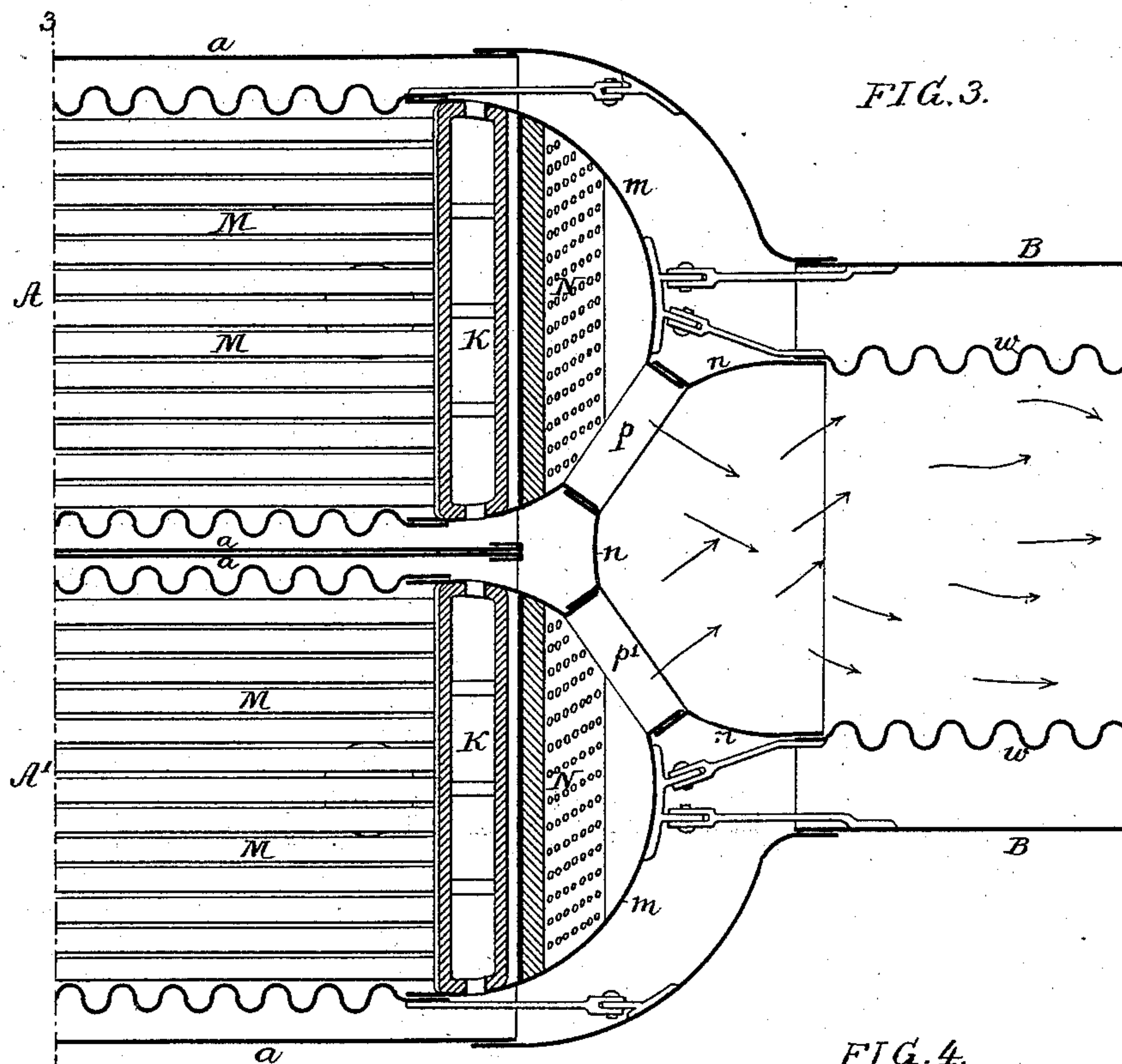
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G. S. STRONG.

STEAM BOILER.

No. 304,973.

Patented Sept. 9, 1884.



WITNESSES:

John C. Parker  
James F. Tobin

INVENTOR:

George S. Strong  
by his Attys  
Howden and Co.

(No Model.)

3 Sheets—Sheet 3.

G. S. STRONG.

STEAM BOILER.

No. 304,973.

Patented Sept. 9, 1884.

FIG. 5.

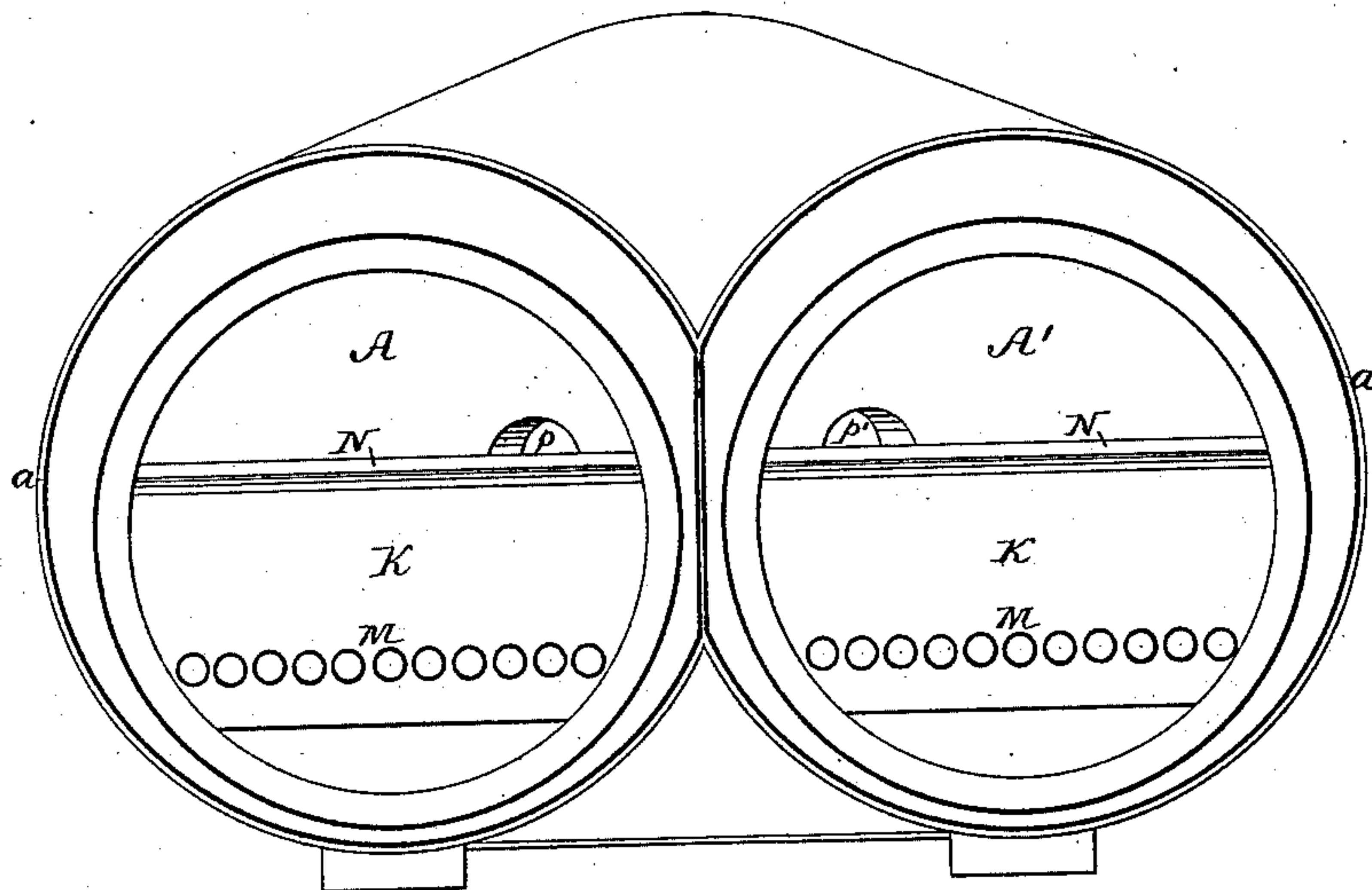
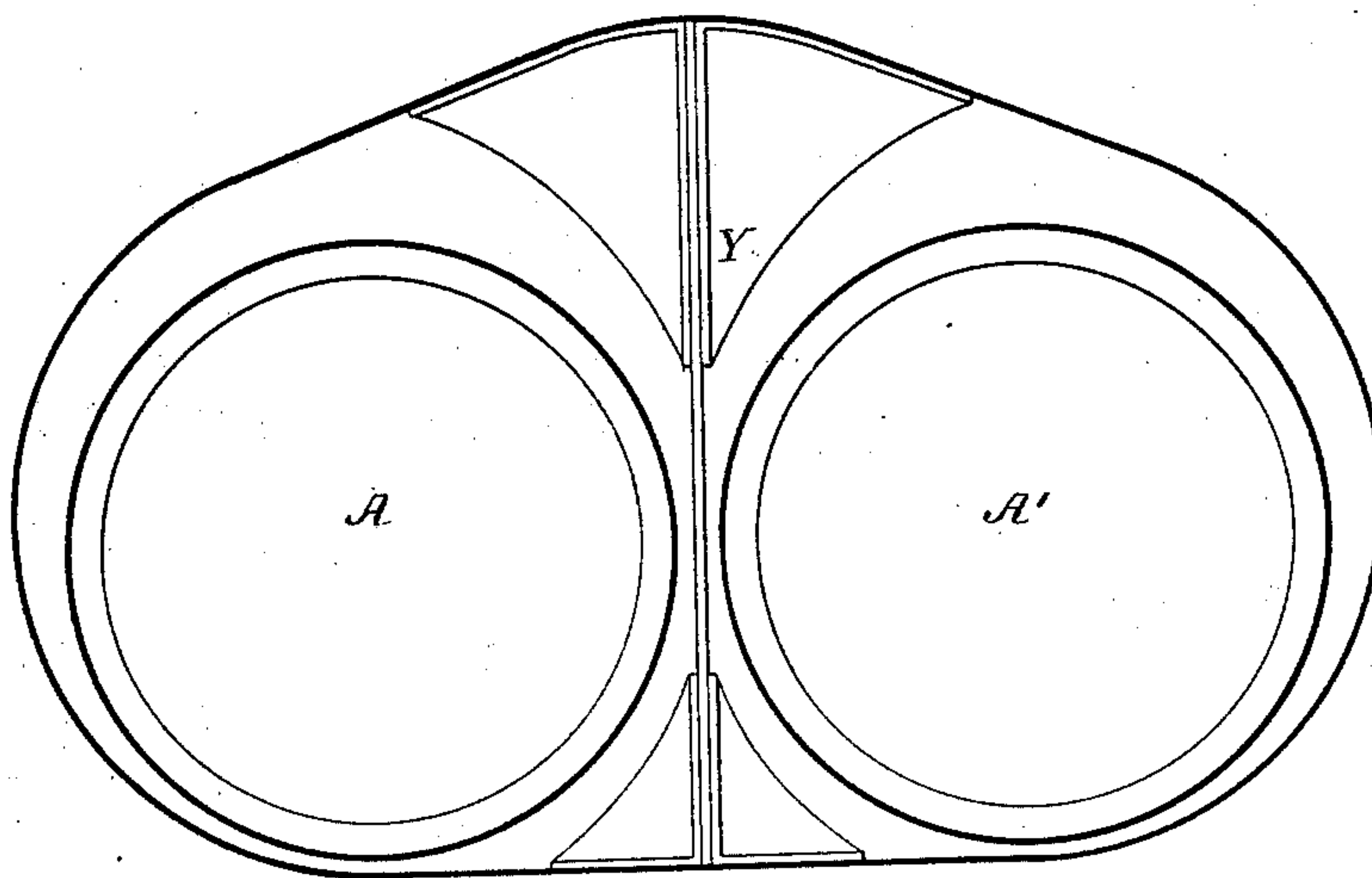


FIG. 6.



WITNESSES:  
John E. Parker  
James J. John

INVENTOR:  
George S. Strong  
by his Attys  
Howden and Co



# UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO  
JOHN T. MORRIS, TRUSTEE, OF SAME PLACE.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 304,973, dated September 9, 1884.

Application filed February 4, 1884. (No model.)

*To all whom it may concern.*

Be it known that I, GEORGE S. STRONG, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Steam-Boilers, of which the following is a specification.

My invention consists, mainly, of improvements in and additions to the steam-boiler for which Letters Patent No. 266,551 were granted to me October 24, 1882, my improvements, which are fully described hereinafter, relating, first, to a combustion-chamber having a corrugated shell, and combined with and interposed between a fire box or boxes of the boiler and the tube-sheet, so as to relieve the boiler and tubes from undue strains to which they would otherwise be subjected; second, to the special construction of the inner shells of the fire-boxes, the end of the combustion-chamber and communicating necks for the purpose of avoiding a multiplicity of stays, and for the further purpose of effectually consuming the gases emanating from the fuel; and, third, to the introduction of air to and its admixture with the gases as they pass from the fire-boxes. Other particulars of my invention are too fully described hereinafter to need preliminary explanation.

In the accompanying drawings, Figure 1, Sheet 1, is a sectional plan of my improved steam-boiler; Fig. 2, a vertical section on the line 1 2, Fig. 1; Fig. 3, Sheet 2, part of Fig. 1 drawn to an enlarged scale; Fig. 4, part of Fig. 2 drawn to the same scale as Fig. 3; Fig. 5, Sheet 3, a transverse section on the line 3 4, Fig. 3; and Fig. 6, a transverse section illustrating a modified form of outer shell for the fire-boxes.

It should be understood in the outset that my improvements may be applied to any steam-boiler in which flue-tubes are used. In the steam-boiler described in my patent of October 24, 1882, No. 266,551, two fire-boxes placed side by side were combined with a tubed barrel, into which the outer shells of the fire-boxes merged. While these general characteristics of the steam-boiler are retained, I have made several improvements and additions, which form the subject of the present

application, and which I will proceed to describe.

In Figs. 1 and 2, A and A' are two cylindrical fire-boxes placed side by side, as in my said patent; *a*, the outer shell of the fire-box; B, the barrel; D, the combustion-chamber, and E the system of tubes forming communications between the said combustion-chamber and the smoke-box. The shell *w* of this combustion-chamber is corrugated circumferentially, and is connected at one end to the tube-sheet *y*, the other end being connected to the two fire-boxes in the peculiar manner presently explained. This corrugated shell of a combustion-chamber interposed between the fire box or boxes of a steam-boiler and the rear tube-sheet is a prominent feature of my invention, and is of especial advantage, as the corrugations permit the expansion and contraction to which this part of the boiler is subjected without disturbing the integrity of other parts and without straining the tubes. This feature of my invention is applicable to steam-boilers in which but one fire-box is used. In my said patent the shells of the fire-boxes had flat rear ends, and this involved the necessity of resorting to a complex system of stays; but in the present case the rear ends, *m*, of the fire-boxes are concavo-convex or dished, as is also the front end, *n*, of the combustion-chamber, and the necks *p p'*, which afford communications between the fire-boxes and the combustion-chamber, are inclined, as best observed in Fig. 3, so that the products of combustion from one fire-box as they enter the combustion-chamber will cross the path of the products of combustion from the other fire-box, as indicated by the arrows, and this promotes the consumption of the gases, especially if judicious firing is resorted to by the engineer—that is, the alternate firing of the two fire-boxes, so that the smoky products of combustion from one fire-box will cross and become intimately mixed with the heated and smokeless products of combustion from the other fire-box.

Within each fire-box, near the front end of the same, is secured a hollow bridge, K, preferably of cast-steel, the interior of the bridge



being in free communication at both ends with the water-space between the fire-box and outer shell of the same, and the bridge being also in communication with the tubular fire-bars M, the air from the ash-pit L taking a course through a passage, *v*, under and behind the bridge, and becoming mixed with the products of combustion as the latter pass through the necks *p p'* into the combustion-chamber, thereby promoting the thorough consumption of the gases; and in order to insure an intimate admixture with the products of combustion of this volume of air, I subdivide it into small streams or jets by a perforated slab, N, of refractory material placed across the passage *v*, between the hollow bridge and the dished end of the fire-box, this slab, which may be supported by a perforated plate, *x*, preferably bearing above against the rear of the bridge, and below on any suitable projection on the fire-box. The perforated slab is inclined so abruptly that ashes cannot find a lodgment on it, and hence its perforations cannot be obstructed.

As regards the outer shells, *a a*, of the two fire-boxes, they are cylindrical, as in Fig. 5, and flattened where they are in contact with each other, as in my aforesaid patent, the two cylinders being made to merge into the barrel B. The two fire-boxes, however, may be contained in one outer shell of the character shown in Fig. 6, a suitable stay, Y, extending from the top to the bottom of the shell between the fire-boxes. In this case also the said outer shell is made to merge into the barrel B of the boiler.

The tubular fire-bars M extend from the hollow bridge to the front water-space of each fire-box below the usual feed-opening, *w*, which should be provided with a door, and there are in the bottom of the fire-box two openings, *y y'*, for admitting air to the ash-pit and for discharging ashes therefrom, these openings being preferably provided with movable doors or valves under the control of the engineer. There is also an opening, *t*, in the bottom of

the combustion-chamber, and this opening should be provided with a cover which can be removed when access to the combustion-chamber is required, and when it becomes necessary to cleanse the interior of the combustion-chamber.

I claim as my invention—

1. The combination, in a steam-boiler of the locomotive type, of a fire-box or fire-boxes and tube-sheet with the circumferentially-corrugated shell of a combustion-chamber interposed between the said box or boxes and tube-sheet, substantially as set forth.

2. The combination, in a steam-boiler, of the two shells of two fire-boxes and that of a combustion-chamber with two inclined necks, *p p'*, one forming a communication between one fire-box and the combustion-chamber, and the other a communication between the other fire-box and the same combustion-chamber, substantially as described.

3. The combination, in a steam-boiler, of two fire-boxes, the shells of which have dished ends, with a combustion-chamber, the shell of which has also a dished end, and with two necks, *p p'*, all substantially as specified.

4. The combination of the fire-box, its dished end and outlet, with the hollow bridge K, which bears the relation described to the said outlet, and the air-passage *v* between the bridge and dished end of the combustion-chamber, all substantially as set forth.

5. The combination of the fire-box, its outlet, the hollow bridge K, and passage *v*, with the abruptly-inclined perforated slab N, the several parts bearing the relation described to each other, as set forth.

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

GEO. S. STRONG.

Witnesses:

JOHN E. PARKER,  
HARRY SMITH.