

(No Model.)

3 Sheets—Sheet 1.

C. D. MOSHER.
STEAM GENERATOR.

No. 472,309.

Patented Apr. 5, 1892.

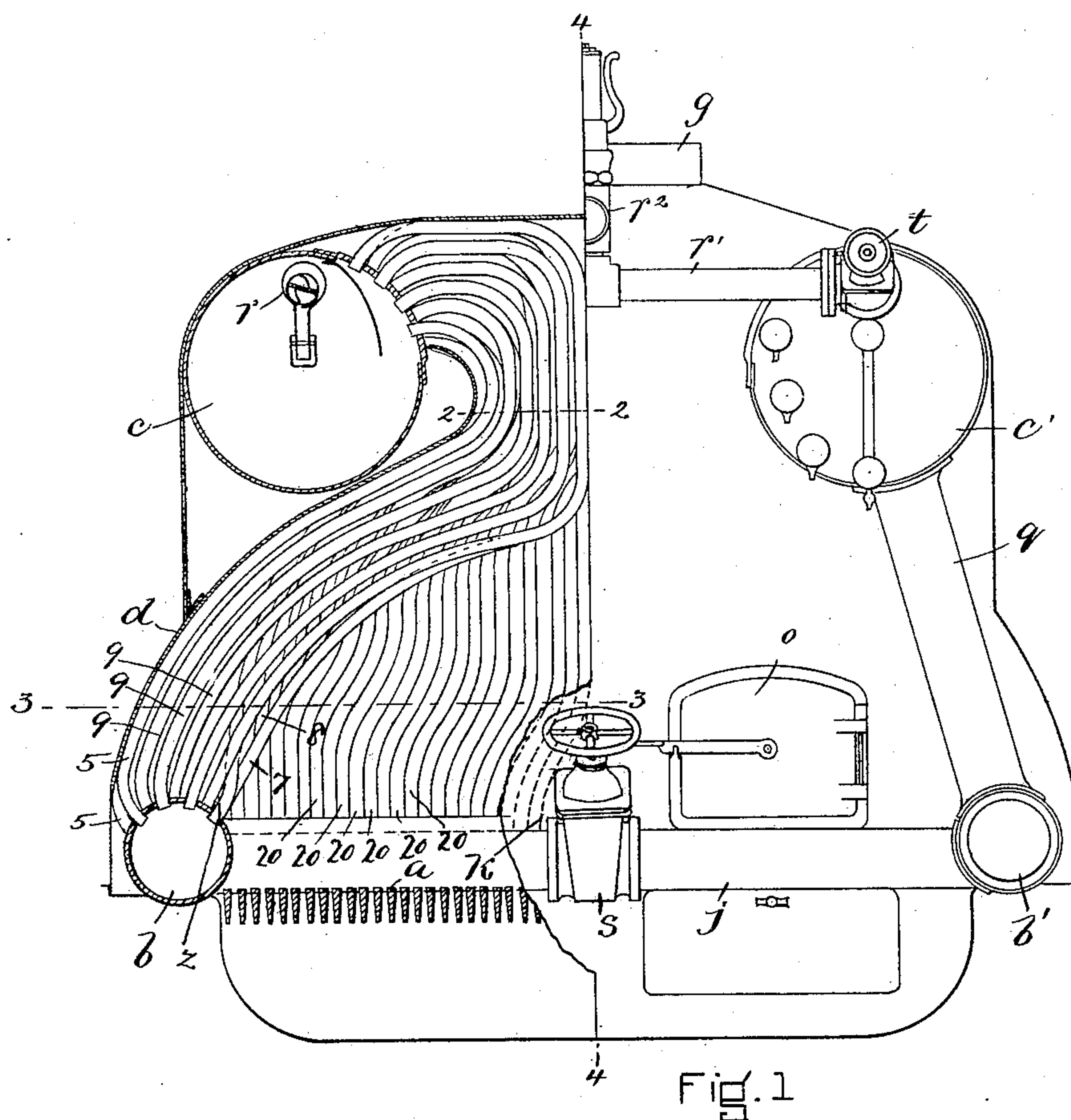


Fig. 1

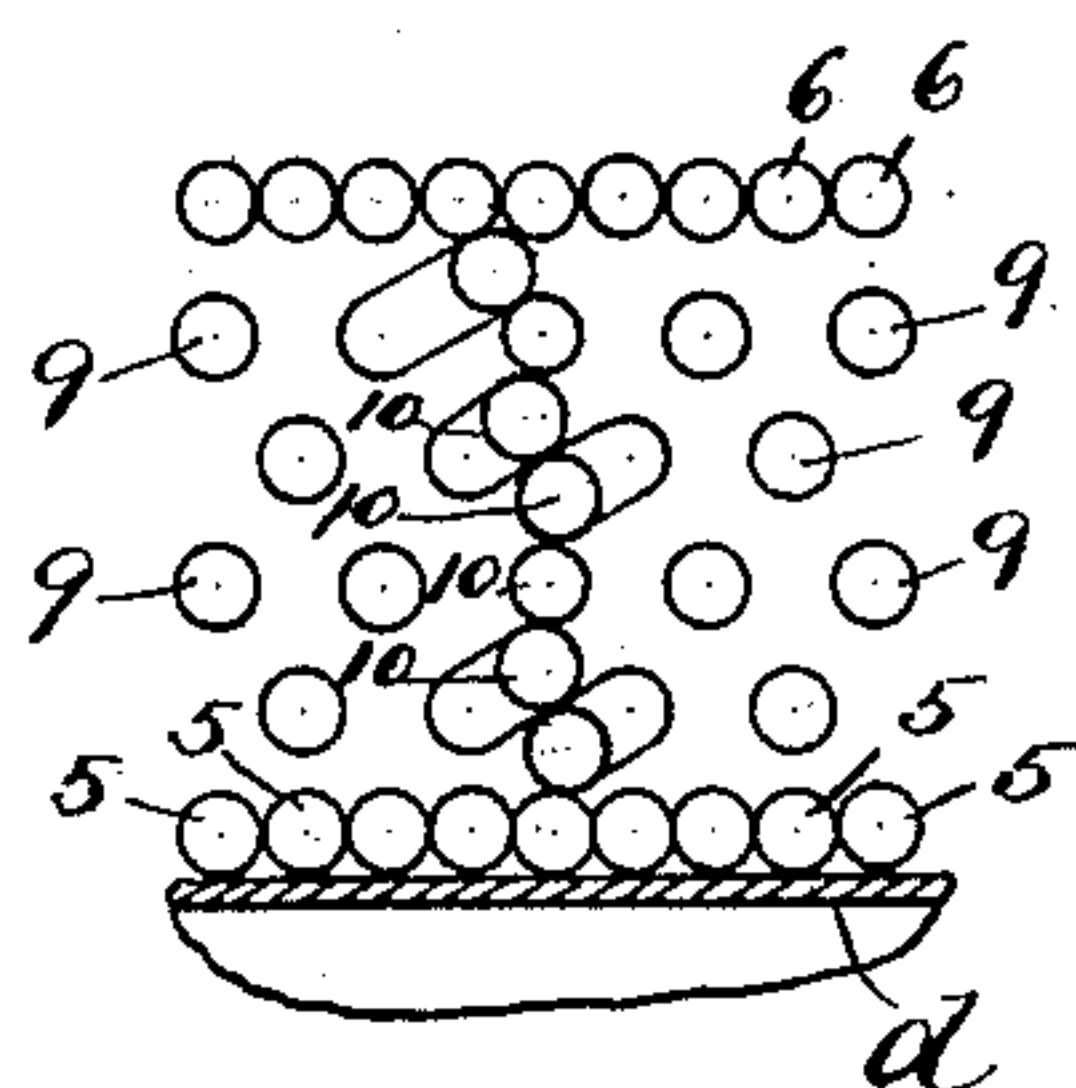


Fig. 2.

WITNESSES.

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A. J. Harrison.

INVENTOR

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Atty!

Atty.

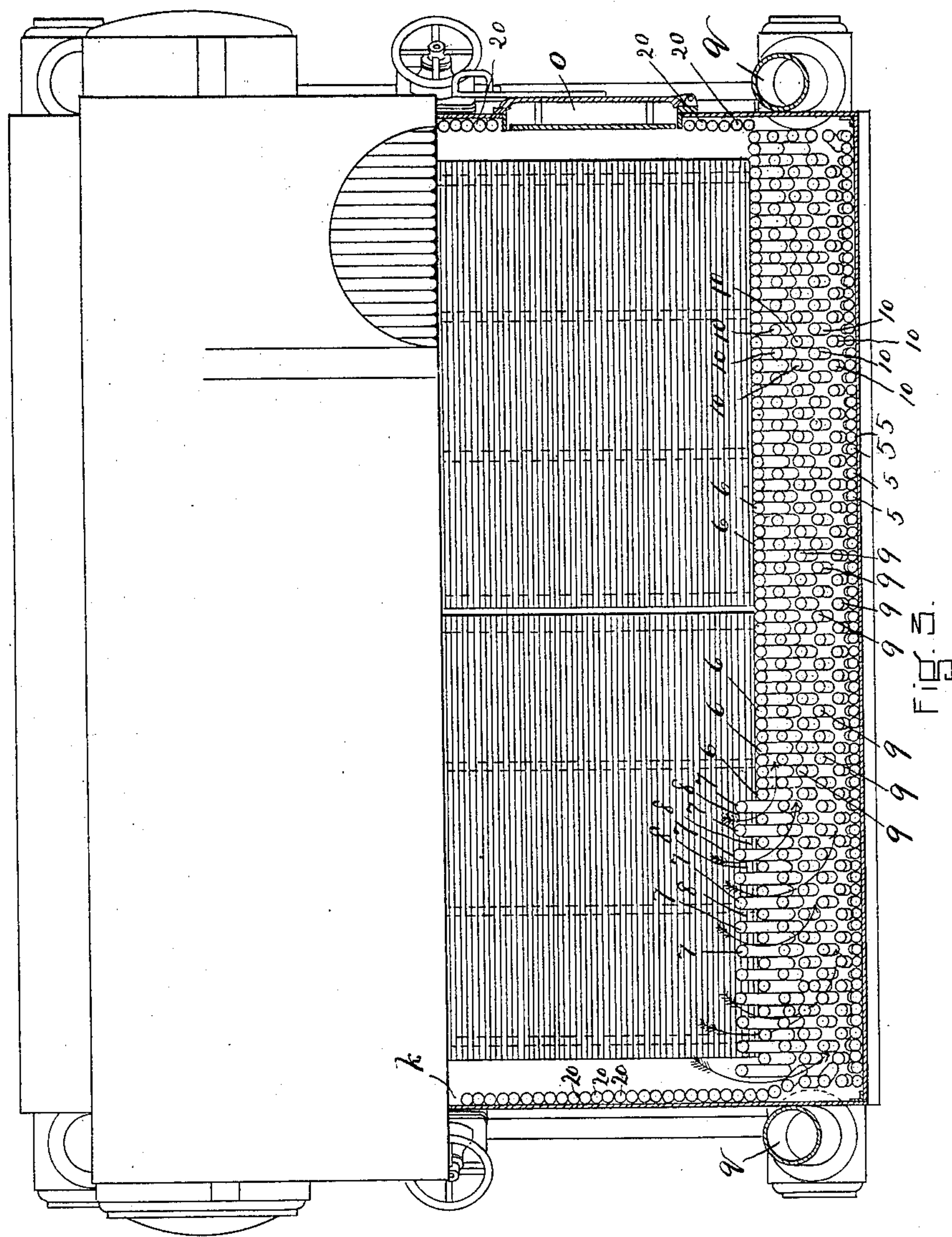
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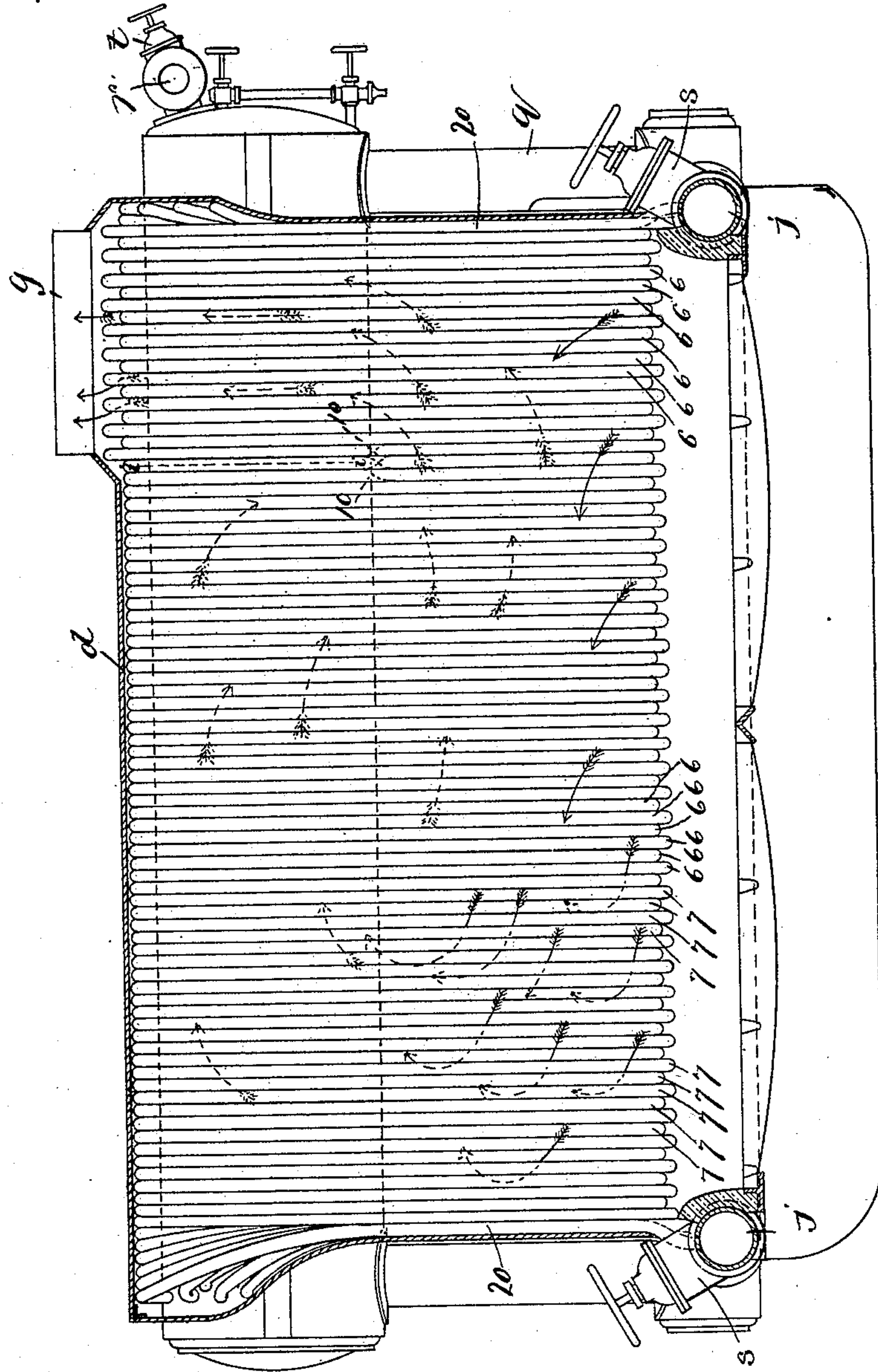


Fig. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES D. MOSHER, OF AMESBURY, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 472,309, dated April 5, 1892.

Application filed December 1, 1891. Serial No. 413,719. (No model.)

To all whom it may concern:

Be it known that I, CHARLES D. MOSHER, of Amesbury, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

This invention relates to boilers of the type shown in Letters Patent of the United States granted to me July 22, 1890, No. 432,760, said patent showing a steam generator or boiler comprising two water-drums located at or near the level of the grate and at opposite sides thereof, two steam-drums located above the water-drums and at opposite sides of the center of the fire-space above the grate, and bent tubes connecting the water-drums with the steam-drums, some of said tubes being arranged close together in rows constituting walls, while other tubes are separated by spaces and are arranged within the inclosure surrounded by said walls.

The present invention has for its object, first, to enable the boiler of the general construction shown in said patent to be treated as two separate boilers or sections, each comprising one of the water-drums, the tubes rising therefrom, and the steam-drum connected with the upper ends of said tubes, and each capable of being shut off or disconnected from the other, so that one part or section constituting one half or side of the boiler may be supplied with more water than the other for the purpose of increasing the weight of one side of the boiler and thereby counteracting the tendency of the vessel to take a permanent heel when impelled by a single screw driven at a high speed. In high-powered single-screw vessels designed to attain a high rate of speed the resistance offered by the water to the revolution of the screw causes the vessel to take a permanent heel varying with the power applied. Hence by providing a boiler adapted to be separated into two sections and loading one of said sections more heavily than the other I am enabled to readily compensate for the tendency of the vessel to heel permanently and keep the vessel normally on an even keel.

My invention also has for its object to provide such an arrangement of the tubes connecting the water and steam drums as that the heated gases in passing among said tubes

in their course from the fire to the stack will be prevented from acting on the upper portions of said tubes, which portions, containing usually only steam, are liable to be burned out by a degree of heat which will not injuriously affect their lower portions containing water. These results I attain by the improvements which I will now proceed to describe.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a partial end elevation and partial section of a boiler provided with my improvements. Fig. 2 represents a section on line 2 2, Fig. 1. Fig. 3 represents a section on line 3 3, Fig. 1, and a top view of the portion of the boiler shown in elevation in Fig. 1. Fig. 4 represents a section on line 4 4, Fig. 1.

The same letters and numerals of reference indicate the same parts in all the figures.

In the drawings, *a* represents the grate of the furnace or fire-box.

b b' represent the water-drums located at opposite sides of the grate, and *c c'* represent the steam-drums elevated above the water-drums and located at opposite sides of the fire-space over the grate.

The water-drums are connected with the steam-drums by tubes rising from the upper portions of the water-drums and entering the steam-drums above the center lines thereof, there being two distinct series of tubes—that is to say, the tubes connecting one water-drum with the corresponding steam-drum are distinct from the tubes that connect the other water-drum and steam-drum. Each series of tubes comprises an outer row of tubes, arranged in close order, so as to form a practically continuous wall of tubes at the outer limit of the series, said wall being close to the casing *d* and serving to protect said casing from injury by the heated gases. The tubes 6 6 6 at the inner side of the series are also arranged to form a close or practically continuous wall, their lower ends being arranged close together to prevent the gases from the fire-box from passing between them. While above said lower ends said tubes are in contact with each other. The wall formed by the tubes 6 extends from the end of the fire-box containing the fire-doors *o*—viz., the right-hand end, as viewed in Figs. 3 and 4—partly, but not entirely, to the opposite end, the in-

ner tubes 7 7 7 at nearest the opposite end of the fire-box being "staggered" or bent so that they are separated by spaces 8, Figs. 1 and 3, through which the products of combustion pass to the space between the outer and inner tubes of the series. This arrangement presents a continuous wall of tubes 6, extending from the fire-door end of the fire-box, compelling the products of combustion to pass from said end, as indicated by the full-line arrows in Fig. 4, partly to the opposite end of the fire-box, and a broken or open row of tubes 7, through which the products of combustion can pass to the space between the outer and inner tubes, as indicated by the curved arrows, partly dotted, in Fig. 4, and by the arrows in Fig. 3.

The space between the outer and inner tubes contains a large number of separated tubes 9 and constitutes a flue or passage along which the products of combustion pass toward the fire-door of the boiler on their way to the stack *g*, as indicated by the dotted arrows in Fig. 4, the tubes 7 and 9 and the inner sides of the tubes 5 and 6 being acted on by the products of combustion passing through the flues. In the upper portion of said flue is a transverse wall or baffle-plate composed of several tubes 10, which are arranged in contact with each other and form a continuous row or wall of tubes across the flue, (see Figs. 2 and 4,) the location of said wall being indicated by the dotted line *i i* in Fig. 4. Said wall extends from the top of the casing *d* to about the level of the lowest portions of the steam-drums, the tubes 10, that compose the wall or baffle-plate, being arranged below said point, so that the products of combustion can pass freely between them, as shown in Fig. 3. The object of said baffle-plate is to prevent the heated products of combustion from rising to the highest part of the flue between the inner and outer tubes, the baffle-plate causing the current to drop downwardly and pass below the level of the steam-drums before reaching the stack, as indicated by the dotted arrows in Fig. 4. The force of the draft, therefore, causes the main volume of the products of combustion to flow in the most direct course toward the lower end of the baffle-plate, and thus prevent the more highly-heated products of combustion from reaching the higher parts of the tubes, which contain, chiefly, steam, said higher parts receiving only what is technically known as a "soaking heat," due to radiation and not to the direct action of the current of hot gases. The lower portions of the tubes, including those forming the baffle-plate, which are subjected to the direct action of the products of combustion, are filled with water. Hence the hotter gases are directed only on those tube-surfaces which are in contact with water, the heat being therefore applied to the best advantage. The baffle-plate formed of tubes, as described, is much more durable than a solid plate not formed to contain water, it being free from liability to be burned out.

The water-drum *b* is connected with the water-drum *b'* by transverse pipes *j j*, extending across the fire-box at the front and rear ends of the grate. From each of these pipes rise a series of tubes 20, communicating at their upper ends with the steam-drums, one half of the tubes from each pipe *j* being connected with the drum *c* and the other half with the drum *c'*. The tubes 20 are arranged to form a close wall of tubes at the end of the fire-box opposite the fire-door end, as shown in Fig. 3, said wall being interrupted or having an opening formed at *k*, Figs. 1 and 3, by the bending of the lower portions of the tubes 20 to accommodate a valve *m*, hereinafter referred to. The tubes 20 at the fire-door end of the fire-box do not extend across the fire-box, their number being necessarily limited to avoid the fire-doors *o*.

The ends of the steam-drums are connected with the ends of the water-drums outside the casing of the boiler by return-pipes *q q*. Each steam-drum has a steam-pipe *r* and a suitable separator to separate the entrained water from the steam, said separator being preferably constructed as shown in Letters Patent No. 454,984, granted to me June 30, 1891. The ends of the steam-pipes of the two steam-drums are connected by transverse pipes *r'* with the pipe *r*², that conducts the steam to the engine.

To enable the boiler above described to be divided into two distinct halves or sections, each having no connection with the other, I provide at the center of each pipe *j*, connecting the water-drums, a shut-off valve *s*, said valve being adapted to entirely close the pipes *j j*, so that water cannot pass from one drum to the other. I also provide valves *t*, adapted to shut off each steam-pipe *r'* from the main pipe *r*², said valves *t* being intended for use in case it is necessary entirely to discontinue the use of one side of the boiler, as in case of the breakage of tubes or other disability. In case of the discontinuance of the use of one side of the boiler it will be desirable to run the other side moderately to avoid liability of burning out tubes of the discontinued side.

It will be seen that when the valves *s* are closed the two sides of the boiler may be treated as independent boilers, either half of the boiler being adapted to be shut off wholly from the other half and from the steam-pipe *r*² in case of disability. This is an important advantage, since it obviates the necessity of stopping the engine when one half of the boiler and not the other is disabled.

Another important advantage resulting from the divisibility of the boiler into two sections is that both sides may be kept in operation, one side being supplied with more water than the other to trim the vessel when the revolution of the screw at a high speed tends to give the vessel a permanent heel, the fact being, as previously stated, that in very high-powered single-screw vessels, such as the latest torpedo-boats, the resistance of the water

to the revolution of the screw gives the vessel a permanent heel, the angle of which varies with the work on the screw. It will be seen, therefore, that by the described construction of the boiler, whereby a preponderance of water may be accumulated in either side of the boiler, affords a convenient and easily-controlled means for correcting the tendency of the vessel to heel under the influence of the screw. When the vessel is running at moderate speed, the tendency to heel does not exist, and the valves *s* may then be opened and permit communication between the water-drums, so that the whole may be run as one boiler.

I claim—

1. As an improvement in a boiler or steam-generator composed of water-drums *b b'*, steam-drums *c c'*, and tubes connecting said drums with the pipes, some of said tubes being arranged to form walls, inclosing flues or passages extending along the sides of the fire-box and adapted to conduct the products of combustion from one end of the fire-box to a stack over the opposite end of the fire-box, the improved baffle-plates formed to obstruct the upper portions of said flues, said baffle-plates being composed of tubes formed and arranged to constitute walls extending across the upper portions of said flues, the lower portions of said tubes being separated to permit the free passage of the products of combustion below said baffle-plates, as set forth.

2. A boiler comprising in its construction two water-drums, two steam-drums located

above the water-drums, pipes connecting the water-drums, return-pipes connecting the water and steam drums, tubes connecting the water-drums with the steam-drums, each water-drum being connected with the corresponding steam-drum by an independent series of tubes, and means for shutting off the communication between the two water-drums, whereby the boiler may be divided and treated as two independent boilers, as set forth.

3. A boiler comprising in its construction two water-drums, two steam-drums located above the water-drums, return-pipes connecting the water and steam drums, pipes connecting the water-drums, valves in said pipes, whereby communication between the two water-drums may be shut off, tubes connecting the water-drums with the steam-drums, and steam-pipes to conduct steam from the steam-drums, each of said steam-pipes having a valve whereby it may be shut off, the valve in the water-drum-connecting pipes and in the steam-pipes enabling either side of the boiler to be entirely cut off from communication both with the other side of the boiler and with the engine, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 4th day of November, A. D. 1891.

CHARLES D. MOSHER.

Witnesses:

C. F. BROWN,

A. D. HARRISON.