

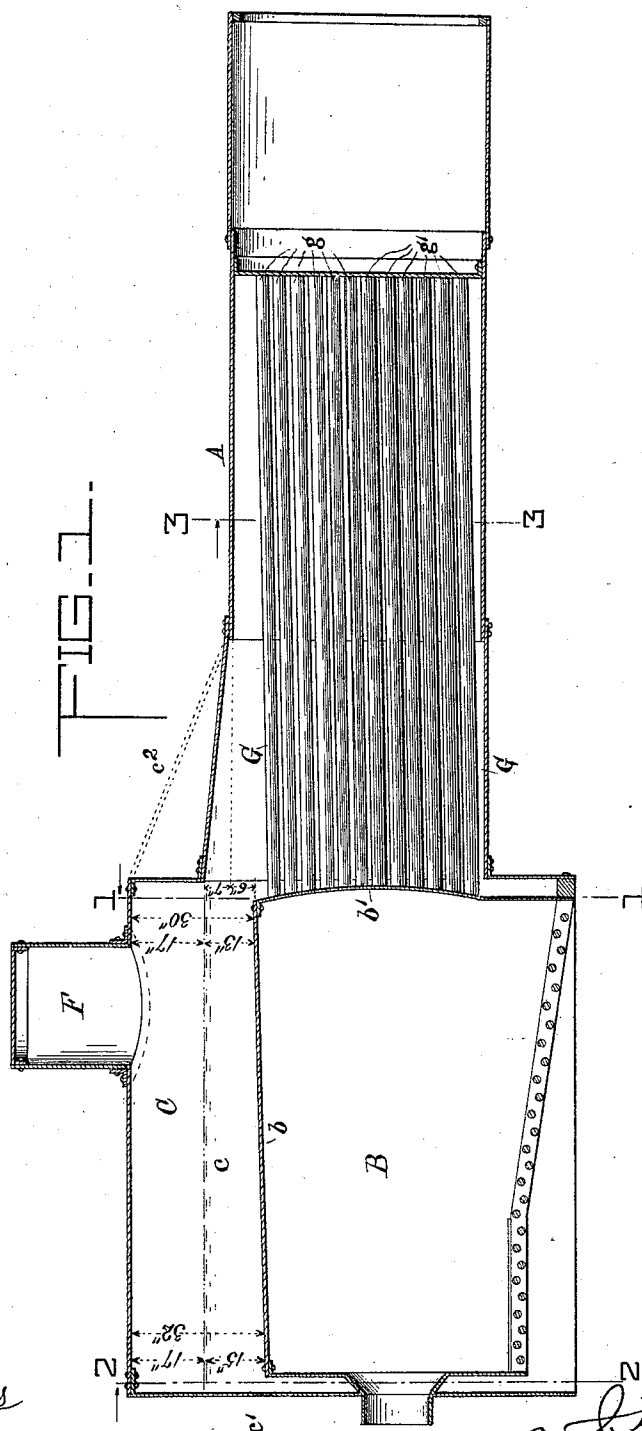
(No Model.)

2 Sheets—Sheet 1.

J. T. CONNELLY.
LOCOMOTIVE BOILER.

No. 579,741.

Patented Mar. 30, 1897.



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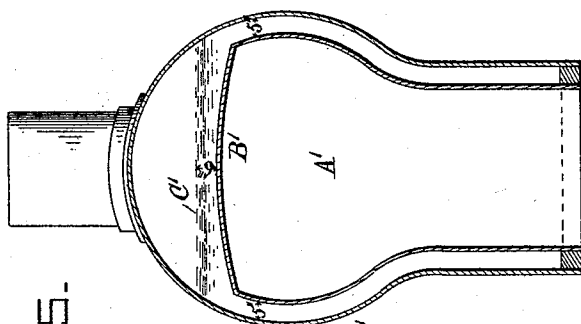


FIG. 5.

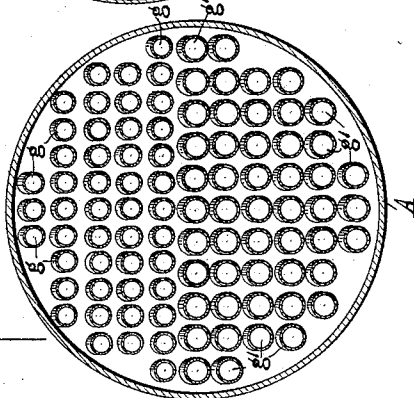


FIG. 4.

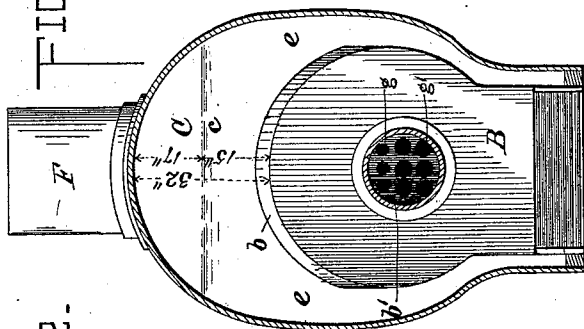


FIG. 3.

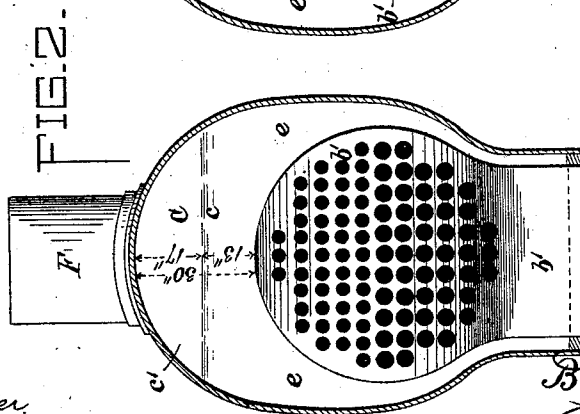


FIG. 2.

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UNITED STATES PATENT OFFICE,

JAMES THOMAS CONNELLY, OF MILTON, PENNSYLVANIA.

LOCOMOTIVE-BOILER.

SPECIFICATION forming part of Letters Patent No. 579,741, dated March 30, 1897.

Application filed May 18, 1896. Serial No. 592,085. (No model.)

To all whom it may concern:

Be it known that I, JAMES THOMAS CONNELLY, a citizen of the United States, residing at Milton, in the county of Northumberland and State of Pennsylvania, have invented certain new and useful Improvements in Locomotive-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.

This invention relates to locomotive-boilers; and it has for its object to provide an improved construction and relative arrangement of parts which will insure a more perfect circulation of the water to every part of the surface and in which the maximum of strength will be attained.

In the drawings, Figure 1 is a vertical longitudinal sectional view of a locomotive-boiler constructed in accordance with my invention. Fig. 2 is a vertical transverse sectional view taken on the line 1 1, Fig. 1. Fig. 3 is a vertical transverse sectional view taken on the line 2 2, Fig. 1. Fig. 4 is a detail vertical transverse sectional view taken on the line 3 3, Fig. 1. Fig. 5 is a vertical transverse sectional view showing a boiler as constructed according to the old or common practice.

Heretofore, as generally constructed, considerable difficulty has been experienced in locomotive-boilers from the burning of the tubes and the crown-sheet and side sheets of the fire-box. As heretofore constructed, the body of water surrounding the fire-box is not sufficient, and this deficiency especially results in the bulging and wrinkling of the side sheets of the fire-box. With a very strong fire forcing the engine the body of water will be raised up in the boiler from around the sides of the fire-box, because so much steam is being generated that the whole body of water around the fire-box and tubes is full of bubbles. This is evidenced by the fact that under such circumstances when the supply of steam to the cylinders is shut off and the draft to the fire is stopped the water in the boiler will at once settle to a lower level. Therefore in a boiler having a small body of water the sides of the fire-box are heated to a temperature approximating a low red heat, say about 700° Fahrenheit, so that the side

sheets are caused to bulge and wrinkle and are rendered useless in a short time. The crown-sheet, which is usually flat or slightly arched, as shown in Fig. 5, also suffers when there is a deficiency of water. The crown-sheet is usually supported by crown-bars, but if the crown-sheet is overheated and bent downward crown-bars or sling-braces will not serve to keep it up or in proper shape, the back of the fire-box is broken, and there is no way in which to remedy the defect. The bulging and wrinkling of the fire-box sheets are thus caused by a deficient quantity of water in the boiler and from the fact that with a small body of water the latter is forced up in the boiler, leaving the sides of the fire-box unprotected and free to become so highly heated that they will bulge and crack. Thus the bulging is not caused by high pressure, because in this event the stay-bolts would break, which they seldom do, and, furthermore, the side sheets must be subjected to a very high excessive heat before they can bulge, but it is simply due to a deficient quantity of water surrounding the fire-box.

In Fig. 5 I have shown the common form of locomotive-boilers, in which the fire-box A' has a flat or slightly-arched crown-sheet or top B'. The relative construction and arrangement is such that the normal level of the water in the boiler, as indicated at C', is but a short distance above the crown-sheet. In common practice the water-space in this construction runs from about three and a half inches at the bottom of the sides of the fire-box to about five and a half inches at the top, thus giving a mean average water-space of four and a half inches surrounding the sides, while the normal water-level is about six inches above the crown-sheet. It is thus evident that but a small body of water is possible and that when in making steam the water is forced in bubbles up in the boiler, and the sides of the fire-box are subject to a very high heat and to consequent damage.

It is the object of my invention to fully obviate the results and disadvantages above set forth; and to this end my invention and improvements consist in the improved construction and relative arrangement of parts as hereinafter described.

Referring to the drawings, A designates the

front shell or barrel of the boiler, which may be in the main of any suitable or adapted construction.

B designates the fire-box, which is circular in cross-section, as shown. Above the circular fire-box the boiler is provided with a large "wagon-top" C, by which relative construction and arrangement the employment of a very large fire-box is enabled, and a much enlarged or wider space is provided between the crown-sheet and outer shell, as indicated at *c*.

The front face *c'* of the wagon-top is preferably straight or at approximately right angles to the front shell or barrel A and is on a vertical plane a short distance in front of the front end of the fire-box B, but the front face of the wagon-top may be inclined or tapered, as shown at dotted lines *c''*, Fig. 1, if desired. In this improved construction and relative arrangement I provide for about three times as much water around the fire-box as has been heretofore possible in the old or common constructions. Ordinarily the space *c* between the crown-sheet and the top of the outer shell will be about thirty-two inches in depth. This enables a normal water-level, as indicated at *d*, fifteen inches above the crown-sheet, thus leaving a very large space of, say, seventeen inches for the steam-space above. I prefer to incline the crown-sheet or top *b* of the fire-box upwardly toward the front end of the boiler, this inclination being about two inches, so that in the arrangement of the space *c* there is a depth of water above the crown-sheet at the rear end of the fire-box of about fifteen inches, while at the front end there is a depth of water of about thirteen inches. The space *c* in relation to the upwardly-inclined crown-sheet thus runs from about thirty-two inches at the rear end to about thirty inches at the front end. In this relative arrangement of the crown-sheet or top of the fire-box at the front end of the latter the crown-sheet is about six inches below the top plane of the front shell or barrel A, so that there is at the front end of the fire-box a normal depth of water of about seven inches above the top plane of the front shell when the engine is in service. This improved construction and relative arrangement thus provide for the employment of a very large body of water, especially over the top of the fire-box, so that the forcing of the water in bubbles up in the boiler from around the sides of the fire-box is prevented by the large body of water, and the overheating of the side sheets, crown-sheet, or tubes is obviated.

The proportions above specified are merely indicated by way of example. I do not of course restrict myself to the exact measurements mentioned, it being only necessary to approximately observe similar relative measurements for the provision of the large space *c* above the circular fire-box and to provide for the very large body of water surrounding the latter and above the same; but important features of my invention are the provision

of the very deep space *c* by means of the enlarged outer shell or wagon-top C, the location of the crown-sheet of the fire-box below the top plane of the front shell or barrel, the consequent provision for the normal water-level above the top plane of the front shell, and also the employment of a very large fire-box which is enabled by such relative construction. The circular form of the fire-box, in conjunction with the improved relative construction and arrangement embodied in my invention, provides for a large body of water surrounding the side portions of the fire-box at the top, as will be seen at *e e*, Figs. 2 and 3.

F designates the steam-dome, which is arranged upon the enlargement or wagon-top C above the large steam-space, as shown.

I prefer to construct the tube-head *b'* of the fire-box in convex form, as shown, to prevent the head from cracking between the tube-holes, and the tubes G are preferably inclined upwardly toward the front end of the boiler. I also divide the tubes into two sets comprising, respectively, the upper and lower halves of the full series of tubes, the tubes of the upper half set *g* being of less diameter than the tubes of the lower half set *g'*. The relative diameters are practically two and one-fourth inches for the upper set *g* and two and one-half inches for the lower set *g'*. The vertical and horizontal distances between the tubes comprised in the lower half set, which are of the larger diameter, correspond, said vertical and horizontal distances between these tubes being, say, eleven-sixteenths of an inch. The vertical and horizontal distances between the tubes comprised in the upper half set, which are of the lesser diameter, differ, the horizontal distances between these tubes being less than the vertical distances. In carrying out this variation relative distances between these lesser-diameter tubes will be, say, eleven-sixteenths of an inch horizontal distance and fifteen-sixteenths of an inch vertical distance. This relative construction and arrangement of the tubes is designed to increase very materially the power of the boiler in generating and raising steam by affording more room for the raising of the steam toward the top of the boiler.

My improved construction and arrangement of the tube-head and tubes in relation to the other main elements of construction comprised in the fire-box and enlargement or wagon-top are especially adapted for effective results in obviating the disadvantages heretofore experienced in locomotive-boilers.

In relation to the circular fire-box it will be noted that the outer shell surrounding the fire-box is of elliptical form in cross-section, by which relative construction the enlarged spaces *c* and *e e* are most effectively secured.

The operation and advantages of my invention will be readily understood by those skilled in the art to which it appertains.

My improvements are designed to produce a more efficient boiler in which the maximum of strength will be attained.

My improved relative construction and arrangement enable the use of a very large body of water and insure a perfect circulation of water to the surface of the fire-box, thus obviating overheating of the crown-sheet or side sheets of the fire-box or of the tubes. My improved construction and arrangement are also designed to produce a quick generating-power, more perfect combustion, and consequently insure economy in fuel.

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

1. An improved locomotive-boiler, comprising, in combination with the shell embodying the enlargement or wagon-top C of elliptical contour in cross-section, the fire-box B of circular contour in cross-section having its crown-sheet extending longitudinally with relation to the enlargement or wagon-top and inclined upwardly toward the front end, the relative size and arrangement of said circular fire-box and the elliptical wagon-top shell being such that the comparatively deep or large space, *c*, is formed longitudinally between the segmentally-curved and inclined top or crown-sheet of the fire-box and the elliptical top of the shell and gradually increases in depth toward the rear end of the fire-box and the wide or broad downwardly-converging space *e e* is formed at the sides of the inclined top portion of the fire-box, substantially as and for the purpose set forth.

2. An improved locomotive-boiler, comprising, in combination with the shell or barrel embodying the enlargement or wagon-top C, the fire-box B having the segmentally-curved

top portion or crown-sheet extending longitudinally under and with relation to the enlargement or wagon-top and having the convex tube-head the apex of said curved top portion being on a longitudinal plane under the wagon-top and below the top plane of the front shell or barrel, the relative arrangement of said curved or circular fire-box and the wagon-top shell being such that the comparatively deep space *c* is formed above the segmentally-curved top portion or crown-sheet of the fire-box and the wide or broad space is formed at the sides of said curved crown-sheet, substantially as and for the purpose set forth.

3. An improved locomotive-boiler, comprising the shell or barrel embodying the enlargement or wagon-top C, the fire-box of circular contour in cross-section arranged within the shell, the relative size and arrangement of the fire-box and the wagon-top shell being such that the relatively deep or large space *c* is formed between the segmentally-curved top or crown-sheet of the fire-box and the top of the shell, substantially as described, the fire-box having the convex tube-head *b'* from which extends the series of tubes divided into an upper and lower set, the tubes of the upper set being of less diameter than the tubes of the lower set and the distances between the tubes being greater in the upper set than in the lower set, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES THOMAS CONNELLY.

Witnesses:

GEORGE B. HOY,
L. S. HARTMAN.