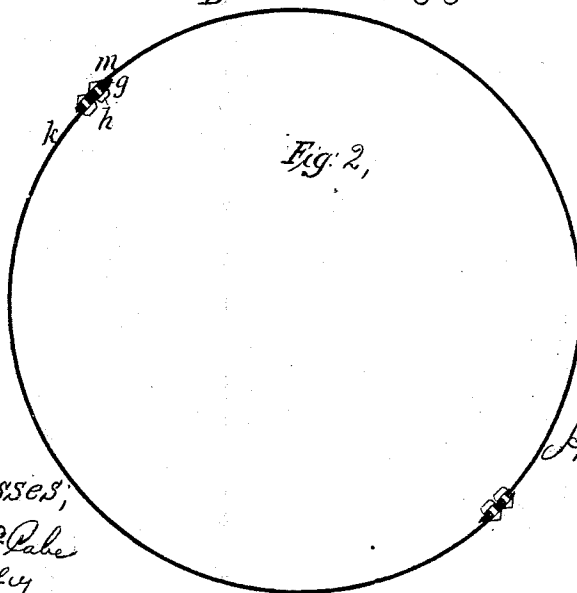
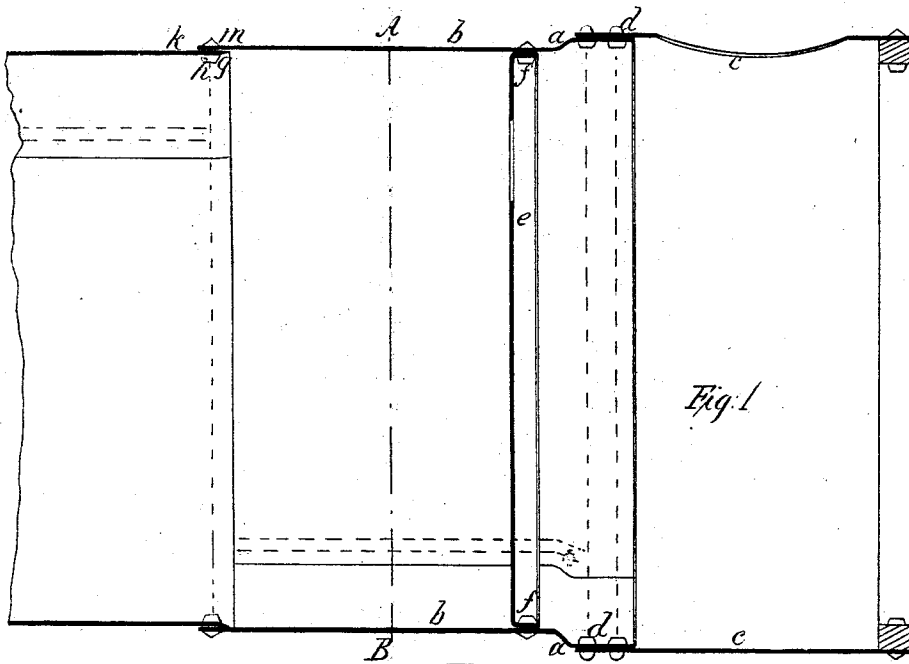
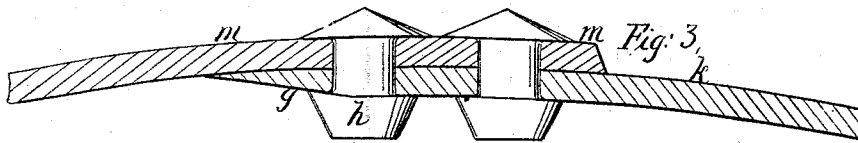


H. G. Brooks,
Steam-Boiler Attachment,
No 83,916. Patented Nov. 10, 1868.



Witnesses,
Wm. W. Baker
Wm. Bailey

Inventor
H. G. Brooks
 by *A. Poller*
 his atty.

United States Patent Office.

H. G. BROOKS, OF NEW YORK, N. Y.

Letters Patent No. 83,916, dated November 10, 1868.

IMPROVEMENT IN STEAM-GENERATORS.

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

To whom it may concern:

Be it known that I, H. G. BROOKS, of New York, in the county and State of New York, have invented certain new and useful Improvements in the Construction of Locomotive and other Boilers; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of a portion of a boiler, made in accordance with my invention.

Figure 2 is a transverse vertical section of the same, on the line A B, fig. 1.

Figure 3 is a view, on an enlarged scale, of a portion of the boiler.

The first part of my invention relates more especially to locomotive-boilers, and its object is to effect the removal of the forward flue-sheet in such boilers with greater convenience and economy than has heretofore been practicable.

In order to remove from an ordinary locomotive-boiler the forward flue-sheet for repairs or any other purpose, it has been heretofore necessary to first remove the rivets, or a portion of them, which secure the smoke-box to the cylinder-part of the boiler, for the reason that these rivets interfere with the flue-sheet, and prevent its withdrawal, and this operation not only consumes considerable time, but is both inconvenient and expensive.

In order to obviate this difficulty, I form a flange or offset, *a*, outward, at the end of the forward course, *b*, of the cylinder-portion of the boiler, so that when the smoke-arch or box, *c*, is riveted thereto, the heads of the rivets *d*, which fasten the smoke-box to the boiler, may entirely clear the periphery of the flue-sheet *e*, which is riveted within the forward course *b*, in the usual manner. From this construction it results that when the flue-sheet rivets *f* are removed, the flue-sheet can at once be withdrawn without trouble or interference with the fastening-rivets of the smoke-box, thus remedying in a simple and effective manner the difficulty above named.

The second and main portion of my invention relates to the construction of locomotive and other boilers, and its object is to impart to them greater strength and durability, and to prevent, as far as possible, danger of rupture, and consequent explosion.

It is well understood that explosions, of course, cannot occur except as the result of rupture, whatever the theory may be as to the causes of rupture.

My own experience in this matter has led me to the conclusion that rupture is occasioned by the abrupt termination of the vibratory movements, from whatever cause, of the boiler-plates. Unequal temperatures at different parts of the boiler result in a quivering, vibratory movement of the plates contiguous thereto. The attachment of machinery to the boiler; the natural jar caused by the movement of the locomotive over the rail, are all forces which tend to disintegrate and separate the metal at all rigid points

or points where the vibratory movement is abruptly terminated.

The points of abrupt termination of this vibratory movement in boilers are the laps or seams where two or more sheets meet; the points where, in locomotive-boilers, the braces or attachments to the frame are riveted or fastened; and, in general, all points where there is a rigid connection between the boiler and other mechanism or devices.

I have found, after careful and repeated investigations of many boiler-explosions, that ruptures generally take place at these points, that is, either directly under the seam or lap, or at some other rigid point determined by the construction and service of the boiler, and that the metal commences to separate at the inner surface of the plates; this latter effect being due, in a measure, to the fact that the metal at the inner surface is compressed, and therefore already partially disintegrated by the bending of the plate.

As, therefore, the abrupt termination of the vibratory movement of the plates at such points is a frequent cause of rupture, it follows that by gradually checking the vibratory movement, instead of abruptly and suddenly terminating it, the disintegrating forces will be, as it were, diffused and gradually expended, and will not, as in the former instance, have a concentrated action upon any one part of the boiler-plates; and by this means the rupture of the plates will be as far as possible prevented.

To effect this result it is necessary that wherever seams or laps occur in the construction of the boiler, the end, *g*, of the inside sheet, *K*, of the lap, (see fig. 3,) which, unlike the end of the outside sheet, is not required to be chipped and corked, should be prolonged, and chamfered or tapered, from the outside of the rivet-head *h*, to the extreme edge of said sheet; in other words, it should be extremely thin at the edge, and then gradually increase in thickness as it approaches the rivet, where it may be of the ordinary thickness.

In ordinary boilers, the end, *g*, of the inner sheet is cut square off, or nearly so, and has the same thickness as the other parts of the plate. The consequence is that the vibrations of the outer sheet *m* are abruptly terminated when they reach the end, *g*, and the sudden checking of this movement causes the disintegration, gradual separation, and final rupture of the metal in the plate *m*, along the line of the lap. But by gradually tapering or chamfering the end, *g*, the movement is but slightly checked at first by the thin edge of the sheet *K*; then, as it progresses, it meets with gradually-increasing thickness of the bevelled end of the sheet, until it is at last checked and terminated without injurious effect, the lap offering a yielding resistance only to the vibratory movements, and thus neutralizing their tendency to disintegrate the metal, and destroying the fulcrum, over which, in boilers of ordinary construction, the sheet is gradually broken. Where practicable, the thin edge of the inner sheet of the

lap may, with good results, instead of being straight, have a curved or undulating outline.

By thus forming the lap, the point at which the rupture, if any, will occur, is transferred from the inner surface of the sheet *m* to the outer surface of the sheet *K*, where it meets the abrupt end of the sheet *m*; this end being necessarily shaped as shown in the drawings, as it requires to be clipped and corked. But this is comparatively of little importance, for the exterior of the boiler may be inspected at all times, and under the best conditions, for the discovery of any flaw or defect in the plates. But the interior of the boiler can only be examined when the boiler is cold, and the plates consequently contracted, so that even if there should be a partial rupture along the line of the inner sheet of the lap, a most rigid inspection would in many instances fail to disclose it.

The same principle should be carried into the construction of all parts of the boiler, and at all points where the boiler attaches to other mechanism or devices which may tend to check abruptly the vibration of the plates. For instance, the braces, which, in locomotives, fasten the boiler to the frame, should have their feet, which are attached to the boiler, largely extended in surface, and so made that a point, at or near the centre of the foot of the brace, shall be the thickest portion, tapering gradually thence towards all the edges of the foot, which edges should be as thin as possible, and with a curved or irregular outline, if desired.

The object of giving a curved or irregular outline to the edge of the laps and other parts is to retard as

far as possible the rupture of the plate, which can be torn less readily than across a straight edge, for the same reason that a sheet of paper can be divided with greater ease by tearing it over a straight edge than over a crooked or irregular edge, as in the latter case there must be a continuous change of direction in the line of separation.

As above indicated, the method I have described of constructing boilers, may be applied to boilers used for any and every purpose, the essential feature being that as far as possible there shall be no abrupt termination to the vibratory movement of the plates of which the boiler may be composed.

Having now described my invention, and the manner in which the same is or may be carried into effect,

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

1. A boiler, in which the ends of the inner sheets of the laps or seams are prolonged beyond the fastening-rivets, and chamfered or bevelled, in the manner and for the purposes set forth.

2. The offset, flanged outwardly, in the manner described, on the end of the forward course of the cylinder-portion of the boiler, in combination with the smoke-arch or box, substantially as and for the purposes set forth.

In testimony whereof, I have signed my name to this specification, before two subscribing witnesses.

H. G. BROOKS.

Witnesses:

M. L. HINMAN,

JNO. W. ROMAINE.