No. 717,432. Patented Dec. 30, 1902.

D. B. MORISON.

CORRUGATED FURNACE FOR STEAM BOILERS.

(Application filed Dec. 17, 1901.)

(No Model.)

Fig. 1.

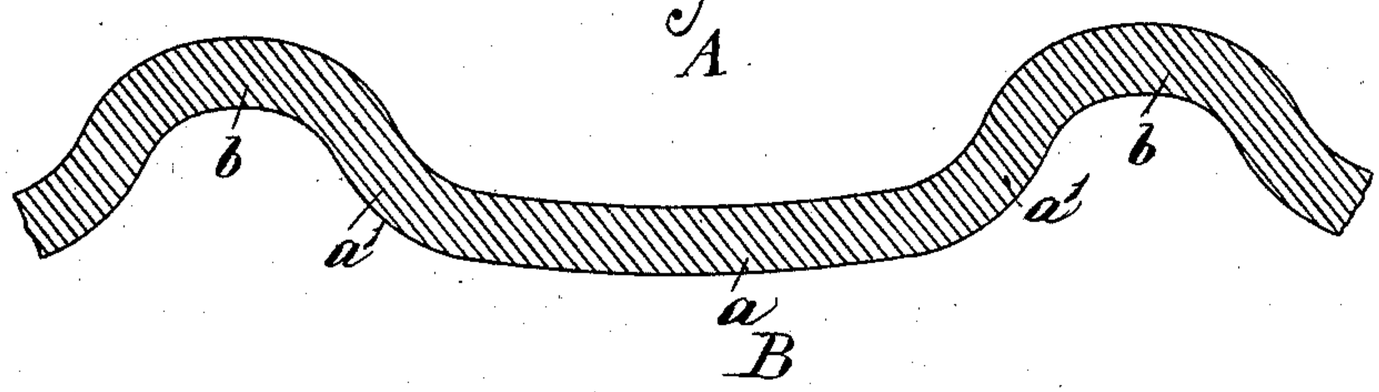


Fig. 2.

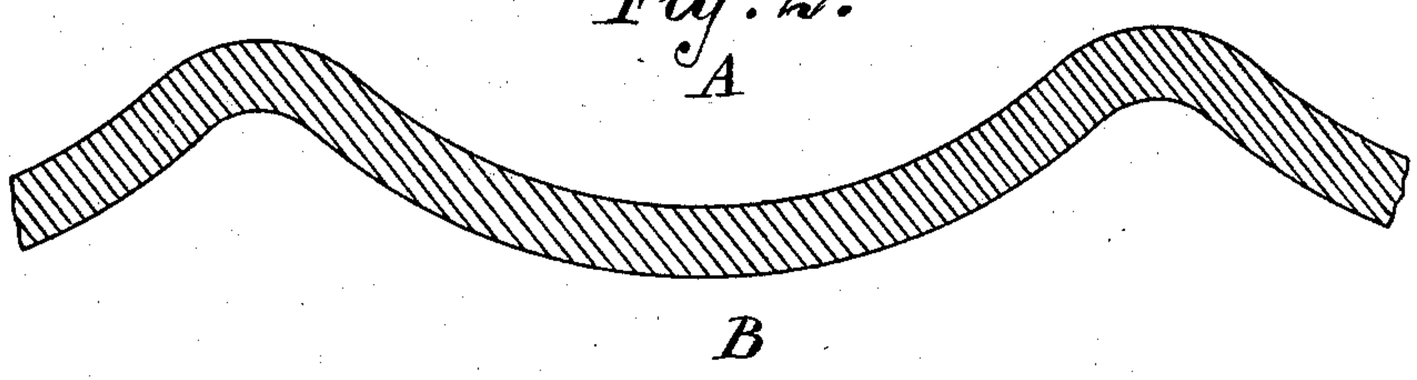
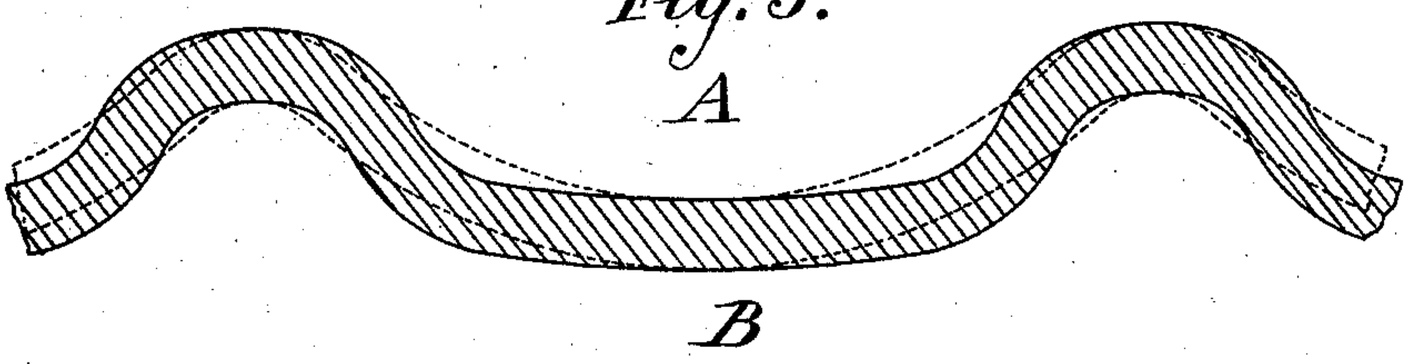


Fig. 3.



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UNITED STATES PATENT OFFICE.

DONALD BARNS MORISON, OF HARTLEPOOL, ENGLAND.

CORRUGATED FURNACE FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 717,432, dated December 30, 1902.

Application filed December 17, 1901. Serial No. 86,290. (No model.)

To all whom it may concern:

Be it known that I, DONALD BARNS MORISON, a subject of the King of Great Britain and Ireland, residing at Hartlepool, in the county of Durham, England, have invented Improved Corrugated Furnaces for Steam-Boilers, of which the following is a specification.

This invention has reference to an improved construction of corrugated furnace of the well-known Morison type, wherein the furnace-wall, as seen in a longitudinal section thereof, is (practically) entirely curvilinear, the inward curves being long relatively to the outward curves.

The very high steam-pressures now commonly used operate directly to increase the difficulty of sustaining them by reason of the fact that they are necessarily associated with high temperatures which in many cases closely approach the critical temperature at which the tensile strength of mild steel diminishes, and therefore the range of temperatures throughout which the strength value of a furnace is unaffected has become considerably restricted. Moreover, the mean temperature of a furnace considerably exceeds that of the steam, even when the plate is free from scale, and it increases with the thickness of the metal, and therefore special technical value now attaches to the strength-giving qualities of formation as distinguished from thickness of plate. Now as the result of much expenditure of time and thought, coupled with actual practical tests, I have succeeded in devising an improved construction of corrugated furnace whereby I am enabled in actual practice to produce with a given weight or thickness of metal a furnace of the said type which is stronger, is less liable to local thinning of the plate during the process of manufacture, and therefore is more uniform in thickness and presents a larger proportion of its surface to the direct action of the natural current of the hot gases, and results in a more uniform distribution of scale than has been the case with furnaces of the said type as they have heretofore been constructed.

In order that others skilled in the art may be enabled to make and use my invention, I now proceed to more particularly describe the same with the aid of the accompanying illustrative drawings, whereof—

Figure 1 shows in longitudinal section so much of the wall of a corrugated furnace as is needful to illustrate my invention. Fig. 2 is a similar view illustrating the well-known Morison formation. Fig. 3 is a similar view to Fig. 1 of my improved construction, with the well-known Morison formation, Fig. 2, indicated by dotted lines, so as to clearly illustrate the important practical difference between a furnace according to my present invention and one of the older construction.

A indicates in each case the water side of the furnace-wall, and B the fire side.

As will be seen on reference to Figs. 1 and 3, in a furnace according to my present invention each of the wide circumferential inward corrugations or "valleys" *a* of which the principal heating-surface is composed is made of a curved formation resembling or approximating to an elliptical arc, and each circumferential outward corrugation or ridge *b*, as seen in a section thereof taken in the same plane, has the form of an elliptical arc, or approximately so, the parts *a'* of the inward corrugations which merge into the outward corrugations or ridges *b* being curved to shorter radii than the adjacent or more inward portions of the said inward corrugations, whereby it results that the material constituting each side of each outward corrugation or strengthening-ridge, as well as the immediately-adjacent outwardly-directed portion of the furnace-wall, is as a whole so disposed that there are produced circumferential girders whose sides are more nearly than heretofore in planes normal to the longitudinal axis of the furnace, and the improved girders thus constituted have the effect of increasing the resistance to collapse or deformation under external pressure, while, furthermore, the peculiar formation of the outward corrugations or strengthening-ridges is such as can in practice, particularly when the furnace is made from an original plate of equal thickness throughout, be produced without risk of undue local thinning, thereby adding to the strength of the furnace, and these advantages, which I have proved by actual test to result from my present invention, are additional to those attending the reten-

tion of long shallow inward corrugations, in combination with the wide distribution of expansion and contraction stresses promoted by a form entirely curvilinear in longitudinal profile.

Referring to Fig. 2, it will be seen that in the well-known Morison formation the inward curves are arcs of circles or approximately catenary curves tangential to the arcs of circles which form the ridges, while Fig. 3 shows how essentially my improved construction, Fig. 1, differs from said well-known Morison construction, Fig. 2.

As is seen by reference to Fig. 3, my improved construction has the effect of disposing the metal forming the sides of the ridges more nearly in planes normal to the axis of the furnace, thereby increasing the effective depth of the metal in the said sides, with the result that the moment of resistence to bending of these strengthening parts is materially increased, thereby adding strength to the furnace as compared with the old construction. Moreover, it will be seen that while in my improved furnace the advantages of the curved formation are retained the curvature of the main portion of each inward corrugation assumes a form which, on the one hand, has the effect of causing more uniform distribution of any deposit that may take place on the water side of the furnace-wall, so reducing the risks of local overheating, and, on the other hand, has likewise the effect of bringing a much larger proportion of the area of the fire side of the wall more directly under the natural current or flow of the products of combustion in the furnace, thereby adding to the steam-generating efficiency.

The formation actually illustrated is susceptible of slight variations—as, for example, the curvature of the tops of the ridges might in some cases be somewhat modified, while still retaining the characteristic features of my improved construction as respects the formation of the wide circumferential valleys or inward corrugations and the sides of the relatively narrow outward corrugations or strengthening-ridges. The furnace may also be made of plates locally thickened, so that the thickness at the ridges may be greater than the thickness at the valleys; but the formation I have described and illustrated is the one I at present prefer.

What I claim is—

1. A corrugated furnace a longitudinal section of the wall of which consists of a series of narrow curved ridges or outward corrugations connected by wide curved intermediate valleys or inward corrugations, both inward and outward corrugations being of elliptical arc shape decreasing in radius toward where the said corrugations merge, as set forth.

2. A corrugated furnace, a longitudinal section of the wall which consists of an inwardly-curved portion, a second inwardly-curved portion of less radius than the first portion and a third outwardly-curved portion of less radius than the first portion, substantially as described.

Signed at West Hartlepool, in the county of Durham, England, this 3d day of December, 1901.

DONALD BARNS MORISON.

Witnesses:

T. HARRY TILLY,

J. B. STROVER.