(No Model.)

G. S. STRONG.

STEAM BOILER TUBE.

No. 266,220. Patented Oct. 17, 1882.

FIG. 1.

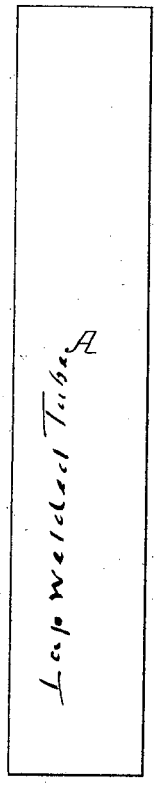


FIG. 2.

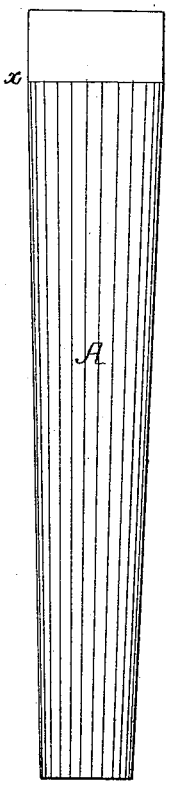


FIG. 3.

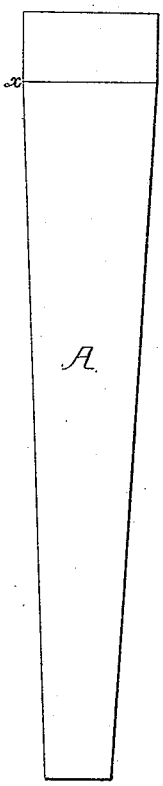


FIG. 4.

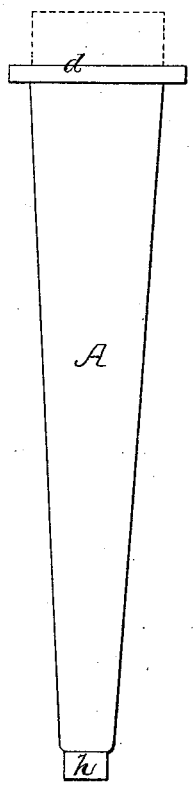


FIG. 9.

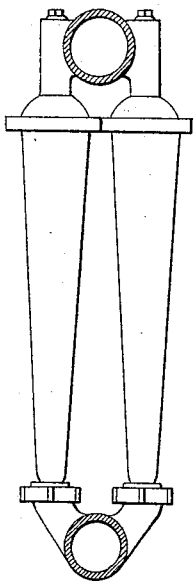


FIG. 5.

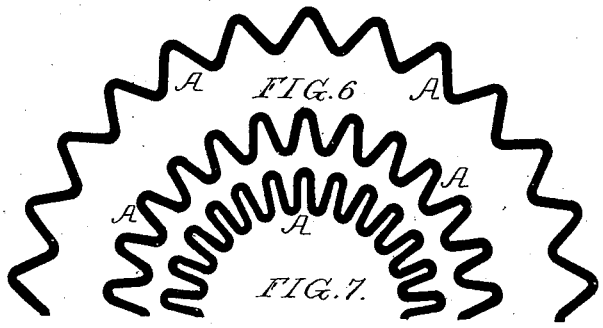


FIG. 6

FIG. 7.

FIG. 8.

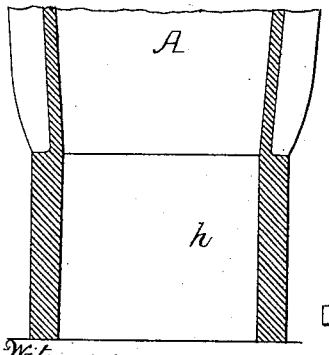
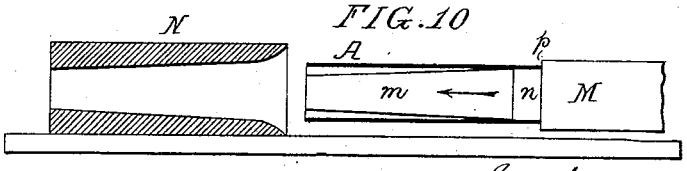


FIG. 10



Witnesses,
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Harry Drury

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George S. Strong
by his Attorneys.
Howson and Sons

UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-BOILER TUBE.

SPECIFICATION forming part of Letters Patent No. 266,220, dated October 17, 1882.

Application filed March 6, 1882. (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 an Improvement in Steam-Boiler Tubes, of which the following is a specification.

My invention relates to an improvement in the upright tapering tubes of steam-boilers; and it consists in reducing an ordinary cylindrical lap-welded tube to the desired tapering shape by corrugating or crimping it in the peculiar manner fully described hereinafter, the tube thus constructed being cheaper and a better transmitter of heat and presenting more heating-surface than an ordinary taper tube.

In the accompanying drawings, Figure 1 represents a side view of a cylindrical lap-welded tube, preferably of steel, and about twelve inches in diameter; Figs. 2 and 3, views of the same tube, showing the successive degrees of taper imparted to it; Fig. 4, a view of the tube in its finished condition. The above views are drawn to a scale of one inch to a foot. Figs. 5, 6, and 7, which are drawn to a scale of six inches to a foot, show the different conditions of the corrugations at the lower end of the tube in the different stages of its reduction to the desired tapering form; Fig. 8, which is also drawn to a scale of six inches to a foot, shows the lower end of the taper tube in its finished condition. Fig. 9 is a portion of a boiler drawn to a reduced scale, and showing the tapering tubes; and Fig. 10, a diagram illustrating the mode in which I prefer to make the tubes.

The upright tapering tubes, larger above than below, of the style of steam-boiler known as the "Galloway," are acknowledged by engineers to possess several advantages over cylindrical vertical tubes, the only objection to them being their expense as heretofore made—that is, by cutting out a sheet of plate-iron of appropriate form, lapping the edges, and welding the lap by hand while the tube is held on a tapering mandrel. The cutting of the plate to waste, the tedious operation of welding by hand, and the necessity of employing thick plate-iron in order to effect a proper welding, all contribute to render ordinary tubes of this class expensive.

In carrying out my invention I take a cylindrical lap-welded tube, A, Fig. 1, of the required length, and reduce it to the desired tapering form by tapering corrugations. These corrugations I prefer to make gradually, or by as many successive operations as the diameter of the tube and other circumstances may require. Thus the taper shown in Fig. 2 is obtained by corrugating the tube, as shown in Fig. 5, which illustrates the condition of the corrugations at the extreme lower end of the said tube, the grooves formed in the exterior of which are tapering, or, in other words, gradually decrease in depth from the lower end of the tube until they finally disappear at *x*, Fig. 2, for a portion of the upper end of the tube above the said line *x* should retain its cylindrical form for a purpose rendered apparent hereinafter. The ribs formed by the corrugations are prominent below, but become gradually less prominent until they merge into the cylindrical portion of the tube at *x*. A more abrupt taper is imparted to the tube by reducing the corrugations at the lower end of the said tube to the condition shown in Fig. 6, the corrugations being still made on a taper and merging into the cylindrical portion at *x*, the tube by this second operation assuming the form, Fig. 3, in which, however, I have shown no lines indicating corrugations, for the reason that, if properly made, they would be too much crowded. By the third operation the folds made by the corrugations are compacted, as shown in Fig. 7, and a still more abrupt taper is imparted to the tube, the corrugations being still on a taper and merging into the upper cylindrical portion of the tube. The final operation is to prepare the tube for attachment to the boiler. This will depend upon the mode adopted of fastening the tube. In the present instance the upper cylindrical portion of the tube is forged into a flange, *d*, for attachment to a branch on the upper horizontal portion of the boiler, while at the lower end of the tube the corrugations are welded together, as shown in Fig. 8, so as to form a short tube, *h*, of solid metal, into which the ribs formed by the corrugations merge.

While in most cases the successive operations described may be advisable, in some instances the desired taper may be imparted by one corrugating operation, or more than three successive operations may be resorted to.

While my improved taper tubes, when form-

ing a part of a steam-boiler, possess all the advantages of the ordinary taper tubes, they possess the additional advantages of being lighter and presenting a more extended heating-surface than ordinary taper tubes of this class; at the same time they can be made of thin metal, and are consequently better transmitters of heat; no waste of metal, moreover, is involved in their construction, and when made by the aid of appropriate mechanism they are much cheaper than the common taper tubes.

While mechanism for manufacturing the tubes forms no part of this application for a patent, I may briefly describe the mode which I propose to adopt of making them, reference being had to the diagram, Fig. 10, in which M represents a ram to be operated by hydraulic or other pressure, this ram having a tapering die, *m*, with tapering corrugations corresponding with those on the inside of the tube, the fixed die N having a tapering bore with corrugations corresponding with those on the outside of the tube.

The cylindrical lap-welded tube A, when properly heated, is fitted to the cylindrical portion *n* of the ram, and bears against a shoulder, *p*, on the same. The ram M is then moved forward in the direction of the arrow and the heated tube passes into the flaring entrance of the die N, and is finally reduced to the desired corrugated condition by and between the two dies, after which the ram is retracted. Different dies will of course be required for the successive operations.

I am aware that it has been proposed to make tapering corrugated tubes by first making a tapering blank and then corrugating the same by the action of suitable dies, and hence I do not claim broadly a corrugated tapering tube. The object of my invention is to avoid the necessity of first making a tapering blank for the tube.

I claim as my invention—

1. The mode herein described of making tapering tubes for steam-boilers, said mode consisting in forming on an ordinary cylindrical lap-welded tube corrugations prominent at the small end of the tube, but gradually decreasing in prominence until they merge into the cylindrical portion of the tube at or near the opposite end, as set forth.

2. The within-described tapering tube for steam-boilers, said tube having at its small end prominent corrugations which gradually decrease in prominence until they merge into the cylindrical portion of the tube at or near the large end of the same, as set forth.

3. A tapering tube having tapering corrugations concentrated and welded at and near the contracted end of the tube, as set forth.

4. A tapering tube having tapering corrugations, and having at its large end a flange, *d*, and at its small end a concentrated and welded portion, *h*, 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:
HARRY DRURY,
HARRY SMITH.