



---

A.D. 1841 . . . . . N° 9140.

---

**Tubular Flues of Steam Boilers.**

**CUTLER'S SPECIFICATION.**

**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Job CUTLER, of Birmingham, in the County of Warwick, send greeting.**

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, 5 the Sixth day of November, One thousand eight hundred and forty-one, in the fifth year of Her reign, did give and grant unto me, the said Job Cutler, my eñors, adñiors, and assigns, Her especial license, full power, sole privilege and authority, that I, the said Job Cutler, my eñors, adñiors, and assigns, and such others as I, the said Job Cutler, my eñors, adñiors, and 10 assigns, should at any time agree with, and no others, from time to time and at all times hereafter during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, and also in all Her said Majesty's Colonies and Plantations abroad, my Invention of "**IMPROVEMENTS IN THE CONSTRUCTION OF THE TUBULAR FLUES OF STEAM BOILERS;**" in which said Letters Patent 15 there is contained a proviso that I, the said Job Cutler, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, to be enrolled in Her said Majesty's High Court of Chancery within six calendar 20 months next immediately after the date of the said in part recited Letters Patent, reference being thereunto had, may more fully and at large appear.

---

*Cutler's Improvements in Tubular Flues of Steam Boilers.*

---

NOW KNOW YE, that in compliance with the said proviso, I, the said Job Cutler, do hereby declare the nature of my Invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof (reference being had to the Drawing hereunto annexed, and to the figures and letters marked thereon, 5 that is to say :—

My Invention consists, first, of improvements in the construction of welded iron tubes used-as flues for steam boilers; and, secondly, consists in constructing the tubular flues of steam boilers of coated iron tubes. And in order to give the best information in my power I will proceed to describe the manner in 10 which I construct or weld tubular flues of steam boilers.

Firstly, I take a strip of rolled or hammered iron or steel of the required length, breadth, and thickness, depending on the diameter and length of tube required, and proceed to convert it into a tube in the following manner :—If for a lap-joint tube I first bevel or chamfer the two opposite edges, as is well understood. When 15 this is accomplished I proceed to bend, strip, or narrow a sheet of iron into a cylindrical shape, by bringing the edges together, or nearly so, as heretofore practised when making wrought iron welded tubes. When the tubes are thus far prepared they are to be placed in a furnace, so as to bring the two edges to a good welding heat, and when in this state, the tubes having a mandril 20 within each of them, are to be drawn through dies or between grooved rollers. At the mouth of the furnace I place the end of a drawbench; upon this bench I place two stops; against these stops a die or dies or a pair of grooved rolls of the required size for the tube about to be welded. A mandril, made in the form of that shewn at Figure 1, is then placed upon the drawbench, as is 25 shown; one end is to be made secure at the back end of the bench; the other end of the mandril is to be passed through the die or groove of the rolls. A ring of iron or steel is to be placed into the end of the tube and capable of sliding over the stem of the mandril or triplet, see Figure 2. When these instruments are provided, and the iron or steel scalp or tube is at a welding 30 heat, the mandrill is to be pushed through the die and inserted sufficiently far into the scalp or tube to allow the end which was previously made smaller being passed through the die or groove of the rolls. The steel ring is then to be forced inside the scalp. The pliers should then take hold of that part of the scalp or tube in which the ring is inserted. The chain being then attached 35 to the plyers should be set in motion, when the hot scalp or tube will be drawn along the mandrill through the die or dies or through the groove of the rolls. The compression on the outer surface of the edges of the hot scalp or tube, and the resistance of the mandrill within, will have the effect of welding the

A.D. 1841.—N<sup>o</sup> 9140.

3

*Cutler's Improvements in Tubular Flues of Steam Boilers.*

joint more firmly and substantially than is now done by only compressing the external surface of the scalp or tube without any resistance being within. The iron or steel I should prefer for welding into tubes upon this principle would not be stronger than eleven wire gauge, but oftener thinner; but I do  
5 not confine myself to the thickness of the iron or steel. The mandril should be made taper for some inches, but that part which is in the die or dies, or in the groove of the rolls where the final welding of the tube is effected, should be the size that is necessary to ensure a good cementation, incorporation, or weld, and to leave the inside perfectly smooth. I do not confine myself to  
10 any particular form in the mandrill or triblet, but have found the one described to answer my purpose. I prefer that the die or dies should be about ten or twelve inches through, and bell-mouthed at the entrance at the end next the fire, and very slightly conical throughout. A butt joint tube can be made by this means and upon this principle; in doing so, however, the two edges of the  
15 scalp should stand up a little, or should be bent or prepared a little more egg shape in section for the purpose of welding. After the welding is accomplished I draw the tubes through a hole in similar dies, either in a hot or cold state, upon a mandrill or triblett, for the purpose of equalizing the thickness of the tube throughout, and for smoothing both the inside and the outside of the  
20 tube, and for closing the pores of the metal and laying the grain all one way. This will have the effect of encreasing the consistency and durability of the tube, and will be found most advantageous in making tubular flues of steam boilers. The shape of the die or dies, and the means of opening and closing them, may be varied, and such as are now commonly used in making what  
25 are known as Russell's tubes may be used, this part of the Invention not depending on the construction of the dies, but on the mode of using them in conjunction with a mandril, and means of drawing tubes to weld them through such dies and over mandrills as above explained. If a welded iron or steel tube made according to the above-described process, or by the means of  
30 welding, is thicker than I require for making tubular flues for steam boilers, I heat it in a furnace and insert a mandrill inside the tube, and proceed to pass it through a pair of groove-rolls, rolling the hot tube off the mandrill in the same manner as described by Henry Osborn in his Patent for welding gun barrels, dated First May, One thousand eight hundred  
35 and seventeen, or I draw them through a hole or dies, when on a mandrill or triblet, in the same manner as I have described above for the welding of iron or steel tubes. If drawn on a mandrill, as above described, there will be no difficulty in extracting the mandrill, as the stem is of smaller diameter than the mandrill, and therefore the tube can be slid off.

---

*Cutler's Improvements in Tubular Flues of Steam Boilers.*

---

For the purpose of still further improving the iron or steel tubes, I would place them in a trough and cover them with a solution of two parts of muriatic acid and three parts of water; after they have remained a sufficient time I take them out, and scour them with some gritty substance to clean them from any oxide that may remain, and then wash them free from the acid, and grease them 5 well inside with any oily or greasy matter, and if mixed with a little powdered black lead, it will be better. I then insert a mandrill or triblet, and draw them through a hole or bed, as before described; this has a very beneficial effect, inasmuch as it hardens the metal, renders both the inside and outside of the tube perfectly smooth and uniform, equalizes the thickness throughout, 10 closes up the pores, lays the grain all one way, and renders it more durable and otherwise more suitable for making tubular flues of steam boilers. It should be remarked that when grooved rollers are used to weld, in place of dies, that the rollers are not driven by machinery, but simply revolve by the draft of the tube being drawn between them. 15

Another mode of producing welded iron tubes, according to my Invention, is as follows:—At the end of the drawbench, and also close to the mouth of the furnace, I fix on the bench an anvil, having a groove or not, but I prefer having a groove (and made bell-mouthed at the end next the furnace) of near three fourths of a circle upon its face; 20 this must be regulated to the sized tube about to be welded. I then have hammers so placed that their faces shall be brought to bear upon the tube or pipe about to be welded, as it is drawn through the groove of the swage or anvil, and over a mandril. These hammers I have worked by machinery very fast, so that a continual succession of blows shall fall upon the iron or steel 25 tube as it keeps progressing over the mandrill. The faces of these hammers may vary in size and form, and may be made a little hollow on their faces or flat; a few inches from the swage or anvil, lower down the bench, are to be placed two stops for dies, or pair of groove rolls. A mandril or triblet is then passed through the dies, or between the groove of the rolls, until its tapered 30 end reached to the mouth of the furnace, when it is inserted into the end of the heated tube which is about to be drawn out and welded, the other end of the rod of the mandril being firmly secured at the back end of the bench, the end of the hot scalp or tube is then brought on to the mandrill through the groove in the anvil, and through the dies, or between the groove of the rolls, 35 when the ring is inserted inside the scalp or tube, and the pliers attached to the chain belonging to the drawbench are to take hold of the end of the tube or pipe at that part where the ferule or ring (which is made to slide over the stem of the mandrill or triblet) is inserted, the bench and hammers are then

A.D. 1841.—N<sup>o</sup> 9140.

5

---

*Cutler's Improvements in Tubular Flues of Steam Boilers.*

---

set in motion as the chain and pliers continue to draw the tube over the mandrill or triblett, which is stationery inside the tube or pipe, and made to bear on that part where the hammers are continually striking, causes a resistance inside the tube or pipe to the blows given on the outer surface of the tube or  
5 pipe, for the purpose of welding the two edges together. This process will not produce a good shape of tube, but, by the tube passing through dies or between grooved rolls while in a hot state, with a mandril within the tube, and this may be done either while the hammering process is going forward or afterwards, and such means will have the effect of bringing the tube or pipe into  
10 a circular or cylindrical form externally; and the mandrill will have the effect of equalizing the thickness of the iron or steel throughout. I cause the welding to be effected by means of the hammers, and the metal to be smoothed both inside and out, and to be equalized throughout by means of the dies or grooved rolls, and also to bring them into a perfectly cylindrical form. I wish  
15 it to be understood, in respect to these parts of my Invention, that I do not claim the welding of iron or steel tubes by means of hammers worked by machinery, nor do I claim their being welded upon a mandrill.

I will now describe another part of my Invention. I take a strip of rolled or hammered iron or steel of the required length, breadth, and thickness,  
20 and, by any of the known methods, convert it into a tube. I then secure the two edges, by either brazing them or by welding them together; I then take a tube made of copper, brass, or other metals, or alloys of metals, and draw it upon the outer surface of the iron or steel tube; I then pass them through a hole or dies by means of a drawbench, or this may be done by means of  
25 grooved rolls, either upon a mandrill or without a mandrill, they must be then either drawn or rolled until they are reduced to the required sizes and thickness, which process is well understood by tube makers. I also take the iron or steel tube, when prepared as above described, but without being soldered or brazed, and proceed to cover it in like manner with copper, brass, or other  
30 suitable alloy of metals. I also proceed to cover or coat a welded iron or steel tube with copper, brass, or other alloys of copper, in manner as before described. I would remark that I do not claim the making of coated tubes, above described; this part of my Invention relating to the application of coated tubes in constructing the tubular flues of steam boilers.

35 What I claim, as the first part of my Invention, is the mode of welding iron or steel tubes by drawing them through dies or between grooved rolls, when, and at the same time as drawing such tubes on mandrills, the mandril being a necessary and important part of the mechanical apparatus in producing the welding.

*Cutler's Improvements in Tubular Flues of Steam Boilers.*

Secondly, I claim the welding of iron or steel tubes by hammering upon a mandrill at the same time I am drawing the tube from the fire along a mandrill, so that the tube is welded on and drawn over a mandrill at one process.

Thirdly, I claim the application of either iron or steel tubes, when coated with copper, brass, or other alloys of copper, in the construction of tubular flues for steam boilers.

And fourthly, I claim, in the construction of tubular flues of steam boilers, the application of welded iron or steel tubes, which have been drawn through a circular hole or die, or between rollers, and which have been drawn over a mandril for the purpose of smoothing the external and internal surfaces of the tubes, and for regulating the thickness of the metal.

In witness whereof, I, the said Job Cutler, have hereunto set my hand and seal, this Sixth day of May, in the year of our Lord One thousand eight hundred and forty-two.

JOB (L.S.) CUTLER. 15

DUCKWORTH.

AND BE IT REMEMBERED, that on the Sixth day of May, in the year of our Lord 1842, the aforesaid Job Cutler came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Sixth day of May, in the year of our Lord One thousand eight hundred and forty-two.

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE, Printers to the Queen's most Excellent Majesty. 1855.

