

UNITED STATES PATENT OFFICE.

GEORGE RICHARD NOBLE, OF BIRMINGHAM, CONNECTICUT.

METHOD OF LINING BOILERS, &c., WITH LEAD.

SPECIFICATION forming part of Letters Patent No. 427,892, dated May 13, 1890.

Application filed December 12, 1889. Serial No. 333,531. (No model.)

To all whom it may concern:

Be it known that I, GEORGE RICHARD NOBLE, of Birmingham, in the county of New Haven, and in the State of Connecticut, have
5 invented certain new and useful Improvements in the Method of Lining Boilers and other Vessels or Utensils with Lead; and I do hereby declare that the following is a full, clear, and exact description thereof.

10 Boilers and other vessels or utensils intended to contain or in which are to be used sulphur acids or solutions thereof have heretofore been lined with a protective coating of lead to resist the action of the sulphur acids
15 and keep the latter out of contact with the metal forming the casing or shell of the boiler or vessel. As heretofore made and applied, however, such lining has been liable to come loose from the metal backing or shell, and
20 then, from buckling and bending, to crack or break, so as to allow the acid to get at and destroy the metal backing or casing. As lead itself is not strong or tenacious enough to form a shell or casing capable of resisting
25 outward pressure, it is obviously necessary, in order to make sure that the lead lining of a boiler shall not be ruptured or torn by pressure in the latter, that every portion of the lining shall be in close contact with or supported
30 by the boiler-shell. To make certain of maintaining such contact or support throughout the entire lining of a boiler, I have invented a process of making the boiler or utensil and method of attaching the lead lining to the iron,
35 copper, copper alloy, or other metal shell or casing, so that such lining will form a continuous protective coating, securely attached throughout and not liable to get loose or buckle away from the metal to which it is at-
40 tached, either because of lead expansion during use of the boiler or utensil or from other causes.

In carrying out my invention I employ tin
45 as a connecting medium to join the lead and iron, copper, copper alloy, or other metal surfaces. For this purpose either the lead or the sheet of iron or other metal, or both, can be tinned in the usual way. In order that the iron, copper, copper alloy, or other sur-
50 face may receive the tin properly, I first clean the plates or sheets either with acids or

by burnishing, scouring, or otherwise. With either one or both of the surfaces to be attached tinned, I then apply a gentle heat to the outer side of the iron, steel, copper, or
55 copper-alloy plate or sheet and press the lead sheet toward it, either by passing the plate and sheet through or between rolls or beating the lead with wooden mallets. Where only one of the opposing surfaces is tinned, 60 this heat and pressure will cause the tin coating on the one to become firmly attached to the other. With both surfaces tinned before being brought together, the heat and pressure will join the two tin layers most closely 65 together.

Where the boiler or other utensil is to be made up of different sheets or plates of steel, iron, copper, copper alloy, or other metal riveted or otherwise fastened together at their
70 edges, I first tin each plate up to within a short distance of its edges, leaving between such edges and those of the tin coating space enough for the rivet-holes in the plates. I then take a sheet of lead of the full size of 75 the plate, either untinned or tinned on its side toward the iron or other plate, and having heated such plate, except around the untinned spaces at its edges, I roll or otherwise force or press the lead toward the plate, as 80 indicated above. For convenience in preventing the fastening of the sheet of lead at the edges of the plate as well as elsewhere, I prefer not to tin the lead sheet, but only the plate, as indicated above. 85

If the plate or sheet of iron, steel, copper, or copper alloy is to be used in making boilers of a circular or cylindrical form, I now roll or otherwise bend it to the desired shape or curvature. The unattached edges or flaps of 90 sheet lead are then turned back to expose the rivet-holes and the plate is riveted in place. The rivet-heads and exposed uncoated portions of the sheet or plate edges are then tinned, and when they have been heated by 95 heat applied from without the sides or unattached flaps of sheet-lead are beaten or otherwise pressed down upon the tinned surfaces. The abutting edges of the lead sheets on the adjoining plates are then burned together by 100 an autogenous blow-pipe. With the heads, man-holes, and man-hole covers also coated

with lead attached in accordance with my process a boiler is secured having a uniform lining of sheet-lead tightly adhering to and covering every portion of its interior surface.

5 Such lining is everywhere impervious to the sulphur acid or acids as used in boiling wood pulp, and can be relied upon to stay in place and not get loose from the casing under any temperature up to 270° Fahrenheit. Where
10 quicker boiling at a higher temperature is desired, I prefer to assist the tin and tin and lead alloy to hold the lead in place by means of lead-coated bolts securing the lead at different points or by lead-coated bands of iron
15 or steel. The boiler can also be provided with a lining of fire-bricks, burnt clay, fire-lumps, cement, blocks of material coated with silicated glaze, or other material impervious to acid. Such second lining should be placed in
20 close contact with the inner face of the lead lining.

Where a boiler or other utensil already made of steel, iron, copper, copper alloy, or other metal is to be lined with lead, I first
25 clean its inner surface from rust, oxides, dirt, or foreign substance and then tin it, the tin being applied in any of the well-known ways of tinning metal surfaces.

The sheet or sheets of lead, of the proper
30 size to cover the boiler interior, are preferably also tinned, and the shell or casing of the boiler, having been heated from without, are applied and pressed or hammered into place, so as to make the two tin surfaces join
35 together.

Any abutting edges of the sheet or sheets of lead are then burned together by the autogenous blow-pipe, as described hereinbefore.

Having thus described my invention, what
40 I claim is—

1. The method of fastening a coating of lead to a backing of other metal, which consists in attaching the two opposing surfaces to an interposed layer of tin, substantially
45 as and for the purpose specified.

2. The method of fastening a lead coating to an iron or other metal backing, which consists in tinning one of the opposing surfaces and then forcing the other surface against
50 the tin under heat, substantially as and for the purpose shown.

3. The method of fastening a lead coating to an iron or other metal backing, which consists in tinning the surface of the backing and
55 then heating such backing and forcing the lead against the tin thereon, substantially as and for the purpose set forth.

4. The process of making a boiler or other utensil with a lead lining, which consists in tinning the inner face of the boiler or utensil casing, heating the latter, applying the lead to the tinned surface under pressure, and burning the abutting edges of the lead together, substantially as and for the purpose described. 65

5. The process of making a boiler or other utensil with a lead lining, which consists in tinning the plates to form the casing, except around their edges, then heating the plates and forcing sheets of lead upon their tinned surfaces, then riveting or otherwise fastening the untinned edges of the plates together, then tinning the exposed untinned surfaces of the plates and fastenings thereof, then heating such surfaces and forcing the edges of the
70 lead sheets against the tin thereon, and finally burning the edges of the lead sheets together, substantially as and for the purpose specified. 75

6. The process of making a lead-lined
80 boiler or utensil, which consists in tinning the plates of which the boiler or utensil casing is to be made, leaving an untinned space around each plate-edge, then heating the plates and forcing sheets of lead against
85 their tinned surfaces, then fastening the plates together, then tinning the seams and exposed untinned surfaces of the joined plates, then heating the plates and forcing the unfastened flaps of lead down upon the
90 tinned surfaces, then burning the edges of the sheets of lead together, and then bolting the lead lining in place at intervals by lead-covered bolts, substantially as and for the purpose shown. 95

7. A boiler or utensil for containing acids, having a protective lining of lead attached to an iron or other metal backing by means of tin, substantially as and for the purpose set forth. 100

8. A boiler or utensil for containing acids, having the casing of iron or other strong metal, a lining of lead to protect the casing, and a layer of tin, to which the casing and lining are both attached, interposed between
105 them, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 9th day of October, 1889.

GEORGE RICHARD NOBLE.

Witnesses:

CHAS. H. DORER,
W. R. EDELEN.