UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN DEVICES FOR REMOVING INCRUSTATIONS OF BOILERS.

Specification forming part of Letters Patent No. **14,230**, dated February 12, 1856.

To all whom it may concern:

Be it known that we, WM. E. EVERETT, at present residing in the city, county, and State of New York, a chief engineer in the Navy of the United States, and M. MINTHORNE THOMPSON, of the city, county, and State of New York, chief engineer of the United States mail steamship Fulton, have invented a new and useful method of softening or of softening and removing the scale which forms upon the water-surface of marine steam-boilers, or those in which water impregnated with salts of various kinds and impurities or common salt-water is used for the generation of steam, of which the following is a specification.

In the ordinary working of such boilers it is now customary to use what is technically termed a "salimeter," by means of which the density of the water within the boiler is from time to time determined, and skillful engineers, by a proper management of the feed and blow-off cocks or valves, usually contrive to keep that density at such a point that the water shall always be a little fresher than water saturated with common salt. If the water be kept in such a state, but little salt will be deposited inside of the boiler, and often none at all; but as the water of the ocean contains various other salts (the term being used in its chemical sense) and other matters, some held mechanically and others in solution, and as other impure water is impregnated in a similar manner, the precise quantity of which existing in the boiler cannot be determined except by analysis, it follows that such other bodies deposit upon the surface of the boiler, forming what is technically termed "scale." This scale is deposited of various thickness, depending upon the nature and quantity of the impurities and upon the skill of the engineer. If he be careless, it will be great in amount and contain large quantities of common salt when sea-water is used. In marine boilers this scale is chiefly composed of sulphate of lime; but in any event (its precise chemical composition being a matter of no practical importance) it is a hard solid body adhering with considerable tenacity to the metal of the boiler, and usually needs the employment of picks, chisels, and sometimes hammers for its removal. This work is laborious, takes considerable time for its completion, and is difficult, owing to the contracted space in which it is necessary to work, and in some cases the water-spaces are so narrow that its removal is impossible. In the latter event, as coat after coat is deposited the water-space, in course of time, fills up solid. Its removal is injurious to the boilers, as the metal is abraded and the calking and rivets loosened by the constant hammering. In places where it is not removed at the end of a voyage, or from time to time, the scale as it increases in thickness becomes a good non-conductor, impairs the evaporating properties of the boiler, and causes waste of fuel.

Now, the objects of our invention are to remedy these evils, saving time, labor, and wear of boilers in places where removal by the ordinary means is possible, and saving fuel and keeping up the efficiency of the engine in cases where the water-spaces are so contracted that a complete removal is now impossible.

To this end the nature of our invention consists in softening or softening and removing the scale by means of the application of steam for a greater or less time, substantially in the manner hereinafter specified. This scale never forms on the steam-space of the boiler, but on the surfaces covered by water, and chiefly where the greatest evaporation takes place. When the boiler is out of use at any convenient time, and is emptied of the water which it usually contains, it is necessary, in proceeding according to our process, to close more or less perfectly all the passages leading to and from the boiler, except one or more through which steam furnished by a supplementary boiler is introduced. This steam fills the boiler and condenses upon the surfaces thereof and on the scale deposited upon them, and after a greater or less time softens the scale and often loosens it so completely that it falls to the lower part of the boiler, whence it may be removed by hoes. The precise period of time necessary for this result depends upon the thickness and special composition of the scale. We have found by actual experiment that a steaming of eighteen hours softens sufficiently ordinary marine-boiler scale of a quarter of an inch in thickness. The pressure of the steam used need be no greater than that of the atmosphere, and as after a boiler is once filled with it a further

supply to make up the quantity lost by condensation is all that is needed, the process may be conducted with but small expenditure of fuel. If the scale be not entirely loosened, it, after a proper steaming, becomes in any event so soft and adheres so slightly to the metal of the boiler, and is so disintegrated, that it may easily be removed by scraping only or by a stiff-wire brush. The usual labor is thus saved, the boiler is not injured by the process, and parts now impossible to be reached may be scaled with facility, thus leading to a saving of fuel. We have found it best to commence the removal of softened or loosened scale as soon as the boiler becomes sufficiently cool, as it has a tendency to harden again in the course of time after the process is completed. We are not able to state with positive certainty the rationale of our process, or in what precise manner the steam as it condenses acts upon the scale, but suppose that the minute particles of pure condensed water attack and dissolve the more soluble salts which enter into its composition, swell them up in the mass, and thereby disintegrate it, honeycombing and softening it, and that these salts in solution drop out from the mass, depriving it thus of its cement. The theory of the process is, however, unimportant, the practical effect which really does result from it being the important point.

Where several boilers are employed in the same ship or factory one of these boilers may be used as a generator to supply steam for scaling its neighbors, and it in its turn may be scaled by steam derived from one of those already acted upon. A tolerably good effect may also be attained by conveying a small quantity of water into the very boiler that is to be scaled and then generating steam from it to soften the scale on the parts not covered by this water. This latter plan, however, should be employed only when a separate generator cannot be procured, as unless carefully conducted it might injure the boiler, whose uncovered fire-surfaces would run a risk of being burned.

Other precise plans might be named by us, and a skillful engineer would readily devise plans suited for each emergency after he has been informed that all that is necessary is to expose the scale to the action of steam, and when scale is so exposed it is according to the nature of our invention, irrespective of the manner in which the steam is generated or the kind of vessel employed as a generator.

Having thus fully described our process and various methods of performing it, we claim as new and of our invention—

The herein-described method of softening or softening and removing the deposit upon boilers, commonly known as "scale"—namely, by exposing the same to the action of steam, substantially in the manner herein specified.

In testimony whereof we have hereunto subscribed our names, in the city of New York, on this 21st day of November, A. D. 1855.

W. E. EVERETT.
M. MINTHORNE THOMPSON.

In presence of—
JOHN H. LONG,
HENRY GREENFIELD.