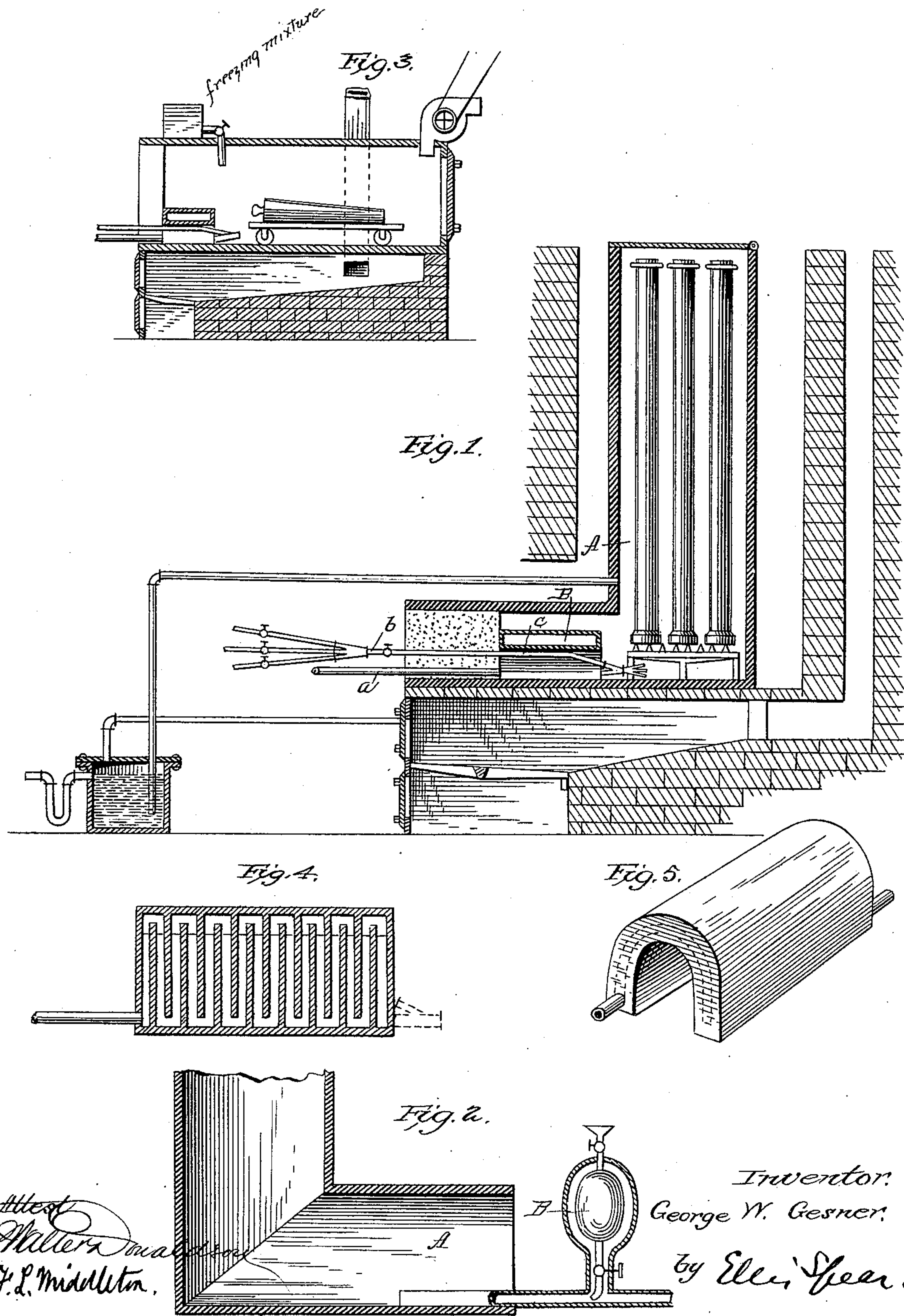


(No Model.)

G. W. GESNER.  
TREATMENT OF METALS.

No. 379,866.

Patented Mar. 20, 1888.



Attest  
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# UNITED STATES PATENT OFFICE.

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## TREATMENT OF METALS.

SPECIFICATION forming part of Letters Patent No. 379,866, dated March 20, 1888.

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*To all whom it may concern:*

Be it known that I, GEORGE W. GESNER, of New York, in the county of New York and State of New York, have invented a new and  
5 useful Improvement in Treatment of Metals; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to the treatment of metals in order to render them non-corrodible.

10 The object of the invention is to treat metals whereby a surface will be imparted thereto composed of an alloy or compound homogeneous with the body of the metal of a practically non-corrodible nature, and at the same  
15 time the ductility, toughness, and tensile strength will not be diminished, without any material increase in the dimensions of the articles and without the formation of scale or film.

20 My invention consists in the method of treating metallic articles in a suitable retort from which atmospheric air is excluded by the application to said articles of superheated steam, next in applying to said articles commingled  
25 superheated steam and hydrocarbon vapors to form an alloy or compound with the metal treated, and, finally, in the application of a fixing agent whereby the alloyed or compound surface previously formed is fixed, the said  
30 articles by this treatment having their surfaces changed so as to be practically non-corrodible.

Further, it consists in the treatment of metallic articles in a retort from which atmospheric air is excluded by superheated steam  
35 of approximately the same or of a higher temperature than that maintained within the retort, by the vapors of commingled superheated steam and hydrocarbon, and, finally, by a fixing agent, whereby the alloyed or compound  
40 surface formed by the action of the first three agents is fixed by the action of the last.

In the accompanying drawings, Figure 1 represents a muffle with the superheater inclosed within the same, with articles to be  
45 treated supported within the vertical portion of the muffle. Fig. 2 is a section of a retort, showing a suitable reservoir for the liquid naphtha or other agents used in the treatment  
50 of the articles. Fig. 3 represents a modified form of muffle for treating large articles. Figs.

4 and 5 are detail views of a form of superheater.

Heretofore it has been proposed to treat metals for the purpose of surfacing them by  
55 the use of superheated steam and hydrocarbon vapor by the application first of the superheated steam and then of the hydrocarbon vapor, or of the two together, these two constituting the steps of the process, which might  
60 be repeated any desired number of times, such repetition, however, being always a repetition of the two steps, in which the application of the hydrocarbon vapor was always the last step.

Heretofore superheated steam, when introduced into a closed retort or muffle for the treatment of metals, has not been at the temperatures required for the treatment of different classes of articles, and as uniformity in  
65 temperature between the superheated steam used and the articles under treatment while in preparation for the formation of a homogeneous alloy thereon is important therefor, I have endeavored to obtain the desired result  
70 by arranging superheaters in the bench containing the muffles and also superheaters within the muffles themselves and heated by the same fire that heats the muffles, whereby the superheated steam passing from the super-  
75 heater in the muffle upon the heated metallic articles under treatment therein shall have its temperature automatically maintained at or nearly the same degree of Fahrenheit as the  
80 articles then under treatment, varying in temperature whenever the temperature of the muffle is varied to meet the varying conditions of such treatment.

In Fig. 1 I have shown at A an ordinary form of muffle from which the atmospheric air  
85 is excluded, which, it will be understood, may be one of many within a bench. The opening in the horizontal part of the muffle is provided with the ordinary mouth-piece and lid, as shown. A suitable furnace is shown below  
90 the muffle, and this may be fed with coal or liquid fuel, gases, or vapors in any well-known manner. A superheater, B, is shown as located upon the floor of the muffle, and may be of the form shown or of any suitable construction. The steam-pipe, *a*, leading to it may  
95 come from any suitable source, such as a boiler  
100



or supplemental superheater. The particular form of superheater represented within the muffle is shown in detail in Figs. 4 and 5. It consists of a chamber in arched form, the steam  
 5 from the boiler or supplemental superheater entering at the front wall, and, after being superheated to the same temperature as the retort, passes out at the rear into the retort. I also use hydrocarbon oil or the vapors of  
 10 hydrocarbon, or both, in my process, as described hereinafter, and the pipe for the liquid or vapor is represented at *b*. The arched form of superheater permits a branch, *c*, of the pipe  
 15 *b* to extend through the same and the liquid hydrocarbon (if liquid be used) to be partially vaporized in its passage, this pipe uniting with the pipe for the superheated steam in the rear of the superheater. The articles to be treated  
 20 are arranged within the muffle either horizontally or vertically, and are supported in such a manner as to expose the greatest amount of surface for the action of the different agents used.

In Fig. 1 I have shown as one means of support grate-bars having knife-edges providing ample support and at the same time allowing the agents used to reach all parts of the surface of the articles under treatment. It will be understood that many modified forms of  
 30 these devices may be used, varying according to conditions. The hydrocarbon used may be, as I have before stated, either in liquid form or in the form of vapor from a suitable vaporizer, and I have shown in Fig. 2 one form  
 35 of reservoir for liquid hydrocarbon. In this figure the muffle is shown at A, with the hydrocarbon reservoir at B, contained within a steam-space, and having a funnel-shaped mouth with a suitable valve to allow its being  
 40 filled with the liquid. The lower end of the reservoir is contracted into the form of a nipple, and extends into the pipe which conveys the superheated steam to the muffle. A suitable valve is also located at the lower end of the reservoir, to control the feed of the contents. A spraying device of any suitable form  
 45 is located upon the end of the pipe within the muffle for the better distribution of the superheated steam and the mingled steam and hydrocarbon vapor. The vapor is fed out by gravity and by injection.

It will be understood that while I have shown in one figure the superheater as being within the muffle I do not limit myself to one  
 55 superheater only, as others may be located at any convenient place within the bench, it being necessary only that the steam should be superheated by the same fire which heats the muffle, and thereafter be delivered upon the  
 60 articles under treatment in the muffle at a uniform temperature equal to that which is at that time required for the articles under treatment.

In the treatment of metals by my improved  
 65 method I place the articles to be treated within the muffle and support them, as before described, so that all parts will be exposed to

the action of the agents employed, it being understood that the muffle is previously heated, the temperature varying according to the  
 70 requirements of the article to be treated. After the articles are heated to the temperature of the muffle, I subject the article to the action of superheated steam, which is at the  
 75 same or a higher temperature than the muffle in which the articles are treated, and the effect of this treatment is to open the pores and to prepare the article for the subsequent treatment. After the action of the superheated  
 80 steam has continued for a proper length of time, (the time varying with the character of the article to be treated,) I subject the article to the action of superheated steam, and the vapor of hydrocarbon either mingled outside  
 85 the muffle or within, and the effect of this is to complete the combination and to fill up the pores of the article previously prepared with the carbon thus introduced. (I have found by  
 90 experiment that in the treatment of some articles hydrocarbon in a liquid form discharged into the muffle is desirable, and for other articles I have found the vapor to give the best results.) After the articles have been sub-  
 95 jected a proper length of time, (which, as in the first case, varies with the character of the articles to be treated,) I shut off the superheated steam and hydrocarbon and then subject the articles to the action of a fixing agent, such as superheated steam, which completes  
 100 the treatment necessary to preserve the homogeneous non-corrodible compound.

In the treatment of large articles—as, for instance, a piece of ordnance—the temperature of the muffle must not be less than 1,000° Fahrenheit during the treatment to form the sur-  
 105 face. The superheated steam must be admitted to the muffle at the stated or a higher temperature, and the article is subjected to the action of the steam, varying from thirty to ninety minutes, according to the density of  
 110 the metal. The mingled steam and vapor is then admitted and the article subjected to the action thereof from ten to twenty minutes, and finally to the action of the fixing agent from five to twenty minutes. As above stated,  
 115 the temperatures and time of treatment by the various agents employed vary according to the size of the article and the density of the metal. The exact operation of the superheated steam as a fixing agent from a chemical point  
 120 of view I am at present unable to fully explain; but I have found by actual experiment that it removes from the surface all extraneous matter, leaving it perfectly clean, absorbing any excess of hydrocarbon, and that  
 125 it serves to give a superior hardened and finished surface not obtainable when the iron is subjected to a final treatment under exposure to any hydrocarbon vapor or similar gas; but my invention is distinguished in this respect  
 130 from any similar processes heretofore known to me in which the fixing agent, whether it be superheated steam or hydrogen or equivalent gas under high heat and without the presence



of oxygen or atmospheric air, is used as a surfacing agent.

While I prefer to use superheated steam as the fixing agent, other agents—such as hydrogen gas or carbonic-oxide or carbonic-acid gas mixed with steam—may be used. It is important, in the method above described, that the superheated steam should be of at least the same temperature as that of the muffle, and never below it.

As a continuation of the treatment just described, I withdraw the articles from the muffle and immerse them while hot, but at a lower temperature than when treated, in a fluid tempering-bath. This latter step in the process increases the non-corrodible nature of the articles; but it will be understood that many articles will not require this latter step.

In Fig. 3 I have represented a muffle for the treatment of large articles, such as ordnance.

The process heretofore described is carried on in like manner except as to variation of the time required, and after the surface of the article has become homogeneous and non-corrodible by the treatment the muffle is made to serve the purpose of an annealing-chamber by providing a fan to draw off the heated contents of the chamber and by reducing the heat of the furnace, and I then apply to the article a freezing-mixture supplied from a suitable reservoir, which is an equivalent and acts in substantially the same manner as the tempering-bath referred to for articles of smaller size. By this method of treatment the heaviest articles can be treated in one chamber without the necessity of their removal until they are finished.

I have shown in Fig. 1 a pipe leading from the muffle to a hydraulic seal for regulating the pressure within the muffle, and I connect the cap of this seal with a pipe extending to the point of combustion of the furnace over the grate. A discharge siphon-trap is connected with the hydraulic seal. When the

pressure within the muffle is ordinary, the gases escape through the pipe, passing upward, being cleansed in the water of the seal, and through the connecting-pipe to the point of combustion, where they are burned; but in case the pressure is excessive and the connecting-pipe to the point of combustion not sufficient to carry them off, they are simply blown out through the siphon. This automatic regulator saves the muffle from any injurious effects caused by sudden increase of pressure.

I claim—

1. The described method of treating metallic articles for changing their surfaces to an alloy or compound homogeneous with the body metal of a practically non-corrodible nature, consisting in applying to said articles within a suitable retort from which atmospheric air is excluded, first, superheated steam; second, commingled superheated steam and hydrocarbon to form the alloy or compound, and, finally, a fixing agent whereby the alloyed surface previously formed is fixed, substantially as described.

2. The described method of treating metallic articles to change the surface to an alloy or compound homogeneous with the body metal, consisting in the treatment of said articles in a retort from which atmospheric air is excluded by superheated steam of the same or a higher temperature as the retort; second, by commingled superheated steam and hydrocarbon, and, finally, by a fixing agent, whereby the alloyed or compound surface formed by the action of the first three agents is fixed by the action of the last, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEO. W. GESNER.

Witnesses:

CHAS. G. HANKS,  
JOS. H. GRENELLE.