A. F. ANDREWS.

Treating Iron and Steel to Anneal and Toughen them.

No. 142,977. Patented September 23, 1873.

Fig. 1.

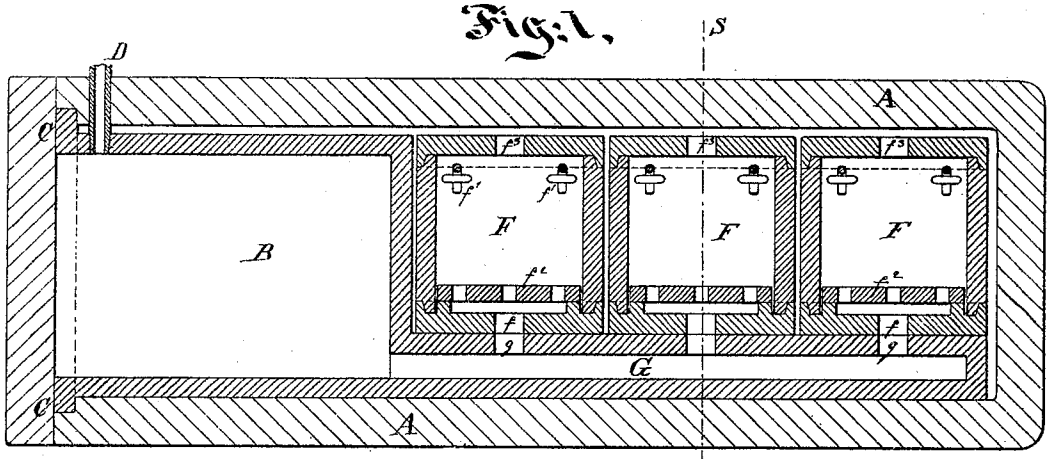


Fig. 2.

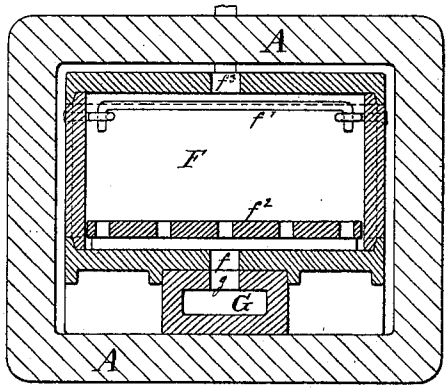
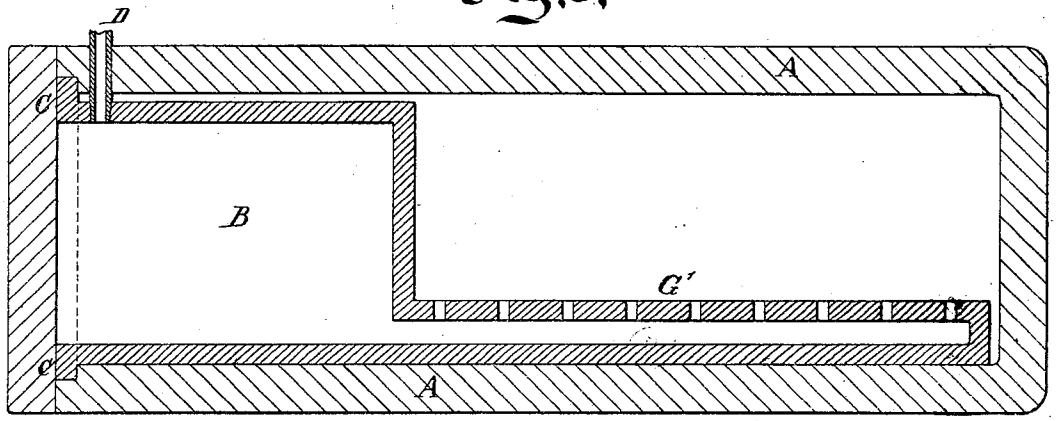


Fig. 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

ALBERT F. ANDREWS, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE ANDREWS MANUFACTURING COMPANY, OF SAME PLACE.

IMPROVEMENT IN TREATING IRON AND STEEL TO ANNEAL AND TOUGHEN THEM.

Specification forming part of Letters Patent No. **142,977**, dated September 23, 1873; application filed May 9, 1873.

To all whom it may concern:

Be it known that I, ALBERT F. ANDREWS, of New Haven, in the State of Connecticut, have invented certain new and useful Improvements in Annealing and Toughening Iron, of which the following is a specification:

I have, in my experiments, succeeded in imparting to common cut nails of the ordinary brittle character a tough and very much improved nature. The nails, after being subjected thirty hours to my treatment, were capable of clinching with success, and even of being folded over or doubled in a cold condition. I esteem my process peculiarly valuable in the treatment of articles cut by dies from sheets of rolled iron. I subject the iron, while hot, to a slow current of hydrogen gas, or of a mixture of gases of which free hydrogen forms a large constituent. I can greatly improve steel, to render it soft for engraving and tough for chisels or other working purposes, by subjecting it to hydrogen at a red heat. For decarbonizing steel for gun work or other purposes the temperature should be higher. It should be almost the same as for toughening wrought-iron. To produce the gas economically in suitable condition for this use I pass steam through a hot vessel containing charcoal at a high temperature. The conditions may be realized by holding the charcoal in a suitable vessel, analogous to a gas-retort, surrounded by fire. The steam is preferably highly superheated before its introduction to the charcoal. In passing through the charcoal it is decomposed; the oxygen of the steam goes to the carbon, to form carbonic oxide. The hydrogen thereby set free flows along in a state of mechanical mixture with the carbonic oxide, and flows up at a high temperature among the previously-heated pieces of iron. It may not be necessary to explain the theory of the action. I believe that the iron is decarbonized and dephosphorized to some extent, but that the effect is largely due to a very thorough desulphurization, which occurs under these circumstances. My experiments have indicated a high degree of certainty in the results. The effect is most marked on very bad iron; but I believe that good iron and steel of all grades will be greatly improved in toughness by this treatment. Thirty hours is the time I have found proper for treating very brittle cut nails. The current of gases should be slow, or the iron is liable to be cut away by its mechanical action when at a very high temperature. On the other hand, the flow of gas should not be intermitted altogether, as the result is liable, in such cases, to be disastrous to the entire batch of material.

The accompanying drawings form a part of this specification, and aid to describe what I consider the best means of carrying out this invention.

Figure 1 is a vertical longitudinal section of a retort with small boxes, suitable for treating iron articles. Fig. 2 is a cross-section thereof on the lines S S in Fig. 1. Fig. 3 represents a modification, adapted for the treatment of iron or steel in long pieces or bars. It is a vertical longitudinal section.

Similar letters of reference indicate corresponding parts in all the figures.

A represents a retort or chamber, of fire-brick, surrounded by fire within a furnace. (Not represented.) B is a box or casing, made of iron or fire-brick, for holding incandescent charcoal. D is a pipe on the top, at one end of this box, to admit steam. C is a flange on end of charcoal-box, on which an iron or fire-brick door is luted. G is a flat tube, to be used in connection with boxes F, a series of which are provided, each containing pieces of iron or steel to be treated. Each box F has a hole in the bottom, to receive the gas from the corresponding hole in the tube G, so that it can circulate, through the perforated false bottom, up among the small pieces of iron or steel, the gas escaping at the top of F. As iron or steel, after heating, adheres more or less together, and for the convenience of unloading said boxes F, each is made entirely of separate and detachable pieces. The bottom of F is flanged on its external edge, to inclose and hold the sides and ends. The cover is also flanged in the same way, for the same purpose. The ends of the box are recessed, to hold the sides. To hold the upper portion of the box when the cover is not on, and while the box is being filled, rods f^1, each with a right-angle bend near each end, traverse the box from end

to end, and engage with loops or lugs to receive them. These boxes can be luted at the joints, to make them gas-tight.

When a box is to be unloaded the cover is removed, and the rods f^1 taken out. Then the sides and ends can be separated, and the contents easily removed. The box F can be made of iron, or of ordinary clay, if preferred.

The nails, latches, parts of gun-locks, or other articles which it is desired to toughen are piled, in a layer of moderate thickness, upon the grating f^2. There may be several of these gratings, supported on suitable ledges on the interior of the boxes F, so as to support several layers above each other without subjecting any of the iron to much pressure from the superincumbent material. The boxes F, with their contents, being placed in the proper positions on the tube G, the gas is allowed to flow into the tube and up through the holes $g\,f$, and thus through the spaces between the pieces of iron in the boxes F, escaping ultimately through the holes f^3 in the top. The furnace is kept at such temperature that the iron is at a heat above bright red. It should approximate to what is generally known as a white heat, but should not go high enough to induce welding.

Referring to the modification shown in Fig. 3, G′ is a broad perforated tube, of the same width of the charcoal-box B and of the inside of the retort A. This broad perforated tube is to be used when iron or steel is to be treated in the bar. The bars are to be laid singly or in bundles on this perforated tube or bottom, being inclosed in the retort A air-tight.

I claim—

1. The charcoal-box B, in connection with the narrow tube G and the box or series of boxes F.

2. The construction of the box F in separate or detachable pieces, substantially as described.

3. The retort A, in connection with the charcoal-box B and broad perforated tube G′, for treating bar iron or steel, substantially as described.

4. The within-described treatment of wrought iron and steel, by subjecting it to a slow current of free hydrogen, as herein specified.

In testimony whereof I have hereunto set my hand this 28th day of March, 1873, in the presence of two subscribing witnesses.

ALBERT F. ANDREWS.

Witnesses:
WM. W. STONE,
GEO. COWLES.