UNITED STATES PATENT OFFICE.

JOHN HALDEMAN, OF PHILADELPHIA, PENNSYLVANIA, NOW RESIDING IN LONDON, ENGLAND.

MODE OF HEATING PILES.

SPECIFICATION forming part of Letters Patent No. 253,599, dated February 14, 1882.

Application filed January 12, 1882. (No specimens.) Patented in Belgium October 30, 1880.

To all whom it may concern:

Be it known that I, JOHN HALDEMAN, of Philadelphia, Pennsylvania, now residing in London, England, have invented a new Improvement in the Mode of Heating Composite Boxes or Piles, of which the following is a specification.

The present invention relates to an improved process of heating piles composed of a steel core surrounded by an iron envelope in such a manner as to obtain a perfect consolidation of the two metals, and, if my mode of heating is strictly adhered to, this consolidation will be perfect in every instance. Patents for such piles or boxes have been taken both in the United States and European countries, and my claim is confined entirely to my mode of heating.

Experience has shown that if composite piles are heated in the usual manner—viz., by subjecting the piles only to a gradually-increasing heat—the result would in most cases be merely an ordinary weld, as the iron would usually be brought to the proper heat before the steel would be molten, or, if kept too long under such heat, the iron would burn. In order to produce the proposed result, I have ascertained that the two metals, differing in nature and melting at widely-differing degrees of heat, should be brought to their respective points of fusion in such a manner that the motion of the heat shall not interfere with the natural tendencies of the steel molecules to place themselves in equilibrium with the contacting iron molecules and create a reciprocal attraction between the two metals. To accomplish this the piles should be first heated so slowly that the heat can entirely penetrate the steel degree by degree until the latter is partially, or preferably entirely, molten, and then, secondly, the character of the heat should be changed, and the iron envelope should be brought as rapidly as possible to a white welding-heat. The steel molecules will surrender a small portion of their carbon to the iron molecules with which they are thus brought into such close contact, and they will fuse and blend together so intimately that on both sides of the line of contact and within a very limited space the change of nature from one metal to the other will shade down very gradually.

In practically carrying out my invention I place the piles in a good iron-heating-furnace well heated, work with a closed damper, and heat so slowly that the heat is kept at a point which will not injure the iron, but will still penetrate into the core of the steel degree by degree and reduce it to a molten condition. I thus reach the first step. The time required to do this will vary with the size of the piles and the condition of the furnace, and it requires only the same kind of experience as that which enables a good heater to ascertain the amount of heat particular iron will bear. When this molten condition of the steel is attained the second stage commences, the damper is raised, and the piles are given as rapidly as possible all the heat which the iron in the piles will bear until it is brought to a high white welding-heat. When brought to this state and the piles are then subjected to compression, either by hammer, rolls, or hydraulic pressure, the process is completed, and the fusion is made so perfect that it is impossible to separate the two metals at the point of union.

I prefer the use of rolls or hydraulic pressure to the hammer, because with the first two, if the piles are properly proportioned and the two metals are each of uniform width and thickness throughout their entire length and breadth, the distinct lines and character of both metals will practically be maintained in uniform lines down to the smallest section.

A simple mode of making the piles or boxes is to shear puddled bars of the requisite length and breadth for top and bottom pieces. Then on the bottom piece are placed on edge two pieces, each one bent to a double right angle, (this may be done as the bars come from the rolls,) sheared long enough to overlap, thus forming bottom, sides, and ends of a box. In the center is then placed steel enough to fill it, top placed on, and the box, wired, is ready for the furnace. The steel may be in one or many pieces, oxidized or not. The expansion of the iron under heat will soon (if the puddled bars are rolled true) make the envelope of iron sufficiently tight to protect the steel during heating and hold it when molten.

It will readily be understood that any required specification for any use can be met. For instance, if the envelope is made of iron

high in phosphorus and the steel is low in carbon, you have a hard surface combined with great strength, as required in rails, wagon-tires, and many other uses. When very high tensile strength, combined with safety under hot or cold treatment, as well as in service, is required, I take a steel high in carbon and an iron very ductile and fibrous. These qualities are demanded in boiler-plates, ship-plates, bridge structures, and many other uses.

This product can be worked and welded precisely as iron, and is as safe in working or service as the best iron, because the iron envelope must be broken fiber by fiber to cause fracture.

The great value of a product uniting the marked and distinctively valuable quality of each metal, and so thoroughly fused as to become homogeneous in structure, but preserving at the same time their distinctive lines, is so well known as to need no elaboration. The difficulty has been to produce it perfect and uniform both in result and quality, and at a cost to make it commercially valuable. Therefore

What I claim as new and forming my invention is—

This mode of heating piles or boxes composed of a steel core of any shape, said core surrounded by an envelope of puddled or other iron—viz., by first subjecting these piles to a low slow heat, such as will not injuriously affect the iron until the heat penetrates the whole body of steel degree by degree until it becomes partially, or preferably entirely, molten, and then, in the second place, changing the character of the heat, so as rapidly to bring the iron envelope to a high white welding-heat, and then by compression completing the process, and thus producing an absolute fusion instead of a weld of the two metals—substantially for the purpose described above.

March 12, 1881.

JNO. HALDEMAN.

Witnesses:
I. N. SEARS,
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