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B. R. PARR & H. E. SHELDON.

METHOD OF ANNEALING AND OXIDIZING METAL SHEETS OR PLATES.

(Application filed Nov. 6, 1899.)

(No Model.)

Fig. 1

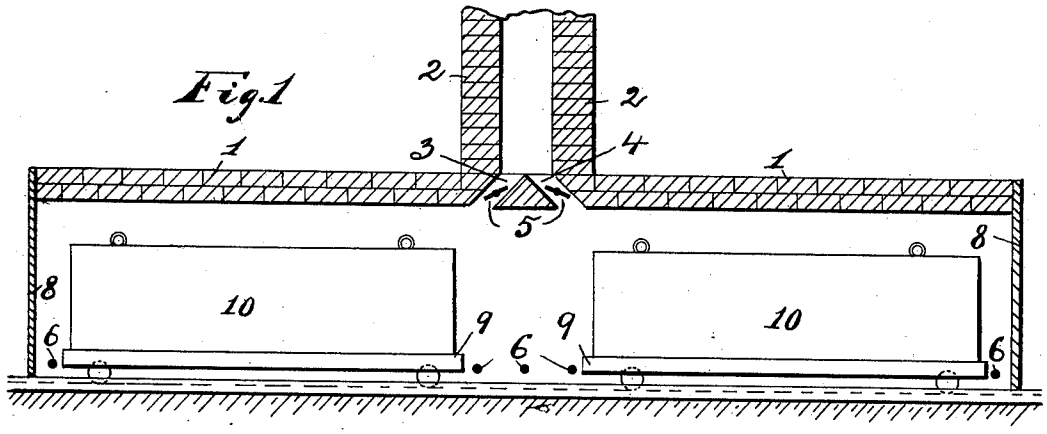


Fig. 5

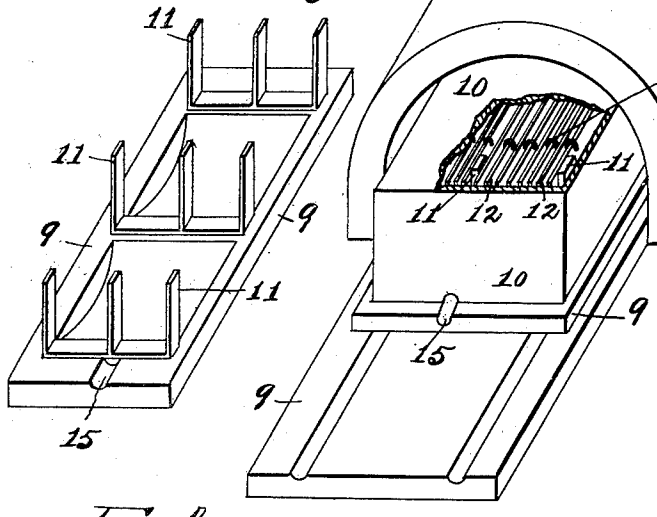


Fig. 4



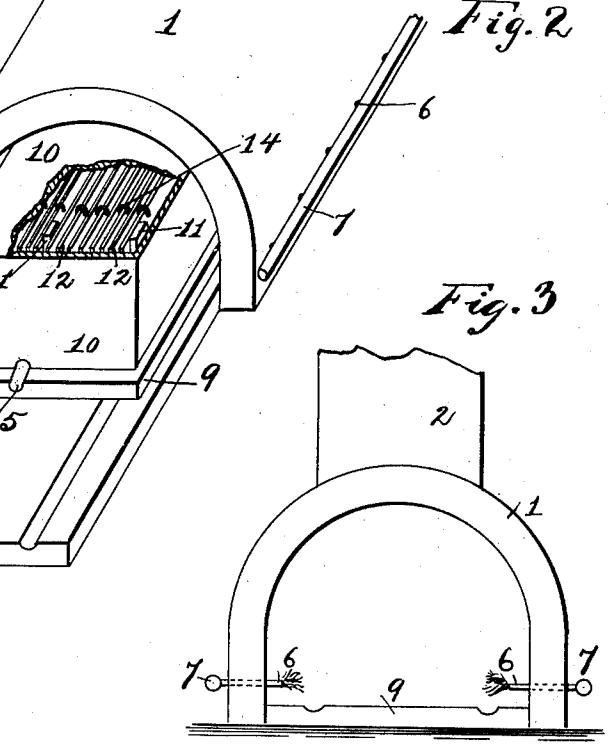


Fig. 2

Fig. 3

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UNITED STATES PATENT OFFICE.

BERNARD R. PARR AND HARRY E. SHELDON, OF LEECHBURG, PENNSYLVANIA; SAID PARR ASSIGNOR TO SAID SHELDON.

METHOD OF ANNEALING AND OXIDIZING METAL SHEETS OR PLATES.

SPECIFICATION forming part of Letters Patent No. 660,533, dated October 23, 1900.

Application filed November 6, 1899. Serial No. 735,894. (No specimens.)

To all whom it may concern:

Be it known that we, BERNARD R. PARR and HARRY E. SHELDON, citizens of the United States, residing at Leechburg, in the county of Armstrong, State of Pennsylvania, have invented or discovered certain new and useful Improvements in Methods of Annealing and Oxidizing Metal Sheets or Plates, of which the following is a specification.

Our invention relates to methods of simultaneously annealing and oxidizing or bluing sheets or plates of iron or steel.

The object of our invention is to produce sheets or plates which are more uniformly colored, better annealed, and also more permanently colored than have heretofore been produced and at the same time greatly reduce the labor and time now expended in the production of such sheets or plates.

In the production of sheets or plates of iron or steel colored or coated with magnetic oxid it is highly desirable that the plates or sheets are not only perfectly and uniformly colored or coated, but that they are also perfectly or sufficiently annealed to avoid excessive elasticity or resiliency, which renders them undesirable or useless for articles or wares which require to be stamped or bent. Heretofore, so far as we are aware, perfect uniform color and a high degree of ductility have not been attained in plates or sheets of this character, due to the fact that in carrying out the coloring or coating process a good or sufficiently-good color has been secured at a sacrifice of a good or sufficiently-good annealing of the plates or sheets, or, on the other hand, the plates or sheets have been sufficiently well annealed at a sacrifice of a good uniform color.

To illustrate, it has been usual heretofore to pile hundreds of weight of sheets or plates one upon the other upon their flats in an annealing-box, highly heat the same, and then expose them to the action of an oxidizing agent. The weight of the mass of superimposed sheets or plates when heated produces such intimate contact of the sheets or plates as to exclude or prevent the oxidizing agent acting upon them, excepting to a limited extent around the edges, the result being nonuniformity of color, the edges being blue or black and the middle gray or brown; or, again, where the sheets or plates are colored or coated by being separately exposed when at a high temperature to the atmosphere they cool so rapidly that, although of a fairly-good color, they are so brittle and springy that it is impossible to use them for purposes in which it is necessary to stamp or bend them, and this last-mentioned evil also occurs when the plates or sheets are colored by exposure to the atmosphere in passing through an open oven or furnace when maintained separate and apart.

As heretefore stated, the object of our invention is to avoid the evils incident to the present practice or methods employed in the production of this character of sheets or plates; and to this end our invention consists, broadly stated, in placing the sheets or plates in a closed vessel or annealing-box, so disposed therein that spaces are formed between the sheets or plates, then raising the sheets or plates to an annealing temperature, or approximately 1,200° Fahrenheit, subsequently gradually cooling them, and during the cooling operation and while they are still in the closed vessel exposing them to the action of an oxidizing agent.

In carrying out our invention we take the sheets or plates after they have been annealed and cold-rolled in the usual manner to produce a smooth surface and place the same on their edge in a substantially upright position in any suitable annealing box or vessel adapted to be sealed, so disposed therein that intervening spaces are formed between the sheets or plates to enable the oxidizing agent to freely circulate between the sheets or plates and to act uniformly upon both surfaces of the same. We then seal the annealing box or vessel in any suitable manner, preferably with sand, to exclude the further admission of air to said box or vessel, and to more effectually prevent the admission of air to said box or vessel and to prevent or lessen the harmful effect of the air then in the box upon the sheets or plates we admit a hydrocarbon gas (commonly called "natural gas") for this purpose. The annealing box or receptacle comprising the bottom and lid is then placed

in any suitable furnace and the sheets or plates contained therein brought to an annealing temperature or approximately 1,000° to 1,200° Fahrenheit. After the sheets or plates have been suitably heated, as heretofore specified, the annealing-box is preferably withdrawn from the furnace and for the best results the contents while still in the annealing-box allowed to cool down to about a dull cherry color. We now admit into the annealing box or vessel superheated steam or other oxidizing agent and subject said sheets or plates to the action thereof for from approximately seven to ten hours or until the temperature of the sheets or plates has attained a point at which oxidation ceases.

When superheated steam is used as an oxidizing agent, we prefer to heat the same by passing it through red-hot tubes containing iron-filings.

When the annealing box or vessel is opened, the plates or sheets will be found to be uniformly coated and usually to a beautiful dark-blue color, although the tint may be varied. The appearance of the plates or sheets, we believe, is unequaled by anything heretofore produced for the market. The utility of the sheets or plates is equally marked. The coating seems to have become almost integral with the body of the sheet or plate, so that no bending, stamping, or working, to which the sheet or plate would ordinarily be subjected, is sufficient to start and crack off the coating or in any wise impair the color. Likewise, which is a matter of the highest importance, the sheet or plate has been so slowly cooled down that its annealed properties have not been destroyed, and the same is exceedingly pliable, being practically devoid of all spring, and will readily assume any desired shape and stay there after once so formed. This gives the product a peculiar value for such difficult pieces of work—as, for instance, elbows on pipes and various forms of range-work.

During the winter months when the sheets or plates are liable through exposure to become moist when subjected to heat, we prefer to use in the annealing box or vessel some hygroscopic substance, preferably lime—*i. e.*, anhydrous calcium oxid, commonly called "quicklime"—to absorb moisture and prevent the same spreading over the surfaces of the sheets or plates in streaks.

Although we have stated that we anneal the sheets or plates before cold-rolling the same, it is superfluous at this stage as the cold-rolling destroys the effect of annealing. Our subsequent treatment of the sheets or plates, however, thoroughly anneals the sheets or plates and renders them extremely ductile.

In the accompanying drawings we show a form of apparatus adapted to the application of our method of oxidizing or bluing metal sheets or plates, in which—

Figure 1 indicates a longitudinal sectional view of the furnace, showing the annealing-boxes therein. Fig. 2 is a perspective view showing one of the boxes with the lid or cover broken away to show the sheets or plates therein. Fig. 3 is an elevation of the furnace. Fig. 4 is an enlarged view of one of the spacer-staples. Fig. 5 is a perspective view of the annealing-bottom.

Referring to said drawings, 1 is a furnace open at both ends and provided with an exit-flue or chimney 2 intermediate its length, which by means of the two ports 3 and 4, controlled by dampers or valves 5, communicates with the furnace. The said furnace is provided with a series of gas-burners 6, which consist of a number of short horizontal pipes which project through the walls of the furnace and are connected on the exterior of the furnace with the gas-supply pipe 7. The said furnace, as heretofore stated, is open at both ends and is adapted to be closed by the plate 8 or by any other suitable means for the purpose of enabling the annealing-box to be quickly withdrawn from and inserted in the furnace. The said annealing-box consists of a bottom 9 and a lid or cover 10. Said bottom 9 is provided with a series of vertically-disposed racks or supports 11, between which the sheets or plates 12 are adapted to be supported in a substantially upright position on their edge, as shown in Fig. 2. The said bottom 9 is also provided with recesses or pans 13 for the reception of any hygroscopic substance, (we use quicklime—*i. e.*, anhydrous calcium oxid.) The said sheets or plates are prevented from coming in contact with each other by means of spacer-staples 14, which are inserted over the upper edge of each alternate sheet or plate, as shown in Fig. 2, and thus form spaces between the sheets or plates to enable steam or other oxidizing agent to freely circulate between the sheets or plates and to act uniformly on both surfaces of the same. When the lid or cover 10 is arranged on the bottom 9, as shown in Fig. 2, the lower edges thereof are sealed, preferably with sand, to prevent the escape of the oxidizing agent from the annealing box or receptacle and likewise prevent the admission of air to the interior of the same. One end of said annealing-box is provided with an orifice 15 for the reception of a pipe to discharge the oxidizing agent into the interior of the box.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The herein-described method of simultaneously annealing and oxidizing sheets or plates of metal, which consists in placing the sheets or plates in a closed vessel so disposed therein that intervening spaces are formed between the sheets or plates, then raising the sheets or plates to an annealing temperature and subsequently gradually cooling the said sheets or plates to a point at which oxidation ceases and during said cooling and while the sheets or plates are still in the closed vessel,

exposing them to the action of an oxidizing agent.

2. The herein-described method of simultaneously annealing and oxidizing sheets or plates of metal, which consists in placing the sheets or plates upon their edge in a closed vessel or annealing-box, then raising said sheets or plates to an annealing temperature and subsequently gradually cooling the said sheets or plates to a point at which oxidation ceases and during the cooling of said sheets or plates and while they are still in said closed annealing box or vessel exposing them to the action of superheated steam.

3. The herein-described method of simultaneously annealing and oxidizing sheets or plates of metal, which consists in placing the sheets or plates upon their edge in a closed annealing box or vessel, admitting to said annealing-box a gas to exclude the air, then raising said sheets or plates to an annealing temperature in a furnace and subsequently gradually cooling the said sheets or plates to a point at which oxidation ceases and during the cooling thereof and while they are still in said closed vessel exposing them to the action of superheated steam.

4. The herein-described method of simultaneously annealing and oxidizing sheets or plates of metal, which consists in placing the sheets or plates in a closed annealing box or vessel in the presence of a hygroscopic substance, the said sheets or plates being so disposed in said annealing-box that intervening spaces are formed between them, then raising said sheets or plates to an annealing temperature and subsequently gradually cooling them to a point at which oxidation ceases and during the cooling operation and while said sheets or plates are still in the sealed vessel exposing them to the action of an oxidizing agent.

5. The herein-described method of annealing and coloring or coating the surfaces of metal sheets or plates, which consists in heating the sheets or plates in a sealed vessel to approximately 1,200° Fahrenheit, then permitting the sheets or plates to become substantially cooler and then subjecting the same to the action of an oxidizing agent while said sheets or plates are still in the sealed vessel.

6. The herein-described method of annealing and coloring or coating sheets or plates of metal, which consists in charging the said sheets or plates into a sealed vessel disposing the same on their edge therein, then heating the sheets or plates above a dull cherry color, then permitting the sheets or plates to become a substantially dull cherry color, and then subjecting the same to the action of an oxidizing agent, until the said sheets come to a point at which oxidation ceases.

7. The herein-described method of annealing and oxidizing sheets or plates of metal, which consists in heating the sheets or plates to an annealing temperature in a sealed vessel in the presence of a hygroscopic substance, and finally subjecting the plates or sheets to the action of an oxidizing agent.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

BERNARD R. PARR.
HARRY E. SHELDON.

In presence of—
C. A. WILLIAMS,
JOHN H. RONEY.