

W. M. THEOBALD.
METHOD OF HEATING AND ROLLING BARS.
APPLICATION FILED JAN. 19, 1910.

1,005,361.

Patented Oct. 10, 1911.

2 SHEETS-SHEET 1.

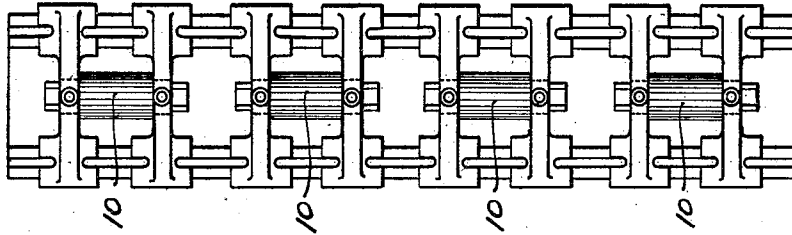
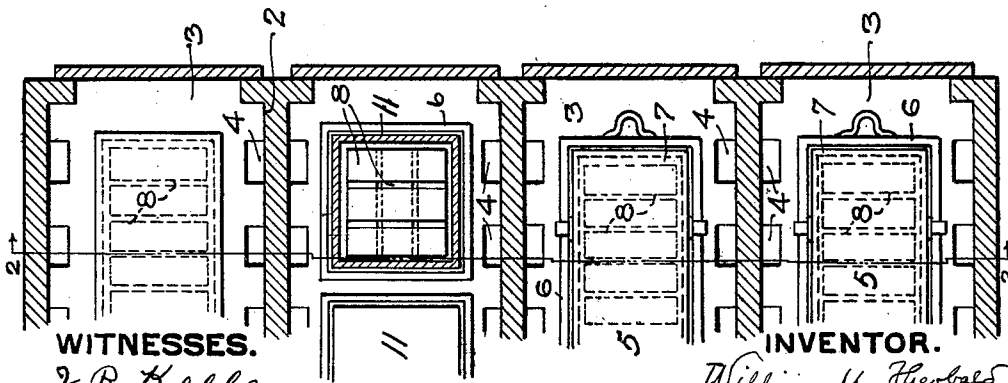
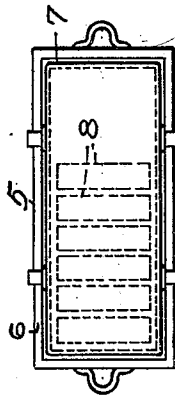


FIG. 1



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2 SHEETS—SHEET 2.

FIG. 3

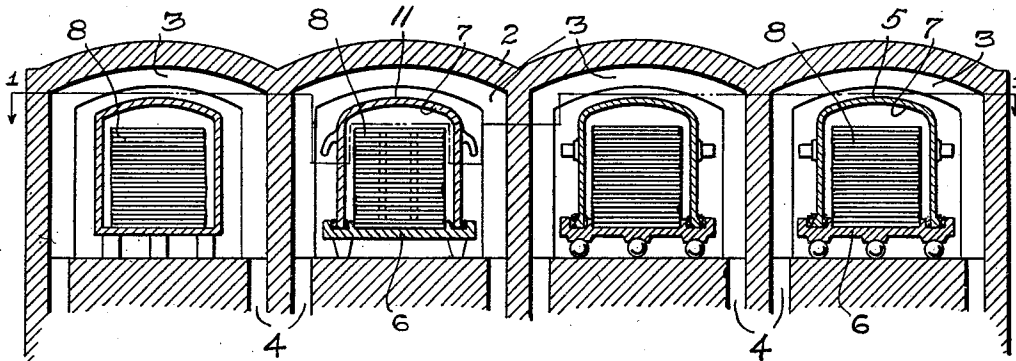
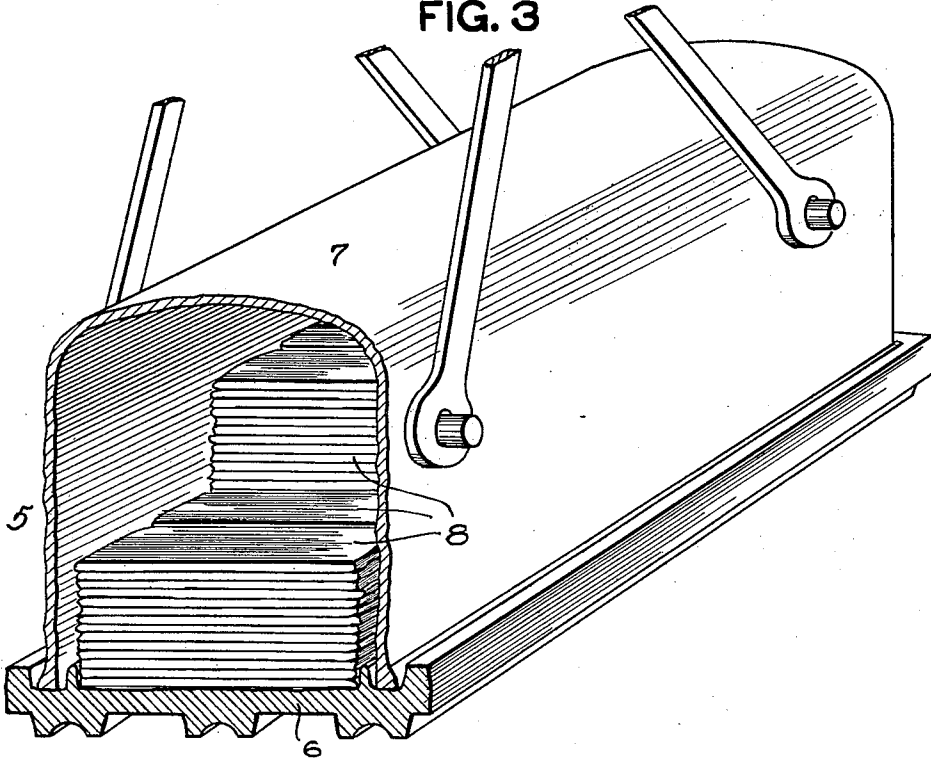


FIG. 2.

WITNESSES.

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UNITED STATES PATENT OFFICE.

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METHOD OF HEATING AND ROLLING BARS.

1,005,361.

Specification of Letters Patent.

Patented Oct. 10, 1911.

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To all whom it may concern:

Be it known that I, WILLIAM M. THEOBALD, a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Methods of Heating and Rolling Bars; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the heating and rolling of bars such as bars that are employed for the manufacture of sheet metal and the like.

The usual method of heating bars for rolling into sheets has been to place them in pairs in the bed or bottom of an open furnace, commonly known as a pair furnace, where the heat and flame pass into and through the heating chamber. The usual custom in this practice is to cut the bars to a length corresponding to the width of the sheets to be made, a width of from six to nine inches, and to charge the bars in the furnace and gradually heat them therein while exposed to the air and to contact with the flame, raising them up to what is known as a good rolling heat, namely, a heat at which they can be first rolled out singly and after a number of passes can be rolled out in pairs without being welded together. After rolling in pairs in this manner, the thick sheets so formed were pulled apart and formed into packs and reheated in a sheet furnace and the rolling continued. The heat in the pair furnace is in the neighborhood of 1200° F. and causes the raising of loose scale on the bars when so exposed to the atmosphere, and this scale rises from the bars irregularly, and in addition to wasting the metal, forms an irregular surface on the bar so that the surface of the sheet formed therefrom is liable to be imperfect. The art at the present time requires perfectly smooth sheets for high grade work, such as for coating with metal or for enameling or painting in automobile, metallic furniture, metal passenger car work and the like; and it is very important to provide means for heating such sheet bars which will overcome the serious difficulties on account of the irregularity of the surface produced by such heating of the sheet bars and the loose scaling of the same.

In such heating of the bars they are liable to take up any loose brick dust, clay or sand from the hearth while the dust or cinder carried over by the flame is liable to settle on the bars, and roll out with them forming streaks or spots which are not removed in acid or cleaning treatment, commonly called "pickling," and form imperfections on the surfaces of the finished sheets. It is also found difficult to heat such bars to such uniform temperature that they will draw properly in the rolls and form plates of uniform length for matching. These difficulties lead to large waste of metal which in some cases runs over 25 per cent. It is also difficult to heat the bars throughout as it depends largely upon the skill of the pair heater, and there is great liability of breaking the rolls, because the interior of a bar may not be in sufficiently soft condition to draw out, and a very heavy strain is brought on the rolls which, even when cast of very great thickness, are liable to break. The heating of bars in this way also requires highly skilled labor, and in running a plant full turn this means three skilled pair heaters for each mill, or in a ten-mill plant, thirty such heaters per day, this being one of the large points of expense in the manufacture of sheet metal.

By my invention I am enabled to so heat the metal as to do away with the formation of loose scale on the bars when raising them up to the full heat necessary for rolling; to insure the soaking of the heat throughout the bars; to insure the uniform heating of a large mass of bars and enable them to draw out uniformly and to substantially the same length while rolled singly preparatory to matching; and to protect them from contact with cinder or dirt, and so save large scrap loss or waste of sheets. I also very largely overcome the liability of the breakage of rolls; and am also enabled to largely reduce the labor cost, for example in an ordinary ten-mill plant to a few common laborers.

It consists, generally stated, in heating the bars in bulk or piles when protected from the atmosphere, to a proper rolling temperature and primarily rolling the bars singly or separately.

It also consists in first cleaning the bars to remove the scale from the same, and then heating them in bulk or pile when protected from the atmosphere and rolling them singly or separately.

It also consists in so heating the bars in bulk or pile when inclosed in a suitable box and so protected from the atmosphere, and carrying the bars in bulk while still protected from the atmosphere to the rolls and withdrawing them as needed from the box and feeding them to the rolls, and holding the remainder of the bars in bulk within the protecting box and thereby maintaining their heat ready for rolling.

It also includes other improvements as hereinafter described.

In the accompanying drawings illustrating the invention, Figure 1 is a plan view illustrating a plant suitable for the practice of the invention (the furnaces being shown in section along the line 1—1 Fig. 2); Fig. 2 is a section through the furnace on the line 2—2 Fig. 1; and Fig. 3 is a sectional perspective view illustrating the withdrawal of the bars from the box.

In the practice of the invention I employ any suitable furnace for heating the bars when protected from the atmosphere. A furnace suitable for this purpose is shown in Figs. 1 and 2, being substantially such as employed for the annealing of sheet metal. The furnace has suitable flues for the entrance of the flame and heat, and for that purpose a suitable regenerative furnace may be employed as illustrated, such as the furnace 2, having the heating chamber 3 and the regenerative ports 4. Within the same is the annealing box 5 having the bottom 6 and cover 7, such furnace being adapted to hold a large number of sheet bars built up in piles. For example, as illustrated, a series of piles 8 are built up within the annealing box 5, these piles extending across the box and being of length corresponding to the width of the finished sheets and of suitable height. These piles of bars are built up in practical contact with each other, though it is desirable that some space may be left for the circulation of the heat around the piles so as to bring all the piles up to the same high temperature. As shown, the piles may also be arranged with the bars crossing each other to give full exposure to the heat. The annealing box can in this way hold a large bulk of sheet bars, several tons of the same being inclosed within the boxes to be heated at the same time. The boxes are placed within the furnace and are subjected to the heat thereof for a number of hours so as to raise the whole bulk of sheet bars within the furnace to a high or rolling heat. It is calculated that this heat is in the neighborhood of 1200° F.

In so heating the bars, they are of course, entirely protected from the atmosphere, and, though they are raised to heat at which loose scale would be formed if they were heated in an open furnace, there is practically no oxidation of the same, because they are protected from any contact with the atmosphere. The heat within the furnace is slow and it soaks in through each bar, so that the bars are raised to such high heat throughout instead of the overheating of the outer surfaces of the bars, even though the interior of the bar may not be raised to the proper heat for rolling, which often occurs in open furnace heating. After the entire charge within the annealing box has been raised to a high rolling heat, and subjected to the proper soaking heat, so as to insure heating throughout the bodies of the bars, in the preferred practice, the box is withdrawn from the furnace and is carried to a position within easy reach of the rollers. For instance, as illustrated in Fig. 1, it may be brought within reach of rollers working on a number of sheet mills 10, four of such sheet mills being illustrated in the drawing, so that the bars may be withdrawn as needed from the box, a supply for the continuous operation of several sets of rolls for a long time being thus provided, so that the rolls can be kept in continuous operation and maintained at the desired contour, a much larger output of more perfect sheets being obtained, instead of being only operated intermittently depending on the operations of the pair heating furnace, and changing contour for this reason. The metal as so heated will remain at high rolling heat for a number of hours, even though exposed to the atmosphere, although it is preferred that means shall be provided for raising the cover 7 of the annealing box when the bars are to be withdrawn from the same, and to again cover up the box so as to prevent loss of heat from the bars. If desired boxes of smaller size, for example, boxes holding only one length of sheet bars may be employed, as illustrated at 11, two or more of such boxes being heated in a single furnace. In this way a smaller bulk may be carried to the rolls sufficient, for example, for a single heat in several sets of rolls, or several heats in a single set of rolls. The sheet bars are thus withdrawn from the box preferably in pairs, as in ordinary rolling of sheet bars, and each bar is fed singly or separately to the plating out rolls and is drawn out as far as desired, and then it may be matched up and rolled in pairs as above stated. The heat having passed entirely through the bars and the bars being at the same temperature throughout, they are relatively much softer than ordinary

bars and will draw out more evenly, so overcoming large waste. As they are of the same heat throughout their width, they will also draw out more evenly, the difficulty of having one edge heated more than another, being entirely overcome. As the bars are heated without exposure to the atmosphere, they are raised to the necessary rolling heat without the raising of loose scale, thus saving a large portion of waste, while as the scale has not been raised upon the bars, a much more perfect surface is formed thereon by the single or separate rolling of each bar. The only oxid formed on the bars is from the exposure to the atmosphere in withdrawing them from the heated piles in the inclosing box and feeding them to the rolls; but this forms only a slight surface oxid causing little or no waste. As the bars are thus heated in piles while protected from the atmosphere, there is no liability of their taking up dirt or cinder such as when heated in the open furnace which would lead to imperfections in the finished sheet.

As the heat soaks through the bars, they can be drawn out to greater length, and greater reduction be obtained without reheating, being in some cases drawn out to finished length depending on the gage worked. The mills can also be kept more steadily at work and a larger output obtained because a large mass of heated bars ready for rolling is maintained, and this makes it possible to operate the several mills more uniformly and to obtain more uniform rolling therefrom as above stated. For certain uses the sheets as rolled according to the method can be used without further treatment. Where they are to be used for galvanizing, tinning or other purposes, and require acid cleaning, as the oxid coating on the sheets is much thinner than the ordinary way of rolling, such acid cleaning can be accomplished at much less expense than with sheets rolled in the ordinary way. As the proper heating of the bar is thus obtained, it is also evident that strain on the rolls is greatly reduced, and consequently the liability to break the rolls such as occurs with bars imperfectly heated in the interior, is practically overcome, and the thin oxid coating adhering to the bar is not liable to separate therefrom and adhere to the rolls, so that a smooth surface of the rolls is more easily maintained. Practically all skilled labor for bar or pair heating is done away with, the only skilled labor required being that in operating the furnace, and as a very large bulk of bars are heated at the same time, this labor cost is reduced to a minimum while providing a continuous supply of heated bars, so that the mills can be run continuously as above set forth.

I find it desirable for some classes of work to first remove all oxid and scale from the rolled bars before heating them such as by pickling them in an acid bath, such as a bath of sulfuric acid solution, and then to pile the bars so cleaned in bulk within the box and heat them when confined therein as above described. For this purpose they may be inserted within a suitable bath, as illustrated at 12. The cleaned bars are heated within the protecting box and are therefore either entirely free from oxid when fed to the rolls or have only a thin skin of oxid.

Instead of the employment of a movable box for the heating of the bars, this may be accomplished by the use of a permanent muffle built within the furnace, the bars being built up therein and the muffle then closed and the bars raised therein to the proper rolling heat, and withdrawn therefrom and carried to the rolls in any suitable way. In such case as the bars remain within the muffle in the furnace until rolled, the heat of the same may be maintained by a low heat within the furnace itself if desired.

While my invention is specially applicable to heating bars for rolling into sheets, it may also be employed to advantage in heating bars for the rolling of plates and the like.

What I claim is:

1. The herein described method of heating and rolling bars in the manufacture of sheets and the like, consisting in heating the bars in bulk or piles to a proper rolling temperature when protected from the atmosphere, and then primarily rolling the bars singly or separately.

2. The herein described method of heating and rolling bars in the manufacture of sheets and the like, consisting in heating the bars in bulk or piles to a proper rolling temperature when protected from the atmosphere, then primarily rolling the bars singly or separately, and then matching the same and further rolling them.

3. The herein described method of heating and rolling bars in the manufacture of sheet metal and the like, consisting in first pickling the bars to remove scale therefrom, then heating the bars in bulk or piles to a proper rolling heat when protected from the atmosphere, and then primarily rolling the bars singly or separately.

4. The herein described method of heating and rolling bars in the manufacture of sheet metal and the like, consisting in inclosing the bars in bulk or piles within a movable box and raising the same to a proper rolling temperature when so protected from the atmosphere, transferring the box containing the bars to the neighborhood of the rolls, withdrawing some of the bars from the box and rolling them singly or

separately, and holding the remainder of the bars in bulk and thereby maintaining their heat until rolled.

5 5. The herein described method of heating and rolling bars in the manufacture of sheet metal and the like, consisting in inclosing the bars in bulk or piles within a movable box and raising the same to a proper rolling temperature when so protected from the atmosphere, opening the box

to withdraw bars therefrom for rolling, closing the box to protect the remainder of the bars and so working until the box is emptied.

In testimony whereof, I the said WILLIAM 15 M. THEOBALD have hereunto set my hand.

WILLIAM M. THEOBALD.

Witnesses:

B. L. JENKINS,

WM. J. PINKETT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."