

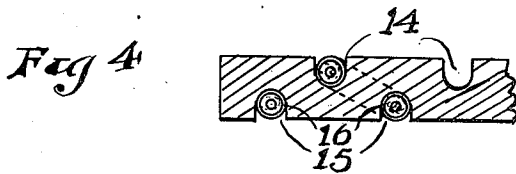
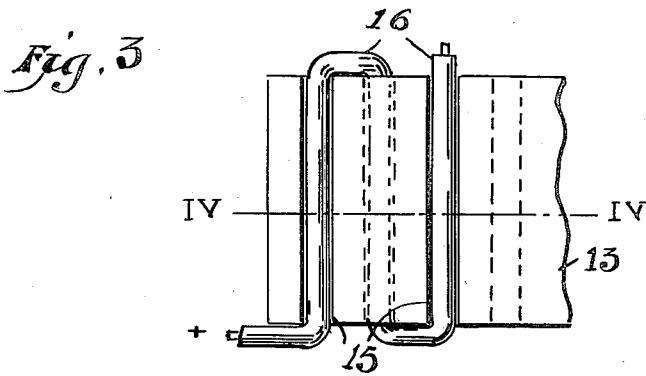
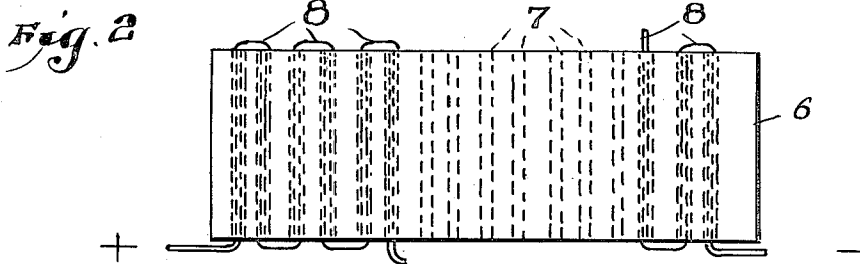
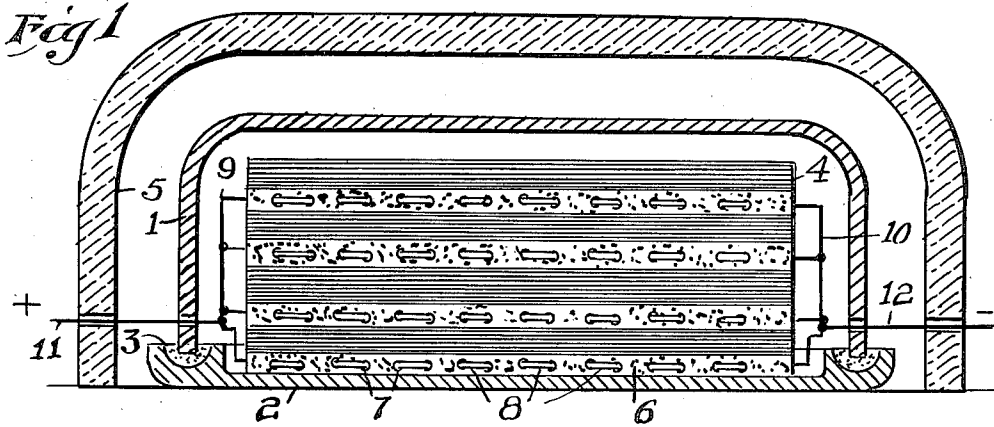
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1,503,639

O. H. CUNNINGHAM

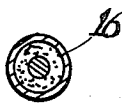
METHOD FOR ANNEALING SHEET METAL

Filed Sept. 25, 1922



Witness
R. F. Dilworth

Fig. 5



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UNITED STATES PATENT OFFICE.

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METHOD FOR ANNEALING SHEET METAL.

Application filed September 25, 1922. Serial No. 590,298.

To all whom it may concern:

Be it known that I, OTTO H. CUNNINGHAM, a citizen of the United States, and a resident of Leechburg, in the county of Armstrong and State of Pennsylvania, have made a new and useful Invention in a Method for Annealing Sheet Metal, of which the following is a specification.

The invention has for its objects the provision of a method which will anneal sheet metal more rapidly and economically than the methods and apparatus heretofore employed and which will give a better product.

Under the present practice the annealing box, with its pack of plates or sheets, is placed in a furnace and gradually raised through a period of several hours to a temperature of approximately 1500° F., after which the temperature of the furnace is maintained for two or more hours, this part of the operation being known as soaking, and being regarded as essential to proper annealing. The furnace is then allowed to cool very gradually during a period of several hours until a temperature of about 900° F. in the pack is reached and the plates are dark red in color or black. At this time, the box is withdrawn from the furnace and opened.

This procedure is long-drawn out and involves a high fuel cost, one reason being the requirement of securing a uniform heating throughout the pack, since the box and pack are heated progressively from the outside inward. This means that in order to secure a proper heat at the center of the pack, the outer portions must be heated to a much greater degree than would otherwise be necessary, which not only involves a waste of heat, but also involves a detrimental degree of over-heat in the outer parts of the pack tending to produce defects in the sheets and reduce their tensile strength.

My apparatus and process are designed to overcome the foregoing objections and to give a more rapid and uniform heating of the pack and a reduced cost. Briefly stated, this is accomplished by the use of electrical heating element suitably distributed throughout the pack so that the tedious process of heating from the outside inward progressively is avoided. The outside heat from a furnace may still be applied if desired, but only a fraction of the

outside heat heretofore necessary need be applied, and the desired degree of heat throughout the pack may be secured in a much shorter period of time. Apparatus embodying the invention is illustrated in the accompanying drawings wherein:

Figure 1 is a vertical section through the apparatus in use; Fig. 2 is a plan view of one form of heating element; and Figs. 3 and 4 are detail views of another form of heating element, Fig. 3 being a partial plan view, and Fig. 4 a section on the line IV—IV of Fig. 3; and Fig. 5 is a section on an enlarged scale through the resistance element of Figs. 3 and 4.

Referring to Fig. 1, the numeral 1 indicates the annealing box resting upon the base plate 2 with its lower edge embedded in the sand in the groove 3 in order to exclude the air which would oxidize the metal during the annealing process. 4 is a pack of sheets which are to be subjected to the annealing operation, and 5 indicates the walls of the furnace in which the box is placed in case furnace heat is employed to supplement the heating effect of the interior electrical heating means.

The interior heating means comprises the plurality of plates 6 interspersed between the sheets of the pack as indicated and provided with suitable electrical heating means. Four plates 6 are illustrated, but it will be understood that the number may be increased or decreased depending upon conditions. The character of the plates and the resistance elements carried thereby may be widely varied and the invention is limited to no particular construction of heating element. As shown in Figs. 1 and 2 the plates 6 are of insulating material, such as magnesia, clay or porcelain, suitably reinforced if necessary and perforated transversely as indicated at 7 to receive the heating wire 8. This wire is woven back and forth through the plates as indicated in Fig. 2 and consists of suitable resistance metal such as nichrome. The various heating wires are connected in parallel by means of the wires 9 and 10 as indicated which are in turn connected to the leads 11 and 12 extending through the walls of the annealing box and suitably sealed and insulated at such points.

Figs. 3 and 4 illustrate a modified form of heating element which may be employed. In this construction a metal plate 13 is used

provided with the grooves 14 and 15 on the upper and lower sides thereof. The resistance element in this device is what is known as "sheathed wire", consisting of a member 16 made up of a resistance wire of nichrome or similar metal surrounded by an insulating sheath of clay or composition enclosed in a metal tube. The member 16 is woven back and forth in the grooves 14 and 15 as indicated in the drawings and as used with a metal plate gives a very durable and effective resistance element for the particular heating service here required, as it may be handled and subjected to the weight of the pack of sheets without breakage or injury.

In carrying out the process, the heating elements are placed in the pack as indicated in Fig. 1, and current applied to heat the pack, and bring the temperature up to a point in the neighborhood of 1500° F. This may be accomplished either by the use of the electrical heating means alone, or the annealing box may be placed in an annealing furnace, as indicated in Fig. 1, and the heating accomplished by the joint application of heat from the furnace and that from the electrical heating elements. In this way the pack is brought to a relatively high temperature and at a more uniform rate throughout the pack than is the case where the pack is heated from the outside alone as has heretofore been the practice. After the temperature of the pack has been raised to the desired point, such temperature is maintained to give a soaking action, after which the temperature is allowed to fall slowly until a temperature of 800 or 900 F. is reached when the box is opened and the pack removed.

The apparatus is capable of considerable modification without departing from the invention involved. Only one form of annealing box is illustrated with the plates of the pack in horizontal position and with all of such plates in a single casing, but it will be understood that this is not necessarily the case, and that the plates might be arranged vertically or at other angles, and the box divided into sections for convenience in handling.

As heretofore stated the annealing may be accomplished entirely by the electrical heating units, in which case the box would be constructed of heat insulating material and if desired, other forms of electrical heating units than the interspersed units illustrated might be employed, the process contemplating broadly the annealing of the sheets by electrical heating means applied internally of the box or casing.

What I claim is:—

1. A process of annealing a pack of iron sheets which consists in heating the sheets in an enclosed space by applying electrical heating means in said space between the sheets of the pack.

2. A process of annealing a pack of iron sheets which consists in enclosing the sheets in an annealing box, applying heat to the exterior of the box, and applying additional heat to the interior of the box at a plurality of different levels between the sheets of the pack to carry the temperature of the pack through its annealing range.

In testimony whereof, I have hereunto subscribed my name this 22nd day of September, 1922.

OTTO H. CUNNINGHAM.