

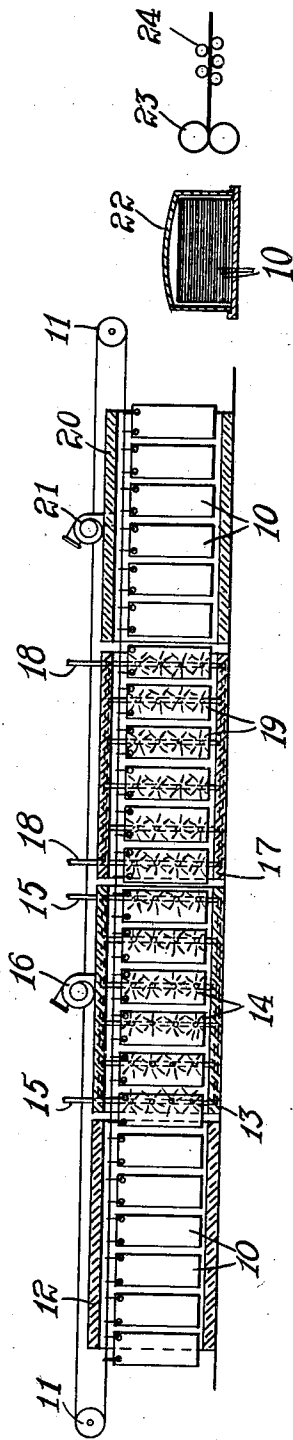
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TREATMENT OF STEEL SHEETS

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## UNITED STATES PATENT OFFICE

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## TREATMENT OF STEEL SHEETS

Application filed September 26, 1929. Serial No. 395,222.

This invention relates to the treatment of steel sheets, such as, and in particular, silicon steel sheets and it more especially relates to a novel series of steps interposed into a complete process for making such sheets from the usual raw materials.

Where certain desired or specified electrical properties are desired in the finished sheets, difficulty has been encountered in attaining uniformity and as a corollary of that disadvantage the further one arises that sheets having specified electrical properties cannot be conveniently duplicated or supplied.

It is, therefore, one of the objects of my invention to so treat the steel sheets during their manufacture as to attain not only improved electrical qualities, but also uniform and predetermined characteristics.

Another object of the invention resides in carrying out certain steps in a certain order and in subjecting the sheets to two different types of annealing steps.

A further object of the invention is to quickly anneal steel sheets and then to box anneal them after having properly prepared them, meanwhile, for such box anneal.

A still further object of the invention is to anneal, clean, dry and reanneal steel sheets under predetermined conditions to obtain predetermined results.

Other objects and advantages will either be apparent hereinafter or will be pointed out as the description proceeds.

The drawing illustrates in substantially diagrammatic form the steps in the process of manufacturing steel sheets which applicant has invented.

Referring to the drawing, there are seen to be diagrammatic portions of certain devices for treating steel sheets which have previously been hot rolled substantially to gauge. After having been rolled in such a manner, the sheets 10 are vertically suspended from a suitable conveying device 11 which leads them in order through the various steps to be hereinafter set forth in detail.

The first step, after having vertically suspended the sheets to be finished, is an annealing step in the chamber diagrammatical-

ly shown at 12. This annealing chamber 12 is so arranged that the vertically suspended sheets are evenly heated on all sides so that the temperature of the sheets is quickly raised to a high temperature between approximately 1800° and 1950° F. The annealing chamber may be suitably heated in any desired way known in the art or the chamber may be electrically heated, if so desired.

After this quick annealing treatment, the sheets are then led, still in a vertical position, into and through a pickling chamber 13. This step follows immediately after the annealing step and in the pickling chamber 13 the sheets are rapidly cooled and pickled. The cooling and pickling is accomplished by a spray and pipe system wherein the spray nozzles 14 are suitably located on the pipes 15 so that the pickling liquid can be forced in any convenient way, such as by a fan or pump 16, through said pipes and out of said nozzles onto both sides of said sheets 10. The sheets are, therefore, immediately cooled due to the comparatively low temperature of the pickling liquid and the liquid itself operates to pickle the sheets in the known manner.

From the pickling chamber, the still vertically suspended sheets are led into a scrubbing or rinsing chamber 17 which may be of the same essential construction as the pickling chamber except that the scrubbing or rinsing liquid may be water or other liquid which will remove the adhering scale from the sheets and which will also wash off or neutralize any pickling solution remaining on the sheets. In said scrubbing or rinsing chamber 17, the pipes 18 have spray nozzles 19 connected thereto so as to scrub all sides of the sheets and the scrubbing or rinsing liquid may be forced or sprayed by means of a suitable fan or pump device, (not shown). These spray nozzles may be said to form hydraulic jets for forcibly scrubbing off the scale and remaining pickling liquid.

After this scrubbing or rinsing step, the still vertically suspended sheets are led into a drying chamber 20, where the sheets are heated only hot enough to assist in driving

off the water or rinsing liquid and the chamber may be provided with an apparatus, such as a pump or fan 21, to carry off the vapors and thus assist the drying. The temperature of this chamber is not at all high and may be in the neighborhood of 100° to 200° F., for example.

The so dried sheets are then removed from the conveyor 11 and are stacked in annealing boxes 22 and then box annealed in the regular or known manner.

After the box anneal, the sheets may be finally rolled and leveled as at 23 and 24 so as to put them in final finished form.

The quick annealing attained in the chamber 12 followed in due course by the box anneal 22 improves the electrical properties of the steel sheets in a manner already referred to in an application filed by William E. Caugherty, Serial No. 395,465, filed September 26, 1929, for Process for heat treating silicon steel sheets.

The manner in which the present steps are carried out, however, are different from said application and are beyond the scope thereof, and the continuous series of operations referred to above are particularly efficient and unexpectedly efficacious in providing a highly improved steel, electrically speaking, and also a steel which is uniform and the properties of which can, therefore, be duplicated when required. The steps are inserted at an appropriate point in the manufacture of steel sheets, but always follow, preferably, a hot rolling step wherein the sheets are hot rolled to substantially final gauge. It is conceivable, however, that the steps forming the present invention could be inserted at some other position in the series of steps leading from raw material to finished sheets but it is, as it will be realized, more logical and preferable to finish the sheets according to the present invention rather than to subject them to further additional steps which might have some effect on the successive annealing steps of different characteristics.

What I claim as new and desire to secure by Letters Patent is:

1. In the process of manufacturing steel sheets such as, and in particular, silicon steel sheets, the steps of quickly annealing vertically suspended steel sheets at about 1800°-1950° Fahrenheit, immediately rapidly cooling and pickling such sheets, hydraulically removing the pickling solution and scale, drying, and box annealing the sheets.

2. In the process of manufacturing steel sheets such as, and in particular, silicon steel sheets, the steps of quickly annealing vertically suspended steel sheets, previously hot rolled, at about 1800°-1950° Fahrenheit, immediately rapidly cooling and pickling such sheets, scrubbing said sheets by hydraulic jets to remove the pickling solution and scale,

drying at moderate temperature, and box annealing.

3. The steps in the manufacture of steel sheets such as, and in particular, silicon steel sheets, of improved electrical qualities consisting of quickly and uniformly raising such sheets, vertically suspended and previously hot rolled, to a temperature of about 1800°-1950° Fahrenheit, immediately rapidly cooling and pickling said sheets, hydraulically scrubbing said sheets to remove scale and adhering pickling solution, raising said sheets to a mild heat to assist in drying the same, stacking said sheets in an annealing box and box annealing them.

In testimony whereof, I have hereunto subscribed my name this 24th day of Sept., 1929.

HARRY E. SHELDON.