

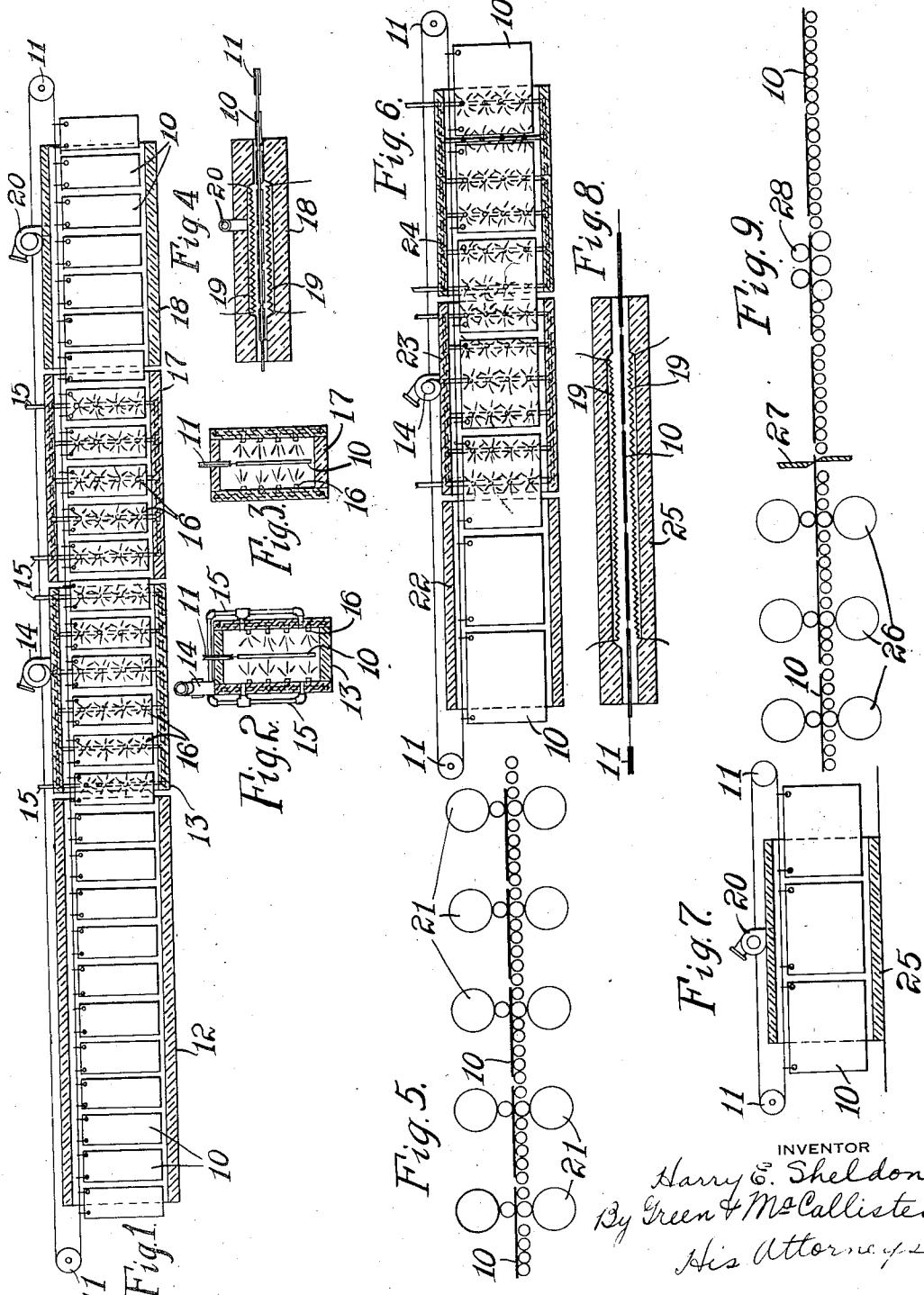
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H. E. SHELDON

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TREATMENT OF STEEL SHEETS

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## UNITED STATES PATENT OFFICE

HARRY E. SHELDON, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO ALLEGHENY STEEL COMPANY, A CORPORATION OF PENNSYLVANIA

## TREATMENT OF STEEL SHEETS

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This invention relates to a process of treating steel sheets such as, and in particular, silicon steel sheets for producing sheets of improved electrical properties, which properties are uniform and predetermined so that they may be duplicated.

Much difficulty has been experienced in obtaining desirable electrical properties in steel sheets not only because the electrical properties are not as great as might be desired, but also because these properties were not uniform and hence it was an impossibility to duplicate sheets, which had been found to be desirable, in order to replace or repair electrical installations containing such sheets. It is obviously a great advantage to predetermine the electrical properties of the finished sheets so that uniformity can be attained with consequent ability to duplicate any particular sheets.

It is, accordingly, one object of my invention to so treat steel sheets as to obtain predetermined electrical properties which are uniform and which can, therefore, be duplicated.

It is another object of my invention to carry out certain steps in the process of manufacturing such sheets and in repeating said steps in the same order.

It is a further object of my invention to normalize, clean, and dry vertically suspended sheets and then to cold roll the same and thereafter to repeat said steps in the same order.

A still further object of the invention is to normalize, clean, dry and cold roll steel sheets, to repeat said steps in the same order, and finally to shear and roller level the sheets.

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

In the drawings, showing diagrammatically the steps in the present process;

Figure 1 illustrates the first normalizing, pickling, rinsing and drying steps;

Fig. 2 is a vertical cross section through the pickling chamber of Fig. 1;

Fig. 3 is a vertical cross section through the rinsing chamber of Fig. 1;

Fig. 4 is a horizontal cross section through the drying chamber of Fig. 1;

Fig. 5 is a representation of a plurality of four-high cold rolling mills;

Fig. 6 is a representation of the second 55 normalizing, pickling and rinsing steps;

Fig. 7 is a representation of the second drying step following along after the second rinsing step of Fig. 6;

Fig. 8 is a horizontal cross section through 60 the drying chamber of Fig. 7; and

Fig. 9 is a representation of the final cold rolling, shearing and leveling steps.

Referring to the drawings in detail and first to Fig. 1, it will be seen that the steel sheets 10 are conveyed by means of a conveying device 11, first, through a normalizing chamber 12, which step follows a previous hot rolling step. In this normalizing chamber, the sheets are quickly and uniformly 65 raised to a comparatively high temperature, for example, about 1800° to 1950° F., for the usual purposes.

The sheets are next led in the same position through a pickling chamber 13 having a 75 pump or fan device 14 forcing the pickling liquid through the pipe system 15, and out through a plurality of spray nozzles 16 from which the pickling liquid impinges upon all sides of the sheets 10 so as thoroughly to 80 pickle them, and, at the same time, to cool them, since the pickling liquid is relatively cold compared to the temperature at which the sheets leave the normalizing chamber 12.

From the pickling chamber, the sheets, 85 still in a vertical position, are conveyed through a rinsing chamber 17 which may be provided with the same type of fluid spraying system as the pickling chamber, but, of course, the liquid passing therethrough is a 90 rinsing one such as water or some neutralizing liquid, since the pickling liquid is generally of an acid character. A pump or fan device (not shown), forces the rinsing liquid through the pipe system 15 and out through 95 the spray nozzles 16 connected thereto so as to scrub thoroughly all sides of the sheets in said chamber, thereby removing any adhering scale and pickling liquid.

From the rinsing chamber, these sheets, 100

- still vertically suspended, are conveyed into and through a drying chamber 18. This chamber is heated electrically as at 19 to a moderate temperature sufficiently high to 5 warm the sheets and to assist in driving off any liquid. A suction fan or pump device 20 is provided to assist the drying by removing the vapors as they are formed.
- The sheets are then removed from the conveying device and are placed in a horizontal position and, as shown, in Fig. 5, led through a plurality of four-high cold rolling mills 21 where a further reduction in the gauge of the sheets occurs.
- 10 The sheets are then again vertically suspended from an overhead conveying device 11 and led through a normalizing chamber 22, a pickling chamber 23, a rinsing chamber 24 and a further drying chamber 25. From the last drying chamber 25 the sheets are again cold rolled in a plurality of four-high cold rolling mills 26, after the sheets have been placed once more in a horizontal position. The nature and construction of these 15 second-mentioned normalizing, pickling, rinsing and drying chambers and the last mentioned cold rolling step require no detailed explanation as they may be of the same or similar nature as the previously explained chambers 12, 13, 17 and 18 and the cold rolling mills 21. The pipe systems with their spray nozzles and pump or fan devices and their electrical heating systems are designated by the same numerals as the same 20 elements have already been designated in the first mentioned set of steps and chambers, thus indicating the same or similar nature thereof.
- After the horizontally disposed sheets 25 have been passed through the final cold rolling and reducing mills they are sheared to desired size as at 27 and then roller leveled and smoothed as at 28 and finally inspected and oiled.
- 45 The above represents a particularly efficient series of steps which may follow any given hot rolling step in order to finish the sheets in such a manner that their electrical properties will be improved and of predetermined uniformity, so that sheets of similar characteristics can be duplicated at any time required by proper control of the apparatus which, as is apparent, lends itself to accurate and uniform control.
- 50 It is obvious that various changes and modifications may be made in the steps such as by varying the temperatures and lengths of the various chambers or by adjusting the cold rolling mills to give a desired and predetermined reduction in size at those points.
- 55 It is further to be understood that either or both of the rinsing steps can be carried out with water and/or a neutralizing medium to eliminate the acidic character of any adhering pickling liquid so as to positively pre-

vent deterioration of the sheets at any subsequent time. The drying step can be carried out at any desired temperature but preferably not at such a high temperature as to affect the characteristics of the product resulting from the previous normalizing and cleaning steps, and merely as an illustrative temperature for the drying chamber a heat of, say, 100° to 200° F. can be used.

What I claim as new and desire to secure 75 by Letters Patent is:—

1. In a process of manufacturing silicon steel sheets, the steps of normalizing previously hot rolled vertically suspended sheets, pickling, rinsing and drying the same, cold rolling said sheets, and repeating said steps on the thus treated sheets.

2. In a process of manufacturing silicon steel sheets the steps subsequent to a previous hot rolling of passing the sheets suspended from a conveyer vertically through a normalizing chamber where they are quickly and uniformly raised to a temperature of about 1800-1950° F.; leading them in the same position through a pickling chamber provided with means for forcing pickling liquid on all parts of said sheets, simultaneously pickling and cooling them; conveying them through a rinsing chamber provided with means for impinging rinsing liquid on all parts of said sheets, thereby thoroughly scrubbing said sheets and removing any adhering scale and pickling liquid; conveying the vertically suspended sheets into and through an electrically heated drying chamber where they are subjected to moderate heat and suction to dry them, removing them from the conveying device and placing them in a horizontal position in which they are passed through a plurality of four-high cold rolling mills for further reducing the gauge of the sheets; repeating said foregoing steps; shearing to size; roller leveling; inspecting and oiling said sheets.

3. In a process of manufacturing silicon steel sheets of uniformly high and reproducible electrical properties the steps of quickly and uniformly raising such sheets to a temperature of about 1800-1950° F., forcing pickling liquid on all parts of the sheets thereby simultaneously pickling and cooling them, forcing rinsing liquid on all parts of the sheets to scrub them and remove any adhering scale and pickling liquid, subjecting said sheets to the action of moderate heat and a partial vacuum, reducing the gauge of the sheets, repeating the same steps in the same order under substantially identical conditions, shearing to size, roller leveling, inspecting and oiling.

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

HARRY E. SHELDON.

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