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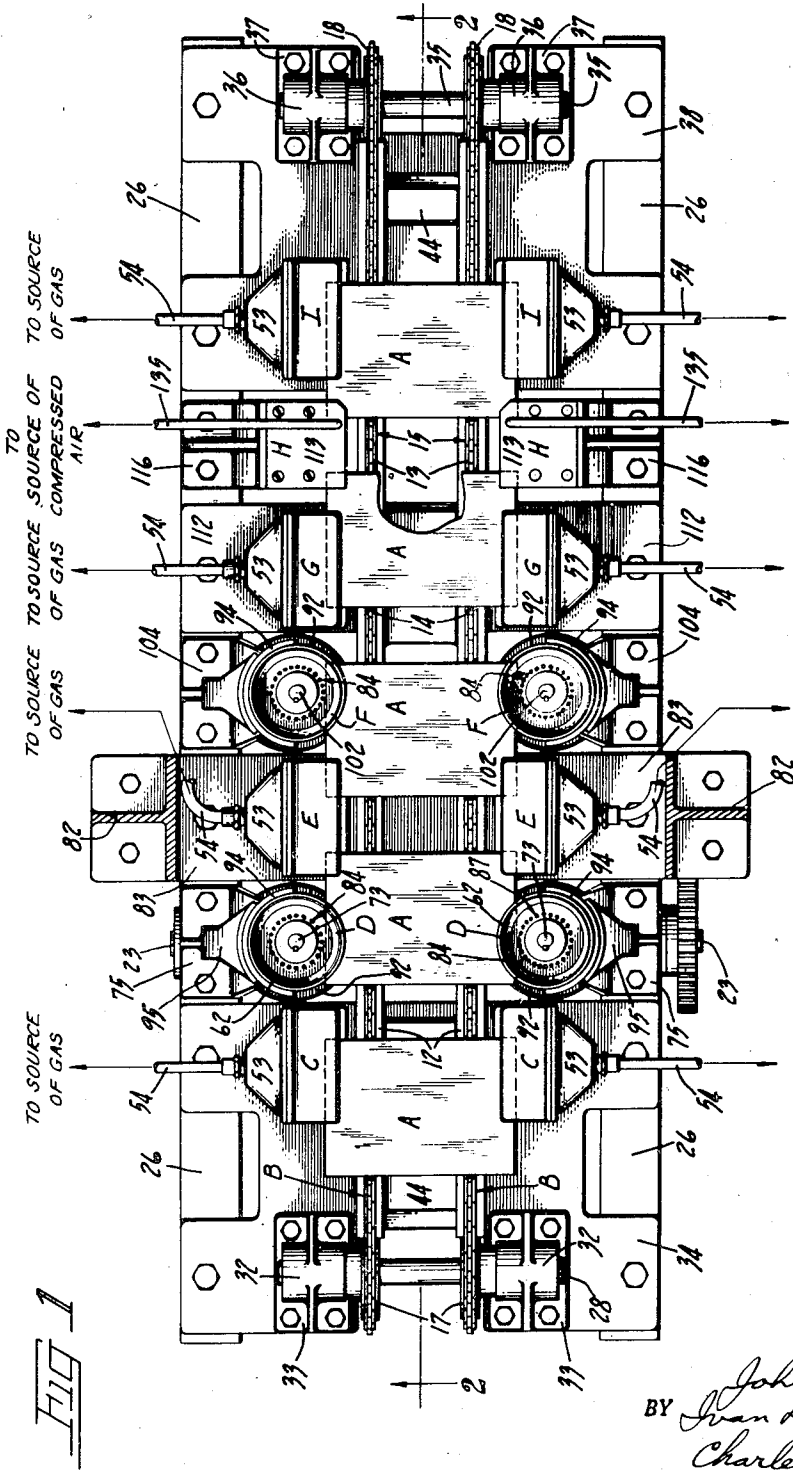
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METHOD AND APPARATUS FOR TREATING SHEETS WITH A DEOXIDIZING MEDIUM

Filed June 10, 1943

4 Sheets-Sheet 1



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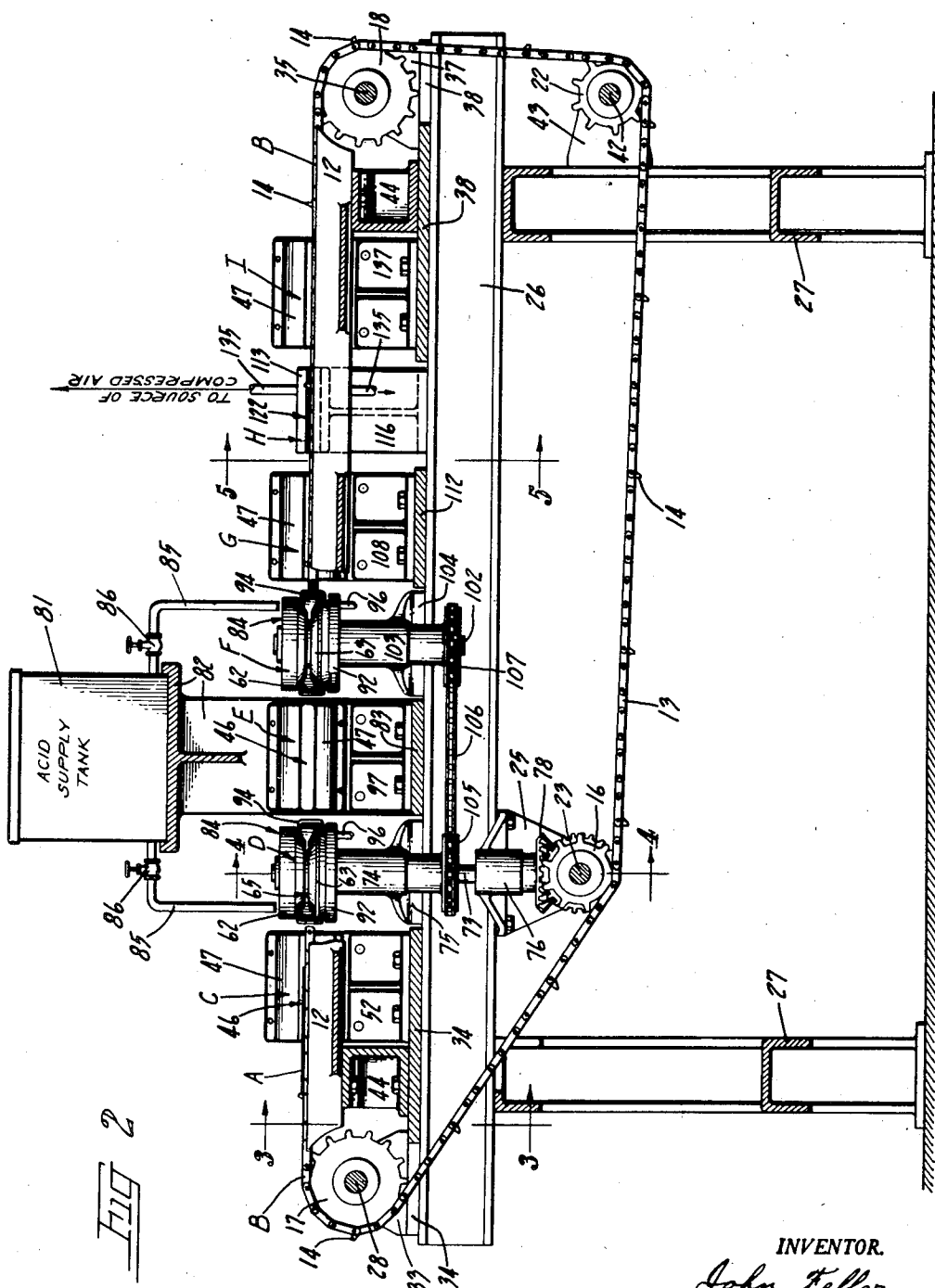
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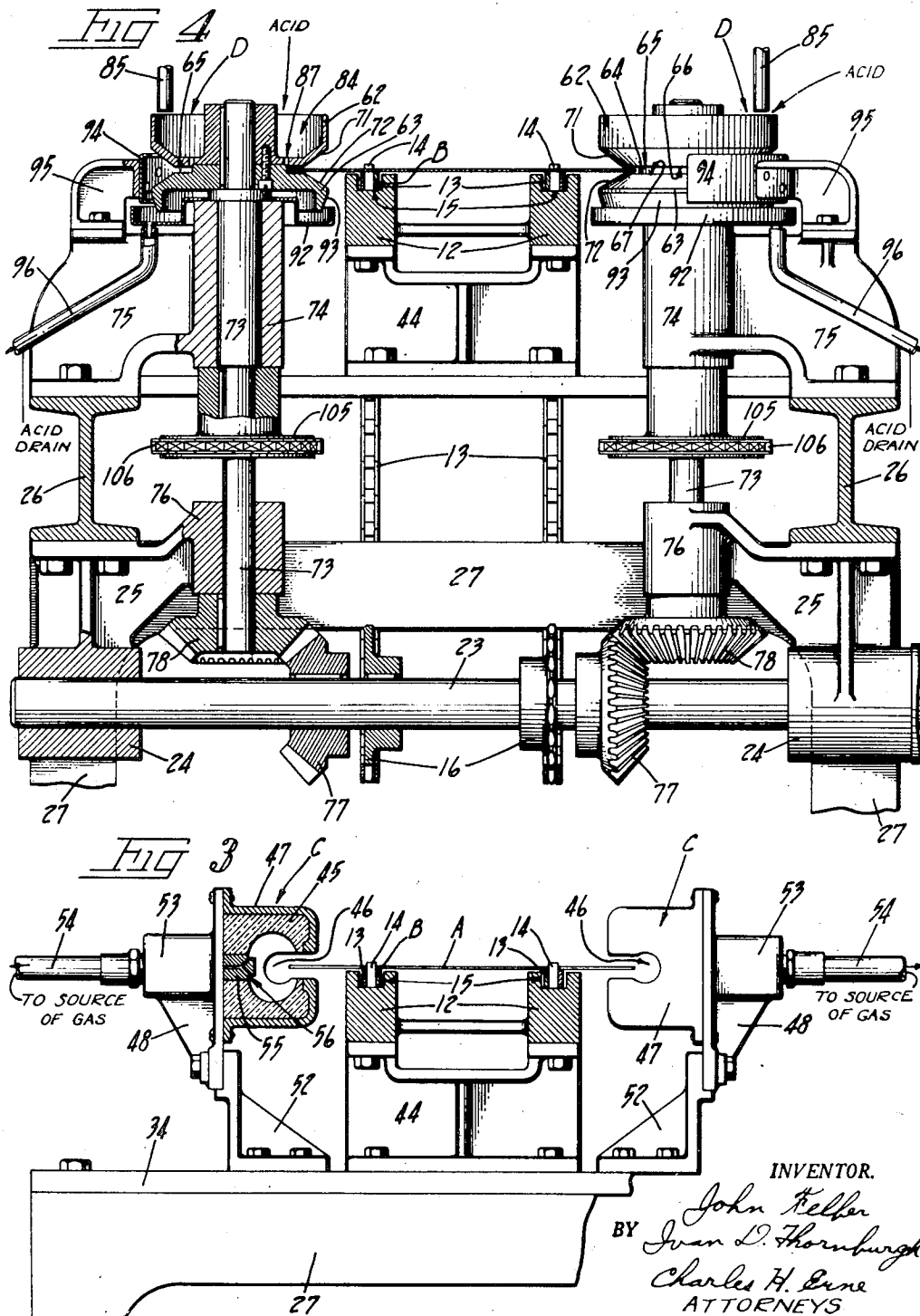
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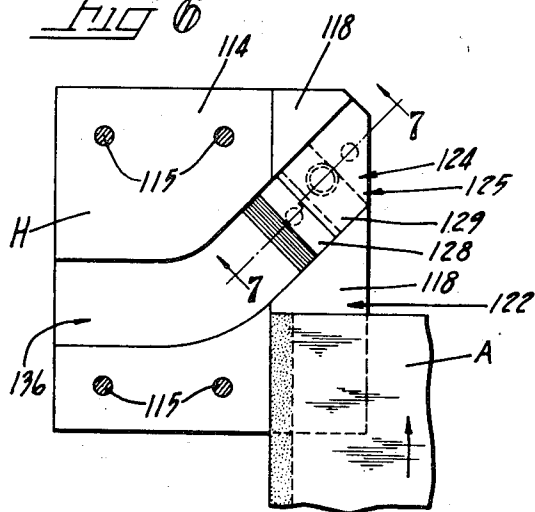
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR TREATING SHEETS WITH A DEOXIDIZING MEDIUM

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11 Claims. (Cl. 134—3)

1

This invention relates to a method of and apparatus for treating metallic sheets with a deoxidizing medium and has particular reference to confining the application of predetermined amounts of such a medium to marginal edge portions of preheated sheets and to drying the medium on the sheets.

In manufacturing sheet metal containers from untinned steel or iron blanks, usually referred to as black iron or black plate blanks, it has been found expedient to deoxidize the black plate blanks before attempting to solder or weld them to produce joints or seams. When making certain kinds of cans it is customary to solder or weld only the side seam, hence it is necessary to deoxidize only the side seam areas of such a blank. The treatment of certain portions of a blank is effected usually by flowing a stream of liquid deoxidizing medium or acid over the surface to be soldered. However, this flowing method requires the use of large quantities of acid, large supply and collecting tanks for reclaiming the acid, which when reused also requires constant care in maintaining uniform strength of the same.

This instant invention contemplates overcoming these difficulties by providing a method of and apparatus for applying a predetermined amount of uniform strength acid along portions of heated and continuously moving sheets to hasten the chemical or deoxidizing action on the coated area of each sheet.

An object of the invention is the provision of a method of and apparatus for applying regulated and adequate quantities of uniform strength acid onto marginal edge portions of preheated metallic sheets and thereafter further heating the acid treated edge portions for accelerating the chemical action of the acid and for drying the acid on the sheets.

Another object of the invention is the provision of a method of and an apparatus for applying layers of acid coating, successively, on edge portions of sheets, the edge portions first being preheated prior to application of the acid coating and then reheated after each layer of coating is applied to prepare the sheets for subsequent can making operations.

A further object is the provision of an apparatus for regulating the application of a liquid acid deoxidizing agent to the opposite marginal edge portions of heated metallic sheets wherein pairs or sets of rotatable wheels are interposed between spaced heating elements located on opposite sides and adjacent the path of travel of

2

the sheets, the wheels having annular openings or separations, between which the sheet edges pass, such edges substantially floating in an acid of uniform strength which results in the application of layers of the acid along the marginal edge portions which are preheated, dried and reheated as an incident to treating the sheets successively.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a top plan view of a deoxidizing apparatus embodying the present invention and which may be used to carry out the method steps, parts of the apparatus being broken away, the view illustrating a procession of sheets in the apparatus;

Fig. 2 is a longitudinal section taken substantially along the line 2—2 in Fig. 1, with parts broken away;

Fig. 3 is an enlarged transverse section taken substantially along the line 3—3 in Fig. 2, parts being broken away and showing a sheet in place for heating;

Fig. 4 is an enlarged transverse section taken substantially along the line 4—4 in Fig. 2, with parts broken away and showing a sheet in position for coating opposite edge portions;

Fig. 5 is an enlarged transverse section taken substantially along the line 5—5 in Fig. 2, with parts broken away and showing a portion of a sheet in a treating position;

Fig. 6 is a plan view taken substantially along a plane indicated by the line 6—6 in Fig. 5, and drawn to a greatly enlarged scale and showing a portion of a sheet in place; and

Fig. 7 is an enlarged sectional detail taken substantially along the broken lines 7—7 in Fig. 6, with parts broken away and showing a sheet in dry-treating position.

As a preferred embodiment of the instant invention, the drawings illustrate an apparatus in which substantially rectangular sheets or blanks A are subjected to a deoxidizing treatment in accordance with the method steps of the invention. In this treatment a liquid deoxidizing medium such as diluted hydrochloric or sulphuric acid, having uniform strength, is applied along oppositely defined marginal edge portions of heated sheets to deoxidize only such portions. This treatment may be used to prepare side seam edge portions of blanks which later are

3

formed into can bodies in the conventional manner.

Sheets to be treated preferably are placed in a horizontal position so that individual sheets are supported on a conveyor B with the marginal edge portions extended outwardly on opposite sides thereof (Figs. 1 and 2). The sheets are carried along in a horizontal plane by the conveyor and are passed through openings in a pair of radiant heating elements C. These elements are disposed on opposite sides of the conveyor and preheat the upper and lower marginal edge portions on each side of the moving sheets (Fig. 3).

The pre-heated sheets then are passed between sets of rotatable wheels D which are located adjacent the heating elements C (Figs. 1, 2 and 4). These wheels apply an even coating of uniform-strength acid along the upper and lower marginal edge portions and on opposite sides of the sheets as they are advanced.

The preheated sheets, upon being coated with the deoxidizing medium, are reheated to dry the acid on the sheets and to accelerate the chemical action of the acid. This reheating operation like that of the preheating, is done by a pair of radiant heating elements E located adjacent the wheels D and disposed in the path of travel of the sheets (Figs. 1 and 2). The elements E are substantially the same as the elements C.

Following the reheating of the marginal acid coated edge portions, these initially coated and substantially dried sheets are passed between a second or auxiliary set of deoxidizing wheels F. These wheels are rotatable and are disposed adjacent the heating elements E and are substantially the same as the wheels D hereinbefore disclosed.

The wheels F apply a second or an additional coating of acid onto the sheet edge portions. Following this second application of acid the sheet edge portions again are reheated to dry the acid and to accelerate its deoxidizing action. This second or auxiliary reheating is done by passing the sheets through openings in heating elements G, located adjacent the wheels F. These heating elements are similar to the heating elements C and E previously mentioned.

Any undried or excess acid adhering to the deoxidized edge portions of the sheets, following the auxiliary reheating operation, is removed. Such acid removal is brought about by passing the advancing sheets through air drying units H (Figs. 1, 2, 5 and 6), which are located adjacent the auxiliary heating units G. In these units a blast of compressed air is blown against the oppositely coated edge portions of each sheet thus removing any remaining moisture.

To insure thorough drying of the edge portions of each sheet before leaving the machine, the sheets after leaving the air drying units H immediately pass through radiant heating element I (Figs. 1 and 2). The heating elements I are substantially the same as the elements C, E and G previously mentioned. The elements I reheat the edge portions again and thereby completely dry the residual acid coating on the treated sheets. This completes the deoxidizing treatment and the sheets then are discharged from the apparatus, for handling in the usual practices of can manufacture.

Referring more in detail to the drawings and to the parts which make up the apparatus for carrying out this present method, the sheets or blanks A to be treated preferably are fed indi-

4

vidually and in timed relation from a supply of such sheets or from an adjacent machine, which for the purpose of this invention need not be shown. The individual sheets are received and are supported in a horizontal position on the conveyor B (Figs. 1 and 2) which operates continuously and which advances the sheets along a pair of spaced and parallel support rails 12 toward the discharge end of the machine.

The conveyor B includes a pair of spaced and parallel endless chains 13, each having a plurality of feed fingers 14 (Fig. 1) spaced at intervals therealong for advancing the sheets. The chains travel in unison through guide channels 15 formed in the tops of the support rails 12 (see also Figs. 2, 3, 4 and 5). These chains operate over a pair of driving sprockets 16 and over three pairs of idler sprockets 17, 18, 22.

The driving sprockets 16 are disposed under the support rails 12 and are mounted on a main drive shaft 23, journaled in bearings 24 formed in brackets 25 which are secured to the under side of two main I-beams 26 onto which the support rails are indirectly fastened as will be explained hereinafter. The beams extend longitudinally of the machine and are bolted to frame legs 27 disposed at each end of the machine. The main drive shaft 23 may be rotated in any suitable manner.

The idler sprockets 17 (Figs. 1 and 2) are located at the entrance end of the machine and are mounted on a transverse shaft 28 carried in bearings 32 of brackets 33 secured to cross plate 34 which is bolted on the top of the main I-beams 26. In similar manner, the idler sprockets 18 are disposed at the discharge end of the apparatus and are mounted on a horizontal shaft 35 carried in bearings 36 of brackets 37 which are secured to a cross plate 38 bolted on the top of main I-beams 26.

The idler sprockets 22 are located below the sprockets 18 and are mounted on a cross shaft 42 carried in bearings of brackets 43. The brackets are bolted to the frame leg 27 which is disposed at the discharge end of the apparatus. The sheet support rails 12 are carried on a pair of brackets 44 mounted on the cross plates 34, 38 at the entrance and at the discharge ends of the machine (Figs. 1 and 2).

Pre-heating of the sheet edges which overhang the support rails 12 is brought about by the radiant heating elements C previously mentioned. These heating elements (of which there are two, Figs. 1 and 3), are located one on each side of the conveyor. Each element comprises a cross sectional horseshoe-shaped ceramic body 45 disposed so that the edge portion of the advancing sheets may pass through an opening 46 in the body, while the machine is operating. Each ceramic body is carried in a casing 47 secured to an element holder 48 bolted to a bracket 52 mounted on the cross plate 34.

Each holder 48 is formed with a boss 53 which encloses a gas chamber for receiving gas, such as illuminating or "Kemp Gas," by way of a pipe 54, one end of which is threaded into the corresponding boss 53. This pipe leads from any suitable source of gas supply. The gas is delivered to a burner 55 (Fig. 3) disposed in the ceramic body

This burner is formed with orifices 56 arranged in the shape of the letter Y and when the gas is ignited, produces a gas flame that heats the inner curved surfaces of the ceramic body.

Hence as the edge portions of the advancing sheets move through the heating elements C

5

(Figs. 1 and 2) the heat of the ceramic bodies 45 is radiated against both surfaces along the opposite sides of the sheets and thus subjects these surfaces to a preheating treatment in preparation for receiving the first coating of deoxidizing medium. The pre-heated sheet as it leaves the heating elements C, passes between the acid applying wheels D of which there are two sets, which are located on opposite sides of the conveyor (Fig. 4) as hereinbefore mentioned.

The acid applying wheels D comprise an upper dish-shaped wheel 62 (Fig. 4) and a lower inverted dish-shaped wheel 63. The wheels 62, 63 are secured together in back-to-back relation so that a stepped section 64 formed on the lower wheel provides an annular groove or channel 65. This groove includes a horizontal face 66 on the upper wheel and a horizontal face 67 on the lower. The groove is slightly wider than the thickness of a sheet and therefore the sheet passes between the wheel faces so that the deoxidizing medium flows around the edge portions of the sheet and substantially floats the sheet as it advances. The face 67 of the lower wheel is slightly below the horizontal plane of the upper surface of the conveyor B.

The depth of the groove 65 preferably is equivalent to that of the desired marginal or edge portions of the sheets which are to be coated. The faces 66, 67 merge into diverging tapered surfaces 71, 72 formed on the upper and lower wheels (Fig. 4).

Each set of rotatable wheels D is mounted on the upper end of a vertical shaft 73 (Fig. 4) journaled in a bearing 74 of a bracket 75 bolted to the frame beam 26 and in a bearing 76 in the bracket 25. Each of the shafts 73 is operated from the drive shaft 23 through the medium of bevel gears 77 mounted on the shaft 23. Each gear 77 meshes with and drives a bevel gear 78 secured to the lower end of each shaft 73.

Acid for deoxidizing the edge portions of the sheets is supplied from one of two acid supply tanks 81 located above and on each side of the conveyor B. Only one tank is shown in the drawings (see Fig. 2). These tanks are mounted on an arch frame 82 which is secured to and is supported by a cross plate 83 which extends across the machine and is bolted to the I-beams 26. The acid from the supply tanks is fed by gravity to a feed reservoir 84 in each of the dish-shaped wheels 62 by pipes 85 (see also Fig. 4) which lead from the tanks to the reservoirs. The flow of acid may be regulated as desired or may be entirely shut off by means of a valve 86 in each pipe line.

The acid coming into contact with the marginal edge portions of the sheets flows from the individual feed reservoirs 84 into the wheel grooves 65 by way of a plurality of small openings 87 in the upper wheel 62 (Figs. 1 and 4). This provides even and controlled distribution of the acid onto the edge portions of each sheet advancing between the wheels D and makes it easier to maintain more uniform acid strength.

Provision is made for draining away any excess or unused acid fed into the wheel grooves 65. For this purpose a drip basin 92 is located beneath each of the lower wheels 63 to collect excess acid flowing outwardly over the face 67, downwardly over the surface 72 and finally it drips off of a depending wall 93 on each of the lower wheels.

Guards 94 (Fig. 4) partially surround the lower wheels 63 and prevent throwing of acid from the wheels onto other parts of the apparatus. These

6

guards are carried on supports 95 which are secured to the brackets 75. Acid collected in the drip basins 92 may be drained away into a catch basin or the like by means of pipes 96 (Figs. 2 and 4) which lead from the bottom of the drip basins.

After the application of the acid coating onto its edge portions, an advancing sheet is heated a second time while it moves through openings in the radiant heating elements E. These heating elements are substantially the same as the heating elements C previously described and are for the purpose of reheating the coated edge portions to dry the acid and to accelerate its chemical reaction. Each element E is carried on a bracket 97 (Figs. 1 and 2) mounted on the cross plate 83.

Following the second heating and drying operations on the initial acid coating, the reheated sheet continues its advancement along the conveyor and next passes between the auxiliary set of deoxidizing wheels F. The wheels F are substantially the same in construction and operation as the wheels D previously described and each wheel is mounted on the upper end of a vertical rotatable shaft 102. The shafts 102 are journaled in bearings 103 formed in brackets 104 bolted to the I-beams 26.

Each of the shafts 102 is rotated from and in unison with the associated shaft 73 disposed on the same side of the apparatus. For this purpose a drive chain sprocket 105 is mounted on each shaft 73 and is rotated by an endless drive chain 106. Each chain also operates over a sprocket 107 secured to the lower end of the associated shaft 102. The wheels D and F thus rotate at the same rate of speed.

After the second coating of acid has been applied to its edge portions, the advancing sheet is heated a third time, this time as it passes through openings in the radiant heating elements G. These heating elements are substantially the same in construction as the heating elements C previously described. The elements G hasten the drying of the second acid coating on the edge portions of the sheet and thus complete the deoxidizing treatment of such sheets. Each element G (Figs. 1 and 2) is carried on a bracket 108 mounted on a cross plate 112 which is bolted to the I-beams 26.

Following the third application of heat, the double coating of acid on the edge portions now is subjected to a blast of compressed air to remove any excess of undried acid adhering thereto. Thus as each sheet leaves the heating elements G, it passes immediately through the air drying units H, of which there are two, one unit being located on each side of the machine (Figs. 1 and 2).

Each drying unit H includes a pair of horizontally disposed plates, an upper plate 113 (see also Figs. 5 and 7) and a lower plate 114 (Fig. 6) which are held together by cap screws 115. This provides a unitary structure. These drying units are secured to individual bracket supports 116 which are bolted to the I-beams 26. The inner edges of these plates are formed with stepped recesses 117, 118 which provide a horizontal opening 122 on each side of the sheet travel through which the opposite edge portions of the sheets pass as the sheets advance through the units.

Plates 113, 114 also have recesses 123, 124 cut in adjacent faces. These recesses are deeper than the recesses 117, 118 (Figs. 6 and 7) the inner ends of the former cutting across the latter

at an angle of about 45 degrees, and extending forward in the direction of travel of the sheet. Each angular inner section of the recesses 123, 124 merges into a curved intermediate section which in turn passes into an outer end extension at right angles to the sheet travel. In a space 125 between the plates at the inner angular ends of the recesses, upper nozzle insert blocks 126, 127 are secured to the upper plate 113 by cap screws 132. Directly beneath lower nozzle insert blocks 128, 129 are secured to the lower plate 114, by cap screws 133.

The upper and lower nozzle blocks on each side are so shaped and so located as to set off between them outwardly inclined nozzle openings 134 having the width of the recesses 123, 124. The discharge end of each nozzle opening terminates one above and the other below the corresponding surface of a sheet passing through the unit. Each discharge opening is located a predetermined distance inwardly from the marginal edges of the sheet and therefore is fully within the boundaries of the sheet (Fig. 6). At the top and at the bottom the nozzle openings 134 communicate with air supply pipes 135 which are threaded into the plates 113, 114. These pipes lead from any suitable source of compressed air.

Hence as a sheet passes between the unit plates 113, 114 on its way toward the discharge end of the machine, compressed air from the pipes 135 flows into and through the nozzle openings 134 and is projected simultaneously against both surfaces of the passing sheet. This air hits the sheet from within its marginal edges and is directed backwardly and outwardly over the edge portions of the sheet. The air in sweeping across these portions and across the acid coatings applied thereto, blows off the excess or undried acid remaining on the sheet.

The excess acid removed from the sheet is blown through a chamber 136 located in the outer end extension of the recesses 123, 124, this being in the outer space 125. Such acid may be collected at the exit of each chamber in any suitable manner.

To insure that the residual acid coating on the deoxidized edge portions of the sheets is perfectly dry before leaving the apparatus, the sheets upon leaving the air drying units H immediately pass through radiant heating elements I (Figs. 1 and 2). Here they are heated a fourth time including the pre-heating, as hereinbefore mentioned. These heating elements I of which there are two, are substantially the same in detail as the heating elements C hereinbefore described. The heating elements I like C, E, and G are located one on each side of the machine. Each element I is carried on a bracket 137 bolted to the cross plate 38.

Hence as the doubly acid-coated edge portions of the advancing sheet move through the heating elements I, the heat of the ceramic body 45 is radiated against both surfaces at opposite ends of the sheet and thus subjects the residual coating on each sheet to the fourth heating or final quick-drying action. It is this radiated heat that insures completely dried and continuous acid coatings on the treated edge portions before the sheets are discharged from the machine. The sheets are discharged from the machine in any suitable manner.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form,

construction, and arrangement of parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the process described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of a conveyor for advancing the sheets through the machine, heating means disposed adjacent the path of travel of the sheets for heating opposite edge portions only to be treated, rotary means disposed adjacent the path of travel of the sheets and on opposite sides of said heating means for successively applying at spaced stations in the path of travel of the sheets a deoxidizing medium onto the heated edge portions for deoxidizing such portions, and air blast means disposed further in the path of the sheets for removing the excess deoxidizing medium from said deoxidized portions of the sheets.
2. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of a conveyor for advancing the sheets through the machine, heating means disposed adjacent the path of travel of the sheets for heating opposite edge portions thereof to be treated, rotary means disposed adjacent the path of travel of the sheets and in advance of said heating means for applying a deoxidizing medium onto the said heated edge portions for deoxidizing such portions, air blast means disposed further in the path of the sheets for removing the excess deoxidizing medium from said heated and deoxidized portions, and drying elements also disposed in the path of travel of the sheets for drying said deoxidized edge portions of the sheets.
3. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of means for pre-heating opposite edge portions of a sheet to be treated, rotary means for applying a coating of a deoxidizing fluid onto the said pre-heated edge portions of the sheet for deoxidizing such portions, re-heating means for heating the deoxidized portions, means disposed further in the path of travel of the sheets for applying an additional coating of deoxidizing fluid to the said sheet edge portions, and means for thereafter removing excess deoxidizing fluid from said deoxidized and re-heated edge portions of the sheet.
4. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of means for pre-heating an edge portion of a sheet to be treated, rotary means for applying a coating of a deoxidizing fluid onto the pre-heated edge portion of the sheet for deoxidizing such portion, re-heating means disposed later in the path of travel of the sheet for heating the deoxidized portion, auxiliary rotatable deoxidizing means disposed further in the path of travel of the sheet for applying a second coating of deoxidizing fluid onto the said re-heated and deoxidized edge portion of the sheet, auxiliary re-heating means disposed still further in the path of travel of the sheet for heating the treated portion of the sheet after the second coating of deoxidizing fluid has been applied thereto, and air blast means disposed still further in the path of travel of the sheet for thereafter removing excess deoxidizing fluid from

said deoxidized and re-heated edge portion of the sheet.

5. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of a conveyor for advancing the sheets through the machine, heating means disposed adjacent the path of travel of the sheets for heating an edge portion to be treated, a deoxidizing device disposed adjacent the path of travel of the sheets and in advance of said heating means, said deoxidizing device including a rotatable wheel having an annular channel through which the edge portions to be treated pass as the sheets advance past said device, a reservoir connecting with the channel in said wheel for feeding a deoxidizing fluid to the channel and onto the edge portions passing through the channel for deoxidizing such edge portions, and means disposed adjacent the path of further travel of the sheets for removing excess deoxidizing fluid from the treated edge portions.

6. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of means for heating both sides of opposite edge portions of a sheet to be treated, rotatable means for applying a deoxidizing liquid onto said heated portions of the sheet for deoxidizing such edge portions, and a plurality of air blast means for ejecting vertically spaced streams of air outwardly against and across the said deoxidized edge portions on opposite sides of the sheet for removing excess deoxidizing liquid from said edge portions.

7. In a machine for treating metallic sheets to permit soldering or welding thereof, the combination of means for heating both sides of opposite edge portions of a sheet to be treated, rotatable means for applying a deoxidizing liquid onto said heated portions of the sheet for deoxidizing such edge portions, a plurality of vertically spaced pairs of air blast means for ejecting streams of air outwardly against and across the said deoxidized edge portions on opposite sides of the sheet edge portions for removing excess deoxidizing liquid from said edge portions and radiant heater means disposed on opposite sides of the sheet at opposite edges thereof for thereafter drying any of the deoxidizing liquid remaining on the deoxidized portions of the sheets.

8. The method of treating the marginal edge portions of flat metallic sheets to permit soldering or welding thereof, which comprises continuously moving the sheets along a predetermined path of travel, heating only a said marginal edge portion of the sheet by passing the edge portion through a confined zone of intense heat to rapidly heat the edge portion, flowing with a rotary motion imparted in a plane substantially parallel to the plane of the moving sheet a coating of liquid deoxidizing medium onto the said heated marginal edge portion by passing such edge portion through a restricted zone of the liquid medium so that a floating effect is obtained in the coating step, and then removing the excess deoxidizing medium from the coated edge portion to leave a predetermined amount of said medium deposited thereon.

9. The method of treating the marginal edge portions of flat metallic sheets to permit soldering or welding thereof, which comprises moving the sheets along a predetermined path of travel,

heating only the said marginal edge portions of the sheet, applying with a rotary motion in a plane substantially parallel to the plane of the moving sheet a coating of liquid deoxidizing medium solely onto the said heated marginal edge portions, and thereafter removing the excess deoxidizing medium from the coated edge portions to leave a predetermined amount of said medium deposited thereon.

10. The method of treating the marginal edge portions of flat metallic sheets to permit soldering or welding thereof, which comprises moving the sheets along a predetermined path of travel, heating the said marginal edge portions only of the sheet, applying with a rotary motion in a plane substantially parallel to the plane of the moving sheet a coating of liquid deoxidizing medium solely onto said heated marginal edge portions, re-heating the coated marginal edge portions to accelerate the chemical action of said deoxidizing medium and to dry the said medium thereon, applying an additional coating of liquid deoxidizing medium solely onto the coated and substantially dried marginal edge portions, and thereafter again heating the applied coatings of deoxidizing medium to dry the coating on the sheet edge portions.

11. The method of treating the marginal edge portions of flat metallic sheets to permit soldering or welding thereof, which comprises continuously moving the sheets along a predetermined path of travel, heating the said marginal edge portion of the sheet, applying with a rotary motion imparted substantially in the plane of the moving sheet a coating of liquid deoxidizing medium onto the marginal edge portions, re-heating the coated edge portions to accelerate the chemical action of said deoxidizing medium and to dry the said medium thereon, applying with a rotary motion also imparted substantially in the plane of the moving sheets an additional coating of liquid deoxidizing medium onto the coated and substantially dried marginal edge portions, further heating the applied coatings of deoxidizing medium to dry the coatings on the sheet, blowing the excess deoxidizing medium from the coated edge portions, and finally again heating the residual deoxidizing medium to dry the same on the sheet edge portions.

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