

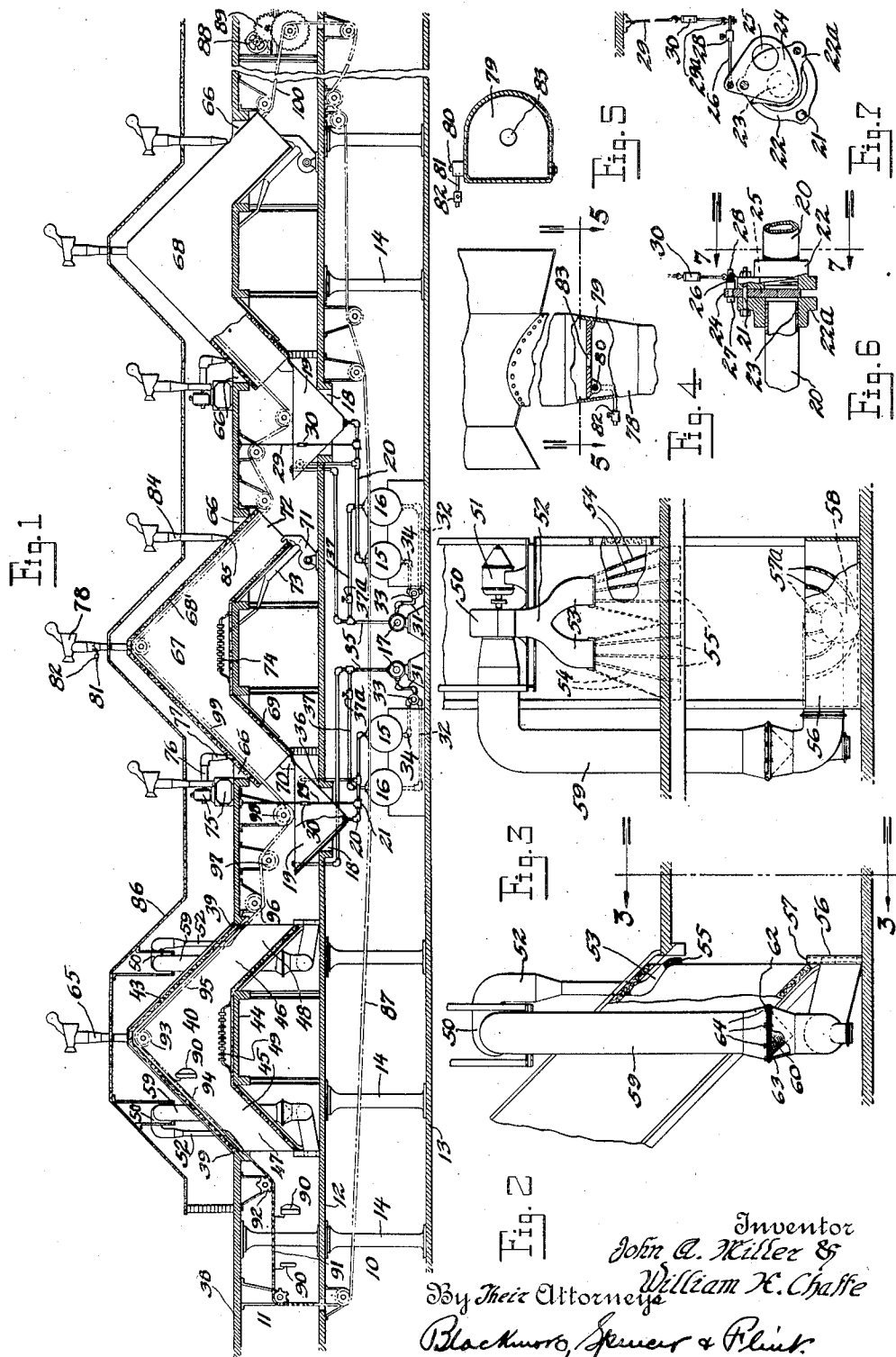
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W. H. CHAFFE ET AL

COATING AND BAKING APPARATUS FOR AUTOMOBILE PARTS AND THE LIKE

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UNITED STATES PATENT OFFICE.

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COATING AND BAKING APPARATUS FOR AUTOMOBILE PARTS AND THE LIKE.

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To all whom it may concern:

Be it known that we, WILLIAM H. CHAFFE and JOHN A. MILLER, citizens of the United States, and residents of Detroit, Wayne County, State of Michigan, and Tarrytown, Westchester County, State of New York, respectively, have invented certain new and useful Improvements in Coating and Baking Apparatus for Automobile Parts and the like, of which the following is a full, clear, concise, and exact description, such as will enable others skilled in the art to which the invention relates to make and use the same, reference being made therein to the accompanying drawings, which form a part of this specification.

This invention relates to processes of, and apparatuses for, applying and drying or baking protective coatings on metallic bodies and articles of various classes.

One of the objects of the invention is the provision of new and improved means for cleaning the surfaces of bodies, or articles preparatory to their being subjected to the coating process.

Another object of the invention is the provision of a system whereby articles may be cleaned, coated, and the coatings baked on the articles in a continuous operation and in quantity production.

A still further object of the invention is to provide a new and improved apparatus for drying and baking a protective covering on vehicle bodies, fenders, parts of vehicles and other articles.

Other and further objects and advantages of the invention will appear as the description proceeds.

On the drawings:

Figure 1 is a vertical section of an enameling plant shown more or less diagrammatically with parts broken away;

Figure 2 is a side elevation of a portion of the cleaning oven, parts broken away and parts in section;

Figure 3 is a vertical section on line 3—3 of Figure 2, showing the arrangement of the air curtain mechanism;

Figure 4 is a detail view of the balanced valve arrangement for the ventilators, with parts in section and parts broken away;

Figure 5 is a sectional view on line 5—5 of Figure 4;

Figure 6 is a detail view of the safety

valve arrangement, parts in section and parts broken away; and

Figure 7 is a sectional view on line 7—7, Figure 6, with parts in section and parts broken away.

In the enameling of automobile fenders, bodies and parts thereof in quantity production it has become necessary to construct plants of very large capacity for this purpose which are capable of performing this work automatically and continuously.

The present invention is so designed that it may also be installed in buildings that were not originally designed for this purpose by making a minimum amount of changes in the building.

The enameling, painting, and other methods of coating automobiles and parts thereof has become such a necessary equipment for the automobile plant that usually buildings are erected especially for this purpose. An embodiment of the invention is shown on the drawing as being associated with a building that is specially designed for this purpose.

For simplicity in illustration and convenience in description, the device is shown more or less diagrammatically on the drawings and the description is limited thereto.

In Figure 1 of the drawing a building is shown that is composed of two stories forming a lower chamber or compartment 10 and the upper chamber or compartment 11. The floor 12 of the upper chamber or compartment may be supported from the lower floor 13 by any suitable means such as the supports 14. On the bottom of the floor 13 are mounted the purifying tanks 15, reservoirs 16, pumps 17 and the various pipes and connections.

The floor 12 of the upper compartment is provided with one or more openings 18 in which are mounted the vats 19 which are adapted to contain the protective coating. These vats may be of any shape or form and secured in the openings 18 in any suitable manner. As shown, they are in the form of an inverted wedge and are secured in the openings 18 in such a manner that they extend both above and below the floor 12. Since the vats and their attendant tanks, reservoirs and pumps are identical, only one set will be described. A pipe 20 has one end secured to the lower conical end of the vat 19 and has its other end secured in an inlet

in the upper portion of the purifying tank 15, whereby the liquid enameling composition may be permitted to run by gravity from the vat 19 down into the purifying tank 15. The pipe 20 contains a valve 21 which is adapted to retain the enameling composition in the vat 19.

The valve 21 may be of any suitable construction but is so arranged that in case of fire it will automatically open and permit the discharge of the enameling composition into a suitable dumping tank 15. This valve 21 is also so arranged that it may be operated manually. As shown in Figures 6 and 7, this valve may consist of two sided plates 22 and 22^a having the circular openings 23—23 therein in which are secured the adjacent ends of pipe sections 20, respectively, and between these plates is pivoted the valve member 24 having the opening 25 therein. The valve is provided with an arm 26 rigidly connected to the valve member 24 by means of the bolt 27, for operating said valve. A weight 28 slidably mounted on the arm 26 tends to open the valve, i. e., it tends to move the valve member 24 to such a position that the opening 25 therein is in alignment with the opening in the pipe 20. The valve member 24 is held in closed position, that is, the arm 26 is held in elevated position by means of the supporting member 29 which may be detachably connected to the arm 26 in any suitable manner, as by means of the hook 29^a. By detaching the hook 29^a from the arm 26 the valve member may be manually operated.

In devices of this nature which employ volatile, highly inflammable, materials it is desirable to provide means for automatically preventing the spread of accidental conflagration and for this reason means are provided whereby in case of fire the liquid in the vats will be automatically dumped into the purifying tank.

In the form shown, hook member 29^a comprises a fusible portion or link 30 and when the temperature about the link reaches a predetermined maximum the link will melt thus severing the connection between the supporting member 29 and the arm 26 to thereby permit the weight 28 to descend by gravity and automatically open the valve 21.

The pump 17 is in communication with the bottom part of the reservoir 16 by means of the passages 31 and 32 through the three way valve 33 and is also in communication with the bottom part of the tank 15 through the passages 31 and 34 through the three way valve 33. The three-way valve 33 permits the pump to be placed in communication with either the reservoir 16 or the tank 15. The pump 17 is adapted to deliver liquid through the pipe or passage 35 into the vat 19. The vat 19 is provided with an overflow pipe 36 which is in communication

with the pipe or passage 20 beyond the safety valve 21. A pipe or passage 37 connecting the pipe 35 with the upper portion of the reservoir or tank 16 and provided with the valve 37^a afford means whereby liquid may be pumped from the purifying tank 15 into the reservoir or tank 16.

In the operation of the device, the enameling compound after it has become unfit for further coating is permitted to run down into the purifying tank 15 where it is purified in the usual manner after which it may be pumped into the reservoir or tank 16 from whence it may be pumped into the vat as needed.

Before the enameling composition is applied to the fenders, bodies or other parts of an automobile or other articles, it is necessary to thoroughly clean the surface of the articles before the protective coating is applied. Usually this has been accomplished by subjecting the articles to a bath which contains a cleaning composition, after which the articles are thoroughly dried. It has been found by experiment that the articles may be thoroughly cleansed by heat treatment without the aid, assistance or necessity of a liquid composition of any kind. The articles are heated to a point just below that at which the temper of the metal will be drawn, which reduces the grease and dust to an ash that is afterward removed by a current of air. This method thoroughly cleans the articles and leaves them in a dry and heated condition for the enameling process. Any suitable form of oven may be employed for this purpose. As shown on the drawing, the roof or ceiling 38 of the upper compartment is provided with a plurality of openings 39 through which is adapted to project the oven 40, which may be termed a pre-heating oven and which may be in the form of a wedge. The roof 43 of this oven is in the form of an inverted V which is secured to and extends above the roof 38.

The floor 44 of the oven 40 is on the same level as the roof 38 and may, in fact, be a continuation thereof. The floor 44 is provided at the forward end thereof with an inclined approach 45 and at its other end with an inclined exit 46. The approach and exit are inclined rather than vertical in order that the articles may not interfere with one another during their ascent into, and their descent from, the oven. The approach 45 is provided with side walls 47 and the exit 46 is provided with the side walls 48. By this arrangement the oven 40 is provided with an approach and an exit which are open at their ends and are closed at the top and bottom and along the two sides. The oven is heated by any suitable means such as electric heaters 49 located in said oven.

Means are provided for subjecting the

articles to be cleaned to a current of air as the articles pass up the approach into the oven and also when they pass down and out of the exit. Any suitable arrangement for this purpose may be employed. In the form shown in the drawing, a current or curtain of air is employed at each end of the oven which not only removes the dust, dirt and ashes from the article but also retains the heat within the oven. Since the arrangement at the approach and the exit are the same only the arrangement at the approach will be described.

In the form of the device shown in Figures 2 and 3 of the drawing, a fan 50 operated by the motor 51 blows the air downwardly through the passage 52 across the opening of the approach. The passage 52 may have its lower end so arranged that it delivers the air in the form of a current through the slot 55 which extends the full width of the entrance opening in the approach. In order that the current of air may be uniform the full length of the slot 55 the passage 52 may be bifurcated and the bifurcations 53 provided with the partitions 54 so arranged that they will direct the air uniformly along the slot 55. Secured directly beneath the slot 55 is an air chamber 56 having a slot 57 in the upper edge thereof. This chamber may be provided with arcuate partitions 57^a for directing the air into the opening 58 located in the rear wall of the air chamber 56. The air chamber 56 is connected to the fan 50 by means of an air conduit 59 which is connected to the intake side of the fan and is secured to the air chamber 56 about the opening 58 therein. By means of this arrangement the fan by exhausting the air from the chamber 56 and delivering the same through the slot 55 will not only form an air current across the opening to the approach but will use the same air over and over again. It has been found by experiment that these air currents or screens—one at each end of the oven—forms a closure for retaining the heat within the oven 40. The passage or conduit 59 is adapted to be provided with an inverted cone-shaped screen 60, see Figures 2 and 3, for collecting dust and dirt removed from the articles. The screen 60 may be provided with a suitable flange which is adapted to be clamped between the flanges 62 and 63 of the conduit 59 by any suitable fastening means such as the bolts 64 which permit the removal of the screen for cleaning the same.

The upper portion of the pre-heating chamber 40 is provided with a ventilator 65 which permits the escape of smoke, fumes and obnoxious gases.

The roof, floors and side walls of the pre-heater 40 are insulated for the purpose of retaining the heat therein. The pre-heating or cleaning oven may be associated with the

enameling apparatus or it may be distinct therefrom. As shown on the drawing, the pre-heating oven is associated with the enameling apparatus in such a manner that the cleaning and enameling processes are combined in a single apparatus in such a manner that the processes are continuous.

The roof 38 is also provided with the openings 66 therein through which project a plurality of drying or baking ovens 67 and 68. There will be as many drying or baking ovens as there are coats of the enameling composition to be applied. In other words, there will be a baking oven for each protective coat applied to the article. Since these ovens are alike in construction only the oven 67 need be described. The form of this oven is substantially the same as the pre-heating oven 40 except that the roof 68' thereof may extend slightly below the roof 38 in order to provide a longer roof for the approach and exit.

It will be noted that the oven approach and exit are inclined as in the pre-heating oven. This not only prevents the articles from coming in contact with each other during their ascent into, and their descent from, the oven, but also provides an arrangement whereby the dripping enamel will fall directly on the floor of the approach instead of on the articles below.

The floor 69 of the approach and the vat 19 are so arranged relatively to each other that the enameling composition dripping from the articles within the approach will fall on the floor 69 and be directed back into the vat 19. This may be accomplished by providing an apron or extension 70 to the floor 69.

In the enameling process, after the liquid enamel has been applied to the article it is first necessary to drive off the volatile elements contained in the liquid after which the enamel may be oxidized in the presence of air and heat. It is very essential that all the volatile substances be driven off before a crust begins to form on the enamel, otherwise the portions of the volatile substances will become imprisoned and will later cause discoloration and deterioration of the enamel. In order to accomplish this, means are provided whereby the air is delivered to the oven through the exit end thereof and is exhausted from the inlet side. By this arrangement a great amount of the oxygen of the air is taken up in oxidizing the enamel composition during the baking operation and consequently the air being deprived of a great amount of its oxygen soon after it enters the oven becomes principally a heating agent for driving off the volatile substances of the enamel without oxidizing the same during the entrance and approach of the articles to the hottest portion of the oven. Moreover, the heated articles as they

emerge from the oven will be cooled by this current of air, thus conserving the heat which would otherwise be carried out of the oven by the articles and be dissipated in the surrounding air.

In order to accomplish this we provide a fan 71 which delivers air to the exit end 72 of the baking oven. As is usual, in such constructions the nozzle of this fan extends the full width of the opening 72. A branch conduit 73 is adapted to direct air across the heater 74 for preventing the same from becoming overheated and thereby igniting the explosive gases formed in said oven and for assisting in circulating the air within the oven.

An exhaust fan 75 is located on the roof 38 and has a passage 76 which is provided with a nozzle 77 extending across the approach to the oven. The nozzle 77 is located above the lower end of the approach for a purpose that will presently appear.

The upper portion of the oven may be provided with a ventilator 78 for the escape of smoke, volatile substances and other gases. This ventilator may be provided with a balanced valve 79, see Figures 4 and 5, whereby the valve will open when the pressure within the oven exceeds a predetermined amount. This valve may be of any suitable construction. As shown in Figures 4 and 5, it consists of a valve proper pivoted as at 80. Rigidly attached to the pivot 80 is a crank arm 81 on which is adjustably mounted the weight 82. The weight 82 is adapted to very nearly balance the weight of the valve 79 and is so adjusted that any excessive pressure will open the valve. The valve is provided with an opening 83 whereby smoke fumes, and obnoxious gases may escape at all times during the operation of the apparatus.

A ventilator 84 similar in construction to that shown at 78 may also be employed in the roof 68' of the exit, as at 85. The ovens and fans may be protected by a covering or roof 86 secured above the same in spaced relation to the roof 38.

A suitable endless chain carrier 87 is provided for carrying the articles through the pre-heating and baking ovens, some of which are shown for illustrative purposes at 90 in Figure 1. The carrier is operated by means of a motor 88 which moves the same by means of reduction gearing 89. Suitable sprockets are provided for changing the direction of the travel of the carrier whereby the same is made to take the proper direction in its travel through the apparatus.

In the operation of the device, the articles 90 are applied to the horizontal flight 91 of the carrier at the loading station and from thence they are directed by the pulleys 92 and 93 up the inclined flight 94 and into the pre-heating oven 40 past or through

the air curtain which removes the dust on the articles. As the articles pass through the oven they are heated to a temperature that is sufficient to reduce the oil and grease thereon to an ash but are not heated to a point that will draw the temper of the metal. For instance, the temperature of this oven may be around 500° F. although the temperature may vary depending on various conditions and circumstances.

The carrier chain directed by the sprocket 96 carries the articles down the incline exit 95 of the preheater past or through the air screen, where the ashes of the consumed dust and grease are blown off and the article cooled by the air current sufficiently to be in condition to be dipped in the vat containing the liquid protecting covering.

The sprockets 97 and 98 direct the chain in such a manner that the articles are prevented from coming in contact with the edge of the tank and are dipped in enameling composition after which they are directed up into the inclined approach 99 of the baking oven 67.

As the articles enter the approach to the oven 67 the air within the approach gradually gets warmer, thus causing the enamel to finish its running or dripping before the article reaches the hot part of the oven. As the article passes farther up the approach it becomes still warmer and the volatile substances are driven off before the articles reach the hottest part of the oven. This process is greatly hastened by the fact that the articles are hot when dipped.

As the articles pass on through the oven the enamel is baked thereon and as they pass down the exit of the oven the air forced therein by the ventilating fan 71 will cool the same to such an extent that it is in condition to have the second coat applied.

After passing through the last enameling oven the articles may be removed from the horizontal flight 100 at the removing station. The lower run of the carrier chain may be located in the lower compartment 10 of the building.

While the device is especially adapted for applying enameling composition to automobile parts and other articles, it may also be employed for applying paints, varnishes, and other protective coverings to said parts and articles. In any event, the temperature of the drying ovens must, of course, be regulated to suit the particular operation employed.

It is thought from the foregoing taken in connection with the accompanying drawings that the construction and operation of the device will be apparent to those skilled in the art, and that various changes in size, shape, and proportion and details of construction may be made without departing

from the spirit and scope of the appended claims.

We claim:

1. In a device of the class described, a heating oven of substantially inverted V-form having an opening at substantially the bottom of the leg of the V, a conveyor for travelling articles through the oven, means for directing a current of air across said opening in angular relation to the conveyor for retaining the heat within the oven, and means for supplying heat to the oven in the neighborhood of the apex portion of the inverted V.

2. In a device of the class described, a heating oven having its end parts depressed and its central part elevated thereabove, and having an opening in an end thereof, an article conveyor traversing said oven and opening, means for supplying heated air to the elevated portion of the oven through which articles on the conveyor are passed, and means for directing a curtain of air across the opening, whereby heat is retained in the elevated part of the oven.

3. In a device of the class described, a baking oven having its central portion elevated above its end portions, means for heating air located in the neighborhood of the floor of the central elevated portion of the oven, and means for directing a current of air about said heating means.

4. In a device of the class described, a baking oven of substantially inverted V-form, having openings at substantially the lower ends of the legs of the V, a heater substantially close to the floor of the intermediate elevated portion of the oven, and means for directing a current of air about said heating means.

5. A baking oven of substantially inverted V-form, means for supplying heat therein at the elevated central portion, said oven supplied with an exit opening at substantially the bottom of one leg of the V, and means for introducing air through the exit opening.

6. A baking oven having its end parts relatively low down and the central part relatively elevated, means for supplying heat therein at the elevated portion, said oven supplied with inlet and exit openings at the lower down end parts, a conveyor travelling said oven from inlet to exit end, and means for creating a circulation of air in opposite direction to the travel of the conveyor.

7. In a device of the class described and in combination with a heating oven, a vat located adjacent said oven for containing a liquid protective composition, a container below said vat, a conduit between said vat and container, a valve in said conduit, and means for automatically opening said valve,

when the environment temperature rises above a predetermined maximum.

8. In a device for cleaning articles, an oven provided with an opening, means for heating said oven, means for retaining the heat within said oven, said means including a narrow nozzle extending the full width of said opening and having transverse partitions therein and a fan for forcing air through said nozzle to form a curtain of moving air across said opening.

9. In a device of the class described, a chamber having an inlet opening, means for forming an air curtain closure for said opening, said means including a nozzle located at one edge of said opening, having a narrow slot therein extending the full width of said opening, means for forcing a fluid through said slot across said opening, a chamber having a narrow slot therein opposite said first named slot, and a conduit for completing the return fluid circuit.

10. In a device of the class described, an oven having an entrance portion and an exit portion, means associated with said exit portion for forcing air into said oven, and means associated with said entrance portion for exhausting air from said oven.

11. In a device of the class described, an oven having an entrance and an exit, means for heating said oven, and means for directing a current of air into said oven through said exit and for forcing a current of air about said heater, means adjacent said entrance for exhausting air from said heater, and a ventilator associated with said oven.

12. In a device of the class described, an oven having an inclined entrance and an inclined exit, said entrance and exit in the form of conduits having open outer ends, heating means for said oven, means for automatically conducting articles into and through said oven, and means for forcing air into said oven through the exit end of said oven.

13. In a device of the class described, a pre-heating oven having entrance and exit openings therein, means for directing air curtains across said entrance and exit openings, means for heating said oven, a vat for containing a liquid protective coating, a heating or baking oven having an entrance and an exit, means for heating said oven, an air blower for directing air into said oven through the exit end thereof, an exhaust at the entrance end thereof, and an endless carrier for carrying articles through said pre-heating oven through said air curtains, and for dipping said articles in the composition contained in said tank and for carrying said articles through said heating or baking oven.

14. In a device of the class described, a pre-heating oven having an entrance and

an exit, means for heating said oven, means for directing an air curtain across said exit, a vat containing liquid coating composition, a drying or baking oven having an entrance and an exit, means for heating said drying or baking oven, means for directing air into said last named oven through said exit, a second drying or baking oven having an entrance and an exit, means for heating said oven, means for directing air into said last named oven through the said exit, and an endless carrier for conducting articles through said pre-heating oven, through said air curtain for partially cooling the same, dipping them in said first named vat, conducting them through said first named drying or baking oven, through the air directed into said exit, dipping them in said second vat, conducting them through said second named drying or baking oven through the air directed into the exit end of said oven and finally conducting them to the unloading station.

15. In apparatus for applying coatings to and baking same on articles such as automobile fenders and parts, an endless conveyor for the parts, coat applying means for coating parts on the conveyor, and an oven traversed by the conveyor, said oven being of substantially A-form, and heating means for applying heat sufficient to bake the coating at substantially the central portion of the oven.

16. In apparatus for applying coatings and baking same on articles such as automobile fenders and the like, an endless conveyor for the parts, coat applying means for coating parts on the conveyor, and an oven through which the parts are passed, comprising an upwardly inclined entering portion and a downwardly inclined leaving portion, the latter portion being located substantially adjacent to the former por-

tion, and means for heating the interior of the oven to an extent sufficient to bake the coating at substantially its highest part.

17. In apparatus for applying coatings and baking same on articles such as automobile fenders and the like, coat applying means for coating parts on the conveyor, and an oven traversed by the conveyor after passing the coat applying means, said oven having relatively low down openings at its inlet and outlet respectively, and said oven comprising an upwardly inclined portion through which the articles pass from the inlet and a substantially adjacent downwardly inclined portion through which the articles pass to the outlet, and means for heating the oven to a temperature sufficiently high to bake the coating at substantially the junction of the upwardly and downwardly inclined portions, whereby articles entering the oven are gradually heated and after being subjected to the highest heat are gradually cooled.

18. In apparatus for applying coatings and baking same on articles such as automobile body parts, an endless conveyor for the parts, a coating tank through which parts are carried by the conveyor, and an oven and means for supporting the conveyor in the oven to provide a flight passing upwardly from the coat applying tank on an incline and a second substantially adjacent flight passing downwardly on an incline, and means for heating the oven to a temperature sufficient to bake the coating at substantially the junction of the upward and downward flights, whereby the parts are gradually heated, baked, and gradually cooled as they pass through the oven.

In testimony whereof we affix our signatures.

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