May 14, 1946. J. A. PAASCHE 2,400,315

COATING MACHINE

Filed June 10, 1944 4 Sheets-Sheet 1

Fig. 1.

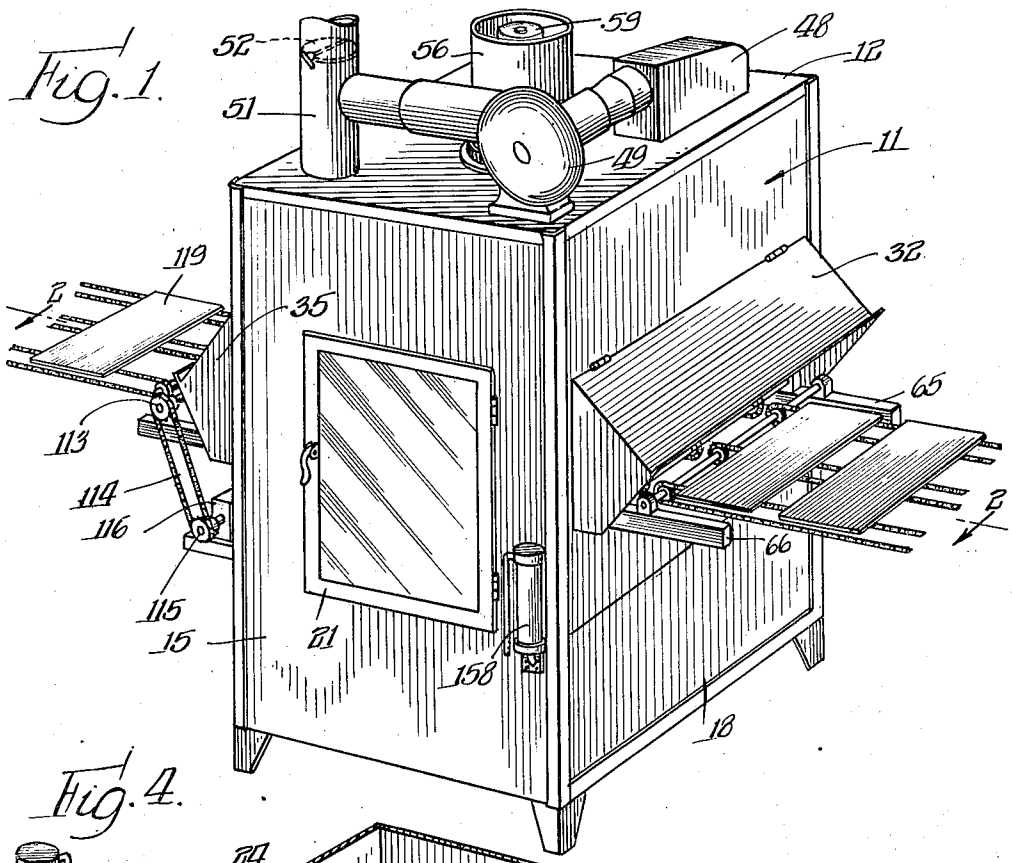
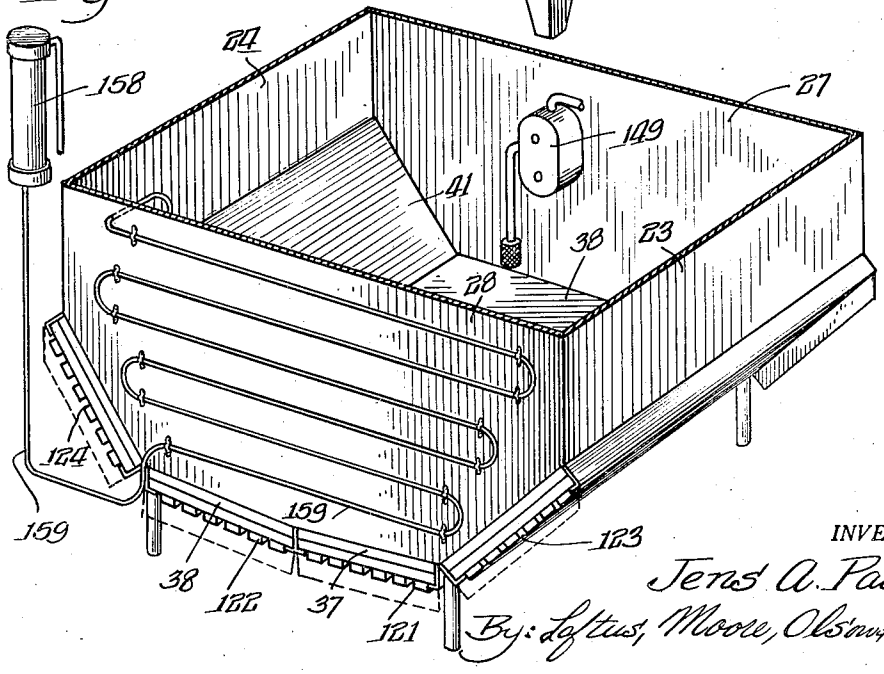


Fig. 4.



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COATING MACHINE

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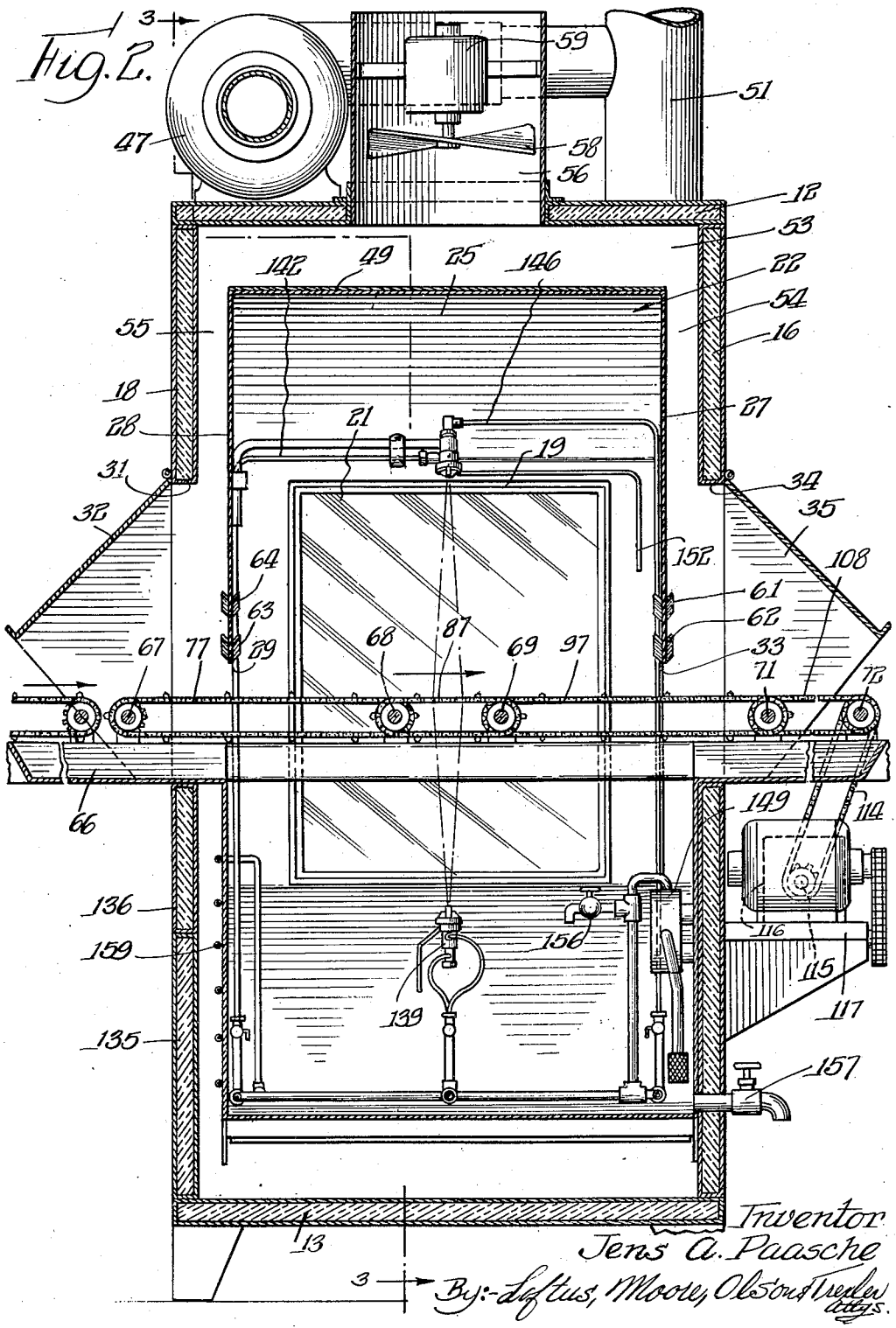
Fig. 2.



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May 14, 1946. J. A. PAASCHE 2,400,315

COATING MACHINE

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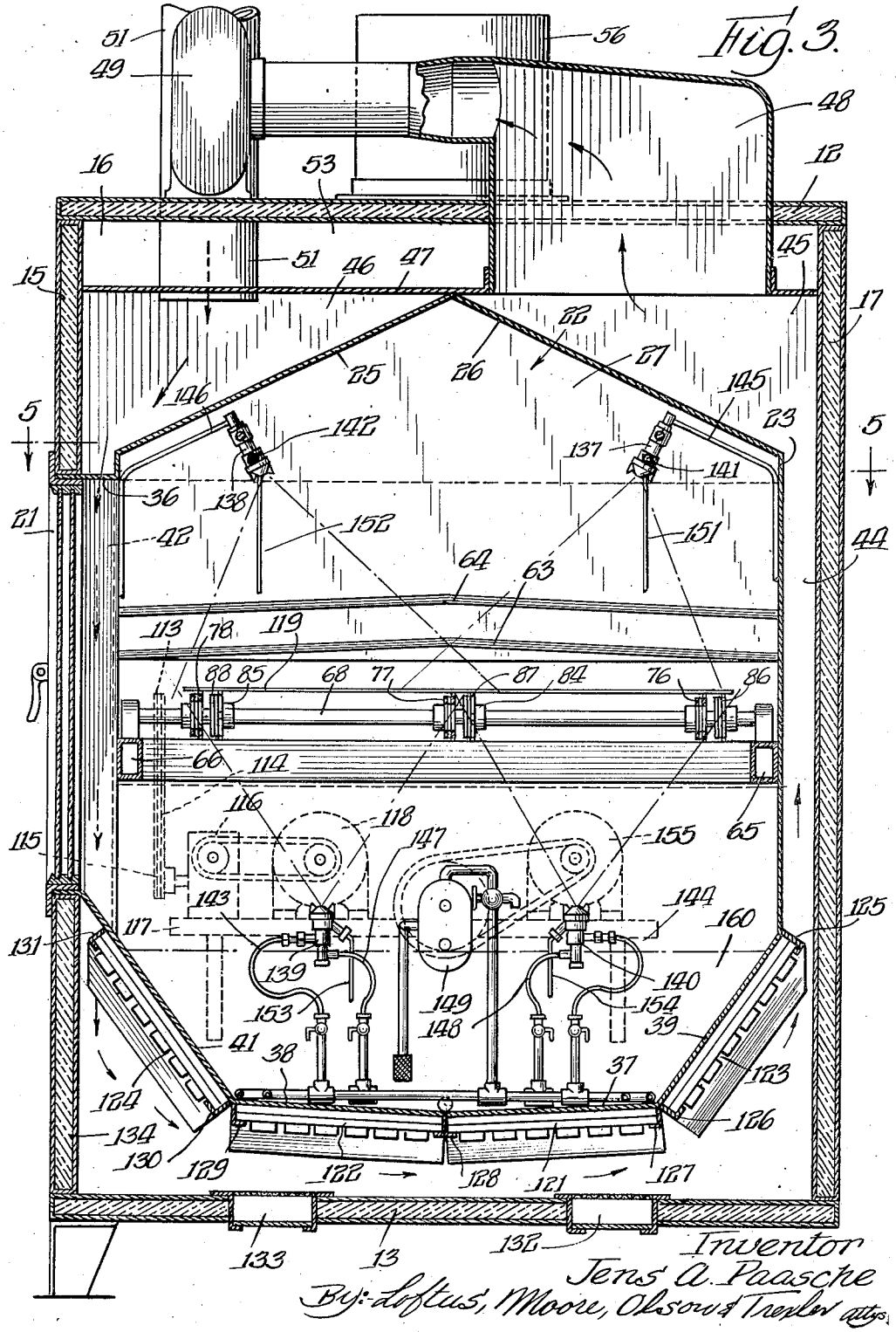
Fig. 3.



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COATING MACHINE

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Fig. 5.

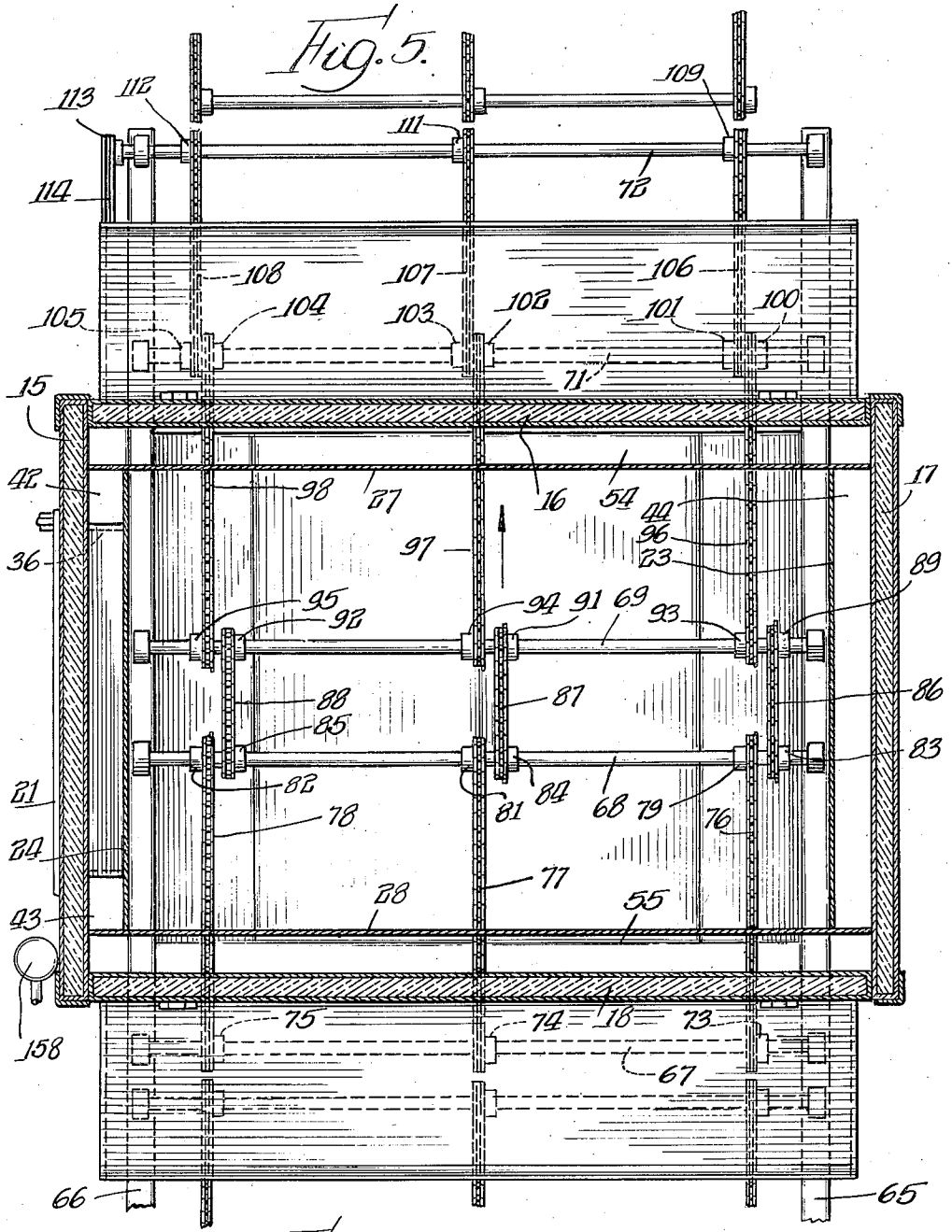
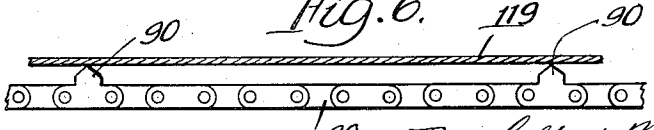


Fig. 6.



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UNITED STATES PATENT OFFICE

2,400,315

COATING MACHINE

Jens A. Paasche, Chicago, Ill.

Application June 10, 1944, Serial No. 539,682

12 Claims. (Cl. 91—45)

The present invention relates to coating machines, and more particularly to a continuously spraying machine for coating articles with heated material such as wax, paraffin or a thermoplastic substance.

In the manufacture of certain articles it is desired to apply protective coating thereto, particularly where such articles are subject to the effects of humidity. In order to completely coat articles with a material such as wax, paraffin, or some thermoplastic substance, with a minimum of effort and a maximum insurance of a uniform coating, it is desirable to utilize a continuous coating apparatus. In providing a continuous coating apparatus numerous factors must be considered in order to provide an even smooth moisture resistant coating. In spraying objects in a closed chamber having air spray guns therein, it is necessary to provide for the removal of air and vaporized particles of the coating material which may pass through the inlet and outlet to the apparatus and come in contact with the articles to be coated at a time when the articles or the particles are not at the proper temperature. Such particles resting upon the articles will cause the coating to be rough and not closely adherent to the article. Since the chamber in which the spraying takes place has certain vaporized particles therein which do not reach the articles to be coated but may strike the walls of the chamber, it is necessary to provide for means to prevent condensated particles from running down the walls and dripping upon the articles as they go through either the inlet or the outlet. In order to provide the best possible uniform coating, it is desirable to minimize as much as possible temperature differentials within the coating chamber. Since articles to be coated are generally supported by a conveyor it also is necessary to provide for a shifting of the point of contact of the articles on the conveyor so that every point on the article may be completely coated with the protective material. In accordance with the present invention there is provided an improved machine for applying a thermoplastic protective coating to the articles passing therethrough, and which makes provisions for the various factors heretofore mentioned and which obviates said disadvantages encountered in machines not having the features incorporated in the present invention.

It therefore is an object of the present invention to provide an improved machine for completely coating articles with a protective material.

It is another object of the present invention to provide an improved coating machine for applying heated material to articles which machine has a minimum of temperature gradients therein.

Still another object of the present invention is to provide an improved spray coating machine the operation of which may be started and stopped without necessitating the disassembly of certain parts thereof.

Other and further objects subsequently will become apparent by reference to the following description taken in connection with the accompanying drawings wherein

Figure 1 is a perspective view of a coating machine embodying the present invention;

Figure 2 is a cross sectional view in the direction of the arrows along the line 2—2 of Figure 1;

Figure 3 is a cross sectional view of the machine as seen in the direction of the arrows along the line 3—3 of Figure 2;

Figure 4 is a perspective view of the lower portion of the inner chamber of the machine;

Figure 5 is a cross sectional view as seen in the direction of the arrows along the line 5—5 of Figure 3; and

Figure 6 is a detailed view of one element of the machine.

Referring more particularly to Figure 1, 2, and 3 of the drawings it will be seen that there is shown a machine having an insulated cabinet 11 having a top 12, a bottom 13, and four walls 15, 16, 17, and 18. The front wall 15 preferably is provided with an opening 19 which is closed by a door 21 which has two panes of wire glass spaced apart to form an insulating air chamber therebetween. The top, bottom, and walls of the cabinet 11 are preferably of the double walled type having a heat insulating material packed there between. Within the cabinet 11 there is mounted an inner chamber 22 supported in spaced apart relation with respect to the inner surface of the cabinet 11. The inner chamber 22 has rear and front walls 23 and 24 which join side walls 27 and 28. The side walls 27 and 28 extend between the front wall 15 and the back wall 17 of the heat insulated cabinet 11 thereby to support the chamber 22 in position. The top of the inner chamber 22 is formed of two members 25 and 26 so that the top constitutes a roof having sufficient pitch so that any vaporized or atomized particles of thermoplastic material coming in contact therewith may condense or agglomerate and run down the roof to the side walls thereby to prevent the

formation of drops which might become heavy enough to drop on the articles supported on a conveyor in the center of the chamber. The upper portions of the two side walls 27 and 28 are spaced apart from the upper side walls 16 and 18 of the outer cabinet 11. The lower portion of the side wall 28 is also spaced from the side wall 18, but the lower portion of the side wall 27 is mounted adjacent the lower portion of the outer wall 16. The side wall 28 is provided with an inlet opening 29 for cooperation with an inlet opening 31 in the outer wall 18. The inlet in the outer wall 18 is considerably larger than the inlet 29 to the inner wall 28, and the opening 21 is provided with a hinged hood 32 so that access may be had to the conveyor and to a portion of the inner chamber wall 28. The opposite wall 27 of the inner chamber is provided with an outlet opening 33, and the outer wall 16 is provided with an outlet opening 34 which is provided with a hinged hood 35. The front wall 24 of the inner chamber 22 is provided with a framed opening 36 which extends to the door opening 19 of the front wall 15 of the outer cabinet 11. The bottom of the inner chamber 22 is formed of two downwardly inclined portions 37 and 38 which are connected by the inclined lower side portions 39 and 41 of the side walls 23 and 24 respectively. The inclined side wall portions 39 and 41 together with lower portions of the side walls 27 and 28 and the bottom members 37 and 38 comprise a receptacle within the chamber 22 for heating the material to be applied to the articles which are to receive a protective coating.

By referring to Figures 4 and 5 it will be seen that the side walls 27 and 28 which extend between the front wall 15 and back wall 17 of the outer cabinet 11 form vertical ducts between the walls of the cabinet and the front and back walls of the inner chamber 22. One duct 42 therefore is formed by a portion of the wall 27 and the front wall 24 of the inner chamber 22 together with the front wall 15 of the outer cabinet and the flange of the opening 36 at the front of the wall 24 of the inner chamber. Another duct 43 is formed by a portion of the front wall 15 of the outer chamber, the flange 36 adjacent the opening in the front wall 24 of the inner chamber and portions of the front wall 24 and the side wall 28 of the inner chamber 22. Another duct 44 is formed by the back wall 23 and portions of the side walls 27 and 28 of the inner chamber 22 together with the back wall 17 of the outer cabinet 11. These ducts communicate with the space between the bottom 13 of the outer cabinet 11 and the lower portions of the side walls of the inner chamber 22 and the outer cabinet 11. At their upper extremities the ducts 42 to 44 communicate with chambers 45 and 46 formed by a plate 47 which extends between the side walls 27 and 28 of the inner chamber 22 and the walls 15 and 17 of the outer cabinet 11. The chamber 45 is connected by a conduit 48 extending upwardly through the top 12 of the insulated cabinet 11 to a blower 49. The blower 49 is connected to a conduit 51 extending through the top of the cabinet 12 to the chamber or conduit 46. The conduit 51 is provided with a control valve or damper 52 so that the other end of the conduit 51 which is open may permit the entrance of outside air to the various conduits associated with the blower 49.

The upper plate 47 seen in Figure 3 is spaced from the top 12 of the outer cabinet 11 so as to form an air duct or conduit 53 which is in communication with a conduit 54 formed between the side wall 16 of the outer cabinet and the side wall 27 of the inner chamber, and the conduit 55 formed between the side wall 18 of the outer cabinet 11 and the side wall 28 of the inner chamber 22. Mounted centrally on the top 12 is an exhaust pipe or conduit 56 having mounted therein a fan 58 driven by a motor 59. The exhaust fan 58 serves to withdraw air from within the chamber 22 and from beneath the hoods 32 and 35 on the inlet and outlet up through the conduits 55 and 54 to the exhaust pipe 56. The suction produced by the exhaust fan 58 is sufficient to prevent vapor particles of heated coating material from dropping downwardly on the articles supported by the conveyor. In order to prevent any vaporized particles which might condense or agglomerate on the inside or the outside of the side walls 27 and 28 from forming drops which might fall off the upper edges of the inlet 29 or the outlet 33, each side wall is provided with a plurality of inclined gutters. Thus the side wall 27 is provided with gutters 61 and 62, and the other side wall 28 is provided with gutters 63 and 64 which as may be seen from Figure 3 extend to the end walls 23 and 24 of the inner chamber 22.

In order to transport articles through the apparatus there is provided a conveyor mounted upon a pair of transversely extending support members or beams 65 and 66 mounted adjacent the back wall 23 and the front wall 24 respectively of the inner chamber 22. The members 65 and 66 may extend through the inlets and outlets to the exterior of the cabinet 11. A plurality of shafts 67, 68, 69, 71 and 72 are suitably supported between the members 65 and 66. The shaft 67 is provided with a plurality of sprockets 73, 74, and 75 which cooperate with a plurality of conveyor chains 76, 77, and 78 which operate on sprockets 79, 81, and 82 mounted upon the shaft 68. The shaft 68 is also provided with a plurality of sprockets 83, 84, and 85 upon which are mounted conveyor chains 86, 87, and 88 which travel over sprockets 89, 91, and 92 mounted on shaft 69. The conveyor chains 86, 87, and 88 therefore are spaced to one side of the conveyor chains 76, 77, and 78 so that different portions of the surfaces of objects moved into the apparatus by the conveyor chain will rest upon different supporting points as the spraying of the articles progresses. The shaft 69 is provided with additional sprockets 93, 94, and 95 upon which spray conveyor chains 96, 97, and 98 operate so that when the articles which are mounted upon the conveyor chains 86, 87, and 88 are transferred to the conveyor chains 96, 97, and 98, there is again brought about a change of the point of contact between the articles and support members comprising a portion of the conveyor chains. The shaft 71 is provided with a plurality of sprockets 100 to 105 upon which the chains 96, 97, and 98 and 106, 107, and 108 operate. The chains 106, 107, and 108 engage sprockets 109, 111, and 112 upon shaft 72 which is driven by a pulley 113 having thereon a chain 114 driven by a sprocket 115 attached to a shaft extending from a gear box 116. The gear box 116 is mounted upon a shelf 117 supported from the outer wall 16 of the cabinet 11 immediately beneath the outlet 34. The reduction gear 116 is driven by a suitable belt and pulley arrangement from an electric motor 118. Each of

the chains of the conveyor is preferably formed as shown in Figure 6 where the chain 80 at regular intervals is provided with pointed support members 90 for engaging the bottom side of objects to be coated such as a sheet of material 119.

In order to heat the material to be applied to the articles to be coated, the lower receptacle portion of the inner chamber 22 is provided with a plurality of electric heaters 121, 122, 123, and 124 associated with the bottom portions 37 and 38 and the side portions 39 and 41 respectively. Each of the heaters 121 to 124 preferably is formed of a plurality of individual strip heaters mounted so as to comprise an electrical heating unit readily removably from support members. To support the various electrical heating units, guide channels 125 to 131 inclusive are provided adjacent the bottom and side portions of the receptacle part of the inner chamber 22. In order that access may be had to the heater units, the bottom 13 of the outer cabinet may be provided with suitable openings 132 and 133; and of course side panel portions of the walls of the outer cabinet 11 such as the portions 134, 135, and 136 may be arranged so as to be readily removable. Preferably the two bottom heaters 121 and 122 and one half of each of the side heaters 123 and 124 are connected so as to be controlled by a single thermostat. The upper portions of the heaters 123 and 124 may be connected to a manually controlled switch for heating the material during a starting period or when the receptacle portion of the inner chamber 22 is loaded substantially to its capacity. Subsequently during the operation of the apparatus, particularly when a lesser quantity is in the receptacle, the thermostatically controlled heaters provide adequate heat for the material.

To apply the material to articles carried by the conveyor such as a sheet of material 119 two spray guns 137 and 138 are mounted adjacent the top of the chamber 22, and two spray guns 139 and 140 are positioned in the receptacle portion of the inner chamber 22 just above the level of the maximum load of material to be heated. Each of the spray guns 137 to 140 is provided with a material conduit 141 to 144 respectively and with an air conduit 145 to 148 respectively. Each of the spray guns 137 to 140 is also provided with suitable drain pipes 151 to 154 respectively so that when it is desired to stop the apparatus the liquid heated material may be permitted to drain from the nozzle portion of each of the guns so that the material will not solidify therein and prevent ready resumption of the operation of the apparatus. The heated liquid material is supplied to the spray guns by a gear pump 149 driven by a belt and pulley arrangement from an electrical motor 155 mounted on the shelf 117 on the outside of the cabinet 11. When it is desired to close down the operation of the apparatus for any appreciable time, air must be supplied to the gear pump 149 by a valve 156 so that the liquid material may drain from the pump and also from the various conduits leading to the various guns. A valve 157 is provided on the exterior of the cabinet 11 for draining the receptacle portion of the inner chamber 22.

Air under suitable pressure is supplied to an air cleaning or dehydrating device 158 which preferably is mounted on the front wall 15 of the cabinet 11 so that the device is readily accessible for cleaning and for replacing the elements contained therein. This air cleaning or air conditioning device preferably is of the type disclosed in my copending application, Serial Number 489,211, filed May 31, 1943, although it is to be understood that other suitable types of devices may be employed. The outlet from the air conditioning device 158 extends into the cabinet 11 where it joins a conduit 159 mounted in folded fashion on the lower portion of the wall 28, as may be seen in Figures 2 and 4, so that the air passing therethrough will be at a temperature in the proximity of the temperature of the heated material supplied to the spray guns. By supplying heated air to the spray guns the atomized particles of the coating material are enveloped in an atmosphere having a temperature such that the particles have a proper consistency so as to reach the surface of the articles to form a continuous coherent and adherent protective coating.

In operation the thermostatically controlled heater units adjacent the receptacle portion of the inner chamber 22 operates to heat the material 160 contained therein. When the material has been brought to the desired temperature so as to be of the proper fluid consistency, the motors 118 and 155 are energized so as to bring about operation of the conveyor and the gear pump 149. The gear pump which is provided with an inlet extending toward the bottom of the receptacle portion of the inner chamber 22 supplies fluid material under pressure to each of the spray guns 137 to 140. Air from a suitable source is supplied through the air cleaning device 158 to the conduit 159 where the air is heated and then supplied to the various spray guns. The spray guns therefore atomize and project the coating material toward the top and bottom of sheets of material 119 carried by the conveyor. The conveyor has a number of chains each of a structure similar to that shown in Figure 6. When a sheet of material reaches the middle portion of the chamber 22 each sheet is shifted from one conveyor chain to another and again to still another chain so that the bottom spray guns 139 and 140 will be able to coat completely the entire bottom surface including those portions of the sheet 119 which are in contact with the supports 90 of the conveyor chain 80 and also those portions which might be masked to some degree by the conveyor chains. The exhaust fan 58 removes from the chamber 22 all those particles of atomized material which may be suspended above the plate 119 particularly in the proximity of the inlet 29 and the outlet 33. Such suspended particles of material if permitted to pass beyond the inlet or outlet and come in contact with the plates 119, would not be at the proper temperature and would impair the finish desired. The exhaust fan 58 therefore draws the particles away from the inlet and outlet together with a certain amount of air from the hoods 32 and 35 up through the passages 54 and 55 into the stack 56.

The blower fan 49 circulates and recirculates air around a greater portion of the walls of the inner chamber 22 so that the chamber in its entirety has a predetermined operating temperature so that temperature gradients within the chamber are minimized. The minimizing of temperature gradients within the chamber 22 is productive of a better protective coat upon the articles to be coated as there is greater assurance that the particles impinging upon the articles are at the proper temperature to produce the desired cohesion and adhesion with one an-

other and with the surface of the article. By regulating the valve or damper 52 the operating temperature of the chamber 22 may be modified as desired since the thermostat which controls the strip heater elements is arranged to be primarily responsive to the temperature required for maintaining the material 160 at the desired fluid consistency, and the ambient temperature of the sheets 119 entering the apparatus may be such as to vary the temperature within the chamber 22 which therefore could be compensated for by the control valve 52.

While for the purposes of explanation a single embodiment of the invention has been disclosed, it is to be understood that it is not to be limited thereby since obviously numerous variations may be made in the instrumentalities employed and in their arrangements without departing from the spirit and scope of the invention as defined in the appended claims.

This invention is hereby claimed as follows:

1. A continuously operating spray coating machine comprising a heat insulated cabinet having an inlet and an outlet for objects to be coated, a conveyer for moving objects through said cabinet, an inner chamber mounted within said cabinet, said chamber having an inlet and an outlet for objects to be treated therein, means for electrically heating the lower portion of said chamber, and means including a fan for circulating and recirculating air around said chamber to minimize temperature differentials therein.

2. A continuously operating coating machine comprising a heat insulated cabinet having an inlet and an outlet for objects to be coated, a conveyor for moving objects in and out of said cabinet, an inner chamber mounted within said cabinet, means for withdrawing air from the upper part of said chamber and from said inlet and outlet along two of the outer sides of said chamber to the exterior of said cabinet, means for heating the lower portion of said chamber, and means for circulating and recirculating air around the bottom, two sides and top of said chamber.

3. A spray coating machine comprising a heat insulated cabinet having an inlet and an outlet for objects to be passed therethrough, a metal inner chamber mounted within said cabinet and spaced from the inner walls thereof, said inner chamber having an inlet and an outlet for objects to be passed therethrough and to be treated therein, means mounted within said inner chamber for coating the surfaces of objects passing therethrough, means for heating the lower portion of said chamber to heat material therein to be applied to the objects passing through said machine, and means for circulating and recirculating air about said inner chamber to minimize temperature differentials therein.

4. A spray coating machine comprising a heat insulated cabinet having an inlet and an outlet for objects to be passed therethrough, a metal inner chamber mounted within said cabinet and spaced from the inner walls thereof, said inner chamber having an inlet and an outlet for objects to be passed therethrough and to be treated therein, a conveyor for passing objects through said machine, spray means mounted within said inner chamber for simultaneously coating the top and bottom of objects passing therethrough, means for heating the lower portion of said chamber to heat material therein to be supplied to said spraying means, and means including a blower for circulating and recirculating air around said inner chamber to minimize temperature differentials in said machine.

5. The combination comprising a heat insulated cabinet having an inlet and an outlet for passing objects therethrough, a metal inner chamber mounted within and in spaced relation to said cabinet, the lower portion of said chamber serving as a receptacle for material to be applied to objects passing through said chamber, said chamber having an inlet and an outlet for said objects, means for electrically heating the receptacle portion of said chamber, said means being located adjacent the exterior sides and bottom of said chamber, a plurality of spraying devices located within said chamber for applying heated material to said objects, and means for circulating and recirculating air around said chamber and said electrical heating means to minimize temperature differentials within said chamber.

6. The combination comprising a heat insulated cabinet, a metal inner chamber mounted within and in spaced relation to said cabinet, said cabinet and said chamber each having an inlet and an outlet for objects to be passed therethrough, means for conveying objects through said chamber and said cabinet, the lower portion of said chamber serving as a receptacle for material to be applied to said objects, means for electrically heating the receptacle portion of said chamber, said means being located adjacent the exterior sides and bottom of said chamber, a plurality of spraying devices located within said chamber for applying said heated material to said objects, means for supplying to said spraying devices an aeriform substance under pressure including a conduit positioned adjacent the lower receptacle portion of said chamber whereby to heat said aeriform substance, and means for producing forced circulation and recirculation of air around said chamber and said electrical heating means to minimize temperature differentials within said chamber.

7. A coating machine for spraying heated material on objects comprising a heat insulated cabinet having a middle inner chamber mounted therein in spaced relation thereto, inlets and outlets for said cabinet and said chamber, a conveyor for passing objects through said inlets and said outlets, the lower portion of said chamber being arranged as a receptacle for material to be applied to said objects, means associated with said lower portion of said chamber for electrically heating said material, a plurality of spray guns mounted within said chamber for completely coating said objects, a source of aeriform substance under pressure for said spray guns, means located adjacent the lower portion of said chamber for heating said aeriform substance to be supplied to said spray guns, a suction fan for withdrawing the aeriform substance from the upper part of said chamber, and means for producing forced circulation and recirculation of air about said chamber and said heating means to minimize temperature gradients therein.

8. A coating machine for spraying heated material on objects comprising a heat insulated cabinet having an inner metal chamber mounted therein in spaced relation thereto, inlets and outlets for said cabinet and said chamber, a conveyor for passing objects through said inlets and said outlets, said conveyor being arranged to shift support contacts with said objects while

they are being sprayed, a plurality of spray guns mounted within said chamber for completely coating said objects, the lower portion of said chamber being arranged as a receptacle for material to be heated and to be supplied to said spray guns, means associated with said lower portion of said chamber for electrically heating said material, a source of aeriform substance under pressure for said spray guns, means located adjacent the lower portion of said chamber for heating the aeriform substance to be supplied to said spray guns, a suction fan for withdrawing the aeriform substance from the upper portion of said chamber and from adjacent said inlet and said outlet, and means including a fan for producing the circulation and recirculation of air about said chamber and said heating means thereby to minimize temperature gradients within said chamber.

9. A coating machine comprising a heat insulated cabinet having an inner metal chamber mounted therein in spaced relation thereto, inlets and outlets for said cabinet and said chamber, conveyor means mounted between said inlets and said outlets, the lower portion of said chamber being arranged as a receptacle for material to be heated for application to objects carried by said conveyor, a plurality of electric strip heating units mounted adjacent the bottom and sides of said lower portion of said chamber, means forming an air conduit around the top, bottom, and two sides of said chamber, means for producing forced circulation and recirculation of air through said conduit, means forming a conduit extending upwardly between two sides of said chamber and adjacent the top of said cabinet, said conduit being in communication with said inlets and said outlets, means for withdrawing air from the upper part of said chamber and from the proximities of said inlets and said outlets through said conduit to the exterior of said cabinet, a plurality of air spraying guns mounted within said chamber, and means for supplying under pressure heated material and air to said air spraying guns.

10. A coating machine comprising a heat insulated cabinet having an inner metal chamber mounted therein in spaced relation thereto, inlets and outlets for said cabinet and said chamber, conveyor means mounted between said inlets and said outlets, the lower portion of said chamber being arranged as a receptacle for material to be heated for application to objects carried by said conveyor, a plurality of electric strip heating units mounted adjacent the bottom and sides of said lower portion of said chamber, means forming an air conduit around the top, bottom and two sides of said chamber, means for producing forced circulation and recirculation of air through said conduit, means forming a conduit extending upwardly between two sides of said chamber and adjacent the top of said cabinet, said conduit being in communication with said inlets and said outlets, means for withdrawing air from the upper part of said chamber and from the proximities of said inlets and said outlets through said conduit to the exterior of said cabinet, a plurality of air spraying guns mounted within said chamber, a source of air under pressure for said guns, means located adjacent the lower portion of said chamber for heating said air, and means for supplying heated material to said guns.

11. A continuously operating spray coating machine comprising a cabinet having an inlet and an outlet for objects to be coated, an inner chamber mounted within said cabinet, said chamber having an inlet and an outlet for objects to be coated therein, a conveyor for moving objects through said cabinet and said chamber, means for heating the lower portion of said chamber, and means including a fan for circulating and re-circulating air within said cabinet about said chamber to minimize temperature differentials therein.

12. A continuously operating coating machine comprising a heat insulated cabinet having an inlet and an outlet for objects to be coated, an inner chamber mounted in spaced relation within said cabinet, said chamber having an inlet and an outlet for objects to be coated therein, a conveyor for moving objects in and out of said chamber and said cabinet, means for withdrawing air from said inlets and outlets along two of the outer sides of said chamber to the exterior of said cabinet, means for heating the lower portion of said chamber, and means for circulating and re-circulating air around the remaining outer surfaces of said chamber.

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