A sealed intermittent coater for coating articles including a conveyor for carrying articles through a coating station and a nozzle at the coating station for directing a sheet of coating material toward the articles, and means responsive to the movement of articles through the coating station for controlling the discharge of coating material from the nozzle.

This invention relates in general to a coating machine, and more particularly to a sealed intermittent coater for coating articles, and still more particularly to an apparatus for applying a coating of protective material onto goods and articles, both edibles and non-edibles, to package same.

With the advent of "hot melt" plastics and films, it has been desired to provide an economically manufactured machine, for economically and efficiently applying a coating of a hot melt plastic to goods and articles for packaging same. The "hot melt" plastics include those that are liquid at elevated temperatures and solid or rigid at room temperatures. For example, one plastic suitable might have an application temperature of between 175° F. and 350° F. whereas it would be in liquid form and easily applicable by a nozzle arrangement, and thereafter solidify or rigidify at normal room temperature. Moreover, some of these plastics decompose or deteriorate rapidly when in liquid form and exposed to ambient air. Therefore, difficulty is encountered in coating with the heretofore available coating machinery.

It is therefore an object of the present invention to obviate the above identified difficulties and to provide a machine for coating articles economically and efficiently with "hot melt" materials.

Another object of this invention is in the provision of a coating machine for coating articles and goods with "hot melt" materials that is capable of maintaining the coating material while in liquid form protected against the ambient air, and is capable of being easily and inexpensively manufactured.

Still another object of this invention is to provide a new and improved coating machine capable of giving intermittent coating operations.

A further object of this invention resides in the provision of a coating machine including a conveyor for passing articles through a coating station, one or more nozzles for discharging one or more sheets or films of coating material onto the article as it passes through the station, and means responsive to the movement of the article into and out of the coating station for controlling the sheets or films of material emanating from the nozzles. Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a diagrammatic view of one form of coating machine and the present invention and showing a transverse sectional view taken through the article carrying conveyor;

FIG. 2 is a somewhat diagrammatic and sectional side elevational view of the conveyor and illustrating the manner in which the articles are advanced through the coating station and under the nozzle;

FIG. 3 is a fragmentary perspective view of an article being coated on the conveyor according to the invention, and illustrating the means for controlling the discharge of the nozzle;

FIG. 4 is a perspective view, somewhat diagrammatic, illustrating the use of the pair of coating nozzles for coating an article moving through the coating zone on a conveyor;

FIG. 5 is a view similar to FIG. 4 but illustrating the use of three nozzles for coating an article moving through the coating zone;

FIG. 6 is a view similar to FIG. 5 but illustrating a single nozzle for coating only the top side of an article moving through the coating zone;

FIG. 7 is a view similar to FIG. 5 and illustrating the use of a single coating nozzle for coating an irregularly shaped article on a packaging board as it moves through the coating zone;

FIG. 8 is a diagrammatic view of an alternate arrangement for controlling the operation of the coating nozzles in the coating zone; and

FIG. 9 is a diagrammatic perspective view, somewhat fragmentary, illustrating the use of a pair of endless conveying members in place of a single conveying member for use in the coating machine of the present invention.

Referring now to the drawings, the coating machine of the present invention illustrated in FIGS. 1-3 includes generally a conveyor 10 for receiving articles 11 thereon to transport same through a coating station arranged below a coating nozzle 12. The conveyor as illustrated shows a solid or closed surface upon which the articles 11 are supported, but it should be appreciated that this surface may be porous, defined by a plurality of moving chains or cables, or of any other suitable type. The conveyor may be endless or reciprocating, depending upon the desires of the user, so long as it serves to advance the articles through the coating station below the coating nozzle 12. It should also be appreciated that the coating nozzle 12 may be of any desired type, but preferably one that will define a sheet or film of coating material that is capable of covering all or any desired part of an article that is advanced by the conveyor to the coating station.

In another embodiment, the articles 11 are mounted on a tray or plate 13 and the article is thereafter anchored to this tray or plate by the coating material which may also strike the areas of the tray outward of the article. The packaging according to the invention could take the place of the well known "blister" or "skin-pack" packaging in the industry.

The discharge nozzle 12 is supplied with heated plastic material from a reservoir or tank 14 having a source of coating material 15 therein in fluid and heated condition. The reservoir 14 is jacketed to permit it to be efficiently and adequately heated for maintaining the plastic in liquid form. Inasmuch as some plastics decompose or deteriorate while in liquid form and exposed to the ambient air, a cover 16 is provided to close the reservoir and seal same from the outside air. Suitable fasteners 17 may be provided for effecting the seal. In order to provide a more perfect atmosphere within the reservoir, a fitting 18 having a valve 19 associated therewith may be arranged to allow the withdrawal of any air existing within the reservoir when it is initially closed and to replace the air with an inert gas if desired.

An outlet 20 is provided at the bottom of the reservoir and connected to an inlet 21 of a suitable positive displacement pump 22. Preferably, the pump may be of the well known screw type. The pump 22 includes an outlet 23 connected to a line 24 that leads to the discharge nozzle.
12. A premelter and feeder 31 may be provided to replenish the supply of coating material in the reservoir 14. A solenoid operated valve 25 is provided ahead of the nozzle 12 to quickly control the nozzle between on and off positions. A pressure regulating valve 26 is provided ahead of the solenoid operated valve 25 to control the pressure at the nozzle 12 regardless of the pressure generated by the pump 22. A line 27 connects into the line 24 ahead of the control valve 26 and leads to a return inlet 28 in the reservoir 14. A pressure relief valve 29 is provided in the by-pass line 27 to allow the coating material to flow into the line 24 by the pump 22 to return to the reservoir when a predetermined pressure is reached, and especially in the event that the nozzle 12 is in off position. The valve 29 may be adjustable if desired.

The solenoid operated valve 25 is controlled by a photoelectric device 30 that detects movement of articles into and out of the coating station, whereby upon detecting the presence of an article in the coating station will cause the solenoid operated valve 25 to open to permit the nozzle 12 to discharge a sheet or film of coating material. And upon detecting the article leaving the coating station or zone, the photoelectrics will cause the solenoid operated valve 25 to close and thereby preclude the continuous operation of the nozzle and wastage of coating material. Thus, the nozzle 12 is operated only when an article is in the coating station or zone, and when the valve 25 is closed, the pressure in the line will build up and cause the pressure relief valve 29 to open and return the coating material to the reservoir 14. If desired, the lines 24 and 27 may be jacketed to provide heat and assure the maintaining of the coating material at a suitable temperature. It should also be appreciated that the present machine may be employed for coating of materials wherein the coating material need not be heated. Typical of the type of non-heated materials would be lacquers, enamels, and edible coatings such as starches, proteins and sugars. The nozzle and coating station may be enclosed in a heated cabinet to facilitate the application of coating material if desired or needed in a particular installation.

Referring particularly to FIG. 2, it is noted that the article 11a has been coated while the article 11b is entering the coating zone or station, and the article 11c follows behind the article 11a.

Referring now to FIG. 4, the coating machine of the present invention is illustrated wherein a pair of coating nozzles 32 and 33 are employed in the coating zone to coat all six sides of the article 34 passing through the coating zone on the conveyor belt 10. The nozzle 32 would be positioned to coat the front side 34a, the side 34b and the top side 34c, while the coating nozzle 33 would be arranged to coat the side 34d and the back side 34e of the article.

The nozzle arrangement of FIG. 5 illustrates the use of three coating nozzles 35, 36 and 37 for coating the six exposed sides of the article 38. In this arrangement, the nozzle 35 is arranged to coat the front side 35a and the adjacent side 35b, while the upper nozzle 36 is positioned to coat only the top side 35c. And the other coating nozzle 37, positioned opposite the nozzle 35, is arranged to coat the side 35d and the back side 35e.

In the arrangement illustrated in FIG. 6, a single nozzle 39 is arranged to coat only the top side 40a of the article 40. In this embodiment, it would only be desirable to apply coating to the top side of the article.

FIG. 7 illustrates the use of the nozzle arrangement in accordance with FIG. 6, wherein the single nozzle 39 is employed to package an irregularly shaped article 41, in this case a toy automobile, onto a cardboard tray 42 by applying a thin film 43 of a desired thickness over the article 41 and across the top surface of the cardboard tray 42, wherein the film 43 is transparent and will adhere to the cardboard tray 42 to secure the article 41 thereto in package form. Such a package simulates a "skin-pack" or "blister" package and may thereafter permit shelving of the articles without subjecting them to the ambient air so that they may be preserved longer. By opening of the film, the article can be easily removed.

From the embodiments shown in FIGS. 4-7, it can readily be appreciated that any desired number of nozzles can be employed in the present invention, all of which may be connected to the solenoid operated valve 25 for obtaining intermittent coating operation. Moreover, it can be appreciated that if the nozzles are so spaced in the coating zone, they may be individually triggered "on" and "off" to give the desired coating operation for the articles passing through the zone. The speed of the conveyor may be between 50 and 500 feet per minute, while the pressure of the coating material emanating from the nozzle may vary between 100 and 2,000 pounds per square inch. Further, the temperature of the heated coating material may vary between 100 and 500° F., while the viscosity of the material may vary from between 50 and 60,000 centipoises. Examples of heated coating materials are thermoplastic coatings, such as polyamides, polyolefins, cellulosics and edibles such as chocolate.

A diagrammatic showing of an alternate control system 44 for opening and closing the nozzle or nozzles in the coating zone is shown in FIG. 8 wherein a signal from a photoelectric cell 44 that detects the movement of an article into the coating zone is amplified by an amplifier 45 which thereafter triggers an electronic timer 46 that maintains the nozzle 47 open for a predetermined period of time. The solenoid valve 47 would then control the coating material being fed to the nozzle or nozzles in the coating zone.

While it has been above mentioned that the conveyor may take the form of a single belt as shown in the drawings in FIGS. 1-7, or the form of a plurality of belts or chains, a clear example of the latter form is illustrated in FIG. 9, wherein a pair of synchronized endless belts 48 and 49 are employed in place of a single belt. The belts 48 and 49 are spaced apart thereby providing a space between them so that the underside of a cardboard tray 50 having an article 51 thereon can be easily lifted off the belts at the end of the conveyor run. Of course, the belts 48 and 49 may be chains or cables if so desired.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

The invention is hereby claimed as follows:

1. A machine for applying a coating of material to articles comprising, a conveyor for carrying said articles through a coating station, a nozzle arranged to direct a sheet of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to the nozzle and forcing the material through the nozzle under high pressure, a valve ahead of the nozzle, means for quickly operating the valve between open and closed positions, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, and means bypassing said valve to return the material to the reservoir when the valve is closed.

2. A machine for applying a coating of material to articles comprising, a conveyor for carrying said articles through a coating station, a nozzle arranged to direct a sheet of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to the nozzle and forcing the material through the nozzle under high pressure, a solenoid operated valve ahead of the nozzle, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, and means
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bypassing said valve to return the material to the reservoir when the valve is closed.

3. A machine for applying a coating of material to articles comprising, a conveyor for carrying said articles through a coating station, a nozzle arranged to direct a sheet of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to the nozzle and forcing the material through the nozzle under high pressure, a solenoid operated valve ahead of the nozzle, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, and a pressure responsive bypass line ahead of said valve to return the material to the reservoir when a predetermined pressure is detected.

4. A machine for applying a coating of material to articles wherein the material is liquid at elevated temperatures and solid at room temperatures, said machine comprising, a conveyor for supporting articles thereon and advancing same through a coating zone, a nozzle positioned adjacent the conveyor for discharging a continuous sheet of coating material into the coating zone, a reservoir for holding a supply of coating material, means for heating the reservoir to maintain the coating material in liquid form, a feed line extending from the reservoir to the nozzle, a pump in said feed line for pumping the liquid to the nozzle under pressure, a control valve between the pump and nozzle operable between open and closed positions, a return line extending from said feed line to said reservoir and communicating with the feed line between the valve and pump, a pressure relief valve in said return line, and means detecting the presence and absence of an article in the coating zone to open and close said control valve.

5. A machine for applying a coating of material to articles wherein the material is liquid at elevated temperatures and solid at room temperatures, said machine comprising, a conveyor for supporting articles thereon and advancing same through a coating zone, a nozzle positioned adjacent the conveyor for discharging a continuous sheet of coating material into the coating zone, a reservoir for holding a supply of coating material, means for heating the reservoir to maintain the coating material in liquid form, a feed line extending from the reservoir to the nozzle, a positive displacement pump in said feed line for pumping the liquid to the nozzle under pressure, a control valve between the pump and nozzle operable between open and closed positions, a return line extending from said feed line to said reservoir and communicating with the feed line between the valve and pump, a pressure relief valve in said return line, and means detecting the presence and absence of an article in the coating zone to open and close said control valve.

6. A machine for applying a coating of material to articles wherein the material is liquid at elevated temperatures and solid at room temperatures, said machine comprising, a conveyor for supporting articles thereon and advancing same through a coating zone, a nozzle positioned adjacent the conveyor for discharging a continuous sheet of coating material into the coating zone, a reservoir for holding a supply of coating material, means for heating the reservoir to maintain the coating material in liquid form, a feed line extending from the reservoir to the nozzle, a positive displacement pump in said feed line for pumping the liquid to the nozzle under pressure, a control valve between the pump and nozzle operable between open and closed positions, a return line extending from said feed line to said reservoir and communicating with the feed line between the valve and pump, a pressure relief valve in said return line, and means detecting the presence and absence of an article in the coating zone to open and close said control valve.

7. A machine for applying a coating of material to articles wherein the material is liquid at elevated temperatures and solid at room temperatures, said machine comprising, a conveyor for supporting articles thereon and advancing same through a coating zone, a nozzle positioned adjacent the conveyor for discharging a continuous sheet of coating material into the coating zone, a reservoir for holding a supply of coating material, means for heating the reservoir to maintain the coating material in liquid form, a feed line extending from the reservoir to the nozzle, a positive displacement pump in said feed line for pumping the liquid to the nozzle under pressure, a control valve between the pump and nozzle operable between open and closed positions, a return line extending from said feed line to said reservoir and communicating with the feed line between the valve and pump, a pressure relief valve in said return line, and means detecting the presence and absence of an article in the coating zone to open and close said control valve.
comprising, a conveyer for supporting articles thereon and advancing same through a coating zone, a nozzle positioned adjacent the conveyer for discharging a continuous sheet of coating material into the coating zone, a reservoir for holding a supply of coating material, means for heating the reservoir to maintain the coating material in liquid form, a feed line extending from the reservoir to the nozzle, a positive displacement pump in said feed line for pumping the liquid to the nozzle under pressure, a control valve in said feed line between said nozzle and pump, an actuator for actuating said control valve between open and closed positions, a return line between said feed line and said reservoir and connected to said feed line between said control valve and said pump, a pressure relief valve in said return line, means detecting the presence and absence of an article in the coating zone to operate said actuator so that the control valve is open when an article is passing through the coating zone and otherwise closed, and means for closing said reservoir in sealed relation to the ambient air.

11. A machine for applying a coating of material to articles comprising, a conveyer for carrying said articles through a coating station, a nozzle arranged to direct a sheet of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to the nozzle and forcing the material through the nozzle under high pressure, a valve ahead of the nozzle, means for quickly operating the valve between open and closed positions, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, said movement responsive means including a photoelectric device that operates to open said valve when detecting an article in the coating station, and means bypassing said valve to return the material to the reservoir when the valve is closed.

12. A machine for applying a coating of material to articles comprising, a conveyer for carrying said articles through a coating station, a nozzle arranged to direct a sheet of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to the nozzle and forcing the material through the nozzle under high pressure, a valve ahead of the nozzle, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, said movement responsive means including a photoelectric device and a timing device whereby the photoelectric device detects an article approaching the coating station and triggers the timer which operates the valve in open position for a predetermined period of time, and means bypassing said valve to return the material to the reservoir when the valve is closed.

13. A machine for applying a coating of material to articles comprising, a conveyer for carrying said articles through a coating station, a plurality of nozzles arranged to direct a plurality of sheets of coating material toward said articles as they pass through the coating station, a reservoir for holding a supply of coating material, a pump for pumping the coating material to said nozzles and forcing the material through said nozzles under high pressure, a valve ahead of said nozzles, means for quickly operating the valve between open and closed positions, means responsive to movement of the articles into and out of the coating station for opening and closing said valve, and means bypassing said valve to return the material to the reservoir when the valve is closed.

14. The combination as defined in claim 13, wherein two nozzles are provided.

15. The combination as defined in claim 13, wherein three nozzles are provided.