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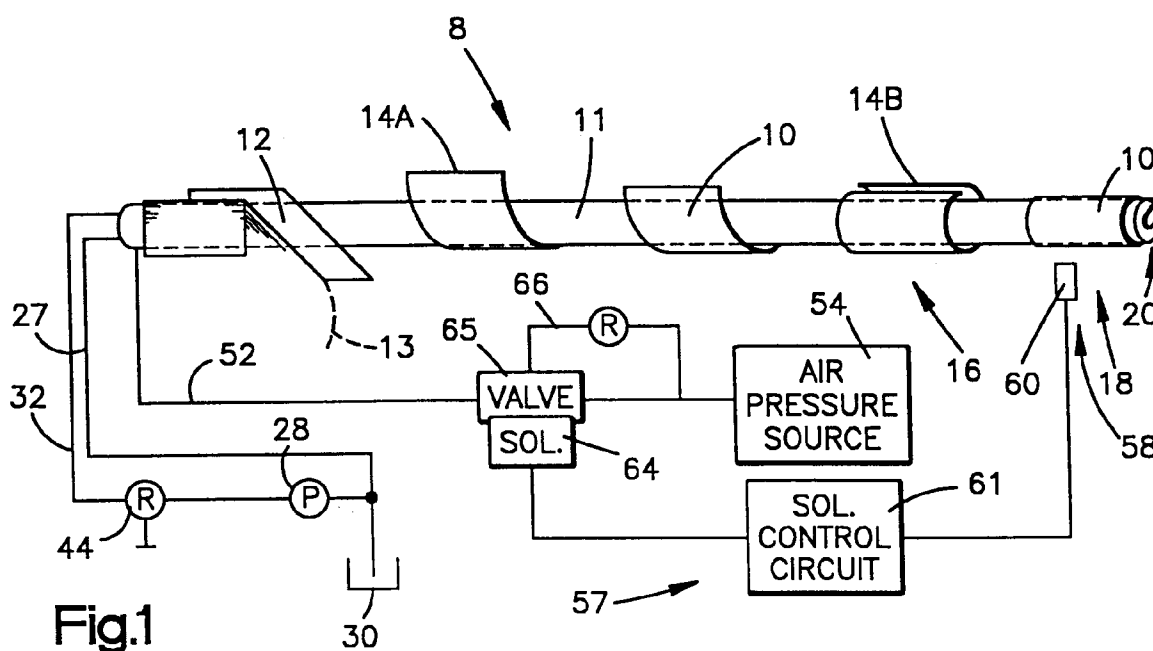
⑦1 Applicant : **NORDSON CORPORATION**
28601 Clemens Road
Westlake Ohio 44145-1148 (US)

(72) Inventor : Novotny, Mark
33390 Chelsea Drive
Avon Lake, Ohio 44012 (US)
Inventor : Armbruster, Paul A.
802 Ninth Street
Lorain, Ohio 44052 (US)

74 Representative : **Allen, Oliver John Richard**
Lloyd Wise, Tregear & Co.
Norman House
105-109 Strand
London, WC2R 0AE (GB)

(54) **Method and apparatus for striping inside seams of cans with a thermoplastic material.**

(57) Methods and apparatus are disclosed for applying a stripe of hot melt coating material at an application temperature over longitudinally welded seam areas (21) of can bodies (10). The hot melt coating material applied to the welded seam areas (21) is then cured by cooling the coating material to a curing temperature below the application temperature of the melt coating material.



This invention relates to the application of protective coatings to the interior seams of cans and, more particularly, to a method and apparatus for applying a hot melt stripe to the interior welded, overlapped seam or butt weld seam of a three-piece metal can.

The process of manufacturing three-piece metal cans involves forming a cylindrical can body from a sheet of metal and then attaching two lids to the opposite ends of the can body. To form the cylindrical can body, a sheet or blank of metal is wrapped around a so-called stubhorn. The ends of the sheet are either butted or overlapped and secured together by a welded seam, a soldered seam, or a cemented seam. The interior of this seam is then covered with a protective coating which functions to protect the contents of the can against metal contamination.

Continuity of the protective coating is extremely critical because any pinholes, cracks or imperfections in the coating will render the can unsuitable for most applications.

After covering the seam with the protective coating, the can is subjected to heat for curing the coating material. The curing process is applied only to the area of the can seam. Therefore, any coating material applied to the interior of the can, other than in the seam area, will not be cured.

The present invention is primarily concerned with applying a continuous, protective coating onto the interior surface of a welded can seam. Welded can seams tend to be more brittle and more irregular than soldered can seams, and therefore, generally require a thicker protective coating than might be required by a soldered can seam.

A thick coating of protective material can be applied by a variety of methods including roller coating, powder coating, and airless spray of a lacquer coating. Each of these methods is deficient for a variety of reasons.

The first or roller coating method is generally expensive because it requires careful and time consuming maintenance of the application equipment.

The second or powder coating method, while capable of covering the welded seam of a can with a high quality, thick stripe of material, is expensive because of the added cost of the powder material itself and the need to pass a coated can through a curing oven to cure the powder coating. The use of a curing oven increases the cost of the manufacturing process because of additional time needed to complete the curing process and the additional expenses relating to higher usage of energy, added capital equipment and use of additional factory floor space.

The third, or airless spray method of applying a liquid lacquer material is capable of airlessly spraying a thick stripe of protective coating onto the welded seam of a can body, as disclosed in our U.S. Pat. No. 4337281 which is incorporated by reference in its entirety herein. The apparatus disclosed in the patent,

airlessly sprays a thick protective coating of controlled width and thickness onto a welded seam of a can body without significant rebound.

While the prior art, airless spray method was effective to apply a protective coating on the seam area, several significant problems were encountered.

First, the protective coating material, as disclosed in our US Patent No. 4337281, was a lacquer material which included solvents that give off dangerous emissions during the curing process. The application of materials with solvent emissions is strongly regulated and therefore must be carefully monitored and controlled by expensive methods and equipment.

As with the powder coatings, the curing step for the lacquer coatings requires considerable floor space in the factory, curing equipment and a high level of energy usage to operate the curing equipment, all increasing the expense associated with the airless spray method.

It is an object of the present invention to provide a method and apparatus for applying a stripe of hot melt coating material over longitudinally welded seam areas of can bodies to obviate the problems and limitations of the prior art systems.

This is achieved in accordance with the invention by a method of applying a stripe of hot melt coating material over longitudinally welded seam areas of can bodies comprising the steps of moving a series of can bodies having longitudinally welded seam areas along a can forming line past a nozzle orifice of a hot melt gun, the hot melt gun being located interiorly of the can bodies whereby the nozzle orifice is located in close proximity to the welded seam areas. Hot melt coating material is supplied to the hot melt gun above a first temperature sufficient to maintain the hot melt coating material as a liquid while being dispensed from the nozzle orifice, whereby the hot melt coating material is applied to the welded seam areas. Finally, the series of can bodies are moved away from the nozzle orifice whereby the hot melt coating material applied to the welded seam areas is cooled below a second temperature to cure the hot melt coating material.

The method preferably includes the step of intermittently dispensing the coating material from the nozzle orifice in synchronization with the can bodies moving along the can forming line. The hot melt coating material is supplied to the hot melt gun at a first temperature of between about 325 degrees to 400 degrees Fahrenheit and at a constant pressure of between about 500 psi and 700 psi. Preferably, the hot melt coating material is a polyamide, polyethylene, and polyester material.

Apparatus in accordance with the invention, for applying a stripe of hot melt coating material over longitudinally welded seam areas of can bodies comprises a supply of hot melt coating material, means for transporting the can bodies down a welding arm of a

can forming device, and a spray gun attached to one end of the welding arm and connected to the supply of hot melt coating material. The spray gun dispenses the hot melt coating material as a liquid from a nozzle orifice for application to the welded seam areas. The hot melt coating material is a thermoplastic material of polyamide, polyethylene, and polyester material. Means are provided for moving the can bodies away from the nozzle orifice whereby the hot melt coating material applied to the welded seam areas is cooled to cure the hot melt coating material.

The invention will now be further described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a diagrammatic illustration of a can body production line including a system for applying a stripe of hot melt coating material to the inside welded seam area of a can body in accordance with the present invention;

Fig. 2 is an enlarged side elevational view of the hot melt gun used to apply the hot melt coating material to the inside welded seam area of a can body in accordance with this invention;

Fig. 3 is a diagrammatic illustration of the nozzle of the hot melt gun positioned near the inside welded seam area of the can body to apply the hot melt coating material thereto; and

Fig. 4 is an isometric view of the preferred embodiment of a nozzle tip used in the present invention.

Referring to Fig. 1, there is illustrated diagrammatically a can production line 8 used in the production of cylindrical can bodies 10. Production line 8 includes a stubhorn or welding arm 11 which acts as a mandrel around which can bodies 10 can be formed as they move in the downstream direction over stubhorn 11. Can bodies 10 are formed from metal blanks 12 which are moved longitudinally over stubhorn 11 from a magazine 13 by lugs (not shown) of a chain conveyor (not shown). These lugs engage the rear edge of metal blanks 12 and push them along stubhorn 11 while they are formed into can bodies 10. After can bodies 10 been formed into a cylindrical configuration, they move away from stubhorn 11 for further processing. In the final stages of movement of can bodies 10 over stubhorn 11, the edges 14A and 14B of sheet metal blank 12 forming each of can bodies 10 are overlapped at a seaming station 16. Seaming station 16 has a welding device (not shown) for welding overlapped edges 14A and 14B of blank 12 together. Although the present invention is not necessarily limited to welded can seams and will function properly with cans seamed together by other means, such as adhesive or solder, the present invention is particularly designed to overcome problems encountered with welded can seams.

As can bodies 10 move off stubhorn 11, they are passed over an inside striping station 18 where a

stripe 20 of hot melt protective material, as shown in Figs. 2 and 3, is applied over the welded, overlapped seam area 21 of can bodies 10. The hot melt coating material is typically selected from a thermoplastic material of the group comprising polyamide, polyethylene, and polyester materials. The specific material chosen must be able to cure without using a curing oven as required by the prior art systems discussed above.

The stripe 20 of hot melt protective material is applied to the overlapped seam area 21 of can bodies 10 by a hot melt gun 22 which is secured to the end of stubhorn 11 and positioned so that can bodies 10 pass over hot melt gun 22 just prior to moving off of stubhorn 11. Hot melt gun 22 is preferably a circulating flow type, such as a Model 200 hot melt gun, manufactured by Nordson Corp. of Ohio.

Hot melt gun 22 can be secured to the end surface 24 of stubhorn 11 by means such as a bracket 26. Hot melt gun 22, being a circulating flow type, has hot melt coating material being continuously delivered thereto under pressure by pressurizing means 28, such as a pump, from a hot melt material source 30, such as a heated tank, through fluid inlet line 32 to hot melt gun 22. There is also a continuous return flow of hot melt material from hot melt gun 22 via return line 27 back to the pump 28, or alternately, to heated tank 30. As a result of this continuous flow, the temperature of the hot melt coating material can be maintained constant in hot melt gun 22 even when not in use. Since the hot melt coating materials are solid at room temperature, they are generally heated in tank 30 to a liquid state and pumped through heated hose or tubing, i.e., inlet line 32, to a heated hot melt gun 32 and dispensed in a liquid state at a temperature substantially above room temperature. In addition, return line 27 can also be heated so that the unused hot melt coating materials from gun 22 are recirculated in a liquid state. It is also important that the temperature of the hot melt material be maintained relatively constant to keep the spray pattern consistent. The continuous circulation of the coating material from heat tank 30, through the heated inlet line 32, heated hot melt gun 22, and heated return line 27 enables the temperature and viscosity of the coating material to be maintained substantially constant.

Line 32 is connected to pump 28 which maintains the liquid coating material circulated through line 32 at an elevated pressure of between about 500 pounds per square inch (psi) and 700 psi. Preferably, line 32 also includes a pressure regulator 44 positioned between pump 28 and hot melt gun 22 to maintain the pressure in line 32, as well as in hot melt gun 22, substantially constant.

Within hot melt gun 22 is a flow line 40 which provides fluid communication between a hot melt nozzle 42 at an outlet end and pressurized line 32 of coating material at an inlet end. A return flow line 43 within

gun 22 connects flow line 40 and return line 27 so that the hot melt, coating material recirculates whenever the coating material is not being dispensed from gun 22.

The hot melt gun 22 functions as a means 46 for controlling the dispensing of hot melt coating material from a conventional nozzle 48, of the type for example, as illustrated in Fig. 4. Means 46 includes a flow control valve 50 which is pneumatically operated by air pressure supplied to hot melt gun 22 via an air line 52. Valve 50 is preferably spring biased to a closed position. Air pressure at approximately 60 psi is applied to air line 52 from a source 54 of air pressure through a solenoid controlled valve 56. The operation of flow control valve 50 and solenoid controlled valve 56 is discussed in more detail below.

A control means 57 for controlling solenoid control valve 65 includes an inductive proximity sensor 60 located at or near the can striping station 18 adjacent the end of stubhorn 11. In response to the presence or absence of can 10, sensor 60 directs a signal to a solenoid control circuit 61. While an inductive proximity sensor 60 is disclosed, it is also within the terms of the invention to substitute other types of sensing devices such as, for example, an electric photocell control device as disclosed in U.S. Pat. No. 4,337,381, on column 3, lines 56 through 65.

Solenoid control circuit 61 has two modes of operation for controlling solenoid control valve 65. In a first mode of operation, control-valve 65 is positioned to supply pressurized air to line 52 so that valve 50 is opened and dispenses hot melt coating material from nozzle 48 whenever a can 10 enters striping station 18 and activates proximity sensor 60. In a second mode of operation, in response to the absence of can 10 in striping station 18, solenoid control circuit 61 positions control valve 65 to prevent the flow of pressurized air to line 52 so that valve 50 is closed and hot melt coating material is not dispensed from nozzle 48.

The solenoid valve 56 can include a conventional, four-way spool valve 65 which is operative to connect source 54 of air pressure at approximately 60 psi to line 52 or alternatively, to exhaust line 52 to atmosphere. The details of solenoid valve 56 and its operation are discussed in U.S. 4,337,281 beginning on column 3, line 66 to column 4, line 21. Typically, air at lesser pressure, as for example 20 psi, is continually supplied through a line 66 to the opposite end of spool valve 65 so that when the solenoid electrical circuit is broken, the high pressure end of spool valve 65 is connected to atmospheric pressure and the opposite end to low pressure, i.e. about 20 psi. When solenoid electrical circuit 61 again energizes solenoid 64, solenoid valve 65 connects the high pressure end of spool valve 65 to air pressure source 54 at 60 psi and spool valve 65 immediately moves towards the low pressure end against the resistance offered by low pressure line 66 so that the high pressure air is fed

into line 52.

The flow line 40 through hot melt gun 22 includes an adaptor or extension 70 which connects the outlet end of flow control valve 50 to nozzle 48. Extension 70 is attached to the outlet end of valve 50 by a conventional thread connection (not shown) and a locking nut 72. A fluid passageway 74 within extension 70 and allows nozzle 48 to be positioned very close to the passing can bodies 10.

Nozzle 48 is secured to the outer end of extension 70 by conventional means, such as a locking sleeve (not shown). Nozzle 48 provides a fluid flow passageway from extension 70 to a nozzle tip 76. Nozzle tip 76, as illustrated in Fig. 4, defines an orifice 78 through which the liquid coating material is dispensed from hot melting gun 22. The details of nozzle tip 76 are described in U.S. 4,337,281, beginning on column 4, line 44 to column 5, line 15. The operation of nozzle 48 is affected by both the configuration of nozzle tip 76, and the operating conditions, i.e. the operating temperature and pressure at which the coating material is fed into hot melt coating gun 22.

In a typical operation, can bodies 10 are formed over stubhorn 11 at the rate of approximately 550 cans per minute. This rate varies from one can manufacturer to another, but quite commonly today averages approximately 575 can bodies per minute per line in the production of standard 3 or 3 and 3/16 inch diameter cans of 4 inch length. As can bodies 10 move along stubhorn 11, a weld is applied to the overlapping or abutting edges 14A and 14B of sheet 12 at seaming station 16. Station 16 is located immediately in upstream of striping station 18 where a stripe 20 of hot melt material from nozzle 76 of hot melt gun 22 is directed onto the welded seam area 21.

An important aspect of the present invention relates to the curing of the hot melt material. That is, as the series of can bodies 10 move away from nozzle orifice 76, by any means such as a conveyor (not shown), the hot melt coating material applied to each of welded seam areas 21 is cooled below the glass transition temperature to cure the hot melt coating material. The glass transition temperature of hot melt coating material, is that temperature when the melted coating material begins to harden. Typically, this temperature is about 300 degrees Fahrenheit.

The dispensing of hot melt material from nozzle 76 is turned on and off in synchronization with the movement of can bodies 10 over stubhorn 11 through striping station 18. This is accomplished by an inductive proximity sensor 60 sensing can bodies 10 and sending a signal to a solenoid control circuit 61. Circuit 61 sends a signal to solenoid 64, which in turn moves valve 65 to connect air line 52 to source 54 of air pressure. The pressurized air opens flow control valve 50 so that hot melt material circulates through hot melt gun 22, including passages 32, 40, 74, nozzle 76 and finally through nozzle orifice 78.

After a predetermined period of time, a can body 10 which was previously sensed by proximity sensor 60, passes out of stripping station 18. Then, control circuit 61 interrupts the signal to solenoid 64 so that valve 65 disconnects air line 52 to air pressure source 54. Control circuit 61 is then reset preparatory to receiving a signal from inductive sensor 60 corresponding to the pressure of the next following can body 10. Upon de-energization of solenoid 64, low air pressure, i.e., 20 psi in line 66, moves the spool of valve 65 so that air line 52 is connected to atmospheric pressure. This causes valve 50 in hot melt gun 22 to close and immediately cut off the flow of hot melt material from nozzle 76 until the next can body 10 enters stripping section 18.

In a typical operation, the hot melt material is applied to seam area 21 at a temperature of about 350 degrees fahrenheit. The hot melt material is supplied to nozzle 76 at a pressure of 500 psi and at a flow rate of 0.02 gallons per minute to apply a coating of at least 0.5 mil thick and about 0.5 inches wide over seam areas 21 of can bodies 10.

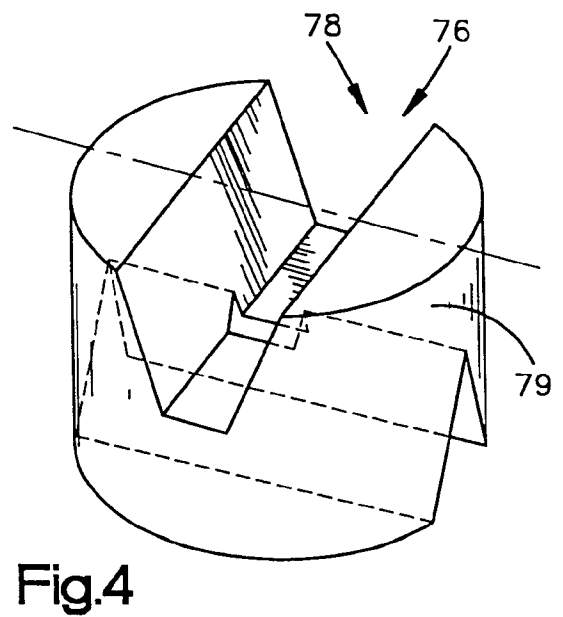
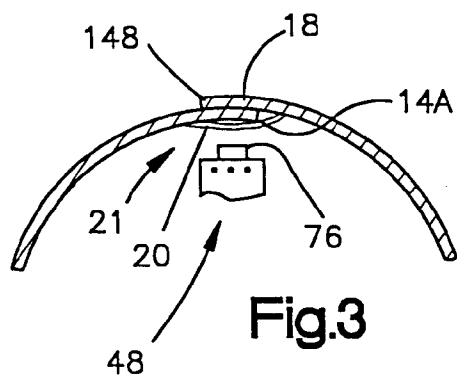
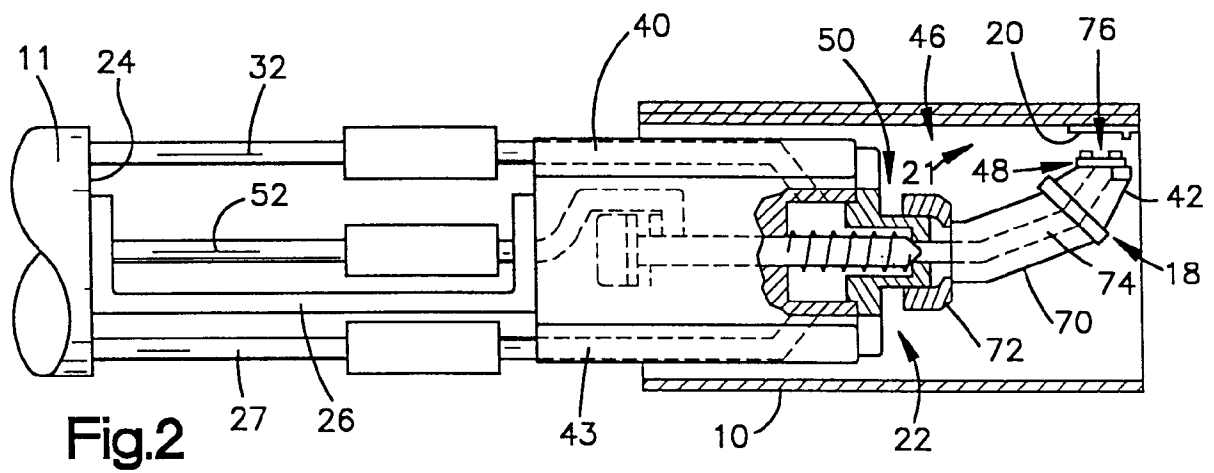
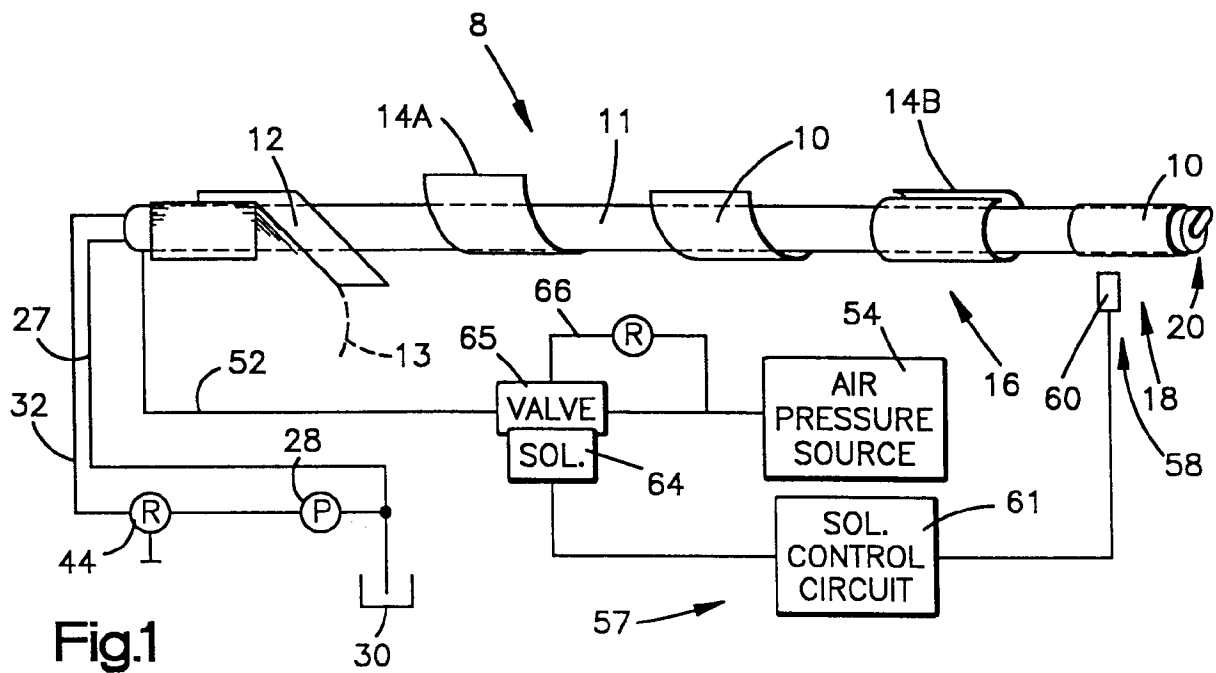
It is apparent that there has been provided in accordance with this invention methods and apparatus for applying a stripe of hot melt coating material at an application temperature over longitudinally welded seam areas of can bodies. According to the invention, the hot melt coating material applied to the welded seam areas is then cured by cooling the coating material to a curing temperature below the application temperature of the melt coating material.

Claims

1. A method of applying a stripe of hot melt coating material over longitudinally welded seam areas of can bodies, comprising the steps of moving a series of can bodies having a longitudinally welded seam area line past a nozzle orifice of a hot melt gun, locating the hot melt gun interiorly of the can bodies whereby the nozzle orifice is located in close proximity to the welded seam areas, supplying hot melt coating material to the hot melt gun above a first temperature sufficient to maintain the hot melt coating material as a liquid while being dispensed from the nozzle orifice, dispensing the hot melt coating material as a liquid from the nozzle orifice whereby the hot melt coating material is applied to the welded seam areas, and moving the series of can bodies away from the nozzle orifice whereby the hot melt coating material applied to the welded seam areas is cooled below a second temperature to cure the hot melt coating material.
2. A method as claimed in claim 1 including the step of supplying the hot melt coating material to the

hot melt gun at a first temperature of between about 325 degrees to 400 degrees Fahrenheit.

3. A method as claimed in claim 1 or 2 including the step of supplying the hot melt coating material to the hot melt gun at a pressure of between about 500 psi and 700 psi.
4. A method as claimed in any of the preceding claims wherein the hot melt coating material is a thermoplastic material.
5. A method as claimed in any of the preceding claims wherein the second temperature is about 300 degrees Fahrenheit.
6. A method as claimed in claim 3 including the step of maintaining the pressure of the hot melt coating material being supplied to the hot melt gun, substantially constant.
7. A method as claimed in any preceding claim including the step of intermittently dispensing the coating material from the nozzle orifice in synchronization with the can body movement along the can forming line.
8. Apparatus for applying a stripe of hot melt coating material over longitudinally welded seam areas of can bodies, comprising a supply of hot melt coating material, means for transporting the can bodies down a stubhorn of a can forming device and a spray gun attached to one end of the stubhorn and connected to the supply of hot melt coating material, the spray gun being adapted to dispense the hot melt coating material as a liquid from a nozzle orifice for application to the welded seam areas.
9. Apparatus as claimed in claim 8 wherein the hot melt coating material is a thermoplastic material.
10. Apparatus as claimed in claim 8 or 9 including means for moving the can bodies away from the nozzle orifice whereby the hot melt coating material applied to the welded seam areas is cooled to cure the hot melt coating material.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 2768

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y,D A	US-A-4 337 281 (BOONE) * column 2, line 40 - column 3, line 65 * * column 6, line 56 - line 63 * ---	1,8-10 6,7	B05B13/06 B05B9/00 B05C7/02 B05C9/14
Y	US-A-4 186 852 (BRAGA) * column 1, line 5 - line 25 * ---	1,8-10	
A	US-A-4 382 525 (KOBAYASHI ET AL.) * column 3, line 48 - line 68 * * column 5, line 45 - line 50; figures 1,2 * ---	1,2,5,8, 9	
A	US-A-3 859 113 (HORVATH ET AL.) * column 1, line 38 - line 56 * * column 5, line 8 - line 61 * * tests no.1-3* * claim 8 * ---	2-4,9	
A	FR-A-2 290 295 (BV VERENIGDE BUIZENFABRIEKEN VBF) * page 4, line 18 - page 5, line 16 * ---	1,9,10	TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 66 (C-157) 18 March 1983 & JP-A-58 000 281 (NAGAKUNI MASAHIITO) 5 January 1983 * abstract * ---	1,8-10	B05B B05C
A	GB-A-1 154 486 (BOSTIK LIMITED) * page 1 * -----	1,4	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 August 1994	Examiner Brevier, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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