SOLVENT CLEANING OF SPRAY NOZZLES

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ABSTRACT

Apparatus for preventing build-up of sealing compound at the outlet of an intermittently operated sealing compound ejecting nozzle. In the device, a stream of air is directed towards the outlet of the nozzle from a suitable air outlet, and a solvent is injected into the air stream at a point upstream from the air outlet, the air outlet being located at a distance from the nozzle such that turbulence of the air stream occurs in the area of the nozzle. The rate of supply of solvent to the air stream is such as to produce an atmosphere saturated with solvent in the turbulent area. This prevents evaporation of solvent from the sealing compound and hence prevents the sealing compound building up at the outlet of the nozzle.

2 Claims, 4 Drawing Figures
SOLVENT CLEANING OF SPRAY NOZZLES

This invention relates to means for improving the operation of nozzles applying soluble materials to ends for cans, caps for jars and similar applications, where the nozzle is required to eject the sealing compound in a series of jets interrupted by waiting periods while the next work piece is placed in position.

The invention has found particular application in the machines used for placing a circle of sealing compound around the peripheries of can ends before they are assembled onto can bodies. In a typical machine used for this purpose, the can ends are fed one at a time to a turntable, located at the center of the turntable, and then rotated under a nozzle which is directed towards the junction between a peripheral flange on the can end blank and the general surface of the blank. The nozzle places in the junction a ring of a sealing compound mixed with a solvent. The solvent quickly evaporates, leaving a resilient seal in intimate contact with the can end blank.

These machines operate at very high speed with the rotational means for the turntable interlocked with a valve or other means which permits or causes the discharge of the stream of sealing compound from the nozzle. It is found that, in the operation of the machine, a deposit of the sealing compound gradually builds up in the form of a feather extending from the outlet of the nozzle. In the absence of appropriate arrangements to prevent this build-up, it is necessary to stop the machine every few minutes to clean the nozzle. Attempts have been made to overcome the problem by spraying a solvent onto or around the nozzle. In general, such attempts have improved the situation but it is still necessary to stop the machine far too frequently for the purpose of cleaning the nozzle. The solvent spraying mechanism appears to be difficult to control with the result that, either too little is applied and the build-up continues at the nozzle outlet, or too much solvent is applied and the compound becomes too dilute to provide an effective seal in the can end.

The situation has been fully investigated by the present invention with a view to improving the performance of the nozzles so that the operation of the machine will become more efficient with reduction in shut-down times. As a result it has been determined that the build-up results from loss of solvent from the sealing compound during the time delay between the completion of the deposit of sealing compound on one can end, and the commencement of the placing of the sealing compound in the next can end.

The time interval is very short and may be of the order of a small fraction of a second, but during this time the sealing compound left in and on the tip of the nozzle after valve closure has its surface exposed to the atmosphere and loses some of its solvent by evaporation. This results in a very thin skin of sealing compound being formed, the edges of which tend to adhere to the tip of the nozzle.

As the lining of the next can end is placed in position, the skin is broken, but tends to adhere to the lip of the nozzle where it gradually builds up into the feather previously referred to, and interferes greatly with the operation of the nozzle and the quality of the can end.

The present inventor has determined that the problem can be overcome by having the nozzle surrounded by an atmosphere charged with droplets of solvent having a concentration such that the evaporation rate from the droplets causes the atmosphere to be saturated with solvent, thereby preventing evaporation of solvent from the sealing compound.

It was found that spraying the solvent alone from a fine aperture in a jet pipe towards the nozzle was unsatisfactory in that there was insufficient breakup of the solvent into airborne droplets. An air stream was therefore added to the solvent jet but again, without additional measures, it was found that the results were unpredictable and uncontrollable.

Finally, it was discovered that good results could be obtained by providing an air pipe with a very fine outlet directed towards the nozzle outlet and injecting solvent into the air stream a short distance from the jet pipe outlet, the air pressure and the pressure of the solvent being closely controlled and the solvent pressure being slightly greater than the air pressure to avoid blow-back.

Part of the atomization of the solvent is thought to take place in the air jet pipe, but the main atomization takes place in the turbulent air which develops at a distance from any jet outlet depending upon the outlet shape, velocity, and other factors. For the purposes of the invention it was found that best results were obtained if the outlet of the sealing compound nozzle was located approximately at the center of this turbulent area.

Thus the invention, in its broadest aspect, provides means for preventing build-up of sealing compound at the outlet of an intermittently operated sealing compound ejecting nozzle comprising means to direct a stream of air towards the outlet of said nozzle from a suitable air outlet, and means to inject a solvent into said air stream at a point upstream from said air outlet, said air outlet being located at a distance from said nozzle such that turbulence of the air stream occurs in the area of said nozzle, and the rate of supply of solvent to said air stream being such as to produce an atmosphere saturated with solvent in said turbulent area.

In order that the invention may be more readily understood it will now be described by way of example with reference to a particular embodiment of the invention as applied to a machine for placing liners of a sealing compound around the peripheries of can end blanks illustrated in the accompanying drawings wherein:

FIG. 1 is a side view in elevation of part of a machine for applying sealing compound to can ends with part of the apparatus of the invention in position.

FIG. 2 is a cross-sectional view on line 2—2 of FIG. 1.

FIG. 3 is a detail view of part of FIG. 1, and

FIG. 4 is a diagrammatic view of part of the apparatus of the invention.

In a machine of the type usually used for the application of sealing compound to can ends the space available for introducing additional equipment into the area near the point of application of the sealing compound is very limited and this has given rise to some of the problems which have been encountered in attempting to prevent build-up of compound on the nozzle.

With the apparatus of the present invention it is possible to locate most of the equipment necessary for this purpose at a distance from the point of application of the sealing compound and to merely run two small-diameter pipes or tubes to the nozzle area.
The equipment used includes a container 10 for a material capable of acting as a solvent for the scaling compound. In a specific example, the sealing compound may be a synthetic rubber and the solvent may be hexane.

The container is fitted with a cap 12 which has an air inlet 14 and a solvent outlet 16. An air supply 18 is fed to the equipment from the usual factory compressed air system. The air supply has two branches 20 and 22, each of which is controlled by a precision regulator 24, 26 and fitted with a gauge 28, 30 from which the pressure in the outlet line from the associated regulator can be read. One of the branches 20 goes to the air inlet 14 in the solvent container 10, while the other branch 22 is fed to an air jet pipe 42 which will be further described below.

The solvent tank cap 12 has a tube 34 extending from its solvent outlet vertically downwards and terminating approximately one inch above the bottom of the tank to ensure that no foreign matter will be drawn in with the solvent. As an additional precaution, the solvent inlet to the tube 34 may be fitted with a filter 36. The solvent outlet is connected to a small-bore tube 38 which has a hyperdermic needle 40 fitted to its outlet end.

The second branch of the air stream is connected to an air jet pipe 42 consisting of a length of tube which may have an outside diameter of about 0.187 inches or 0.5 cm and which as its outlet end swaged down to a small diameter as indicated at 44 in FIG. 3 so that the bore of the tube at the outlet end may be of the order of 0.015 inch (0.038 cm). The reduced end, for convenience of installation in a particular application, may be bent at about 120° to the general length of the tube, the bend 46 being of relatively large radius to maintain streamline flow.

At a short distance, for example a little over an inch or about 3 cm from the outlet 48 of the air jet pipe, a small diameter hole 50 is drilled into the pipe, its diameter being such that it is capable of receiving the hyperdermic needle 40. The angle at which this hole is drilled is such that, when the hyperdermic needle is inserted, it will be pointing as nearly as possible in the direction of the flow of air through the jet pipe. The hole is drilled in the radiused section 46 of the pipe and, if its location is on the outside of the bend, this assists in having the outlet of the hyperdermic needle located at approximately the center of the cross-sectional area of the jet pipe, and pointing in approximately the same direction as the flow of air.

The space between the hyperdermic needle and the hole through which it enters the jet pipe must be sealed to prevent escape of air. A sealing compound may be used, but it has been found simpler and more effective to place a short length of rubber or plastic tube around the pipe in the area of the drilled hole, and to pass the needle through this tube.

The precision regulators 24, 26 on the airstream are so controlled that the first branch 20 of the air line applied a pressure to the surface of the solvent in the tank which results in the pressure in the solvent at the outlet of the hyperdermic needle 40 being slightly greater than the pressure in the airstream from the second branch 22 of the air line at the same location. As an example, the airstream pressure may be of the order of 3 lbs./inch² (about 0.21 kg/cm²) and the pressure in the solvent may be of the order of 4 lbs./inch² (about 0.28 kg/cm²).

The jet pipe 42 is clamped in position adjacent the sealing compound nozzle 52 with its outlet directed generally towards the nozzle outlet. Nozzle 52 is supported in a fixed bracket 54 above a turntable 56 to which end blanks 58 may be fed one at a time for lining with sealing compound. The nozzle is aligned so that a stream of sealing compound can be directed into the junction between the general surface the can end blank and an upstanding peripheral flange 60 while the blank is being rotated through one revolution by turntable 56. The ejection of sealing compound from nozzle 52 is controlled by suitable means such as valve gear 62 illustrated in FIG. 1.

The distance between outlet 48 of air jet pipe 42 and the outlet of nozzle 52 is such that, having regard to all of the variables, the air jet from the jet pipe 46 will have deteriorated from streamline motion into a condition of turbulence in the area of the outlet of nozzle 52. The dimensions chosen are such that very little vaporization or atomization of the solvent takes place in the jet pipe, atomization occurring primarily in the area of turbulence referred to above. This enables the production of an atmosphere saturated with solvent in the area of the nozzle outlet with a continuous supply of droplets of solvent to maintain the saturated condition.

The rate of input of the solvent, having regard to the rate of the airflow, is such as to avoid

a. a condition in which an excess supply of solvent makes the outside of the nozzle too wet and gives a dilute sealing compound which is ineffective for its purpose.

b. a condition in which solvent is supplied at a rate low enough to enable it to vaporise immediately, thereby failing to give the saturated atmosphere required around the nozzle outlet.

In any given operating situation it is possible with a minimum amount of experimentation, to determine the optimum pressures for the two branches of the air line. These pressures can be noted and maintained for future operation of the machine. Unless the machine is operating in controlled atmospheric conditions, it may be necessary on any given day to alter the rates of flow and/or the proportions of air and solvent fed through the jet pipe. Hence, if the apparatus is not operating effectively, the two precision regulators can be easily adjusted to give optimum operating conditions.

What is claimed is:

1. Apparatus for preventing build-up of sealing compound at the outlet of an intermittently operated sealing compound ejection nozzle comprising: means to direct a stream of air towards the outlet of said nozzle, said means being in the form of a jet pipe having a small-diameter outlet and a bend of relatively large radius located at a distance from said nozzle such that turbulence of the airstream occurs in the area of said nozzle, and the rate of supply of solvent to said airstream being such as to produce an atmosphere saturated with solvent in said turbulent area.
2. Apparatus for preventing build-up of sealing compound at the outlet of an intermittently operated sealing compound ejecting nozzle as claimed in claim 1 including a container for said solvent from which solvent is dispensed under air pressure applied to the surface of said solvent in said container, means being provided to control the pressure of the air in said jet pipe and at the surface of the solvent in the container so that the former pressure is at least slightly less than the latter pressure.