AIR-OPERATED DEVICE AND METHOD FOR LUBRICATING COMPONENTS WITH ELIMINATION OF LUBRICANT WASTE

BACKGROUND OF THE INVENTIVE FIELD

The present invention is directed generally to a system and method for lubricating components while preventing contamination of the surrounding area and re-capturing unused portions of lubricant for subsequent re-use.

At points during the assembly of various devices, it may be desirable or necessary to lubricate one or more individual components thereof. Lubrication may be necessary to proper subsequent operation of a device. Lubrication may also facilitate assembly by reducing installation force, which may result in reduced assembly cycle times and, thus, manufacturing costs.

It has been found that applying lubricants in the form of a fine mist or pressurized spray is one of the most effective ways to lubricate components, as a mist provides a more uniform distribution of lubricant. However, it has been found that the application of lubricants in the form of a fine mist can be difficult to control. When a mist is used within an open environment there may be overspray and subsequent contamination of other components (e.g., other device components that do not require lubrication). This results in a waste of lubricant, and may be detrimental to the inadvertently lubricated component(s). In addition, once the lubricant mist becomes airborne it may settle on the clothing or skin of an operator or other nearby personnel. Further, overspray may fall upon work surfaces, including platforms, flooring, or other work surfaces that may result in slippery conditions.

SUMMARY OF THE GENERAL INVENTIVE CONCEPT

The present invention is directed to systems, devices and methods that eliminate or minimize the aforementioned problems with applying a lubricant mist. Exemplary embodiments of the present invention permit the application of a pressurized spray or fine mist of lubricant to components of interest. A component(s) requiring lubrication is placed in an enclosed lubrication chamber that includes a spray head. Lubricant is drawn into the spray head from a lubricant reservoir. The spray head injects a fine mist of lubricant onto the component of interest, which mist is substantially contained within the lubrication chamber. Excess lubricant drains through a provided orifice in the lubrication chamber and returns to the reservoir via a drain line for subsequent re-use. Thus, the lubrication process can be more accurately controlled and overspray is significantly reduced. Further, the ability to recapture unused lubricant significantly reduces waste and may provide a substantial cost savings.

BRIEF DESCRIPTION OF THE DRAWINGS

In addition to the features mentioned above, other aspects of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments, wherein like reference numerals across the several views refer to identical or equivalent features, and wherein:

FIG. **1** is a front perspective view of an exemplary lubrication system of the present invention;

FIG. **2** is a partial top perspective view of the exemplary device of FIG. **1**, showing a component to be lubricated associated with a lubrication chamber and spray head thereof;

FIG. **3** is a top perspective view of a spray head with the top cover removed to better show the features of a base portion thereof; and

FIG. **4** schematically illustrates application of lubricant to a component by the spray head of FIG. **3**.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

FIGS. **1-4** illustrate one exemplary embodiment of a lubricant application system **10** of the present invention. The system **10** includes a pneumatic source line **15** in communication with a pneumatic pump **20**, which includes both a lubricant pump **145** and an air pump **150** portion. The pneumatic pump **20** is also in communication with a lubricant reservoir **25** that holds a supply of lubricant. An actuator **30** (in this particular case, a foot switch) is provided to activate the pneumatic pump **20**, thereby causing lubricant and pressurized air to be transferred from the lubricant reservoir **25** to a spray head **35** located within an enclosed lubrication chamber **40**. A bundle of separate lubricant and air supply lines **45** extend from the pump **20** to transfer the lubricant and air to corresponding lubricant orifices and air nozzles within the spray head **35**. Other embodiments may employ a lesser or greater number of lubricant and air supply lines depending on the number of lubricant orifices and air nozzles present in the spray head. The various components of the system **10** may be mounted to a frame **55** as shown, or to another structure that allows their retention in a desired arrangement. Such a frame **55** may be provided with wheels or may otherwise made mobile so as to permit easy relocation thereof.

When the pump **20** is activated by the actuator **30**, lubricant is caused to fill a lubricant groove **105** in the spray head **35**, whereafter a burst of pressurized air is emitted from several air nozzles **115** to atomize the lubricant and to project it onto the component to be lubricated (see FIGS. **3-4**). The pneumatic pump **20** comprises multiple (in this case, four) individual pumps to produce the proper lubricant/air supply timing. A drainage line **50** is provided to transfer excess lubricant from the spray head **35** back to the reservoir **25** for subsequent re-use. More than one drainage line may be employed in alternative embodiments.

FIG. **2** shows a partial view of the system **10**, wherein a part **60** having a component to be lubricated has been temporarily located to the lubrication chamber **40** and its associated spray head **35**. The portion of the part **60** having the component to be lubricated is passed through a wall **65** of the lubrication chamber **40** and a cover plate **70** of the spray head **35**. In this particular example, the part **60** having the component to be lubricated is a portion of an automobile HVAC system. However, it is to be understood that the present invention is not limited to use with a particular component or type of component.

Details of the spray head **35** are depicted in FIGS. **3-4**. For purposes of clarity, the cover plate **70** of FIGS. **1-2** has been removed in FIG. **3**. Further, alternative cover plates **75**, **80** are shown in FIG. **3** to illustrate that a number of different cover plates may be provided to accommodate a number of different components to be lubricated. In this example, the diameter of opening **75***a* in the leftmost cover plate **75** is shown to be smaller than the diameter of the opening **80***a* of the rightmost cover plate **80** so as to receive different components to be lubricated. It should be obvious to one of skill in the art that the size and/or shape of the opening in any cover plate may be adjusted as required to accommodate various components to