Light Source for Use With Pneumatic Hand Tools

Federal Manufacturing & Technologies

Michael G. Chapman and
Marty J. Anderson, Pnu-Light

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Light Source for Use With Pneumatic Hand Tools

Background

Pnu-Light was formed in 1991 to provide research, design, manufacturing, and wholesale distribution of pneumatically powered lighting systems of the highest quality. These pneumatic lighting systems would replace ordinary flashlights in the industrial workplace. When integrated with hand tools, the pneumatic lighting device would provide superior lighting capability, while eliminating battery procurement and battery disposal costs. A portion of the compressed air supplied to the tool would spin a small air motor installed with a miniature generator, producing an electric current. The current would be routed to a lamp that would focus light onto the immediate work area. The company incorporated in March 1993 and was granted U.S. Patent 5,267,129 and International Patent #PCT21731 on the concept.

Pnu-Light was referred to AlliedSignal Federal Manufacturing & Technologies (FM&T) by the Missouri Small Business Development Center at Central Missouri State University located at Warrensburg, Missouri. Pnu-Light approached the FM&T through the Technical Assistance Program with the intent of exploring a potential Cooperative Research and Development Agreement (CRADA). It was determined that a CRADA was in the best interest of both parties at that time. This CRADA effort applied FM&T's broad base of technical expertise and advanced manufacturing facilities to evaluate, design, and test hardware.

Description

FM&T and Pnu-Light planned to evaluate and demonstrate the effectiveness of a pneumatically generated lighting system in the expected working conditions as supplied by Pnu-Light. FM&T and Pnu-Light would evaluate cost-effective measures for production of the retrofit lighting system. FM&T would evaluate and test the Pnu-Light manufactured prototype under normal working conditions and in worst-case conditions and would develop design improvements to the retrofit lighting system. This evaluation would include tests ranging from bench or laboratory testing to real-life use in existing shops.

The retrofit light was designed to be a self-contained module to be used with pneumatically driven hand tools. Adaptation included installing a small compressed air motor that drives a miniature generator to produce electrical current. A lamp was provided in a circuit with the generator for emitting light that was focused onto the working area of the tool. The lighting apparatus could be operated either independently or simultaneously with operation of the tool.

Sales in 1993 of power-driven hand tools world-wide were over \$2,460,000,000. The cumulative number of pneumatic tools currently in use is over 1,700,000 (U.S. Census Bureau). This represents a large potential market for the retrofit light patented by Pnu-Light. The technical assistance provided by FM&T in optimizing the design of the device would help position Pnu-Light to profit from the universal need for this product.

Benefits to the Department of Energy

This project provided technical work for FM&T in several of its core competencies such as designing for manufacturability, transformer/generator design, optics design, concurrent engineering, and testing applications. The project offered a "non-weapon" related opportunity to transfer technology while enhancing in-house technical skills necessary to commercialize a product that will benefit the U.S. economy.

Technologies Being Exercised at FM&T

Mechanism design for manufacturing improvements were used. An example was the resolution of the magnet/shaft assembly process. It was changed from a swaging method to a bonding process. Tool design to concentrically mount the shaft to the magnet was accomplished. Design modifications such as the suggested change to the magnet material were developed. A circuit board was also designed to replace a number of individual parts. Generator characterization was used to identify an over-design of the system.

Miniature mechanical processing and manufacturing of small parts were used to develop test parts.

Economic Impact

The U.S. Census Bureau estimates sales in 1992 of pneumatic tools in the U.S. alone to be over 300,000 units and the cumulative number of pneumatic tools currently in use to be over 1,700,000. This represents a large potential market with a universal need for this product. The initial focus will be the aviation and manufacturing pneumatic tool market. In these industries, the operator of pneumatic tools often works in small, relatively inaccessible areas that are difficult to illuminate using standard lighting methods. The worker is forced to either use an AC-powered droplight or find a way to hold a flashlight while doing the work.

The pneumatic lighting device uses a small amount of available air pressure to produce the lighting required to view the immediate working area. The initial benefit of the device is the avoidance of hazardous electrical current at the work site and increased worker productivity. Longer range benefits are the savings in cost of disposable flashlight batteries and the positive environmental impact by reducing the need to dispose of batteries. An estimated 8,000,000 lead-acid flashlight batteries are currently disposed of annually as hazardous waste by the U.S. aircraft maintenance industry alone.

Project Status

A number of unit technical issues have been addressed. Quantities of evaluation hardware were manufactured. Environmental testing of the unit at FM&T was not completed. Project funding to address this activity was exhausted.

The Pnu-Light Company during FY96 merged with the PRO-Dex Corporation of Boulder, Colorado. Pro-Dex, through a subsidiary, Micro Motors of Santa Ana, California, will contract manufacture the Pnu-Light product line. Additionally Pnu-Light had signed an exclusive sales agreement with AiMCO, Inc. of Portland, Oregon, to sell all product lines.

DOE Facility Points of Contact for Project Information

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