High Energy Cutting and Stripping Utilizing Liquid Nitrogen

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ABSTRACT

The Aerospace Industry has endeavored for decades to develop hybrid materials that withstand the rigors of mechanized flight both within our atmosphere and beyond. The development of these high performance materials has led to the need for environmentally friendly technologies for material re-work and removal.

The NitroJet™ is a fluid jet technology that represents an evolution of the widely used, large-scale water jet fluid jet technology. It involves the amalgamation of fluid jet technology and cryogenics technology to create a new capability that is applicable where water jet or abrasive jet (water jet plus entrained abrasive) are not suitable or acceptable because of technical constraints such as process or materials compatibility, environmental concerns and aesthetic or legal requirements.

The NitroJet™ uses ultra high-pressure nitrogen to cut materials, strip numerous types of coatings such as paint or powder coating, clean surfaces and profile metals.

Liquid nitrogen (LN_2) is used as the feed stream and is pressurized in two stages. The first stage pressurizes sub cooled LN_2 to an intermediate pressure of between 15,000 and 20,000 psi at which point the temperature of the LN_2 is about –250°F. The discharge from this stage is then introduced as feed to a dual intensifier system, which boosts the pressure from 15,000 – 20,000 psi up to the maximum operating pressure of 55,000 psi. A temperature of about –220°F is achieved at which point the nitrogen is supercritical. In this condition the nitrogen cuts, strips and abrades much like ultra high-pressure water would but without any residual liquid to collect, remove or be contaminated. Once the nitrogen has performed its function it harmlessly flashes back into the atmosphere as pure nitrogen gas. The system uses heat exchangers to control and modify the temperature of the various intake and discharge nitrogen streams. Since the system is hydraulically operated, discharge pressures can be easily varied over a very wide range providing considerable flexibility for various operations.

The NitroJet™ is an advance on the nitrogen fluid jet technology initially developed at the Idaho National Engineering Laboratory in Idaho Falls, Idaho. NitroCision® first introduced the NitroJet™ into a commercial setting in 2003 and there has been considerable interest from many diverse sectors of government and industry since then. While the current system is an industrial system with the size and mass normally associated with industrial applications, a smaller system that is much more compact is being contemplated for those applications that do not need the full capabilities of the larger system.

The NitroJet™ can be deployed as a fixed or mobile system with multiple end effectors capable of cutting, stripping, cleaning, and surface profiling either in robotic or manual applications.

Information Request

Author(s) will complete all blocks and questions 1 thru 10 in part A only

United Space Alliance

PART A - REQUEST

Title: High Energy Cutting and Stripping Utilizing Liquid Nitrogenls			Date of Request: 05-20-2005
Author(s): Donald E. Noah	Div/Dept: 0311240	Mailcode: USK 807	Phone No.: (321) 853-5774
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