COLD-ENVIRONMENT SERVO MOTOR DESIGN PATENT

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United States Patent Application No. 16/789,432

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Assignee: Polar Dynamics Robotics, Inc.

ABSTRACT

A servo motor system specifically designed for reliable operation in extreme cold environments, comprising a thermally-isolated housing assembly, cold-resistant lubricant circulation system, and proprietary magnetic field

compensation mechanisms enabling consistent torque delivery at temperatur
ranging from -40°C to +25°C. The system incorporates novel thermal manag
features and specialized materials to maintain precision control in sub-zero
industrial environments.

BACKGROUND OF INVENTION

[0001] Conventional servo motors experience significant performance degra
in cold environments due to increased viscosity of lubricants, thermal
contraction of components, and altered magnetic field characteristics. This
invention addresses these challenges through innovative design elements
specifically engineered for cold-environment operation.

[0002] Prior art solutions have failed to adequately address the combined
challenges of thermal isolation, consistent lubrication, and magnetic field
stability in extreme cold conditions, particularly in automated mobile robotic

applications requiring precise position control.

SUMMARY OF INVENTION

[0003] The present invention provides a servo motor system comprising:

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A thermally-isolated housing assembly utilizing composite materials with lo

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A pressurized lubricant circulation system incorporating proprietary cold-res

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Magnetic field compensation mechanisms adjusting field strength based on t

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Integrated temperature monitoring and adaptive control systems

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Specialized bearing assemblies designed for extreme cold operation

DETAILED DESCRIPTION

Housing Assembly

[0004] The housing assembly comprises multiple layers of thermal isolation:

- Outer shell: Carbon fiber composite (specification PDR-CF-201)
- Middle layer: Vacuum-sealed thermal barrier
- Inner shell: Aluminum alloy with specialized surface treatment
- Sealed interfaces utilizing proprietary gasket system (Patent No. 15/432,876)

Lubrication System

[0005] The lubrication system incorporates:

- Synthetic lubricant compound PDR-L100 rated for -50°C operation
- Pressurized circulation system maintaining 2.4 MPa at operating temperature
- Filtered recirculation with debris monitoring
- Temperature-compensated viscosity control

Magnetic Field Management

[0006] The magnetic system includes:

- Neodymium magnets with temperature-specific coating

Active field strength compensation using Hall effect sensors

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Microprocessor-controlled field adjustment algorithms

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Thermal monitoring and feedback control loop

CLAIMS

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A cold-environment servo motor system comprising:

a. A thermally-isolated housing assembly

b. A pressurized lubricant circulation system

c. Temperature-compensated magnetic field control

d. Integrated thermal management systems

The system of claim 1, wherein the housing assembly comprises multiple lay

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The system of claim 1, wherein the lubricant circulation system maintains pr

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The system of claim 1, wherein the magnetic field control system actively ad

DRAWINGS

[0007] Figure 1: Cross-sectional view of housing assembly

[0008] Figure 2: Lubrication system schematic

[0009] Figure 3: Magnetic field compensation diagram

[0010] Figure 4: Control system architecture

INVENTORS

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ASSIGNMENT

The inventors hereby assign all right, title, and interest in this patent application to Polar Dynamics Robotics, Inc., a Delaware corporation, includ the right to file corresponding patent applications in foreign countries and claim priority therefrom.

DECLARATION

I hereby declare that I am the original inventor of the subject matter which is claimed and for which a patent is sought; that I have reviewed and understan the contents of this application; and that all statements made herein are true and further that these statements were made with the knowledge that willful false statements are punishable by fine or imprisonment, or both, under Secti 1001 of Title 18 of the United States Code.

Executed on: March 15, 2022

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