

PATENT SPECIFICATION

PATENT SPECIFICATION

ARCTIC-GRADE CHASSIS DESIGN

Patent Application No. PDR-2023-045

Filed: March 15, 2023

Assignee: Polar Dynamics Robotics, Inc.

Inventors: Chen, Marcus; Barrett, James; Nordstrom, Sarah

Priority Date: March 15, 2023

ABSTRACT

A reinforced chassis design for autonomous mobile robots operating in cold environments, comprising a thermally-isolated power core housing, a multi-layer composite frame structure, and integrated thermal management system, capable of maintaining operational integrity in temperatures ranging from -40 C to +25 C.

TECHNICAL FIELD

[001] The present invention relates to structural designs for autonomous mobile robots, specifically addressing chassis configurations engineered for stable operation in sub-zero environments while maintaining thermal stability and mechanical integrity.

BACKGROUND

[002] Autonomous mobile robots operating in cold storage and industrial environments face unique challenges related to material brittleness, thermal stress, and power system efficiency. Conventional chassis designs fail to adequately address these challenges, leading to reduced operational lifespan and increased maintenance requirements.

[003] Prior art solutions have not successfully resolved the competing demands of thermal isolation, structural rigidity, and power system protection in extreme cold environments.

SUMMARY OF THE INVENTION

[004] The present invention provides a novel chassis design incorporating

a) A thermally-isolated central core housing ("BlueCore(TM)") maintains optimal operating temperature for critical electronic and power components.

b) Multi-layer composite frame structure utilizing alternating layers of:

-

Carbon fiber reinforced polymer (CFRP)

-

Aerogel-based thermal isolation material

-

High-density polyethylene (HDPE) with cold-resistant additives

-

Titanium alloy structural supports

c) Integrated thermal management system featuring:

-

Active heating elements

-

Thermal monitoring sensors

-

Programmable control unit

-

Redundant insulation barriers

DETAILED DESCRIPTION

[005] The chassis design comprises three primary structural zones:

Zone 1: Core Housing

[006] The central BlueCore(TM) housing maintains internal temperature

+10 C and +30 C regardless of external conditions through:

-

Double-wall construction with vacuum-sealed cavity

-

Proprietary phase-change material (PCM) thermal buffer

-

Redundant heating elements rated for 500W total output

-

Sealed access panels with thermal gaskets

Zone 2: Load-Bearing Frame

[007] The primary frame structure features:

-

Modular design allowing component replacement without complete disassembly

-

Stress-distributed load paths managing up to 500kg payload

-

Flexible mounting points accommodating thermal expansion/contraction

-

Impact-resistant external shell rated for industrial environments

Zone 3: Mobility System Integration

[008] The chassis incorporates:

-

Reinforced wheel well structures

-

Protected cable/hydraulic routing channels

- - 7 -

Integrated sensor mounting points

-

Serviceable component access ports

CLAIMS

A chassis design for autonomous mobile robots comprising:

- a) A thermally-isolated central core housing;
- b) Multi-layer composite frame structure;
- c) Integrated thermal management system;

wherein said chassis maintains operational integrity in environments b

C and +25 C.

The chassis design of claim 1, wherein the central core housing main

The chassis design of claim 1, wherein the multi-layer composite fram

[Claims 4-20 continued...]

DRAWINGS

[Drawing descriptions and references omitted for brevity]

DECLARATION AND ASSIGNMENT

The undersigned inventors hereby declare that:

They believe themselves to be the original inventors of the subject ma

They have reviewed and understand the contents of the above-identified

They acknowledge the duty to disclose information which is material to

Inventors:

/s/ Marcus Chen_ Date: 3/15/2023

Marcus Chen, Chief Technology Officer

Polar Dynamics Robotics, Inc.

/s/ James Barrett_ Date: 3/15/2023

Dr. James Barrett, Chief Robotics Officer

Polar Dynamics Robotics, Inc.

/s/ Sarah Nordstrom Date: 3/15/2023

Sarah Nordstrom, Chief Operating Officer

Polar Dynamics Robotics, Inc.

ASSIGNMENT

The inventors hereby assign all right, title, and interest in this patent application to:

Polar Dynamics Robotics, Inc.

100 Innovation Drive

Wilmington, DE 19801

Assignee Acceptance:

/s/ Elena Frost_ Date: 3/15/2023

Dr. Elena Frost, CEO

Polar Dynamics Robotics, Inc.

