PATENT SPECIFICATION

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MOISTURE-RESISTANT HOUSING DESIGN FOR CO

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ABSTRACT

A moisture-resistant housing assembly for autonomous mobile robots

sub-zero environments, comprising a multi-layer composite shell struc
integrated thermal barriers and moisture management channels. The
incorporates novel sealing mechanisms and condensation prevention
specifically engineered for extreme temperature differential conditions

BACKGROUND OF THE INVENTION

[0001] Autonomous mobile robots operating in cold storage environm
significant challenges related to moisture accumulation and condensa
formation when transitioning between temperature zones. Existing ho
fail to adequately address the combined effects of thermal cycling, hu
variation, and mechanical stress in sub-zero conditions.

[0002] Traditional robotic housings typically employ single-layer shells
basic weatherproofing, which prove insufficient for preventing moistur
and managing condensation in extreme temperature environments ra

to +25 °C.

SUMMARY OF THE INVENTION

[0003] The present invention provides a moisture-resistant housing as
specifically designed for autonomous mobile robots operating in cold
environments. The housing comprises:

a) A three-layer composite shell structure featuring:

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Outer layer: Impact-resistant thermoplastic polymer with hydrophobic

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Middle layer: Closed-cell foam thermal barrier with integrated moisture

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Inner layer: Condensation-resistant liner with active moisture wicking

b) Proprietary sealing system incorporating:

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Double-barrier gasket design with primary and secondary moisture ba

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Temperature-compensating seal compression mechanism

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Integrated heating elements at critical seal interfaces

DETAILED DESCRIPTION

[0004] The primary housing structure utilizes a proprietary composite
(BlueCore(TM)) comprising:

Material Composition:

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Outer shell: Modified polyethylene terephthalate (PET) with nano-scal

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Thermal barrier: Cross-linked polyethylene foam with directional mois

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Inner liner: Moisture-wicking composite with integrated temperature se

Sealing System:

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Primary seal: Silicone-based compression gasket with shore hardnes

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Secondary seal: Expandable foam barrier with temperature-activated

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Heating elements: Distributed 24V DC heating strips with thermal mon

Moisture Management:

Channeled ventilation system with positive pressure maintenance

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Automated condensation detection and prevention system

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Active moisture removal through integrated collection and evacuation

CLAIMS

What is claimed is:

A moisture-resistant housing assembly for autonomous mobile robots

a) A multi-layer composite shell structure;

b) An integrated thermal barrier system;

c) Active moisture management channels;

d) Temperature-compensating sealing mechanisms.

The housing assembly of claim 1, wherein the composite shell structu

a) An impact-resistant outer layer with hydrophobic properties;

b) A thermal barrier middle layer with moisture channels;

c) A condensation-resistant inner liner.

The housing assembly of claim 1, further comprising:

a) A double-barrier gasket system;

b) Integrated heating elements;

c) Active condensation monitoring and prevention systems.

DRAWINGS

[0005] Figure 1: Cross-sectional view of the three-layer composite stru

[0006] Figure 2: Detailed view of the sealing system assembly

[0007] Figure 3: Moisture channel configuration and flow patterns

[0008] Figure 4: Temperature sensor and heating element placement

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ASSIGNMENT

The entire right, title, and interest in this patent is assigned to:

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