Title: Reconfigurable Foam Block System with Hook and Loop Attachment for Object Securement

Field of the Invention:

The present invention relates to systems for securing and protecting objects within hardshell storage cases. Specifically, it pertains to a customizable foam block system utilizing a hook and loop attachment method, enabling reconfigurable placement of foam blocks to securely hold and protect objects of various shapes and sizes during transport.

Background

The secure transportation of delicate or valuable objects within hardshell cases has long been a challenge, particularly in industries that require precision and reliability. Traditional methods for securing items in these cases often involve custom-cut foam inserts tailored to specific items. While these methods provide some degree of protection, they lack flexibility; once cut, the foam cannot be reconfigured to accommodate different objects, rendering them impractical for users with varying storage needs.

Existing solutions typically involve pre-molded foam inserts or generic foam sheets designed to fit particular items. These methods offer limited customization and reconfiguration, restricting their utility. Moreover, they struggle to securely hold irregularly shaped objects, increasing the risk of damage during transport.

This invention addresses these limitations by introducing a reconfigurable foam block system that utilizes a hook and loop attachment method. This system provides superior protection by allowing foam blocks to be easily repositioned within the case, adapting to different objects and configurations. The foam blocks are designed to deform around the objects, creating a secure fit through an undercut mechanism. Additionally, the system leverages commonly available hardshell cases and upper eggshell foam inserts, making it a versatile and cost-effective solution for a wide range of applications.

Reference Numbers

Here is the list of reference numbers used throughout the application, along with a brief description of the corresponding component or feature:

Here is the list of reference numbers used throughout the application, along with detailed descriptions of the corresponding components:

100: Foam block system deployed in a common weapon case.

100': Alternate arrangement using reconfigurable foam blocks for different object configurations.

101: Hardshell case, a rigid protective case commonly used for transporting sensitive items.

102: Hard shell upper eggshell foam, providing downward pressure to secure objects in place.

103: Discarded foam from the originally purchased case, typically replaced by the custom foam deck.

104: Long rifle, an example of an object secured within the case.

105: Gun barrel, part of the long rifle secured by the foam blocks.

106: Magazine clips, stored and secured within the foam block system.

107: Gun stock, another part of the long rifle secured by the foam blocks.

110: Customizable foam block system designed to be added to hardshell cases.

112: Foam deck layer, the base layer of the system, covered with loop fabric material.

114: Adhesive layer, used to attach the foam deck securely to the bottom of the hardshell case.

116: Loop fabric material layer, affixed to the foam deck to interact with the hook fabric material on the foam blocks.

120: Rectangular foam block, a standard block shape used for securing objects.

121: Sidewall ribs, found in some foam blocks, designed to grip and secure objects with irregular surfaces.

122: Adhesive layer, present on the bottom of foam blocks for additional stability.

123: Foam core, the deformable low-density foam within the blocks that conforms to object shapes.

124: Hook fabric material layer, attached to the bottom surface of the foam blocks, engaging with the loop fabric on the foam deck.

125: Dense outer skin layer (embodiment 2), providing rigidity and durability to the foam blocks.

126: Void for logo plate, a designated area for branding or identification.

127: Interior void (embodiment 3), a hollow section within the foam block designed to hold specific objects.

130: Triangular foam block, another standard block shape used for securing objects.

131: Sidewall ribs (embodiment 4), designed to create an undercut for enhanced grip.

132: Adhesive layer, for additional block stability.

133: Foam core, similar to that of the rectangular block.

134: Hook fabric material layer, identical in function to that on the rectangular blocks.

135: Dense outer skin layer (embodiment 2), providing additional durability.

136: Void for logo plate, for branding purposes.

137: Interior void (embodiment 3), used for securing objects within the triangular block.

138: Logo plate, used for identification or branding purposes.

140: Magazine holder foam container, a block specifically designed with apertures to secure rifle magazines.

142: Adhesive layer, securing the magazine holder within the case.

143: Foam core, deformable material within the magazine holder.

144: Hook fabric material layer, attaching the magazine holder to the foam deck.

145: Dense outer skin layer (embodiment 2), providing rigidity to the magazine holder.

146: Aperture in container, designed to securely hold rifle magazines.

147: Interior void (embodiment 3), creating a secure space for the magazines.

190: Deformation of foam blocks due to solid object placement, illustrating how blocks conform to object shapes.

191: Sidewall ribs gripping top of object, showing the enhanced security provided by the ribs.

Brief Description of the Drawings

1. **FIG 1:** A perspective view of the system deployed within a hardshell case, illustrating objects being secured by the foam blocks.
2. **FIG 2:** An exploded view of the system showing the hardshell case, foam deck, and various foam blocks positioned around the objects.
3. **FIG 3:** A perspective exploded view of different types of foam blocks used in the system, including rectangular and triangular shapes.
4. **FIG 4:** A section cut line across three foam block types, highlighting their internal structure.
5. **FIG 5:** A section cut showing the interior foam core of the block types, illustrating the deformable nature of the foam.
6. **FIG 6:** A section cut showing an alternate embodiment of the foam blocks, featuring a dense outer skin with a foam core.

7. **FIG 7:** A section cut showing an alternate embodiment of the foam blocks, depicting a dense outer skin and an interior void.
8. **FIG 8:** A section cut showing an alternate embodiment of foam blocks with sidewall ribs designed to grip objects securely.
9. **FIG 9:** A close-up perspective view of the loop fabric material on the foam deck, used to secure the foam blocks.
10. **FIG 10:** A close-up perspective view of the hook fabric material on the underside of all foam blocks, illustrating how they attach to the foam deck.
11. **FIG 11:** A section cut line across a closed case with the system deployed, showing a rifle secured inside using the foam blocks.
12. **FIG 12:** A section cut showing the deformation of foam blocks around the gun stock and barrel, enhancing the secure fit.
13. **FIG 13:** A perspective view of the system being modified and adapted to fit within a common hardshell case.
14. **FIG 14:** An alternate arrangement of foam blocks and a container, securing multiple objects in different placements within the case.

Detailed Description

The present invention pertains to a foam block system designed to securely hold and protect objects within a hardshell case during transport. This system offers a significant improvement over traditional custom-cut foam inserts by providing a highly customizable and reconfigurable solution.

System Overview

The foam block system **110** is designed to be added to standard hardshell cases **101**. The system features a foam deck layer **112**, which forms the base of the system. This foam deck is securely adhered to the bottom of the hardshell case using an adhesive layer **114**. The upper surface of the foam deck **112** is covered with a loop fabric material layer **116**, which serves as the attachment surface for the foam blocks.

Foam Blocks

The core components of the system are the foam blocks, which are available in various shapes, including rectangular blocks **120** and triangular blocks **130**. These blocks are constructed from a deformable low-density foam **123, 133**, which allows them to conform closely to the shapes of the objects they secure. This conformability is a key feature that enhances the security and stability of the hold.

Each foam block is equipped with a lower surface covered in hook fabric material **124, 134**. This hook fabric engages with the loop fabric material **116** on the foam deck, allowing the blocks to be

securely attached and easily repositioned as needed. This reconfigurability enables users to customize the arrangement of foam blocks within the case, providing a tailored fit for different objects.

Alternate Embodiments

In one embodiment, the foam blocks are designed with a dense outer skin layer **125, 135**. This outer skin, made from materials such as thermoplastic polyurethane (TPU), provides additional rigidity and durability, making the blocks suitable for securing heavier or more delicate items.

Another embodiment features foam blocks with an interior void **127, 137, 147**. These voids are designed to create a container within the block, allowing the foam to securely hold specific objects, such as rifle magazines **106**. The voids can be customized to fit the dimensions of various items, ensuring that they are held securely on all sides.

Some foam blocks include sidewall ribs **121, 131**, which are designed to enhance the grip on objects with irregular surfaces. These ribs create undercuts within the foam, allowing the blocks to grip objects more securely, preventing lateral movement during transport.

Customization and Reconfiguration

The ability to reposition and reconfigure the foam blocks is a central feature of this invention. Users can easily detach the blocks from the loop fabric material **116** and reposition them as needed to accommodate different objects or configurations. This flexibility ensures that the system can be adapted to a wide range of items, providing a snug and secure fit regardless of the object's shape or size.

The foam deck **112** is intentionally oversized to allow users to trim it to a precise fit within the hardshell case **101**. This ensures that the entire system remains securely in place during transport, even when subjected to movement or vibration.

Pressure Application

When the foam block system is fully deployed, the objects within the case are further secured by the upper eggshell foam **102** commonly found in hardshell cases. This foam applies downward pressure on the objects, pressing them into the foam blocks **120, 130** and further enhancing the stability of the hold. The combination of the foam blocks' conformability and the pressure from the eggshell foam ensures that the objects are held firmly in place, preventing any lateral or vertical movement.

Specific Applications

One practical application of this system is illustrated in **FIG 11**, where a long rifle **104** is secured within a hardshell case **101**. The foam blocks **120** deform around the gun barrel **105** and gun stock **107**, providing a stable and secure hold that is further reinforced by the eggshell foam **102**.

Another application is shown in **FIG 13**, where the system is modified and adapted to fit a different hardshell case. The flexibility of the foam blocks allows for easy repositioning to accommodate various objects, demonstrating the system's versatility in different use scenarios.

Claims:

1. **A system for securing objects within a hardshell case,** comprising:
    - A lower foam deck configured to fit within the base of the hardshell case, said foam deck including a layer of loop fabric material affixed to its upper surface;
    - A plurality of reconfigurable foam blocks, each block comprising:
        - A lower surface covered with a hook fabric material that is complementary to the loop fabric material on the foam deck;
        - A deformable low-density foam core that conforms to the shape of an object when pressed against it;
        - The capability of being securely attached to and detached from any position on the foam deck, thereby allowing infinite reconfigurations of the blocks within the case to adapt to different objects.
2. **The system of claim 1,** wherein the foam blocks are available in multiple geometric shapes, selected from the group consisting of rectangular, triangular, and custom-shaped blocks, each of which can be positioned at various angles relative to one another and to the objects within the case.
3. **The system of claim 1,** wherein at least some of the foam blocks further comprise:
    - An outer shell made of a denser material surrounding the low-density foam core, providing additional rigidity and durability to the blocks, thereby enhancing their suitability for securing heavier or more delicate objects.
4. **The system of claim 3,** wherein the outer shell is composed of a thermoplastic polyurethane (TPU) material, which is resistant to wear, deformation, and environmental factors.
5. **The system of claim 1,** further comprising foam blocks with interior voids, wherein the voids create a container within the block for securely holding objects of specific shapes and sizes, such as rifle magazines.
6. **The system of claim 5,** wherein the interior voids extend vertically through the foam blocks, forming apertures that allow the blocks to securely encase elongated objects, preventing movement within the case.
7. **The system of claim 1,** wherein at least some of the foam blocks include sidewall ribs with undercuts, said ribs being designed to grip the edges or surface details of objects placed within the case, thereby enhancing the stability and preventing lateral movement.
8. **The system of claim 7,** wherein the sidewall ribs are configured parallel to the surface of the foam deck and are designed to deform around and grip the upper edges or irregular surfaces of objects placed within the case.

9. **A method for securing objects within a hardshell case using the system of claim 1,** comprising the steps of:
    - Placing the foam deck with the loop fabric material inside the base of the hardshell case;
    - Selecting and positioning foam blocks onto the loop fabric material at desired locations to create a customized fit around the objects to be secured;
    - Pressing the objects into the foam blocks, allowing the low-density foam to deform and conform around the objects, creating an undercut that enhances the grip;
    - Applying an upper foam layer, such as an eggshell foam insert, to exert downward pressure on the objects and foam blocks, thereby further securing the objects within the case.
10. **The method of claim 9,** wherein the foam blocks can be repositioned at any time by detaching them from the loop fabric material and reattaching them in new positions to accommodate different objects or configurations, offering a high degree of flexibility and customization.
11. **A foam block for use in a system for securing objects within a hardshell case,** the block comprising:
    - A deformable low-density foam core;
    - A lower surface covered with hook fabric material for attachment to a loop fabric material on a foam deck;
    - Sidewall ribs designed to grip and conform around the edges or irregular surfaces of objects, providing enhanced stability and security.
12. **The foam block of claim 11,** wherein the block further includes an interior void, the void being shaped to accommodate and securely hold an object placed within the block, enhancing the versatility of the system.
13. **The foam block of claim 11,** wherein the block's sidewall ribs are configured to interact with the surface details of the object’s exterior to improve the grip and prevent both lateral and vertical movement within the case.
14. **The system of claim 1,** wherein the lower foam deck is oversized relative to the base of the hardshell case, allowing it to be trimmed to a precise fit using common tools such as scissors or a blade, ensuring a snug and secure placement within the case.
15. **A foam block system for securing items within a hardshell case,** utilizing a hook and loop attachment method to provide infinite reconfigurability of foam blocks that conform to the shape of objects, thus enhancing the stability, protection, and customizability of the objects during transportation.

Glossary of Terms

Foam Block: A low-density, deformable foam unit designed to secure objects in place within a hardshell case. Foam blocks may come in various shapes, such as rectangular or triangular, and can include additional features such as sidewall ribs or outer shells.

Hook Fabric Material: A fabric layer affixed to the underside of the foam blocks, comprising one half of the hook and loop attachment system, which allows the blocks to be securely attached to the foam deck.

Loop Fabric Material: The complementary fabric layer affixed to the upper surface of the foam deck, interacting with the hook fabric material on the foam blocks to secure them in place.

Foam Deck: A layer of foam installed at the bottom of the hardshell case, covered with loop fabric material, which serves as the base for attaching the foam blocks.

Outer Shell: A rigid material layer that surrounds the low-density foam core of some blocks, providing additional durability and rigidity for securing heavier or delicate objects.

Interior Void: A hollow section within the foam block, designed to hold objects by creating a container-like structure. The void may extend vertically through the block to accommodate elongated objects such as magazines.

Sidewall Ribs: Protrusions on the sides of some foam blocks that create undercuts, designed to grip the edges or surface details of the secured objects, enhancing the stability of the hold.

Hardshell Case: A rigid, protective case typically used for transporting sensitive or valuable objects, often featuring an upper eggshell foam layer for additional securement.

Eggshell Foam: A pre-existing foam insert with an uneven, textured surface, commonly found in hardshell cases, that applies downward pressure on objects to secure them in place.

Reconfigurability: The ability of the foam blocks to be repositioned and rearranged within the case, allowing the user to customize the system to fit different objects or configurations.

Abstract

A reconfigurable foam block system for securing objects within hardshell cases utilizes a hook and loop attachment method. The system comprises a foam deck with a loop fabric layer affixed to the case base, onto which foam blocks, covered with hook fabric material, can be attached and repositioned as needed. The blocks are made from deformable low-density foam, allowing them to conform to the shape of objects and securely hold them in place. Alternate embodiments include blocks with a dense outer shell for added rigidity, interior voids for specific object retention, and sidewall ribs for enhanced grip. This system provides a customizable and secure storage solution, adaptable to various objects and case configurations.

Other Embodiments

The invention described herein can be implemented in various alternative embodiments to enhance its versatility and applicability across different use cases. Below are several other potential embodiments of the foam block system:

1. **Variable Density Foam Blocks:** In this embodiment, the foam blocks could be manufactured with variable density layers. The core of the block could be composed of a softer, more deformable foam to conform closely to the objects, while the outer layers could be made of a denser material to provide additional support and stability. This configuration would allow the blocks to better absorb impacts while still providing a secure grip on the objects.
2. **Magnetically-Enhanced Foam Blocks:** Another embodiment could incorporate magnets within the foam blocks, either in addition to or instead of the hook and loop system. These magnets could interact with ferromagnetic materials embedded in the foam deck or directly within the objects themselves, providing an alternative method of secure attachment. This could be particularly useful for securing metal objects, such as tools or electronic devices, within the case.
3. **Temperature-Responsive Foam:** The foam material could be modified to include temperature-responsive properties, such as shape-memory polymers. These blocks could change their firmness or shape in response to temperature variations, providing enhanced protection in environments where temperature control is crucial. For example, the foam blocks could soften in warmer temperatures to provide cushioning and then harden in cooler conditions for added structural support.
4. **Integrated Sensor Systems:** Foam blocks could be equipped with embedded sensors that monitor the environment within the case, such as temperature, humidity, or shock levels. These sensors could relay information to a connected device, alerting the user if conditions within the case exceed predefined thresholds. This embodiment would be particularly beneficial for transporting sensitive electronics, medical devices, or other items that require careful environmental control.
5. **Customizable Modular Foam System:** In this embodiment, the foam blocks could be part of a modular system where users can select and combine different block types and sizes based on their specific needs. Blocks could be interlocked or connected via built-in connectors, allowing for more complex configurations. This modular system would enable users to create custom compartments within the case, tailored precisely to the dimensions and shapes of their objects.
6. **Rotationally-Molded Foam Blocks:** Another embodiment could involve foam blocks produced through rotational molding, creating hollow blocks with intricate internal structures. These blocks could be lighter while maintaining the structural integrity needed to secure objects. The hollow design could also provide storage space within the foam blocks themselves for small items, further maximizing the use of space within the case.

7. **Adjustable Height Foam Blocks:** This embodiment would feature foam blocks with adjustable height, allowing users to fine-tune the block dimensions to fit various objects snugly. The height adjustment could be achieved through stackable foam layers or an internal mechanism within the blocks that allows them to extend or retract. This would provide an additional level of customization for securing objects of varying heights within the case.
8. **Transparent or Translucent Foam Blocks:** To allow for easy identification of objects without removing them from the case, foam blocks could be made from transparent or translucent materials. This would enable users to quickly verify the contents of the case at a glance, making it particularly useful for cases with multiple small or similar-looking items.