

# STUDIES ON THE DEVELOPMENT OF TRUNK PRODUCT FOR DESIGNER CLOTHING AND SHOES WITH INTEGRATED SECURITY SYSTEM

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*ABSTRACT: The main objective of this project is to research the design requirements in order to make a trunk for designer clothes and shoes with an integrated safety system that is consistent with the requirements of potential customers. A thorough market study will be carried out where the products already on the market and their related patents will be analyzed in order to determine the major new functions. The scientific importance of the theme is given by the two research directions of the creation and implementation of the new product: **conceptual design** – where the main functions will be determined, research based on existing patents, systematic exploration and product architecture; **detailed design** – where the 3D model will be made according to the proportions, dimensions and related tolerances, taking into account the ergonomic and anthropometric aspects, the definition of the design elements and the materials used.*

*KEY WORDS: trunk, conceptual design, detailed design, analysis, 3D design.*

## 1. Introduction

This paper aims to research the new design requirements for creating a multifunctional trunk for designer clothes and shoes, in order to meet the demands of potential customers. The identified functions will help us develop the new requirements that the product must adhere to, in order to satisfy customer needs.

Furthermore, the analysis of existing trunks on the market and their patents is pursued in order to address existing issues and improve the existing functionalities of these products.

Moreover, the product architecture will be developed based on the functions identified to meet the needs and desires of consumers, enabling us to start creating the 3D model and identify any potential issues before the product reaches the production stage.

Once the main functions have been determined, the detailed design stage will commence, where the 3D model will be created according to the specifications, while simultaneously checking for any issues alongside the main functions. After this is accomplished, the product will be analyzed from an ergonomic and anthropometric perspective. If the product meets all these criteria, the 3D model will be finalized by incorporating the design elements that relate to the final architecture of the product.

Once the final 3D model is completed, a thorough analysis of the materials available on the market will be conducted to determine which ones meet our requirements and can be sent for production.

The certification, use, commercialization, and recycling of the product also play an important role in this process. All these stages are closely linked to the economic analysis.

The final stage involves creating the product manual, which will be extremely useful for the user to understand exactly how the product functions and how to resolve any potential errors that may arise.

Thus, the purpose of this project is to determine whether the product is practical and meets all the needs of potential customers. The most important aspect is for the product to provide the user with the best quality and ensure the safety of the stored items.

## 2. Conceptual design

### 2.1 General function and component functions

Starting from the identified need and customer requirements, it has been determined that the general function of the developed product is storage and safekeeping of clothing items. The general function undergoes an analysis process, which results in identifying the main functions and then the secondary functions. The main functions are characteristics of the product that determine the general function. The secondary functions, resulting from the interaction between the main functions, are referred to as internal interactions. Additionally, there are interactions between the main functions and the environment in which they operate, which are called external interactions.

The main functions of the "Trunk for designer clothes and shoes with integrated security system" product are presented in Table 2.1.

**Table 2.1 Main functions of the product**

No. Function	Main functions of the product
Ø <sub>11</sub>	Maintaining the safety of the items
Ø <sub>12</sub>	Storing clothing items
Ø <sub>13</sub>	Signaling the operational status of the security system
Ø <sub>14</sub>	Easy transportation
Ø <sub>15</sub>	User-friendliness
Ø <sub>16</sub>	Increased durability
Ø <sub>17</sub>	Luxurious and ergonomic design

From the previously established main functions, a list of critical functions has been compiled, presented in Table 2.2, which determines the commercial success of the product. These critical functions correspond to dimensions and requirements with maximum relative importance.

**Table 2.2 Critical function of the product**

No. function	Critical function of the product
Ø <sub>11</sub>	Maintaining the safety of the items
Ø <sub>12</sub>	Storing clothing items
Ø <sub>13</sub>	Easy transportation
Ø <sub>14</sub>	Increased durability

The system of phenomena used in the development of the general function - "Allows for the safe storage of clothing items" - is further analyzed:

**Table 2.3 Applicable effects**

No. function	Critical function of the product	Possible effects
Ø <sub>11</sub>	Maintaining the safety of the items	adsorption, chemisorption, coating layer, electrochemical deposition
Ø <sub>12</sub>	Storing clothing items	deformation limiters, adsorption, coating layer, electrochemical deposition
Ø <sub>13</sub>	Easy transportation	gravity, inertia, vibrations, friction
Ø <sub>14</sub>	Increased durability	shape memory effect, mechanical fixation, absorption

## 2.2 External research to identify known constructive solutions

To establish the known conceptual solutions for the development of the main functions, we conducted a bibliographic study that primarily considers invention patents related to similar products.

The objective of this invention, as shown in Figure 2.1, is to overcome the difficulties faced by the traveling public. The series of drawers that usually occupy half of the wardrobe trunk are, according to this invention, housed in a detachable frame. This frame is arranged in such a way that it has smooth contact with the walls of the trunk in which it is housed, thus not practically losing any extra space in the trunk and not compromising its appearance in any way. [1]

When the trunk with its detachable frame is brought on board an aircraft or into a hotel room, the frame carrying all the drawers can be easily removed and stored under the bed or in any convenient location, while the trunk itself can be stored until it is needed again.

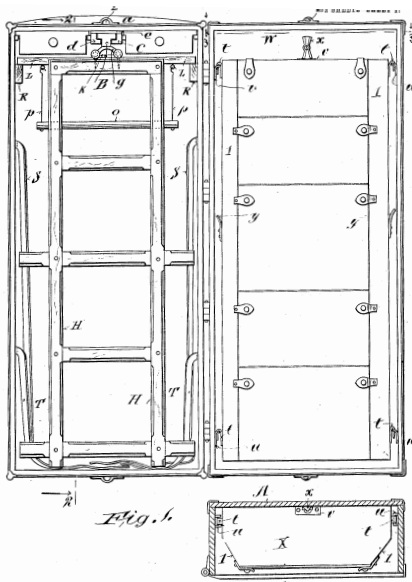


Fig. 2.1 Wardrobe trunk [1]

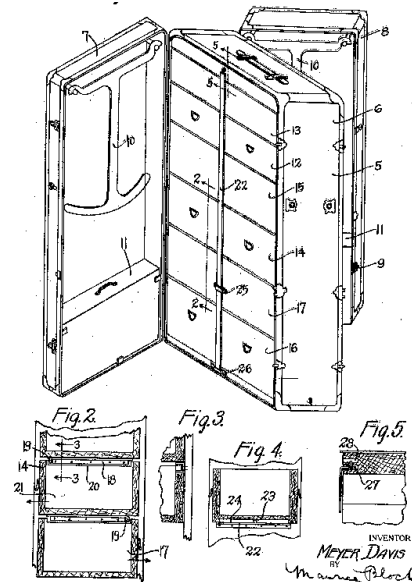


Fig. 2.2 Wardrobe trunk [2]

The invention presented in Figure 2.2 refers to improvements in a wardrobe trunk. The purpose of the invention is to construct a wardrobe trunk that can be used as a practical closet for storing clothing items in the same way a regular closet is used. Another object of the invention is to arrange multiple interior parts of the trunk, used for storing clothing items, in such a way that the garments can be easily and securely held in their appropriate places when the trunk is intended for travel purposes. [2]

## 2.3 Internal research for new constructive solutions

In order to create the product, several technical solutions have been found that can easily fulfill the critical functions. The solutions found for the designer clothing and shoe trunk with an integrated security system are listed in the table 2.4

Table 2.4 Technical and conceptual solutions

Ensuring the safety of the items	Storage of clothing items	Easy transportation	Increased resistance
Integrated security system	Adequate compartments	Retractable wheels Handle	Superior quality of materials Post-sale warranty

## 2.4 Systematic exploration

To conduct a systematic exploration, a rigorous method of selecting relevant research is necessary, as well as a critical evaluation of their quality and relevance. After identifying relevant research, they should be evaluated based on criteria such as the methodology used, sample size and participants, as well as the obtained results and their relevance to the research domain.

Upon compiling the database of known conceptual solutions for the product's main functions, we have identified a number of technically feasible solutions through the combination of concepts. However, given the specific objective specifications established in previous works, certain conceptual solutions are excluded due to their incompatibility.

## 2.5 Product architecture

During the product architecture process, several key factors will be considered, including consumer needs and desires, available materials, available technology, and production costs. Additionally, it is important to evaluate the product's market viability and existing competition to ensure that the product has real chances of success.

The image below depicts the chosen concept for the product design:

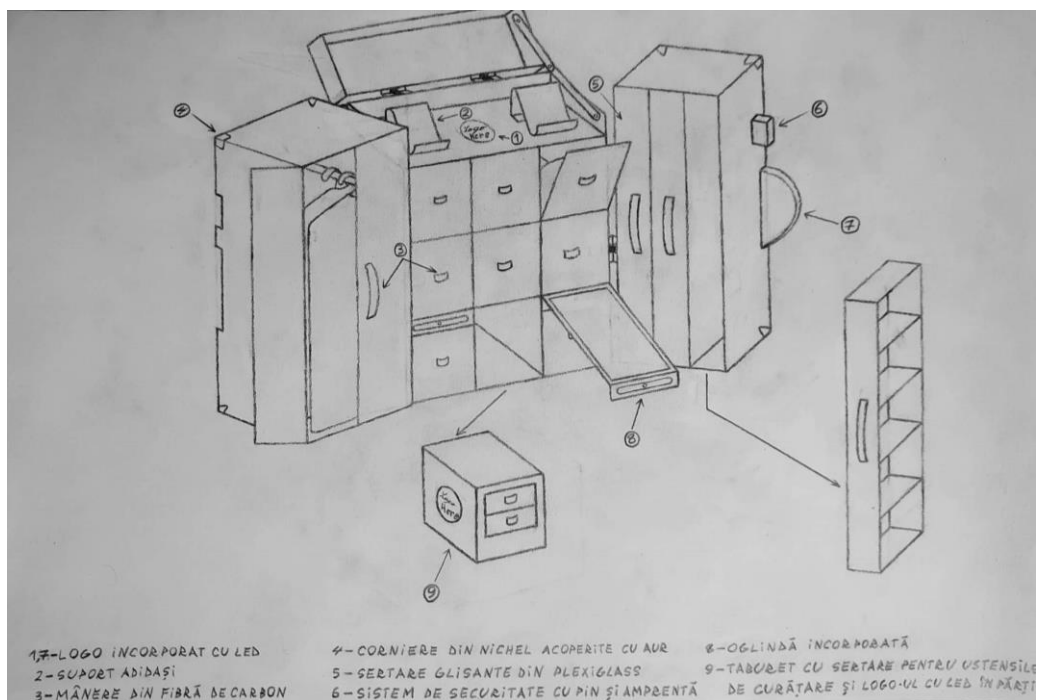


Fig. 2.3 Trunk sketch [3]

### **3. Detailed design**

#### **3.1 Proportioning, shapes, dimensions, and tolerances**

- Proportioning: The overall dimensions of the trunk are 100x80x150 cm (L x W x H).
- Shapes: The shapes used in the construction of the trunk are quite common, including circles, rectangles, and curved forms for certain elements.
- Tolerances: Tolerances will primarily be applied to the drawers to ensure ease of use, with a tolerance of  $\pm 0.3$  mm.

#### **3.2 Determining ergonomic and anthropometric conditions**

- Ergonomics

Ergonomics plays an important role in designing the trunk for the user to benefit from optimal conditions of use. The product must be made so that the user does not develop physical problems along the way due to proportional causes or due to certain elements inside the trunk.

- Anthropometry

Anthropometry, as well as ergonomics, plays an important role for this product, because the trunk must have a suitable height for the user to be able to use this product as easily and efficiently as possible.

#### **3.3 Defining design elements**

The main design elements used are the following:

- Brand logo placed on multiple parts of the product;
- Mirrors for viewing shoes and clothes;
- Display supports for shoes;
- Metal elements in the corners of the trunk to prevent hitting;
- The stool with mini drawers;



Fig. 3.1 Logo SEB'NDIA full color [4]

#### **3.4 Determining materials and treatments**

- Cedar wood

Cedar is resistant to weathering, rotting, does not require treatment before use, making it ideal for the trunk skeleton.

- **Plexiglass**

The side drawers for the individual pairs of shoes will be made of Plexiglas, because it is durable, weighs half as much as glass and can be found in any color.

- **Carbon fiber**

This material will be used to cover the trunk because it is durable, modern, and does not attract moisture from the air to damage the inner skeleton.

- **Velvet**

This material will be used for subtle accents inside the trunk as it is a slightly reflective material and gives the trunk a subtle tint.

- **Brass**

With its lower copper content, CW508L is a single-phase material that is still very good for cold forming. Therefore, this alloy is very suitable for stamping, riveting, crimping and edging. Therefore, this material will be used for the outer corners of the trunk and for the inner support.

### 3.5 3D modeling, development of overall and execution drawings

Following the specifications, functions, shapes and colors determined, the 3D model for the designer clothes and shoes trunk was made:



Fig. 3.2 Model 3D – rendering 1,2 [5]

## 4. Approval, use, marketing and recycling of the product

- **Homologation:** As part of the technical preparation for the manufacture of new products, the execution and homologation of the prototype as well as the zero series is a very important requirement. In order to proceed with the homologation phase, it is aimed to check whether the new product corresponds to the documentation (technical-economic study, design theme, specification, etc.) and to certify the manufacturing technology within the established technical-economic indicators.

Homologation, however, represents the confirmation activity, based on tests and tests, to which the prototype with the zero series is subjected to attest that the product corresponds to the designed one. Homologation is carried out in two stages, namely:

1. **Preliminary approval** – of the prototype;
2. **Final approval** – of the zero series product;

- **Usage:** After the product has reached the market and is publicly accessible, its use depends on the buyer and how they develop their day-to-day business. Of course there are certain concepts already anticipated, namely: **Fashion designers, artists, businessmen, ordinary people.**
- **Marketing:** The marketing of the trunk will be carried out through several channels, depending on the marketing strategy adopted and the targeted market segment, and thus we have: **online store, luxury stores, fashion events, influencer marketing, direct sales.**
- **Product recycling:** After the product has reached the end of its life and can no longer be used due to defects, excessive wear or inconvenience, it can be returned to the brand for recycling for a certain amount of money. Once the used product reaches recycling, it will be separated into components and types of materials that will then be properly recycled to allow their future use.

## **5. Elaboration of the product book**

The product book is an important tool in the development, production and sale of a product. The product book should provide a detailed description of the product and answer any questions or concerns potential customers may have. This can be distributed electronically or in print with the product and used as a marketing tool to increase customer trust and satisfaction.

In the case of a clothing trunk, the product book might include the following information: what's in the box, product overview, specifications, quick start guide, applicable repairs and fixes, important safety information, and consumer warranty.

## **6. Conclusions**

The purpose of this scientific research is to develop a new and modern product, namely a trunk for designer clothing and shoes. This product is innovative and highly relevant in today's market.

The product incorporates many new elements that provide greater confidence and a much stronger impact among people. However, during the development of this product, regardless of its nature and type, various issues can arise. These problems can be of different types and can stem from various reasons. Examples include material selection, product weight that may hinder transportation, and so on. Additionally, technical issues such as safety system failures or improper functioning can also occur.

The most important aspect of this trunk for designer clothing and shoes is to ensure that customers receive a high-quality product. Thanks to the chosen materials, design, weight, and advanced safety system, potential customers can benefit from a qualitative, modern, and affordable product.

Furthermore, similar products are already available on the market, such as those from Italian brand Gucci and French brand Louis Vuitton, which are competitors. However, there are some aspects that put them at a disadvantage, such as dimensions and the lack of an integrated safety system.

The main objective of this project is to research the new market requirements in order to create a trunk for designer clothing and shoes. It involved a detailed analysis of the requirements and the factors that influenced the design of the new product. Nowadays, higher-quality materials are being used, continuously improving, and the models are more complex and sophisticated. The developed product benefits from these aspects, and in addition, it features an integrated security system with fingerprint and PIN.

The original contributions of this work lie primarily in the design, the materials used for the product, and the integrated safety system.

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[1] <https://patentimages.storage.googleapis.com/b2/d8/d4/3f1bd779d3ea03/US1561486.pdf>

[2] <https://patentimages.storage.googleapis.com/14/be/c8/a41715ea720db7/US947940.pdf>

[3] Personal sketch

[4] Personal logo

[5] Personal renders