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Recreate Tank Wheels into Rocking Chair Furniture

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ABSTRACT
This research developed an innovative lounge chair design by incorporating elements of armored vehicles, specifically steel tank wheels, with merbau wood. A qualitative approach employing a creative exploration method was employed to comprehend the design engineering process and the interaction between metal and wood materials in furniture. The design process encompassed three primary stages: conceptualization, prototyping, and testing. The findings demonstrated that the steel tank wheels imparted high stability and durability, while the merbau wood enhanced aesthetic appeal and comfort. Trials of the lounge chair revealed its capacity to support substantial loads, provide ergonomic support, and offer a stable and comfortable seating experience. Additionally, the research identified challenges associated with joining metal and wood materials and the chair's substantial weight, necessitating further design optimization. Overall, the outcomes of this study substantiate the utilization of combat vehicle materials in furniture, enhancing its functional, aesthetic, and sustainable attributes. This research contributes to the advancement of contemporary furniture design, particularly through the application of the upcycling concept to create products that possess enhanced durability and aesthetic value.

KEYWORDS

Culture Furniture Design, Steel Tank Wheels, Merbau Wood, Creative Exploration, Ergonomics

INTRODUCTION

Armoured vehicles are one of the technological innovations in defence that have undergone rapid development since the 20th century. These vehicles are designed with extra protection, high mobility, and effective combat capabilities, thus becoming a major element in modern defence strategies (Aritonang et al., 2024 ; Cavanagh, 2017). One of the most recognisable types of armoured vehicles is the tank, which has a strategic role in various military operations. Tanks are not only a symbol of a country's military power, but also an object of study in engineering, industrial design, and ergonomics Smith & Brown, 2018). The application of the concept of product design inspired by these forms has begun to be carried out by companies that adhere to this concept (Muttaqien & Adiluhung, 2023).

The tank's unique shape, with its aerodynamic design and solid armoured structure, makes it one of the most iconic combat vehicles in the history of warfare. Its design, which combines protection, mobility and weapon effectiveness, has attracted the attention of designers outside the military, including in the world of creative industries and product design (Anderson, 2017). Inspiration from the shape and structure of these combat vehicles is not only found in civilian vehicle design, but also in various other design elements, such as furniture and home furnishings.

One of the innovations that emerged from the design inspiration of the armoured vehicle was the design of a rocking chair with design elements that adopt principles from the tank structure.

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Rocking chairs are traditionally known as furniture that prioritises comfort and ergonomic balance, allowing users to enjoy a stable swinging motion. By taking inspiration from the shape and structure of tanks, rocking chairs can be designed with a new approach that emphasises a balance between stability, durability and modern aesthetics. Research by (Rizka, 2021) also shows that adapting design from vehicles to furniture can improve efficiency in the production process and extend the life of the product by using stronger and more durable materials.

In the world of industrial design, many elements can be adapted from military technology into civilian products. For example, the aerodynamic shape and modular structure of tanks can be implemented in furniture design to create more durable and ergonomic products (Peters & Gomez, 2021). In addition, the use of impact-resistant materials commonly used in armoured vehicles can also be applied in the production of rocking chairs that are more robust and have longer durability than conventional rocking chairs. The study by (Setyowati, 2015) discusses how ergonomic considerations in furniture design can improve user comfort and safety in the long run.

Furthermore, the inspiration from combat vehicles in the design of rocking chairs is not only related to functional aspects, but also to the aesthetic value and symbolism contained in their form. Tanks are often associated with strength, durability and protection, so the application of their design in rocking chairs can provide a deep symbolic meaning for the user (Kumar & Anderson, 2020). A futuristic design with bold lines and a layered structure can create a rocking chair that is both modern and innovative.

Not only that, the ergonomic design adopted from combat vehicles can also improve user comfort. Tank-inspired rocking chairs can be designed with a structure that better supports the body, reduces pressure on the back, and provides optimal balance during use (Esmaeel et al., 2022). Hermawan's research states that ergonomic considerations in furniture design can reduce the risk of injury due to improper posture, as well as improve the overall user experience Ergonomic considerations in furniture design can reduce the risk of injury due to improper posture, as well as improve the overall user experience (Hermawan, 2019).

Apart from design and ergonomics, this approach can also support sustainability in the furniture industry. Many studies have shown that materials used in armoured vehicles, such as mild steel or impact-resistant polymers, can be recycled and utilised in the manufacture of more environmentally friendly furniture (Gonzalez & Torres, 2021). Thus, this design approach not only contributes to product innovation but also supports more sustainable production practices. The use of recycled materials in furniture design can reduce industrial waste and provide added value to products (Hanifah, 2020).

Based on the above studies, the research gap is only to develop a rocking chair design inspired by tank structures to balance aesthetics, functionality and symbolism. This study explores impact-resistant materials to enhance durability, integrates ergonomic principles of armoured vehicles for comfort, and creates innovative furniture with deep symbolic and aesthetic value.

Overall, the inspiration from armoured vehicles in the design of the rocking chair reflects an interdisciplinary approach in product design. By adopting elements from the tank structure, the rocking chair can be developed into a product that is more durable, comfortable, and has a strong aesthetic and symbolic value. Design that adapts cultural elements can be an effective tool in introducing and maintaining a community's identity (Rohiman et al., 2022). But it also influenced the social, economic and spiritual realities of the time, resulting in an interconnected and mutually supportive knowledge structure (Muryasari et al., 2024). Further studies in ergonomics, materials, and futuristic design can provide deeper insights into how best to implement the design principles of combat vehicles in the furniture industry.

This research aims to develop a rocking chair design concept inspired by the structure and shape of armoured vehicles, particularly tanks, to create a balance between aesthetics, functionality and stability. Through this research, it is hoped that a design solution can be found that not only offers innovation in form and material, but also enriches aspects of ergonomics, symbolism, and sustainability in the world of furniture.

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METHOD

This research uses a qualitative approach with a creative exploration approach. This approach was chosen to deeply understand the design engineering process as well as to explore the interaction between traditional and modern elements in furniture. According to (Creswell, 2017). Qualitative research aims to explore and understand the meaning that individuals or groups give to a social phenomenon or problem under study. In this context, research was conducted to understand how the combination of steel tank wheels and merbau wood can create a unique and functional lounge chair design.

The design process in this design includes: (1) Conceptualisation: Developing the design concept of the lounge chair by combining steel tank wheels and merbau wood. Making initial sketches based on the results of literature studies, observations, and interviews. (2) Prototyping: Making a prototype lounge chair from modified steel tank wheels with additional merbau wood elements. Manufacturing Technique: Using welding techniques to combine the steel tank wheels with the merbau wood structure and ensure the strength and stability of the final product. (3) Trial: Conducted trials of the prototype to evaluate the comfort, functionality and durability of the product. Collected feedback from potential users on the design and comfort of the lounge chair.

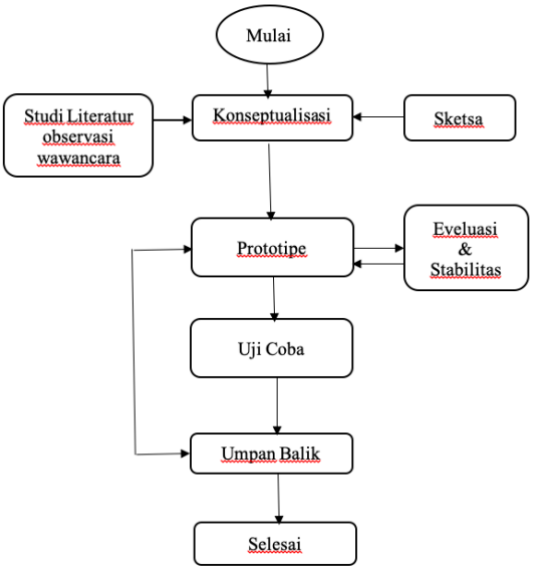

Figure 1. Research Flow Chart

RESULT AND DISCUSSION

1. Design Concept

This research successfully developed an innovative rocking lounge chair design inspired by tank wheel elements and merbau wood as the main material. The creative exploration approach used in this research enabled the identification and application of design elements that combine traditional and modern aspects in furniture. The design process included conceptualisation, prototyping and testing stages, each of which yielded significant results in the development of an ergonomic, aesthetic and functional lounge chair. The results of the literature study and observation showed that steel tank wheels have a sturdy structure and unique aesthetics to be applied in furniture design. Merbau wood was chosen as an additional material due to its strong, durable characteristics and high aesthetic value.

2. Sketch

Initial sketches showed that the combination of steel tank wheels and merbau wood could create a lounge chair with a modern-industrial look, while retaining the natural elements of wood. Interviews with designers and potential users revealed that comfort and balance factors should be the main focus in the development of this chair.

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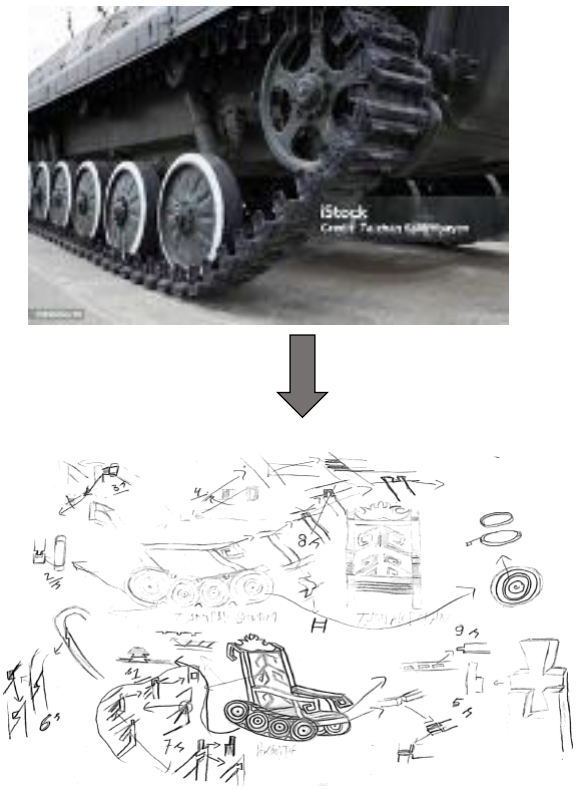

Figure 2. Conceptual Sketch

3. Production.

In the context of production, the rocking chair product mock-up will certainly apply a wooden material assembly process that has been adjusted to the level of complexity of the series between wooden materials. The process of producing this chair product will begin with the availability of wooden materials that have been packaged into one unit to get a context of innovation that can represent steel tank wheels. This process is very important because the beginning of producing a rocking chair can be related to creating a design concept that suits the characteristics of steel tank wheels. In addition, the process of preparing merbau wood material with the size of wide planks and beam sortiments can affect the context of material strength for construction durability.

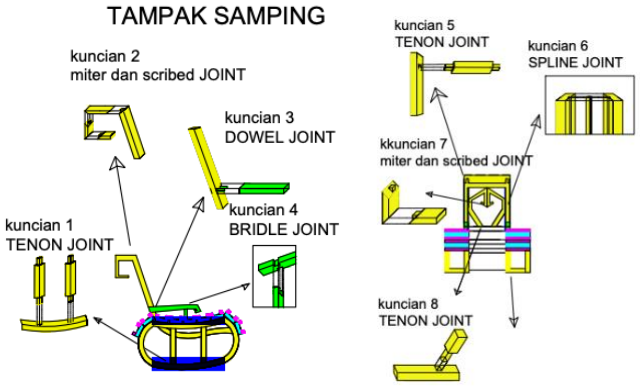

Figure 3. Shop Drawing

The locking process is used to combine the tank wheels with the structure using merbau wood. Modifications to the steel tank wheels are made so that they can function as a stable and safe chair

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base. Merbau wood elements are processed and adjusted to an ergonomic design to improve user comfort. The final result shows that the use of welding techniques and tank wheel modifications can produce a strong and stable structure.

4. Construction.

The application of construction applied to the material on the seat and backrest uses a tenon and dowel joint construction system. This construction requires very strict supervision of MC, straightness of wood and smoothness of planing. tenon joints, and dowel joints are the most popular and strong construction wood joint constructions (Figure 3). The area of the glue field is much larger because the construction radius is greater. Special machine investment is required to make this joint construction. Usually companies that specialize in the production of wood flooring use this construction.

For the application of construction on the leg frame section, using a tenon joint system with consideration of the strength of the wood bond locked in the hole will get resistance to shear force to the side and compressive force to the bottom, as well as with the addition of recommended wood glue material.

While in the application of the construction of the formation of wood material in the corner of the quarter circle on the leg frame will use the formation of a wooden plane with a "curved mall" where the wood material is formed with a truncated arch formation system (Figure 5). With the condition of the construction structure that uses intact curved raw materials, it will provide the effect of material solidity strength with the accuracy of the size and diameter of the arch according to the design concept.

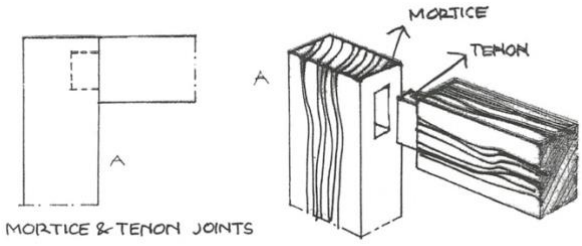

Figure 4. Mortice & Tenon Joint

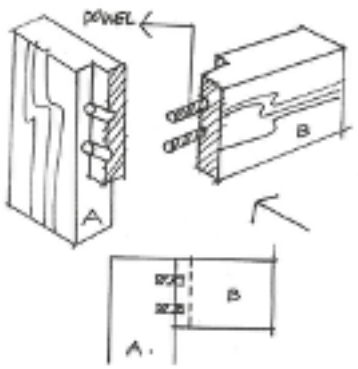

Figure 5. Doel Join

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Figure 6. Mal Lengkung untuk Membentuk Lengkungan Kaki Kursi

Tests were conducted to measure the comfort, functionality, and durability of the lounge chair. Comfort evaluation results: The chair is able to support the body well, providing optimal support for the user's back and arms. Functionality evaluation results: The chair structure is proven to be stable, and the steel tank wheels can provide an aesthetic effect without reducing functionality.

Figure 7. Desain Modeling Kursi Goyang Roda Tank

Durability evaluation results: The chair can withstand heavy loads without deformation or damage to the joints between the tank wheels and merbau wood. User feedback: The majority of respondents stated that the design of this chair has a unique visual appeal and provides a comfortable and stable sitting experience. This research shows that the combination of tank wheels and wood in the design of a lounge chair can produce a product that is not only highly aesthetic, but also functional and ergonomic.

1) Integration of Traditional and Modern Design

The creative exploration approach used in this research successfully explored the interaction between modern-industrial elements (steel tank wheels) and traditional natural materials (merbau wood). This integration gives the impression of a harmonious contrast, where the metal elements create a sturdy and masculine impression, while the merbau wood gives a warm and natural touch to the chair design.

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2) Durability and Stability of the Structure

The use of steel tank wheels as the main part of the chair's structure provides advantages in terms of durability and stability. The test results show that the chair is able to withstand heavy loads without deforming or disturbing its balance. This proves that the use of used armoured vehicle materials can provide added value in furniture innovation, especially in the aspects of durability and structural strength. In addition, these results also support a previous study by (Anderson, 2017)) which showed that materials from combat vehicles can be adapted in civilian products to increase durability without compromising on aesthetics. Thus, this approach can be an inspiration in the development of sustainable furniture that prioritises the principles of reuse and upcycling in product design.

3) Ergonomics and User Comfort

From the test results, it was found that the designed lounge chair is able to provide optimal support for the user's body, especially in the back and arm areas. This is in line with ergonomics theory which states that a good chair design should be able to adjust the contours of the human body to reduce pressure on certain points. In addition, the circular shape of the tank wheels creates a design base that gives the chair extra stability, allowing users to sit comfortably without any wobble. User feedback also indicates that the merbau wood material used in the seat provides a warm and cosy sensation during prolonged use

CONCLUSIONS

The incorporation of the tank wheel model and merbau wood in the design of the lounge chair results in a unique piece of furniture with high aesthetic, ergonomic and durability values. The designed lounge chair is able to withstand heavy loads, as well as providing optimal comfort for the user. The utilisation of ex-combat vehicle materials has the potential to be a solution in sustainable design and modern furniture innovation. The main challenges in this design are the mobility of the chair and the material joining techniques, which still need to be refined in further research. Thus, this research proves that creative exploration in furniture design can result in innovations that are not only functional but also have artistic and historical value. Further research can be conducted to develop this lounge chair with more efficient production techniques as well as improving its ergonomic aspects to better suit the needs of the users.

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