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DOI <https://doi.org/10.24919/2308-4863/87-3-15>**Sun HU,***orcid.org/0009-0006-0093-7612**PhD student at the Department of Fashion and Style  
Kyiv National University of Technologies and Design  
(Kyiv, Ukraine) 14344380@qq.com***Alla RUBANKA,***orcid.org/0000-0003-0298-0850**PhD in Technical Sciences,  
Associate Professor at the Department of Fashion and Style  
Kyiv National University of Technologies and Design  
(Kyiv, Ukraine) rubanka.ai@knutd.edu.ua*

## RESEARCH ON THE APPLICATION OF THE CREATIVE WISDOM OF TRADITIONAL CHINESE WATER WHEELS IN THE DESIGN OF DAILY NECESSITIES

*As an outstanding representative of ancient agricultural civilization, the traditional Chinese waterwheel contains rich and profound creative wisdom. In the long-term practice of agricultural production, the waterwheel not only effectively solved the irrigation problem, but also reflected people's deep understanding of the laws of nature, precise grasp of functional needs, and unremitting pursuit of aesthetic and cultural connotations at that time with its unique design concept and manufacturing process. This paper discusses the design logic of traditional Chinese waterwheel in depth, and analyzes it from the aspects of structure, power, material, craftsmanship and cultural connotation. It aims to realize the innovative application of the creative wisdom of traditional Chinese waterwheel in the design of daily necessities, breaking through the limitation that modern everyday objects design only focuses on the function and appearance but neglects the traditional cultural foundation. Through literature research and case study method, the structural design, energy utilization, material technology and cultural connotation embedded in traditional waterwheel are studied and integrated into the process and details of the design of everyday objects, which summarizes the important insights of the creative wisdom of traditional waterwheel in the design of modern everyday objects in the aspects of functional innovation, sustainability, cultural inheritance and aesthetic enhancement, and promotes the design of everyday objects to be more innovative, sustainable and aesthetic. It also summarizes the importance of the wisdom of traditional waterwheel creation in the design of modern everyday objects in terms of functional innovation, sustainability, cultural inheritance and aesthetic enhancement, and promotes the development of the design of daily necessities in the direction of more diversity and personalization. It opens up a new way of thinking for the application of traditional Chinese agricultural tools in the design of modern daily necessities, and promotes the organic integration and innovative development of traditional and modern design.*

**Key words:** Traditional Chinese waterwheel, intelligent creation, daily necessities design, organic integration and innovation.

**Сунь ХУ,***orcid.org/0009-0006-0093-7612**аспірант кафедри моди та стилю  
Київського національного університету технологій та дизайну  
(Київ, Україна) 14344380@qq.com***Алла РУБАНКА,***orcid.org/0000-0003-0298-0850**кандидат технічних наук,  
доцент кафедри моди та стилю  
Київського національного університету технологій та дизайну  
(Київ, Україна) rubanka.ai@knutd.edu.ua*

## ДОСЛІДЖЕННЯ ЗАСТОСУВАННЯ ТВОРЧОЇ МУДРОСТІ ТРАДИЦІЙНИХ КИТАЙСЬКИХ ВОДНИХ КОЛІС У ДИЗАЙНІ ПОВСЯКДЕННИХ ВИРОБІВ

*Як видатний представник стародавньої сільськогосподарської цивілізації, традиційне китайське водяне колесо містить багату і глибоку творчу мудрість. У багаторічній практиці сільськогосподарського виробни-*

*цтва водяне колесо не лише ефективно вирішувало проблему зрошення, але й відображало глибоке розуміння законів природи, точне розуміння функціональних потреб та невпинне прагнення людей до естетичних і культурних конотацій того часу завдяки своїй унікальній концепції дизайну та процесу виробництва. У цій статті детально розглядається творча логіка традиційного китайського водяного колеса та аналізується з точки зору структури, потужності, матеріалу, майстерності та культурної конотації. Вона має на меті реалізувати інноваційне застосування творчої мудрості традиційного китайського водяного колеса в дизайні предметів повсякденного вжитку, долаючи обмеження, яке полягає в тому, що сучасний дизайн предметів повсякденного вжитку зосереджується лише на функціях і зовнішньому вигляді, але нехтує традиційною культурною основою. Завдяки дослідженню літератури та методу тематичних досліджень, структурний дизайн, використання енергії, матеріальні технології та культурні конотації, що містяться в традиційному водяному колесі, вивчаються та інтегруються в процес і деталі дизайну предметів повсякденного вжитку, що узагальнює важливі ідеї творчої мудрості традиційного водяного колеса в дизайні сучасних предметів повсякденного вжитку в аспектах функціональних інновацій, стійкості, культурної спадщини та естетичного вдосконалення, а також сприяє дизайну предметів повсякденного вжитку, який стає більш інноваційним, стійким та естетичним. Вона також підсумовує важливість мудрості створення традиційного водяного колеса в дизайні сучасних предметів повсякденного вжитку з точки зору функціональних інновацій, стійкості, культурної спадщини та естетичного вдосконалення, а також сприяє розвитку дизайну предметів повсякденного вжитку в напрямку більшого розмаїття та індивідуальності. Це відкриває новий спосіб мислення для застосування традиційних китайських сільськогосподарських інструментів у дизайні сучасних предметів повсякденного вжитку, а також сприяє органічній інтеграції та інноваційному розвитку традиційного та сучасного дизайну.*

**Ключові слова:** китайське традиційне водне колесо, творча мудрість, дизайн повсякденних предметів, органічна інтеграція та інновації.

**Problem Statement.** Known as «overturned cart» or «tube cart,» the traditional Chinese waterwheel traverses the annals of ancient agricultural society, exemplifying the Chinese nation's exceptional creative wisdom and deep reverence for natural laws. Daily necessities, as indispensable artifacts of everyday life, demand a design equilibrium among practicality, convenience, and aesthetics. While modern design has thrived in industrial manufacturing, material science, and fashion integration—offering consumers abundant choices and enhancing quality of life—this rapid innovation often engenders a «rupture of cultural roots.» The profound creative wisdom embedded in waterwheels remains underexplored, leading to a scarcity of cultural heritage in daily products that prioritize novel functions and trendy aesthetics over historical continuity.

This article focuses on the organic combination of the creative wisdom of traditional Chinese waterwheels and the design of daily necessities. On the basis of systematically sorting out the structural principles, power mechanisms, material processes, and cultural symbols of traditional waterwheels, this paper explores in depth the application forms of their creative wisdom in modern daily necessities design, providing theoretical basis and basis for further promoting the widespread application of traditional waterwheel creative wisdom in the field of modern daily necessities design, and promoting the inheritance, innovation, and sustainable development of Chinese traditional culture in the context of modern design.

**Analysis of research.** Marx (Marx K, 1949:141-143) argued in The Poverty of Philosophy that social relations are intrinsically tied

to productive forces, emphasizing that technological advancements inherently reshape societal structures. Rooted in ancient agricultural practices, traditional Chinese waterwheels served multifunctional roles in irrigation, drought mitigation, drainage, and transportation, embodying both practical utility and technological ingenuity. Consequently, researching waterwheels holds dual significance: preserving historical heritage while offering practical insights for contemporary design.

In China, scholarly inquiries into traditional waterwheels can be categorized into two distinct paradigms. The first paradigm examines waterwheels as irrigation and water-lifting apparatuses through the lenses of Chinese science & technology history, agricultural history, and agricultural science & technology history, focusing on structural analyses and dynamical principles. Notable works include Wu, W.'s (吴卫, 2004:4) Chinese Waterwheels: Studies on Design Concepts of Traditional Water-Lifting Equipment in Late Ming China, Zhao, Y.S.'s (赵雅书, 1979:26) The Evolution of Chinese Waterwheels, and Zhang, B.C.'s (张柏春, 1994:254-263) Research on Traditional Chinese Waterwheels and Their Mechanical Drivers. The second paradigm comprises dynasty- or region-specific case studies exploring the historical dissemination and application of waterwheels, such as Tang, G.L.'s (唐耕耦, 1978:74-77) Utilization and Promotion of Waterwheels in the Tang Dynasty, Yang, X.Y.'s (杨希义, 1983:114-117) Water Wheels in Tang Dynasty Hydraulic Systems, Jiang, T.Y.'s (蒋廷瑜, 1998:326-327) Applications of Tube Carts in Ancient Guangxi, and Zhang, B.C.'s (张柏春, 1994:41-49) Field Studies on Traditional Hydraulic

Machinery in Yunnan. Collectively, these studies prioritize descriptive and analytical investigations of waterwheel structures, morphological characteristics, and operational mechanics. There is relatively little research on waterwheels by foreign scholars, such as Japanese scholar Masatoshi Tanaka's «Dragon Bone Cart and Farmers» (田中正俊, 鹤见尚弘, 1992:3). The author personally experienced the technical performance and labor requirements of dragon bone carts, revealing the rural social rules behind their use.

Comprehensive analysis of extant scholarship, both domestic and international, reveals substantial achievements in documenting the historical evolution of waterwheels, dissecting their structural principles, and evaluating their impact on traditional agrarian societies. Nevertheless, scholarly attention to their contemporary evolution and innovative adaptation remains limited, particularly regarding the lack of systematic integration of waterwheels' creative wisdom into modern daily necessities design. This gap has precluded the establishment and deepening of an organic dialogue between traditional waterwheel technology and contemporary design practices.

**Purpose of the article.** This study seeks to facilitate the innovative integration of traditional Chinese waterwheel wisdom into daily necessities design, transcending the contemporary design paradigm that prioritizes functionality and aesthetics at the expense of cultural heritage. By dissecting the structural mechanics, energy dynamics, material techniques, and cultural narratives embedded in waterwheels, this research aims to translate these insights into design processes and details, fostering a new trajectory for daily design—one that harmonizes cultural legacy with modernity, embracing diversity and personalization. Ultimately, this endeavor seeks to:

Establish a theoretical framework for inheriting and innovating traditional Chinese culture within modern design contexts;

Enhance consumers' cultural awareness and appreciation of daily products;

Provide empirical and theoretical support for the synergistic development of traditional craftsmanship and modern industrial design.

**Research analysis.** The structural design of traditional waterwheels can be regarded as a model of mechanics and engineering. Take the common tube car (Fig. 1) as an example: its core structure consists of a large circular wheel with evenly spaced bamboo or wooden tubes encircling its perimeter. As the core supporting component of the entire structure, the wheel axle bears a huge weight and rotational torque. It is usually made of sturdy and durable wood and undergoes fine processing and treatment to

ensure its strength and stability. The spokes connect the wheel axle and rim in a radial pattern, like the bones of the human body, tightly integrating the wheel disc together, allowing various parts to work together, evenly distribute forces, and effectively prevent structural deformation or damage. The design of bamboo or wooden tubes fully considers the functional requirements of water intake and delivery, and their shape, size, and inclination angle have been cleverly calculated and adjusted. During the rotation of the water wheel, the mouth of the cylinder can accurately cut into the water surface, quickly filling the water with buoyancy and impact force. Then, as the wheel rises, the water in the cylinder naturally flows towards the predetermined irrigation channel under the action of gravity, achieving efficient collection and transmission of water resources. The subtlety of this structural design lies in its extremely simple and effective implementation of complex irrigation functions. The various components are interdependent and mutually constrained, forming a stable and efficient mechanical system, fully reflecting the outstanding wisdom and exquisite skills of ancient people in the field of engineering design.

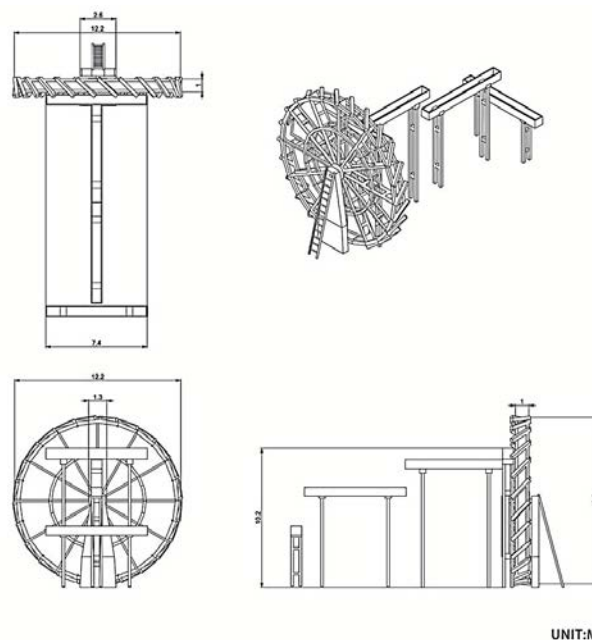


Fig. 1. The structural of traditional waterwheels

The energy mechanism of traditional waterwheels is fundamentally anchored in hydraulic dynamics, epitomizing ancient artisans' profound understanding and sophisticated manipulation of natural energy systems. Typically situated along rivers, streams, or watercourses with turbulent currents or significant hydraulic head, waterwheels leverage strategically calibrated positioning and angular orientations to

harness either direct waterflow hydraulic impact on their blades or potential energy derived from water level differentials for rotational momentum. For instance, in mountainous irrigation systems, artisans utilize the kinetic force of mountain streams to power small-scale waterwheels, elevating water from lower elevations to terraced farmland; conversely, in plain-region irrigation networks, dams are employed to regulate water storage and create sustained hydraulic head, ensuring consistent rotational energy for large-scale waterwheels. This mode of energy utilization not only obviates the need for external energy inputs—consistent with historical productivity limitations and local resource endowments—but also embodies a philosophical commitment to natural law, fostering symbiotic human-environment relations. When contrasted with modern machinery reliant on non-renewable energy sources, traditional waterwheels' energy paradigms offer a timeless model of sustainable development, urging contemporary designers to prioritize natural energy harvesting—such as solar, wind, or hydropower—in daily product design and innovate eco-friendly power solutions.

The selection of materials and craftsmanship for traditional Chinese waterwheels fully embodies the concept of adapting to local conditions and materials. Due to the long-term exposure of waterwheels to humid water environments and the need to withstand significant weight and water flow impacts, the material selection is mainly based on locally abundant wood with good water resistance and strength, such as pine and fir wood (Fig. 2). These woods are carefully selected and treated to remove impurities and moisture, enhancing their durability and corrosion resistance. In terms of craftsmanship, traditional craftsmen have employed a series of exquisite woodworking techniques, such as mortise and tenon connections, carving, polishing, etc. The mortise and tenon connection technology is the key to the stability of traditional waterwheel structures. Through the precise fit of tenons and mortise and tenon holes, various components are tightly connected together without the need for auxiliary materials such as nails or glue. This not only ensures the strength of the structure, but also adapts to the expansion and deformation of wood in different environments, effectively extending the service life of the waterwheel. In addition, for the production of components such as water turbine blades and bamboo tubes, craftsmen also used carving techniques to make their shapes more in line with fluid mechanics principles, reduce water flow resistance, and improve the efficiency of the water wheel. At the same time, the meticulous polishing process not only makes the surface of the waterwheel smoother and

more beautiful, but also further reduces the friction loss between components. This careful selection and exquisite application of materials and craftsmanship reflects the ancient people's deep understanding of material characteristics and proficient mastery of craftsmanship skills in the process of creation, providing valuable reference experience for material innovation and craftsmanship inheritance in modern daily necessities design.



**Fig. 2. Waterwheel material**

Traditional waterwheels transcend their role as mere utilitarian agricultural implements, serving as significant repositories of Chinese cultural heritage imbued with profound symbolic systems and socio-cultural meanings. In ancient agrarian societies, their perpetual rotation epitomized the cyclicity of life and the perpetuity of natural rhythms—functionally sustaining agricultural productivity while symbolically embodying harvest, prosperity, and the harmonious interplay between human labor and ecological systems. As tangible embodiments of farmers' aspirations for abundance, they merged material utility with spiritual symbolism, acting as both hydraulic machines and cultural totems. The communal nature of waterwheel construction and operation—requiring collective labor and intergenerational knowledge transmission—reinforced social cohesion and kinship networks, instantiating Confucian values of collectivism and mutual support. This collaborative ethos not only optimized resource allocation in pre-modern societies but also codified into enduring cultural practices, such as village-level water management rituals still observable in regional traditions. In the realm of cultural production, waterwheels emerge as a quintessential motif in literati poetry, classical paintings, and folk narratives. For example, the Tang Dynasty verse «Waterwheels irrigate rice fields, strings of silver beads cascade to the sky» (translated by the author) captures their aesthetic allure while eulogizing their role in agrarian

life. Such representations transform waterwheels into archetypal symbols of pastoral idyll and technological ingenuity, embedding them in the nation's collective memory. For contemporary design, these layered cultural significances offer a fertile ground for emotional and narrative integration. By translating waterwheels' symbolic vocabulary—such as rotational dynamics as metaphors for life cycles or communal labor as motifs for social connectivity—into material forms, designers can create artifacts that transcend functionalism, serving as mediums for dialogues between contemporary users and historical narratives. This approach not only enriches products with cultural depth but also activates heritage as a living resource, fostering cross-generational empathy and reinforcing design's role as a custodian of intangible cultural heritage.

**Presentation of the main material.** The formal vocabulary of traditional waterwheels has undergone innovative reinterpretation in modern daily design, exemplifying heritage-driven innovation. In product design, the Waterwheel Washing Machine (Fig. 3) integrates the rotational dynamics of ancient waterwheels with contemporary laundry technology, embodying a design ethos of retro-futurism, affordability, and eco-consciousness. Clothing is placed within the waterwheel-inspired drum, where hydromechanical rotation—driven by recirculating water flow—achieves cleaning through both mechanical agitation and gravitational water displacement. With three independent cabins enabling communal use, this design transcends mere aesthetic mimicry, transforming the waterwheel's iconic circular form into a functional metaphor for shared resources and sustainable living. In landscape architecture, the Rural Culture Research Institute (Fig. 4) takes the Water Transport Instrument Elephant Platform as its architectural archetype, structuring its design around the theme of «observation.» A helical corridor traverses the building, guiding visitors through a choreographed journey that merges spatial perception with historical narrative. By synthesizing partial material substitutions (e.g., composite wood-steel structures), parametric architectural language, and kinetic spatial sequences, the project translates the ancient mechanical device's astronomical observation functions into a contemporary typology for cultural pedagogy. The result is a hybrid structure where traditional wooden joinery coexists with modern engineering systems, performing a symbolic dialogue between agrarian past and technocratic present while repositioning rural heritage as a dynamic catalyst for modern design innovation.



Fig. 3. Chinese «Pen Group», 2014



Fig. 4. Yuhang Yang, Suyan Qiao and Zhiyu Jiang, Nanjing University of the Arts, 2024

These application examples demonstrate that the styling elements of traditional waterwheels have strong plasticity and adaptability in modern daily necessities design, which can bring novel visual effects and unique cultural charm to products.

The functional principles of traditional waterwheels have inspired innovative transdisciplinary applications in modern daily design, demonstrating their relevance to contemporary sustainability challenges. Passive ventilation systems, for instance, draw conceptual inspiration from waterwheels' natural energy capture mechanisms, translating hydraulic dynamics into aerodynamic design. These unpowered fans, typically installed in cross-ventilated windows or balconies, feature aerofoil-shaped blades with optimized pitch angles, enabling efficient harvesting of ambient airflow—both indoor and outdoor—to generate rotational momentum via Bernoulli's principle. By converting low-velocity air currents into mechanical rotation, they facilitate natural air circulation without electrical consumption, offering energy-efficient, silent, and maintenance-free ventilation solutions that align with green building standards and healthy living initiatives. In outdoor recreational design, solar-powered showers

exemplify the adaptation of waterwheels' energy conversion logic to modern renewable technologies. These systems employ photovoltaic panels to convert solar irradiance into electrical energy, which powers submersible pumps to elevate water to elevated storage tanks. Gravitational force then drives water through showerheads, mimicking waterwheels' reliance on hydraulic head for fluid transport. Beyond mere energy substitution, this design integrates closed-loop water recycling systems, mirroring ancient water management practices while achieving 90% energy savings compared to conventional electric heaters. Such applications illustrate how pre-modern engineering wisdom can inform post-fossil design strategies, bridging historical hydraulics with cutting-edge sustainable technologies.

Modern daily necessities design actively inherits and innovates the creative wisdom of traditional waterwheels in terms of materials and craftsmanship. In terms of material selection, some designers have begun to refocus on the use of natural materials such as bamboo, wood, and other renewable resources, and combine modern materials science and technology to improve and optimize them. For example, the new material made of bamboo fiber and plastic composite not only retains the natural texture and environmental characteristics of bamboo, but also enhances the strength and durability of the material, which can be used to make various daily necessities such as tableware and home accessories. In terms of craftsmanship, traditional woodworking techniques such as mortise and tenon structures have been reinterpreted and applied in modern furniture design. Some high-end furniture brands combine mortise and tenon craftsmanship with modern minimalist design styles to create furniture products that have both traditional craftsmanship charm and modern lifestyle. At the same time, modern manufacturing techniques such as laser cutting and CNC machining have provided strong support for the innovation of traditional crafts, enabling them to achieve complex design shapes more accurately and efficiently. For example, in the production of some metal crafts, laser cutting technology can accurately carve the patterns or textures of traditional waterwheels on the metal surface, showcasing unique artistic effects.

Contemporary daily design has increasingly sought to infuse products with cultural resonance by interweaving the symbolic narratives of traditional waterwheels. In stationery design, for instance, notebooks adopt waterwheel-inspired iconography—such as ink-wash paintings or silk embroidery of waterwheel motifs—paired with archaic calligraphy typography and handcrafted paper textures. These

semiotic assemblages evoke a temporal porosity, allowing users to engage with historical narratives through the tactile act of writing, thus transforming mundane objects into cultural palimpsests that bridge past and present. Tourist souvenirs offer another locus of cultural translation. Ceramic figurines, keychains, and textile goods featuring waterwheel motifs often integrate local landscape elements and ethnic craft techniques, such as batik or lacquerware. Functioning as ambassadors of intangible heritage, these objects not only serve as mnemonic devices for travel experiences but also perform cultural brokerage—mediating between visitors' gaze and the represented locale's agrarian identity. Their dual role as commodities and cultural artifacts highlights design's capacity to commodify heritage while fostering cross-cultural understanding. In domestic soft furnishings, designers deploy waterwheel-inspired aesthetics to cultivate agrarian nostalgia in urban environments. Carpets and curtains often feature muted earth tones, concentric wheel patterns, and woven textures mimicking wooden waterwheel structures. Drawing on sensory ethnography, these designs evoke the rhythmic motions of waterwheels and the pastoral tranquility of rural life, creating haptic and visual anchors that mitigate urban alienation. By embedding traditional symbols into the domestic sphere, they afford residents emotional solace and cultural rootedness, aligning with design theorist Victor Papanek's ethos of design for human needs.

**Conclusions.** Traditional waterwheels have achieved efficient irrigation functions through clever structural design and power utilization under limited technological conditions. This inspires modern daily necessities designers to deeply explore the functional requirements of products in the design process, break through traditional thinking patterns, and explore novel ways of implementing functions. For example, in kitchen appliance design, the transmission principle of water wheels can be used as a reference to design a kitchen utensil that can automatically stir ingredients. By driving the transmission device with water flow or other natural forces, the stirring function can be automated, improving cooking efficiency and user experience. At the same time, attention should also be paid to optimizing and integrating product functions, avoiding redundancy and waste of functions, so that each component and function can coordinate and promote each other, in order to maximize the overall functionality of the product.

The dependence of traditional waterwheels on natural power and their environmental friendliness provide important references for sustainable development in modern daily product design. In today's

increasingly scarce resources and severe environmental problems, modern daily necessities design should pay more attention to sustainability, reduce dependence on non renewable energy, and fully utilize natural energy such as solar energy, wind energy, and hydropower. For example, in the design of outdoor lighting products, solar or wind powered street lights can be developed to collect natural energy and convert it into electrical energy to provide power support for lighting. In addition, renewable and biodegradable materials should be given priority in material selection to reduce the negative impact of products on the environment throughout their lifecycle, and achieve green and environmentally friendly design throughout the entire process from raw material acquisition, production and manufacturing, use to waste disposal.

The rich cultural connotations carried by traditional waterwheels are precious spiritual wealth of the Chinese nation. Modern daily necessities design should actively take on the responsibility of cultural inheritance, cleverly integrate traditional cultural elements into product design, and enable traditional culture to continue and develop in modern society. However, cultural inheritance is not simply copying and pasting, but requires innovative design based on a deep understanding of traditional cultural connotations. Designers can extract, transform, and reconstruct traditional elements to give them new contemporary significance and aesthetic value, making them compatible with modern lifestyles and aesthetic concepts. For example, in fashion clothing design, traditional waterwheel patterns or colors can be innovatively processed using modern printing and dyeing techniques and design methods to create clothing styles that have both traditional cultural characteristics and fashionable trends, meeting consumers' pursuit of personalization and cultural connotations.

Traditional waterwheels exhibit unique aesthetic charm with their simple, natural, and harmonious design and exquisite craftsmanship. Modern daily necessities design can draw aesthetic inspiration from it, emphasizing the simplicity and smoothness of product styling, and avoiding overly complex and

cumbersome designs. At the same time, emphasis should be placed on the harmonious relationship between the product, the natural environment, and the user, creating a comfortable and pleasant atmosphere through the combination of color, material, and texture. For example, in interior decoration design, the proportion and scale relationship of traditional waterwheels can be borrowed to design ornaments or pendants with rhythm and beauty, enhancing the overall aesthetic quality of indoor space. In addition, attention should also be paid to the details of the product, showcasing its high quality and uniqueness through exquisite craftsmanship and delicate texture, so that the product not only meets user needs in terms of functionality, but also gives people pleasure and enjoyment in terms of aesthetics.

The creative wisdom of traditional Chinese waterwheels is a treasure of thousands of years of civilization development of the Chinese nation. Its outstanding achievements in structural design, power utilization, material technology, and cultural connotation provide rich and valuable inspiration and practical guidance for modern daily necessities design. Through the analysis of the application examples of traditional waterwheel manufacturing wisdom in modern daily necessities design, we deeply realize that tradition and modernity are not separated from each other, but can be integrated and promoted as an organic whole. Drawing on the creative wisdom of traditional waterwheels in modern daily necessities design can not only promote innovation and optimization of product functions, practice sustainable design concepts, achieve cultural inheritance and innovative development, but also effectively enhance the aesthetic value of products and meet people's growing material and cultural needs. In the future, designers should delve deeper into the essence of traditional creative culture, combining it with modern technology, materials, and aesthetic concepts to create more creative, culturally rich, and socially valuable modern daily necessities, making positive contributions to promoting Chinese design to the world stage, inheriting and promoting excellent traditional Chinese culture.

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