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Design manual of chess and card table

Guofeng Shi

Wenzhou Tanxing Precision Machinery Co., Ltd, Wenzhou 325000, China.

Abstract: This board table in the design process, the chessboard uses parallelogram mechanism to make the three-prism synchronous rotation scheme. Using this scheme to achieve three kinds of chessboard transformation (Go, Chinese chess, chess). In the foldable table leg part, a four-bar mechanism is adopted, and the static point in the four-bar mechanism is used to realize the expansion and stable support of the table. The stop mechanism is also used in the design of folding stool. This design is integrated, reducing the overall folding volume to 34% of the unfolding volume.

Keywords: Synchronous rotation; Four bar mechanism; The check point; Folding.

1. Introduction

At present, China has become the country with the largest elderly population in the world, and is also one of the countries with the fastest aging population. As one of the countries with the largest market potential of aging industry in the world, China's pension industry still needs to be improved. And pension is related to everyone's vital interests of the practical problem, has aroused widespread concern of the whole society.

This multi-functional board table for the elderly outdoor entertainment development, its development significance lies in: This design innovates the structure of the traditional board table, changing the situation of the traditional board table with single function and heavy overall, making it more convenient for the elderly to carry, more comfortable to use, and more diversified and rich entertainment functions. This design has a huge market economic value, can make the promotion of the product of the enterprise from the market to obtain fat profits.

2. 3D view of this design

2.1. Folded state

Users can fold the board table together when not in use, storage or transportation to save space. The user has a variety of carrying modes to choose when using this design, which can be carried by a handle mounted on one side, can be dragged by a car with wheels, and can also be fixed by the belt to carry the board table. The folded state of this design is shown in Fig.1.

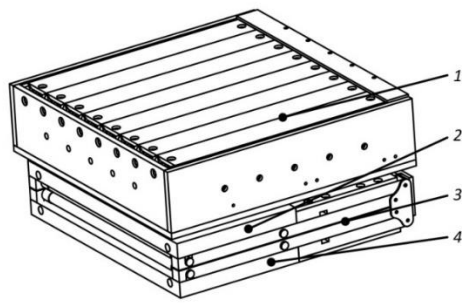


Fig.1 Board Table Folding State View

1. Chessboard 2. Chessboard support seat 3. The stool 4. The stool

2.2. Foldable seat retrieval

There are two collapsible seats in this design, which can be folded and placed in the position shown in Fig.2 when not in use.

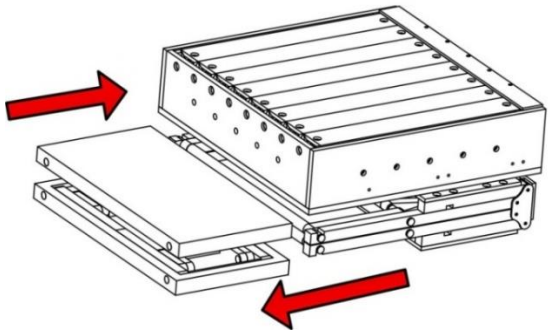


Fig. 2 Stool Retrieval

2.3. Board Table Use

The board takes out the seat and deforms it into the unfolded state when it is in use. The checkerboard support seat is unfolded and secured, and the checkerboard is positioned along the guide rails in the middle of the guide rails. Fig.3 shows the status of the checkerboard table.

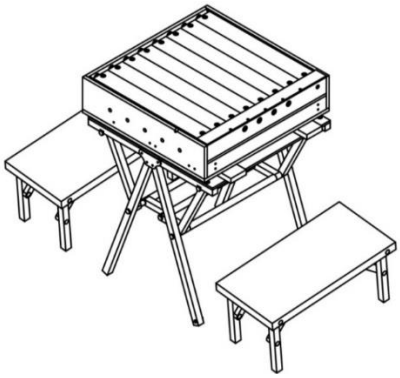
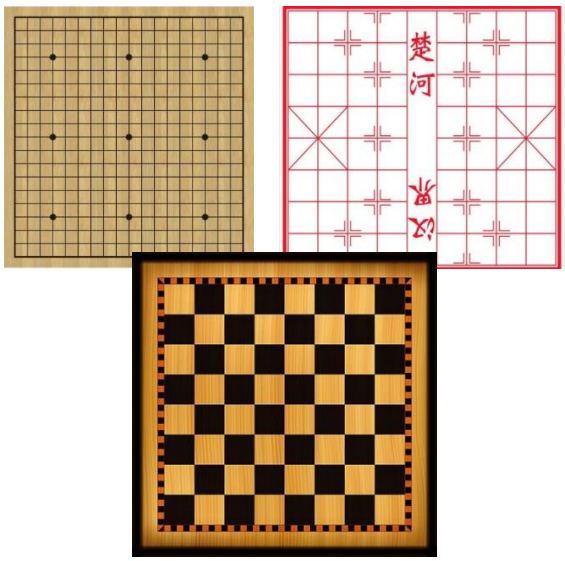


Fig.3 Board Table Use

3. Design Scheme

3.1. Checkerboard Transformation Scheme Design

This chessboard design can realize three kinds of chessboard transformation (Go, Chinese chess, chess, as shown in Fig. 4).



(a)Go (b)Chinese chess (c)chess

Fig. 4 Board Spray-painted Stickers

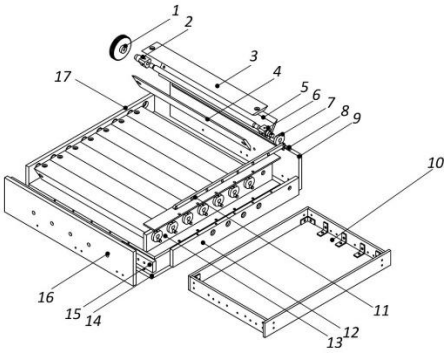


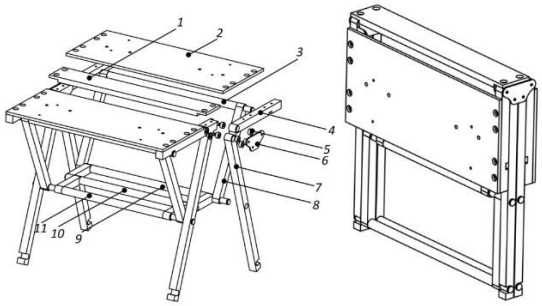
Fig. 5 Design of Board Table

1.hand wheel 2. fixed base 3. Go paste board 4. Chinese chess paste board 5. Chess paste board 6. fixed base 7. crank synchronization plate 8.pin 9. right mounting plate 10. chess piece storage box 11. synchronization linkage 12. front mounting plate 13. trigon front support plate 14. bottom mounting plate 15. drawer guide plate 16. left mounting plate 17. back mounting plate

The three checkerboards are cut in strips and pasted on the three faces of the triangular prism. Three kinds of checkerboard switch are realized by the positioning and rotation of the hand wheel. The chessboard is cut into seven decibels and pasted on seven identical triangular prismatic turning surfaces. The seven triangular prismatic structures are all the same. The synchronous rotation of the seven triangular prismatic is realized by the parallelogram mechanism composed of the crank synchronous disc and the connecting rod. In the lower part of the chessboard is installed a sliding drawer, which is divided into multiple compartments to store various pieces and cards.

3.2. Chessboard table folding support chassis scheme

The design scheme of the board table supporting the chassis is shown in FIG. 6(a). In the non-folded state, the supporting legs on both sides are stretched open, and the middle link is pulled flat. At this time, the supporting legs and the middle link are in a relatively stable state (the middle link is in the dead center position). The folded plates on both sides are flattened and the folded plates in the middle are coplanar, and the axis on the oblique support beam is placed in the groove of the supporting skeleton. At this time, the whole plane and the whole table support chassis are in a stable state. Its folded state is shown in Fig. 6 (b).



(a)Support Chassis Explosion Diagram (b)Folding Of Support Base

Fig. 6 Design Scheme Of Supporting Chassis

3.3. Connection Scheme Between Chessboard and Supporting Chassis

The connection scheme of the chessboard and the foldable support base is shown in Fig.7.The chessboard and the foldable support base are connected by slider rails, which allow them to slide opposite each other. In the unfolded state, the slider fixed on the folding board is located at the leftmost end of the chessboard slide, and the right side is positioned by the support block fixed on the chessboard. When folding the board table, slide the board table to the far left and fold the bottom to support the chassis.

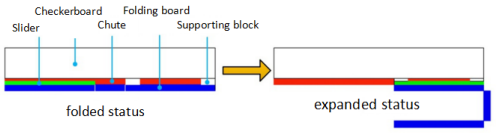


Fig.7 Connection Scheme

4. Board table simulation analysis

Finite element analysis of mechanical parts can effectively know the stress distribution and deformation of the machine. Since the use process of this design involves the elderly, the product is required to be light and safe and reliable. Therefore, this chapter optimizes the design of the board table from the perspective of finite element analysis.

The finite element analysis software used in this design is Solid works Simulation. From SolidWorks 2009, its famous FEA software COSMOS Works was renamed SolidWorks Simulation. In order to embody the solution of design and simulation integration, it made creative changes in the seamless integration interface, and seamlessly integrated the simulation interface and simulation process into the design process of SolidWorks.

4.1. Finite Element Analysis of Stool

The stool mainly carries the gravity of the person in the process of use, which is completely applied to the stool according to the person's weight in the process of use, which is the limit state of the stool.

(1) Build the model and add materials

The supporting legs and supporting links of the stool are made of aluminum, and the stool surface is made of nylon.

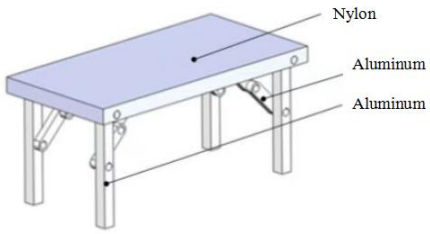


Fig. 8 Stool Material

(2) Add constraints and external loads

Add connections and constraints to the stool according to the actual situation of the stool. The connection between the legs of the stool, the support rod and the stool surface is the pin connection, and the bottom of the stool and the ground are fixed by the fixed end constraint. A uniform load of 980N vertically downwards is applied to the face of the stool to simulate the user sitting down.

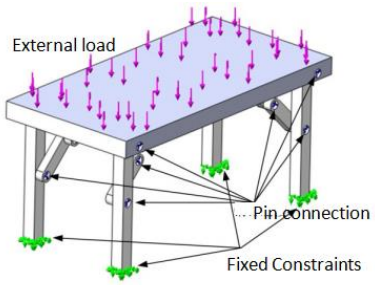


Fig. 9 Stool Constraints and External Loads

(3) Divide the grid

The stool was automatically meshed, and the grid cell size was 5mm.

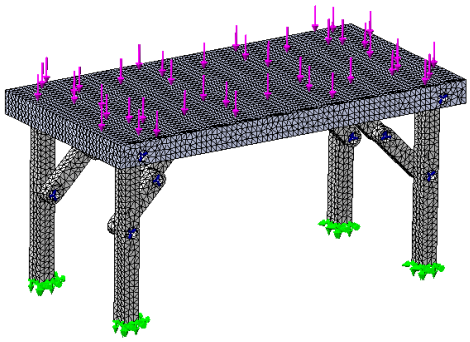


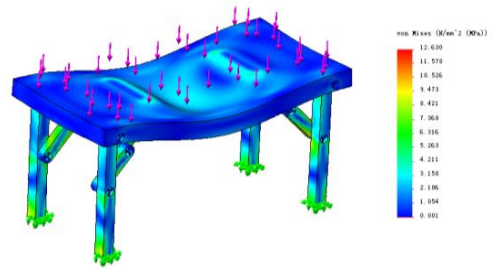
Fig. 10 Grid division of stool

(4) Finite element analysis results

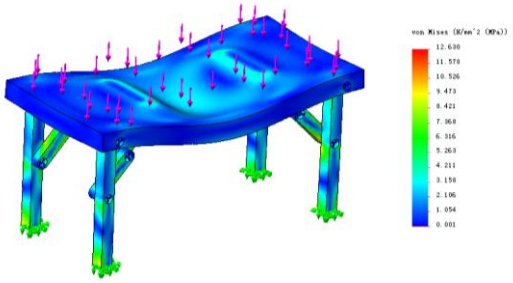
The finite element analysis results of the stool are shown in Fig. 11 (a) shows its stress distribution. It can be concluded from the analysis of the stress distribution cloud diagram that the overall maximum stress of the stool is 12.63Mpa, and the overall strength meets the requirements. The point with the maximum stress is concentrated at the edge of the connecting rod.

Fig. 11 (b) shows the strain situation, which reflects the stiffness of the stool. The maximum deformation of the stool occurs in the center of the stool surface, and the maximum deformation is 1.29mm. The overall deformation is the same as the actual deformation.

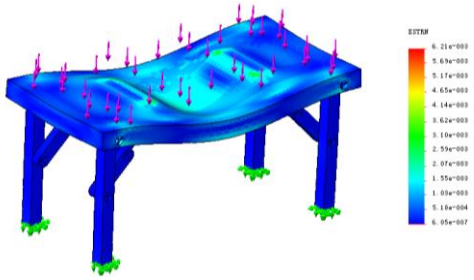
The strain of the stool is shown in Fig. 11 (c).



(a) Stress Distribution



(b) Combined Displacement



(c) Strain

Fig. 11 Finite element analysis result of stool

4.2. Sample preparation and test

The result of the board table is shown in Fig.12.

(a)Folding State (b)Expanded Status

Fig.12 Making A Board Table

5. Conclusion

This board table is specially designed for the elderly's outdoor chess and card entertainment. Compared with other similar products, it has the following innovation points: This design can be folded, folded into a cube, easy to store and carry. All parts of this design are made of aluminum and plastic, the overall weight is light, convenient for the elderly to carry. And his design uses the dead end of the plane connecting rod mechanism, the board table can bear a large weight after unfolding, and it is safe to use. Besides, this design board table has three kinds of board can be changed, the user's entertainment forms are diverse.

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