

Movable Stand with Variable Viewing Angles

Field of the Invention

The present invention relates to a theater movable stand, in particular, a theater movable stand with a large-span of variable viewing angles.

Background of the Invention

Most audience seat stands in traditional theaters are fixed. Even though some audience seat stands can be moved, their positions are already settled before a performance. In some theaters, hoistable seats or retractable stands are deployed. Furthermore, some patents relate to, for example, a viewing-angle shifting apparatus for a retractable moving stand, with serial No. of CN200920222695, and retractable moving stand, with serial No. of CN86210674. But all these prior arts cannot achieve movement or rotation of the whole audience stand during a performance, nor do they allow the audience to participate in the performance.

Modern performance requires not only variation of scenes on stage, but also audience participation in the movement of the story, so that the audience may have different experiences from different viewing angles. So the audience seats need to move as a whole for the duration of the performance. There is demand for equipment for a large span of motion with heavy loads that can drive the entire weight of the platform of the stand.

Summary of the Invention

The present invention aims to overcome the above-mentioned shortcomings in the prior art by means of providing a movable stand with a large-span of variable viewing angles, in which an upper hoistable part and a lower rotatable part can cooperate with each other.

The present invention provides a movable stand with variable viewing angles, which

comprised of hoistable seats, rotatable seats and a main control system. The hoistable seats include a hoistable platform structure, guiding pillars and hydraulic devices. The hoistable platform structure is connected to the guiding pillars on its sides. The hydraulic devices comprise hydraulic cylinders in a foundation pit beneath the hoistable platform structure, which hydraulic cylinders operate synchronously for supporting and driving the hoistable platform structure to move up and down. The rotatable seats comprise rotatable platform structures, rotating pillars, and friction driving mechanisms, wherein the respective rotating pillar is arranged in a corner of the corresponding rotatable platform structure. The respective friction driving mechanism is arranged on the bottom of the corresponding rotatable platform structure away from the axial center of the corresponding rotating pillar so that the rotatable seats are rotatable around the rotating pillar. The movement of the hoistable seats and rotatable seats is controlled by the main control system in such a way that, the hoistable seats are on the same level as the rotatable seats when the hoistable seats are in the lowest position, and the rotatable seats move below the hoistable seats when the hoistable seats are lifted up.

Preferably, the rotatable seats have two fan-shaped rotatable platform structures that form mirror images of each other with respect to their adjacent surfaces. The rotatable platform structures each have four angular points, wherein each end of a connecting surface forms the first and the second angular points, and the rotating pillar is arranged at the third angular point. Both rotatable platform structures will move toward each side, respectively, with the rotating pillar as its axis and with the adjacent surface as its boundary. The space formed within the adjacent surfaces will be filled when the hoistable seats descend.

Preferably, the friction driving mechanism comprises elastic friction wheels, a friction transmission means, a driver chip at the bottom of the rotatable platform structure, and motor reducers on both sides of the driver chip, and electrically connected to the main control system.

Preferably, the rotatable seats are provided with at least two friction driving mechanisms.

Preferably, each hydraulic cylinder of the hydraulic devices is provided with two hydraulic starters. Each of the hydraulic starters is controlled by a separate controlling valve and protected by a separate isolating valve; and each of the hydraulic starters is provided with a separate positioning feedback device connected to the main control system.

Preferably, the lowest point of the hoistable seats after being lifted up is still higher than the height of the rotatable seats.

Preferably, there are at least eight hydraulic cylinders.

The advantageous effect of the invention is that using hydraulic jacking enables significant reduction of noise and enables movement at a high speed with heavy loads, so that the hoistable platform itself and the audience thereon can be lifted up and down as a whole. Friction transmission is used under the rotatable seats, beneath which supporting wheels are provided to rotate around a central axis of rotation. The power to be supplied only needs to overcome the overall friction resistance, and the power required to overcome the rolling friction is significantly reduced. This, in cooperation with horizontal movement of the rotatable seats, enables the audience seated in different areas to change overall viewing angles according to movement of the story by means of changing the audience area where they are located. As a result, the audience may not only enjoy the experience with the story better, but also experience the shock brought by modern technology in the course of changing viewing angles.

Brief Description of the Drawings

Figure 1 is a structure diagram of the invention;

Figure 2 is a structure diagram of the invention;

Figure 3 is a structure diagram of the hoistable seats according to the invention;

Figure 4 is a structure diagram of the hoistable seats according to the invention;

Figure 5 is a structure diagram of the hoistable seats according to the invention;

Figure 6 is a structure diagram of the rotatable seats according to the invention; and

Figure 7 is a structure diagram of the rotatable seats according to the invention;

Detailed Description of the Invention

The present invention will be further illustrated hereinafter with reference to Figures 1- 7:

A movable stand with variable viewing angles according to the invention comprises two sections of hoistable seats and rotatable seats. The both sections are jointly controlled by a main control system, and cooperate with each other in movement. A single unit of hoistable seats as shown in Figures 3 to 5 comprises a hoistable platform structure 1, hydraulic devices 2, and guiding pillars 3. The hoistable platform structure 1 is connected to the guiding pillars 3 on its sides to ensure that the hoistable platform may stably move in vertical direction. The hydraulic devices 2 comprise at least eight hydraulic cylinders beneath the hoistable platform structure 1. A foundation pit for receiving the hydraulic cylinders is provided in the foundation under the hoistable platform structure 1, such as to reduce the structural effects on the building. A plurality of hydraulic cylinders 21 operate synchronously to support and drive the hoistable platform structure 1 to move up and down.

The rotatable seats as shown in Figures 6 and 7 comprise a rotatable platform structure 4, rotating pillars 5 and at least two friction driving mechanisms 6. The rotatable

seats can comprise one or more rotatable platform structures. In this embodiment, there are two fan-shaped rotatable platform structures that form mirror images of each other with respect to their adjacent surface. Each of the rotatable platform structures is provided with four angular points, wherein each end of the adjacent surface forms the first angular point 41 and the second angular point 42, and a rotating pillar is arranged at the third angular point 43. The friction driving mechanisms 6 are arranged on the bottom of the rotatable platform structure 4 away from the axial center of the rotating pillar 5, for example between the second angular point 42 and the fourth angular point 44, so that the rotatable seats are rotatable around the rotating pillar 5.

The friction driving mechanisms 6 comprises elastic friction wheels, friction transmission means, and a driver chip provided at the bottom of the rotatable platform structure 4, as well as motor reducers provided on the both sides of the driver chip (which are known in prior art and not shown in the figures), and is electrically connected to the main control system. Each friction driving mechanism 6 is provided with a plurality of motor reducers so that it can be supplied with power by at least two motor reducers at any operation point. The horizontal movement of the platform is achieved by using the friction transmission means to act on the driver chip mounted on the bottom of the platform structure.

The hoistable seats and rotatable seats are controlled by the control group of the main control system and have all necessary functions to ensure their safe operation.

As shown in Figures 1 and 2, the rotatable seats are a seating area movable in a horizontal direction, which enables the audience seated in the seating area, theater staff, technological equipment system, etc., to horizontally move during the performance by virtue of two functioning rotatable platform structures. These two rotatable platform structures can move between two positions to change the internal deployment within the theater, so that the theater can be changed from a proscenium stage into a thrust theater. These two rotatable platform structures are separated from each other through pivot effect

with the adjacent surface as boundary, and move toward each side of the audience seats, respectively. The resulting space formed is filled when the hoistable seats descend. The hoistable seats are on the same level as the rotatable seats when the hoistable seats are in the lowest position, and the rotatable seats will move to a position below the hoistable seats when the hoistable seats are lifted up. The lowest point of the hoistable seats after being lifted up is still higher than the height of the rotatable seats, so that the rotatable seats can move in an appropriate way to a position below the hoistable seats while the angles are changing.

The rotatable seats are positioned below a planned area of the hoistable seats in a certain period during operation, so there is an interlocking mechanism between these two pieces of equipment. The rotatable seats enable all the fixed and moving adjacent key surfaces to make an exact fit with each other.

The hoistable seats form a vertical-movable seating area is situated such that the audience seated in the seating area, the theater staff and the technological equipment can move up and down in vertical direction as a whole. The hoistable platform structure is supported and driven up and down by the synchronous operation of the eight hydraulic cylinders mounted in the foundation pit under the system. This hydraulic mechanism is supplied with oil by a special machine room, where the hydraulic power package and any relevant energy storage devices are located.

The hydraulic power package is provided with a backup mechanism so that the safe operation of the lifting equipments will not be interrupted by any single fault in the power system. The power package includes a highly efficient pump whose operation is driven by a motor. A large oil tank is included in the power package, and the oil in the tank is sufficient for the changing oil consumption of the system during operation in various modes. Any key standard data of the power package is monitored and feed back is relayed to the main control system, where the data will be sent to the operator for monitoring. In cases of serious situations, the affected power package will be shut down

automatically. For safety, all power can be shut down automatically when necessary.

If the need for emergency braking arises, relief valves are used to prevent excessive speed reduction. Each hydraulic cylinder is provided with two hydraulic starters. Each of the hydraulic starters are controlled by a separate speed/direction controlling valve and protected by a separate isolating valve, and both of the hydraulic starters is provided with a separate positioning feedback device connected to the main control system. The feedback information from the hydraulic starters is monitored and compared constantly by the main control system. Hydraulic circuit and the main control system are designed in such a way that, when failure occurs with either of the hydraulic starters, the other starter that can operate normally and can be used to push the affected robot arm axostyle back to its safe position. The system can operate at a very slow speed and acceleration in failure mode of a single starter.

The entire movable stand is provided with safety devices comprising load sensors, emergency braking, safe edge, interlocking, on-off encoders, over-travel limit switches and so on.

The description above is merely preferred embodiments for illustrating the invention, and in no way means to limit the scope of the invention. Any equivalent alternations and modifications made within the claimed scope of the invention are believed to fall into the scope of the invention.

CLAIMS

1. A movable stand with variable viewing angles, comprising hoistable seats, rotatable seats and a main control system, characterized in that the hoistable seats include a hoistable platform structure, guiding pillars and hydraulic devices, wherein the hoistable platform structure is connected to the guiding pillars on its sides, and the hydraulic devices comprise hydraulic cylinders beneath the hoistable platform structure, which hydraulic cylinders operate synchronously for supporting and driving the hoistable platform structure to move up and down; the rotatable seats comprise rotatable platform structures, rotating pillars, friction driving mechanisms, wherein each rotating pillar is arranged in a corner of the corresponding rotatable platform structure; the friction driving mechanisms are arranged on the bottom of the rotatable platform structure away from the axial center of a rotating pillar, so that the rotatable seats are rotatable around the rotating pillar; the movement of the hoistable seats and rotatable seats is controlled by the main control system in such a way that, the hoistable seats are on the same level as the rotatable seats when the hoistable seats are in the lowest position, and the rotatable seats move below the hoistable seats when the hoistable seats are lifted up.

2. The movable stand with variable viewing angles according to claim 1, characterized in that the rotatable seats have two fan-shaped rotatable platform structures that form mirror images of each other with respect to their adjacent surfaces; the rotatable platform structures each have four angular points, wherein both ends of the connecting surface form the first and the second angular points, and the rotating pillar is arranged at the third angular point; the two rotatable platform structures move towards each side, respectively, with the rotating pillar as its axis and with the adjacent surface as its boundary; the space formed within the adjacent surfaces is filled when the hoistable seats descend.

3. The movable stand with variable viewing angles according to claim 2, characterized in that friction driving mechanisms comprise elastic friction wheels, a

friction transmission means, and a driver chip at the bottom of the rotatable platform structure, as well as motor reducers on the both sides of the driver chip, and is electrically connected to the main control system.

4. The movable stand with variable viewing angles according to claim 3, characterized in that friction driving mechanisms are provided with at least two motor reducers.

5. The movable stand with variable viewing angles according to claim 1, characterized in that each of the hydraulic cylinders of the hydraulic devices is provided with two hydraulic starters; each of the hydraulic starter pairs is controlled by a separate controlling valve and protected by a separate isolating valve; and each of the hydraulic starter pairs is provided with a separate positioning feedback device connected to the main control system.

6. The movable stand with variable viewing angles according to claim 1, characterized in that the lowest point of the hoistable seats after being lifted up is still higher than the height of the rotatable seats.

7. The movable stand with variable viewing angles according to claim 1, characterized in that there are at least eight hydraulic cylinders.