

TITLE OF THE INVENTION

Rotary Apparatus

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a rotary apparatus for manually rotating a cabinet containing electronic equipment such as a television set and bringing the cabinet to rest in any position.

Description of the Background Art

Fig. 15 is a top view of a rotary apparatus for a television set and the like disclosed in Japanese Patent Application Laid-Open No. 07-203335 (1995). Fig. 16 is a general front elevation of the rotary apparatus for the television set illustrated in Fig. 15.

In Figs. 15 and 16, the reference numeral 1 designates a base; the reference character 1a designates a center of rotation of the base 1; 2 designates a television set body; 2a designates a cabinet for housing the television set body 2; 2b designates a power supply portion; 2c designates parts of the contour of the cabinet 2a positioned at a given angle of rotation; 2d designates parts of the contour of the cabinet 2a positioned at a maximum angle of rotation; and 3 designates a skirt wall.

Fig. 17 is a front elevation of the base 1. In Fig. 1, the reference numeral 1 designates the base; the reference character 1a designates the center of rotation of the base 1; 1b designates a bottom; 1c designates an outer peripheral wall; 1d designates an inner peripheral wall; 1e designates strengthening ribs; 1f

designates an internal gear; 1g designates a central wall; 4 designates a unit roller; 4a designates spherical elements; 4b designates a retainer; 5 designates a gear unit; 5a designates an external gear; 6 designates a leaf switch; 7 designates a ring rib; 8 designates a cam; 9 designates forced stop ribs; 10 designates spring members; 11 designates an outer peripheral cam; 12 designates a reference boss; 13 designates a back-center boss; and 13a designates a back-center hole.

The structure of the conventional rotary apparatus for the cabinet containing electronic equipment such as the television set is described below with reference to Figs. 15 through 17.

The base 1 is circular in configuration, and the bottom 1b of the base 1 includes a disk-shaped member. The outer peripheral wall 1c extending upwardly at right angles to the bottom 1b is formed over the entire circumference of the bottom 1b. The ring rib 7 and the inner peripheral wall 1d are provided in parallel inside the outer peripheral wall 1c.

The ring rib 7 and the inner peripheral wall 1d are integrated together by the strengthening ribs 1e. The spring members 10 are provided in left-hand and right-hand predetermined angular positions on the bottom 1b and serve as a stopper when the cabinet 2a housing the television set body 2 is rotated about the center of rotation 1a to the positions of the cabinet contour parts 2d shown in Fig. 15 (or to the maximum angle of rotation).

The forced stop ribs 9 are provided in left-hand and right-hand predetermined angular positions between the ring rib 7 and the inner peripheral wall 1d and serve as a stopper when the cabinet 2a is rotated about the center of rotation 1a to the positions of the cabinet contour parts 2c shown in Fig. 15 (or to the given angle of rotation). The forced stop ribs 9 also act as an alternative to the

strengthening ribs 1e.

The internal gear 1f is provided adjacent the outer peripheral wall 1c and is circular in configuration. The reference boss 12 and the back-center boss 13 for center alignment are provided externally of the outer peripheral wall 1c of the base 1 at front and rear positions, respectively.

Fig. 18 is a cross-sectional view illustrating the positional relationship between the base 1, the unit roller 4 and the gear unit 5. Fig. 19 is a detailed cross-sectional view of principal parts of Fig. 18.

Referring to Figs. 18 and 19, the central wall 1g extending vertically upwardly from the bottom 1b is fitted on a circular central boss 2e extending vertically downwardly from the lower end surface of the cabinet 2a for the television set to serve as the center of rotation 1a when the cabinet 2a rotates.

The gear unit 5 is provided between the base 1 and the cabinet 2a. The external gear 5a of the gear unit 5 mounted to the cabinet 2a and the internal gear 1f of the base 1 transmit power to rotate the cabinet 2a.

Such a conventional rotary apparatus has been designed such that electric power supplied from the power supply portion 2b drives the gear unit 5 by remote control to rotate the cabinet 2a.

The conventional remote-controlled rotary apparatus as above described involves a motor-driven gear unit, resulting in complicated structure and accordingly increased fabrication costs.

SUMMARY OF THE INVENTION

The present invention is directed to a rotary apparatus having a cabinet containing electronic equipment and placed manually rotatably on a base.

According to a first aspect of the present invention, the rotary apparatus comprises: a rolling member provided between a bottom surface of the cabinet and a top surface of the base for smoothly rotating the cabinet; and at least one sliding member provided between the bottom surface of the cabinet and the top surface of the base so that the cabinet is prevented from readily rotating when the cabinet is stopped rotating in a desired position, the sliding member for sliding over a slide surface formed in one of the bottom surface of the cabinet and the top surface of the base.

Preferably, according to a second aspect of the present invention, in the rotary apparatus of the first aspect, the sliding member is provided in a position substantially vertically lower than the center of gravity of the cabinet.

Preferably, according to a third aspect of the present invention, in the rotary apparatus of the second aspect, the sliding member comprises a first piece made of nonwoven fabric for sliding and a second piece made of hard rubber on the opposite side.

Preferably, according to a fourth aspect of the present invention, in the rotary apparatus of the first aspect, a surface roughness of the slide surface is changed whereby a frictional force between the slide surface and the sliding member is adjusted.

Preferably, according to a fifth aspect of the present invention, in the rotary apparatus of the first aspect, the at least one sliding member comprises a plurality of sliding members arranged circumferentially about a center of rotation and each having the shape of a convex lens for sliding; and the slide surface comprises a plurality of recesses arranged circumferentially about the center of rotation and each having the shape of a concave lens, the plurality of sliding

members being fitted in the plurality of recesses, respectively.

Preferably, according to a sixth aspect of the present invention, in the rotary apparatus of the fifth aspect, each of the plurality of sliding members is urged by a spring toward the slide surface.

Preferably, according to a seventh aspect of the present invention, in the rotary apparatus of the first aspect, the sliding member comprises a plurality of sliding members arranged circumferentially about a center of rotation and each recessed in the shape of a concave lens for sliding; and the slide surface comprises a plurality of protrusions arranged circumferentially about the center of rotation and each having the shape of a convex lens, the plurality of protrusions being fitted in the plurality of sliding members, respectively.

Preferably, according to an eighth aspect of the present invention, in the rotary apparatus of the seventh aspect, each of the plurality of sliding members is urged by a spring toward the slide surface.

In accordance with the first aspect of the present invention, the need for expensive parts such as a gear unit is eliminated, and there is provided an inexpensive easy-to-assembly manual rotary apparatus of simple construction.

In accordance with the second aspect of the present invention, the weight of the cabinet containing the electronic equipment may be efficiently used to produce a frictional force for bringing the cabinet to rest in any position.

In accordance with the third aspect of the present invention, the sliding member is inexpensive and has good processability and shock-absorbing property.

In accordance with the fourth aspect of the present invention, the frictional force acting between the sliding member and the slide surface by the rotation of the cabinet may be arbitrarily established without difficulty.

In accordance with the fifth aspect of the present invention, the cabinet may be positively brought to rest in a more stabilized state.

In accordance with the sixth aspect of the present invention, as the cabinet is rotated, the sliding member is smoothly moved up and down by the spring and fitted in the concave recess of the base. This provides very smooth rotation and rest of the cabinet.

In accordance with the seventh aspect of the present invention, the cabinet may be positively brought to rest in a more stabilized state.

In accordance with the eighth aspect of the present invention, as the cabinet is rotated, the sliding member is smoothly moved up and down by the spring and fitted on the convex protrusion of the base. This provides very smooth rotation and rest of the cabinet.

It is therefore an object of the present invention to provide an inexpensive rotary apparatus of simple construction for manually smoothly rotating a cabinet and bringing the cabinet to rest in any position with reliability without the need for a remote-controlled motor-driven gear unit.

These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view of a rotary apparatus according to a first preferred embodiment of the present invention;

Fig. 2 is a cross-sectional view of principal parts of the first preferred embodiment;

Fig. 3 is a cross-sectional view of the rotary apparatus according to a second preferred embodiment of the present invention;

Fig. 4 is a perspective view of a sliding piece according to a third preferred embodiment of the present invention;

Fig. 5 is a cross-sectional view of principal parts of the third preferred embodiment;

Fig. 6 is a top view of a base according to a fourth preferred embodiment of the present invention;

Fig. 7 is a bottom view of the rotary apparatus according to a fifth preferred embodiment of the present invention;

Fig. 8 is a cross-sectional view of principal parts of the fifth preferred embodiment;

Fig. 9 is a bottom view of the rotary apparatus according to a sixth preferred embodiment of the present invention;

Fig. 10 is a cross-sectional view of principal parts of the sixth preferred embodiment;

Fig. 11 is a bottom view of the rotary apparatus according to a seventh preferred embodiment of the present invention;

Fig. 12 is a cross-sectional view of principal parts of the seventh preferred embodiment;

Fig. 13 is a bottom view of the rotary apparatus according to an eighth preferred embodiment of the present invention;

Fig. 14 is a cross-sectional view of principal parts of the eighth preferred embodiment;

Fig. 15 is a plan view of a conventional rotary apparatus;

Fig. 16 is a general front elevation of the conventional rotary apparatus;
Fig. 17 illustrates a base for use in the conventional rotary apparatus;
Fig. 18 is a cross-sectional view of the conventional rotary apparatus; and
Fig. 19 is an enlarged cross-sectional view of principal parts of Fig. 18.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Preferred Embodiment

Fig. 1 is an exploded perspective view of a rotary apparatus for a television set according to a first preferred embodiment of the present invention. Fig. 2 is a cross-sectional view of principal parts of the rotary apparatus taken along the line II-II of Fig. 1.

The structure and operation of the rotary apparatus for the television set according to the first preferred embodiment will now be described with reference to the drawings.

A disk-shaped base 10 has a rotation center hole 10a provided centrally therein. The rotation center hole 10a has a circular seat sunk so that a washer 50 is received therein and the head of a self tapping screw 60 does not protrude from the bottom surface of the base 10.

A cabinet 20 containing electronic equipment, for example, a television set has a bottom surface formed with a central boss 20a. The central boss 20a may be inserted in the rotation center hole 10a and has an outer diameter slightly smaller than the inner diameter of the rotation center hole 10a so that the cabinet 20 freely rotates over the base 10. The central boss 20a has a cylindrical hole for threaded engagement with the self tapping screw 60.

The central boss 20a is high enough to slightly protrude from the seat of

the rotation center hole 10a when the base 10 engages the cabinet 20.

A pair of annular rails 20b spaced a predetermined distance apart from each other are provided on the bottom of the cabinet 20 about the rotation center boss 20a. A circular seat 10c opposed to the rails 20b is provided on a surface of the base 10 which is opposed to the bottom surface of the cabinet 20 (referred to hereinafter as an "opposite surface"). A unit roller 40 including rollers 40a connected to each other in an annular form and having a smaller radius than the outer shape of the base 10 is held between the rails 20b and the seat 10c.

The unit roller 40, the rollers 40a and the rails 20b constitute a rolling member for smoothly rotating the cabinet 20 over the base 10.

On the bottom surface of the cabinet 20 are provided seats 20c which form any predetermined angle with respect to the centerline (corresponding with the line II-II for representation of the cross section) of the cabinet 20 which extends through the center of the central boss 20a. Sliding pieces 30 are fitted respectively in the seats 20c and positioned therein. The sliding pieces 30 slide over a slide surface 10b included in the opposite surface of the base 10.

The sliding pieces 30 are made of, for example, nonwoven fabric with a pressure sensitive adhesive material or an adhesive applied to one surface thereof. The sliding pieces 30 are fixed on the cabinet 20 for the television set by fitting the sliding pieces 30 in the seats 20c with the side of the pressure sensitive adhesive material or adhesive facing the seats 20c.

The rotary apparatus thus constructed is held by the self tapping screw 60 through the washer 50, with the central boss 20a on the bottom surface of the cabinet 20 inserted in the rotation center hole 10a of the base 10 as above described.

A slight clearance between the central boss 20a and the rotation center hole 10a allows the base 10 to freely rotate about the central boss 20a.

Further, the rollers 40a of the unit roller 40 positioned between the rails 20b on the bottom surface of the cabinet 20 and the seat 10c of the base 10 allow the cabinet 20 to smoothly rotate about the rotation center boss 20a.

In this state, the rollers 40a receive the full weight of the cabinet 20 containing the electronic equipment. However, the sliding pieces 30 having a thickness slightly greater than the spacing between the seats 20c on the bottom surface of the cabinet 20 and the slide surface 10b of the base 10 are fixed to the seats 20c on the bottom surface of the cabinet 20. This permits the weight of the cabinet 20 to be distributed between the rollers 40a of the unit roller 40 and the sliding pieces 30.

The sliding pieces 30 made of nonwoven fabric is elastic, and is compressed when loaded.

Thus, the thickness of the sliding pieces 30 may be changed to adjust the load applied to the sliding pieces 30.

As the cabinet 20 for the television set is rotated, the sliding pieces 30 rub against the slide surface 10b of the base 10, producing a frictional force against the rotation.

The frictional force acts as a resting force which stops the rotating cabinet 20 containing the electronic equipment in any desired position.

For example, when the thickness of the sliding pieces 30 is slightly greater than the spacing between the seats 20c provided on the bottom surface of the cabinet 20 and the slide surface 10b of the base 10, a decreased load is applied to the sliding pieces 30 to produce a decreased frictional force between the sliding

pieces 30 and the slide surface 10c. Then, the cabinet 20 rotates lightly, and the resting force is decreased.

On the other hand, when the thickness of the sliding pieces 30 is much greater than the spacing between the seats 20c provided on the bottom of the cabinet 20 and the slide surface 10b of the base 10, an increased load is applied to the sliding pieces 30 to produce an increased frictional force between the sliding pieces 30 and the slide surface 10c. Then, the cabinet 20 rotates heavily, and the resting force is increased.

Thus, the cabinet 20 may be rotated smoothly by the rollers 40a and brought to rest in any desired position by the sliding pieces 30 by optimizing the thickness of the sliding pieces 30.

Second Preferred Embodiment

Fig. 3 is a cross-sectional view of the rotary apparatus according to a second preferred embodiment of the present invention and illustrates the positional relationship between the center of gravity 20d of the cabinet 20 including the electronic equipment, for example, the television set body and the sliding piece 30. The second preferred embodiment is basically similar in construction and operation to the first preferred embodiment but specifies the positional relationship between the seat 20c on the bottom surface of the cabinet 20, the slide surface 10b of the base 10 and the sliding piece 30.

Specifically, the seat 20c, the sliding piece 30, and the slide surface 10b of the base 10 are located in a position vertically lower than the center of gravity 20d of the cabinet 20 including the electronic equipment body. Then, the weight of the cabinet 20 may be efficiently applied to the sliding piece 30.

The arrow 70 of Fig. 3 indicates the loading direction of the cabinet 20

containing the electronic equipment body.

Third Preferred Embodiment

Fig. 4 is a perspective view of the sliding piece 30 for use in the rotary apparatus according to a third preferred embodiment of the present invention. Fig. 5 is a cross-sectional view of the sliding piece 30 fixed to the seat 20c on the bottom surface of the cabinet 20, with the base 10 incorporated in the rotary apparatus.

The third preferred embodiment is basically similar in construction and operation to the first preferred embodiment except the construction of the sliding piece 30. The sliding piece 30 comprises a first piece 30a made of nonwoven fabric and a second piece 30b made of hard rubber which are bonded together with an adhesive or a pressure sensitive adhesive material.

The second piece 30b is opposed to and fixed to the seat 20c. The first piece 30a is opposed to the slide surface 10b of the base 10.

The sliding piece 30, if comprised of only nonwoven fabric, must have some thickness in consideration for wear due to sliding and collapse due to the weight of the cabinet 20 containing the electronic equipment, resulting in increased costs.

To solve such a problem, in the third preferred embodiment, the thickness of the nonwoven fabric of the sliding piece 30 is decreased, and the first piece 30a of nonwoven fabric and the second piece 30b of hard rubber are bonded together to compensate for the decreased thickness by using the hard rubber.

The hard rubber is relatively inexpensive and has good processability and shock-absorbing property. On the other hand, the nonwoven fabric of the first piece 30a sliding over the slide surface 10b of the base 10 allows smooth rotation

of the cabinet 20 placed rotatably on the base 10.

Fourth Preferred Embodiment

Fig. 6 illustrates the base 10 for use in the rotary apparatus according to a fourth preferred embodiment of the present invention as viewed from the cabinet 20.

The fourth preferred embodiment is basically similar in construction and operation to the first preferred embodiment except that the surface roughness of the slide surface 10b of the base 10 is suitably established. Specifically, the surface roughness of the slide surface 10b of the base 10 may be arbitrarily changed to change the coefficient of friction of the slide surface 10b, thereby controlling the frictional force between the first piece 30a made of nonwoven fabric of the sliding piece 30 used in the third preferred embodiment and the sliding surface 10b.

For example, when the base 10 is fabricated by plastic molding process, a satin finish or an embossed finish is imparted to the mold in a position of the slide surface to change the surface roughness thereof, thereby readily changing the surface roughness of the slide surface 10b.

Thus, the force required to rotate the cabinet and the frictional force for bringing the cabinet to rest in a desired position may be arbitrarily established.

Fifth Preferred Embodiment

Fig. 7 is a bottom view of the cabinet 20 and the base 10 of the rotary apparatus according to a fifth preferred embodiment of the present invention. A plurality of recesses 10e each having the shape of a concave lens are arranged in circumferentially spaced relation about the rotation center hole 10a in the opposite surface of the base 10.

Fig. 8 is a cross-sectional view of the recesses 10e taken along the arc

VIII-VIII of Fig. 7.

A sliding piece 31 having the shape of a convex lens is provided on each of the seats 20c on the bottom of the cabinet 20. The recesses 10e and the sliding pieces 31 are provided in corresponding relation.

Referring to Fig. 8, the sliding piece 31 is shown fitted in the recess 10e formed in the slide surface 10b, and the cabinet 20 remains at rest in a stable state.

As the cabinet 20 in this state is rotated, the sliding piece 31 is compressed along the concave recess 10e. Further continuous rotation of the cabinet 20 causes the sliding piece 31 to be fitted into an adjacent concave recess 10e to bring the cabinet 20 to rest into the stable state again.

Thus, the plurality of sliding pieces 31 described above and the plurality of concave recesses 10e are arranged in circumferentially predetermined spaced relation to allow the cabinet to stably rest in a desired rotated position.

Sixth Preferred embodiment

Fig. 9 is a bottom view of the cabinet 20 and the base 10 of the rotary apparatus according to a sixth preferred embodiment of the present invention. The plurality of recesses 10e each having the shape of a concave lens are arranged in circumferentially spaced relation about the rotation center hole 10a in the opposite surface of the base 10.

Fig. 10 is a cross-sectional view of the recesses 10e taken along the arc X-X of Fig. 9. The sliding piece 31 having the shape of a convex lens is provided on each of the seats 20c on the bottom of the cabinet 20. A spring 80 is provided in each of the seats 20c to urge the sliding piece 31 toward the base 10. The recesses 10e and the sliding pieces 31 are provided in corresponding relation.

Referring to Fig. 10, the sliding piece 31 is shown fitted in the recess 10e

formed in the slide surface 10b, and the cabinet 20 remains at rest in the stable state.

As the cabinet 20 in this state is rotated, the sliding piece 31 compresses the spring 80 along the concave recess 10e and is forced smoothly upwardly toward the bottom of the cabinet 20. Further continuous rotation of the cabinet 20 causes the sliding piece 31 to be fitted into an adjacent concave recess 10e to bring the cabinet 20 to rest into the stable state again.

Thus, the plurality of sliding pieces 31 urged by the springs 80 and the plurality of concave recesses 10e are arranged in circumferentially predetermined spaced relation to allow the cabinet to very smoothly rotate and stably rest in a desired rotated position.

Seventh Preferred Embodiment

Fig. 11 is a bottom view of the cabinet 20 and the base 10 of the rotary apparatus according to a seventh preferred embodiment of the present invention. A plurality of protrusions 10f each having the shape of a convex lens are arranged in circumferentially spaced relation about the rotation center hole 10a in the opposite surface of the base 10.

Fig. 12 is a cross-sectional view of the convex protrusions 10f taken along the arc XII-XII of Fig. 11.

A sliding piece 32 having the shape of a concave lens is provided on each of the seats 20c on the bottom of the cabinet 20. The protrusions 10f and the sliding pieces 32 are provided in corresponding relation.

Referring to Fig. 12, the sliding piece 32 is shown fitted on the protrusion 10f formed on the slide surface 10b, and the cabinet 20 remains at rest in the stable state.

As the cabinet 20 in this state is rotated, the sliding piece 32 is compressed along the convex protrusion 10f. Further continuous rotation of the cabinet 20 causes the sliding piece 32 to be fitted onto an adjacent convex protrusion 10f to bring the cabinet 20 to rest into the stable state again.

Thus, the plurality of concave sliding pieces 32 described above and the plurality of convex protrusions 10f are arranged in circumferentially predetermined spaced relation to allow the cabinet to stably rest in a desired rotated position.

Eighth Preferred Embodiment

Fig. 13 is a bottom view of the cabinet 20 and the base 10 of the rotary apparatus according to an eighth preferred embodiment of the present invention. The plurality of protrusions 10f each having the shape of a convex lens are arranged in circumferentially spaced relation about the rotation center hole 10a in the opposite surface of the base 10.

Fig. 14 is a cross-sectional view of the protrusions 10f taken along the arc XIV-XIV of Fig. 13. The sliding piece 32 having the shape of a concave lens is provided on each of the seats 20c on the bottom of the cabinet 20. The spring 80 is provided in each of the seats 20c to urge the sliding piece 32 toward the base 10. The protrusions 10f and the sliding pieces 32 are provided in corresponding relation.

Referring to Fig. 14, the concave sliding piece 32 is shown fitted on the protrusion 10f formed on the slide surface 10b of the base 10, and the cabinet 20 remains at rest in the stable state.

As the cabinet 20 in this state is rotated, the sliding piece 32 compresses the spring 80 along the convex protrusion 10f and is forced smoothly upwardly toward the bottom of the cabinet 20. Further continuous rotation of the cabinet 20

causes the sliding piece 32 to be fitted onto an adjacent convex protrusion 10f to bring the cabinet 20 to rest into the stable state again.

Thus, the plurality of sliding pieces 32 urged by the springs 80 and the plurality of convex protrusions 10f are arranged in circumferentially predetermined spaced relation to allow the cabinet to very smoothly rotate and stably rest in a desired rotated position.

While the invention has been described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is understood that numerous other modifications and variations can be devised without departing from the scope of the invention.

I claim:



1. A rotary apparatus having a cabinet containing electronic equipment and placed manually rotatably on a base, said rotary apparatus comprising:
a rolling member provided between a bottom surface of said cabinet and a top surface of said base for smoothly rotating said cabinet; and
at least one sliding member provided between the bottom surface of said cabinet and the top surface of said base so that said cabinet is prevented from readily rotating when said cabinet is stopped rotating in a desired position, said sliding member for sliding over a slide surface formed in one of the bottom surface of said cabinet and the top surface of said base.
2. The rotary apparatus according to claim 1,
wherein said sliding member is provided in a position substantially vertically lower than the center of gravity of said cabinet.
3. The rotary apparatus according to claim 2,
wherein said sliding member comprises a first piece made of nonwoven fabric for sliding and a second piece made of hard rubber on the opposite side.
4. The rotary apparatus according to claim 1,
wherein a surface roughness of said slide surface is changed whereby a frictional force between said slide surface and said sliding member is adjusted.
5. The rotary apparatus according to claim 1,



wherein said at least one sliding member comprises a plurality of sliding members arranged circumferentially about a center of rotation and each having the shape of a convex lens for sliding, and

wherein said slide surface comprises a plurality of recesses arranged circumferentially about said center of rotation and each having the shape of a concave lens, said plurality of sliding members being fitted in said plurality of recesses, respectively.

6. The rotary apparatus according to claim 5,

wherein each of said plurality of sliding members is urged by a spring toward said slide surface.

7. The rotary apparatus according to claim 1,

wherein said sliding member comprises a plurality of sliding members arranged circumferentially about a center of rotation and each recessed in the shape of a concave lens for sliding, and

wherein said slide surface comprises a plurality of protrusions arranged circumferentially about said center of rotation and each having the shape of a convex lens, said plurality of protrusions being fitted in said plurality of sliding members, respectively.

8. The rotary apparatus according to claim 7,

wherein each of said plurality of sliding members is urged by a spring toward said slide surface.