

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN ROLLERS

(71) I, YOSHITAKA NAKANISHI, a Japanese Citizen, of No. 12-9, 5-chome, Yawata, Ichikawa-shi, Chiba-ken, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a roller for a sliding door, a sash door, a paper door, a movable stack, a movable platform, other portable furniture, building member, a structural member, and the like.

One object of this invention is to provide a smoothly rotatable roller.

The present invention provides a roller comprising two complementary circular roller halves, each roller half having a centre aperture and an annular groove opening into the circumference of said centre aperture, the annular grooves of each roller half cooperating with each other to define a ball bearing race, the contiguous faces and the outerfaces of each roller half being flat and the body of each roller half between said contiguous face and the outside face being solid, a shaft being inserted through said centre aperture, and ball bearings being disposed between said annular groove and said shaft.

The present invention further provides a roller comprising two complementary circular roller halves, each roller half having a centre aperture and an annular groove opening into the circumference of said centre aperture, the annular grooves of each roller half cooperating with each other to define a ball bearing race, each annular groove having a circular arc in transverse section, at least one of said roller halves having a peripheral edge effective to retain ball bearings in said annular groove, a plurality of ball bearings being disposed in said annular grooves, and a shaft being inserted through said centre aperture in contact with said bearing balls.

In the accompanying drawings:

Figure 1 is a perspective view of a roller unit embodying the present invention.

Figure 2a is an enlarged vertical sectional view of Figure 1.

Figure 2b shows a modified form of Figure 2a in which the jointing means of the roller half etc. is different, and the lower half thereof is omitted.

Figure 2c is an enlarged vertical sectional view showing a roller having a differently formed roller half.

Figure 2d is an enlarged vertical sectional view showing the roller of this invention without the control edge.

Figure 3a is an enlarged perspective cut-away view from outside showing one roller half constituting the roller of this invention.

Figure 3b is an enlarged perspective view showing the other roller half viewed from its inside.

Figure 4 is an enlarged perspective view cut nearly at the center of the roller of this invention.

Figures 5a and 5b are schematic drawings showing the relation between the annular groove and the ball bearing, the ball bearing being shown by dotted line.

Figure 6 shows a plan view of the roller shown in Figure 3b wherein the annular groove is divided by partition walls and the bearing balls are inserted therebetween.

Figure 7 is a cut-away cross section of a castor embodying this invention.

Referring to Figures 1—3b, 5a and 5b and Figure 7, a roller 1 comprises roller halves 2 and 2h composed of solid metallic material.

The roller halves 2, 2h are provided with an annular groove 3, 3h having a peripheral surface 30, 30h, rolling on a rail (not shown). The peripheral surface may be a peripheral surface without a groove and which contacts the floor (see Figure 7). The roller halves 2, 2h have a center aperture 4, 4h, a shaft 10 passing therethrough. Annular grooves 6 and 6h (Figures 5a and 5b) for receiving ball

bearings are formed within the roller and adjacent the edge of the center aperture 4 and 4h. Referring to the annular grooves, it may be suitable to dispose ball bearings partially or completely around the whole periphery of the center aperture, but in Figure 6, the ball bearings extend only partially around the periphery.

Roller half 2 has a suitable number of pins 7, for example, two, on its inner face, and pin holes 8 penetrating the roller half body. The pins 7 and holes 8 are disposed in a definite position in opposed relation to each other as clearly shown in the drawing. The other roller half 2h also has pins 7 and pin holes 8. When these two halves are meshed and the pin of one side is inserted into the pin hole of the other, the pin is of such length that the head 9 of the pin extends out from its pin hole. The head 9 of the pin is then hammered and suitably flattened at the drill shaped hole 23 so as to fix the roller halves together.

For the sake of convenience, common holes 13 of each of the two roller halves may be drilled, and after the pin 14 has been passed through the halves, it may be fixed (Figure 2b), or clamped by screw (not shown).

Each roller half is preferably made of metallic material. Manufacture by die casting is especially preferable for increasing the quality and efficiency of the roller. The metal may be zinc alloy, aluminium alloy, copper alloy, magnesium alloy, tin alloy, lead alloy, or iron material or other metallic material may be used. The roller may also be made of synthetic plastics materials having a strength no less than those materials described above, for example, strengthened polycester resin, polyamide resin (Nylon) etc.

In this case, it may be manufactured by extrusion or by a suitable injection process, or the like. It may be made of iron powder and other metallic powder and the synthetic resin as described above by the sintering process.

It has been found that the pin can be molded simultaneously as a part of the roller half.

A plurality of steel balls or the ball bearings 5 as described above are disposed in the annular groove which retains them.

Figure 2c shows one example of one modification. One of the roller halves 2h forms a stepped part 18, a recess 18a in the other one roller half corresponds to stepped part 18 and each roller half is connected by means of these stepped parts.

In Figure 6, the modified annular groove is shown in the plan view. Partition walls 6a have ball bearings disposed between them. Ball bearings may be disposed in the individual recesses provided in the bottom of the annular groove, and these recesses can be

made simply during the molding process such as die casting, etc. described above.

If desired, another groove 19 may be provided in the grooves 3, 3h in the roller half described above, and a tyre 20 (Figure 2b) may be engaged in the groove, the tyre being composed of a synthetic resin, or of the same material as the bush to be described later or of rubber.

Bush 15 is made of self lubricant resin and engaged in the center aperture 4, 4h. The term "self lubricant resin" includes, for example, polyamide resin (Nylon resin), Delrin (Registered Trade Mark), resin, Fluor resin, Phenol resin, and the like.

On assembling the roller, as one example, one of the roller halves is supported in horizontal state. Ball bearings are then placed in the annular groove, the mating roller half is placed thereon, and each member of the roller half is combined integrally by means of the pins and pin holes.

Thereby, the roller halves 2, 2h, annular groove 6, 6h embrace the balls oppositely, and the center apertures 4, 4h are interconnected.

The roller is then placed in a hole 27 in the frame 16, shaft 10 is passed through the center aperture 17 of the frame 16 and center aperture of the roller and through the center aperture 17h on the opposite side of the frame 16. The head of the shaft is then calked 10a, 10b. Holes 26 are provided for attaching the roller of this invention to the bottom of a door (not shown in the drawing).

In the roller half 2, the shape of the annular groove 6 is such that the length of the circular arc 62 between the intersecting point 60 (Figures 5a, 5b) of the joining face of the roller halves 2, 2h with the annular groove 6 and the intersecting point 61 of the groove 6 with the center aperture 4, is more than $1/4$ of the total circumference of a circle of the same radius as groove 6 and less than $1/2$. In this way, the annular grooves 6, 6h in the roller halves 2, 2h have an opening area 63, 63h starting at the center aperture 4, 4h. The points 65 and 65h show the case where the length of the arc is one half of the circumference.

In Figure 5b, the intersecting point of the junction face of the roller halves 2, 2h with the annular groove 6 is labelled 50 and the intersecting point of the center aperture and the tangent at the point 55 separated by $1/4$ of the whole circumference from the intersecting point 50 of the annular groove 6 being labelled 51. In this case, the opening areas between the annular groove and the center aperture are shown by 53 and 53h.

In Figure 5a, the control edge 11 extends to the opening area adjacent to the center aperture from the point 65 or 65h which is $1/4$ of the circular arc between the intersecting point 61 or 61h and this control edge

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embraces the ball in the center aperture in such a way that the ball may not fall out.

In the part where the annular grooves 6, 6h open in the center aperture, the control edge 11 of the roller halves forms an arcuate curved surface 12 and/or 12h and the annular groove 6, 6h includes this curved surface 12, 12h. When the balls (shown in dotted lines) are inserted in one roller half, the balls are embraced by the control edge and are prevented from falling out. The mating roller half is then superposed thereon and engaged and thereafter the wheel shaft may be passed through the center aperture.

The limit of the control edge is shown at 61, 61h but when the length of the circular arc from point 60 to point 61 and/or 61h is about $1/4$ of the whole circumference then this case is shown in Figure 2d, and when this distance is nearly $1/2$, then the ball bearing is held perfectly and is not in contact with the wheel shaft.

If desired, at least one of the annular grooves opposing each other of the roller half to be assembled may include the arcuate surface of the control edge and the other may be omitted.

Figure 7 shows a castor having a roller of the present invention.

Roller halves are shown by 40, 40h and are provided with a peripheral surface 41 wrapped by a belt 21 of synthetic resin. An annular groove 6, ball 5 supported by the annular groove, (center aperture), shaft 10 passing through, calked part 10a, 10b of the head of the shaft, bush 15 inserted in the center aperture etc. are all the same as described above. A frame 43 is supported by an enlarged head 45 and cover 44 to the attaching portion 43 and the assembled roller half is supported by the shaft 10.

WHAT I CLAIM IS:—

1. A roller comprising two complementary circular roller halves, each roller half having a center aperture and an annular groove opening into the circumference of said center aperture, the annular grooves of each roller half cooperating with each other to define a ball bearing race, the contiguous faces and the outer faces of each roller half being flat and

the body of each roller half between said contiguous face and the outside face being solid, a shaft being inserted through said center aperture, and ball bearings being disposed between said annular groove and said shaft.

2. A roller according to claim 1, wherein a bushing is positioned at the periphery of each center aperture, the shaft being supported by said bushing, and wherein said bushing is composed of a resilient self lubricating plastics material.

3. A roller according to claim 2, wherein the shaft is attached to a frame.

4. A roller comprising two complementary circular roller halves, each roller half having a center aperture and an annular groove opening into the circumference of said center aperture, the annular grooves of each roller half cooperating with each other to define a ball bearing race, each annular groove having a circular arc in transverse section, at least one of said roller halves having a peripheral edge effective to retain ball bearings in said annular groove, a plurality of ball bearings being disposed in said annular grooves, and a shaft being inserted through said center aperture in contact with said bearing balls.

5. A roller according to claim 4, wherein a bushing is disposed on the peripheral edge of each center aperture, said shaft being supported by said bushing and being in contact with said ball bearings, a frame having an aperture for supporting said shaft being provided and said bushing being composed of resilient self lubricating plastics material.

6. A roller according to claim 4, wherein a frame is disposed around a part of the shaft, engaging with the shaft, and the roller is supported so as to be freely rotatable.

7. A roller or castor, substantially as described with reference to and as shown in any of the Figures of the accompanying drawings.

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1. A roller comprising two complementary circular roller halves, each roller half having a center aperture and an annular groove opening into the circumference of said center aperture, the annular grooves of each roller half cooperating with each other to define a ball bearing race, the contiguous faces and the outer faces of each roller half being flat and

the body of each roller half between said contiguous face and the outside face being solid, a shaft being inserted through said center aperture, and ball bearings being disposed between said annular groove and said shaft.

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