ANTI-CREEP BALL BEARING RETAINER FOR A DRAWER SLIDE

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ABSTRACT
A drawer slide assembly comprising an elongated first track member, an elongated second track member, load bearing anti-friction elements such as ball bearings movably supporting the second member for longitudinal movement on the first member, a longitudinally extending retainer for such bearings, and an energy-storing spring arrangement for urging the retainer in the direction of movement of the second member.

18 Claims, 5 Drawing Figures
ANTI-CREEP BALL BEARING RETAINER FOR A DRAWER SLIDE

It is a primary object of the present invention to provide a simple but very effective means for preventing the bearing retainer of a conventional drawer slide from creeping away from its synchronized position relative to the fixed and extensible track members. In drawer slide assemblies, it is a common practice to have a fixed track member, an extensible track member, and load bearing anti-friction means, such as ball bearings or rollers, supporting the extensible member for longitudinal movement on the fixed member. Conventionally, retainers are used to hold the anti-friction means in longitudinal spaced apart relationship. Such retainers are often referred to as bearing cages or bearing retainers.

Reference is made to the U.S. Pat. No. 3,488,097 issued Jan. 6, 1970 to Fall which refers to an earlier U.S. Pat. No. 3,205,025 issued Sept. 7, 1964 to Jordan. The device of the present invention is particularly suited for use on the drawer slides disclosed in these two patents. Particularly, these two patents disclose a ball bearing drawer slide with the ball bearings held in a longitudinal spaced relationship by a bearing retainer.

Reference is also made to copending U.S. Patent applications Ser. No. 152,250 filed June 11, 1971 and now U.S. Pat. No. 3,679,505; Ser. No. 152,257 filed June 11, 1971; and Ser. No. 152,258 filed June 11, 1971 and now U.S. Pat. No. 3,679,275. These patent applications also disclose the general type of slide which may include the device of the present invention.

In such conventional drawer slides, movement of the extensible track member involves a proportional movement of the bearing retainer. Conventionally, the extensible track member and the fixed track member carry stop members which engage opposite ends of the bearing retainer so that the movement of the extensible member is limited by the length of the bearing retainer. That is, desirably, at the end of the travel of the extensible member, one end of the bearing retainer is engaged by a stop on the fixed track member while the other end of the bearing retainer is engaged by a stop on the extensible track member. Desirably, the stops on the respective track members will engage the opposite ends of the bearing retainer at exactly the same time. This will happen, of course, only as long as the bearing retainer is in synchronization with the extensible track member.

For reasons not fully understood, the bearing retainer creeps in a direction opposite to the direction of movement of the extensible track member. One possible reason for this creeping movement may be that, as the extensible track member moves to the extent of its travel relative to the fixed track member, the load on the track members causes flexing of the raceways in which the balls run so that there is a component of force directed longitudinally along the raceways.

In any event, the creep problem is an additive one in that the bearing retainer is caused to creep rearwardly relative to the fixed track member a small distance, for instance, one-sixteenth inch, each time the extensible member is moved forwardly. That is, each time a drawer is pulled forwardly from a cabinet, the bearing retainer creeps rearwardly a small distance relative to the fixed track member in the cabinet. When this occurs, the stop on the extensible track member will engage the adjacent end of the bearing retainer well before the other end of the bearing will engage the stop on the fixed track member. This means that the person pulling out the drawer must then exert sufficient force to move the bearing retainer frictionally to the end of its travel, i.e., to the point at which its forward end strikes the stop on the fixed track member. When this happens, there is considerable drag because each ball bearing is not rolling against two oppositely moving surfaces.

The present invention provides a solution to the creep problem just described. The present invention involves means for urging the bearing retainer in the direction of movement of the extensible track member. The urging means includes energy storage means effective to urge the retainer in the direction of movement of the extensible track member, i.e., in a direction opposite to the direction it normally creeps. In the illustrative and preferred embodiment, the extensible track member carries stop means positioned and arranged to move against the urging means to store energy in the said energy storage means. The release of that energy is effective to resist whatever forces might tend to create the creeping movement discussed above.

To the accomplishment of the above and related objects, this invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is an exploded perspective view of a drawer slide incorporating the advance of the present invention;

FIG. 2 is a sectional view of a drawer slide assembly including a plurality of the drawer slides of FIG. 1 to provide a double extension drawer slide assembly;

FIG. 3 is an elevational view of a bearing retainer with the anti-creep device of the present invention mounted thereon;

FIG. 4 is a fragmentary somewhat diagrammatical view of an anti-creep device including another type of energy storage means; and

FIG. 5 is a fragmentary somewhat diagrammatical view of an anti-creep including still another type of energy storage means.

Referring now particularly to the drawings, it will be seen that there is illustrated a drawer slide 10 comprising an outer track member 12 and an inner track member 14, sometimes respectively referred to as the first and second track members. In the illustrative embodiment of FIG. 2, four such drawer slides, indicated generally by the reference numerals 10a, 10b, 10c, 10d, are connected together to make a double extension drawer slide assembly. Particularly, a longitudinally extending plate 16 is provided for connecting the inner track members 14 of the slides 10a and 10b to the outer track members 12 of the slides 10c and 10d.

The drawer slide 10 of FIG. 1, therefore, is the basic building block of the slide assembly shown in FIG. 2. It will be appreciated that this basic building block may be used with other such basic building blocks in a variety of ways to support heavy or light loads and to provide single or double extension capability.

In the illustrative and preferred embodiment, the outer track member 12 is formed to provide a longitudinally and outwardly extending first downwardly fac-
ing raceway 18 along its upper edge and a longitudi-
nally and outwardly extending first upwardly facing 
raceway 20 along its lower edge while the inner track 
member 14 is formed to provide a longitudinally and 
inwardly extending second upwardly facing raceway 22 
along its upper edge and a longitudinally and inwardly 
extending second downwardly facing raceway 24 along 
its lower edge. The relationship of these raceways 18, 
20, 22, 24 and the ball bearings 28 carried thereon 
are best seen in FIG. 2. Particularly, ball bearings 28 are 
carried on the first upwardly facing raceway 20 and 
under and in rolling contact with the second down-
wardly facing raceway 24 and additional ball bearings 
28 are carried on the second upwardly facing raceway 
22 and under and in rolling contact with the first down-
wardly facing raceway 18. Each inner member 14, 
therefore, is longitudinally extensible relative to its asso-
ciated outer member 12. In the illustrative embodi-
ment of FIG. 2, the outer members 12 of the slides 10a, 
10b are rigidly connected together by a plate 30 and, 
for instance, to a cabinet structure while the inner 
members 14 of the slides 10c, 10d are rigidly connected 
together by a plate 32 and, for instance, to a drawer 
mounted in the cabinet. In such an embodiment, the 
two outer members 12 of the slides 10c, 10d move with 
the inner members 14 of the slides 10a, 10b relative to 
the cabinet structure; and the inner track members 14 
of the slides 10c, 10d move relative to the outer track 
members 12 of the slides 10c, 10d. A cable-drive syn-
chronizing mechanism of the type disclosed in the said 
prior U.S. Pat. No. 3,687,505 is indicated generally by 
the reference numeral 34 in FIG. 2. As clearly disclo-
sed in this prior application, the cable-drive synchron-
izing mechanism synchronizes the movement of the 
plate 16 and the plate 32.

A drawer slide 10 includes a longitudinally extending 
bearing retainer 40 formed to provide longitudinally 
and outwardly extending flange sections 42 along its 
upper and lower edges. In the illustrative and preferred 
embodiment, these flange sections 42 are divided into 
a plurality of longitudinally spaced flange tabs by slots 
43. Each flange tab is then provided with a bearing ap-
erture 44 which receives a ball bearing 28. The ball 
bearings 28 are retained in these apertures 44 for 
movement with the retainer 40.

The bearing retainer 40 is also provided with a longi-
tudinally extending intermediate section 50 which is 
fitted to provide a longitudinally extending channel 
best seen in cross section in FIG. 2.

In the illustrative and preferred embodiment, stop 
means are provided on the inner track member 14 for 
engaging the ends of the bearing retainer 40 and stop 
means are provided on the outer track member 12 for 
engaging the ends of the bearing retainer 40. Since the 
bearing retainer 40 may be, for instance, approximately 
one-half the length of the outer and inner track mem-
bers 12, 14, the track member 14 may be extensible a 
distance approximately equal to its length less the 
length of the bearing retainer 40.

In the illustrative embodiment, the right-hand end 
(FIG. 1) of the outer track member 12 is provided with 
spaced apart stop tabs 58, 60, while the left-hand end 
of the member is provided with similar stop tabs 62, 64. 
The stop tabs 58, 60 engage, respectively, the engaging 
portion 66, 68 of the right-hand end of the bearing re-
tainer 40 while the stop tabs 62, 64 engage similar por-
tions 70, 72 of the left-hand end of the bearing retainer.

Then, stops 78, 80 are rigidly connected to opposite 
end portions of the track member 14. The illustrative 
stops 78, 80 are rivet stops which are secured in the il-
lusttrated openings 82, 84. The stop 78 engages the axi-
ally inner end 86 of the elongated slot 88 entering the 
right-hand end of the bearing retainer while the stop 80 
engages the axially inner end 90 of the slot 92 entering 
the left-hand end of the bearing retainer. It will be ap-
preciated that the engagement of the stops 78, 80 
against the inner ends of the slots 88, 92 is a matter of 
design choice and the stops may, in some cases as indi-
cated in FIG. 3, engage the squared off ends of the 
bearing retainer.

Assuming that the member 12 is the fixed track mem-
ber and that the member 14 is the extensible track 
member, i.e., movible in both directions as indicated by 
the arrows 98, 100 relative to the fixed member, it 
will be appreciated that the movement of the extensible 
member 14 in the direction of the arrow 98 is halted 
when the right-hand end of the bearing retainer 40 is 
against the stop tabs 58, 60 and the stop 80 is against 
the axially inner end 90 of the slot 92. Conversely, 
movement of the member 14 in the direction of the 
arrow 100 is halted when the left-hand end of the bear-
ing retainer 40 is against the stop tabs 62, 64 and the 
stop 78 is against the axially inner end 86 of the slot 88.

Desirably, when the member 14 moves to the end of 
its travel relative to the member 12, the applicable 
stops on the members 12 and 14 will simultaneously 
engage the opposite ends of the bearing retainer 40. Of 
course, this will happen only when the bearing retainer 
40 is in synchronization with the member 14 and the 
member 12. If the bearing retainer creeps out of syn-
chronization, the stop on one of the members 12, 14 
will engage one end of the retainer before the stop on 
the other member engages the opposite end of the re-
tainer. Particularly, when the member 14 is extended 
in the direction of the arrow 98, the retainer 40 tends 
to creep in the direction of the arrow 100 and when the 
member 14 is pulled in the direction of the arrow 100, 
the retainer 40 tends to creep in the direction of the 
arrow 98. The amount of this creep may be, for in-
stance, only one-sixteenth inch each time. However, 
the creep is additive such that, if the member 14 is 
pulled in the direction of the arrow 98 more times than 
it is pulled in the direction of the arrow 100, the bear-
ing retainer 40 will creep gradually in the direction of 
the arrow 100 as much as two or three or more inches. 
This occurs quite often when a drawer movable out the 
front and the back of a cabinet is pulled from the front 
many more times than it is pulled from the rear or vice-
versa. Although the slide 10 is constructed so that the 
member 14 is extensible in both directions, the present 
invention and the creep problem are applicable to 
slides in which the movable member is extensible in 
only one direction.

Thus, if the bearing retainer 40 creeps a considerable 
distance in the direction of the arrow 100, and the 
member 14 is pulled in the direction of the arrow 98, 
the stop 80 will engage the inner end 90 of the slot 92 
well before the points 66, 68 engage the stop tabs 58, 
60. When this happens, in order to get the member 14 
to the extent of its travel in the direction of the arrow 
98, a force great enough to cause the ball bearing 28 
to slide against the raceways 18, 20 must be exerted. It 
will be appreciated that this sliding action unduly wears 
the raceways and that, depending upon the load, may
require a great degree of extension force. In other words, the extensible track member 14 will move freely as it is supposed to only as long as the retainer 40 is moving in the opposite direction.

The present invention includes means for urging the retainer 40 in the direction of movement of the member 14, the urging means including energy storage means effective to overcome the tendency of the retainer to creep in the direction opposite to the movement of the member 14. This may be accomplished by providing an engaging portion movable relative to the retainer 40, spring means for resisting movement of the engaging portion relative to the retainer 40, and arranging the engaging portion such that it is moved relative to the retainer in the direction of movement of the member 14 as the member 14 approaches the limit of its travel.

In the illustrative embodiment, the member providing the said engaging portion or portions is an elongated pressure bar 106 proportioned and designed to lie in the channel of the longitudinally extending intermediate section 50 of the bearing retainer 40, this bar providing engaging portions 108, 110 at its opposite ends. When the pressure bar 106 is in its normal position in the channel of the section 50, the engaging portion 108 is disposed to the right of the axially inner end 86 of the slot 88 and the engaging portion 110 is disposed to the left of the axially inner end 90 of the slot 92. Thus, the stops 78, 80 engage the engaging portions, respectively, 108, 110 before they engage the slot ends 86, 90.

The bar 106 is connected to the bearing retainer 40 for longitudinal movement relative to the bearing retainer. In the illustrative embodiment, this is accomplished by rivets 112, 114 which are secured to the openings 116, 118 in the bar 106. The bearings retainer 40 intermediate section 50 is provided with elongated slots 120, 122 through which the shanks of the rivets 112, 114 extend, the heads of the rivets 112, 114 being wider than the slot 120, 122 to keep the bar 106 in the channel section of the bearing retainer.

The bar 106 is provided with an elongated, rectangularly shaped aperture 123 intermediate its ends and the retainer 40 is provided with an elongated, rectangularly shaped aperture 124 intermediate its ends. These two apertures 123, 124 are preferably identical in size and disposed such that, when the bar 106 is in its normal position relative to the retainer 40, the apertures are in registry to receive a coiled compression spring 125. The spring 125 may be secured in the aperture 123, for instance, by a wire 126 extending axially through the coils of the spring to have its ends spot-welded to the bar 106 at the points indicated at 128, 130. Then, the retainer 40 may be provided with clearance slots 132, 134 for the ends of the wire 126, these slots leading away from the opposite ends of the aperture 124. The ends 136, 138 of the wire forming the compression spring 125 are disposed to hook over the longitudinally extending edges of the aperture 124 in the bearing retainer as best seen in FIG. 3. Since the spring 125 is disposed in both apertures 123, 124 and held there by the wire 126 on the bar 106, the ends 136, 138 hook over the longitudinal edges of the aperture 124, movement of the pressure bar 106 longitudinally relative to the bearing retainer 40 is yieldably resisted by the spring. That is, the scissors action of the apertures 123, 124 compresses the spring 125. In accordance with the present invention, longitudinal shifting of the pressure bar 106 from its normal position relative to the retainer 40 stores energy in the spring 125, which energy, upon release, is effective to resist the creeping motion of the retainer 40.

The stop tabs 58, 60 and the stop tabs 62, 64 are spaced apart by a distance such that the engaging portions 108, 110, respectively, can move between the stop tabs.

With the structure as described, it will be appreciated that, when the member 14 is extended in the direction of the arrow 98, the stop 80 on the member 14 will engage the end portion 110 of the bar 106 and move the bar 106 in the direction of the arrow 98 relative to the retainer 40. The amount of movement of the bar 106 relative to the retainer 40 is equal to the normal distance between the end of the engaging portion 110 and the axially inner end 90 of the slot 92. That is, the stop 80 engages the end portion 110 and moves it to the right until the stop also engages the end 90 of the slot 92. Thus, when the member 14 is at the extent of its travel in the direction of the arrow 98, the stop 80 is against the inner end 90 of the slot 92 and the engaging portion 110 of the bar while the stop tabs 58, 60 are against the point 66, 68 on the right-hand end of the retainer. In this condition, the spring 125 is compressed and storing energy. When the member 14 is retracted in the direction of the arrow 100, the spring 125 urges the retainer 40 in the direction of the arrow 98 as long as the stop 80 is against the end portion 110. In other words, energy is stored in the spring 125 as the track member 14 approaches the end of its travel to be released as the track member 14 starts back toward its fully retracted position.

It will be appreciated that the anti-creep device just described is symmetrical in that, when the track member 14 moves in the direction of the arrow 100 to the extent of its travel, the stop 78 will move the pressure bar 106 in the direction of the arrow 100 relative to the retainer 40 to load the spring 125 to resist creeping in the direction of the arrow 98.

In the embodiment of FIG. 3, the pressure bar 106' is shown with engaging portion 108', 110' which extend beyond the squared-off ends of the bearing retainer 40. These engaging portions 108', 110' are disposed to be engaged, respectively, by the stop 78, 80 on the track member 14 or other stops placed upon the track member 14.

Thus, the anti-creep structure solves the creeping problem by applying a pressure on the retainer 40 during the final portion of extension of the track member 14 and in the direction of extension of the track member 14. This pressure causes a creep forwardly, i.e., in the direction of extension of the track member 14, sufficient to overcome any rearward creep during the rest of the extension-retraction cycle of the track member 14. If this forward creeping movement should become excessive, the retainer 40 will move out of the range of the stop mechanism applying the forward pressure and the natural tendency of the rearward creep will move the retainer rearwardly to its desired position. The result of this operation is a balance in the location of the retainer 40 which may vary only slightly depending upon the amount of energy stored in the spring 125 and the distance over which it is applied.

While a single compression spring 125 is illustrated as being the energy storage means or spring means for
the anti-creep structure of FIGS. 1, 2 and 3, it will be appreciated that the single compression spring is merely illustrative and that any number of spring arrangements may be used. For instance, the engaging portions 108, 110 could be separate and could be separately connected to the retainer 40 for movement relative thereto and then such movement could be resisted by separate springs. Further, any such relative movement of an engaging portion could be resisted by a tension spring arranged such that energy will be stored therein as the track member 14 moves through its travel during extension and released during its travel during retraction.

Further, the energy storage means or spring means might be carried, for instance, by the stops 78, 80. In FIG. 4, there is illustrated a stop 80' rigidly connected to the extensible track member 14' and carrying a plunger 150 which engages the adjacent end of the bearing retainer 40. This plunger 150 is urged to its projected position by a compression spring 152 as illustrated. When the track member 14' moves in the direction of the arrow 98, the plunger 150 will engage the left-hand end of the retainer 40 to compress the spring before the rigid stop 80' contacts the retainer.

Still further, a tension spring could be connected between the right-hand end of the bearing retainer and the right-hand end of the track member 14 and another such tension spring could be connected between the left-hand end of the bearing retainer and the left-hand end of the track member 14. In such a case, with the spring properly selected or calibrated, when the track member 14 moves in the direction of the arrow 98, the tension spring connected to the right-hand end of the retainer would urge it in the direction of the arrow 98 to overcome any tendency to creep in the direction of the arrow 100. Conversely, when the member 14 moves in the direction of the arrow 100, the tension spring connected to the left-hand end of the retainer 40 would urge the retainer in the direction of the arrow 100 to overcome any tendency of the retainer to creep in the direction of the arrow 98. Such an arrangement is suggested in the diagrammatical view of FIG. 5 showing the tension springs 160.

What is claimed is:

1. A slide assembly comprising an elongated first track member, an elongated second track member, load bearing anti-friction means movably supporting said second member for longitudinal movement on said first member, said anti-friction means including a plurality of longitudinally spaced apart anti-friction elements and a longitudinally extending retainer for said elements, and means for urging said retainer in the direction of movement of said second member, said urging means including storage means effective to urge said retainer in said direction of movement.

2. The slide assembly of claim 1 in which said second member carries stop means, said stop means being positioned and arranged to move against said urging means to store energy in said energy storage means.

3. The slide assembly of claim 1 in which said urging means is operatively connected to said retainer and positioned such that movement of said second member through a portion of its travel relative to said first member stores energy in said storage means.

4. The slide assembly of claim 2 in which said urging means includes an engaging portion disposed in the path of said stop means, means for connecting said engaging portion to said retainer for longitudinal movement relative to said retainer, and said energy storage means including spring means yieldably resisting movement of said engaging portion relative to said retainer.

5. The slide assembly of claim 4 in which said stop means is arranged to move against said retainer, said urging means being disposed on said retainer so that said stop means engages and moves said urging means relative to said retainer before engaging said retainer.

6. A drawer slide comprising a fixed elongated track member, an extensible elongated track member, load bearing anti-friction means supporting said extensible member for longitudinal movement on said fixed member, said anti-friction means including a plurality of longitudinally spaced apart anti-friction elements and a longitudinally extending retainer for said elements, and spring means for urging said retainer in the direction of extension of said extensible member.

7. The drawer slide of claim 6 in which said extensible track member is movable a predetermined distance relative to said fixed track member, the last portion of which is against the urging of said spring means, said spring means being disposed such that energy is stored therein to urge said retainer in said direction as said extensible track member moves through said last portion.

8. The drawer slide of claim 7 in which said spring means includes a compression spring which is compressed as said extensible track member moves through said last portion.

9. The drawer slide of claim 8 including an engaging portion movable relative to said retainer, said compression spring being disposed to resist such relative movement of said engaging portion, said engaging portion being disposed to be moved by said extensible track member as it moves through said last portion.

10. A drawer slide comprising a fixed elongated track member, an extensible elongated track member, a plurality of ball bearings for movably supporting said extensible member on said fixed member, an elongated retainer for said bearings, stop means on said extensible member for engaging said retainer, an engaging portion, means for movably connecting said engaging portion to said retainer, spring means for yieldably resisting movement of said engaging portion relative to said retainer, said stop means being disposed to engage said engaging portion to move it against the urging of said spring means in the direction of movement of said extensible member and relative to said retainer.

11. A drawer slide as in claim 10 including second stop means on said fixed track member for engaging said retainer and stopping its movement, thereby stopping movement of said extensible track member.

12. A drawer slide as in claim 11 in which said first mentioned stop means includes first stops adjacent respectively opposite end portions of said extensible member and said second stop means includes second stops adjacent respectively opposite end portions of said fixed member, said retainer providing opposite end portions engageable by said stops, said extensible member being movably in both directions along said fixed member with the movement in both directions being limited by said retainer being engaged at one end by said first stop adjacent one end portion of said extensible member and at its opposite end by said second stop adjacent an opposite end portion of said fixed member.
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13. A drawer slide as in claim 12 in which said engaging portion includes a bar extending longitudinally along said retainer, said bar providing opposite end portions extending respectively longitudinally outwardly from the adjacent end portions of said retainer.

14. A drawer slide as in claim 13 in which said end portions of said bar and said second stops are proportioned and positioned such that said second stops do not engage said bar, said first stops being proportioned and positioned to engage respectively the adjacent ends of said bar to move said bar relative to said retainer.

15. A drawer slide comprising a first elongated track member formed to provide a longitudinally and outwardly extending first downwardly facing raceway along its upper edge and a longitudinally and outwardly extending first upwardly facing raceway along its lower edge, a second track member formed to provide a longitudinally and inwardly extending second upwardly facing raceway along its upper edge and a longitudinally and inwardly extending second downwardly facing raceway along its lower edge, ball bearings carried on said first upwardly facing raceway and under and in rolling contact with said second downwardly facing raceway and additional ball bearings carried on said second upwardly facing raceway and under and in rolling contact with said first downwardly facing raceway, a bearing retainer having longitudinally spaced apart apertures therein for receiving, respectively, said ball bearings, stop means on said second track member, an engaging portion, means for movably connecting said engaging portion to said retainer, spring means for yieldably resisting movement of said engaging portion relative to said retainer, said stop means being disposed to engage said engaging portion to move it against the urging of said spring in the direction of movement of said second member and relative to said retainer.

16. The drawer slide of claim 15 in which said retainer is formed with a longitudinally extending intermediate section and longitudinally and outwardly extending flange sections along its upper and lower edges, said apertures being disposed in said flange sections, said intermediate section being formed to provide a longitudinally extending channel, said engaging portion being a bar disposed in said channel for longitudinal movement therein.

17. The drawer slide of claim 16 in which said bar is elongated to provide an abutment portion adjacent each end of said retainer, said stop means being disposed to engage said abutment portions to move said bar relative to said retainer.

18. The drawer slide of claim 17 in which said bar is formed to provide a longitudinally extending first aperture intermediate its ends, said channel being formed with a longitudinally extending second aperture in registry with said first aperture, said spring means including a coiled compression spring disposed in said apertures to bear against the ends thereof when said bar is in its normal position relative to said retainer.

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