Jan. 14, 1958 E. DICK 2,819,486

CASTER FOR FURNITURE

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FIG. 3

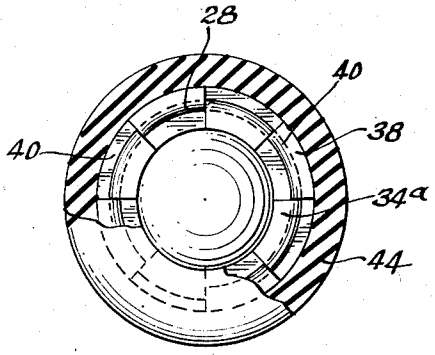


FIG. 2

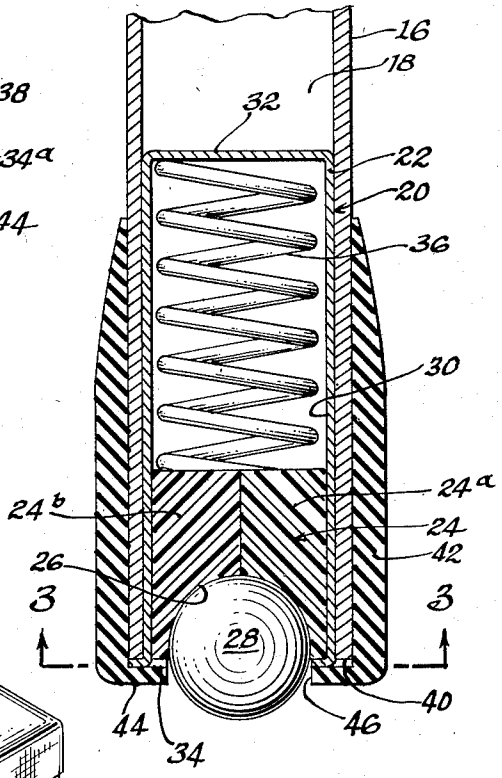


FIG. 1

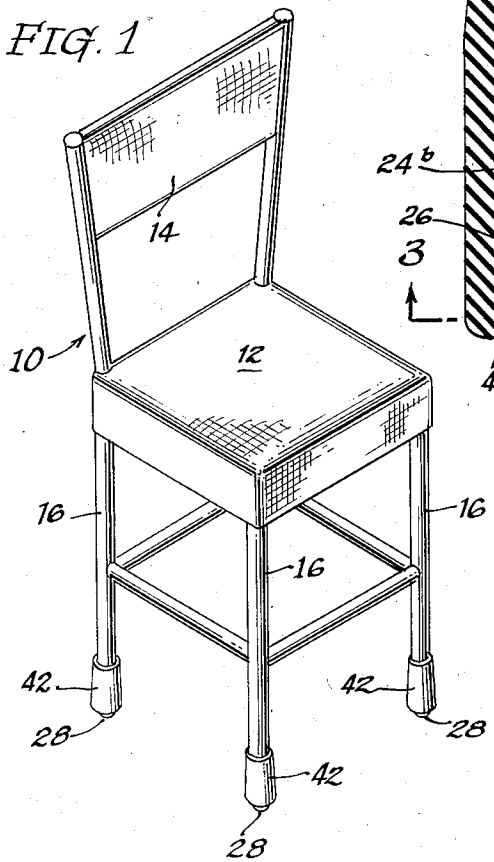
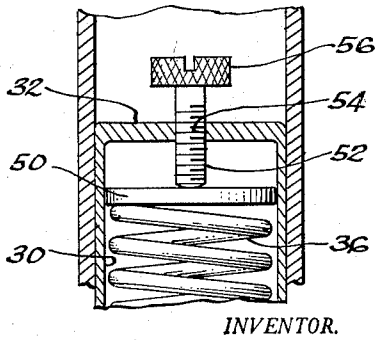


FIG. 4



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CASTER FOR FURNITURE

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2 Claims. (Cl. 16—24)

This invention relates to an article of furniture and its relates more particularly to a leg construction in an article of furniture or equipment which is adapted to be moved about from place to place for purposes of cleaning, use, placement, or repair.

For various reasons well known to man, various articles of furniture and equipment are moved about over a supporting surface from place to place. In the home or office, articles of furniture such as chairs, sofas, beds, tables or the like are moved about a room and in and out of a room for giving access to the underlying surface for cleaning, for clearing the room of the articles of furniture for decorating, for removal of the furniture or equipment for repair, or for shifting the furniture or equipment for use or other reasons. In the retail establishment, such articles of furniture are moved about for similar reasons, and in the plant articles of furniture and equipment are moved from place to place for use as well as for many of the reasons pointed out.

The frequency of movement and the extent of movement places a demand upon the energy of the person, depending upon the weight of the article of furniture or equipment and the surface over which the article is to be moved. Not infrequently, the article of furniture or equipment is of a weight or size which cannot be easily handled by the housewife or other single person, with the result that the article of furniture or equipment becomes unavailable for use or else placement thereof must await the presence of more than one person or special equipment before it can be shifted from one place to another.

This inflexibility in operation and use and the demand for manpower and time is, of course, undesirable, and it is therefore an object of this invention to produce an improvement in the structure of a leg supporting such furniture, equipment and the like which enables the article of furniture and equipment to be moved easily and efficiently over the supporting surface without the demand for labor, without the need to lift the piece of furniture or equipment off of its supporting surface, without limitation because of the weight or size of the piece of furniture or equipment, and without interfering with the stability of the piece of furniture or equipment in use, and without detracting from the utility of the piece of furniture or equipment for its intended use.

The improvement embodying the features of this invention resides in the construction of the legs with a hollow end portion having a roller in the form of a sphere shiftable into and out of the end portion of each of the legs between a normally extending position into engagement with the supporting surface and a retracted position. When in extended position, the roller projects outwardly from the end portion of the leg into rolling contact with the supporting surface so that the article of furniture or equipment can be shifted about in any direction without effort. When in retracted position, the roller is displaced wholly within the open end portion

of the leg so that the article of furniture or equipment is supported by the leg itself in contact with the supporting surface, thereby to provide a sturdy support which resists lateral displacement when in use.

In practice, the roller is adapted normally to be located in the extended position in rolling contact with the supporting surface to enable movement of the article of furniture or equipment. However, when in use, as when occupied by a person or the like, the added weight is adapted to be sufficient automatically to displace the roller from extended to retracted position so that rolling contact is replaced by the desired steady support which is provided when the leg itself engages the surface for support of the chair, other article of furniture, or equipment.

Retractable rollers have heretofore been suggested for use in the end portions of supporting legs for furniture or equipment, but they have not been adopted commercially because of the complex nature of the contemplated structures or because of the inflexibility in adapting the structure for universal use with pieces of furniture or equipment of different dimensions, weight, or for use on different types of surfaces or for a number of other reasons, including the inability to provide for continuous or periodic use, the inability to effect repair or replacement of parts in a simple and efficient manner, and the inability to maintain the rollers in satisfactory condition for operation.

Thus it is a further object of this invention to produce a leg structure of the type described and to provide an improved roller attachment for use in same which is replaceable or else can be repaired in a simple and efficient manner and which is flexible in operation for use with structures of various dimensions and weights and which operates smoothly whether used periodically or continuously.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing, in which—

Figure 1 is a perspective elevational view of a chair embodying the features of this invention;

Figure 2 is a sectional elevational view of the end portion of the chair shown in Figure 1;

Figure 3 is a sectional view taken along the line 3—3 of Figure 2; and

Figure 4 is a sectional view of a portion of the leg structure shown in Figure 2, embodying a modification in the construction thereof.

Description herein will be made of the practice of this invention in the leg structure of a chair, but it will be understood that the concepts of this invention in an improved leg structure can be adapted as well to other pieces of furniture or equipment supported on legs, and which are moved from place to place over a supporting surface.

Referring now to the drawing, **10** represents a chair or other article of furniture or equipment having a seat **12**, a back **14**, and legs **16** depending from the underside of the seat into engagement with the supporting surface.

In accordance with the practice of this invention, the lower end portion of each of the legs **16** is provided with an opening **18** extending upwardly from the end for a substantial distance into the leg for receiving an adaptor **20** in the form of a rigid, cup-shaped housing **22** formed of sheet metal or the like material and mounted in fitting relation within the opening **18** to prevent inadvertent endwise displacement of the housing **22** from the leg. The opening in the leg may be of rectangular

shape or of other polygonal shape but it is preferred to form the leg, or at least the end portion thereof, of a tubular member such as of a tubing formed of aluminum, stainless steel, or the like having a bore extending therethrough which is of uniform dimension. The cross-sectional dimension and shape of the housing **22** will correspond to the opening **18** so as to enable a fitting relationship to be established upon insertion of the housing 22 into the opening to prevent relative endwise or crosswise movements.

Mounted within the housing **22** for endwise sliding movement is a block **24** formed of bearing material or other material having a low coefficient of friction. A spherically-shaped groove **26** is formed in the center of the underside of the block for purposes of receiving a roller **28** in the form of a steel ball or the like in seating relation therein. The bearing block **24** is dimensioned to have a cross-section corresponding in shape and dimension to the opening or bore **30** through the housing to enable free sliding movement of the bearing block in guiding relation endwise between the walls of the housing. When the desired fitting relationship is provided, the walls of the block bear in sliding relation against the walls of the housing to prevent collapse, while the legs of the chair engage the outer walls of the housing all around to support the housing and maintain the desired interfitting and assembled relation.

The top end of the housing is closed by the wall **32** to form the housing into a cylindrical cup-shaped member, and the portion of the housing defining the open end at the bottom is formed with a flange **34** extending inwardly into the path of the bearing block **24** to engage the underside and prevent displacement of the bearing block from the housing. The bearing block is constantly urged in the direction toward the open end into engagement with the inturned flanges **34** by resilient means, such as a coil spring **36**, having one end bearing against the underside of the top wall **32** while the other end bears against the top wall of the bearing block **24**. The coil spring is tensioned within the opening existing between the bearing block and the wall **32** to provide a force urging the bearing block towards its normal position into engagement with the flange **34** sufficient to overcome the load normally supported by the leg **16** but insufficient to overcome the load existing when an added weight is supplied, as in normal use of the chair or other piece of furniture or equipment.

Thus, when the housing **22** is inserted as a unit into the end of the leg with the flanged open end of the housing at the lower edge of the leg, the spherical roller 28 supported in the bearing block **24** will normally extend outwardly beyond the end of the leg into rolling engagement with the supporting surface when the bearing block is displaced endwise by the coil spring **36** into engagement with the flange **34**, while the chair is not in use. Thus the chair or other piece of furniture or equipment can be moved easily on its rollers in any direction over the surface. When, however, the load is increased in use, the proportional load added to each leg will be sufficient to overcome the force exerted by the springs, thereby to cause the bearing block to be displaced upwardly within the housing until the end of the leg 16 comes into engagement with the surface to support the load, thereby to inactivate the roller and prevent further rolling movement of the chair over the surface until the added load is removed to enable the elements to return to their normal position.

The improvement embodying the features of this invention resides further in the construction of the roller in an assembly which can be formed into a unit separate and apart from the chair legs to enable insertion or removal as a unit into and out of the open end of the chair leg for use. Thus the units can be assembled in the most efficient manner and inserted in position of use or removed for replacement or repair without difficulty and without the necessity for special equipment or labor.

For this purpose, the end portion of the cup-shaped housing is formed with a plurality of circumferentially spaced apart slots which subdivide the lower end portion of the housing into separated sections. The coil spring **36**, which is the first to be inserted into the housing in assembly, is dimensioned to have a normal length, when extended, which is greater than the distance remaining between the top wall **32** and the upper surface of the bearing block **24** when the latter is in its normal extended position so that the bearing block will be constantly urged by the spring towards its extended position with the desired force. The strength of the coil spring **36** can be preselected for counterbalancing the calculated weight expected normally to be supported by the particular leg.

After the spring **36** has been inserted, the bearing block **24** is inserted and then alternate sections *34a* on the ends of the cup-shaped housing are turned inwardly substantially perpendicularly to form the stop flange **34** for engaging the bearing block to prevent displacement beyond the extended position. The intervening sections **38** are turned outwardly substantially perpendicularly from the walls of the housing for engaging the end **40** of the leg when the housing is inserted in position of use into the opening **18**, thereby positively to locate the housing in the leg with the end of the housing aligned with the end of the leg.

The bearing block **24** may be molded of a plastic material having a low coefficient of friction, such as polyethylene, polystyrene, polymethylmethacrylate, and the like, or a graphite composition or bearing metal or the like. The bearing block may be molded into a unitary structure which is dimensioned to be inserted into the open end of the cup-shaped housing prior to bending of the sections to form the stop flanges. When formed of a single piece of bearing material, the spherical groove adapted to receive the roller is preferably formed to a hemispherical shape or as close to a hemisphere as possible but no greater, otherwise the spherical ball cannot be inserted or replaced without destroying the bearing.

When the groove **26** is formed to hemispherical shape or less, the spherical roller cannot be held in the groove by the bearing. Under such circumstances, the flanges **34** turned inwardly from the lower end portion of the cup-shaped housing should be dimensioned to provide a spaced relation between diametrically disposed edges which is slightly less than the diameter of the spherical roller so that the inturned flanges will operate to permit the roller to extend outwardly from the housing, yet prevent the spherical roller from falling out of the housing.

It is preferred to form the bearing block **24** of two or more sections *24a* and *24b* separable along radial lines so that the groove may be formed to provide a spherical section which is slightly greater than a hemisphere (about 190°) when the sections are fitted together. Thus the block can be fitted together with the roller prelocated within the groove that is formed to provide a self-supporting assembly which can be inserted as a unit into the open end of the cup-shaped housing to be retained therein by the flanges **34** which are subsequently provided. The close fitting relationship of the bearing block with the inner walls of the housing prevent separation of the pieces so that the spherical roller is held by the block in position of use during movement endwise between extended and retracted positions of adjustment.

It will be apparent from the foregoing that the roller, the bearing block, and the spring may be assembled into the housing in the manner described to provide an adaptor for use with various pieces of furniture. It is only necessary to select an adaptor for size and weight and then insert the adaptor into the opening provided in the end of the chair leg. To avoid scratches to the floor or other pieces of furniture, a foot **42** formed of rubber or other

cushioning material is dimensioned to be slipped over the end of the chair leg after the adaptor has been inserted. The bottom wall **44** of the foot is provided with a central opening **46** which is dimensioned to enable the spherical ball to extend therethrough into rolling contact with the supporting surface when the bearing block is displaced to its extended position. When in retracted position, the lower wall **44** of the foot **42** engages the supporting surface in a manner to prevent inadvertent displacement.

By way of modification, means may be provided for adjustment of the tension of the coil spring **36** to provide the described balance between load and force to adapt the unit for a range of loads, thereby to extend the range of use per unit and to decrease the amount of inventory required by suppliers thereof. For this purpose, a slideable disc plate **50** is provided in the housing **22** for shifting movement endwise in the upper end portion thereof. The spaced relationship between disc plate **50** and the top wall **32** of the housing is adapted to be adjusted by means of a set screw **52** which extends through an opening **54** in the top wall of the housing into engagement with the plate **50**. The top wall of the housing is threaded about the opening for receiving the threaded shank of the set screw **52** so that the end portion of the set screw can be adjusted endwise in the housing by turning movement of the head **56** in one direction or the other. The head is accessible from the outside of the housing. Thus the tension of the spring **36** bearing against the plate **50** can be adjusted. The plate **50** can be adjusted prior to insertion of the adaptor into position of use. If the desired balance is not achieved, or in the event that the unit should become unbalanced in use, the force available from the coil spring may be adjusted merely by removing the unit as a whole from the opening in the chair and then adjusting the coil spring by means of the set screw to increase or decrease the tension thereof, after which the adjusted unit can then be reinserted into the opening for use.

While description herein is made of a chair having the adaptor on all four legs, it will be understood that the adaptor may be employed only on the two front legs, or the two back legs so that the chair can be tipped onto the rollers for movement from place to place. In this event the force urging the spherical rollers to extended position would be sufficient to support the weight of the chair but insufficient to support the weight with a person sitting in the chair. In the preferred assembly, the legs are formed of tubular members such as the aluminum tubing which is used in the manufacture of modern kitchen or dinette sets with straight legs having open ends.

It will be further understood that other similar means may be employed for adjusting the slideable plate endwise within the housing and it will be still further understood that other changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In a caster, the combination comprising a housing having a cylindrical side wall and an end wall extending across one end thereof, a split cylindrical block slidable longitudinally in said housing and having a spherically curved cavity in one end thereof, a spherical ball slidably rotatable in said cavity, said block being made of antifriction material, said cavity being substantially less than fully spherical in extent but substantially greater than hemispherical in extent to retain said ball in said cavity with said ball projecting out of one end of said block to a substantial extent, said block being split longitudinally into two complementary identical parts to provide for insertion of said ball into said cavity, said housing retaining said parts of said block together with said ball therebetween, a spring compressed between said end wall of said housing and said block on the end thereof opposite from said ball for biasing said ball outwardly of said housing, and flange means turned inwardly on said housing from said side wall at the end thereof opposite from said end wall for retaining said block in said housing, said ball normally projecting from said housing beyond said flange means but being movable into said housing against the resilient resistance of said spring.

2. In a caster, the combination comprising a housing having a cylindrical side wall and an end wall extending across one end thereof, a split cylindrical block slidable longitudinally in said housing and having a spherically curved cavity in one end thereof, a spherical ball slidably rotatable in said cavity, said block being made of antifriction material, said cavity being substantially less than fully spherical in extent but substantially greater than hemispherical in extent to retain said ball in said cavity with said ball projecting out of one end of said block to a substantial extent, said block being split longitudinally into two complementary identical parts to provide for insertion of said ball into said cavity, said housing retaining said parts of said block together with said ball therebetween, a spring compressed between said end wall of said housing and said block on the end thereof opposite from said ball for biasing said ball outwardly of said housing, a plurality of angularly spaced inwardly extending flange elements turned inwardly on said housing from said side wall at the end thereof opposite from said end wall for retaining said block in said housing, said ball normally projecting from said housing beyond said flange elements but being movable into said housing against the resilient resistance of said spring, and a plurality of outwardly extending flange elements turned outwardly from said side wall on said housing and interspersed angularly between said inwardly extending flange elements.

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