June 6, 1961 L. K. JACKSON 2,986,746

CASTER WITH SPECIAL SUPPORTING SURFACE

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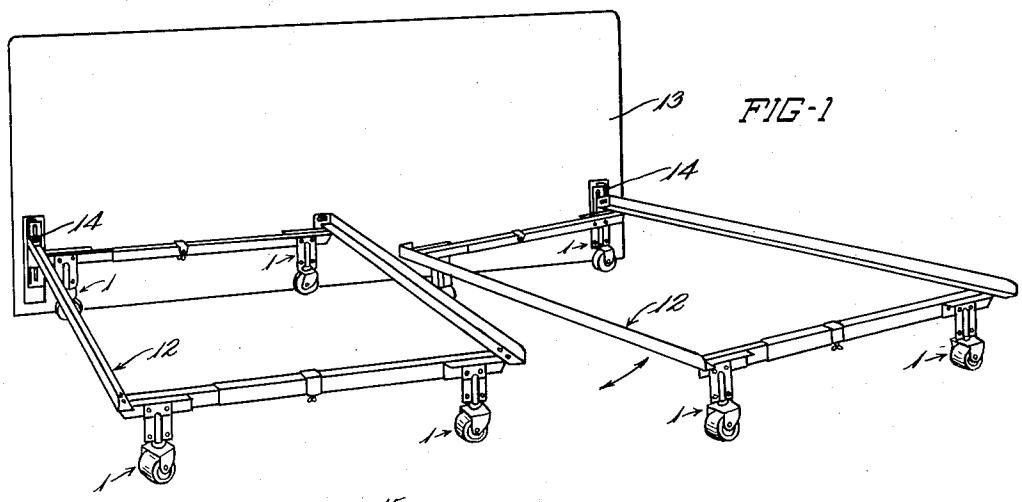

FIG-1

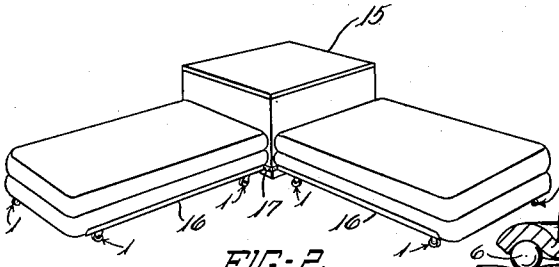

FIG-2

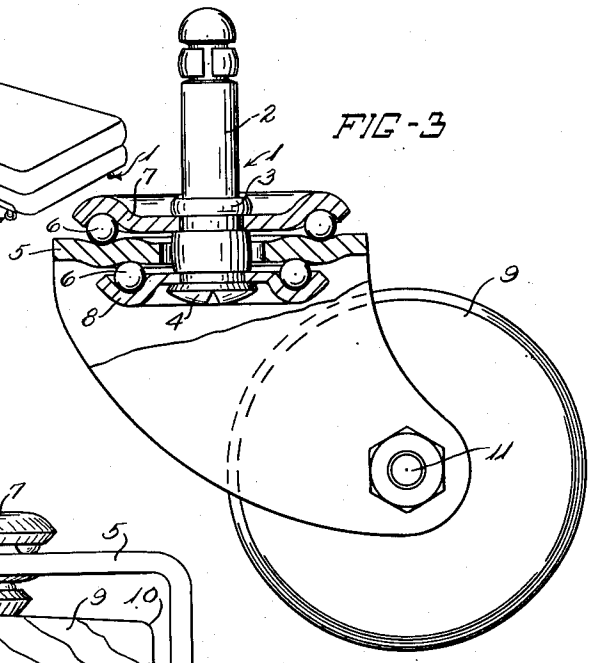

FIG-3

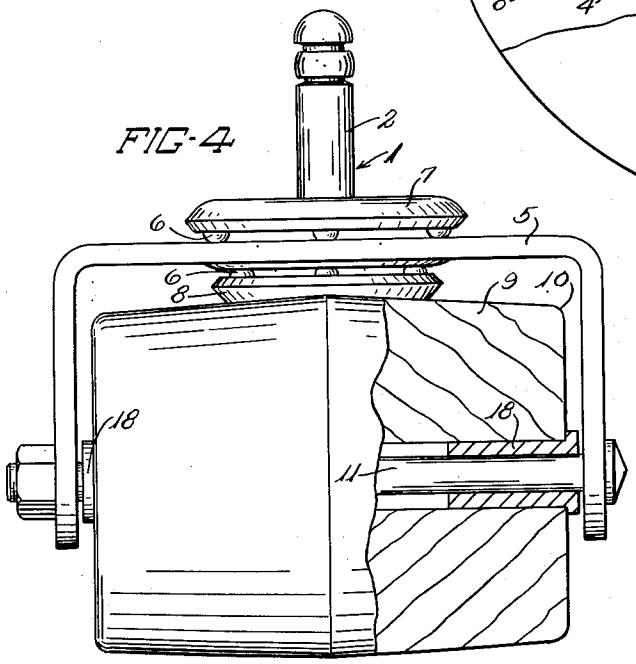

FIG-4

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FIG-5

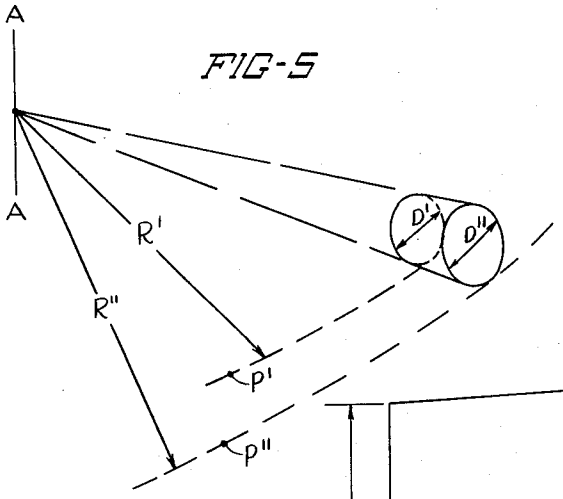
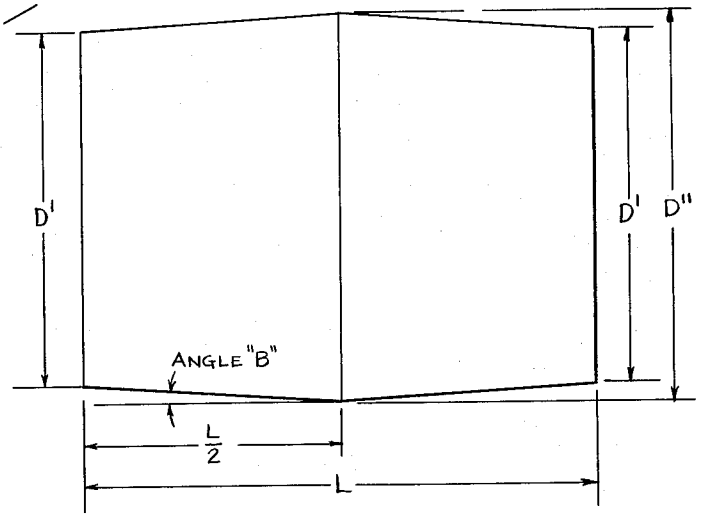


FIG-6



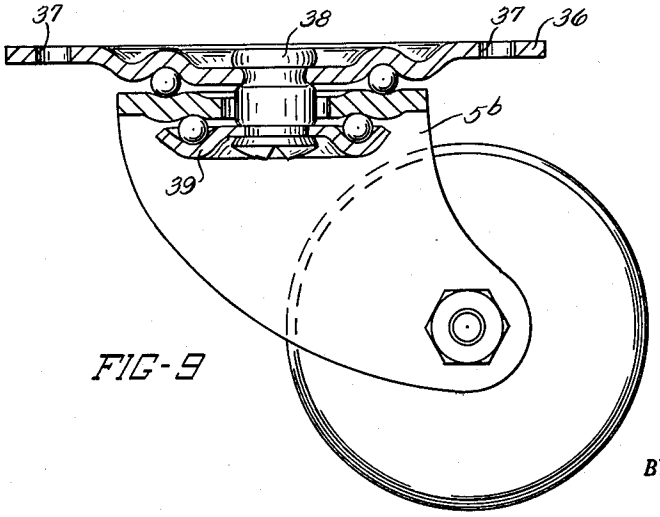


FIG-9

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CASTER WITH SPECIAL SUPPORTING SURFACE

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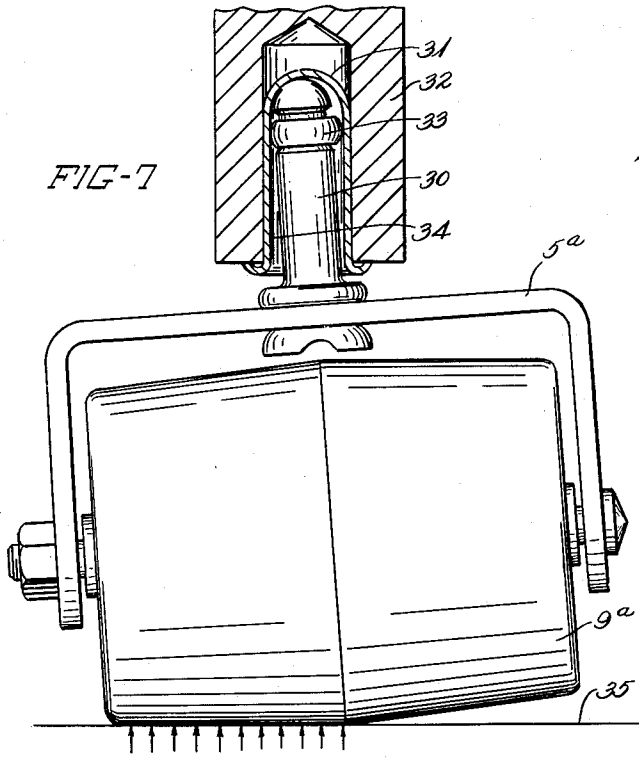
FIG-7



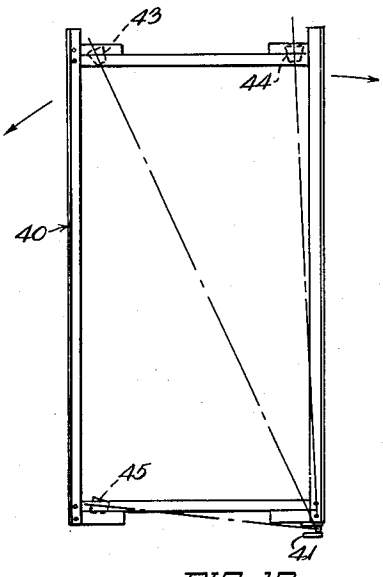
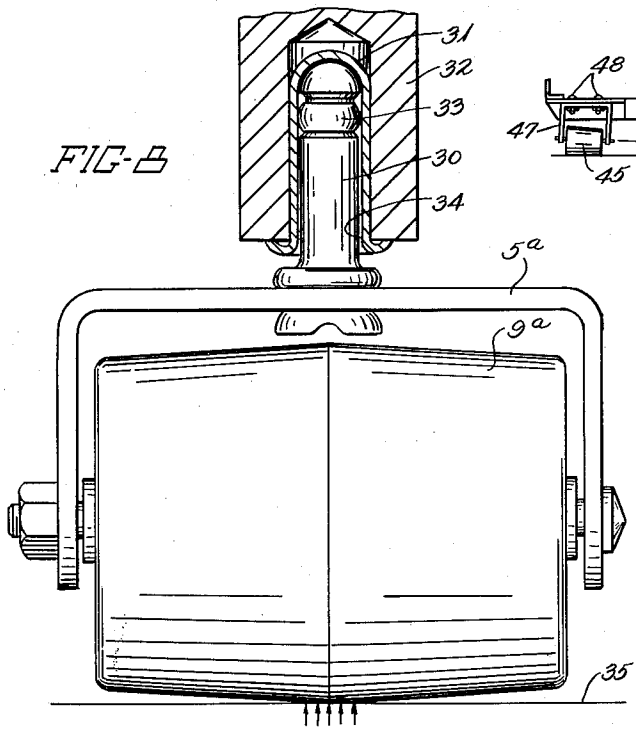


FIG-10

FIG-8



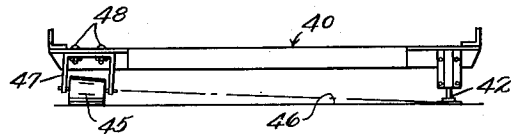


FIG-11

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2,986,746

CASTER WITH SPECIAL SUPPORTING SURFACE

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Filed July 23, 1956, Ser. No. 599,614
3 Claims. (Cl. 5—8)

This invention relates to casters, especially to casters particularly adapted for use upon carpets or other relatively soft supporting surfaces and to combinations of casters and bedframes or the like.

At the present time, wide commercial acceptance has been secured for so-called Hollywood style of beds. One specific use for twin Hollywood beds has been to have them pivotally secured in close parallel relation to a common bed headboard. This relationship is often referred to as a twin-swing bed. By such an assembly and by the provision of casters upon the individual bedframes, it is possible to roll the beds apart from each other for making the beds, changing the linens, for cleaning purposes, etc. and then to roll the beds back into adjacent parallel relationship, as desired. Another popular arrangement is the so-called "Corner Swing Bed." With this type, two separate twin beds are hinged to a common corner of a large corner table and are set at right angles to each other, to lie one along each of two walls during the day, for seating accommodation, and to swing away from the wall for use as beds. Other similar arrangements may be used and all are characterized by the swinging action of the beds about a pivot near a corner of the bedframe. The corner about which the frame or frames pivot may be hinged to a stationary object such as a headboard or corner table standing securely on the floor. To facilitate the movement of the bed or beds, the bedframes are supported on casters. The action may also be duplicated in a single bedframe having no headboard or connecting member. This may be done by substituting a glide for one caster. The vertical axis of the glide would now be the hinge axis. In general, the popular type of Hollywood bed is supported on casters which function for easy maneuverability either in a random or defined path.

One difficulty heretofore encountered with this construction has been that the casters travel in a defined path about the pivot point and under constant usage have marked the carpets or floors, particularly when supported on carpets or other soft material because of the fact that relatively heavy loads are carried on small supporting surfaces of the caster wheel. In addition, it is necessary that these casters swivel readily and "caster" or "trail" with relation to their supports so that arcuate movement of the bedframes is easily secured. It will be realized that the foot portions of the bedframes must sweep through rather extended arcs on even small pivotal movement of the head portions of the bedframe as one head corner is pivotally secured to the headboard. Thus it is particularly important that the casters function smoothly and that they caster or track readily as the bedframes are moved to and from adjacent parallel relationship with each other. Normally, most casters are relatively narrow and do not provide a large bearing surface which increases the tendency for cutting deep grooves in piled carpeting, or padding thereunder. Increasing the bearing surface by making wider cylindrical casters is not sufficient, in an application of this type, as a cylinder, when rolling will only roll truly on a line normal to its axis. Any deviation from the straight line path requires the application of a restraining force which results in the cylinder sliding and not rolling and causes wear to the carpet or scuffing of hard supporting surfaces.

It is a general object of the present invention to provide a new and improved type of a caster especially suited

for use on bedframes and which has desirable swiveling and castering properties.

Another object of the invention is to provide a caster with a flat conically shaped surface portion extending inwardly from a maximum diameter mid-section of the caster.

Another object of the invention is to provide a new and special type of a caster particularly adapted for supporting relatively heavy articles for movement over a soft supporting surface and wherein the caster is made from a pair of identical frusto-conical sections each having a low angle of inclination on its slanting surface.

Yet another object of the invention is to provide a novel caster having a frusto-conical supporting section which may be held in fixed rotary position with its longitudinal axis at an inclination to the support surface so as to insure line contact with the support surface over the entire length of the caster section.

Another object of the invention is to position a bedframe or the like for pivotal movement about one corner thereof by either tracking or non-tracking casters.

A further object of the invention is to provide a caster which is greater in width than it is in diameter.

Another object of the invention is to provide a wooden caster roll particularly adapted for use in supporting bedframes on carpets or other material without leaving any flattened areas thereon.

The foregoing and other objects and advantages of the invention will be made more apparent as the specification proceeds.

In order to understand the present invention completely, reference should be had to the accompanying drawings, wherein:

FIG. 1 is a perspective view showing a pair of bedframes supported on casters of the invention and wherein the bedframes are pivotally secured to a common headboard;

FIG. 2 is a perspective view of a second bed and furniture article embodying the principles of the invention;

FIG. 3 is a side elevation of the caster of FIG. 1;

FIG. 4 is a front elevation, partially broken away and shown in section of the caster of the invention;

FIG. 5 is a geometrical drawing illustrating the principles and theory of the invention;

FIG. 6 is a line drawing of a caster of the invention dimensioned for use in developing the theory of the invention;

FIG. 7 is an elevation of a caster of the invention and a vertical section of a caster support to show the proper operative position of the caster;

FIG. 8 is a section, like FIG. 7, only with the caster being secured improperly in a vertical position;

FIG. 9 is a vertical section through a modification of the caster horn and support means of the invention with the caster being indicated in dotted lines;

FIG. 10 is a plan of a bedframe showing yet a further modification of the caster of the invention engaged therewith; and

FIG. 11 is an end view of a bedframe showing caster means similar to those of FIG. 10.

When referring to corresponding parts shown in the accompanying drawings and referred to in the specification, corresponding numerals are used to facilitate comparison between such parts.

In general, the present invention relates to an improved caster particularly adapted for supporting relatively heavy loads on soft surfaces without leaving marks thereon, or on hard surfaces without scuffing, wherein the caster comprises a caster horn of generally inverted U-shaped section, suitable means for rotatably attaching the horizontal portion of the horn to the article to be castered with the said means providing a vertical swivel axis for the horizontal

portion, a caster wheel in the form of two opposed conical frustums having a common base such that the combined height of the frustums are at least as great as the common base diameter, and means supporting the caster wheel in the vertical legs of the U-shaped horn with the axis of said caster wheel being offset from the vertical projection of the vertical swivel axis.

Attention now is directed to the details of the structure shown in the drawings, and a caster is indicated as a whole by the numeral 1. This caster 1 of the invention includes a conventional stem or caster king pin 2 which has a pair of spaced flanges 3 and 4 adjacent the lower end thereof. A caster horn 5, of generally inverted U-shape in section, is rotatably secured to the stem 2, as by means of bearings 6 secured between the horn 5 and annular retainers, or bearing races 7 and 8 held in place by being staked or otherwise secured to the stem 2. These retainers 7 and 8 are intermediate the flanges 3 and 4 to provide bearing support for the caster horn on both the upper and lower surface thereof.

As an important feature of the caster 1, a caster wheel or roller 9 is provided in the caster and as a novel feature, this caster roller 9 is at least as great in length as it is in height, and preferably is of greater width than its height, or when considered in another way, it has greater length than thickness. The caster wheel 9 can be made from wood, metal, plastic or other suitable material. Yet a further feature of this caster wheel 9 is that the caster wheel is of maximum diameter at a mid-section thereof and is composed of two identical frusto-conical sections. At the corners, the caster wheel 9 may be more sharply rounded off as indicated at 10 and flat parallel end portions are provided on the caster wheel. The caster wheel 9 thus will have two substantially, or generally frusto-conical load support sections provided thereon. The caster wheel 9 through its insert bearings 18, is supported on the horn 5, as by means of a bolt or axle 11 extending through a bore provided in the caster wheel 9 and with the axle being secured in the opposed ends of the horn 5.

FIG. 3 of the drawings best shows that the axle 11 is offset from a projection of the center line of the caster stem 2 and this aids in obtaining the desired "castering" or "tracking" action in the caster wheel of the invention.

The caster 1 is pivoted either in or on a supporting leg or surface and, when the bedframe is moved, the caster will rotate in its pivot and assume a position such that the axle of the caster wheel will always follow or trail behind the pivot axis. In the present caster, the wheel will assume a position in which one-half of the wheel will contact the flooring and receive traction therewith when moved in one direction but when the movement is reversed, the caster will immediately rotate in its pivot and the other half of the wheel will become active. The active part of the wheel will always be the side closest to the center of the arc around which movement takes place.

FIG. 1 of the drawings clearly shows one important use of the casters 1 to show how a pair of bedframes 12 can be pivotally secured to a common headboard 13 by hinge means 14. These hinge means engage the outer corners of the pair of bedframes when positioned in parallel relationship against the front side of the headboard 13 so that the bedframes 12 can readily be swung to and from parallel, closely spaced relationship, as desired. The drawing indicates that the casters 1 of the invention are suitably secured to these bedframes 12 for support purposes. Thus when these bedframes 12 are swung outwardly with relation to the bed headboard, the casters are so designed and arranged that they will swivel readily about the caster stems 2 and will track or follow readily as the bedframes are swung in any desired direction. The horn 5 is free to rotate through 360° with relation to its positioning stem.

By providing the relatively wide caster wheel 9 which has the contour referred to hereinabove, this caster of the invention effectively supports relatively heavy loads upon soft surfaces such as carpets, cork floors or the like and no noticeable mark or track is formed on the carpet or floor even after long periods of use with one corner of the bed in one position and with the remainder of the bed swinging on an arc about such position.

With reference to the construction shown in FIG. 2, a substantially conventional corner table 15 is shown and a pair of twin bedframes 16, 16 are pivotally secured to a common corner edge of the table 15 by hinges 17. These bedframes 16 are supported on casters 1 of the invention and thus the bedframes are adapted to be swung towards each other and extend out into the room, or else one bed may be swung over adjacent the other one, as desired. Such a construction particularly is adapted for use wherein the beds may be used as divans in the day time and be used for sleeping purposes at night. The ready movement of the beds facilitates making up the beds and the novel casters of the invention prevent any undesirable marks from appearing on the supporting surface over the routes repeatedly traveled by the support casters for the beds.

In order to explain the principle of the invention, the theory on which it is based is developed by reference to FIGS. 5 and 6. FIG. 5 shows a frustum of a cone which represents one-half of a caster wheel. The frustum is actually a portion of a rolling cone having an apex at the hinge axis, or other pivot point. In FIG. 5, A—A represents the hingle axis, or a vertical line through the pivot point, R′ is the distance, or radius, from the hinge point to the smallest diameter of the conical frustum, D′, R″ is the distance from the hinge point to the largest diameter of the conical frustum, D″, P′ is a point at a distance R′ from the hinge axis and P″ is a point at a distance R″ from the hinge point. From the geometry of FIG. 5, equations may now be determined which will establish the true shape of the caster wheel. For the conical portion to roll freely, without sliding, an equation may be written, as follows:

$$\frac{2\pi R'}{\pi D'}=\frac{2\pi R''}{\pi D''} \tag{1}$$

If this condition is satisfied, the circumference of the section of D′ will roll along the circumference described by the path of the point P′ at radius R′, the same number of times as the section D″ will roll along the circumference described by the path of point P″ at radius R″.

Cancelling equalities in Equation 1 results in:

$$\frac{R'}{D'}=\frac{R''}{D''} \tag{2}$$

But, $R''-R'$ is one-half the overall length of the caster wheel, and from FIG. 6,

$$R''-R'=\frac{L}{2}$$

and from this,

$$R'=R''-\frac{L}{2}$$

Substituting this value for R′ in Equation 2, then

$$\frac{R''-\frac{L}{2}}{D'}=\frac{R''}{D''} \tag{3}$$

and from 3

$$D'=\frac{\left(R''-\frac{L}{2}\right)D''}{R''} \tag{4}$$

In Equation 4, D′, D″, and L, represent dimensions of the caster wheel and R″ is approximately the distance from the axis of the hinge to the center line of the caster stem socket. If values are assigned to D″, L, and R″,

then D' may be determined and from D' and D'', the desired angle of the cone may be then calculated.

As an example, assume the following: $D''=2\frac{7}{8}$; $L=3\frac{1}{4}$; and $R''=72$ then,

$$D'=\frac{(72-1\frac{7}{8})(2\frac{7}{8})}{72}=2.8$$

Now from FIG. 6, angle B is required and is computed as follows:

$$\text{Tan } B=\frac{\frac{D''-D'}{2}}{\frac{L}{2}}=\frac{\frac{2.875-2.8}{2}}{1.875}=\frac{.0375}{1.875}=.02$$

and from trigonometric tables, the angle B is equal to 1 degree 9 minutes.

These figures were chosen arbitrarily and should not be construed to in any way limit the invention. However, it has been found that under most conditions of application, the angle should be within a range of one to two degrees. The higher degree of anguarity is due to deviations from the theoretical which are necessary in tolerance allowances required for production. The greatest deviation is produced by variations in the axis of the caster socket from a true vertical due to a misalignment of the caster socket supporting leg.

The foregoing has established the nature of the invention as it applies to the developed shape of the caster wheel. Reference to FIGS. 7 and 8 will now disclose another requirement in the application of the caster wheel to a bedframe. FIG. 7 shows a caster wheel 9*a* supported on a caster horn 5*a* and attached to a bedframe by means of a stem 30 attached to the horn 5*a*. A caster socket 31 inserted in a supporting leg of the bedframe 32 acts as a swivelling means for the stem 30. A split collar 33 has frictional engagement with the inside of the socket and permits the frame to be lifted without the caster assembly pulling out of the socket. The figure shows a space at 34 between the caster stem 30 and the caster socket 31. In order that full contact of the conical portion of the caster wheel with the supporting surface 35, as shown by the arrows, may be achieved, it is necessary that a greater anguarlity is permitted between the stem and the socket, as shown by the space at 34, than the actual angle of the conical portion of the wheel, shown as angle B in FIG. 6. FIGURE 8 now shows the effect of having little, if any, clearance at point 34. The contact of the caster wheel 9*a* is influenced by the permitted inclination of the caster stem with respect to the socket. With little clearance, the contact pattern, as shown by the arrows, is the result and this nullifies the effect of the tapered wheel shape.

Various forms of attachments between the caster horn and the bedframe have been shown. FIGS. 3 and 4 show a "full-floating" type of stem support. FIGS. 7 and 8 show a "top-bearing" stem support, and FIG. 9 shows a plate type mounting. The caster stems of FIGS. 3 and 4 fit into sockets similar to those shown in FIGS. 7 and 8, but in the plate type of FIG. 9, the top plate 36 is adapted to be fastened to the bedframe by means of bolts attached through holes 37, of which there are usually four. In all three types of mountings shown, it is necessary, for proper use of the caster of the invention, that the attachment permits the increased angularity between the stem and its socket, as described above. One way of accomplishing this in the plate type of FIG. 9 is to provide float (clearance) between the king pin 38 and the members it contains, top plate 36, bottom plate 39, and caster horn 5*b*. The caster in FIG. 9 may be considered to comprise only the caster wheel and its support means including the caster horn 5*b*.

FIGS. 10 and 11 show yet a further application of the special caster of the invention and its use in supporting a bedframe, divan or the like. In this instance, a bedframe 40 is provided which has a fixed pivot or hinge provided at 41, FIG. 10, at one head corner of the bedframe. The pivot or hinge 41, FIG. 10, may be substituted by a glide 42, FIG. 11, or similar member attached at or close to one corner of the bed or frame to provide the arcuate action thereabout. Three special casters of the invention, 43, 44 and 45 are provided and each one of these casters provides one frusto-conical section of a right circular cone connected to the bedframe 40 for rotation on the axis of the right circular cone but being held with the axis of such caster at all times passing through the axis of the hinge 41 for the bedframe where it meets the supporting surface for the bedframe. These casters 43 through 45 would all be positioned at a slight angle to the horizontal so that their supporting frusto-conical surfaces will have full line engagement with a support member 46 and have proper rolling contact therewith. It will be appreciated that the angles of the right circular cones for the different casters 43 through 45 will vary slightly in accordance with the equations and formula developed herein and set forth hereinbefore. However, the cones developed from the casters 43 through 45, as in other embodiments of the invention, have their vertexes at the fixed pivot or hinge point 41 where it intersects the support member 46.

FIG. 11 indicates how a horn 47, for the caster 43, positions such caster at a slight angle to the horizontal and holds it fixedly in position for rolling action about the pivot 41. Bolts, or similar means 48, secure the horn 47 fixedly to the bedframe 40.

The term "bedframe" is broadly used in the specification and claims and includes divans, cots or other articles of furniture where it is desirable to move them frequently through arcuate paths.

It should be noted that the casters 43, 44 and 45 can be of any desired length and normally would be at least as long as they are in maximum diameter for load distribution action.

In view of the foregoing, it is believed that a novel principle of caster support action has been described herein and that several embodiments of such novel caster have been fully disclosed. These casters will have full line or rolling contact with the supporting surface at all times and will not mark or mar any supporting surface, or break down the rug support pad on a floor. Smooth pivotal movement is provided for the supported article. Hence, it is thought that the objects of the invention have been achieved.

While several complete embodiments of the invention have been disclosed herein, it will be appreciated that modification of these particular embodiments of the invention may be resorted to without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a caster, a caster stem, a support horn, means rotatably securing said support horn to said caster stem, a caster wheel with greater width than height rotatably carried by said support horn, said caster wheel having twin substantially frusto-conical surfaces sloping downwardly in opposite directions from a maximum diameter mid-section therein, the said frusto conical surfaces making an angle of about 1 to 2 degrees with a line parallel to the axis of said caster wheel, said caster wheel being offset from a projection of the center line of said stem to enable such wheel to caster readily, and a caster socket receiving said caster stem and positioning it at an angle of about 1° to about 2° to the vertical when the caster socket is vertically positioned and the caster is loaded.

2. In a caster, a channel shaped support horn having a base portion with leg portions extending downwardly at both sides thereof, a stem secured to said base portion and extending vertically in opposed relationship to said leg portions, a wheel axle mounted in said leg portions parallel to said base portion, a wheel with greater width than height carried by said wheel axle, said wheel having

twin substantially frusto-conical surfaces sloping downwardly in opposite directions from a maximum diameter mid-section therein, and a caster socket receiving and supporting said stem in such a manner as to allow said stem to move relative to the axis of said socket to an angle at least equal to the slope angle of said wheel surface.

3. In a bedframe, or the like, adapted to be castered in an arcuate path around a fixed fulcrum, a caster including a channel shaped support horn having a base portion with leg portions extending downwardly at both sides thereof, a stem having an enlarged upper end portion secured to said base portion and extending vertically in opposed relationship to said leg portions, a wheel axle mounted in said leg portions parallel to said base portion but offset from said stem axis, and a wheel with greater width than height carried by said wheel axle, said wheel having twin substantially frusto-conical surfaces sloping downwardly in opposite directions from a maximum diameter mid-section therein; and a caster socket receiving

said stem and engaging said upper end portion of said stem in such a manner as to allow the axis of said stem to move relative to the axis of said caster socket at an angle equal to or greater than the slope angle of said wheel surface and to allow tilting movement of said stem when reversing the direction of rotation of said caster about the fixed fulcrum of the bedframe.

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