

Aug. 11, 1964

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3,144,234

SUPPORT STRUCTURE FOR FURNITURE, AND THE LIKE

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3 Sheets-Sheet 1

FIG. 1

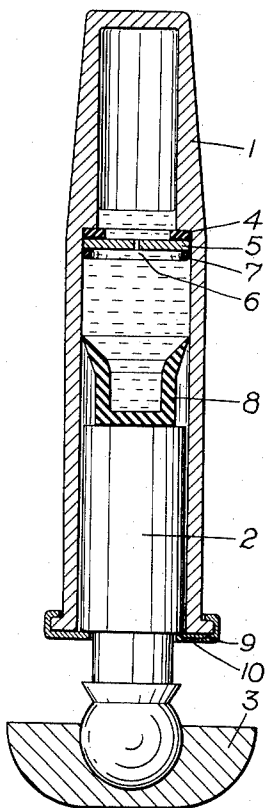
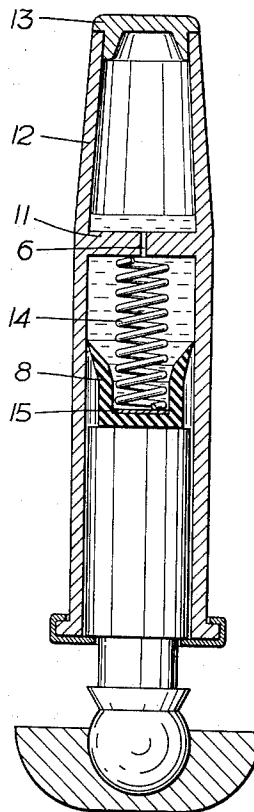


FIG. 2



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FIG. 3

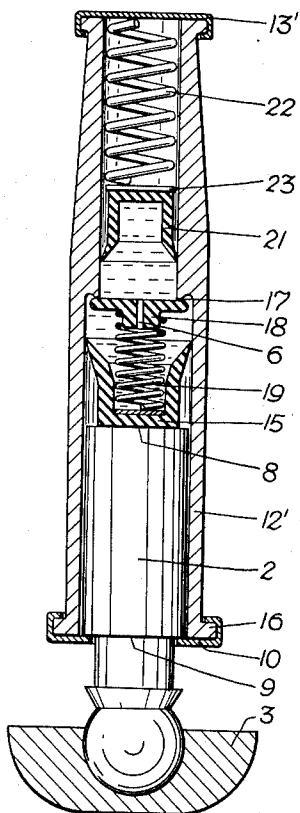
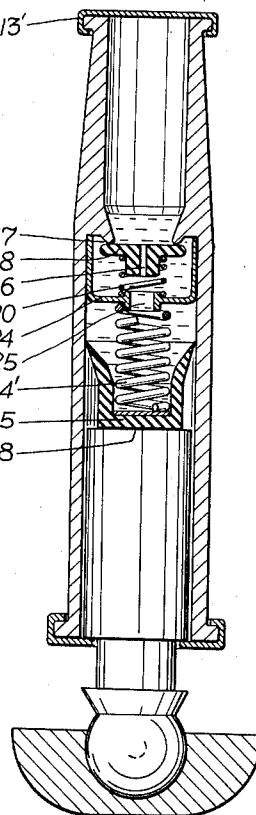


FIG. 4



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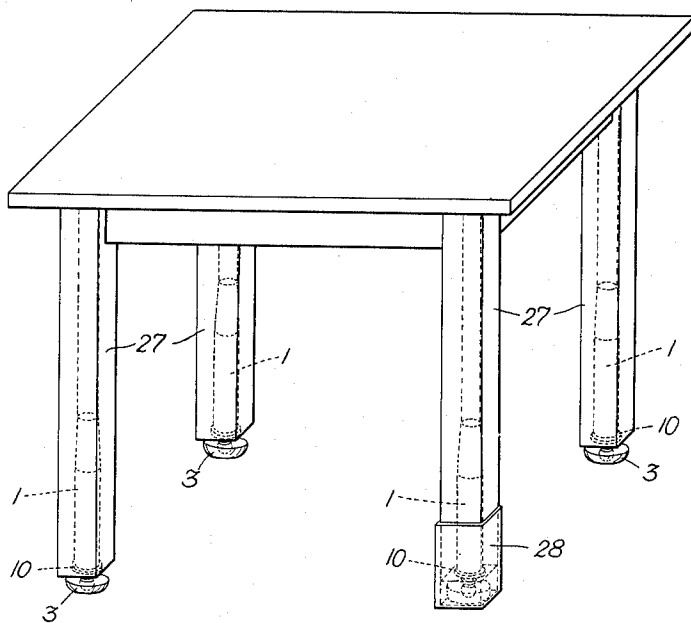
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FIG. 5



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SUPPORT STRUCTURE FOR FURNITURE AND THE LIKE

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6 Claims. (Cl. 248—188.2)

The present invention relates to articles of furniture.

Certain articles of furniture, such as tables, have the disadvantage of being relatively unstable as, for example, when the legs thereof engage an uneven floor. The vibrations and rocking of a table under such conditions are particularly noticed and of particular disadvantage when the table or the like has loads placed on and removed therefrom or when work is performed at the table of a nature which requires the table to absorb impacts.

It is accordingly a primary object of the present invention to provide for an article of furniture a device which will increase the stability of the article of furniture particularly under conditions such as those referred to above where the legs of the article of furniture engage an uneven floor.

Another object of the present invention is to provide for an article of furniture a stabilizing device which will not only compensate for unevenness in the floor on which the article of furniture rests but which will also absorb loads permitting the article of furniture to yield under certain loads and to return to its original condition when the load is removed.

Another object of the present invention is to provide a device of the above type which will dampen the movement of the article of furniture under load while permitting the article to yield while moving at a relatively slow rate and at the same time providing a relatively rapid return of the article of furniture to its original condition when the load is removed.

The objects of the present invention also include the provision of a device of the above type which can either be incorporated into newly-manufactured furniture or can be built into already finished furniture which may already be in use.

It is also an object of the present invention to provide a device of the above type which can be inexpensively manufactured by mass production methods.

With these objects in view, the invention includes, in a device for increasing the stability of an article of furniture, an elongated cylinder adapted to form at least part of a leg of an article of furniture and having a bottom open end when attached to the article of furniture. A piston is slidable in this cylinder and extends through and beyond the bottom open end thereof. At its end which is located beyond the cylinder the piston carries a floor-engaging means. A hydraulic means is located within the cylinder and cooperates with the piston for the movement of the cylinder relative to the piston. This hydraulic means includes a perforated member extending across the interior of the cylinder between the piston and the end of the cylinder distant from the piston, and a hydraulic liquid in the cylinder on both sides of the perforated member extending only partially into the space in the cylinder which is above the perforated member. Also, the hydraulic means includes an elastic sealing member engaging the end of the piston which is in the interior of the cylinder and slidably and fluid-tightly engaging the inner surface of the cylinder to prevent movement of the hydraulic liquid to the piston.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, to-

gether with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

5 FIG. 1 is a longitudinal sectional elevation of one embodiment of a device according to the present invention;

FIG. 2 is a longitudinal sectional elevation of a second embodiment of a device according to the present invention;

FIG. 3 shows in a longitudinal, sectional, elevational view a third embodiment of a device according to the present invention; and

FIG. 4 shows a fourth embodiment of a device according to the present invention, also in a longitudinal, sectional, elevational view.

FIG. 5 shows an article of furniture.

Referring to FIG. 1, the embodiment of the invention which is illustrated therein includes a cylinder 1 made of a suitable rigid plastic material, and it will be noted that this cylinder is closed at its top end and has a bottom open end. A piston 2, made of metal, is slidable within the cylinder 1 and extends through and beyond the bottom open end thereof. At its end which is located beyond the cylinder 1, the piston 2 carries a floor-engaging means in the form of a spherical member rigidly fixed with the bottom end of the piston 2 and a floor-engaging member 3 formed with a recess which is also spherical and which matingly receives the bottom end of the piston 2 so that the floor-engaging member is connected to the piston 2 by way of a ball-and-socket joint. The floor-engaging member 3 is also made of a rigidly plastic material and directly engages the floor.

The piston 2 is formed adjacent the bottom open end of the cylinder 1 with a downwardly annular shoulder 9, and the cylinder 1 carries a limiting means 10 which engages the shoulder 9 to limit the upward movement of the cylinder 1 with respect to the piston 2. This limiting means 10 is in the form of an annular metal member having an inner peripheral portion directed toward and adapted to engage the shoulder 9, and the upper annular edge of the member 10 is bent downwardly around an outwardly directed flange of the cylinder 1 so that in this way the limiting means 10 is fixedly carried by the cylinder 1.

A hydraulic means is located within the cylinder 1 and cooperates with the piston 2 for damping the movement of the cylinder 1 with respect to the piston 2, and this hydraulic means includes a perforated member 5 which, in the embodiment of FIG. 1, is in the form of a disc formed with a central small aperture 6, the disc 5 being held by a snap ring 7 against an annular sealing member 4 which is located against the downwardly directed shoulder formed in the interior of the cylinder 1 between its ends. The snap ring 7 may be seated in a groove formed in the interior of the cylinder 1 or may simply engage the inner surface thereof with sufficient friction to maintain the parts 4 and 5 in their illustrated position relative to the cylinder 1. The hydraulic means further includes a hydraulic liquid in the form of a suitable oil, although even water may be used, if desired, and this hydraulic liquid is located on both sides of the perforated member 5 in the rest position of the parts, the parts being shown in their rest position in FIG. 1. The hydraulic liquid extends only partially into the space in the cylinder 1 which is above the perforated member 5.

Below the perforated member 5 there is located within the cylinder 1 and elastic sealing member 8 having the configuration shown in FIG. 1 and having an outer periphery which is in slidable fluid-tight engagement with the inner surface of the cylinder 1, so that the sealing mem-

ber 8 will prevent the hydraulic liquid from reaching the piston 2.

When the parts are assembled the air trapped in the cylinder 1 above the hydraulic liquid is compressed so that the pressure of this air will maintain the parts in the illustrated position with the shoulder 9 engaging the limiting means 10, until, of course, a downwardly directed load acts on the cylinder 1 so as to compress the air in the upper part of the cylinder 1 to a greater degree while displacing the cylinder 1 downwardly with respect to the piston 2. Because the hydraulic liquid can move only at a relatively slow rate through the small aperture 6, this downward movement of the cylinder 1 under these conditions is resisted and damped, and of course, when the load is removed the air will expand to return the parts to their illustrated position, and in this case also because the liquid can move only at a slow rate through the aperture 6, the return movement of the cylinder 1 is also damped.

The cylinder 1 may itself have an exterior configuration which renders it suitable to form the leg of an article of furniture such as a table, or it may be built into a leg of a table or the like in any suitable way.

The embodiment of the invention which is illustrated in FIG. 2 operates in much the same way as the embodiment of FIG. 1, but the embodiment of FIG. 2 has certain advantages over the embodiment of FIG. 1 from a manufacturing standpoint. Thus, it will be noted that in the embodiment of FIG. 2, the rigid plastic cylinder 12 which corresponds to the cylinder 1 has both of its ends open and the perforated member of the hydraulic means takes the form of a partition 11 which is integral with the cylinder 12 and which is formed with the central aperture 6.

After this cylinder 12 is manufactured it is closed at its top end by a suitable plug 13. These parts 12 and 13 can be manufactured in large numbers at an extremely low cost by die-casting methods, and the plug 13 which forms a closure member closing the top end of the cylinder 12 is fluid-tightly fused to the cylinder 12 in any one of several methods well known in the art. For example, by the application of heat or by the use of a suitable solvent the parts 12 and 13 may be fused together when they are assembled.

The only other distinction of the embodiment of FIG. 2 over that of FIG. 1 resides in the fact that the embodiment of FIG. 2 includes a spring 14 which forms part of the hydraulic means of the embodiment of FIG. 2 and which is compressed between the perforated member 11 and the piston, the bottom, the bottom end of the spring 14 engaging a metal disc 15 located in the bottom interior of the elastic sealing member 8.

When one or more of the devices of the invention are included in an article of furniture such as a table, then under the weight of an article of furniture itself, without any additional load thereon, the device of the invention will compensate for any unevenness in the floor. If work is performed on a table which is provided with the structure of the invention, e.g. as shown in FIG. 5, and as a result of this work a downwardly directed load is applied in any way to the table, the force of this load is absorbed by the structure of the invention and the cylinder will even slowly yield downwardly under such a load, and of course the table will slowly return to its rest position when the load is removed. The perforation 6 is small enough to have a capillary action with respect to the hydraulic liquid so that the liquid moves slowly through the aperture 6. It should be noted that in the embodiments of FIGS. 1 and 2 the downward movement of the cylinder is strongly damped, the spring 14 of FIG. 2 contributing to this effect. However, when the load is removed so that the cylinders return to their rest positions, the cylinder of FIG. 1 will also slowly return whereas the cylinder of FIG. 2 will return at a faster rate than its downward movement because the spring 14 adds its force to that of the compressed air above the hydraulic liquid so that with the embodiment of FIG. 2 the cylinder returns at a faster

rate to its starting position and such operation is more desirable under certain circumstances.

In the embodiment of the invention which is illustrated in FIG. 3 there is also a metal piston 2 slidable in a plastic cylinder 12' which is closed at its top end by a closure member 13' in the form of a plate fixed to the top end of the cylinder 12' by having its bottom peripheral edge bent inwardly under an outwardly directed flange at the top end of the cylinder 12'. The flange 16 of the cylinder 12' fixedly carries the limiting means which cooperates with the shoulder 9 of the piston 2 in the manner described above, and the piston carries a floor-engaging means identical with that described above. Of course the floor-engaging means can be replaced by any other equivalent structure such as, for example, a wheel which may be swingably connected to the bottom end of the piston, and the entire device may be made more or less entirely housed with a sleeve 28 which can be fixed to the piston 2 adjacent the bottom end thereof beyond the cylinder and which has a configuration conforming to that of the profile of the leg 27 of the table so that it can telescopically slide onto the table leg for providing a suitable covering or housing for the device of the invention. Such an outer sleeve 28 may also be slidably connected to the piston 2 at its portion located beyond the cylinder, if desired.

With such an arrangement the table leg 27 would telescopically slide into and out of the sleeve 28.

The embodiment of FIG. 3 also includes an elastic member 8 provided in its interior with a metal disc 15 engaged by the bottom end of a spring 19 which is compressed between the piston 2 and the apertured member of the hydraulic means. However, in the embodiment of FIG. 3 the downwardly directed shoulder of the cylinder takes the form of a valve seat 17 engaged by an axially bored valve member 18, this valve member 18 forming the perforated member of FIG. 3 and this valve member is formed with the capillary bore 6 passing there-through. The upper end of the spring 19 urges the perforated valve member 18 toward the seat 17.

Also, in the embodiment of FIG. 3 there is located in the space within the cylinder 12' above the perforated member 18 a downwardly directed elastic sealing member 21 having an outer peripheral edge slidably and fluid-tightly engaging the inner surface of the cylinder, so that with this embodiment the hydraulic liquid is trapped between the sealing members 8 and 21. The top surface of the sealing member 21 is engaged by a metal plate 23 which is in turn engaged by the bottom end of a spring 22 compressed between the elastic sealing member 21 and the closure member 13', so that the spring 22 adds its force to the urging of the parts to the rest position illustrated in FIG. 3.

This construction of FIG. 3 is independent of the particular position in which it is built into the article of furniture and greatly widens the possibility of use of the structure of the invention since the hydraulic liquid is maintained at all times between the sealing members 8 and 21. For example, even if the structure of FIG. 3 were inverted the parts would still remain in the position shown with respect to each other since the spring 22 would prevent movement of the sealing member 21 toward the closure member 13', whereas with the other embodiments of the invention if the device is not maintained in a substantially vertical position the liquid will flow toward the end of the cylinder distant from the piston. Thus, the device of FIG. 3 can be used between an article of furniture and a wall or even between an article of furniture and a ceiling. Of course, the double sealing member and spring assembly of FIG. 3 may be incorporated into the other embodiments to enable these other embodiments to be used in situations where the device will not extend in a generally up and down direction with the piston extending downwardly beyond the cylinder.

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It will be noted that with the embodiment of FIG. 3 downward movement of the cylinder relative to the piston is damped in the same way as in the other embodiments. However, here again there will be a rapid return of the structure to a rest position. The spring 22 is stronger than the spring 19 and when the downwardly directed load is removed from the cylinder 12' the valve seat 12 will move upwardly away from the valve member 18 during the initial part of the return movement of the cylinder so that a rapid return of the parts is guaranteed.

The embodiment of FIG. 4 is substantially similar to that of FIG. 3, the main difference being that there is nothing between the hydraulic liquid and the air space in the upper part of the cylinder, and in the embodiment of FIG. 4 the pair of springs are both arranged between the perforated member 18 and the piston. Thus, in the embodiment of FIG. 4 an apertured wall member 24 is arranged between the valve member 18 and the piston. This wall member is formed with a relatively large aperture 25, and the outer periphery of the wall member 24 is in the form of an upwardly directed cylinder slidably engaging the inner surface of the cylinder 12' and having its upper edge in engagement with the shoulder which forms the valve seat 17 so as to limit the upward movement of the wall member 24 relative to the cylinder 12'. The spring 14' extends between the wall member 24 and the sealing member 8 engaging the plate 15 carried thereby and a weaker spring 20 is compressed between the valve member 18 and the wall member 24. With this embodiment also the structure will provide a slow downward yielding of the cylinder 12' and a rapid return thereof. Assuming that the cylinder 12' has been depressed by a downwardly directed load to an elevation lower than FIG. 4, then when the load is removed because the hydraulic liquid can move only at a slow rate through the capillary bore 6 of the valve member 18, the spring 14 will compress the spring 20 beyond the condition thereof shown in FIG. 4 displacing the wall member 24 and the cylinder 12' upwardly with respect to the valve member 18 during the initial part of the return movement of the cylinder 12' so that the valve seat 17 becomes displaced upwardly from the valve member 18 and the liquid can flow at a faster rate into the space above the valve member 18 so as to hasten the return movement of the cylinder 12'. By suitable dimensioning of the spring 14' and 20 it is possible to very accurately regulate the relationship between the speeds of downward and upward movement of the cylinder 12', and the same is of course true with respect to the springs 19 and 22 of FIG. 3.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of furniture differing from the types described above.

While the invention has been illustrated and described as embodied in furniture legs, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A device for increasing the stability of an article of furniture comprising, in combination, a cylinder adapted to be fixed to an article of furniture to form at least part

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of a leg thereof, and said cylinder when fixed to the article of furniture having a bottom open end; a piston slidable in said cylinder and extending downwardly through and beyond said bottom open end thereof; floor-engaging means connected to said piston at a portion thereof located beyond said cylinder; and hydraulic means in said cylinder cooperating with said piston for hydraulically damping the movement of said cylinder with respect to said piston, said hydraulic means including a perforated member extending across the interior of said cylinder above the piston therein and a hydraulic liquid located in said cylinder on both sides of said perforated member and extending only partially into the space in said cylinder above said perforated member, said hydraulic means also including an elastic sealing member engaging the end of said piston in said cylinder, extending across the interior of said cylinder, and fluid-tightly and slidably engaging the inner surface thereof, said sealing member preventing the hydraulic liquid from moving to said piston.

2. A device for increasing the stability of an article of furniture comprising, in combination, a cylinder adapted to be fixed to an article of furniture to form at least part of a leg thereof, and said cylinder when fixed to the article of furniture having a bottom open end; a piston slidable in said cylinder and extending downwardly through and beyond said bottom open end thereof; floor-engaging means connected to said piston at a portion thereof located beyond said cylinder; and hydraulic means in said cylinder cooperating with said piston for hydraulically damping the movement of said cylinder with respect to said piston, said hydraulic means including a perforated member extending across the interior of said cylinder above the piston therein and a hydraulic liquid located in said cylinder on both sides of said perforated member and extending only partially into the space in said cylinder above said perforated member, said hydraulic means also including an elastic sealing member engaging the end of said piston in said cylinder, extending across the interior of said cylinder, and fluid-tightly and slidably engaging the inner surface thereof, said sealing member preventing the hydraulic liquid from moving to said piston, and a spring in said cylinder compressed between said perforated member and said sealing member.

3. A device for increasing the stability of an article of furniture comprising, in combination, a cylinder adapted to be fixed to an article of furniture to form at least part of a leg thereof, and said cylinder when fixed to the article of furniture having a bottom open end; a piston slidable in said cylinder and extending downwardly through and beyond said bottom open end thereof; floor-engaging means connected to said piston at a portion thereof located beyond said cylinder; and hydraulic means in said cylinder cooperating with said piston for hydraulically damping the movement of said cylinder with respect to said piston, said hydraulic means including a perforated member extending across the interior of said cylinder above the piston therein and a hydraulic liquid located in said cylinder on both sides of said perforated member and extending only partially into the space in said cylinder above said perforated member, said cylinder being provided in its interior with an annular valve seat directed toward said piston and said perforated member being in the form of an axially bored valve member engaging said valve seat, said hydraulic means further including a spring extending between said piston and valve member and urging the latter toward said valve seat, and a pair of elastic sealing members located in said cylinder respectively on opposite sides of said valve member in fluid-tight engagement with the inner surface of said cylinder and the hydraulic liquid being located between and engaging said sealing members so that said sealing members limit the space in said cylinder in which the hydraulic liquid is located, and said spring extending between and engaging said valve member and the sealing member between said valve member and piston and holding the lat-

ter sealing member against the end of said piston in the interior of said cylinder.

4. A device for increasing the stability of an article of furniture comprising, in combination, a cylinder adapted to be fixed to an article of furniture to form at least part of a leg thereof, and said cylinder when fixed to the article of furniture having a bottom open end; a piston slidable in said cylinder and extending downwardly through and beyond said bottom open end thereof; floor-engaging means connected to said piston at a portion thereof located beyond said cylinder; and hydraulic means in said cylinder cooperating with said piston for hydraulically damping the movement of said cylinder with respect to said piston, said hydraulic means including a perforated member extending across the interior of said cylinder above the piston therein and a hydraulic liquid located in said cylinder on both sides of said perforated member and extending only partially into the space in said cylinder above said perforated member, and said hydraulic means including a pair of elastic sealing members respectively located in the interior of said cylinder on opposite sides of said perforated member in slidable fluid-tight engagement with the inner surface of the cylinder and the hydraulic liquid being located between and engaging said sealing members so that the latter limit the space in the interior of said cylinder in which the hydraulic liquid is located, and the sealing member which is between said perforated member and said piston engaging the end of said piston which is in the interior of said cylinder.

5. A device adapted to be connected to an article of furniture for increasing the stability thereof, comprising, in combination, an elongated cylinder adapted to form at least part of a leg of an article of furniture and having a bottom open end when connected to the article of furniture, said cylinder being formed in its interior with a valve seat directed toward said bottom open end thereof; a piston in said cylinder extending through and beyond the bottom open end thereof and carrying a floor-engaging means at its end which is located beyond said cylinder, said position being formed with a downwardly directed shoulder; limiting means carried by said cylinder at said open end thereof for engaging said shoulder of said piston to limit upward movement of said cylinder with respect to said piston; an axially bored valve member engaging said valve seat; an apertured wall member extending transversely across and slidably engaging said cylinder between said valve member and piston, said wall member having means which limits the movement of said wall member toward said valve member to a position where the apertured part of said wall member is spaced from said valve member; a first spring located between and engaging said wall member and valve member for urging them apart from each other and urging said valve member toward said valve seat; a second spring stronger than said first spring extending between said wall member and piston.

than said first spring extending between said wall member and piston and urging them apart from each other; and a hydraulic liquid in said cylinder extending through said valve member and located on both sides thereof, said liquid extending only partially into the space in said cylinder which is above said valve member at least when said shoulder of said piston engages said limiting means.

6. A device adapted to be connected to an article of furniture for increasing the stability thereof, comprising, in combination, an elongated cylinder adapted to form at least part of a leg of an article of furniture and having a bottom open end when connected to the article of furniture, said cylinder being formed in its interior with a valve seat directed toward said bottom open end thereof; a piston in said cylinder extending through and beyond the bottom open end thereof and carrying a floor-engaging means at its end which is located beyond said cylinder, said piston being formed with a downwardly directed shoulder; limiting means carried by said cylinder at said open end thereof for engaging said shoulder of said piston to limit upward movement of said cylinder with respect to said piston; an axially bored valve member engaging said valve seat; an apertured wall member extending transversely across and slidably engaging said cylinder between said valve member and piston, said wall member having means which limits the movement of said wall member toward said valve member to a position where the apertured part of said wall member is spaced from said valve member; a first spring located between and engaging said wall member and valve member for urging them apart from each other and urging said valve member toward said valve seat; a second spring stronger than said first spring extending between said wall member and piston and urging them apart from each other; a hydraulic liquid in said cylinder extending through said valve member and located on both sides thereof, said liquid extending only partially into the space in said cylinder which is above said valve member at least when said shoulder of said piston engages said limiting means; and an elastic sealing member located between and engaging said piston and second spring, said sealing member slidably and fluid-tightly engaging the inner surface of said cylinder and preventing the hydraulic liquid from reaching said piston.

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