Feb. 7, 1967 L. MASLOW 3,302,827

COUNTER MOUNTED SELF-LEVELING DEVICE

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FIG. 1

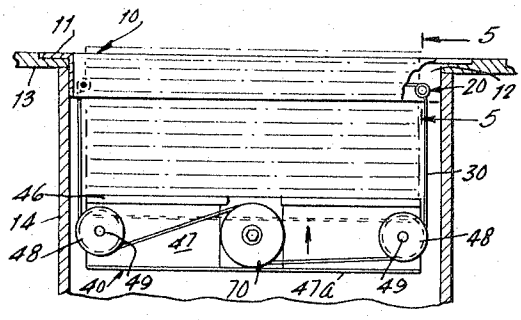


FIG. 2

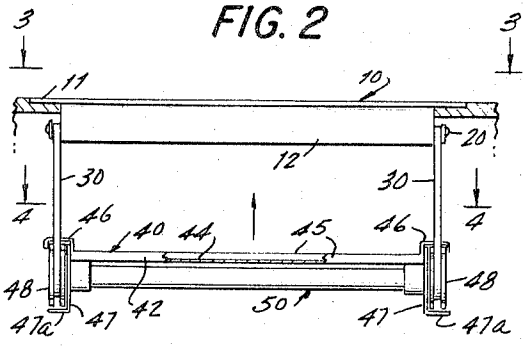


FIG. 3

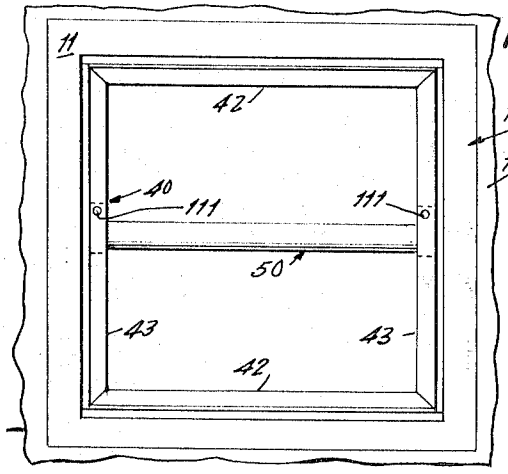


FIG. 4

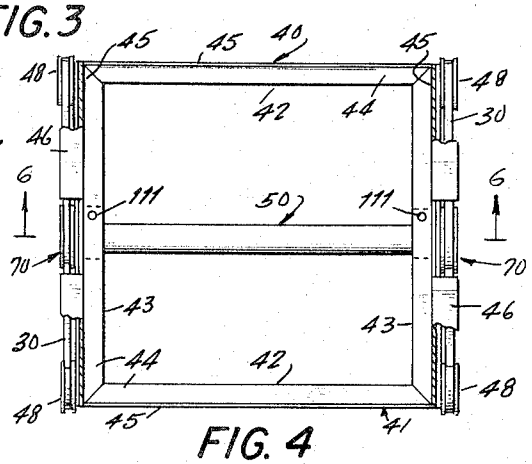


FIG. 6

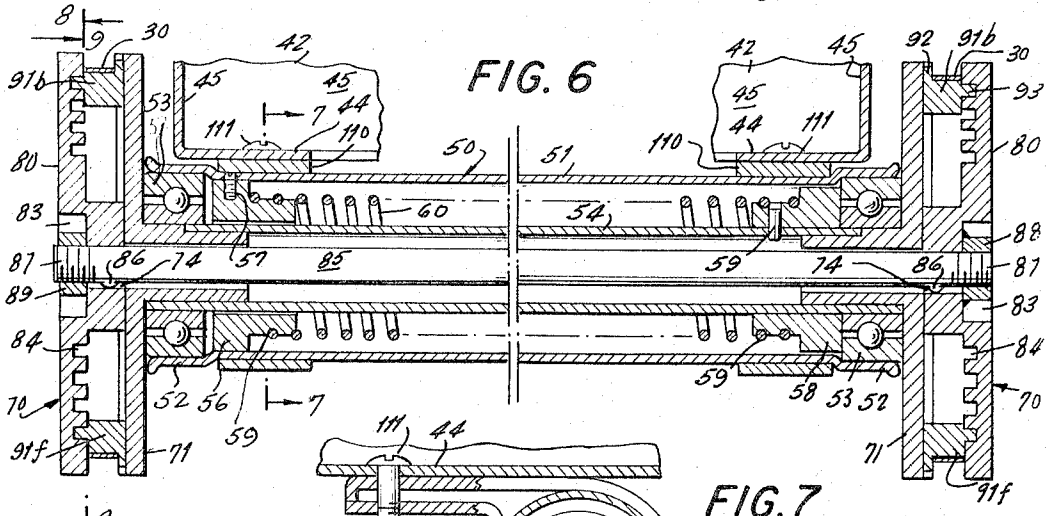


FIG. 7

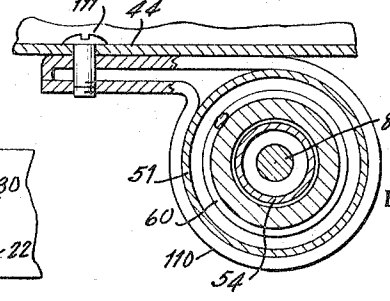
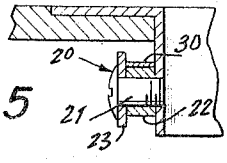


FIG. 5



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FIG. 8

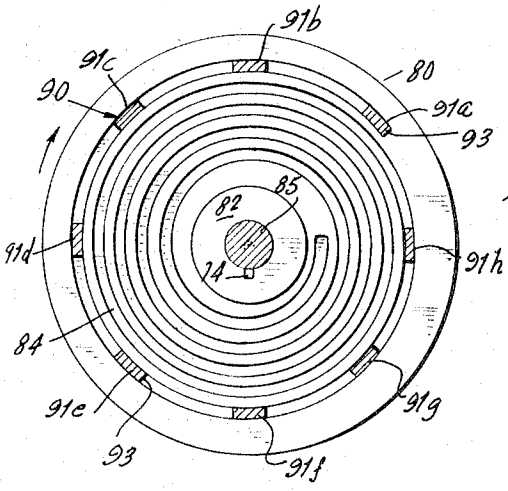


FIG. 9

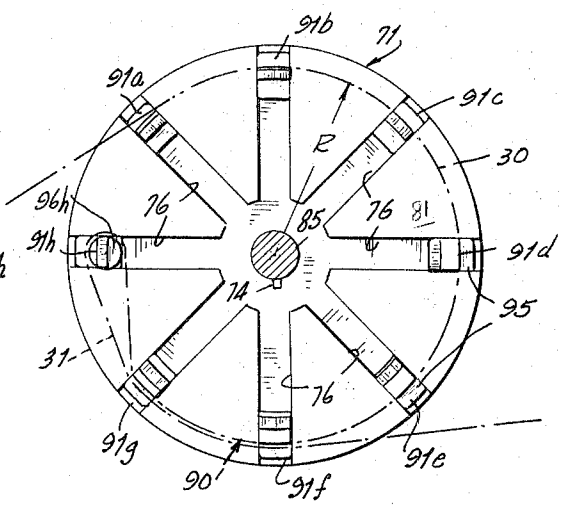


FIG. 10

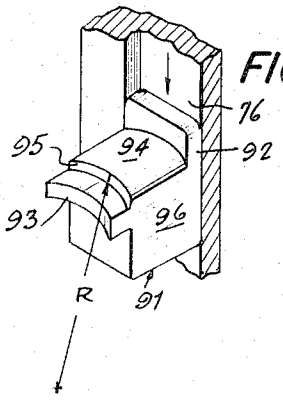
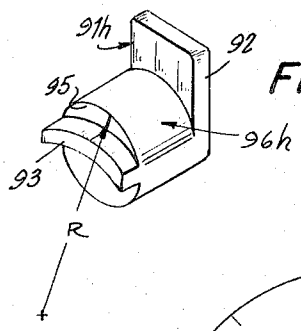


FIG. 11



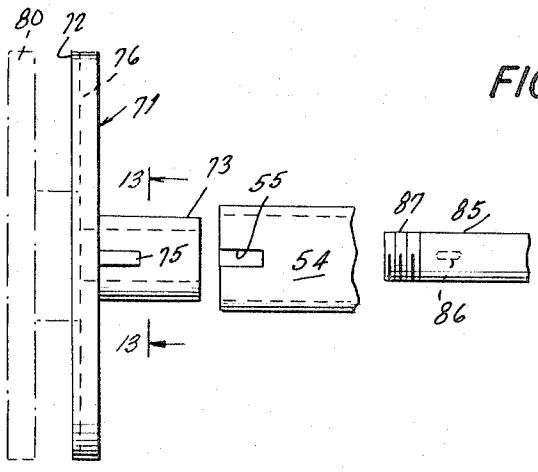
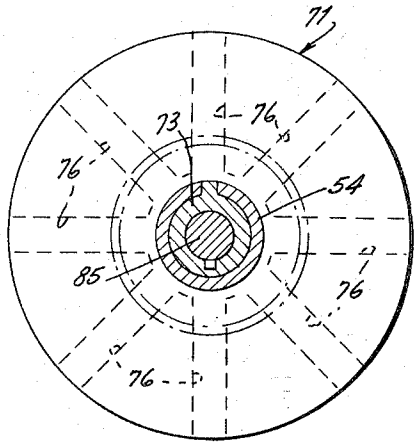


FIG. 12

FIG. 13



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United States Patent Office 3,302,827 Patented Feb. 7, 1967

3,302,827

COUNTER MOUNTED SELF-LEVELING DEVICE

Louis Maslow, Dallas, Pa., assignor to American Machine & Foundry Company, New York, N.Y., a corporation of New Jersey

Filed Mar. 30, 1965, Ser. No. 443,917
9 Claims. (Cl. 220—93)

This invention relates to a self-leveling device for receiving, storing and dispensing articles.

Under many circumstances, it is desirable to dispose a series of articles in stacked relation in conjunction with a table or counter and to remove said articles therefrom as desired. In this, as well as in many other applications, it is quite important that the articles be maintained at a constant level with respect to the counter or table surface regardless of the number of stacked articles disposed upon the carrier in order to minimize the amount of effort required and to maintain the uppermost rack or article at the most desirable level.

It is therefore an object of this invention to provide a self-leveling device for receiving, storing and dispensing articles which is simple in arrangement and construction and which effectively maintains a plurality of articles in stacked relation, with the uppermost article being maintained at a predetermined level regardless of the number of articles comprising the stack.

Another object of this invention is to provide a self-leveling device of the character indicated which may be readily adjusted to accommodate various stacks of articles as when it is desired to change over from a stack comprised of articles of a certain weight and vertical dimension to a stack comprised of articles of a different unit weight or vertical dimension.

It is also an object of this invention to provide a device of the character indicated wherein it is not necessary to employ special types of spring elements in order to provide for the maintenance of a stack of articles at a predetermined constant level regardless of the number of articles comprising the stack and variations in the characteristics of the group.

An additional object of this invention is to provide an arrangement wherein a stack elevating spring is employed and means are provided for adjusting the leverage exerted upon the spring means in accordance with the desired vertical displacement of each article comprising the stack to be supported thereby.

This invention also has for its object the provision of a device of the character indicated wherein positioning means are provided for accurately locating the uppermost article of the stack at a predetermined elevation.

Other and further objects of this invention will become apparent from the description thereof contained in the annexed specification, or will otherwise become obvious. It will be understood that the invention here disclosed may be employed for other purposes to which the structure and arrangement are adapted.

In the accompanying drawings:

FIGURE 1 is a side elevational view of a self-leveling device embodying the features of the instant invention, the showing being partly in section in order to illustrate the manner in which the device is mounted in the well of a counter or table;

FIGURE 2 is a front elevational view of the device shown in FIGURE 1;

FIGURE 3 is a top plan view of the device when viewed in the direction of the arrows 3—3 of FIGURE 2;

FIGURE 4 is a cross-sectional view of the device taken along line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary vertical section taken along line 5—5 of FIGURE 1 illustrating the clamping stud arrangement;

FIGURE 6 is a cross-sectional view taken along line 6—6 of FIGURE 4 illustrating the arrangement of torque tube assembly;

FIGURE 7 is a cross-sectional view taken along line 7—7 of FIGURE 6;

FIGURE 8 is a cross-sectional view taken along line 8—8 of FIGURE 6;

FIGURE 9 is a cross-sectional view taken along line 9—9 of FIGURE 6;

FIGURE 10 is a fragmentary view of one of the reel flanges showing one of the bridging bosses forming part of the reel assembly, in perspective;

FIGURE 11 is a perspective view of a bridging boss particularly adapted to serve as an anchor for the suspension band loop;

FIGURE 12 is a fragmentary exploded view showing a reel flange and shaft assembly; and

FIGURE 13 is a cross-section taken along line 13—13 of FIGURE 12.

Other objects, benefits and advantages of this invention will appear from the drawing, specification and claims appended hereto.

A self-leveling, receiving, storing and dispensing device embodying the features of the instant invention as illustrated in FIGURES 1, 2, 3 and 4. As may be seen from said figures, the device comprises a supporting frame designated generally by the numeral 10 which comprises a horizontal face plate 12 and a vertically disposed perimetric flange depending from the interior of the opening in the face plate. The supporting frame is adapted to be disposed in an opening provided in a table or counter top indicated by the numeral 13 which may be provided with spaced housing walls 14. The supporting frame is thus adapted to suspend the device from the counter or table top into a well defined below said top surface.

The supporting frame 10 has suspended therefrom a carrier assembly designated generally by the numeral 40 by means of a pair of suspension bands 30 supported on the vertically disposed perimetric side walls of said supporting frame.

The carrier assembly 40 comprises a carrier platform identified by the numeral 41 which is advantageously formed of front and rear angle members 42 and side angle members 43. The angle members define a carrier platform having horizontal inwardly directed portions 44 upon which the articles to be supported are to be disposed as well as vertical portions 45 which define a perimetric confining wall 45 which serves to prevent the lateral displacement of any article disposed thereon. The vertical portions 45 of the side angle members 43 are additionally provided with inverted U shaped flanges 46. The side angle members 43 have secured thereto side plates 47 which in turn are provided with outwardly extending horizontal flanges 47*a*. Each of the side plates 47 is provided with a pair of idler pulleys 48 which are rotatably mounted adjacent the extremities of said side plates as by means of stud bolts 49 as may be seen in FIGURE 1. The pulleys 48 may be formed of any suitable material. It has further been found particularly advantageous to form them of nylon. Each of the pulleys is provided with a circumferential groove within which the associated suspension band is received and guided.

The carrier assembly 40 further includes a torque tube assembly designated generally by the numeral 50 and more particularly illustrated in FIGURES 6 and 7. As may be seen from said figures, the torque tube assembly 50 comprises a cylindrical tubular housing 51, each end of which is provided with a bell-shaped enlargement 52 within which a ball bearing 53 is received. The inner races of the ball bearings receive the ends of a hollow axle or shaft 54 which extends coaxially through said housing and is thereby adapted for relative rotation with respect

to said housing. Referring now to FIGURE 12, it will further be seen that each end of shaft 54 is provided with a key slot 55 which is adapted to receive a complementary key 75 formed on the collar portions 73 of each of the flange plates 71. Shaft 54 is thus keyed to the suspension band reels 70 for rotation therewith as will more clearly appear hereafter.

Intermediate of said ball bearings 53, there are provided flanged collars 56 and 58 which are disposed in proximity to said bearings. The reduced body portions of said collars are formed with grooves as indicated at 59 to fixedly receive and anchor the ends of a coiled torsion spring 60. Collar 58 is secured to shaft 54 for rotation therewith by means of a set screw or pin 59, the peripheral surface of the flange portion of said collar 58 being spaced from the inner wall of the tubular housing 51. Collar 56, on the other hand, is fixedly secured to the wall of housing 51 by means of a pin or setscrew 57 for rotation therewith. It will be noted that the wall of the bore through collar 56 is spaced from the peripheral surface of shaft 54. As heretofore indicated, the ends of torsion spring 60 are fixedly secured to the collars so that rotation of collar 56 with respect to axle shaft 54 as by means of the rotation of housing 51 winds said spring biasing it and imparting a set or corresponding resistance to opposite rotation which may be exerted on shaft 54 and communicated to reels 70.

The end portions of tubular housing 51 are provided with clamps 110 which are secured to the horizontal portions 44 of the carrier platform as by means of bolts 111. The loosening of bolts 111 permits the tubular housing 51 to be manually grasped and rotated with relation to axle shaft 54 to impart the desired degree of initial tension, set or bias, to torsion spring 60. When the desired bias or set has been achieved, the tightening of bolts 111 causes the housing to be firmly gripped and to be retained in fixed position against further rotation. An initial bias or set is thus imposed upon axle shaft 54 which is communicated to the reels 70 and consequently to the entire carrier assembly as will more clearly appear hereafter.

The carrier assembly 40 is suspended by means of suspension bands 30, portions of which are wound about suspension band reels 70 disposed at the ends of the torque tube assembly. These suspension band reels are essentially similar to each other and each comprises an inboard flange plate 71 which is provided with an operative face 72 having a plurality of radial grooves 76 each communicated with a central annular depression 78. The opposing surface of the flange plate 71 is provided with a collar 73 having a keyway 74 formed in the bore thereof. The opposing or outboard flange plate of the suspension band reels 70 is identified by the numeral 80 and comprises an operative face 81 which has formed therein a scroll or spiral groove 84 and a centrally disposed spacer or core projection 82 provided with a keyway 74. The spiral grooves formed in the operative faces of the flange plates 80 are of opposite hand. There is also provided a recess 83 in the outer surface of each of the flange plates 80. As will be noted from FIGURE 6, a tie rod 85 having threaded ends extends through the interior of hollow shaft 54 co-axially therewith and is provided with swaged ears 86 which are disposed within the keyways 74 formed in the core projection 82 of the flange plates 80. Each end of the tie rod 85 is provided with a threaded nut for cooperative engagement therewith. Nut 88 is welded or otherwise fixedly secured to the body of its associated flange plate 80 while nut 89 in threaded engagement with the other end of said tie rod is removably disposed thereon.

The reels are further provided with a plurality of bosses more particularly illustrated in FIGURE 10. Each of said bosses comprise a foot or base portion 92 at one end thereof and an outwardly projecting arcuate tongue 93 at the other end thereof. The foot or base portion 92 of each of the bridging bosses 91 is adapted to be disposed within one of the radial grooves 76 of the flange plates 71 and is capable of sliding movement within said groove. The outwardly projecting arcuate tongue 93 of each of bridging bosses 91 extends into the confronting spiral groove formed in flange plates 80. It will be noted that the outwardly projecting tongue 93 of the body portion 96 of each of the bridging bosses 91 is offset from the arcuate upper surface or crown 94 of said body portion to a differing degree. Referring more specifically to FIGURES 8 and 9 it will be noted that this offset increases from bridging boss 91*a* through bridging boss 91*h* in a counter-clockwise direction. The offset is introduced for the purpose of compensating for the fact that the spiral groove departs from a true circle in 360° of revolution by the radial distance between adjacent grooves. By means of this offset, the crown surfaces 94 of the bridging bosses more closely approximate a perfect circle. Body portion 96*d* of bridging boss 91*d* is in the form of a cylinder so as to more conveniently receive the loop portion 31 of the suspension band 30. It will be noted that the body portions 96 of the boss 91 bridge the space between the confronting operative faces of each pair of flange plates and form a squirrel cage hub of circular conformation, the diameter of the circle being determined by the portion of the spiral groove within which the bridging bosses are disposed. It will further be apparent that the diameter of the hub cage designated generally by the numeral 90 thus formed may be changed by relative rotation of a spirally grooved flange plate 80 with respect to its confronting radially grooved flange plate 71. It will further be noted particularly from FIGURE 6 that when unit 89 is loosened, the spirally grooved flange plate 80 may be rotated with respect to its associated radially groove flange plate 71. However, since the keys 86 at the ends of the tie rod are in engagement with the keyways formed in the core portions 82, the spirally grooved flange plates 80 are tied together for simultaneous movement. Since the spiral grooves in each of the flange plates 80 are of opposite hand, it will be apparent that rotation of the flange plates will simultaneously increase or decrease the diameter of the hub cage defined by the bridging bosses.

As heretofore indicated, portions of the suspension bands are wound about the hub cages of the suspension band reels 70. The suspension bands 30 are each advantageously comprised of a continuous loop of flexible stainless steel strip material. The continuous loop may be formed by winding or riveting the free ends of each band and the bands are each trained about an associated pair of studs 20 and idler pulleys 48. A portion of each endless band is looped about bridging stud 96*h* as indicated in FIGURE 9 so that the band emerges tangentially of the reel hub cage at diametrically opposite points. As a consequence of this, each reel will simultaneously wind or unwind the suspension band in a balanced manner. Furthermore, it will be apparent that the diameter of the hub cage formed in each of the reels may be changed by unwinding the band from the reel and repositioning the bridging studs by relative rotation between the flange portions of each reel in order to achieve a circle of desired diameter whereupon the band may be rewound thereon. Varying the diameter of the reel hub cage in this manner permits the position of the suspension band to be varied with respect to the center of the reel. The moment arm of the band with respect to the axis of the reel may be set for any desired length. An infinite variation of the lever or moment arm is also possible since this variation is accomplished in a continuous rather than in a incremental or step manner.

As heretofore indicated, the suspension bands 30 are looped or trained about the clamping studs 20. The suspension bands are of equal length and permit the carrier assembly to descend to a desired lower limit. The suspension band reels 70 are keyed for simultaneous rotation and consequently, the bands are simultaneously

wound about each reel when rotated in one direction causing the carrier assembly to ascend whereas rotation of the reel in the opposite direction causes the unwinding of the bands and the descent of the carrier assembly. The upper limit of movement of the carrier assembly is determined by the abutment of the inverted U shaped flanges **46** with the confronting surfaces of the vertically disposed perimetric flange **12** of the supporting frame **10**.

The clamping studs **20** are comprised of a threaded screw **21** provided with a collar **22** and a clamping washer **23** of larger outer diameter when the outer diameter of the collar. The length of collar **22** is selected so that it is slightly less than the width of band **30** disposed thereon. As a result of this arrangement, the tightening of screw **21** results in the imposition of a clamping force upon a portion of the band **30**.

It will be apparent from the foregoing that there has thus been provided an arrangement wherein a carrier assembly for receiving stacked articles and maintaining the uppermost article of the stack at a predetermined level is provided. The carrier assembly **40** is suspended from a supporting frame which may be disposed in an opening or well defined in a table top or counter. The suspension means comprise a pair of flexible cables or bands **30** in continuous loop form which are looped about projecting studs along each side of the supporting frame. Each of the bands is further wound about an associated reel **70** in such manner that portions of the band are wound thereabout in diametrically opposed relation so that simultaneous rotation of the reels in one direction as by the removal of a load from the carrier serves to wind the bands about the reels and elevates the carrier assembly while the imposition of additional load on the carrier causes rotation of said reels in the opposite direction and causes the bands to be unwound from the reels simultaneous with the descent of the carrier and the stacked articles disposed thereon as may be seen in FIGURE 1. The carrier assembly includes a torque tube assembly **50** including a torsion coil spring **60** which serves to provide a biasing force for the reels in order to maintain the carrier assembly in elevated position under no load conditions and controls its ascent and descent under varying loads. As a load is placed upon the carrier assembly it is caused to descend a distance determined by the degree of resistance of the coil spring to further tensioning. The amount of deflection of the coil spring under any given band will depend upon the lever or moment arm of the suspension bands with respect to the axis of the reels. This moment arm arm is determined by the radius of the circular hub cage formed on the reels by means of a circular array of bosses provided. This moment arm may be set to any desired radius so that the degree of deflection and consequent vertical movement of the carrier for any given weight may be controlled. In this manner it is possible to adjust the distance that the carrier platform will drop as each article is added to the stack. The carrier may therefore be readily adapted for accommodating groups of articles such as dish racks or the like of various heights, the height and weight of the members of the group being uniform, while maintaining the uppermost article on the stack at a uniform predetermined level. When the stack is to be composed of racks of a different weight or height the vertical travel of the carrier for each of the additional weights may be adjusted by appropriate initial setting of the coil spring of the torque tube assembly in conjunction with the positioning of the moment arm of the bands with respect to the axis of each band reel. The initial adjustment of the device may be accomplished in the following manner. The torque tube clamps **110** are released for rotation by loosening of screws **111**. This permits the housing **51** and axle shaft **54** to rotate freely and consequently releases the tension upon coil spring **60**. The suspension band reels are thus permitted to rotate, unwinding the suspension bands as the entire carrier assembly descends to its lowermost point. At this point, bridging stud **91***h* is uppermost and the tape extends vertically therefrom, all of the remaining bridging studs **91** being free of tape. Nut **89** is loosened so as to permit relative rotation between each pair of flanges comprising a reel and to free the bridging studs for sliding movement. Rotation of either one of the spirally grooved flanges **80** will then result in a simultaneous rotation of the other of said spirally grooved flange plates **80** on the opposing side of the carrier. The diameter of the hub cage may thus be reduced or increased in size as desired by the rotation of the spirally grooved flanges resulting in the radial displacement of the bridging bosses.

When the circular array of bridging bosses reach the desired diameter, the tightening of the nut **89** will result in fixing the bosses in position in a circular array of the desired diameter. Manual rotation of the housing will now cause each of the bands to be wound about its associated reel causing the assembly to rise with some initial tensioning of the coil springs. When the carrier assembly reaches the upper limit of its movement as determined by abutment of the inverted channel portions with the lower edge of the supporting frame, further manual rotation of the housing portion of the torque tube assembly significantly tensions the coil spring since the suspension bands now prevent further rotation of the reels and the axle shaft. When the coil spring has been set to the desired tension or bias, the clamps **110** are locked by tightening their associated screws. It should be noted that the tangential offset of the arms of the clamps forms a clamping loop which tends to assist in preventing the counter rotation of the housing.

The arrangement further permits the carrier assembly to be readily adjusted to level condition whenever such adjustment is desired. The leveling adjustment is accomplished in the following manner. With the carrier in unloaded condition and disposed at the top of its travel, the screws **21** of the clamping studs **20** are retracted. This action frees each of the suspension bands for movement. With the torque tube assembly clamps opened, the housing thereof is rotated in the direction for elevating the carrier until the suspension bands are equalized by the abutment of all four corners of the supporting frame with the inverted U shaped channels of the carrier. With the four corners of the carrier assembly thus accurately located, the carrier is in level condition and the screws of the clamping studs are driven home to clamp the bands against further movement thereon. Leveling the carrier may also be accomplished by opening of the torque tube clamps and permitting the carrier to descend to its lowermost position at which point the screws of the clamping studs are opened thereby permitting the bands to equalize. The tightening of the screws on the clamping studs then results in fixing the bands against further movement.

The embodiment of the invention illustrated and described hereinabove has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the present invention is susceptible to being modified in respect to details of construction, combination and arrangement of parts which may be resorted to without departure from the spirit and scope of the invention as claimed.

I claim:

1. A self-leveling device comprising a support, a carrier assembly including a platform suspended from said support for vertical movement with respect thereto, suspension means extending between said support and said carrier assembly for suspending said carrier assembly from said support, said suspension means comprising a suspension band extending between each of a pair of opposing sides of said support and a corresponding opposing side of said carrier assembly, a reel means for each of said opposing sides of said carrier assembly, each of said bands

being trained about portions of said support and said carrier assembly and having portions thereof wound about one of said reel means to form a pair of continuous loops suspending said carrier assembly from said support, said reel means each comprising a pair of spaced apart flange members, one flange member of each pair being provided with a spiral groove formed in the operative face thereof and the other flange member thereof being provided with a plurality of radially extending grooves on the operative face thereof, said operative faces being in confronting relation, a plurality of bridging elements for each of said reels, each of said bridging members having portions extending into the radial groove in alignment therewith, said bridging elements in each reel being disposed in a circular array defining a hub cage therefor about which one of said bands is wound, the level at which said carrier assembly is disposed with respect to said support being determined by the extent to which said bands are wound about said reels.

2. The device according to claim 1 wherein the bridging element includes a body portion, one end of which is provided with a outwardly projecting tongue disposed within said portion of said spiral groove, the other end of said body being provided with a base portion being disposed in the portion of said radial groove in alignment therewith.

3. The device according to claim 2 wherein the tongue portions of adjacent bridging elements are offset with respect to the body portions to a differing degree.

4. The device according to claim 2 wherein the body portion of one of the bridging elements of each circular array is cylindrical.

5. A self-leveling device comprising in combination a supporting frame including a horizontally disposed face plate and a vertically disposed perimetric flange extending from the opening thereof to define a well opening, a carrier assembly disposed within the well thus defined suspended for vertical movement, in accordance with the weight of articles disposed thereon, the suspension means for said carrier assembly comprising a pair of suspension band loops disposed along opposing sides of said perimetric flange and the carrier assembly, the sides of said perimetric flange being provided with bosses about which said bands are trained, said carrier assembly including torque tube means including a torsion spring for biasing said carrier to elevated position, said torque tube means including a pair of spaced apart reels having hubs for receiving portions of said loops wound thereabout and being operatively connected with said spring, said reels including means for continuously varying the lever arm presented by the hub portions of said reels with respect to the axes thereof, the level at which said carrier assembly is maintained being determined by the extent to which portions of said loops are wound about said reels.

6. A self-leveling device comprising a support, a carrier assembly including a platform suspended from said support for vertical movement with respect thereto, suspension means extending between said support and said carrier assembly for suspending said carrier assembly from said support, said suspension means comprising a suspension band extending between each of a pair of opposing sides of said support and a corresponding opposing side of said carrier assembly, a reel means for each of said opposing sides of said carrier assembly, each of said bands being trained about portions of said support and said carrier assembly and having portions thereof wound about one of said reel means to form a pair of continuous loops suspending said carrier assembly from said support, said reel means each comprising a pair of spaced apart flange members, one of said flange members being provided with a face having a spiral groove and the confronting face of the other of said flange members having a plurality of radial grooves formed therein, bridging elements extending between spiral and radial groove pairs arranged in circular arrays and defining a hub cage about which a band is wound, said reel means being spring biased for urging said reels toward a wound condition for elevating said carrier.

7. The device according to claim 6 wherein each spirally grooved flange member is mounted for rotation with respect to its associated radially flanged member whereby the diameter of said hub cage may be varied.

8. The device according to claim 7 wherein said spirally grooved flange members are mounted for simultaneous rotation for simultaneously varying the diameter of the hub cages of said reels.

9. A self-leveling device comprising a support, a carrier assembly including a platform suspended from said support for vertical movement with respect thereto, suspension means extending between said support and said carrier assembly for suspending said carrier assembly from said support, said suspension means comprising a suspension band extending between each of a pair of opposing sides of said support and a corresponding opposing side of said carrier assembly, a reel means for each of said opposing sides of said carrier assembly, each of said bands being trained about portions of said support and said carrier assembly and having portions thereof wound about one of said reel means to form a pair of continuous loops suspending said carrier assembly from said support, a shaft rotatably supported by said carrier, said shaft being biased by a torsion spring disposed thereon and being provided wtih means for imparting an initial bias thereto, each of said reel means being provided with means for selectively varying the leverage exerted by said bands upon said spring, in a continuous manner, said means comprising a pair of spaced apart flanges mounted for relative rotation one with respect to the other, the confronting faces of said flanges being provided with spiral and radial grooves respectively, bridging means disposed within the grooves of each confronting pair arranged in circular arrays defining a squirrel cage hub about which portions of said bands are wound and presenting a lever arm extending radially between said pulleys, the diameter of said circular arrays being variable by relative rotation between the members of each pair.

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THERON E. CONDON, *Primary Examiner.*

RAPHAEL H. SCHWARTZ, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,302,827 February 7, 1967

Louis Maslow

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 13, after "into" insert -- a portion of a spiral groove as well as a portion extending into --.

Signed and sealed this 17th day of October 1967.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents