Oct. 27, 1964 I. BRONSON 3,154,029

SELF-LEVELING DEVICE WITH CLAMPING MEANS FOR ADJUSTING INITIAL SPRING TENSION

Filed Aug. 24, 1961 3 Sheets-Sheet 1

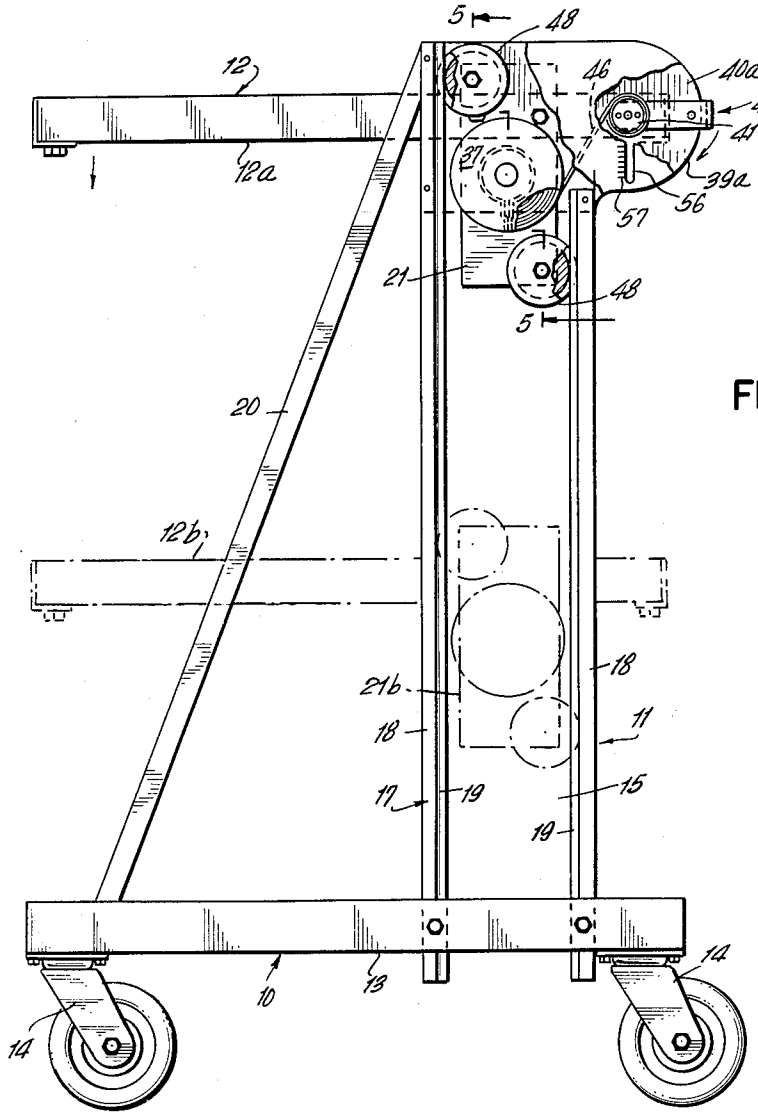


FIG. 1

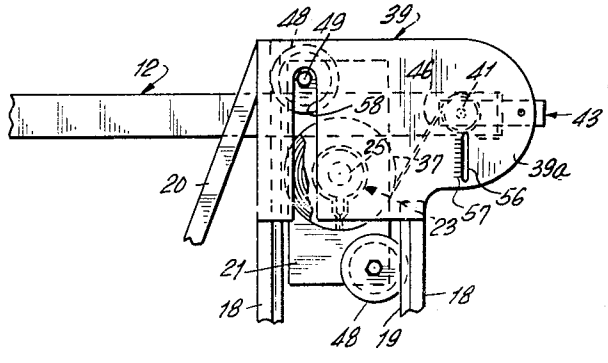


FIG. 2

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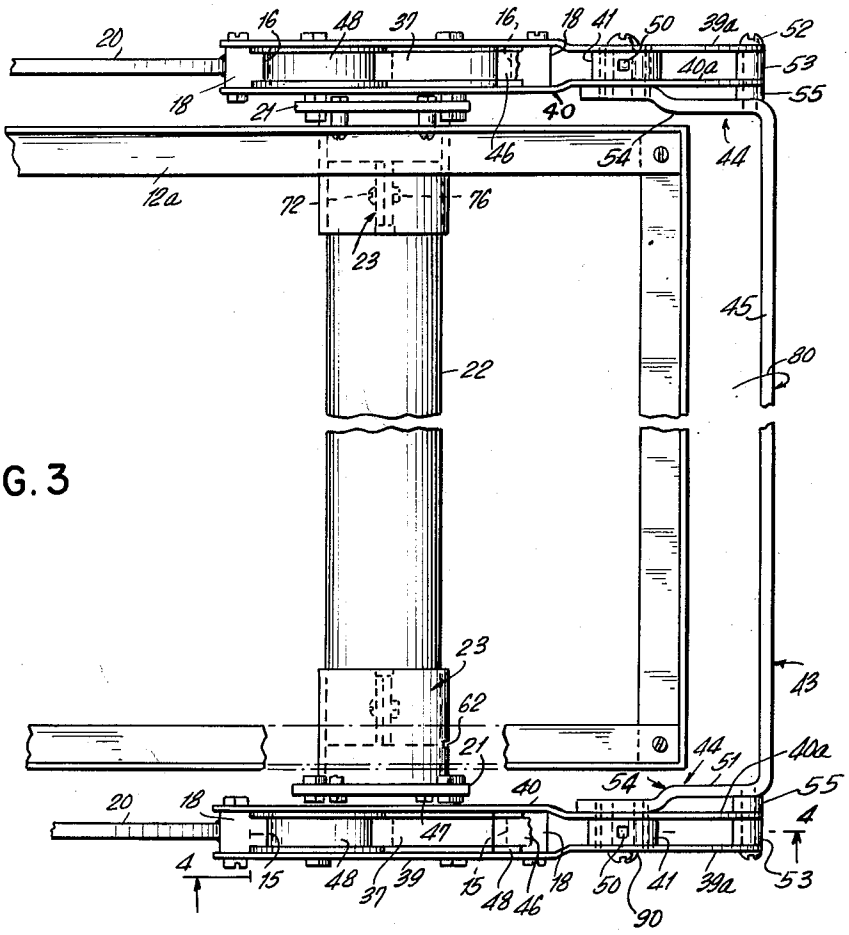


FIG. 3

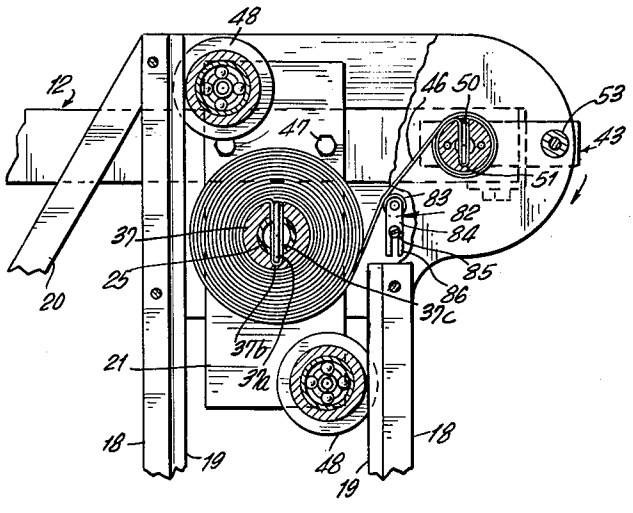


FIG. 4

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SELF-LEVELING DEVICE WITH CLAMPING MEANS FOR ADJUSTING INITIAL SPRING TENSION

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FIG. 5

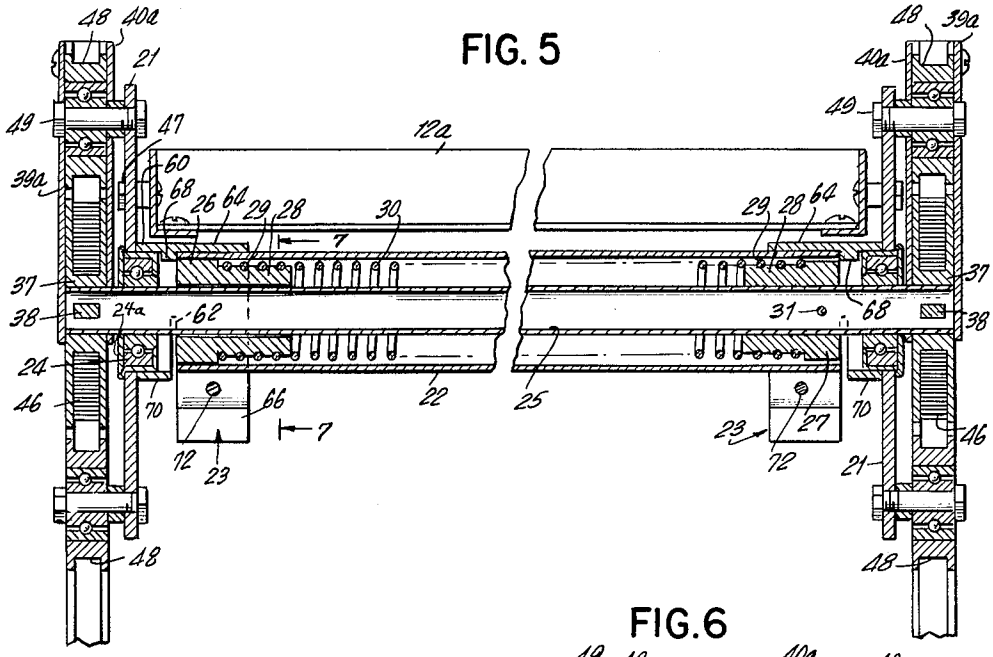
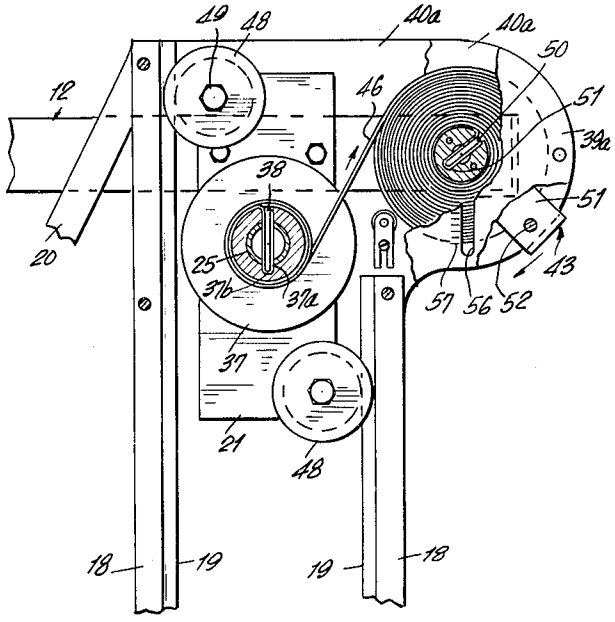


FIG. 6



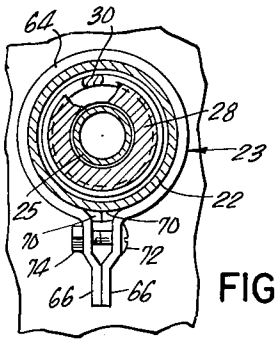


FIG. 7

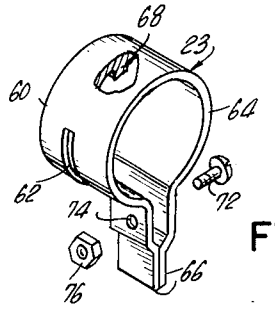


FIG. 8

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3,154,029

SELF-LEVELING DEVICE WITH CLAMPING MEANS FOR ADJUSTING INITIAL SPRING TENSION

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Filed Aug. 24, 1961, Ser. No. 133,726
7 Claims. (Cl. 108—136)

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

The subject application is a continuation in part of my copending applications Serial Numbers 49,856, 49,857 and 49,912 filed August 16, 1960 and Serial Number 65,137 filed October 26, 1960, now U.S. Patents 3,123,218, 3,123,829, 3,123,023, and 3,123,024, respectively.

Under many circumstances, it is desirable to dispose a series of articles in stacked relation upon a wheel-mounted carrier and to remove said articles therefrom as desired. Thus, for example, restaurants or similar food service institutions may require that a series of dish racks be stacked as they are removed from a dishwashing machine and thereafter transported to another location at which the racks are unloaded as required. In this, as well as in many other applications, it is quite important that the loading and unloading points be maintained at a constant level 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. Although self-leveling devices of this character have been suggested, they have been characterized by shortcomings which are overcome by the instant invention.

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 maintain 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 and 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 arrangement is employed which provides for varying the stress exerted upon the spring means to accord with the degree of winding or unwinding thereof. It is a further object to provide generally improved means for adjusting the initial spring tension and degree of leverage exerted thereon.

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, partly in section and also showing the carrier platform under load in broken lines;

FIGURE 2 is a fragmentary side elevational view of the upper portion of the self-leveling device depicted in FIGURE 1;

FIGURE 3 is a fragmentary plan view of the form of the invention depicted in FIGURE 1;

FIGURE 4 is a fragmentary side elevational view taken on line 4—4 of FIGURE 3, showing one of the carriage assemblies employed in said form of the invention, said carriage assembly being shown partly in section and being in operative association with one of the upright frame assemblies provided in said form of the invention;

FIGURE 5 is a cross-sectional view taken about the line 5—5 of FIGURE 1;

FIGURE 6 is a fragmentary side elevational view of one of the carriage assemblies employed in said form of the invention, said view being similar to that depicted in FIGURE 4 but showing the spring member employed in connection with said carriage assembly wound to a position wherein the spring exerts a substantially greater torque than it does from the position depicted in FIGURE 4;

FIGURE 7 is a cross-sectional view taken about the line 7—7 of FIGURE 5; and

FIGURE 8 is a perspective view of a clamping device utilized in the present invention.

A self-leveling, receiving, storing and dispensing device embodying the features of the instant invention is illustrated in FIGURE 1 of the accompanying drawing. As may be seen from said figure, the device comprises a wheel-mounted base assembly, designated generally by the numeral **10**, which supports an upright frame assembly, designated generally by the numeral **11**. A carrier assembly, designated generally by the numeral **12** and disposed forwardly of the upright frame assembly, receives, stores and dispenses the desired articles and is mounted for vertical movement on the upright frame assembly **11**. Articles, such as dish rack for example, are stacked upon the carrier platform **12***a* of the carrier assembly and with the placement of each successive rack thereon, the stack is depressed or lowered so that the uppermost article in the stack is always at the same working level. Conversely, as each article is successively removed from the stack, the entire remaining stack is elevated so that the next succeeding article is brought up to the desired working level.

The base assembly **10** in the form of the invention illustrated comprises a generally rectangular frame **13** which is advantageously formed of angle members of steel, aluminum or other suitable material. The frame is further provided with casters **14**, which are mounted adjacent the corners of the base. By forming the base in the manner indicated, it is possible to make use of this portion of the device for further storage of used racks for example. Thus, as a rack is removed from the stack upon the carrier platform the carrier is elevated as a consequence of such removal, a used rack may be disposed upon the frame assembly in the space thus formed.

The upright frame assembly **11** is mounted upon the

wheeled base 10 and comprises a pair of vertical trackways 15 and 16, disposed on the opposing sides of the base frame 13. Each of trackways 15 and 16 comprises guide rails 17 having flange portions 18 and head portions 19. On each side of the base assembly an inclined brace member 20 extends from the base to the upper portion of the guide rails, thereby supporting the said trackways.

Each of the guide rails receives a vertically movable carriage assembly which supports an important feature of this invention residing in the means for presetting a spring drum so as to provide a predetermined resistance to variation in the level of the carrier platform 12*a*.

Thus, as may be seen by references to FIGURES 1 to 5, the upright frame assembly houses a pair of rectangular carriage plates 21 which mount a transverse hollow drum 22 therebetween. Each plate 21 mounts a ball bearing 24 which rotatably secures a shaft 25. Intermediate of said bearings 24 are provided a pair of flanged collars, generally designated by the numerals 26, 27, the bodies 28 of said collars 26, 27 being formed with grooves 29 to receive a coiled torsion spring 30. One of the collars 26 is secured to the drum 22 by a press fit and additionally may be staked thereto. The other of said collars 27 is rotatable with respect to the drum. The shaft 25 is rotatable relative to collar 26 but collar 27 is press fit to shaft 25 and is secured thereto by a pin 31. The ends of the aforesaid coiled torsion spring 30 are also suitably affixed to the collars so that any rotation of the collar 26 with respect to the shaft 25 imparts a set or corresponding resistance to any opposing rotation which may be exerted upon the shaft 25.

Drum 22 is mounted on the fixed housings 24*a* of ball bearings 24 by means of clamps 23. As best shown in FIGURE 8, each clamp 23 has a circular mounting portion 60, separated from the remainder of the clamp by a peripheral slot 62 and a clamping portion 64 provided with the companion clamping arms 66—66. The mounting portion 60 is provided on its upper inner surface with a projection 68. Each clamp 23 is mounted on its associated bearing housing 24*a* by means of the mounting portion 60, slot 62 defining cooperating tabs 70—70 which are urged together for this purpose. The opposite ends of drum 22 are received in the clamping portions 64, the clamping arms 66—66 being spread apart to facilitate the insertion of the drum and then being secured together by a bolt 72 passing through the arm apertures 74 and retained in position by a nut 76.

The rotation of the collar 26 with respect to the shaft 25 may be accomplished by loosening the nuts 76 on bolts 72 in each clamp 23 sufficiently for manual rotation of the drum so as to rotate the collar 26 which rotates therewith. After the drum has been rotated to provide the desired stress or torque to spring 30, clamping arms 66 associated with collar 26 are clamped together by tightening nut 76, the procedure then being repeated to clamp arms 66 associated with collar 27.

It will be noted from the foregoing arrangement that the coiled torsion spring 30 may be rotated with respect to the shaft 25 by simply loosening clamp arms 66 of both clamps 23 and the drum 22 so that it will be displaced from an initial position thereof. As a result of such rotation, it is possible to produce any desired amount of torsion in the spring 30, maintaining the drum in adjusted position by tightening nuts 76.

The shaft is provided with a pair of opposing flanged pulleys 37 secured to the ends of the shaft by suitable fastening elements such as transverse pins 38, the pulleys 37 being provided with two pair of outer and inner cover plates 39, 40 secured by suitable bolts 90 to the opposing guide rails 17.

The external periphery of each of the pulleys 37 receives a flexible member, such as a flexible band 46, which is secured to said pulley, as by a suitable pin or key 37*a* engaged with a portion of said band within

an open notch 37*b* provided in each of the pulleys 37, the key passing through diametrical openings 37*c* provided in the hollow shaft 25. More specifically, it will be noted that the band is reflexed into a U-shaped portion at the free end thereof by means of the pin 37*a* extending through the shaft openings 37*c*. As a result, the U-shaped band portion is wedged into position in the shaft by the pin but may be readily released from the shaft by withdrawing the pin therefrom. The carriage plates 21 are supported within the vertical trackways 15, 16 and since said plates are affixed to the carrier assembly, as by bolts 47, the said carrier assembly is also supported between said trackways.

It will be seen from this arrangement that the coiled spring 30 may be initially deflected to any desired extent by rotation of the drum 22. Such deflection of the torsion spring 30 together with any corresponding tension of the band 46 will vary the lifting force applied to the carrier platform to accommodate items of different weights.

The position of each of the bands 46 with respect to the center of each pulley 37 may be varied by the following described mechanism. Thus, the outer and inner cover plates 39, 40 are provided with arcuate extensions 39*a*, 40*a* disposed rearwardly of the upright frame assembly 11. A reel 41 is disposed between each pair of cover plates 39, 40, the said reel 41 being secured to a shaft 42 extending through the cover plates 39, 40. A generally U-shaped handle 43, including a pair of substantially parallel arms 44 and an intermediate connecting member 45, is disposed between the opposing inner cover plates 40, the said arms 44 being secured, as by welding to the shafts 42. Said handle 43 may be manually engaged to permit movement of the self-leveling device as a whole, as by pushing, for example, and may also be used for winding of the band 46 and unwinding thereof from the pulleys 37 in the manner hereafter described. The aforesaid band 46 is disposed upon the reel 41 and secured thereto as by a pin or key 50 engaged with a portion of said tape disposed in an open notch 51 provided in said reel 41. The said tape 46 is wound upon each reel 41 by rotating the handle 43, as, for example, in the direction indicated by the arrow 80 shown in FIGURE 3, thereby causing said handle to occupy extreme positions. At the same time, said band is correspondingly unwound from the pulleys 37. An adjustable guide means 82 is provided for each band 46 between each pulley 37 and associated reel 41. Said guide comprises a roller 83 provided on an adjustable mount 84 which is vertically adjustable by means of a screw 85 passing through the tines of a fork 86 provided thereon.

It will be observed that when the handle 43 is not being employed for the winding of the reel 41, as aforesaid, it may be locked in its extreme rearward position shown in solid lines in FIGURE 3, by means of a pair of transverse screws 52, which project through the arcuate extensions 39*a*, 40*a* of the outer and inner cover plates 39, 40, the said arcuate extensions being maintained in spaced relation with respect to each other by a collar 53 disposed intermediately of each pair of said extensions, the said arcuate extensions 40*a* of the inner cover plates 40 also being maintained in spaced relation with respect to offset portions 54 of the arms 44 by a collar 55 disposed between said arcuate extensions 40*a* and said offset portions 54 of the arms 44. The screws 52 are threadedly engaged with the handle 43 when it is locked against rotation, but may be removed to permit the rotation of the handle and winding of the band 46 upon the reels 41 to any desired extent.

In this way, the moment arm of the band 46 with respect to the axis of each of the pulleys 37 may be preset as desired.

With this arrangement, any given weight placed upon the platform of the carrier assembly will accomplish a corresponding deflection of the band and of the carriage

plate and carrier assembly, as, for example, to the position depicted in broken lines in FIGURE 1 and designated by the numerals 12*b* and 21*b*, the amount of such deflection being determined by the moment arm of said band with respect to the axis of the shaft **37** and the present torsion of the coiled spring **30**. In this connection, it will be particularly noted that the moment arm of the band will shorten as the carrier platform descends and the counter-pull of the spring increases and the said moment arm will lengthen as the carrier platform rises and the counter-pull of the spring decreases.

It will also be noted that in the upper and lower portions of the carriage plate **21** in each trackway, carriage rollers **48** are mounted, each of said rollers being provided with suitable flanged portion for engagement with the trackways. As may be seen in FIGURES 1 and 6, the band contacts the periphery of the pulley at a point which is offset with respect to the vertical axis of the carriage plate, thereby canting the carriage roller into contact with the head portions **19** of the guide rails **17**.

The carriage rollers may be suitably mounted upon the carriage plate by a conventional shaft and nut assembly **49**, said mounting permitting rotational movement of the carriage rollers.

With this arrangement, the carrier platform may receive a plurality of articles of equal weights, such as dish racks, the uppermost of said racks being maintained at a predetermined level. When the stacks are composed of a different weight, the level thereof may be adjusted by appropriate setting of the spring drum in conjunction with positioning of the moment arm of the band **46** with respect to the axis of each of the pulleys **37**. It will be seen that such adjustment is easily, quickly and conveniently accomplished, and does not require the employment of specialized spring elements, the coiled torsion spring within the spring drum being of conventional design. Moreover, a definite positioning of the carrier platform is accomplished without the necessity of using a delicate or unduly complex mechanism.

It will also be observed that the arcuate extensions **39***a* of the outer cover plates **39** are provided with at least one vertical slot **56** extending radially of the reel **41** adjacent to each of said arcuate extensions **39***a*, thereby permitting easy observation of the flexible band **46** disposed thereon. The slot **56** is also provided with a series of linear graduations **57** adjacent to that portion of the band **46** which is wound upon the reel **41**, each of said graduations **57** being spaced from the adjacent of said graduations at a distance equal to one or more thicknesses of the band **46**, thereby permitting determination of the number of windings of said band **46** upon the reel **41** when the outermost of said windings is gauged against said linear graduations. In this way, the setting of the reel **41** is easily determined, said setting in turn determining the moment arm of the band with respect to the axis of the pulley **37**.

In order to accomplish the initial setting of band **46** upon reels **41**, drum **22** is first released for rotation free of the action of torsion spring **30**. This release of drum **22** for free rotation is accomplished by loosening nuts **76** to allow for the separation of the preferably resilient clamping arms **66** in each clamp **23**. The restraint upon one end of the spring is thus removed and shaft **25** and pulleys **37** are freed from the biasing action of the spring and consequently the entire carrier assembly **12** drops to the base **10** under its own weight. The position of each of the bands with respect to the center of each of pulleys **37** may then be adjusted as desired by means of handle **43** which winds the bands on reels **41**. When the lever arm has thus been adjusted to the desired point, clamp arms **66** in each clamp **23** are tightened. This restores the operative connection between shaft **25** and drum **22** through the torsion spring. By continuing the operation of handle **43**, the torsion spring is wound as the bands are additionally reeled up. The carrier assembly thus rises under the increased tension of the spring. With the carrier assembly thus elevated, handle **43** is locked in fixed position in the manner heretofore indicated. The torsion spring may then be adjusted to any desired degree of tension by loosening clamps **23**, rotating drum **22** and tightening the clamps in the manner heretofore indicated.

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. In a self-leveling device comprising, a base member, an upright frame supported by said base member, vertically movable carriage means retained within said frame, a platform supported by said carriage means for the receipt of articles thereon, rotatable means associated with said upright frame, carriage supporting carrier means disposed upon said frame, a rotatable shaft housed within said carriage supporting carrier means, a pulley affixed to said rotatable shaft, a flexible band supporting said carriage, said band communicating between said rotatable means and said pulley, a coiled torsion spring disposed on said shaft to bias the latter and drum means in which said shaft is mounted for rotation, that improvement which comprises means including said spring for effecting an operative connection between said shaft and said drum means, means mounting said drum means for rotation relative to said shaft for imparting an initial deflection to said spring, and means for releasably clamping said drum means in a rotatably adjusted position thereof for retaining said initial deflection of said spring.

2. A self-leveling device as in claim 1, said clamping means comprising a pair of clamps mounted in laterally spaced relation by said carriage supporting carrier means, each of said clamps having a releasable clamping portion in which an adjacent end of said drum is clamped.

3. A self-leveling device as in claim 1, said clamping means comprising a pair of clamps mounted in laterally spaced relation by said carriage supporting carrier means, each of said clamps having a releasable clamping portion in which an adjacent end of said drum is clamped, said carriage supporting carrier means having a pair of laterally spaced rotary bearing means for said shaft, said clamps being mounted by said bearing means.

4. A self-leveling device as in claim 1, said clamping means comprising a pair of clamps mounted in laterally spaced relation by said carriage supporting carrier means, each of said clamps having a releasable clamping portion in which an adjacent end of said drum is clamped, said carriage supporting carrier means having a pair of laterally spaced rotary bearing means for said shaft, said clamps being mounted by said bearing means, said clamps each having a mounting portion separated from the clamping portion thereof by a peripheral slot which defines companion mounting tabs.

5. A self-leveling device as in claim 1, said clamping means comprising a pair of clamps mounted in laterally spaced relation by said carriage supporting carrier means, each of said clamps having a releasable clamping portion in which an adjacent end of said drum is clamped, said carriage supporting carrier means having a pair of laterally spaced rotary bearing means for said shaft, said clamps being mounted by said bearing means, said clamps each having a mounting portion separated from the clamping portion thereof by a peripheral slot which defines companion mounting tabs, and said clamping portion having a pair of cooperating clamping arms in which the adjacent end of the drum is received and means to releasably clamp said arms together.

6. A self-leveling device as in claim 1, said operative connection comprising a collar to which one end of said spring is secured, said collar being secured to said drum, said shaft extending through said collar and being rotatable relative thereto.

7. A self-leveling device as in claim 1, said operative connection comprising a collar to which one end of said spring is secured, said collar being secured to said drum, said shaft extending through said collar and being rotatable relative thereto, and a second collar to which the other end of said spring is secured, said second collar being fixed to said shaft and rotatable relative to said drum.

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