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

The object of the present invention is 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.

This invention also has for its object the provision of a device of the character indicated wherein supporting 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 conjunction 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 3; 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 12c of the carrier assembly and with the placement of each successive rack thereto, 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 slanting portions 18 and bend 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 12a.

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 collars 26 and 27 being formed in the 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 collar 27 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 24a 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 24a 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 arms 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 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 37a engaged with a portion of said band within an open notch 57 provided in each of the pulleys 37, the key passing through diametrical openings 57c provided in the hollow shaft 25. More specifically, it will also be noted that the band 46 is disposed into a U-shaped portion at the free end thereof by means of the pin 37a extending through the shaft openings 37c. 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.

Carriage plates 41 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 28 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 39a, 40a disposed rearwardly of the upright frame assembly 11. Said outer and inner 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 said band 46 is disposed upon the reel 41 and secured thereto 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 an associated groove 84, said guide means 82 being 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 39a, 40a 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 immediately of each pair of said extensions, the said arcuate extensions 40a 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 40a and said offset portion 54 of the arms 44. The screws 52 are threadedly engaged with the handle 43 and are 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 126 and 216, the amount of such deflection being determined by the indicated. The torsion spring is wound 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 any desired position. When a determined lever component 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 of the outer cover plates 30 are provided with at least one vertical slot 56 extending radially of the real 41 adjacent to each of said arcuate extensions 39, thereby permitting easy observation of the flexible band 46 disposed therein. 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 real 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 40 upon the real 41 when the outermost of said windings is gauged against said linear graduations. In this way, the setting of the real 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 23 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 thereby 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 18 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 is withdrawn from the biasing action of the spring 30.

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 as

seemly 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 is wound 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.

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In order to accomplish the initial setting of band 46 upon reels 41, drum 23 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 thereby 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 18 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 is withdrawn from the biasing action of the spring 30. 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 as
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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