March 3, 1964 I. BRONSON 3,123,023

SELF-LEVELING DEVICE

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FIG. 1

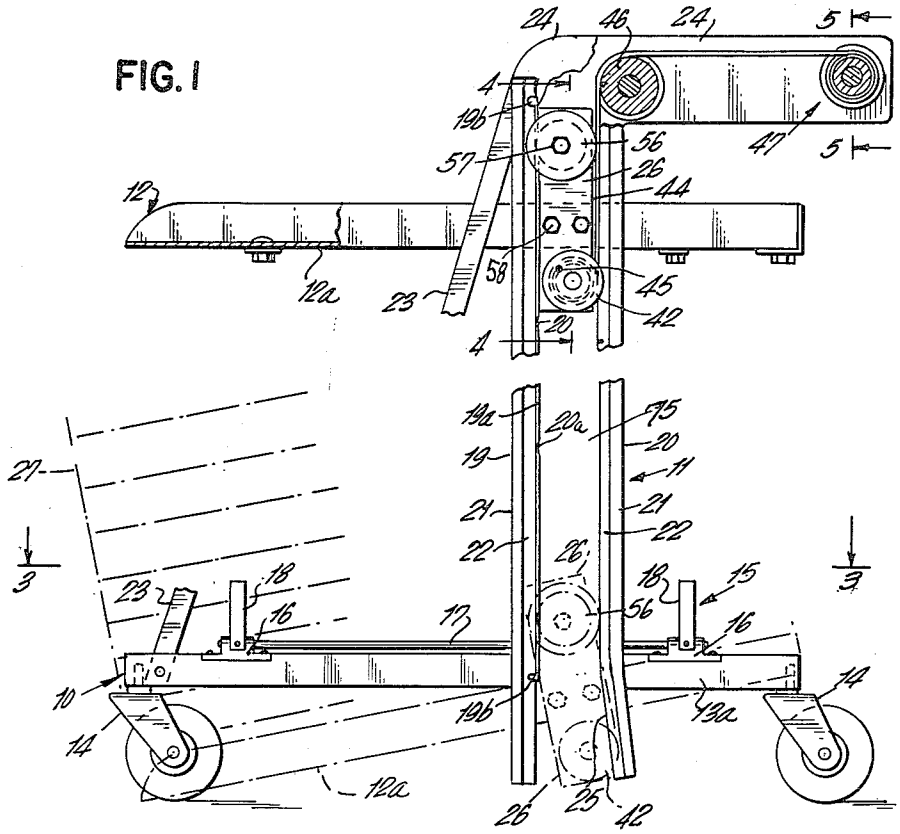
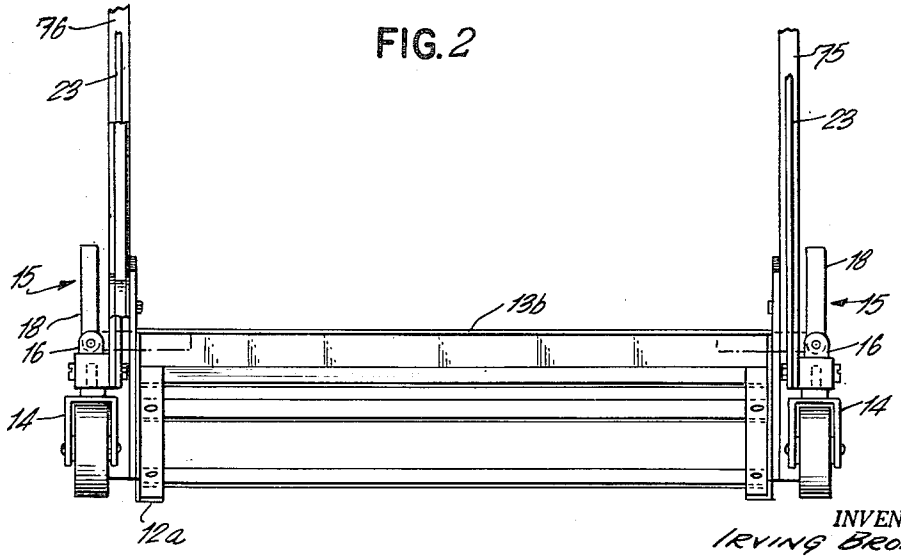


FIG. 2



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FIG. 3

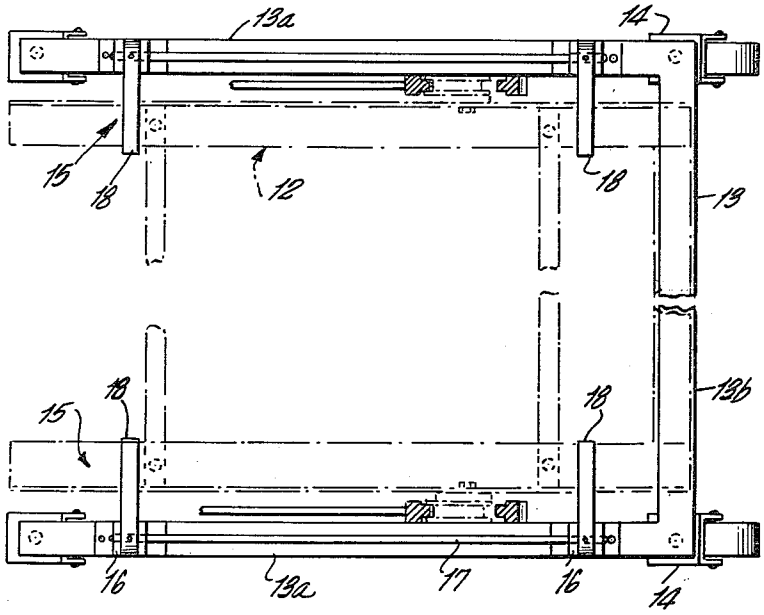
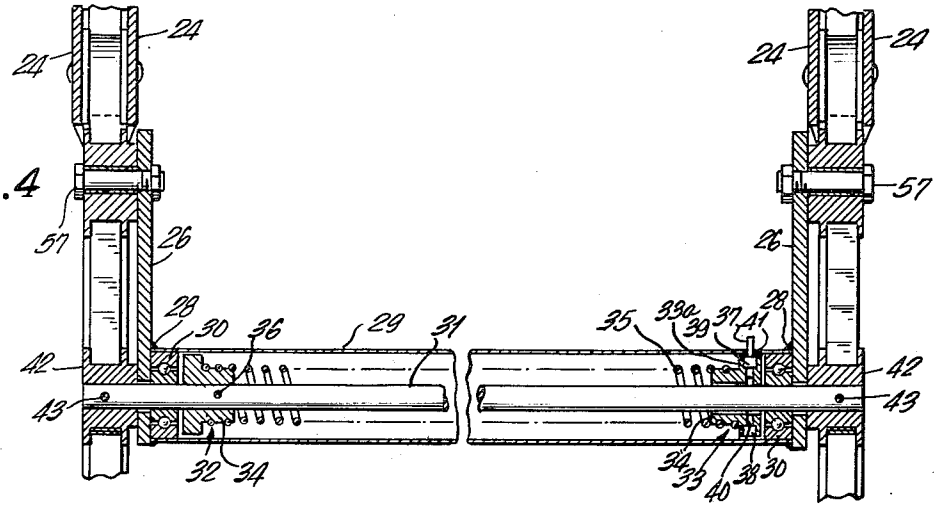


FIG. 4



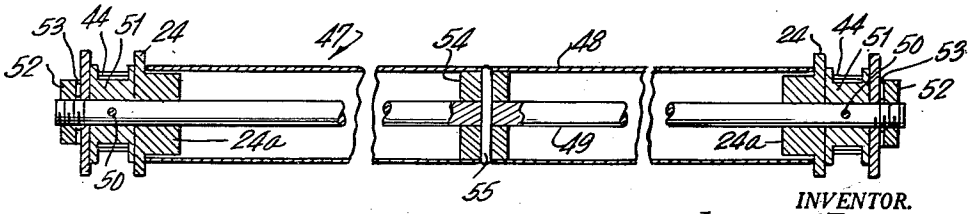


FIG. 5

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SELF-LEVELING DEVICE

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8 Claims. (Cl. 108—136)

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

The subject matter of this application is related to my copending applications Serial No. 49,856 and Serial No. 49,857, both filed simultaneously herewith.

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 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 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.

Another object of the invention is to provide a device of the character indicated with improved means for unloading articles stacked thereon.

An additional object of this invention is to provide an arrangement wherein a stack elevating spring arrangement is employed which provides for varying the leverage exerted upon the spring means to accord with the degree of winding or unwinding thereof. It is a further object to provide 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 in broken lines the unloading position of the carrier platform;

FIGURE 2 is a fragmentary end view of the self-leveling device depicted in FIGURE 1;

FIGURE 3 is a cross-sectional view taken about the line 3—3 of FIGURE 1;

FIGURE 4 is a cross-sectional view taken about the line 4—4 of FIGURE 1; and

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

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, receives, stores and dispenses the desired articles and is mounted for vertical movement on the upright frame assembly 11. Articles, such as dish racks 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 U-shaped frame 13 including two parallel elements 13*a* and an intermediate connecting element 13*b*, said elements being formed of angle members of steel, aluminum or other suitable material. The base assembly further includes a pair of supports, generally designated by the numeral 15, and oppositely disposed upon the aforesaid parallel elements 13*a*. Each of these supports includes a pair of brackets 16 secured, as by bolts, to the parallel elements 13*a* and being aligned to maintain rotatably a shaft 17. Within a generally U-shaped guide portion of each pair of the brackets parallel cantilever members 18 are secured to the said shaft 17 so as to be pivotable between upright and horizontal positions. The base assembly is also provided with casters 14, which are mounted adjacent the corners of the base assembly. By forming the base assembly 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 new rack is removed from the stack upon the carrier platform which is elevated as a consequence of such removal, a used rack may be disposed upon the cantilever members 18 when they are disposed in their horizontal positions.

The upright frame assembly 11 is mounted upon the wheeled base 10 and comprises a pair of vertical trackways 75 and 76, disposed on the opposing sides of the frame 13. Each of trackways 75 and 76 comprises two spaced-apart guide rails 19 and 20 each having a flange portion 21 and a head portion 22. As will be more particularly seen from FIGURE 1, the head portion of the guide rail 19 is advantageously provided with an insert 19*a* having a plurality of vertically spaced arcuate indentations 20*a* which serve as positioning detents for the carriage rollers, as will be more particularly apparent hereafter. Furthermore, it should be noted that the insert 19*a* is removably secured to the rail head as by flanges 19*b* formed on the ends of said insert and received within suitable slots provided in the rail head 19, thereby enabling the

insert to be removed and replaced as required due to wear, or for the purpose of substituting an insert having differently spaced indentations. On each side of the base assembly an inclined brace member 23 extends from the base to the upper portion of the guide rails.

The guide rails on each side of the frame 13 are advantageously formed to facilitate the unloading of articles held in stacked relation upon the carrier platform. Thus, as may be seen in FIGURE 1, one of the guide rails 19 is a substantially straight member extending from below the frame 13 into supporting contact with a pair of horizontally disposed rearwardly extending bracket plates 24 whose function will be hereinafter more fully set forth. The other of the guide rails 20 is provided with an offset portion 25 at its lower end, the remainder of the guide rail being substantially parallel to the guide rail 19 and also extending into supporting contact with the bracket plates 24.

The platform 12*a* is supported by a pair of movable carriage assemblies which are disposed within each of the trackways. As will be hereinafter noted in detail, the carriage assemblies are provided with a pair of rectangular carriage plates 26 which are confined to substantially vertical movement in the upper portion of each of the trackways. However, at the lower end of each trackway, the offset portion 25 permits the carriage plates to be inclined, as to the position depicted in broken lines in FIGURE 1, and since the platform 12*a* is supported by the carriage assemblies at a right angle thereto, it follows that the aforesaid inclination of the carriage plates will produce a corresponding inclination of the platform to the position thereof depicted in broken lines in FIGURE 1 and in full lines in FIGURE 2. In this position, it will be seen that any articles, such as the racks 27 depicted in broken lines in FIGURE 1, which are supported in stacked relation upon the platform, may be easily and quickly unloaded, as by sliding them off the said platform. Thus, no special unloading equipment is required and the necessity of lifting such articles from the platform is eliminated.

It will be noted that to accomplish such inclination of the platform, the cantilever members 18 must be rotated to an upright position, thereby removing them from the path of the platform. Absent such rotation of the cantilever members 18, they serve as a guard to prevent any accidental disposition of the carriage plates to the lower ends of the trackways and any undesired unloading of the platform which may be consequent upon such accidental disposition of the carriage plates.

Each of the vertically movable carriage assemblies 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 reference to FIGURE 4, the upright frame assembly houses a pair of rectangular carriage plates 26 which are rigidly secured, as by welding 28, to a transverse hollow drum 29. At each end of this drum, there is housed a ball bearing 30 which rotatably secures a shaft 31. Intermediate of said bearings 30 are provided a pair of flanged collars, generally designated by the numerals 32, 33, the bodies 34 of said collars 32, 33 being formed with grooves to receive a coiled torsion spring 35. One of the collars 32 is secured to the shaft 31 by a radially disposed pin 36 and the other of said collars 33 is rotatable with respect to the shaft 31. The ends of the aforesaid coiled torsion spring 35 are also affixed to the collars so that any rotation of the collar 33 with respect to the shaft 31 imparts a set or corresponding resistance of the spring 35 to any opposing torque which may be exerted upon the shaft 31.

The rotation of the collar 33 with respect to the shaft 31 may be accomplished by means of a detent or pin 37 which is removably receivable within a plurality of equally spaced-apart radial apertures 38 formed in the

flanged portion 33*a* of said collar 33, the said detent or pin 37 being provided with an expanded annular portion 39 which is seatable upon annular shoulders 40 formed in each of said radial apertures 38. The said pin 37 is also slidably received in a slot 41 formed in the hollow drum 29.

It will be noted from the foregoing arrangement that the coiled torsion spring 35 may be rotated with respect to the shaft 31 by simply rotating the detent or pin 37 so that it will be displaced from an initial position at one end of the slot 41 to the other end thereof. Upon such rotation, another of the said radial apertures 38 is aligned with that end of the slot which was occupied by the detent or pin 37 prior to its aforesaid rotation. To maintain this position, another of said pins 37 may be inserted in said last-mentioned aperture so as to be biased against the edge of the slot by the force of the torsion spring. Further rotation of the collar 33 with respect to the shaft 31 may also be accomplished in a similar manner so as to align successively any of the apertures 38 with the ends of the slot 41 and produce any desired amount of torsion in the spring 35.

The shaft is also received within a pair of opposing flanged pulleys 42 secured to the shaft by a suitable fastening element such as transverse pins 43. The pulleys 42 are rotatably contactable with the carriage plates 26, and bear on tracks 20 to resist counter-clockwise moment on the carriage.

The external periphery of each of the pulleys 48 receives a flexible member, such as a flexible band 44, which is wound upon and secured to said pulley, as by a suitable pin 45, the other end of said band passing over an idler pulley 46 mounted between each pair of bracket plates 24, said band also being secured to a flanged pulley upon a biasing drum, generally designated by the numeral 47. As may be seen by reference to FIGURE 5, the biasing drum comprises a tube 48 and a shaft 49 received within said tube 48. The shaft 49 extends through plugs 24*a* abutting one member of each pair of bracket plates 24 disposed at each end of the tube, the said shaft 49 also being affixed, as by a transverse pin 50 to a pair of flanged pulleys 51 disposed within the bracket plates 24. Each end of the shaft 49 is threadedly engaged with a nut 52 seated upon a washer 53 abuttable against one of the bracket plates 24. The shaft 49 is also affixed to a transverse member 54 secured within the tube 48. A transverse aperture 55 extends through the tube 48, transverse member 54 and shaft 49, so as to be capable of receiving a turning rod or lever (not shown), whereby the tube 48 and pulleys 51 affixed thereto may be rotated upon rotation of said turning rod or lever. In any position to which said shaft and pulleys are thus rotated, they may be retained by tightening of the nuts 52 and washers 53 so as to cause the bracket plates to abut against the pulleys 51. In this way, the flexible bands 44 may be secured upon the flanged pulleys 51 of the biasing drum so as to determine the initial length of the moment arms of said bands 44 with respect to the axis of the shaft 31. In this manner, also, the carriage plates are supported within the vertical trackways 75, 76 and since said plates are affixed to the carrier assembly, as by bolts 58, the said carrier assembly is also supported between said trackways.

It will be seen from this arrangement that the coiled spring 35 may be initially deflected to any desired extent by rotation of the detent or pin 37. Such deflection of the torsion spring 35 together with the corresponding counter-pull of the band 44 will vary the lifting force applied to the carrier platform to accommodate items of different weights.

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, the amount of such deflection being determined by the moment arm of said band with respect to the axis of the shaft 31 and the preset torsion

of the coiled spring 35. In this connection, it will be particularly noted that the moment arm of the band will shorten as the carried 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 portion of the carriage plate 26 in each trackway, a carriage roller 56 is mounted, each of said rollers being provided with suitable flanged portion for engagement with the trackways. As may be seen in FIGURE 1, the band contacts the periphery of the pulley 42 at a point which is offset with respect to the vertical axis of the carriage plate and roller, thereby canting the carriage roller into contact with the insert disposed upon the forward portion of the guide rail, the cylindrical body portion of said carriage roller being receivable within the vertically spaced arcuate indentations 20*a*.

The carriage roller may be suitably mounted upon the carriage plate by a conventional shaft and nut assembly 57, said mounting permitting rotational movement of the carriage roller.

As previously noted, the arcuate indentations 20*a* serve as positioning detents for carriage rollers. Thus, when the carriage assembly has been lowered by a weight imposed upon the carriage platform to a position wherein said rollers are in the approximate vicinity of the centers of said arcuate indentations—i.e., where the rollers make contact with any portion of said indentations, the rollers tend to be forced to the center of said indentations by the canting action of the band, as aforesaid. In this way, the level carriage assembly, and hence of the carrier platform, will tend to be definitely determined at positions corresponding with the arcuate indentations.

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. 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.

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. An improved self-leveling device comprising in combination a base member supporting an upright frame communicating with a housing means, a vertically movable carriage associated with said frame, said carriage supporting carrier means, said carriage being supported by a flexible member communicating between adjustable means secured within the housing means and a torsion spring means associated with said carriage, means for imparting an initial set to said spring means, said spring means including a spring biased shaft, and said adjustable means being operable to adjust the initial moment of said flexible member relative to said shaft, whereby the topmost portions of articles disposed on said carrier means are maintained at a constant level independently of the number of such articles.

2. An improved self-leveling device comprising in combination a base member supporting an upright frame provided with a plurality of bracket plates, a vertically movable carriage retained within said frame, said carriage supporting a platform adapted for receipt of a plurality of articles, said carriage being supported by at least one flexible band communicating between a biasing drum secured to said bracket plates and a pulley affixed to a rotatable shaft secured within said carriage, said shaft being biased by a coiled torsion spring disposed thereon, said shaft being provided with means for imparting an initial deflection to said coiled torsion spring, and said biasing drum having means to adjust the initial moment arm of said band about the axis of said shaft, whereby the topmost portions of said articles disposed on said platform are maintained at a constant level independently of the number of such articles.

3. An improved self-leveling device comprising in combination a base member supporting an upright frame, a vertically movable carriage retained within said frame, said carriage supporting a platform for receipt of a plurality of articles, said carriage including an elongated plate secured within said frame and provided with a roller, the said roller being in rollable contact with a plurality of arcuate indentations provided upon said frame, said elongated plate being supported by a flexible band, extending from biasing means disposed upon a plurality of bracket plates supported by said upright frame, said band canting said roller into contact with the portion of said frame whereon said arcuate indentations are provided, the said arcuate indentations being disposed at a predetermined spaced relation with respect to the platform, said flexible band communicating with pulley means affixed to a rotatable shaft secured within said elongated plate, said shaft being biased by a coiled torsion spring disposed thereon, said shaft being provided with means for imparting an initial deflection to said coiled torsion spring, said biasing means having provision to adjust the initial moment arm of said band about the axis of said shaft, whereby the topmost portions of said articles are maintained at a constant level independently of the number of such articles.

4. An improved self-leveling device as in claim 1, said vertically movable carriage being retained within said frame, said frame being provided with an offset portion, said vertically movable carriage being receivable in said offset portion, said carrier means being a platform for receipt of a plurality of articles of equal weights, the said platform being inclined with respect to said frame when the vertically movable carriage is disposed within said offset portion.

5. A device according to claim 4, the said base member being provided with pivotable means disposable in a first position to underlie said carriage in the path of movement thereof, whereby said pivotable means is contactable with said platform to block entry of said carriage means into said offset portion, the said pivotable means being disposable to a second position out of said path of movement, whereby said pivotable means is withdrawn from contact with said platform to permit entry of said carriage means into said offset portion.

6. A device according to claim 5, the said base member comprising a substantially U-shaped frame including a pair of parallel elements and an intermediate connecting element, said pivotable means including a pair of brackets secured upon each of said parallel elements and aligned to maintain rotatably a shaft journalled therein, each of said brackets housing a cantilever member secured to said shaft, the said shaft being rotatable to said first position to dispose said cantilever elements horizontally, the said shaft also being rotatable to said second position to dispose said cantilever elements in an upright position.

7. An improved self-leveling device comprising in combination a generally U-shaped base member including a pair of parallel elements and a rearwardly disposed intermediate connecting element, said base member being provided with a plurality of casters and supporting a pair of upright trackways disposed upon opposing sides of said

base member, a vertically movable rectangular plate disposed in each of said trackways, said trackways being provided with an offset portion, said rectangular plate being receivable in said offset portion, said rectangular plate supporting at right angles a platform for receipt of a plurality of articles of equal weights, the said platform being disposed between said trackways and being inclinable with respect thereto when the rectangular plate is received within said offset portion, each of the said parallel elements being provided with a pair of brackets aligned to maintain rotatably a shaft journalled therein, each of said brackets housing a cantilever member secured to said shaft, the said shaft being rotatable to dispose said cantilever members in horizontal abutment with one of said parallel elements, whereby the said platform is supportable thereon and the said rectangular plates are restrained against entry into said offset portions of the trackways, the said shaft also being rotatable to dispose said cantilever members in an upright position, whereby the said platform is permitted to assume an inclined position and said rectangular plates are permitted to enter into the said offset portions of the trackways, the upper extremities of each of said trackways being in supporting contact with a pair of rearwardly extending bracket plates, each pair of said bracket plates housing one end of an idler pulley and a biasing drum, each of the said rectangular plates supporting a flanged roller inclinable to contact an insert secured upon a forwardly disposed guide rail provided in each of said trackways, said roller being receivable in arcuate indentations formed in said insert and determining pre-selected positions of the said platform, each of the said rectangular plates also housing the ends of pre-settable spring means including a shaft extending through said rectangular plates and journalled within a pair of pulleys, the said shaft being rotatably mounted in a pair of ball bearings secured within a tubular drum disposed between said rectangular plates, said shaft also being provided with a pair of flanged collars upon which is seated a coiled torsion spring, one of said collars being affixed by means to said shaft, the other of said collars being rotatably secured to said shaft and provided with a plurality of radial apertures, the said apertures being engageable with a removable radial pin abuttable against the ends of a slot formed in the tubular drum, said last-mentioned collar being rotatable by said pin to impart a predetermined deflection to said torsion spring, said spring being securable in the position of such deflection by the abutment against one end of said slot of another radial pin received within another of said apertures, each of said pulleys journalled upon said shaft being provided with a flexible band extending over said idler pulley and supported upon a pulley mounted upon one end of said biasing drum and housed between the said pair of bracket plates, said last-mentioned pulley being journalled upon a shaft extending between said pairs of bracket plates and received within a tubular member, said shaft also extending through a transverse member secured within said tubular member, said tubular member, transverse member and shaft being provided with aligned apertures wherein lever means are receivable to rotate said shaft and the pulleys disposed thereon to any predetermined position, the said pulleys being maintainable in said predetermined position upon the tightening of nuts threadedly engaged with the ends of said shaft whereby the said bracket plates are urged into frictional abutment with said pulleys, the initial moment arm of said band with respect to the pulleys supported by the shaft extending through said rectangular plate being determined by the position of the pulleys of said biasing drum, the said band also cooperating with the said platform to urge said roller into contact with said arcuate indentations, the said band and the center of gravity of said platform being offset with respect to the axis of said pulley.

8. A self-leveling device comprising a platform, means mounting said platform for vertical movement, torsion spring means including a spring biased shaft, pulley means operatively secured to said spring means and rotatably biased thereby, a flexible member supporting said carriage and windable on said pulley means to raise and lower said platform in response to the weight of a load thereon, said torsion spring means being mounted for movement with said platform, and a biasing roller secured against vertical movement on said mounting means, one end of said flexible member being windable on said pulley means and the other end thereof being windable on said biasing roller, and said biasing roller having provision to adjust the initial moment arm of said flexible member about the axis of said shaft.

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