July 8, 1969 B. E. STENTZ 3,454,319

SELF-LEVELING LIFTER

Filed Nov. 3, 1967 Sheet 1 of 4

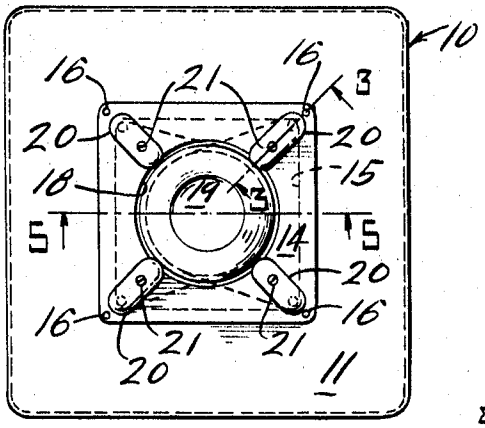


FIG-1-

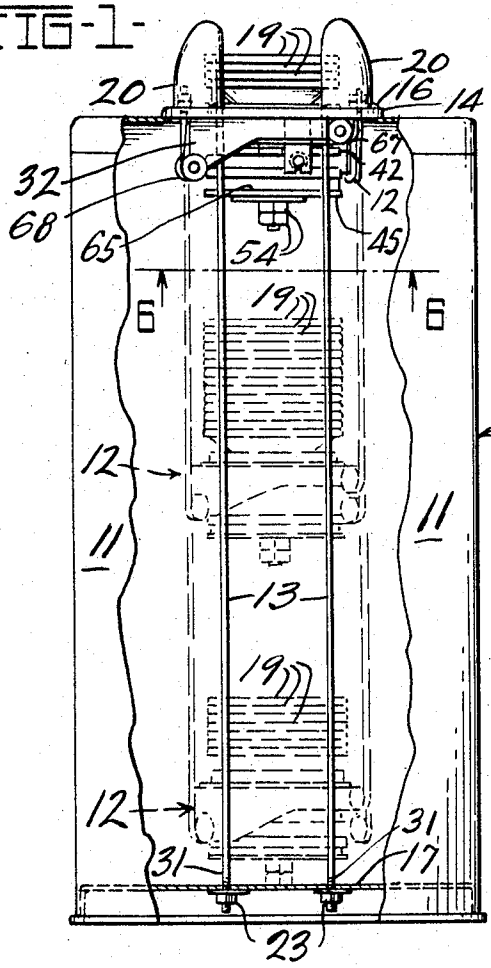


FIG-2-

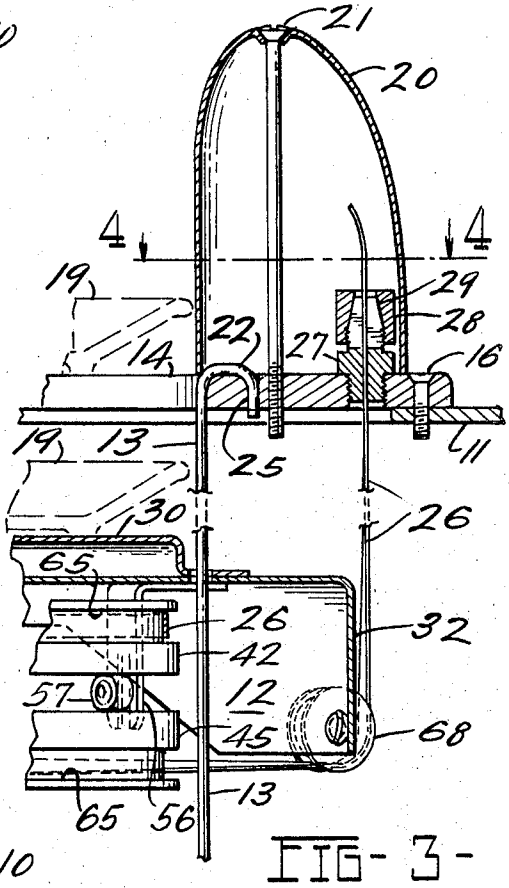


FIG-3-

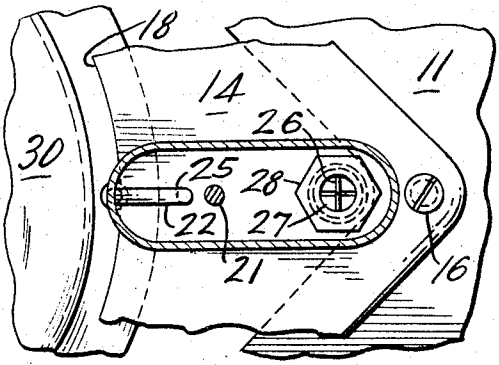


FIG-4-

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SELF-LEVELING LIFTER

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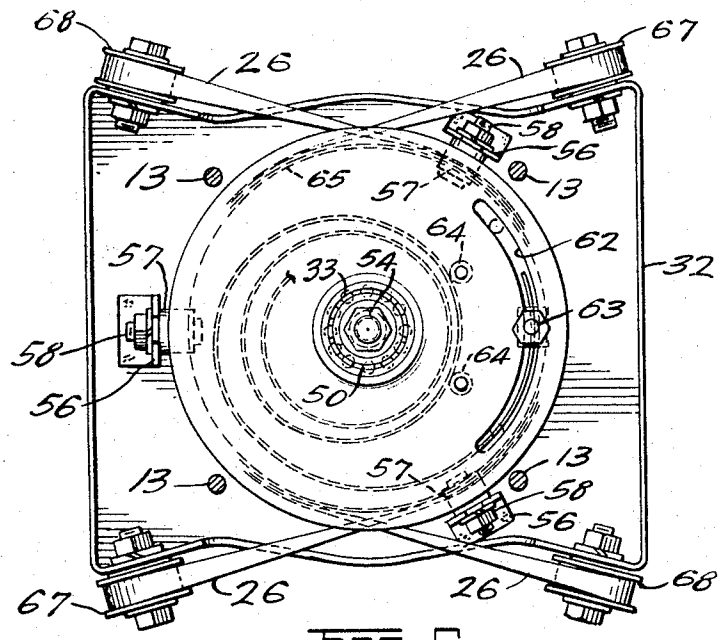


FIG-6-

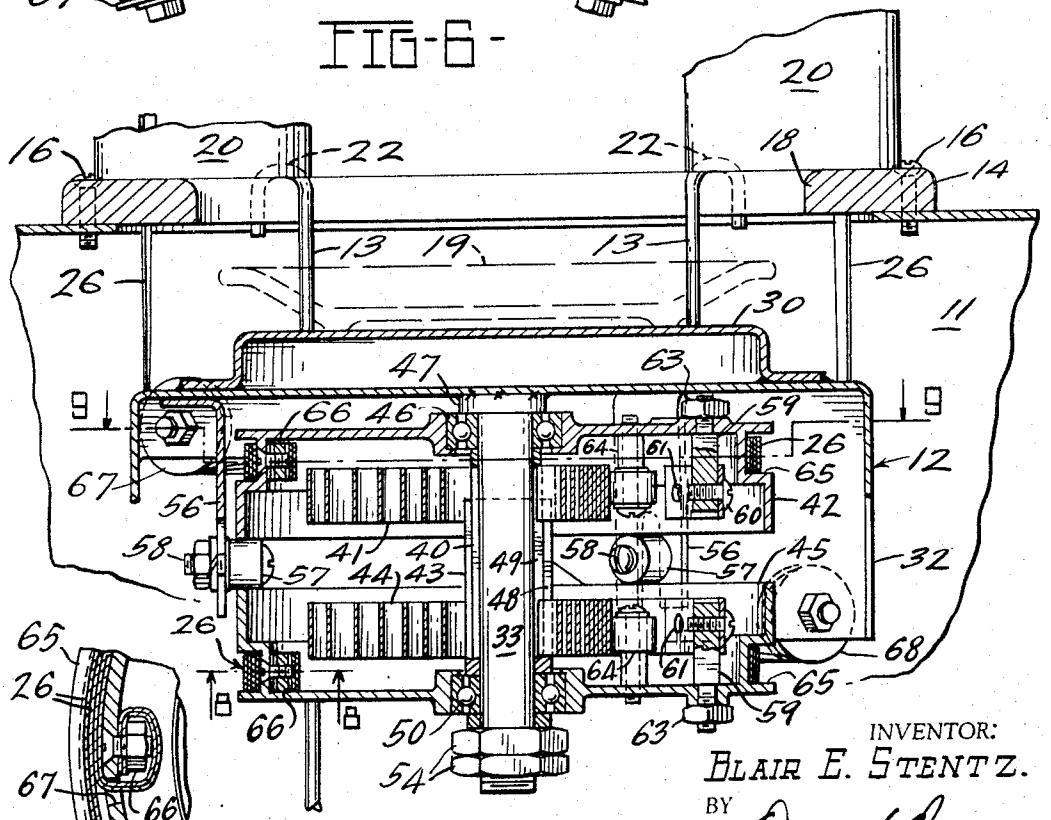


FIG-8-

FIG-5-

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SELF-LEVELING LIFTER

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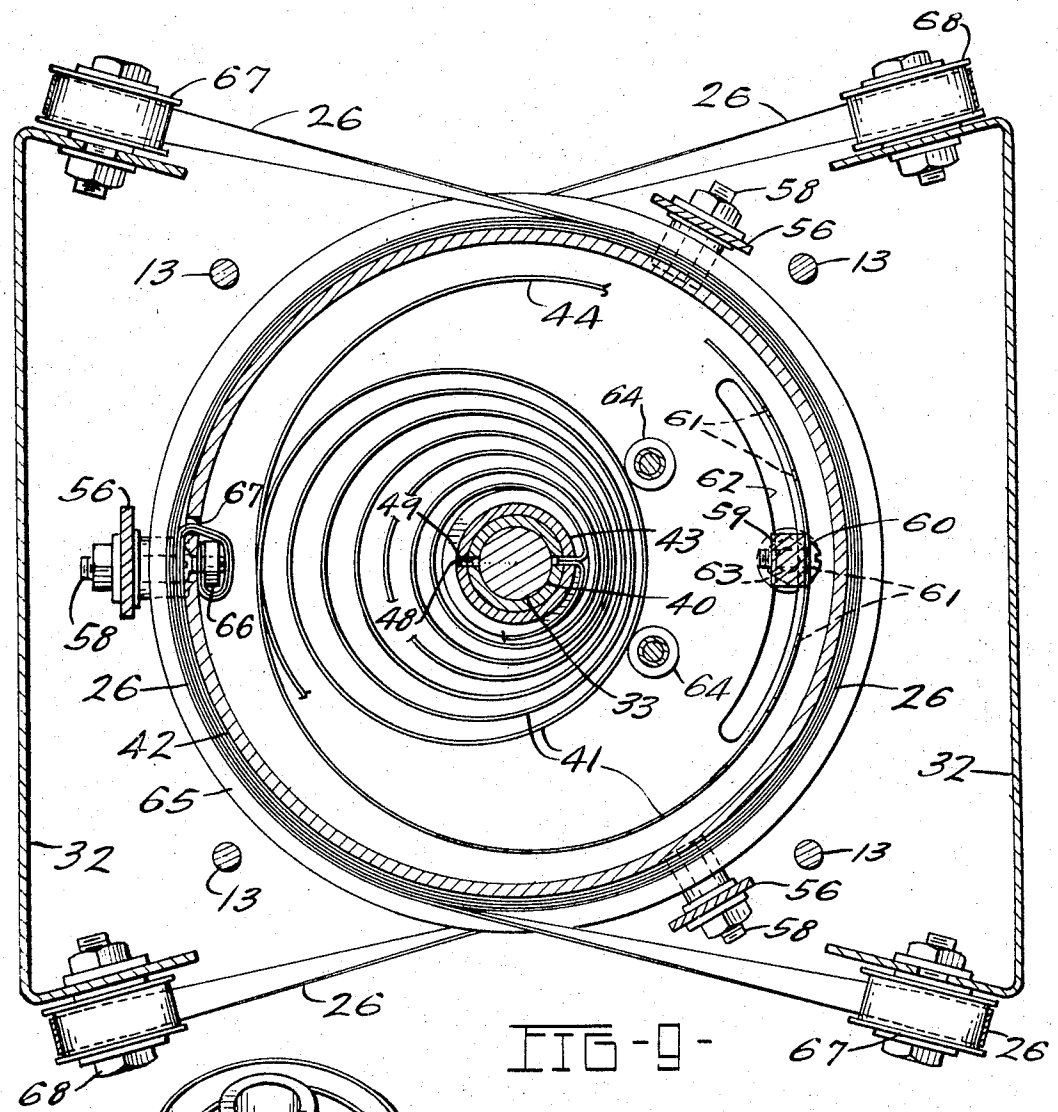


FIG-9-

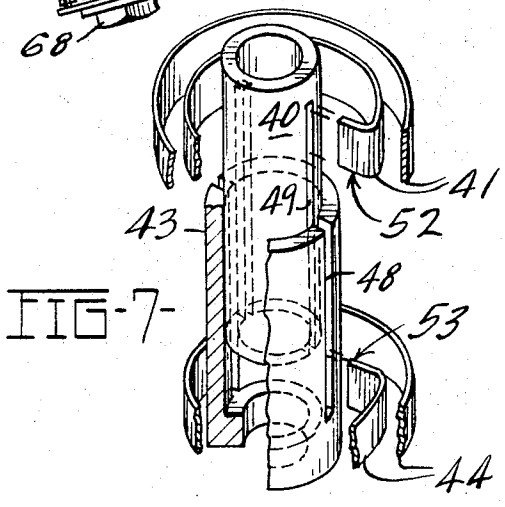


FIG-7-

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SELF-LEVELING LIFTER

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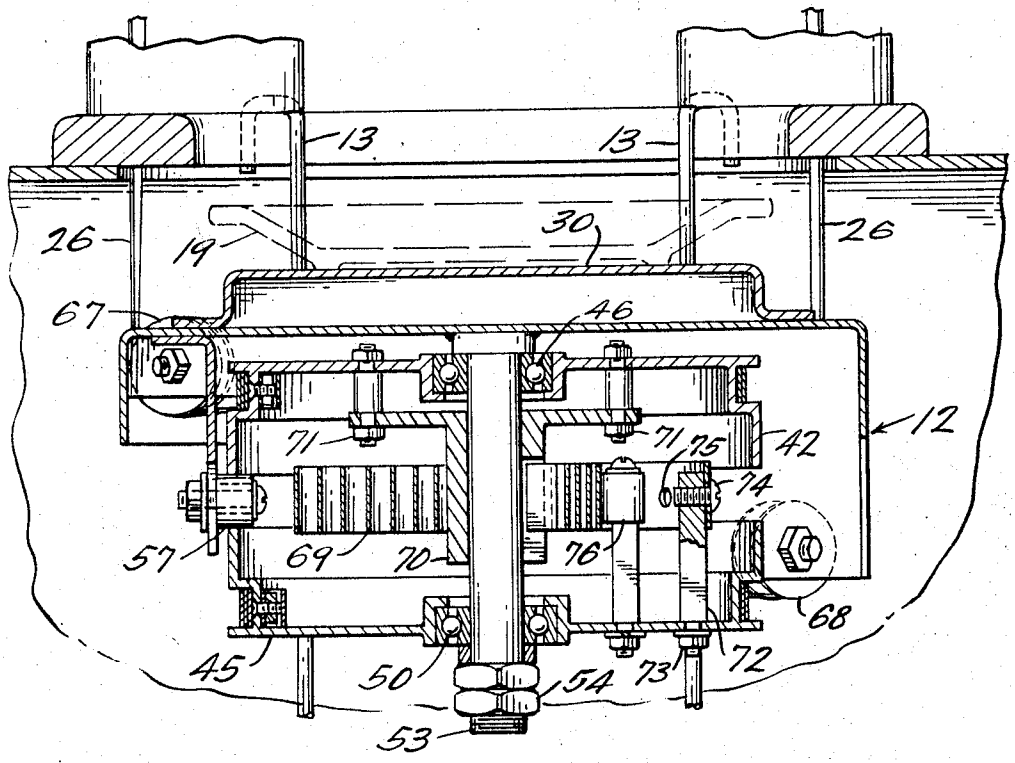


FIG-10-

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United States Patent Office

3,454,319

Patented July 8, 1969

3,454,319

SELF-LEVELING LIFTER

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Int. Cl. B65g 1/16

U.S. Cl. 312—71 12 Claims

ABSTRACT OF THE DISCLOSURE

A self-leveling lifter for storing stacked articles such as dishes or trays. The articles are stacked on a platform which lowers or raises as the stack increases or decreases, to keep the top of the stack at a predetermined elevation. Two oppositely wound spiral springs are attached at one end to a freely rotating axle which is mounted on the bottom of the platform. A reel is placed over and attached to the free end of each spring. Two tapes are wound on each reel. Each tape is directed over a pulley located at each corner of the platform and the end of each tape is attached adjacent the top of the lifter frame. As the platform is pushed down, the tapes unwind causing the two reels to turn in opposite directions. As the two springs turn against each other the spring forces are increased, urging the platform upwardly. The upward forces balance the increased load resulting from the addition of stacked articles maintaining the top of the stack at the predetermined elevation. In another embodiment of the self-leveling lifter, a single spiral spring is connected between the two reels.

Background of the invention

Many attempts have been made in the past to provide a satisfactory storing and dispensing apparatus for the handling of trays, dishes or similar articles of uniform weight which are capable of being stacked. This type of apparatus is used in, for example, food handling operations in restaurants and hospitals.

Many of the prior art devices were suitable for the use intended when they were built for one article of a particular size and weight. However, most of the prior art devices could not easily be adjusted to accommodate stacked articles of a unit weight or a size different than the design weight or size. Adjustment of the prior art devices often required a separate spring or set of springs for each article of a different size and unit weight.

Summary of the invention

The present invention solves the major problems of the prior art by providing a self-leveling lifter for storing and dispensing stacked articles which is easily adjusted to accommodate nonsymmetrical articles having a unit weight differing from the design weight.

The self-leveling lifter, according to the present invention, includes a support having a hole in its top for inserting stacked articles. The stacked articles rest on a platform which is mounted on guides below the hole. Two oppositely wound spiral springs are attached to a freely rotating axle, which is mounted on the bottom of the platform. Two reels are mounted coaxially with the axle and each reel is attached to one end of a spring. Two tapes are wound on each reel in a coil direction similar to the coil direction of its associated spring. Each tape is directed over a pulley at each corner of the platform such that the two tapes from one reel go to diagonal corners. The tapes are attached adjacent the top of the support. As the platform is pushed down, the tapes unwind, causing the two reels to rotate in opposite directions and the two springs to turn against each other. The platform will remain level even when the force pushing it down is not at its center. The spiral springs are adjusted so that the top one of the stacked articles will always be near the top of the support irrespective of how many articles are in the stack. In a second embodiment, a single spiral spring replaces the two spiral springs and the freely rotating axle.

It is a primary object of the present invention to provide an improved self-leveling lifter for storing and dispensing stacked articles.

Another object of the present invention is to provide a self-leveling lifter suitable for use when the load of stacked articles is not located at the center of the platform.

Still another object of the present invention is to provide a self-leveling lifter for storing stacked articles which is easily adjusted to operate with articles of a size and unit weight different than the design size and unit weight.

Other objects and advantages of the invention will become apparent from the following detailed description of a preferred form of the invention, reference being made to the accompanying drawings.

Brief description of the drawings

FIG. 1 is a plan view of a self-leveling dish lifter embodying the features of the instant invention;

FIG. 2 is a side elevational view of a self-leveling dish lifter embodying the features of the instant invention, partially in section and showing the carrier platform in two different loaded positions in broken lines;

FIG. 3 is a fragmentary, vertical cross-sectional view of a guide post taken along line **1**—**1** of FIG. 1;

FIG. 4 is a fragmentary, horizontal cross-sectional view of the guide post taken along line **4**—**4** of FIG. 3;

FIG. 5 is an enlarged vertical cross-sectional view of the carrier platform taken along line **5**—**5** of FIG. 1;

FIG. 6 is an enlarged horizontal cross-sectional view taken along line **6**—**6** of FIG. 2 and showing the bottom of the carrier platform;

FIG. 7 is a partially sectioned, exploded view showing the axle in detail;

FIG. 8 is an enlarged, fragmentary cross-sectional view taken along line **8**—**8** of FIG. 5 showing the bolt arrangement for holding the tapes to the lower reel;

FIG. 9 is a cross-sectional view of the carrier platform taken along line **9**—**9** of FIG. 5; and

FIG. 10 is an enlarged, vertical cross-sectional view similar to FIG. 5, but showing an embodiment of the carrier platform using a single spiral spring.

Description of the preferred embodiments

A self-leveling lifter for storing and dispensing stacked articles according to the present invention is generally indicated in FIGS. 1 and 2 by the reference number **10**. The self-leveling lifter **10** includes a housing **11** and a carrier assembly **12** which is mounted on four guides **13**. The guides **13** are mounted between a collar **14** and a base plate **17** at the bottom of the housing **11**.

The collar **14** fits over a hole **15** cut into the top of housing **11** and is held in place by screws **16**. The collar **14** has a hole **18** cut in its center for receiving stacked

articles **19**, which are stored in and dispensed from the self-leveling lifter **10**. Guide posts **20**, which are mounted on collar **14** by screws **21**, keep the articles **19** that extend above the collar **14** stacked and also guide the stacked articles **19** into the hole **18**. The uppermost one of the stacked articles **19** is located at a predetermined vertical elevation, which in the present embodiment is a few inches above the surface of the collar **14**.

Referring to FIGS. 3 and 4, a hook **22** in the upper end of guide **13** is anchored in a hole **25** extending through the collar **14**. The guide post **20** is mounted with its inner edge **24** flush with the inner edge of guide **13** so that the stacked articles **19** can pass through hole **18** in the collar **14** without obstruction. A screw **21**, which holds the guide post **20** in place, is secured to the collar **14**.

As FIG. 2 shows, the base plate **17** has holes **31** adapted to receive the lower ends of the guides **13**. The holes **31** are spaced to hold guides **13** parallel. This enables the carrier assembly **12** to move freely on the guides. The lower ends of guides **13** are threaded and anchored to base plate **17** by nuts **23**.

Referring to FIGS. 3 and 4, the carrier assembly **12** is suspended on tapes **26** which are anchored to the collar **14**. Clearly, other flexible tension members such as wire cables may be used to replace tapes **26**. The anchors consist of split bolt assemblies **27**, which are screwed into collar **14**, and locking nuts **28**. The tapes **26** extend through the split bolt assemblies **27** and are held in place by locking nuts **28** which are mounted on upper tapered portions **29** of the split bolt assemblies **27**. When the self-leveling lifter **10** is first assembled, the tapes **26** are adjusted so that a platform **30** mounted on the carrier assembly **12** is level. Subsequent adjustments can be made by loosening the nuts **28** and readjusting the tapes **26**.

Referring to FIG. 5, the carrier assembly **12** is shown in greater detail. The carrier assembly consists of a frame **32** having the platform **30** welded to its top and a shaft **33** depending from its top. A tape reel assembly is mounted on shaft **33**.

The tape reel assembly includes an inner axle sleeve **40**, an upper spiral spring **41**, an upper reel **42**, an outer axle sleeve **43**, a lower spiral spring **44**, and a lower reel **45**. In assembling the tape reel assembly, upper bearings **46** and the upper reel **42** are placed on the shaft **33** against a spacer **47**. The inner axle sleeve **40** is then placed on the shaft **33** and the upper spiral spring **41** is installed between the inner axle sleeve **40** and the upper reel **42**. Next, the outer axle sleeve **43** is placed over the inner axle sleeve **40** so a groove **48** in the outer axle sleeve **43** is aligned with a groove **49** in the inner axle sleeve **40**. A bent end **52** of the upper spiral spring **41** fits into the aligned grooves **48** and **49** (see FIG. 7).

The lower spiral spring **44** is attached to lower reel **45** in a manner that, when assembled, it will wind about the shaft **33** in a direction opposite to upper spiral spring **41**. The lower reel **45**, the lower spral spring **44**, and the lower bearing **50** are placed on the shaft **33**. The lower reel **45** is rotated until a bent end **53** of the lower spiral spring **44** mates with the aligned grooves **48** and **29**. A nut assembly **54** is mounted on the shaft **33** beneath the lower bearing **50**.

When the upper reel **42** and the lower reel **45** are rotated in opposite directions, the inner and outer sleeves **40** and **43** will turn until the upper and lower spiral springs **41** and **44** are locked between grooves **48** and **49**. Once the springs **41** and **44** are locked in place, the inner and outer sleeves **40** and **43** coact as a single freely rotating axle which acts on both the upper and lower spiral springs **41** and **44**.

Three brackets **56** having vertical slots (see FIGS. 5 and 6) depend from the top of the frame **32** and are radially spaced from the peripheries of the reels **42** and **45**. A bolt **58** which mounts a roller **57** is positioned in the vertical slot of each bracket **56**. Each of the rollers **57** extends between the upper reel **42** and the lower reel **45**.

The rollers **57** maintain a predetermined vertical spacing between the reels **42** and **45**.

Referring to FIGS. 5, 6 and 9, the upper and lower spiral springs **41** and **44** are each attached to an arm **59** with a screw **60**. Each of the spiral springs **41** and **44** has several holes **61** adjacent one end adapted to receive the screw **60**. The effective length and so the spring rate of each of the springs **41** and **44** is changed by using different ones of the holes **61** to attach the spring to the arm **59**. The arms **59** extend through arc shaped slots **62** in each of the reels **42** and **45** and each arm **59** is held by a nut **63**.

The initial spring tension is set and subsequent adjustments are made by loosening one of the nuts **63** and sliding the arm **59** in the slot **62**. Two spacer rollers **64** (see FIG. 9) mounted on each of the reels **42** and **45** keep the spiral springs **41** and **44** from interfering with the adjustment of the arms **59** and keep the springs from twisting to one side as they are wound up.

Each of the reels **42** and **45** is provided with a peripheral groove **65** (see FIG. 5) adapted to receive two of the tapes **26**. The two tapes **26** are bolted to the inside of each reel by bolt and nut **66** which is mounted flush with the outer edge of the reel (see FIG. 8). The tapes **26** are wrapped around the nut and threaded through a slot **67** in the reel and over the head of the bolt. This prevents the bolt and nut **66** from loosening. The two tapes **26** on each reel **42** and **45** are wound on each of the reels in the same direction that the spiral spring for that reel is wound about shaft **33**.

Referring to FIGS. 5, 6 and 9, the two tapes **26** on the upper reel **42** extend to diagonal corners of the carrier frame **32** and over upper rollers **67** which are bolted to the frame **32**. The two tapes **26** on the lower reel **45** extend to the other two diagonal corners of the carrier frame **32** and over lower rollers **68** which are also bolted to the frame **32**. The tapes **26** then extend upwardly substantially parallel to the guides **13** and the ends are anchored in the split bolt assembly **27** in collar **14**, as described above.

It is to be noted that the platform will remain level as the carrier assembly moves up and down on guides **13**. If a downward force is applied to one edge of platform **30**, the tape **26** extending over the roller **67** or **68** nearest the applied force will unwind along with the tape over the furthest rollers **67** or **68**. The downward force will also result in an unwinding of the other two tapes as the first two begin to unwind. As a result, each of the four tapes will unwind an equal amount and the platform will remain level.

The amount each tape will unwind for any given force is determined by the spring constant. Therefore, changing the effective length of the two spiral springs by changing the holes **61** from which they are connected to brackets **59** will change the amount the platform will move when the number of stacked articles is changed. The number of articles that can be stacked on the platform before it will move from its up position is adjusted by moving bracket **59** in slot **62** to set the initial spring force.

As the load of the stacked articles moves the platform **30** downwardly, the movement is opposed by upward forces generated by the spiral springs **41** and **44**. The spring forces are transmitted to the tapes **26**. The springs **41** and **44** are designed to produce forces which counterbalance the downward forces resulting from the addition of stacked articles onto the platform **30**. The spring forces are such that the platform **30** is returned to a static condition when the uppermost stacked articles is at the predetermined vertical elevation. It is noted that because the inner and outer sleeves **40** and **43** rotate together on the depending shaft **33**, the total forces on each pair of tapes **26** is essentially equal.

FIG. 10 shows a second preferred embodiment of the self-leveling lifter. In this embodiment a sleeve **70** is

fastened with bolts **71** to upper reel **42** such that the sleeve and the upper reel can turn on shaft **33**. As an alternative, the sleeve **70** could be welded to upper reel **42** or it could be cast as a part of upper reel **42**. A single spiral spring **69** is connected between the sleeve **70** and an adjusting arm **72**, which is locked in the arc shaped slot **62** in lower reel **45** with a nut **73**. In this arrangement, the single spiral spring **69** replaces upper spiral spring **41**, lower spiral spring **44**, and the freely rotating axle formed by the inner axle sleeve **40** and the outer axle sleeve **43**.

The spiral spring **69** can be attached to sleeve **70** with a screw, by welding, by inserting a tab bent in the end of the spiral spring into a slot cut into the sleeve, or by other obvious methods. A screw **74** is used to attach the outer end of the spiral spring **69** to the adjusting arm **72**. Changing the hole **75** in the spiral spring **69** through which the screw **74** is inserted changes the effective length of the spring and therefore changes the spring rate. Two spacer rollers **76** (only one shown) are mounted to keep the single spiral spring **69** from twisting to one side as it is wound up.

The operation of the single spiral spring embodiment of the invention is similar to that of the embodiment using two spiral springs. As articles **19** are stacked on platform **30**, the carrier assembly **12** descends on guides **13** and the pairs of tapes **26** unwind from the upper and lower reels **42** and **45**. As the tapes unwind, the upper and lower reels **42** and **45** turn on shaft **33** in opposite directions, causing the single spiral spring **69** to wind up. It is noted that the total forces on each pair of tapes **26** is essentially equal because the upper reel **42** and the lower reel **45** are free to rotate on shaft **33** and the spiral spring **64** is attached between them.

Although the drawings show four guides, four tapes, two tape reels, and a circular platform, it is obvious that these may be changed to fit the requirements of the items to be stored. For example, for circular dishes, a single reel having three tapes wound on it can be used. Similarly, the platform and collar may be made square to receive trays, or the like.

It will be appreciated that other arrangements, modifications and changes may be made without departing from the scope of the appended claims.

What I claim is:

1. A self-leveling lifter for storing and dispensing stacked articles, wherein the uppermost one of the stacked articles rests at a predetermined vertical elevation, said lifter comprising, in combination, a frame, a platform mounted for vertical movement in said frame, a shaft depending from said platform, a reel rotatably mounted in coaxial relationship on said shaft, a spiral spring mounted on said shaft, said spring having one end operatively connected to said shaft and its other end operatively connected to said reel, and a plurality of elongate flexible members wound around said reel, each of said members having one end connected to the reel and the other end operatively connected to said frame, whereby when stacked articles are placed on such platform moving such platform downwardly, the force of the spiral spring transmitted through such members resists the downward movement of the platform bringing the platform to rest with the uppermost stacked article being located at the predetermined elevation.

2. A self-leveling lifter according to claim **1**, including guide means for guiding the vertical movement of said platform along a predetermined path.

3. A self-leveling lifter according to claim **2**, including adjusting means for adjusting the tension of said spiral spring.

4. A self-leveling lifter according to claim **1**, including means for changing the rate of said spiral spring by changing the effective length of said spring.

5. A self-leveling lifter for storing and dispensing stacked articles, wherein the uppermost one of the stacked articles rests at a predetermined vertical elevation, said lifter comprising, in combination, a frame, a platform mounted for vertical movement in said frame, a shaft depending from said platform, first and second reels rotatably mounted in coaxial relationship on said shaft, a spiral spring mounted on said shaft, said spiral spring having one end operatively connected to said first reel and its other end operatively connected to said second reel, at least one elongate flexible member wound about said first reel, said member being attached at one end to said first reel and at its other end to said frame, and at least one second elongate flexible member wound about said second reel, said second member being attached at one end to said second reel and at its other end to said frame, whereby when stacked articles are placed on such platform moving such platform downwardly, the force of the spiral spring transmitted through said elongate flexible members resists the downward movement of the platform bringing the platform to rest with the uppermost stacked article being located at the predetermined elevation.

6. A self-leveling lifter according to claim **5**, including means for changing the rate of said spiral spring by changing the effective length of said spring.

7. A self-leveling lifter according to claim **6**, including adjusting means for adjusting the tension of said spiral spring.

8. A self-leveling lifter for storing and dispensing stacked articles, wherein the uppermost one of the stacked articles rests at a predetermined vertical elevation, said lifter comprising, in combination, a frame, a platform mounted for vertical movement in said frame, a freely rotating axle operatively mounted on said platform, first and second reels rotatably mounted in coaxial relationship with said axle, first and second spiral springs mounted on said axle, said first spring having one end attached to said axle and having its other end operatively connected to said first reel, said second spring having one end attached to said axle and having its other end operatively connected to said second reel, said second spring being wound around said axle in a direction opposite from said first spring, at least one elongate flexible member wound about said first reel, said member being attached at one end to said first reel and at its other end to said frame, and at least one second elongate flexible member wound about said second reel, said second member being attached at one end to said second reel and at its other end to said frame, whereby when stacked articles are placed on such platform moving such platform downwardly, the force of the spiral springs transmitted through their respective elongate flexible members resists the downward movement of the platform bringing the platform to rest with the uppermost stacked article being located at the predetermined elevation.

9. A self-leveling lifter according to claim **8**, including guide means for guiding the vertical movement of said platform along a predetermined vertical path.

10. A self-leveling lifter, according to claim **9**, including adjusting means for adjusting the tension of said first and second springs.

11. A self-leveling lifter, according to claim **10**, including means for changing the effective length of said first and second springs.

12. A self-leveling lifter for storing and dispensing stacked articles, such that the uppermost one of the stacked articles rests at a predetermined vertical elevation, said lifter comprising, in combination, a support housing having an article receiving opening defined in its upper surface, a platform mounted within said support housing for vertiral movement along a predetermined path, a plurality of vertical guide rods mounted in said support housing adjacent said platform for guiding said platform along such predetermined path, a vertical shaft depending from said platform, a freely rotating axle mounted on said shaft, first and second reels, having tape

receiving grooves in their peripheries, rotatably mounted on said shaft, first and second spiral springs wound around said axle in opposed directions, said first spiral spring having one end connected to said axle and its other end operatively connected to said first reel, said second spiral spring having one end connected to said axle and its other end operatively connected to said second reel, means for adjusting the tension of said first and second spiral springs, a first pair of tapes engaged in such tape receiving groove of said first reel, said first pair of tapes having one end attached to said first reel and their other ends attached adjacent diagonal upper corners of said support housing, and a second pair of tapes engaged in such tape receiving groove of said second reel, said second pair of

tapes having one end attached to said second reel and their other ends attached adjacent the remaining diagonal upper corners of said support housing.

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