United States Patent [19]

Healy

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[54] **DISPENSING APPARATUS**

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[73] Assignee: **Peters & Co. Inc.**, Boston, Mass.

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[52] **U.S. Cl.**.....**312/71**, 211/49

[51] **Int. Cl.**.....**A47f 1/00**, B65g 1/16

[58] **Field of Search** ...312/71, 319; 211/49; 221/226, 221/279; 220/93; 108/136, 147

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Primary Examiner—Casmir A. Nunberg

Attorney—John Noel Williams

[57] **ABSTRACT**

A dispensing apparatus of the self-leveling type in which a vertically movable platform is balanced by a spring and in which a balance beam is interposed between the spring and the platform to permit adjustment for different types of materials carried on the platform. Among the features shown are adjustment of effective moments by moving the fulcrum while constraining the beam longitudinally; moving the fulcrum with gear, rack, and stationary track; moving the fulcrum by pivotal link; rolling of surfaces in the fulcrum region; constraining the beam by a pivotal link connected at a point spaced from the fulcrum; vertical arrangement of the beam and adjusting rod in a compact arrangement; and a multiple parallel support cord arrangement, together with other important related features.

38 Claims, 12 Drawing Figures

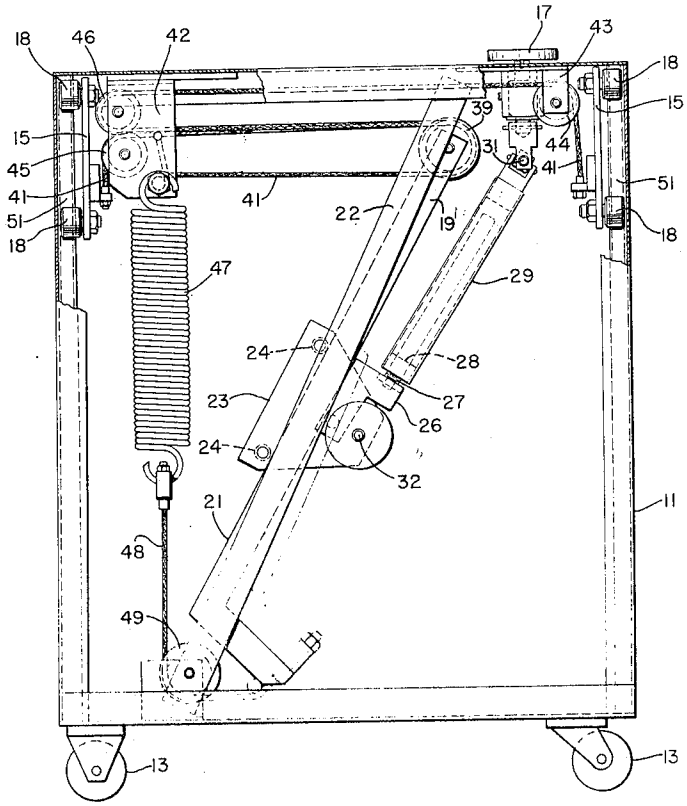

FIG 1

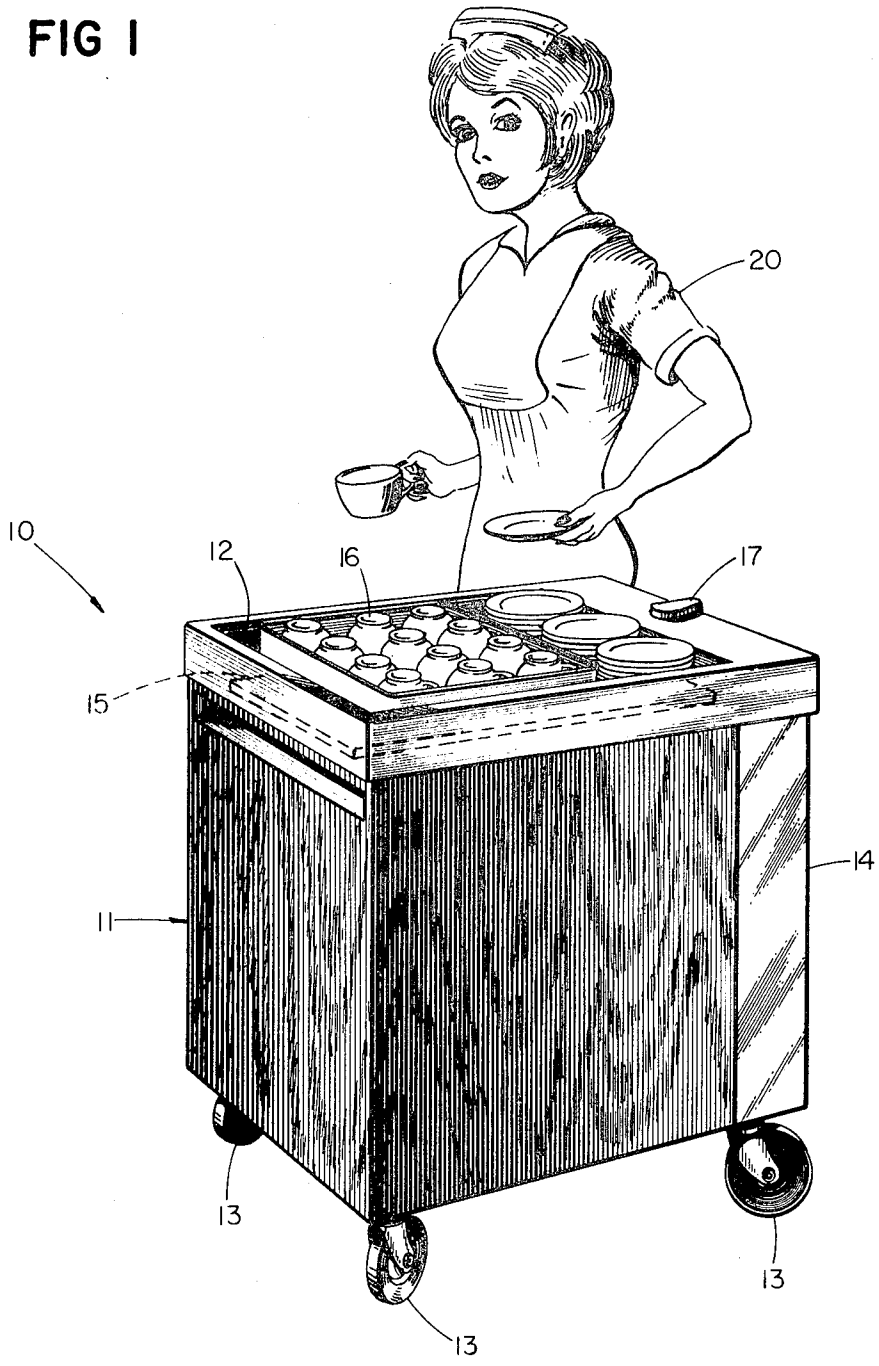

FIG 2

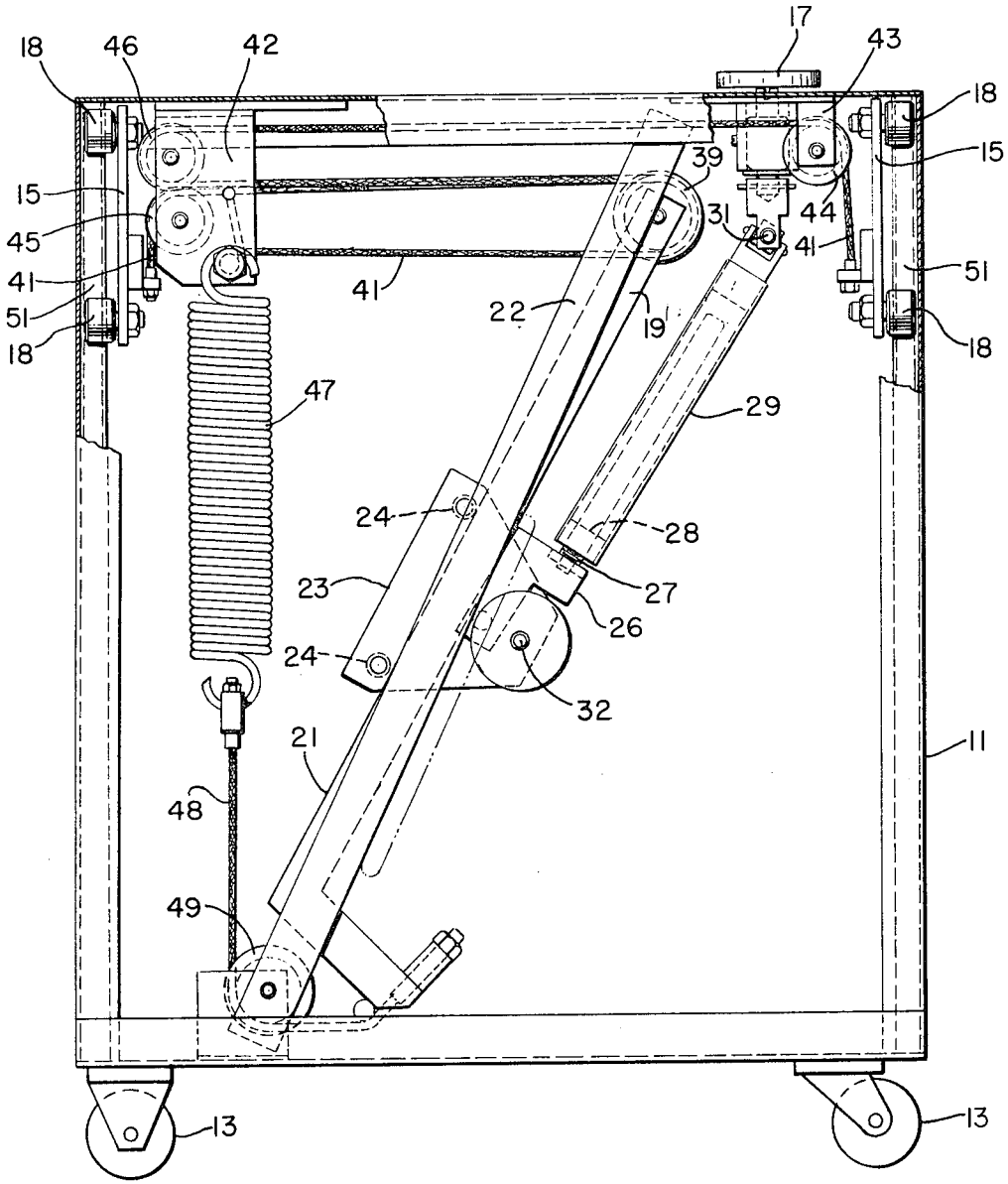
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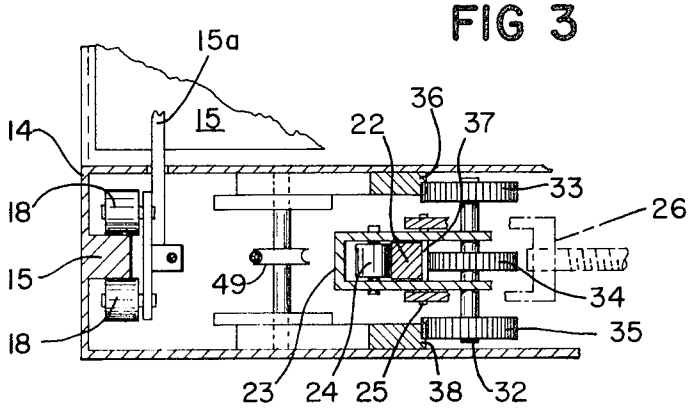
FIG 3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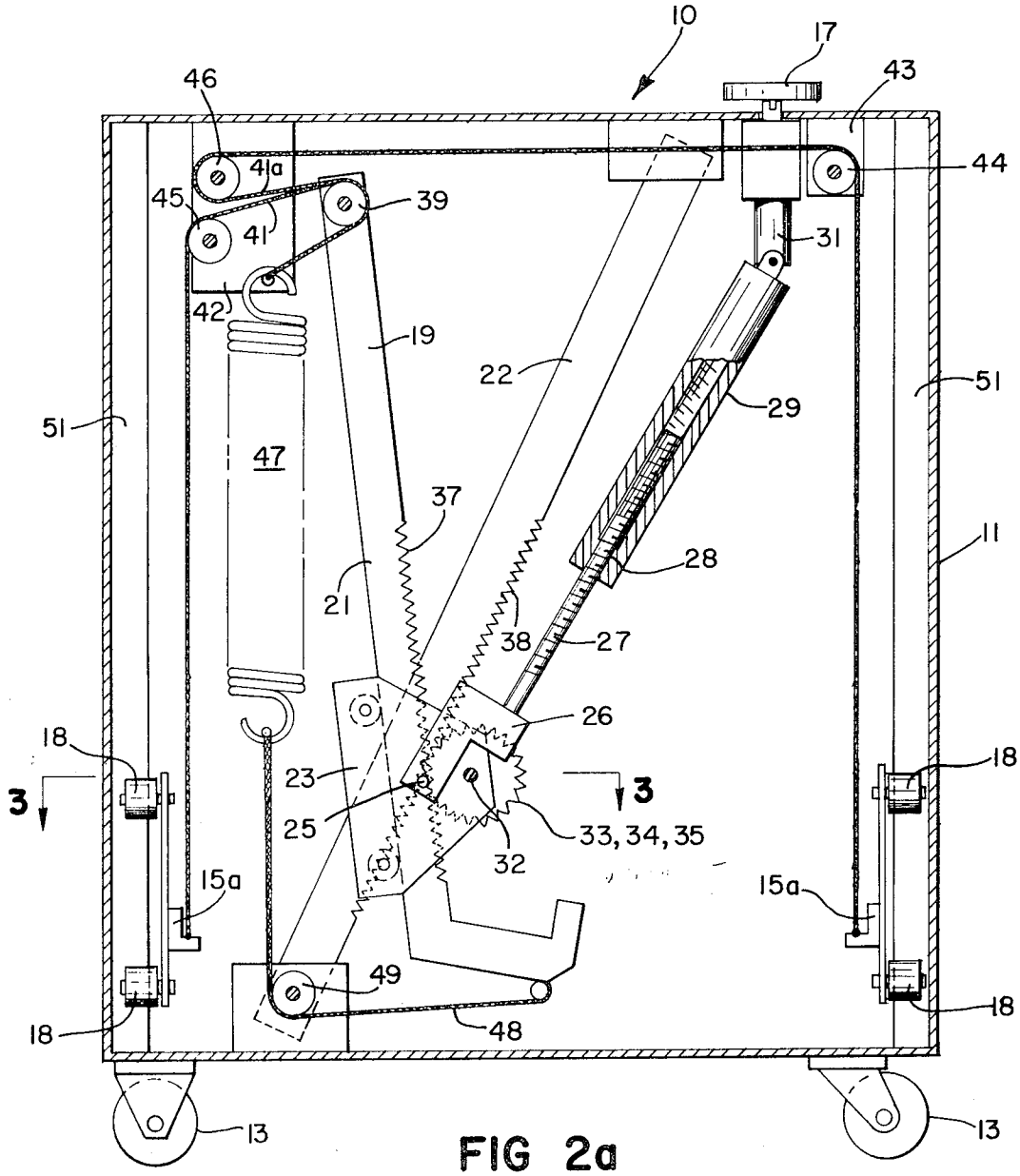
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FIG 2a

FIG 5

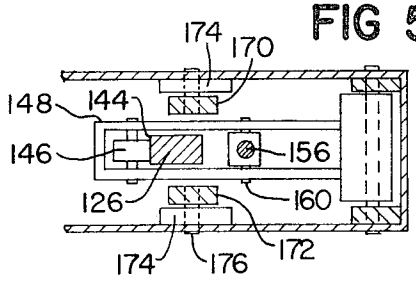
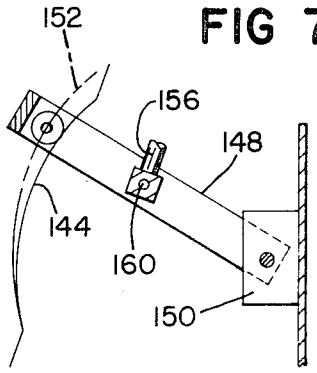


FIG 7



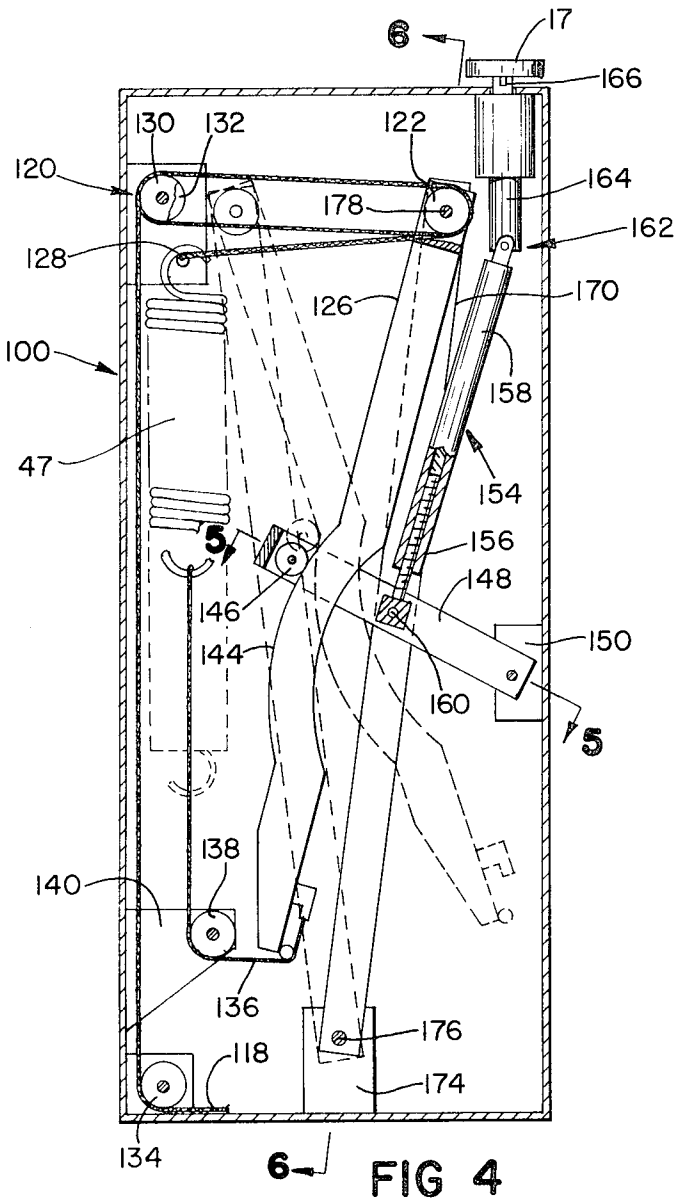


FIG 4

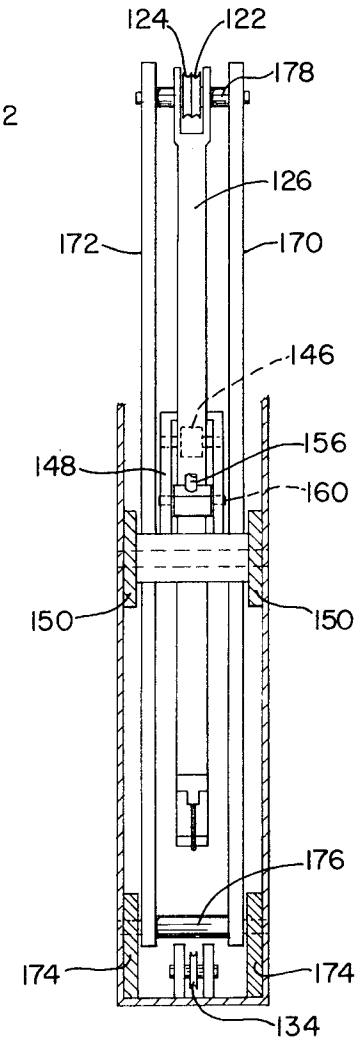
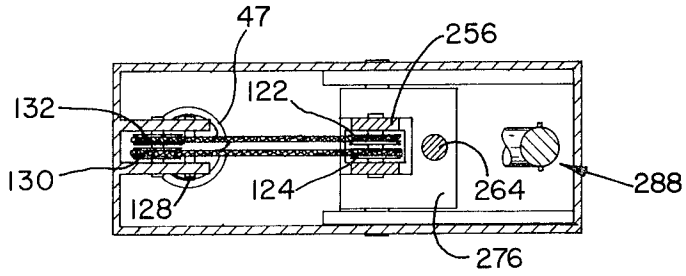


FIG 6

FIG 9



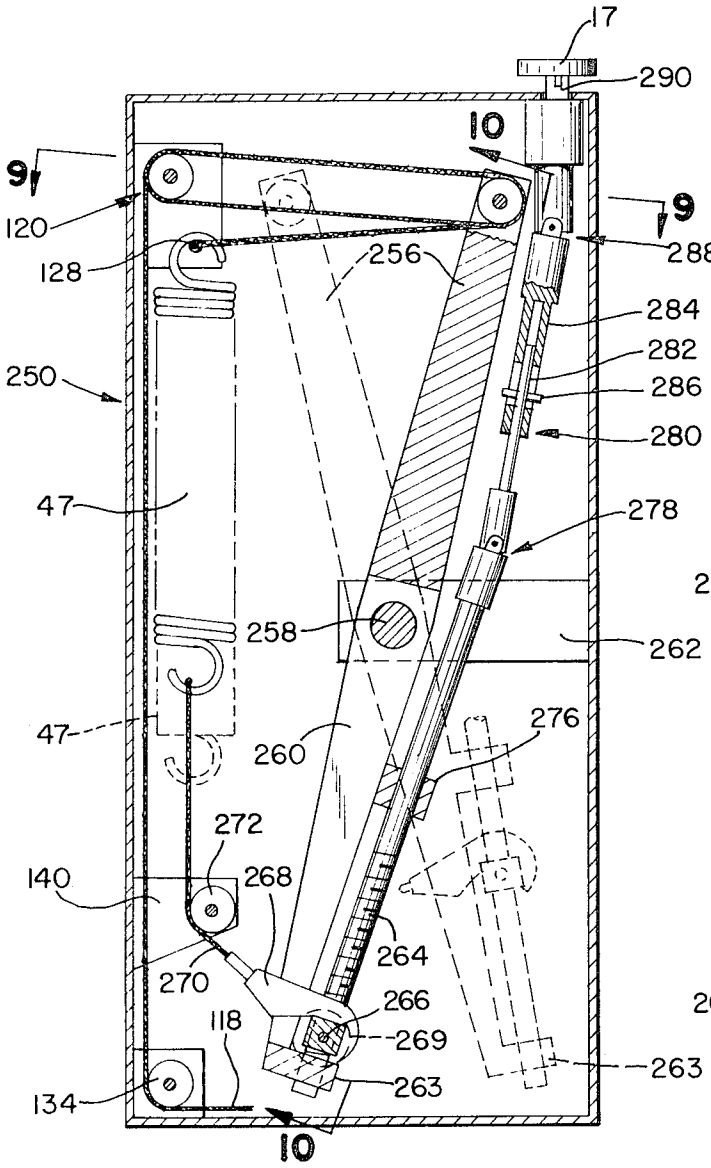


FIG 8

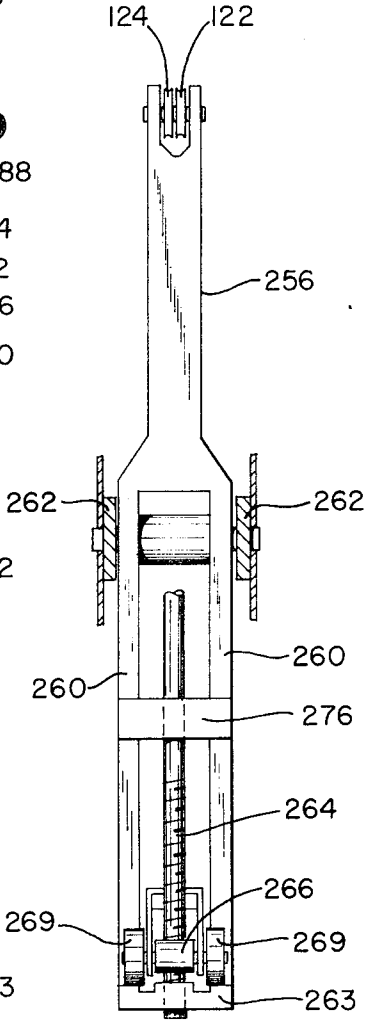
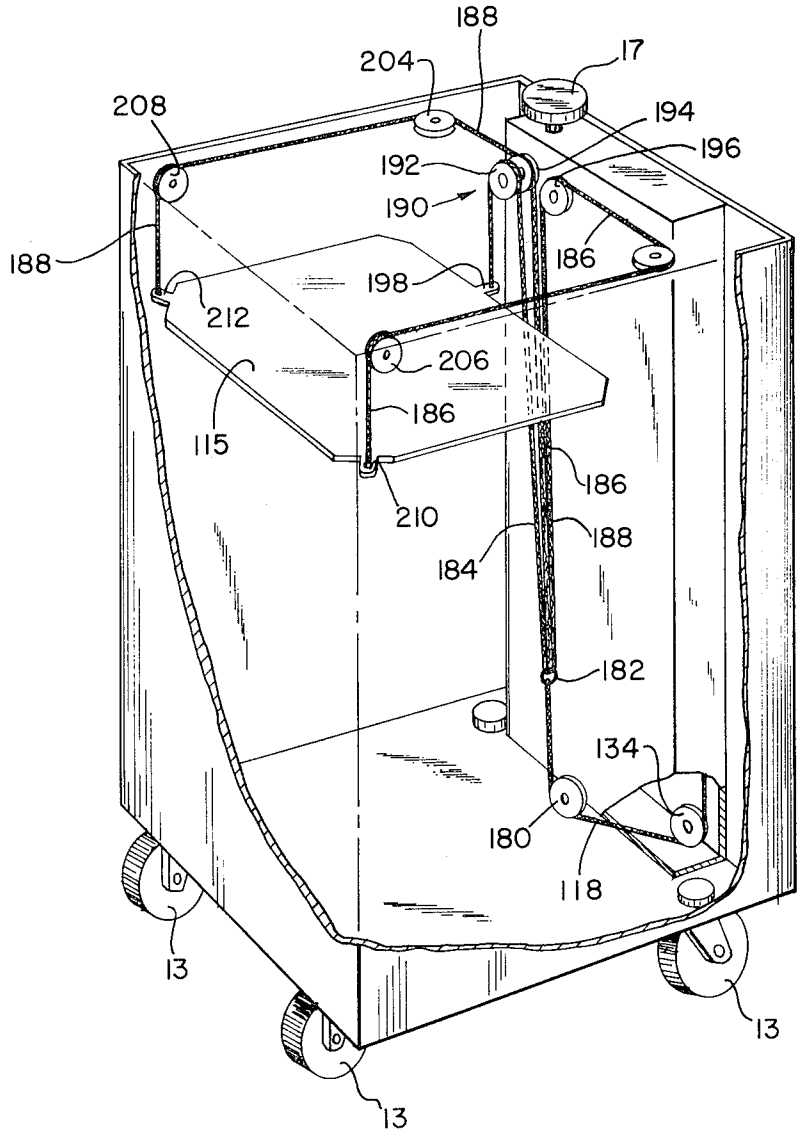


FIG 10

FIG 11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DISPENSING APPARATUS

In the dispensing of trays, glass, and cup racks, dishes, saucers, and the like in food service operation, it has been common practice to provide a table having a platform or elevator on which the articles to be dispensed can be stacked. By properly balancing the platform, the top of the stack of articles remains at a constant level at all times. In the past, most of these platforms have been balanced by the use of springs and, when the type of article to be dispensed is changed, it has been necessary to change the type or number of springs. It has been suggested that the spring effect, hence the dynamic range, be regulated by use of a lever interposed between the spring and the elevator and by adjusting the effective moment arms, however this has occurred with various drawbacks.

It is an object of this invention to provide variable moment arm self-leveling dispensers which are improved from the points of view of wideness and ease of adjustability of dynamic range, simplicity, few parts, ease of manufacture, compactness, and reliability of operation without maintenance. Particular objects are to provide a dispenser which can be simply adjusted by the operator from the top to readily vary the dynamic setting to permit self-level dispensing of such heavy articles as oven ware or as light articles as paper tableware, and to do this with a dispensing apparatus having a simple and rugged mechanism which is inexpensive to manufacture and which is capable of a long life of useful service with a minimum of maintenance.

This invention concerns a self-leveling dispenser comprising a frame, a platform supported for vertical movement, an elongated balance beam for balancing first and second loads applied to the beam at first and second load points on opposite sides of a fulcrum, a spring providing the first load and the platform providing the second load.

In one aspect, the invention features a beam-engaging member defining the fulcrum having means for moving along the beam to vary the ratio of moment arms, and the beam is generally restrained against lengthwise movement during adjustment of the fulcrum.

In preferred embodiments of this aspect, the beam is generally vertically arranged; the fulcrum is defined as a surface of revolution (e.g., a roller or a gear) along which the beam rolls slightly during dispensing, and which rolls along the beam during adjustment of position; the adjustable fulcrum and beam provide a predetermined small pivotal movement of the beam during movement of the fulcrum, this movement being in a direction tending to change the force condition on the spring in the sense opposite to the change due to movement of the fulcrum to provide a substantially constant support for the tare weight of the platform despite variation in the effective spring rate obtained by varying the ratio of moment arms for the first and second loads.

In one embodiment of this aspect a follower, such as a sprocket, engages a stationary track for movement along the direction of the track; the beam engaging member, e.g., another sprocket, is secured for movement with the track follower and for rotation with the first sprocket to cause advancement along the beam.

In another embodiment of this aspect, the fulcrum-defining member is carried by a link pivotally mounted on the frame and an axially adjustable linkage is connected to rotate the link to adjust the fulcrum along the beam. Preferably the beam has a curved surface where engaged by the fulcrum-defining member, the curvature of this surface being selected to maintain preselected tension conditions, avoid undue work during adjustment while the link pivots, as well as to provide support for the tare weight of the platform as heretofore described.

In another aspect, the invention features connecting means for connecting the platform and the spring to the beam constructed to apply their respective loads from substantially fixed positions relative to the frame, means defining a pivotal fulcrum for the beam, and means for adjusting the effective point of the fulcrum including restraining means comprising a freely pivotal elongated link mounted on the frame and secured to the beam at a linking point spaced substantially from the fulcrum, the elongated link extending from the linking point in the general direction of and past the fulcrum and positioning the beam longitudinally relative to the aforesaid fixed positions.

In preferred embodiments of this aspect the distance along this elongated link between the pivotal mounting of the link on the frame and the linking point is greater than the distance along the beam between these load points; the linking point is coincident with one of said load points; and the elongated link extends generally along the elongated axis of the mid position of the beam and traverses an arc less than about 30°.

In still another aspect, the invention features a platform support means comprising a first elongated flexible element engaged with one end of the beam at the second load point, guide means including a guide member for flexible element mounted near the bottom of the frame, tie means connecting the elongated member at a point past the guide member to a cluster of vertically oriented parallel elongated flexible members, separator means mounted on the frame near the top of the frame for receiving the cluster of parallel elongated members from the tie means and directing these members individually to selected spaced locations on the platform, and means securing these members to the platform at these spaced locations. In a preferred embodiment thereof, a multiple pulley arrangement having a mechanical advantage greater than two is secured to the beam at the second load point, the first elongated flexible element passing around the pulley arrangement between the second load point and the guide member; and the cluster of elongated elements comprises three flexible cables, with the separator means comprising a plurality of sheaves mounted close to one another with their axes lying in a common plane, and directing the three cables to spaced locations on the platform located near the two opposite corners of one side of the platform, and near the center of the opposite side of the platform.

In another aspect, the invention features adjusting means comprising an axially adjustable elongated linkage external of the beam, this linkage having a line of action disposed generally along the length of the beam, one end of the linkage terminating at a permanently positioned rotary knob mounted in an upper portion of the frame and accessible for rotation by an operator, and the other end being arranged to move along the

beam to alter the position of one of the load points or of the fulcrum along the beam to vary the ratio of the moment arms of the beam.

In preferred embodiments: the adjustable linkage comprises a pair of telescoping shafts threaded to each other, the upper shaft of this pair being connected through a universal joint to the knob, the lower end of the pair being connected to move the fulcrum means upon rotation of the knob; and the beam and the adjustable linkage both extend generally from the top of the dispenser downwardly. In another preferred embodiment the adjustable linkage is adapted to move one of the load points along the beam and comprises a pivotal assembly including an axial lost motion connection permitting axial lengthening and shortening of the linkage during normal rotation of the beam during dispensing, without effect upon the setting of the adjustable linkage.

Other objects, features and advantages will appear to one skilled in the art from the following description of preferred embodiments of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a perspective view of a dispensing apparatus according to one preferred embodiment of the invention;

FIG. 2 is a sectional view of the invention taken on the line II—II of FIG. 1, showing the platform in the up position;

FIG. 2*a* is a diagrammatic view corresponding generally to FIG. 2, showing the platform in the down position;

FIG. 3 is a horizontal sectional view of a portion of the apparatus taken on the line III—III of FIG. 2;

FIG. 4 is a view similar to FIG. 2 of another preferred embodiment, FIG. 5 being a vertical side view and FIG. 6 a horizontal plan view of the mechanism;

FIG. 7 is a diagrammatic view of the curved surface of the balance beam of FIGS. 4—6;

FIGS. 8, 9, and 10 are views similar to FIGS. 4, 5, and 6 of another preferred embodiment; and,

FIG. 11 is a diagrammatic view of a platform support arrangement according to a preferred embodiment of the invention.

Referring first to FIG. 1, the dispensing apparatus, indicated generally by the reference numeral 10, is shown as having a generally cube-shaped enclosure 11 with an opening 12 at its upper surface. The enclosure may be provided at the lower corners with casters 13. Along one side of the enclosure is a frame 14 on which is slidably mounted a platform 15 supported on a pair of cantilever arms 15*a*. Resting on the platform are stacks of articles 16 which are to be dispensed by the operator 20. In the illustration, the articles 16 are shown as consisting of cups and saucers. Located on the top of the frame 14 is an adjusting knob 17.

In FIGS. 2 and 3, it can be seen that cantilever arms 15*a* (one shown) for the platform 15 are provided with rollers 18 at the sides by which it is guided on channel 51 in the frame 14 for vertical movement. A balance beam 19 is mounted more or less centrally of the frame in a generally vertical direction and is provided with a straight surface 21. Extending angularly from top to bottom of the frame are two stationary parallel struts 22 and between these struts lies a slide 23 having rollers 24 which engage and slide along the surface 21 of the beam 19. Hinged to the slide 23 by means of hinge pins 25 is a U-shaped bracket 26 which is connected to the upper part of the frame by a downwardly extending adjusting means, such as the screw 27 and a nut 28. The nut 28 is fixed to an elongated tube 29 which is connected through a universal joint 31 to the adjusting knob 17 mounted on the top of the apparatus.

Extending through the slide 23 is a shaft 32 on which are mounted three gears 33, 34 and 35 which engage racks 36, 37, and 38 attached to the surfaces of the struts 22 and the beam 19. It can be seen that this arrangement provides for a pivoting of the beam 19 about an axis determined by the inter-engagement of the gear 34 with the rack 37, this being theoretically the intersection of the two pitch lines. Thus the fulcrum of the beam is defined by the gear.

At the upper end of the beam 19 is mounted a pulley 39 around which extend cables 41, 41*a* leading to the platform 15. Cable 41a passes around pulley 46 at the left, thence to pulley 44 at the right over which the cable passes as it goes to the right-hand side of the elevator 15. Cable 41 passes over pulley 45 at the left, thence to the left-hand side of the platform 15. Coil springs 47 are attached at one end to the top of the frame, bracket 42, and at the other end to a cable 48. This cable passes around a pulley 49 rotatably mounted in the bottom of the frame 14 and is attached at its other end to the lower end of the beam 19.

Referring to FIG. 3, it can be seen that the rollers 18, which guide the elevator 15, are operative on either side of a hollow tubular column 51, which is welded to the side of the frame 14.

For the operation of the invention the beam 19 should be visualized as a first degree lever in which the contact of the gear 34 with the rack 37 constitutes the fulcrum and in which two forces or loads are applied to the ends of the lever or beam in opposite directions. One force is applied at the lower end of the lever and is the force due to the stressing of the springs 47, while the other force operates on the upper end of the lever and represents the weight of the platform and its contents as carried to the lever through the cables 41, 41*a*. The force due to the elevator 15 and its load is always applied to the extreme upper end of the lever and the force from the springs 47 is always applied to the lower end of the lever, but the fulcrum lies in the position determined by the position of the slide 23 and the gear 34. By adjusting the position of the slide 23 (and, therefore, the position of the gear 34 on the lever) it is possible to adjust the effect of the spring 47 on the elevator to match various weights of articles carried on the elevator. In other words, adjustment of the fulcrum leads to adjustment of the ratio of the spring moment arm to the load moment arm. The rotation of the nut 28 by means of the rotatable knob 17 will cause the nut to move to any of various positions along the screw 27. The screw is attached to the slide 23 in such a way that it can change its angularity to compensate for the fact that the lengthening of the tube 23 and the screw 27 causes them to lie at a different angle to the beam 19. When the nut 23 has been drawn close to the bracket 26, it has the effect of moving the slide 23 closer to the upper end of the beam; that is to say, closer to the pulley 39. This means that the spring 45 is operating on a longer moment arm and is capable of balancing a larger

force on the elevator. It is only necessary for the attendant 20 at the dispensing apparatus to turn the knob 17 after a complete load of dishes or new types of articles have been placed on the elevator. She turns the knob until the top of the stack appears at the opening 12 and, as she removes articles from the stack, the forces will cause the next lower article to move up to the opening, so that there is always an article located at a desired height above the opening 12 ready to be used.

This embodiment enables continual compensation for the tare weight of the platform. It will be understood that the tare weight is a fixed valve, regardless of what kind of load is on the platform. When the fulcrum is moved to decrease the spring moment arm, according to the invention an oppositely compensating effect on the spring is also applied, so that at the light load setting a sufficient force remains applied to raise the elevator when empty. Referring to FIG. 2 it will be seen that in the up position the lower portion of surface 21 tends to move past the angled strut. It will be seen therefore, that when the fulcrum is moved downward and to the left, when turning the knob to a lower load setting as the sprockets 33 and 35 move down the strut, the rollers 24 force the lower portion of the beam (which protrudes to the left of the strut) to the right, adding tension to the spring, and thus compensating for the tare weight of the platform.

In summary, it can be seen that this embodiment has a relatively simple construction which can be adapted to use with a complete line of dispensers, irrespective of the nature of the platform or elevator, the nature of the enclosure, or of the articles being dispensed. There is usually no necessity for changing springs because the nature of the spring action can be changed without difficulty to match the type of articles being dispensed. It is possible, however, by removing one of the springs 47 to arrange the machine to handle an entirely different range of weights of articles. The adjustment, however, once the springs have been changed, can be done without the need for a skilled mechanic. The apparatus is of such a nature that it can be built in a very rugged manner, so that its life will be extremely long and there will be no need for maintenance.

FIGS. 4 to 7 show a self-leveling dispenser 100 having a frame 114 on which is mounted for vertical movement a platform for carrying a series of articles such as previously shown in FIG. 1. The platform is secured, by cable 118, through a pulley and cable system shown in detail in FIG. 11, described below, to a block and tackle arrangement 120, which includes two coaxial sheaves 122, 124 mounted on the upper end of balance beam 126. The end of cable 118 is secured to the frame at 128, and the cable 118 passes successively over beam-mounted sheave 122, a sheave 130 mounted on frame 114, beam-mounted sheave 124, a sheave 132 mounted on frame 114 coaxially with sheave 130, and thence down along frame 114 to lower sheave 134. The lower end of balance beam 126 is attached to cable 136, which passes around a sheave 138 rotatably mounted on a bracket 140 secured to frame 114, and is attached at its other end to coil springs 47. A bracket 142 is secured to frame 114, and the coil springs 47 are mounted on bracket 142.

Balance beam 126 has a curved surface 144 which is engaged by a rotary bearing 146 mounted on the free end of a U-shaped pivotal link 148, which is pivotally mounted at its other end by bracket 150 on frame 114. The curvature of surface 144 differs from the arc 152 which is traversed by pivot link 148 about bracket 150, for purposes hereinafter described. An axially expansible member 154 includes telescoping, threadably engaged shafts 156, 158 of which shaft 156 is rotatably mounted through pin 160 to pivot link 148, and shaft 158 is secured through universal joint 162 and shaft 164 to an exposed rotatable knob 166, such that rotation of knob 166 rotates shaft 158 relative to shaft 156, expanding or contracting the axially expansible member 154.

Two elongated links 170, 172 commonly pivotally mounted at one end on frame 114 by bracket 174 and mounting pin 176, are connected at their other ends to the upper end of balance beam 126 through mounting pin 178 coaxially with beam-mounted sheaves 122, 124.

Referring now to FIG. 11, the cable 118 travels from lower sheave 134 around guide sheave 180, and is connected to tie structure 182.

Vertical cables 184, 186, 188 are secured at their ends to tie structure 182. A three-sheave separator structure 190 is mounted on frame 114 and has three vertical sheaves 192, 194, 196, mounted close together with their axes arranged in a single horizontal plane, and receive cables 184, 186, 188, respectively. The end of cable 184 is secured to platform 115 at about the midpoint 198 of one side of the platform. Cables 186 and 188 travel to horizontal corner sheaves 202, 204, respectively, and thence to vertical corner sheaves 206, 208 respectively. The ends of cables 186 and 188 are secured to the corners 210, 212, respectively, of platform 115. Since the three cables 184, 186, 188 are all connected to a single vertically movable tie structure 182, the cables will move synchronously over the various sheaves, thereby maintaining platform 115 horizontal at all times.

In operation, when the load of platform 115 is increased by placing dishes or other articles on the platform, a pull is exerted through cable 118 on balance beam 126, tending to pivot the beam about the fulcrum defined at the point of engagement of the rotary bearing 146 carried by pivotal link 148, with the curved surface 144 of beam 126. As the beam pivots on its fulcrum, the cable 136 exerts a pull on coil springs 47, increasing the spring force until it is sufficient to again balance the load of platform 115, ceasing pivotal movement of the beam.

The pivotal movement of the upper end of the beam is confined by links 170, 172 to the arc traversed by those links. As seen in FIG. 4, the links 170, 172 are pivotally mounted at bracket 174 at about the midpoint of the arc traversed by the lower end of the beam during pivotal movement of the beam. Since the arc traversed by the links 170, 172 is flatter than the arc that would otherwise be traversed by the upper end of the beam 126 about a fixed fulcrum located at the point of engagement of rotary bearing 146 and curved surface 144, this point of engagement will shift somewhat along the curved surface during pivotal movement of the arc. The mounting of the links 170, 172 as described at the midpoint of the range of travel of the beam and the flat arc traversed by the long elongated

links result in very little vertical movement of the ends of the beam during pivotal movement of the beam. Thus, the line of action along cables **118** and **136** between the beam and platform **115** and springs **47** respectively remains substantially perpendicular throughout movement of the beam. Hence, the incremental movement of platform **115** in response to an incremental load change will remain about the same, regardless whether the platform has no dishes thereon, so that the tie structure **182** is near lower guide sheave and the beam is at the full-line position shown in FIG. **4**, or is fully loaded, so that the tie structure **182** is near the three-sheave separator structure **190**.

To adjust the response of the platform to the application of articles of different weight, the rotary bearing **146** is moved along the curved surface **144** of beam **126**, thereby changing the fulcrum point of the beam. To adjust for lighter weights, the fulcrum point is moved toward the lower end of the beam, lengthening the platform moment arm relative to the spring moment arm. To adjust for heavier weights, the fulcrum point is moved toward the upper end of the beam.

Fulcrum adjustment is carried out by rotating adjusting knob **166** which in turn either expands or contracts expansible member **154**, thereby pivoting pivotal link **148** about bracket **150**. The links **170, 172** restrain the balance beam **126** against longitudinal or vertical movement during fulcrum adjustment. The curvature of beam surface **144** is selected not only to compensate for the arcuate movement of the rotary bearing **146** due to its being mounted in a pivotal link, thus maintaining substantially constant tension conditions and avoidance of performing work during adjustment and also to compensate for the tare weight of the platform. In particular, FIG. **7** shows that the curvature of surface **144** deviates from the arc traversed by the pivotal link **148** in such a way as to cause balance beam **126** to pivot in a manner tending to adjust the spring force of coil springs **47** so as to compensate for the change in the relative lengths of the platform moment arm and the spring moment arm. Thus, e.g., as the fulcrum is moved downwardly along the balance beam, toward the lower end of the beam, increasing the platform moment arm, the lower end of the beam is caused to pivot toward the right, thus causing cable **136** to expand coil springs **47**.

FIGS. **8** to **10** show a self-leveling dispenser **250** having a frame **252**, a vertically movable elevator platform, and a generally vertically disposed elongated balance beam **256** pivotally mounted on a pivot pin **258** extending through the two sides **260**, of the lower V-shaped portion of balance beam **256**, and journalled in a bracket **262** mounted on frame **252**. Pivot pin **258** thereby defines a fixed fulcrum for the balance beam. The upper end of balance beam **256** is secured through a block and tackle arrangement identical to that described above with reference to the dispenser **100** of FIGS. **4** to **7**, to a cable **118** which is in turn secured to the platform through a pully arrangement also identical to that described with reference to dispenser **100**. The lower end of balance beam **256** terminates in a mounting block **263**, through which is slidably received the free end of an adjusting shaft **264**, which is threaded adjacent block **263**. Spring load nut **266** is threadedly engaged with shaft **264**, and is linked at each side to cable mount **268**, and rollers **269**, arranged to roll along the sides **260, 262**, respectively, of balance beam **256**. One end of cable **270** is secured within cable mount **268**, from whence the cable **270** passes across guide sheave **272** and is connected at its other end to coil springs **47**. A guide block **276** mounted on balance beam **256** has an internal bearing surface for the unthreaded portion of adjusting shaft **264** received therein. A universal joint **278** pivotally connects the upper end of shaft **264** to a lost motion device **280** consisting of an inner shaft **282** slidably received within an outer hollow shaft **284**, the shafts **282, 284** being keyed by key **286** against relative rotation. Another universal joint **288** connects shaft **284** to the adjustable knob **290**, which is otherwise identical to the adjustable knob **17** shown and described with reference to FIGS. **1** and **4**.

Adjustment of this dispenser for articles of different weight is achieved by rotating the shaft **264** by rotating knob **290**, thus causing spring load nut **266** to move along shaft **264** relative to mounting block **263**, thus changing the position along said beam at which the coil spring acts on the lever i.e., changing the length of the moment arm along the balance beam from the fulcrum to the spring load. The spring load nut is moved toward the fulcrum for lighter articles and away from the fulcrum for heavier articles.

In operation, changing the load on the platform causes the balance beam to pivot on fulcrum pin **258**, carrying threaded shaft **264** with it. As the shaft rotates with the balance beam, the shafts **282, 284** of the lost motion device **280** slide axially with respect to one another to accommodate the shortening or lengthening of the distance between the end of shaft **264** in mounting block **263** and the universal joint **288** at knob **290**.

Other embodiments will be apparent to those skilled in the art and are within the following claims.

What is claimed is:

1. A self-leveling dispenser comprising

a frame,

a platform supported for vertical movement,

an elongated balance beam for balancing a first load and a second load applied to said beam at first and second fixed load points, respectively, spaced along said beam on opposite sides of a fulcrum,

a spring connected at one end to said frame and at the other end to said beam at the first load point to provide said first load,

means connecting said platform to said beam at the second load point to provide said second load, and

fulcrum means including a beam-engaging member defining said fulcrum for said beam and adjusting means for moving said fulcrum-defining structure along said beam to vary the distance along said beam between said fulcrum and said load points,

and means for generally restraining said beam against lengthwise movement during adjustment of said fulcrum.

2. The self-leveling dispenser of claim **1** wherein said fulcrum-defining structure comprises a surface along which said beam rolls slightly during dispensing, and said adjusting means is adapted to shift the position of said surface relative to the length of said beam.

3. The self-leveling dispenser of claim **2** wherein said surface is of the general form of a surface of revolution,

and said adjustment means is adapted to cause said surface to roll along the length of said beam during adjustment.

4. The self-leveling dispenser of claim 3 wherein said surface of revolution is in the form of a gear, and a track therefor is provided on said beam.

5. The self-leveling dispenser of claim 3 wherein said surface is in the form of a roller mounted on a movable carrier.

6. The self-leveling dispenser of claim 1 wherein said beam is generally vertically arranged and said adjusting means comprises a threaded shaft forming an elongated axially expansible linkage pivotally mounted on said frame separate from said balance beam, with the line of action of said linkage disposed generally vertically, connected at its top to a manually rotatable knob, said linkage being expansible and contractible to move said fulcrum-defining structure along said generally vertical beam.

7. The self-leveling dispenser of claim 1 wherein said adjustable fulcrum means includes a stationary track, and track follower means connected to said adjusting means and engaging said track for movement along the direction of said track, said beam engaging member being secured for movement with said track follower means, and arranged to movingly contact said beam throughout said movement.

8. The self-leveling dispenser of claim 7 wherein said stationary track comprises a stationary rack, said track follower means comprises a first rotatable sprocket engaging said rack, said balance beam has a rack secured along one elongated side of said beam, and said beam-engaging member comprises a second rotatable sprocket, and said apparatus includes a sprocket mounting, commonly mounting said first and second sprockets.

9. The self-leveling dispenser of claim 7 wherein said adjusting means comprises an axially expansible elongated linkage pivotally mounted on said frame and secured to said sprocket mounting, the line of action of said expansible linkage being arranged generally parallel to said tracks.

10. The self-leveling dispenser of claim 7 wherein said track comprises first and second stationary parallel racks spaced from said beam with one rack extending along each side of said beam and said track follower means comprises first and second coaxially mounted rotatable sprockets arranged to engage said first and second racks, respectively.

11. The self-leveling dispenser of claim 10 wherein said beam includes a third rack mounted on said beam along the elongated direction of said beam, and said beam-engaging member comprises a third rotatable sprocket, coaxially mounted to turn with said first and second sprockets, arranged to engage said third rack and providing said fulcrum at the point of engagement of said third rack and said third sprocket.

12. The self-leveling dispenser of claim 10 wherein said apparatus includes a sprocket mounting, coaxially mounting the three sprockets, and restraining means mounted on said sprocket mounting for movement therewith along said beam and arranged to contact the side of said beam opposite the side of said beam in which said third chain is mounted.

13. The self-leveling dispenser of claim 12 wherein said restraining means comprises rollers engaging said opposite side of said beam.

14. The self-leveling dispenser of claim 1 wherein said adjustable fulcrum means and said beam are cooperatively mounted to provide a predetermined small pivotal movement of said beam during movement of said fulcrum defining structure, said pivotal movement being in a direction tending to change the force condition on said spring in the sense opposite to the change due to movement of said fulcrum-defining structure thereby to provide a substantially constant support for the tare weight of the platform despite variation in the effective spring rate obtained by varying the ratio of moment arms for said first and second loads.

15. The self-leveling dispenser of claim 14 wherein said fulcrum is carried on a stationary track, and said track is angled to cause said change in force condition during the adjusting movement of said fulcrum along said track and beam.

16. The self-leveling dispenser of claim 1 wherein said fulcrum-defining structure comprises a beam-engaging member carried by a link pivotally mounted on said frame, said fulcrum defined at the point of engagement between said beam and said beam-engaging member, and

said adjusting means comprises an axially adjustable linkage connected to rotate said link thereby moving said beamengaging member along said beam to change the position of said fulcrum.

17. The self-leveling dispenser of claim 16 wherein said beam has a curved surface where engaged by said beam-engaging member, the curvature of said surface being selected to maintain preselected tension conditions between said arm and said beam as said beam-engaging member travels over said curved surface in the arc defined by said pivotal link.

18. The self-leveling dispenser of claim 17 wherein the curvature of said curved surface is selected to change the force condition on said spring in the sense opposite to the changes due to movement of said fulcrum to provide support for the tare weight of the platform despite variation in the effective spring rate obtained by varying the ratio of moment arms for said first and second loads.

19. The self-leveling dispenser of claim 16 wherein a portion of said beam spaced from the area of said fulcrum means is pivotally connected to an elongated link, said elongated link extending generally in the same direction as said beam and pivotally mounted on said frame.

20. A self-leveling dispenser comprising

a frame,

a platform supported for vertical movement,

an elongated balance beam for balancing a first load and a second load applied to said beam at first and second load points, respectively, spaced along said beam on opposite sides of a fulcrum,

a spring including first connecting means, said spring connecting at one end to said frame and at the other end to said beam at the first load point to provide said first load,

second connecting means connecting said platform to said beam at the second load point to provide

said second load, said connecting means constructed to apply their respective loads from substantially fixed positions relative to said frame,

means defining a pivotal fulcrum for said beam,

and means for adjusting the effective point of said fulcrum along the length of said beam and restraining means for generally restraining the beam against lengthwise movement during adjustment of the fulcrum, said restraining means comprising a freely pivotal elongated link mounted on said frame and secured to said beam at a linking point spaced substantially from said fulcrum, said elongated link extending from said linking point in the general direction of and past said fulcrum, said link positioning said beam longitudinally relative to said fixed positions.

21. The self-leveling dispenser apparatus of claim **20** wherein the distance along said linking member between the pivotal mounting of said link on said frame and said linking point is greater than the distance along said beam between said load points.

22. The dispenser of claim **20** wherein said linking point is coincident with one of said load points.

23. The dispenser of claim **22** wherein said beam is coupled to the respective load at said coincident load point, by a sheave supporting an elongated flexible member connected to said load, the axis of said sheave being located at said coincident load point, said beam and said elongated links being connected at said linking point by a connecting pin coaxial with said sheave.

24. The self-leveling dispenser of claim **23** wherein said elongated link traverses an arc less than about 30°.

25. The dispensing apparatus of claim **20** wherein said elongated link extends generally along the elongated axis of the mid position of said beam.

26. A self-leveling dispenser comprising

a frame,

a generally vertically arranged elongated balance beam for balancing a first load and a second load applied to said beam at first and second load points, respectively, spaced along said beam,

fulcrum means engaging said beam intermediate of said load points defining a fulcrum for said beam,

a spring effectively connected at one end to said frame and at the other end to said beam to provide said first load,

a vertically movable platform providing said second load, and

platform support means comprising a first elongated flexible element engaged with one end of said beam at said second load point, guide means including a guide member for said flexible element mounted near the bottom of said frame, tie means connecting said elongated member at a point past said guide member to a cluster of at least three vertically oriented parallel elongated flexible members, separator means mounted on said frame near the top of said frame for receiving said cluster of parallel elongated members from said tie means and directing said members individually to selected spaced locations on said platform, and means securing said members to said platform at said spaced locations.

27. The self-leveling dispenser of claim **26** including a multiple pulley arrangement having a mechanical advantage greater than two secured to said beam at said second load point, said first elongated flexible element passing around said pulley arrangement between said second load point and said guide member.

28. The dispenser of claim **26** wherein said cluster of elongated elements are flexible cables, and said separator means comprises a plurality of sheaves mounted close to one another with their axes lying in a common plane.

29. The self-leveling dispenser of claim **28** wherein there are three cables in said cluster, and said spaced locations on said platform are located near the two opposite corners of one side of said platform, and near the center of the opposite side of said platform.

30. A self-leveling dispenser comprising

a frame

a platform supported for vertical movement

a generally vertically arranged elongated balance beam for balancing a first load and a second load applied to said beam at first and second load points, respectively, on said beam fulcrum means engaging said beam at a third point intermediate of the load points defining a fulcrum for said beam,

a spring connected at one end to said frame and at the other end to said beam at the first load point to provide said first load,

means connecting said platform to said beam at the second load point to provide said second load, and

adjusting means for varying the ratio of the first moment arm of said beam defined between said fulcrum and said first load point to the second moment arm of said beam defined between said fulcrum and said second load point, said adjusting means comprising an axially adjustable elongated linkage external of said beam, said linkage having a line of action disposed generally along the length of said beam, one end of said linkage terminating at a permanently positioned rotary knob mounted in an upper portion of the frame and accessible for rotation by an operator, the other end being arranged to move along said beam to alter the position of one of said three points along said beam to vary said ratio.

31. The self-leveling dispenser of claim **30** wherein the movable end of said axially adjustable linkage is connected to move the point of action of said fulcrum means, and said adjustable linkage is stationary during vertical movement of the platform.

32. The self-leveling dispenser of claim **31** wherein said fulcrum means comprises a beam-engaging member carried by a link pivoted to said frame, said movable end of said adjustable linkage connected to move said link to a preselected position, said beam being constrained whereby the point of action of said fulcrum means is adjusted along said beam by said movement of said link.

33. The self-leveling dispenser of claim **32** wherein a portion of said beam spaced from the area of said fulcrum means is pivotally connected to an elongated link, said link extending generally parallel to said beam and pivotally mounted on said frame.

34. The self-leveling dispenser of claim **31** wherein said fulcrum means comprises a beam-engaging member carried along stationary guides.

35. The self-leveling dispenser of claim 31 wherein said adjustable linkage comprises a pair of telescoping shafts threaded to each other, the upper shaft of said pair connected through a universal joint to said knob, the lower end of said pair connected to move said fulcrum means upon rotation of said knob.

36. The self-leveling dispenser of claim 30 wherein said first load point for said spring is at the lower end of said moment arm and said adjustable linkage is longer than said moment arm, extending from the top of said dispenser downwardly to the lower end of said beam, said linkage adapted to shift said first load point along the length of said beam.

37. The self-leveling dispenser of claim 30 wherein said adjustable linkage is adapted to move either said first or second load point along said beam, said linkage comprising a pivotal assembly including an axial lost motion connection permitting axial lengthening and shortening of said linkage during normal rotation of said beam during dispensing, said lost motion connection permitting free movement of said beam without affect upon the setting of said adjustable linkage.

38. The self-leveling dispenser of claim 37 wherein said linkage comprises a pair of shafts telescopically fitted together and freely movable axially relative to each other to define said lost motion connection, said shafts being connected together for mutual rotation, the upper shaft of said pair connected through a universal joint to said rotatable knob, the lower shaft connected through a universal joint to a threaded lead screw mounted on said beam, and a nut constrained in guides of said beam, said nut providing the connection for said load, the nut being threaded on said screw and driven therealong by rotation of said screw.

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