Jan. 27, 1953 W. J. GIBBS ET AL 2,626,727

MATERIAL RECEIVING, STORING, AND DISPENSING APPARATUS

Filed Sept. 8, 1948 3 Sheets-Sheet 1

FIG. 1

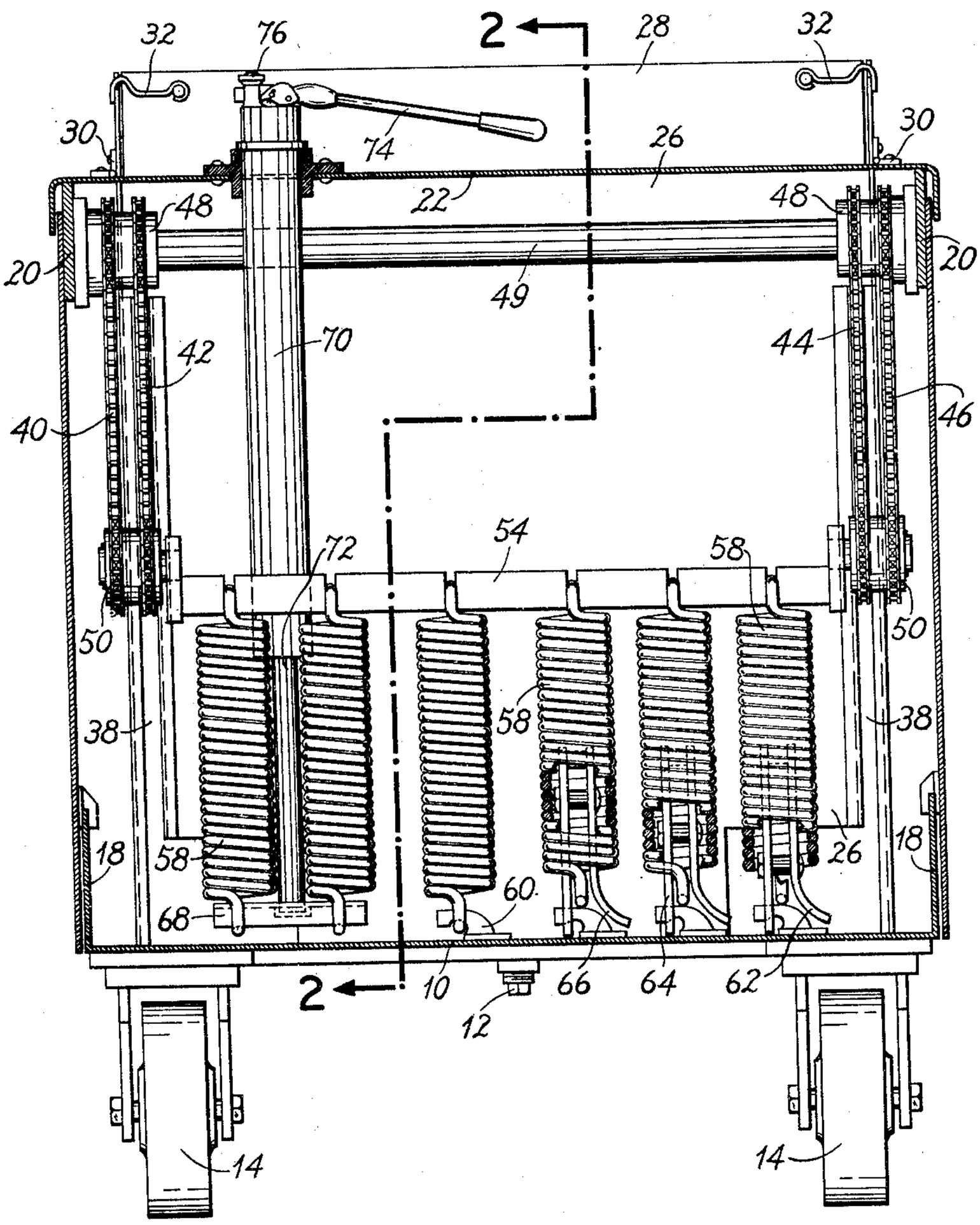


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FIG. 3

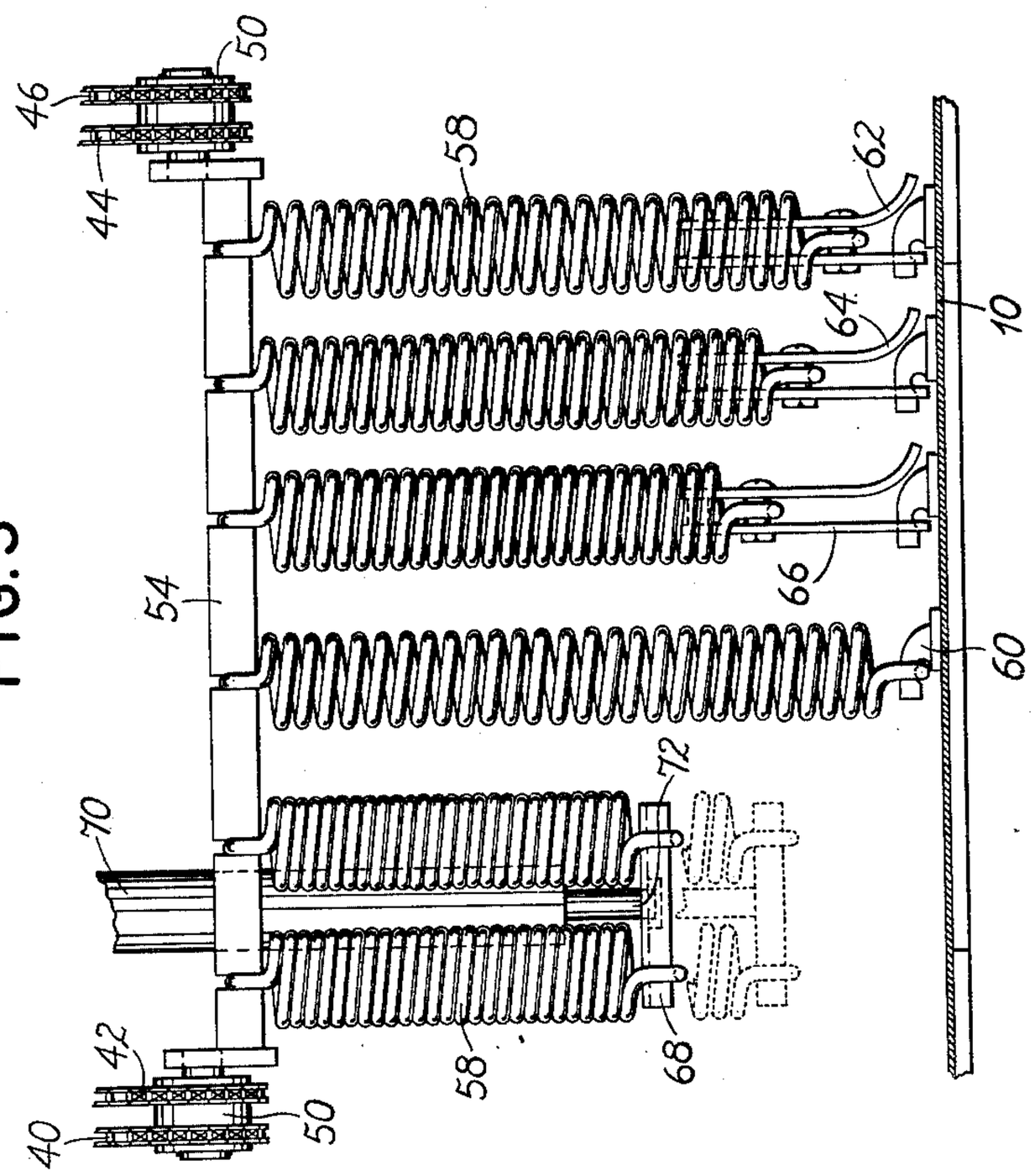
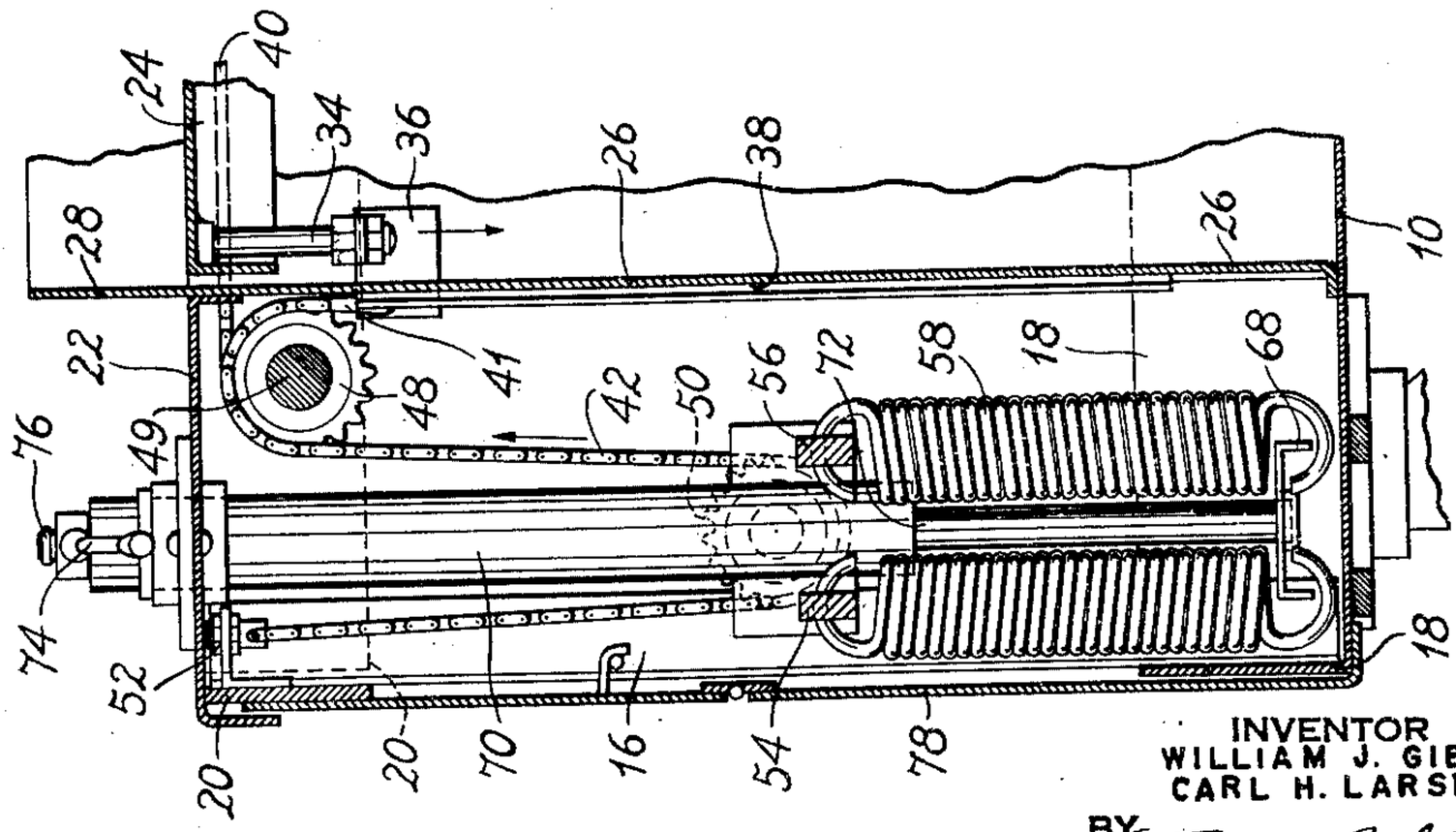



FIG. 2

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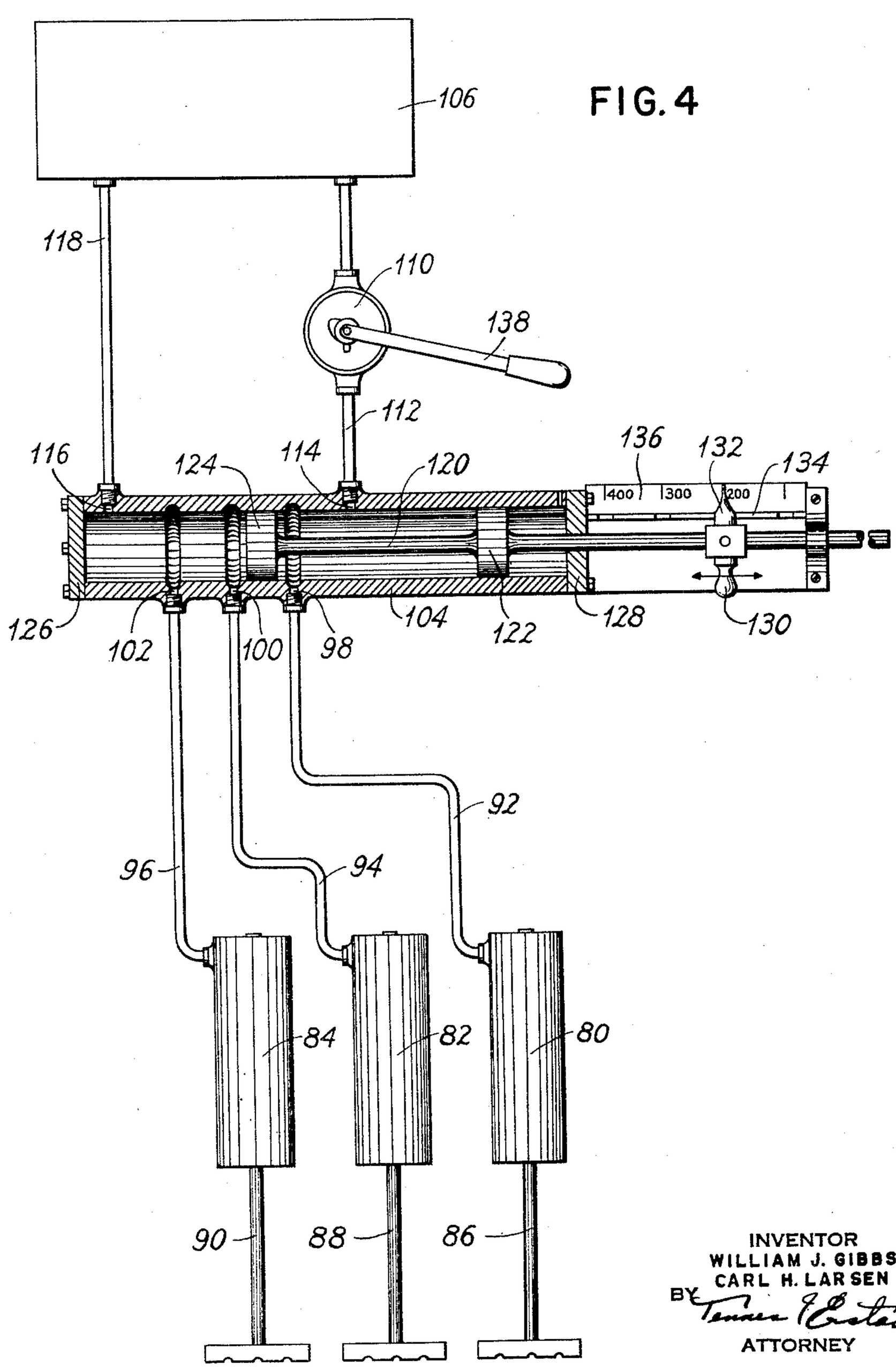
MATERIAL RECEIVING, STORING, AND DISPENSING APPARATUS

Filed Sept. 8, 1948 3 Sheets-Sheet 3

FIG. 4

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# UNITED STATES PATENT OFFICE

2,626,727

## MATERIAL RECEIVING, STORING, AND DISPENSING APPARATUS

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Application September 8, 1948, Serial No. 48,166

21 Claims. (Cl. 220—93)

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This invention relates to improvements in material receiving, storing and dispensing apparatus of the self-leveling type.

In apparatus of this general type such as shown in copending patent application S. N. 736,479 filed March 22, 1947, by Christopher Bockius it is desired that the upper surface of the material stored in such a dispenser be always maintained at a constant predetermined level regardless of whether material is added to or removed from the dispensing unit. Sometimes when material is stored in bulk friction between the material and the inner shell which surrounds the path of travel of the material carrying platform is sufficient to interfere with the calibrated springs raising or lowering the material stored the distance required to maintain the top thereof at a constant predetermined level. As a result the top of the material will either be at too high or too low a level in the dispenser.

Originally this problem was provided for in this type of dispenser by a mechanical device which would positively raise the top of the material to the desired level if the counter-balancing mechanism failed to raise same to the proper level. If the top of the material was at too high a level pressure would be exerted on the material itself to lower the carrier platform to the extent desired. In other words mechanical force was applied each time to position the load correctly.

It is an object of this invention to solve this problem by providing compensating means which when set will provide for a gradual increase or diminishment of the amount of force exerted by the counterbalancing means as needed so that as the frictional element begins to affect the uniform movement of the carrier, an appropriate adjustment in the amount of force exerted by the counterbalancing means is also made.

Another object is to provide calibrated counterbalancing spring mechanism which will exert a calibrated counterbalancing force on the material supporting carrier of a self-leveling dispenser which will be greater when the carrier travels in an upward direction than when the carrier travels in a downward direction to compensate for friction and thereby maintain the top of the material at a constant level regardless of whether material is added to or removed from the dispenser.

Another object is to provide a self-leveling apparatus wherein the force exerted by the calibrated counterbalancing springs can be supplemented by energizing additional calibrated counterbalancing springs when the dispenser is loaded to facilitate unloading and to overcome

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friction encountered when the material is raised upwardly.

Another object is to mount the springs in a self-leveling dispenser so as to stagger the time said springs become active over the distance traveled by said carrier to compensate for friction encountered when the carrier moves downwardly and thereby maintain the top of the material at a constant predetermined level.

A further object is to provide a simple device for readily changing the capacity of a self-leveling storing and dispensing apparatus to handle material of one weight and size at one time and another material of different weight and size at another time.

Another object is to provide a device for changing the capacity of a self-leveling storing and dispensing apparatus that can be readily operated regardless of whether material to be stored has or has not been placed in the dispenser.

Other objects and features of the invention will appear as the description of the particular physical embodiment selected to illustrate the invention progresses. In the accompanying drawings, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which made up the drawings.

Fig. 1 is a sectional end elevation of the storing and dispensing apparatus.

Fig. 2 is a sectional side elevation taken on the line 2—2 of Figure 1, illustrating the hydraulic booster.

Fig. 3 is a partial front elevation showing the partially extended springs connected by graduated links to the frame of the dispenser.

Fig. 4 is a schematic view of a modified form of the invention showing how the invention may be used to readily change the capacity of a self-leveling storing and dispensing apparatus.

The housing for the self-leveling dispenser used to illustrate this invention is similar to that shown in copending patent application of Christopher Bockius, S. N. 736,479, referred to above.

Referring to Figs. 1, 2 and 3 of the drawings the dispenser is provided with a bottom plate 10 having a drain plug 12. Affixed to the bottom plate 10 are suitable casters 14 which permit the dispenser to be readily moved about the floor. The sides 18 of the bottom plate 10 are bent upwardly to form an enclosed liquidtight drain pan for collecting any liquids which may drip from the articles being carried by the material handling apparatus.

At the front end of the dispenser in each corner,

are upright angle irons 16 (Fig. 2) which are secured at the bottom by suitable means such as welding to the upwardly bent sides 18 of the bottom plate 10. Secured to the upper ends of the upright angle irons 16 are suitable cross bars 20 which constitute the skeleton framework for the dispenser.

The dispenser has a cover plate 22 which covers the top of the apparatus except for an opening formed in the center portion thereof through which the carrier platform 24 raises and lowers material. The vertical path of travel of the carrier platform 24 is closely surrounded by a rectangular inner shell 26 which laterally supports material carried and supported by the carrier platform 24.

The inner shell 26 is secured at its lower end to the bottom plate 10 and at its upper end to the cover plate 22. The inner shell 26 has projections 28 which extend above the cover plate 22 to laterally support material elevated above the surface of the cover plate 22. Two sides of the upwardly extending projections 28 have a hinged mounting 30 which permits the sides to be lowered into a horizontal position. The hinged projections are held in vertical position by suitable means such as hooks 32 carried by the projecting plates 28.

The carrier platform 24 is raised and lowered, by means of calibrated counterbalancing springs, a distance correlated with the weight of each increment or decrement added to or removed from the material supported on the platform to maintain the top of the material at a constant predetermined level with respect to the top of the dispenser. While various types of calibrated springs can be employed to practice the teachings of this invention, for purposes of illustration calibrated tension springs have been used to illustrate the invention in this application. By the term calibrated springs is meant a spring which deflects at a uniform rate within its rated capacity.

The carrier platform 24 is supported on four bolts 34 secured by suitable means such as welding to each corner of the carrier platform 24. A bracket 36 is adjustably connected to each bolt 34 and extends through slits 38 formed in each corner of the rectangular inner shell 26. One end 41 of each of the sprocket chains 40, 42, 44 and 46 are connected to each bracket 36 and supports the carrier platform 24 for vertical movement within the inner shell 26.

Elongated flexible members such as sprocket chains 40, 42, 44 and 46 travel over suitable pulleys such as sprockets 48 and under the sprockets 50 and are connected at their opposite ends to suitable anchor bolts 52. Sprocket chains 40 and 46 travel over another pair of sprockets, mounted on the skeleton frame 20 adjacent the far end of the carrier platform 24 (shown in copending application of Christopher Bockius referred to above).

A loop is formed in the sprocket chains 40, 42, 44 and 46 between the sprockets 48 and the anchor bolts 52. Supported by this loop are sprockets 50 mounted at opposite ends of a double saddle shaft consisting of bars 54 and 56. Calibrated tension springs 58 are hooked at one end at spaced intervals to the saddle shaft bars 54 and 56.

In the embodiment used to illustrate the invention some of the calibrated tension springs 58 are connected directly to the bottom plate 10 by suitable anchors 60 while others are connected by suitable means such, for example, as graduated links 62, 64, and 66 to the anchors 60 to stagger the time said springs become active when the carrier 24 is lowered by material placed thereon. Some of the springs 58 also are connected to the cross frame 68 of a suitable mechanical spring stretcher. In the present application for purposes of illustration the spring stretcher shown consists of a cylinder 70 attached at one end to the cover plate 22 of the dispensing apparatus. It will be understood that other suitable stretching mechanisms could also be used for this purpose. The number of calibrated springs having staggered connections and the number of calibrated springs connected to the spring stretching mechanism may be varied as necessary to handle the material for which the dispenser is used.



A hydraulically operated piston 72 is reciprocally mounted within the cylinder 70 and has at its actuating end the cross frame 68. The piston 72 is pushed downwardly by means of a suitable hydraulic fluid which is pumped by a conventional pump, such as a hydraulic bumper jack, actuated by the pump handle 74. The fluid pumped by the pump handle 74 is released when desired by a suitable valve 76. By actuating the pump rod 74 when the valve 76 is closed pressure will be built up behind the piston 72 which causes the piston to stretch the springs which are connected to the frame 68. When the valve 76 is opened the fluid is allowed to escape which allows the piston 72 to be freely moved in and out of the cylinder 70 by the calibrated tension springs connected to the frame 68.

A suitable removable door 78 is mounted at the front end of the dispenser to permit access to be had to the springs and operating mechanism described. For additional details concerning the construction of a self leveling, storing and dispensing apparatus for bulk material, reference may be made to copending application of Christopher Bockius, S. N. 736,479, mentioned hereinbefore.

The operation of the invention may be briefly described as follows:

When material to be stored, such as machine parts undergoing manufacture, are placed on top of the carrier platform 24, the weight of the parts causes the platform to descend a distance correlated with the weight added to the platform. As more parts are added, the carrier platform 24 descends still further so that the top of the material supported on the carrier platform 24 is always maintained at a constant predetermined level. The plate 28 laterally supports that portion of the material which extends above the upper surface 22 of the dispensing apparatus.

When the carrier platform 24 is depressed by material placed thereon it pulls downwardly on the ends 41 of sprocket chains 40, 42, 44 and 46 which are connected to the supports 36. This causes the sprocket chains just mentioned to rotate the sprockets 48 thereby shortening the loop in which the sprockets 50 are supported. Since all the sprockets 48 are keyed on the shaft 49 the sprocket chains 40, 42, 44 and 46 all move an equal distance in the same direction thereby preventing the carrier platform 24 from tilting.

As the sprocket chain loops are shortened the saddle shafts 54 and 56 are elevated thereby causing the springs 58 which are connected directly to the anchors 60 to be stretched. As additional material is added the springs 58, which are attached to the shortest graduated link 62, become active. As the loading process continues,

additional springs connected to the graduated links **64** and **66** progressively become active also as shown in Fig. 3.

It will be understood that the valve **76** is open when the dispenser is being loaded so that as the saddle shafts **54** and **56** travel upwardly the springs attached to the support **68** causes the piston **72** to be moved upwardly inside of the cylinder **70**. During the loading process friction between the material supported on the carrier platform **24** and the inner shell **26** gradually increases. Therefore the force exerted on the saddle shafts **54** and **56** will vary not only in accordance with the weight of the material supported on the carrier platform **24** but also in accordance with the amount of friction between the material and the inner shell **26** of the dispenser. To compensate for this variation the graduated link structure consisting of links **62**, **64** and **66** shown in Fig. 3 is employed to stagger the time the counterbalancing spring tension force become active as the saddle shafts **54** and **56** move upwardly.

As a result when the frictional element begins to modify the downward force exerted by the weight of the material on the platform **24**, allowance for this retarding effect has already been made by staggering the time the springs **58** become active in supporting the material. Consequently the top of the material being stored is maintained at a constant predetermined level since the friction and the force of the calibrated springs have been balanced to lower the material the distance desired.

After the dispenser is fully loaded and the operator commences to remove the articles from the dispenser it has been found that the amount of friction existing between the material and the inner shell is greater than the amount of friction which exists when the dispenser is being loaded. Therefore as the operator removes material from the dispenser, the top of the material, because of friction, is prevented from rising to the predetermined level at which it is desired to have the material maintained. When this occurs the operator manipulates the pump handle **74** and applies pressure in the cylinder **70** on the end of the piston **72**. This causes the piston **72** to be moved downwardly thereby stretching the springs attached at one end to the support **68** as shown in Fig. 3 in dotted outline. This causes additional spring tension force to be exerted on the saddle shafts **54** and **56**. When the required amount of force has been added to counteract the increased friction encountered when the carrier travels upwardly the carrier **24** automatically raises the top of the material to the level desired and maintains it there. Thus the material reassumes the desired predetermined level with respect to the top **22** of the dispensing apparatus.

The invention also has considerable value as a device for varying the capacity of a self-leveling storing and dispensing apparatus which is used to store stacked material rather than material in bulk as will now be explained.

By closing the valve **76**, when the dispenser is empty, the piston **72** will be locked in its lowermost position. As a consequence the capacity of the dispenser will be increased by the rating of the springs attached to the piston **72**. By leaving the valve **76** open, the springs attached to the piston **72** will not be stretched when the apparatus is loaded. Accordingly the capacity of the apparatus will be less by the amount of springs rendered inactive in this manner.

In cases where a still greater amount of capacity changing is desired in a self-leveling storing and dispensing apparatus a plurality of spring locking devices shown in Fig. 4 may be employed for activating and deactivating the calibrated tension springs. In such a case a single control knob **130** such as shown may be employed so that the task of changing the capacity of the apparatus can be easily and quickly accomplished by an operator. In Fig. 4 the cylinders **80**, **82** and **84** have hydraulically actuated pistons **86**, **88** and **90** similar to those designated by the numerals **70** and **72** in Fig. 1 and are employed for locking the lower end of as many calibrated tension springs against movement as is necessary to counterbalance the weight of the material to be stored in the dispenser.

The cylinders **80**, **82** and **84** are connected by ducts **92**, **94** and **96** to ports **98**, **100** and **102** respectively formed in the valve cylinder **104**. When the pump handle **138** is moved up and down, a conventional pump **110** pumps suitable hydraulic fluid received from the reservoir tank **106** through duct **112**, port **114** into the valve cylinder **104** between the collars **122** and **124**. Hydraulic fluid is permitted to flow freely between the far end of the cylinder **104** to the tank reservoir **106** through port **116** and duct **118**. The path of flow of the hydraulic fluid is controlled by the position of the valve piston **120** in the cylinder **104**. Valve piston **120** may be manually moved along the length of cylinder **104** by means of the knob **130**. A scale **136** having notches **134** into which the pointer **132** slips indicates the position of the valve piston in the cylinder **104**. When the pointer **132** is set in the notch **134** corresponding to the weight of the material to be handled before loading the dispenser, hydraulic fluid is locked in the cylinders which have pistons connected to springs which are to be active when the dispensing apparatus is loaded.

If an operator should inadvertently over estimate the weight of the material to be handled and sets the pointer **132** at the 400 pound notch, for example, instead of at the 300 pound notch the error may be simply corrected even after the apparatus is partially loaded by merely moving the pointer **132** to the correct notch. When this is done hydraulic fluid is allowed to escape through port **102** thus permitting the piston **90** to be pulled up into the cylinder **84** by the springs connected thereto and thus deactivating the springs which are not needed to counterbalance the load.

On the other hand if the operator inadvertently under estimates the weight of the material and sets the pointer **132** at 200 pounds when it should have been set at 400 pounds the operator will notice that as material is placed on the dispenser the top of the material descends to a level lower than desired. To correct this error the operator merely has to put the pointer **132** over to the 400 pound notch and then operate the pump **110** by means of the pump handle **138**. This causes the additional springs required to counterbalance the load to be stretched by means of the pistons **88** and **90** being forced downwardly by hydraulic fluid being pumped into the cylinders **82** and **84**.

It will thus be seen that a simple one knob control has been provided in accordance with the object of this invention which permits an operator to readily adjust the capacity of the dispensing apparatus regardless of whether mate-

rial has or has not been loaded into the dispensing apparatus.

Heretofore it was the practice to connect and disconnect springs manually from the anchors at the bottom of the dispensing apparatus. If the incorrect number of springs was chosen to counterbalance the load and this error was not noticed until after the dispenser was partially loaded it would be for all practical purposes impossible to correct this error without unloading the dispenser because the springs would be under tension and they would have to be stretched manually to either hook or unhook them. As previously mentioned errors in fixing the capacity of the dispenser can be corrected at any time by merely moving the pointer 132 to the correct designation. If it should so happen that the operator has under estimated the load to be handled, the pump handle 138 is given a few strokes to stretch the additional springs required to counterbalance the material.

While we have shown only three cylinders 80, 82 and 84 in the modified form of our invention, it should be understood that this number has been chosen for purposes of illustration only and that a greater or lesser number of cylinders could be used so as to obtain whatever amount of variability is desired. It should also be understood that one or more springs can be connected at their lower ends to each of the pistons 86, 88 and 90 in the manner shown in Fig. 1. Likewise for purposes of simplicity and clarity we have not shown springs in Fig. 4 since the manner in which they may be connected is clearly shown in Figs. 1, 2 and 3. It will be further understood that as a practicable matter, a certain number of springs are always needed to take care of the minimum requirement in counterbalancing the usual run of material in a self-leveling apparatus. Such springs would be connected at all times between the saddle shafts 54 and 56 and the bottom of the dispenser 10 as shown by the spring connected to anchor 60 in Figs. 1 and 3.

When the pointer 132 is set on zero position none of the springs connected to the pistons 86, 88 and 90 will be stretched. If desired the zero position could have a designation corresponding to the spring force exerted by the springs which remain connected at all times between the saddle shaft and the dispensing apparatus. Similarly if the pointer 132 is positioned opposite to number 200 the pistons 88 and 90 will not be locked against movement and when the saddle shaft 54 and 56 travels upwardly as shown in Fig. 3 the pistons 88 and 90 will be drawn upwardly inside of the cylinders 82 and 84 by the springs which are connected to the pistons 88 and 90. When the pistons 88 and 90 travel upwardly they push the hydraulic fluid through ducts 94 and 96 out through ports 100 and 102 into port 116 and duct 118 back into the reservoir tank 106. When the saddle shafts 54 and 56 are lowered the springs connected to the pistons 88 and 90 allow the pistons 88 and 90 to descend. This causes hydraulic fluid to flow from the tank 106 through duct 118, port 116, ports 100 and 102, ducts 94 and 96 into the cylinders 82 and 84.

When the pistons 88 and 90 are in their lowermost position and the pointer 132 is set at some figure higher than the zero position one or more of the ports 98, 100 and 102 will be confined between the collars 122 and 124 so that hydraulic fluid cannot escape therethrough. In other words the apparatus disclosed in Fig. 4 constitutes a convenient method for varying the capacity of a self-leveling storing and dispensing apparatus by activating and deactivating calibrated springs by the simple movement of a control knob.



It should be understood that while hydraulic means have been employed for the purpose of illustrating how the lower end of calibrated tension springs may be locked in place by only moving a single control knob, other suitable mechanical means could also be employed for locking the lower end of the calibrated tension springs against movement by use of a single control knob and that the scope of this application should not therefore be restricted to the use of hydraulic apparatus for accomplishing this objective.

The invention above described may be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a self-leveling dispensing apparatus, a material carrying platform, elongated flexible members supporting said material carrying platform for up and down movement, an inner shell surrounding the path of travel of said platform, guide members for confining said elongated members to a predetermined path of travel, counterbalancing calibrated tension springs connected to said elongated flexible members for raising and lowering said carrier a distance corresponding with the weight of each increment or decrement added to or removed from the carrying platform, anchorages for said springs, and lost motion connections between said springs and said anchorages, said lost motion connections being constructed and arranged to provide varying amounts of lost motion to stagger the time said springs become effective in accordance with the amount of friction encountered at the various positions of the descending material carrying platform.

2. In a self-leveling dispensing apparatus, a material supporting platform, elongated flexible members supporting said platform for vertical movement, rotary members over which said elongated flexible members are trained, an inner shell surrounding the path of travel of said platform to laterally confine material supported thereon, calibrated tension springs connected to said elongated flexible members for counterbalancing the weight of material supported on said platform, and graduated link mechanism controlling the time said springs commence stretching with respect to the distance traveled by said platform to compensate for frictional differences encountered when the carrier descends.

3. Apparatus of the self-leveling type for receiving, storing and dispensing material wherein the top of the material stored is maintained at a constant predetermined level comprising, an outer housing enclosing said dispensing apparatus, a material supporting platform mounted for vertical movement within said outer housing, an inner shell closely surrounding the vertical path of movement of said platform to laterally support material carried thereon, counterbalancing calibrated springs coacting with said platform to raise and lower said carrier a distance corresponding to each increment and decrement of material added to and removed from the material supported on said platform to maintain the top of the material at a constant predetermined level,

normally inactive calibrated spring means for supplementing the counterbalancing force exerted by said first named calibrated springs and mechanism for stretching said calibrated spring means after said dispenser has been loaded to add additional counterbalancing force to that exerted by said first named springs to overcome friction retarding the upward movement of said carrier.

4. Apparatus of the self-leveling type for receiving, storing and dispensing material wherein the top of the material stored is maintained at a constant predetermined level comprising, an outer housing enclosing said dispensing apparatus, a material supporting carrier mounted for vertical movement within said outer housing, an inner shell closely surrounding the vertical path of movement of said carrier to laterally support material carried thereon, elongated flexible members connected at one end to said carrier for supporting said carrier for vertical movement, anchors connecting the other end of said elongated flexible members to a stationary part of said dispensing apparatus, a saddle shaft supported in loops formed in said elongated flexible members intermediate the ends of said elongated flexible members, calibrated tension springs connected at one end to said saddle shaft, spring anchors connecting the other end of at least one of said springs to a stationary part of said dispensing apparatus, and a spring stretching device associated with the remainder of said springs to apply when required additional counterbalancing force to said saddle shaft by stretching the remainder of said springs to counterbalance material supported on said carrier.

5. A storing and dispensing apparatus of the self-leveling type for storing material in bulk comprising, a framework for the dispensing apparatus, a material supporting platform mounted for vertical movement within said framework, an inner shell surrounding the vertical path of movement of said platform for laterally confining material carried by said platform, a set of calibrated counterbalancing springs for lowering said platform a distance correlated with the weight of each increment of material added to the material supported on said platform, additional calibrated springs for supplementing the counterbalancing force exerted by said first named set of calibrated springs when material is removed from said platform to compensate for friction between the inner shell and the material supported on said platform, and means for stretching said additional calibrated springs an amount sufficient to maintain the top of the material at a constant predetermined level.

6. Apparatus of the self-leveling type for receiving, storing and dispensing material in bulk, comprising, a frame, a vertically movable material supporting platform associated with said frame, confining walls surrounding the vertical path of travel of said material supporting platform, a plurality of active and inactive calibrated springs for counterbalancing material on said supporting platform, means interconnecting said platform with said springs, mechanism for staggering the time said active springs become energized in counterbalancing material carried on said platform to provide a uniform descent of said platform, and mechanism for stretching said inactive calibrated springs when said dispenser is loaded to facilitate a uniform ascent of the material on said platform.

7. Apparatus of the self-leveling type for receiving, storing and dispensing material comprising, a housing, a material carrier mounted for up and down movement with respectf to said housing, calibrated springs for raising and lowering said carrier a distance correlated with the weight of material supported on said carrier to maintain the top of the material at a substantially constant level, elongated flexible members interconnecting said springs with said carrier, and a hydraulically operated piston connected to one end of at least one of said springs to render the same inactive when the carrier descends and for rendering said spring active by stretching said spring which the carrier is to ascend.



8. Apparatus of the self-leveling type for receiving, storing and dispensing material comprising, a housing, a material carrier mounted for up and down movement with respect to said housing, calibrated counterbalancing springs for counterbalancing material supported on said carrier to maintain the top of the material at a substantially constant uniform level, and lost motion connections connected to one end of said calibrated springs to stagger the time said springs become energized in counterbalancing material placed on said carrier.

9. Apparatus as specified in claim 8 in combination with a spring stretcher employed for stretching additional calibrated springs after the apparatus is loaded to supplement the amount of force applied to the carrier to maintain the top of the material at a substantially constant level when the apparatus is being unloaded.

10. Apparatus of the self-leveling type for receiving, storing and dispensing material comprising, a housing, a material carrier mounted for up and down movement with respect to said housing, elongated flexible members for supporting said carrier for up and down movement within said housing, calibrated tension springs connected with said elongated flexible members to exert a force thereon in a direction opposite to the direction of movement of said flexible members and in an amount correlated with the distance said flexible members move, and mechanism for varying the amount of force exerted by said springs on said elongated flexible members when the dispenser is being loaded and unloaded to maintain the top of the material at a substantially constant level at all times.

11. Apparatus of the self-leveling type for receiving, storing and dispensing material wherein the top of the material stored is maintained at a constant predetermined level comprising, a housing for said apparatus, a material carrier mounted for up and down movement within said housing, elongated flexible members supporting at one end said carrier, pulleys mounted at the top of said housing over which said elongated flexible members travel, mechanism for causing said elongated flexible members to move equally in the same direction, means for connecting the other end of said elongated flexible members to said housing and forming a loop in said members between said means and said pulleys, a spring support carried in said loop, calibrated tension springs connected at one end to said spring support to assist in counterbalancing material placed on said carrier, and a staggering device connecting the other end of said springs to said housing to stagger the time said springs begin to exert force in counterbalaneing the carrier.

12. Apparatus of the self-leveling type for receiving, storing and dispensing material wherein the top of the stored material is maintained at

a constant predetermined level regardless of whether material is added to or removed from the dispenser, comprising a housing for said apparatus, a material carrier adapted and arranged to move up and down within said housing, pulleys connected to said carrier adjacent the upper end of the path of travel of said carrier, elongated flexible members connected at one end to said carrier and passing over said pulleys to support said carrier for up and down movement, calibrated tension springs connected at one end with said elongated flexible members for applying calibrated tension thereto and means secured to and traveling with the other end of said tension springs and mechanism locking said means from movement to cause the springs to stretch when said carrier is depressed to obtain the amount of tension required to counterbalance the material placed on said carrier.

13. In a self-leveling storing and dispensing apparatus, a frame, a material supporting platform movable up and down with respect to said frame, calibrated tension springs for counterbalancing material placed on said platform to raise and lower the material supported thereon a distance corresponding to each decrement and increment removed from and added to the material on said platform so as to maintain the top of the material at a constant level, means interconnecting one end of each of said springs with the platform to cause said ends of said springs to travel a distance proportional to that traveled by the platform, movable means traveling with the other end of said springs, mechanism for rendering as many of said movable means as desired stationary when the apparatus is empty and a manually operated control knob for setting said mechanism to activate the number of calibrated tension springs necessary to counterbalance material to be handled in the apparatus.

14. A self-leveling storing and dispensing apparatus, comprising a housing, a material supporting member mounted for movement up and down with respect to said housing, calibrated counterbalancing springs connected at one end with said member for raising and lowering said member at a uniform rate corresponding to the weight of the material supported thereon so as to maintain the top of the material at a constant predetermined level, and a movable control for locking against movement the other end of as many of said springs as necessary to counterbalance the type of material to be handled in said apparatus.

15. A self-leveling material storing and dispensing apparatus comprising, a housing, a carrier movable up and down with respect to said housing, calibrated tension springs for counterbalancing material placed on said carrier to raise and lower the material supported thereon a distance corresponding to each decrement and increment removed from and added to the material placed on said platform so as to maintain the top of said material at a constant predetermined level, elongated flexible members supporting said carrier for up and down movement, calibrated tension springs associated at one end with said elongated flexible members, means connecting the other end of at least one of said calibrated tension springs to said housing, a capacity changing control knob readily reached from the outside of said housing for changing the capacity of said apparatus, and devices actuated by said knob for connecting optional numbers of springs by moving said knob a distance corresponding to a scale showing the weight of material to be counterbalanced in the apparatus.



16. A self-leveling apparatus for storing and dispensing material comprising, a housing, a material carrier movable up and down with respect to said housing, calibrated tension springs for counterbalancing material placed on said carrier to raise and lower the material supported on said carrier a distance corresponding to each decrement and increment of material removed from and added to the material supported on said carrier so as to maintain the top of the material at a constant predetermined level, elongated flexible members connected to said carrier for supporting the carrier and material supported thereon, calibrated tension springs associated at one end with said elongated flexible members, a spring holder connected to and traveling with the other end of said calibrated tension springs, and mechanism for stretching as many of said springs as is needed to counterbalance the material on said carrier by moving the holders of said springs to a predetermined position with respect to said housing.

17. A self-leveling storing and dispensing apparatus, comprising a housing, a carrier mounted for vertical movement within said housing, calibrated tension springs connected to said carrier for counterbalancing material supported thereon, movable anchors connected to the other end of said calibrated tension springs, hydraulic cylinders and pistons for exerting pressure on said movable anchors to move them to a predetermined position with respect to said housing to stretch the calibrated tension springs after the dispenser is partially loaded to exert additional counterbalancing force thereon, a pump for pumping hydraulic fluid into said cylinders, and a control valve for fixing the number of cylinders into which hydraulic fluid is pumped to stretch the tension springs attached to the anchors so moved by hydraulic fluid.

18. A device for changing the capacity of a self-leveling storing and dispensing apparatus, comprising a material carrier for supporting material to be stored, calibrated springs connected to said carrier for counterbalancing material supported thereon, mechanism allowing at least one of said springs to remain unstretched when said apparatus is in use, and hydraulic means for stretching at least one of said springs to change the capacity of said self-leveling dispenser.

19. Operating mechanism for a self-leveling storing and dispensing apparatus, comprising a carrier for supporting material to be stored and dispensed, calibrated tension springs for counterbalancing material supported on said carrier for raising and lowering said material a distance corresponding to each decrement and increment added to and removed from the dispensing apparatus to maintain the top of the material at a constant predetermined level, and mechanism for staggering the time said springs become stretched in supporting material placed on said carrier and for exerting additional stretching force on said springs after the apparatus is completely loaded to apply additional counterbalancing force to the carrier.

20. The method of maintaining at a substantially constant level the top of material stored in a bulk storing and dispensing apparatus of the self leveling type employing calibrated counterbalancing springs which comprises staggering the time the calibrated counterbalancing springs begin to stretch when the dispensing apparatus is being loaded to allow for friction retarding the

material from descending in the apparatus when being loaded, and then stretching the counterbalancing springs in the self leveling apparatus a greater distance when the carrier ascends than when the carrier descends to apply additional counterbalancing force on said carrier to overcome friction retarding the upward movement of the material so as to maintain the top of the material at a constant level at all times.

21. The method of maintaining at a substantially constant level the top of the material stored in a bulk storing and dispensing apparatus of the self-leveling type having side walls surounding the material and calibrated springs for counterbalancing the material supported in the dispensing apparatus which comprises changing the amount of the counterbalancing force exerted on the carrier when it descends and increasing the amount of counterbalancing force when the material stored in bulk is being removed from the apparatus so as to maintain the top of the bulk material at a substantially constant level with respect to the top of the dispensing apparatus at all times.



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