United States Patent

[11] **3,576,313**

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[54] **APPARATUS FOR SETTLING THE CONTENTS OF CONTAINERS**
12 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **259/59,** 259/2
[51] **Int. Cl.** **B01f 11/00**
[50] **Field of Search** 99/186; 259/1, 2, 72, 73, 91, 92, 94, 93, 48, 54, 55, 56, 59, 57; 99/361, 362, 367, 369

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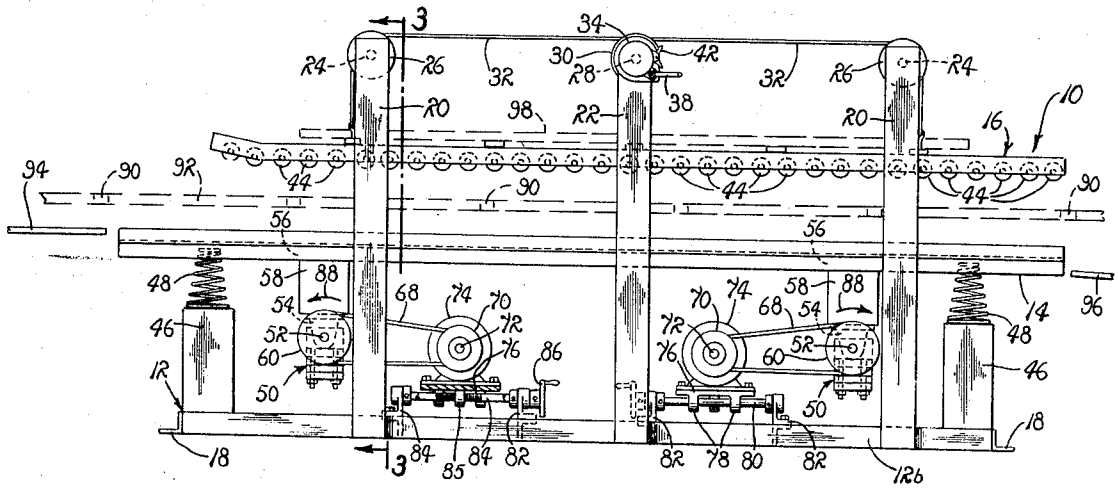
ABSTRACT: Apparatus for settling the contents of containers and the like including a vertically vibratory platform and a weighted floating cover plate between which the containers pass. The platform is resiliently mounted and is vibrated by a pair of eccentric weights coordinately driven in opposite directions at substantially the same speed of rotation.



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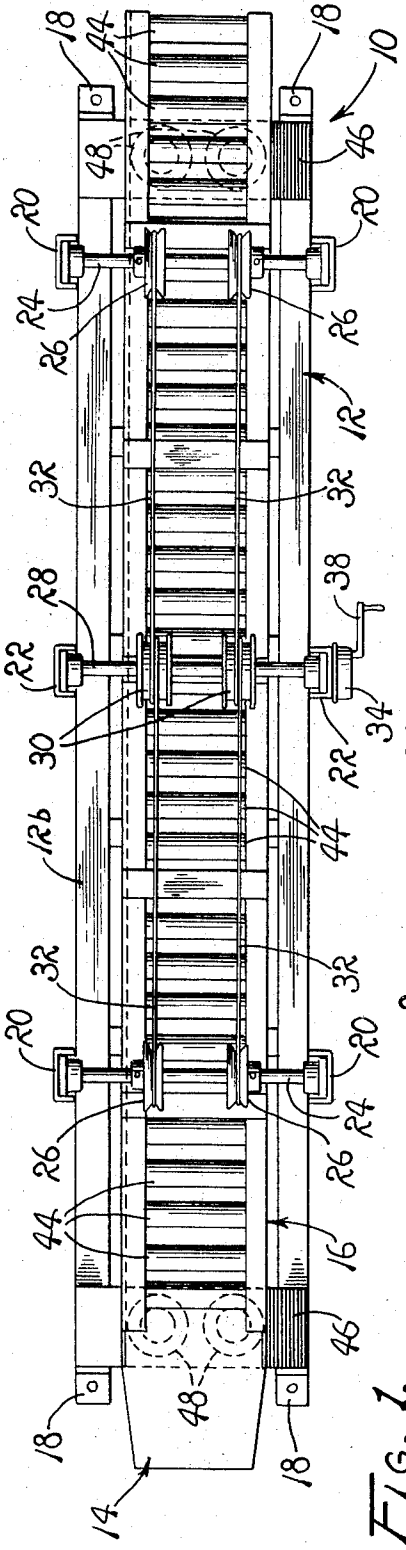

FIG. 1.

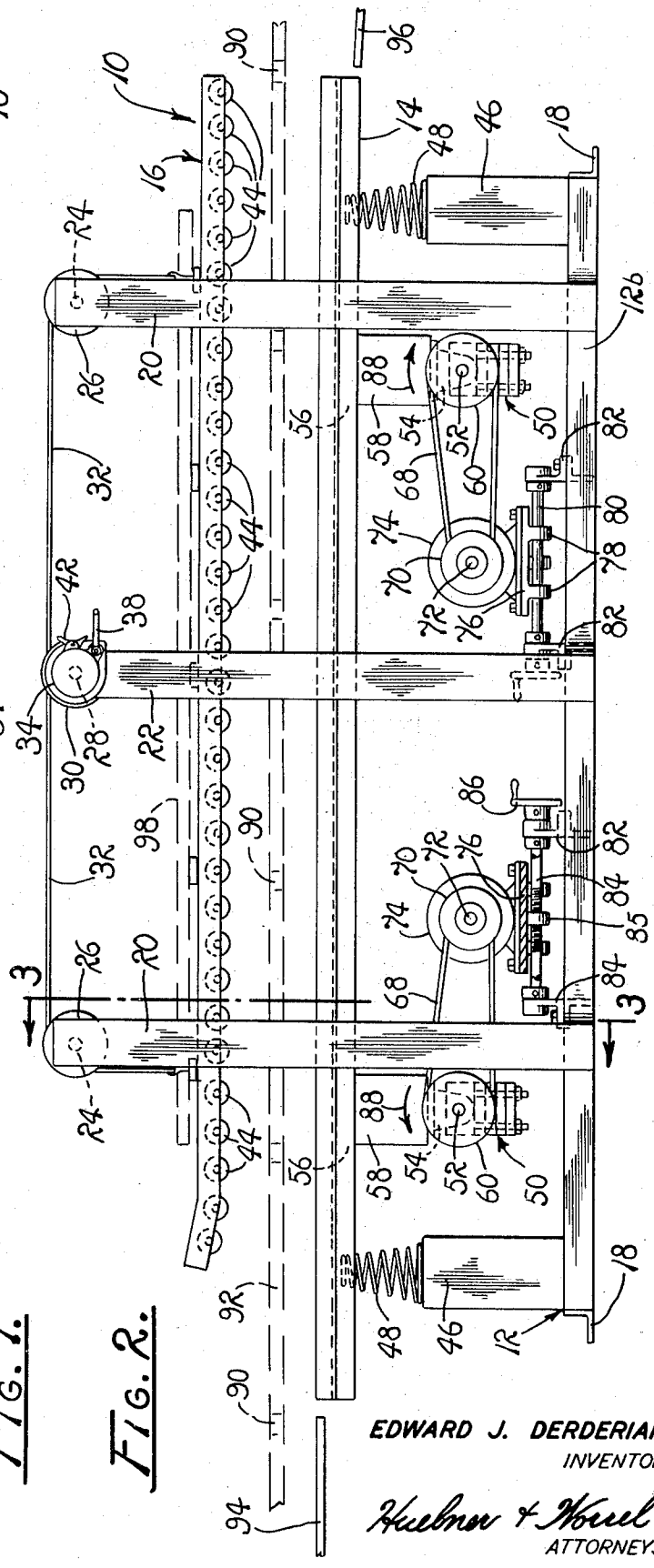

FIG. 2.

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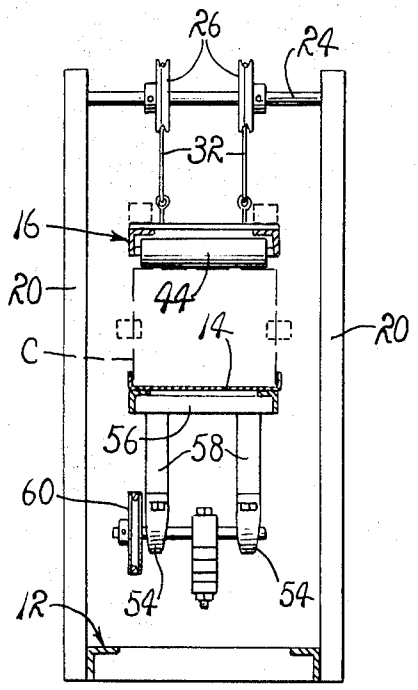

FIG. 3.

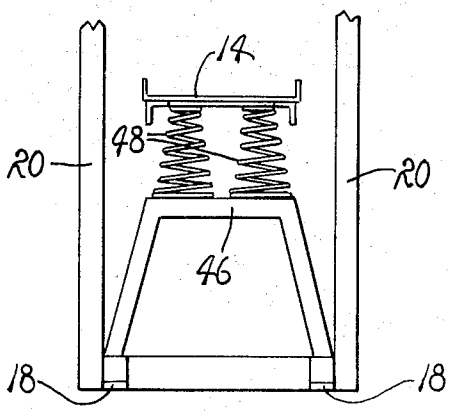

FIG. 4.

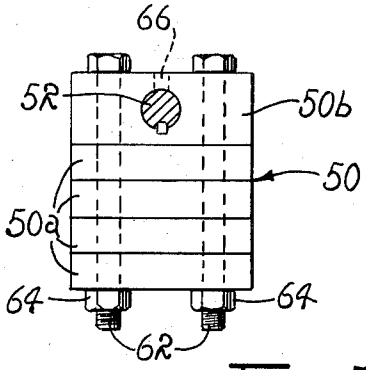

FIG. 5.

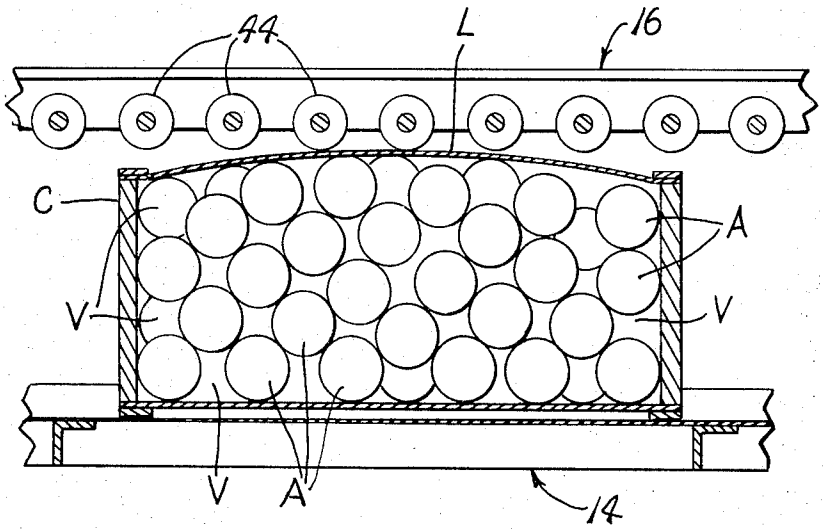

FIG. 6.

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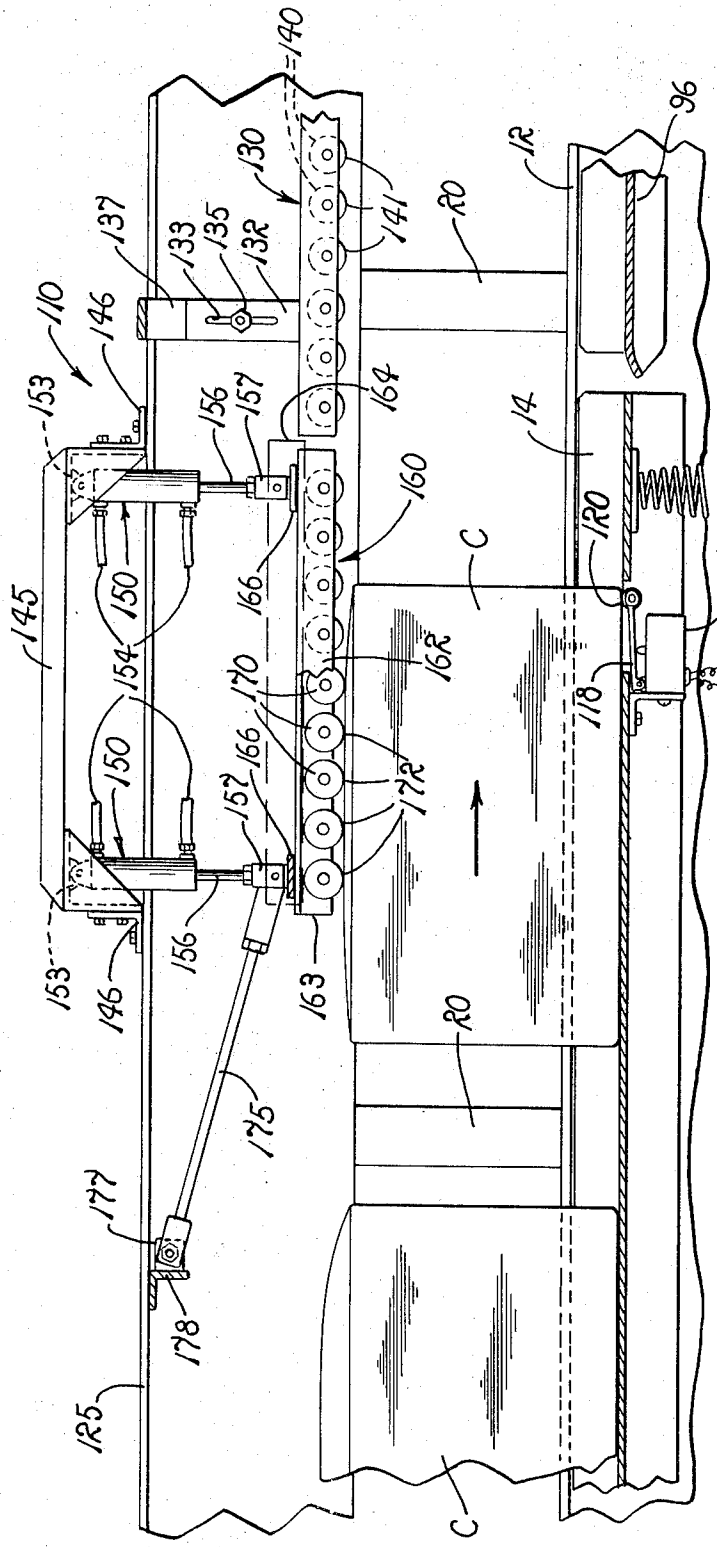

FIG. 7.

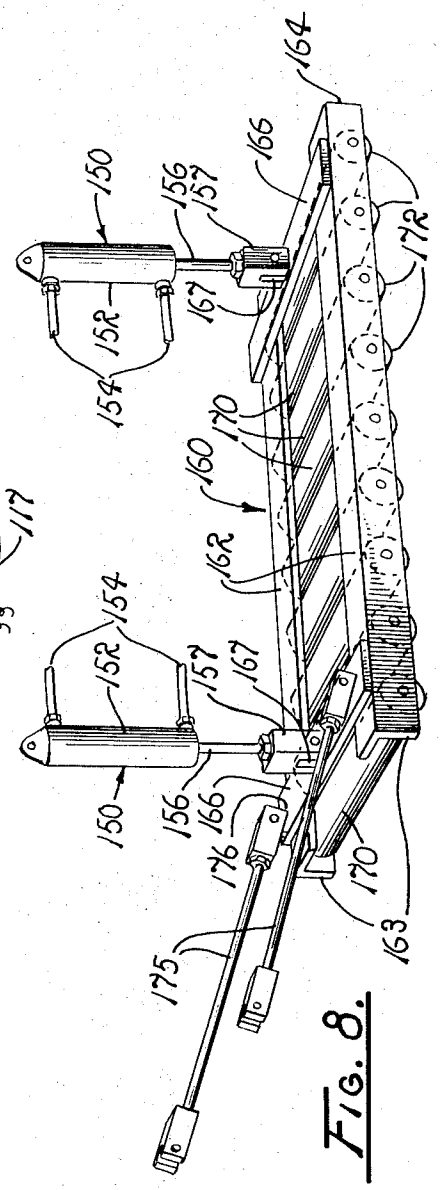

FIG. 8.

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APPARATUS FOR SETTLING THE CONTENTS OF CONTAINERS

BACKGROUND OF THE INVENTION

The present invention relates to apparatus and method for settling the contents of containers, as in the settling of fruit and other produce for shipment or storage and more particularly to improved apparatus of such type which reliably settles the content of the containers to a desirable disposition in a rapid and reliable manner.

In the preparation of produce for shipment, it has long been the custom to hand pack the produce into containers so that it will be compact, protected during transport, and present a pleasing visual appearance when displayed to the ultimate customer. However, modern labor costs are rapidly making such packing economically unfeasible. As a substitute, it has been necessary to adapt what is known as the "random pack." In the random pack, the produce is simply deposited by any suitable means, frequently mechanical, into a container and the container lidded for shipment. However, later when the container is subjected to jostling and shaking incident to handling and transporting, the contents settle. As a result, the container arrives at its destination only three-fourths to two-thirds full. This is completely undesirable because, not only does it result in a waste of shipping space, but it creates an unfavorable impression upon the customer. Apparently what happens is that while static, the items of produce are held in initial dispositions by static friction, the coefficient of which is, of course, greater than the coefficient of kinetic friction related thereto. Thus, because of shaking and jostling during handling and shipping, kinetic friction becomes effective in various parts of the container so that relative movement occurs and the articles redispose themselves, settling to a greater density lower in the container.

Heretofore, vibrating devices have been employed to settle fruit and the like in a container prior to shipping or storage. However, such devices have not been completely satisfactory because although the produce has been settled in certain portions of the container it has been piled up in others. In other words, while intending to compact the produce downwardly, conventional vibrators have moved the produce horizontally and in some instances even tended to loosen the pack in certain portions of the container.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved apparatus for settling fruit and the like in containers.

Another object is to provide an apparatus for settling packing fruit in containers which overcomes the disadvantages of prior art devices.

Another object is to provide an apparatus which is effective in settling fruit in containers so that the containers can be shipped in substantially full condition.

Another object is to provide an apparatus for settling produce in containers which operates in a rapid and reliable manner.

Another object is to provide an apparatus for settling fruit in containers which is of relatively simple and economical construction.

These and other objects and advantages are achieved by an apparatus having a vertically vibrating platform, over which the filled containers are adapted to slide, and a floating weighted cover plate pressing downwardly on the containers. Vibratory movement is imparted to the platform by a plurality of rotary eccentric weights driven in opposite directions in coordination at substantially the same rate of speed. The weights can be varied for obtaining predetermined vibratory effects.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of an apparatus embodying the principles of the present invention.

FIG. 2 is a side elevation of the apparatus of FIG. 1 showing a container feeding means related thereto.

FIG. 3 is a vertical section taken on line 3–3 of FIG. 2.

FIG. 4 is a fragmentary end elevation of the apparatus illustrating the manner of resiliently supporting the vibratory platform of the apparatus.

FIG. 5 is an enlarged side elevation of one of the eccentric weights of the apparatus.

FIG. 6 is an enlarged fragmentary vertical section illustrating the relation of the containers to the apparatus during operation thereof.

FIG. 7 is a fragmentary side elevation of a second form of upper container compressing mechanism for the apparatus of the present invention.

FIG. 8 is a somewhat enlarged perspective of the compressor device removed from the apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, and to FIGS. 1 and 2 in particular, there is illustrated an apparatus embodying the principles of the present invention designated generally by reference numeral **10** and consisting essentially of a framework **12**, a vibratory platform **14** and a floating cover plate **16**. The platform and plate are adapted to receive containers C therebetween, as shown in FIG. 3 in dashed lines.

The framework **12** is conveniently constructed in any suitable manner to provide a base **12***b* having anchor members such as angles **18** or the like for securing the framework in fixed relation to a stable supporting surface such as a floor or foundation. The framework **12** also includes spaced pairs of uprights or vertical standards **20**, which can be of channel members or of any other suitable structural form secured to the sides of the base **12***b*. Intermediate the pairs of channel members **20** is another pair of channel members or uprights **22** also secured to the base sides. Each pair of standards **20**, at the upper ends thereof, journal one of a pair of parallel shafts **24** on which are mounted a pair of pulleys **26**. The upper ends of the uprights **22** journal a transverse shaft **28** parallel to the shafts **24**. The shaft **28** carries a pair of spaced drums **30** to which are connected the inner ends of lines or cables **32**. The lines are reeved over the pulleys **26** and have their other ends connected to the cover plate **16**, best seen in FIG. **3**.

The drums **30** are parts of a winch device and the lines **32** are adapted to be wound thereabout upon rotation. To this end, shaft **28** has secured to one end thereof a drive mechanism **34** which is actuated by a hand crank **38** and held in any desired position of rotative adjustment by a detent **42**.

The cover plate **16** includes a suitable framework journaling a series of transverse parallel rollers **44** along the length thereof. As will later appear, the rollers **44** are adapted to engage the tops of the containers C filled with fruit or the like for gravitationally exerting downward pressure thereon as the containers slide along the platform **14**. By manipulating the crank **38** and detent **42** the cover plate can be disposed as desired with respect to the platform.

At each end of the base **12***b* there is provided an archlike support **46**, as shown in FIG. 4. Mounted on top of each of the supports **46** is a pair of springs **48** the upper ends of which are secured to the platform **14** for resiliently mounting the same. The platform is adapted to be vibrated vertically while containers of fruit or the like slide therealong. Vibratory movement is imparted to the platform by a pair of rotary eccentric weights **50**, each secured to one of a pair of rotary shafts **52**. Each respective shaft **52** is journaled in bearing mounts **54** which are secured to the platform **14** by a bracket **56** having depending arms **58**, best seen in FIG. **3**. Each shaft **52** has a pulley **60** secured to one end thereof.

Referring to FIG. **5**, each of the eccentric weights **50** is made up of a plurality of weights **50***a* attached to a block **50***b* by bolts **62** and nuts **64**. The block is keyed to its shaft **52** for rotation therewith and is held in place thereon by a setscrew or the like **66**.

Returning to FIG. 2, reeved about each of the pulleys 60 is a belt 68 which is also reeved about a split pulley 70 secured to a rotary driven shaft 72. The pulley 70 is of the type that provides for adjustment of the speed of the belt 68 by varying the radial distance thereof from the shaft 72.

Each of the shafts 72 is rotated by an electric motor 74 mounted on a support frame 76. The frame 76 is positioned to dispose the shaft 72 parallel to its associated shaft 52 and is adjustable to vary the space between the shafts. To this end, the frame 76 has depending portions 78 which are suitably perforated to receive a pair of generally horizontal, parallel support rods 80 for free sliding movement thereon. The ends of the support rods are affixed to cross members 82 suitably secured to the base 12*b*, as shown in FIG. 2. Disposed intermediate the support rods 80 and parallel thereto is a threaded shaft 84 suitably journaled on the cross members 82. Each shaft 84 is threadedly connected to its frame 76 by a depending nut portion 85 and has a crank wheel 86 secured to one end thereof. Thus, turning of the crank wheel 86 serves to move shaft 72 relative to its shaft 52 to permit adjustment of the pulley 70 for speed regulation and take up slack in the belt 68. Alternatively, the motors 74 and their associated structure can be mounted in depending relation from the platform 14 in a manner similar to the eccentric weights 50 without changing the desired operation of the platform.

The motors 74 are selected to have an appropriate range of speeds and to operate within 20 r.p.m. of each other over the range. As shown by arrows 88 in FIG. 2, the shafts 52 and the weights 50 are rotated in opposite directions. Accordingly, with the eccentric weights rotated in opposite directions at a coordinated speed, the horizontal thrusts imparted to the platform 14 of the weights are substantially equal and opposite and therefore cancel out so that the movement imparted to the platform is substantially vertical. It will be appreciated, of course, that the direction of rotation of the motors could be reversed and the vibratory movement of the platform would still be substantially vertical.

In actual practice, an apparatus in accordance with the invention is constructed with a cover plate 16 having a weight of about 365 pounds and covering three containers C moving along the platform 14 in end-to-end relation, each container being packed with fruit or the like and weighing between 22 and 26 pounds. The apparatus was equipped with 1,750 r.p.m., ¼-horsepower motors which are operated in the range of 800 to 1,000 r.p.m. To facilitate the movement of the containers over the platform, the upper surface thereof is polished or coated with a low friction material such as polytetrafluoroethylene, commonly known as "Teflon."

The containers can be moved along the platform 14 by any suitable means, for example, suitably spaced flight bars 90 carried by chains 92, as shown in dashed lines in FIGS. 2 and 3. An on ramp 94 serves to feed the containers onto the platform 14, and an off ramp 96 receives the containers coming off. It will be appreciated, of course, that other suitable means could be utilized to advance the containers along the platform.

Where the sizes of the containers and their contents are greater, weight can be added to the cover plate 16 by securing weight bars or strips 98 thereto, as shown in dashed lines in FIGS. 2 and 3, and the eccentric weights can be modified accordingly. With respect to the weights 50*a*, it will be appreciated that they can be adjustably mounted on the bolts 62 by the use of lock nuts securing one or several of them, as necessary, in spaced relation from the block.

OPERATION

The operation of apparatus of the present invention is believed to be clearly apparent and is briefly summarized at this point. Referring to FIG. 6, there is shown a container C filled with articles A, such as fruit or the like, with various shaped spaces or voids V therebetween. The filling of the container C is usually accomplished by filling to overflowing with articles A and dumping or scraping off the excess. A lid L of thin material is then applied, usually in arched condition. Thus, the peripheries of the articles A have various pressure points with adjacent portions of the container or other articles and are held in such dispositions by static friction. As previously indicated, the apparatus is designed to handle a continuous string of containers with about three containers being disposed on the table at a time, the containers sliding from one end of the platform 14 to the other, while the cover plate 16 rests gravitationally on the containers and their contents. Thus, as the platform 14 is vibrated vertically by coordinated rotation the eccentric weights 50, in opposite directions, the platform alternately pushes upwardly against the bottoms of the containers C and withdraws therefrom because of the inertia of the containers and their contents. During upward pushing by the platform 14, the containers C and their contents are pressed upwardly against the gravitationally induced downward pressure of the cover plate 16. Because of the inertia of the plate and the vibratory effect of the platform, the contents of the containers are subjected to varying compressive forces. This, combined with the shaking imparted by the vibration of a platform, causes relative movement between the articles A and a change from static friction to kinetic friction. As a result, the articles redispose themselves to reduce the size of the voids therebetween and contact adjacent articles and/or the interior of the container so that pressures on the peripheries of the articles are equal and opposite and the articles thereafter remain substantially in equilibrium. With such redisposition the articles are packed to a greater density within the containers and in a more stable relationship with respect to each other so that there is substantially little or no further settling of the articles during subsequent handling and shipment.

SECOND FORM

A second form of container compressing apparatus is shown in FIGS. 7 and 8. The upper compressing device is generally indicated by the reference numeral 110 and is substituted for the floating cover plate 16 of the first form of the present invention. This form incorporates the framework 12 and the vibratory platform 14 of the first form with the exception of the addition of a limit switch 117 mounted on the platform 14. The limit switch includes an actuating arm 118 which is pivotally mounted on the switch body and which includes an outer roller end 120 normally upwardly extended into the path of container travel.

An upper frame 125 is elevationally adjustably supported on the vertical standards 20 of the first form in predetermined spaced substantially parallel relation to the platform 14. An elongated stationary roller frame 130 is disposed above the off ramp 96 in endwardly overlapping relation to the container discharge end of the platform 14. The stationary roller frame is mounted on the upper frame 125 by a plurality of adjustable brackets, one of which is indicated by the reference numeral 132. Each of the brackets includes an elongated slot 133 for slidably receiving a locking bolt and nut assembly 135 therethrough which is secured to a hanger strap assembly 137 on the upper frame. The stationary roller frame mounts a plurality of transversely extended spaced substantially parallel rollers 140 which provide substantially horizontally aligned lower peripheral portions 141 for rolling engagement with the tops of the containers C. The roller frame is elevationally positions so as to engage the tops of the containers C in a tightly closed compressed condition prior to sealing.

The compressing apparatus of the second form of the present invention includes an upper superstructure 145 on the upper frame 125. The superstructure is rigidly secured to the upper frame by a plurality of angle brackets 146 in upwardly spaced relation from the discharge end of the vibratory platform 14. A pair of longitudinally spaced power jacks 150 are mounted in depending relation from the superstructure. Each of the jacks has a cylinder end 152 which is pivotally connected to a mounting ear 153 on the superstructure and includes a pair of power supply hoses 154 connected to a suita-

ble source of power, not shown. The jacks further include extendible-retractable rod ends **156** having lower connection clevices **157** thereon.

An elongated container compressing head **160** is suspended from the power jacks **150** for elevational movement therewith in spaced, substantially parallel relation to the vibratory platform **14**. As best shown in FIG. **8**, the compressing head provides a pair of spaced substantially parallel angle iron side rails **162** which have opposite leading and trailing ends **163** and **164**, respectively. The rails are rigidly interconnected by a pair of cross plates **166** individually adjacent to the ends of the rails. Each of the plates has an upstanding ear **167** extended therefrom for pivotal connection to the associated clevices **157** of the power jacks **150**. A plurality of rollers **170** identical to the rollers **140** of the stationary roller frame are mounted in spaced substantially parallel relation between the side rails **162** and include lower peripheral portions **172** extended beneath the rails. The compressing head is stabilized during its movement between an upper retracted position, as indicated in dashed lines in FIG. **7**, and a lower compressing position, as shown in full lines, disposed in substantially coplanar relation with the stationary roller frame **130** by a pair of stabilizer arms **175**. The arms are pivotally mounted at their lower ends on ears **176** upwardly extended from the cross plate at the leading end **163** of the compressing head and similarly pivotally mounted at their upper ends on ears **177** secured to an angle bracket **178** on the upper frame **125**.

The limit switch **117** is operatively connected to a suitable valve, not shown, for controlling the power flow to the jacks **150**. The jacks are initially retracted to dispose the compressing head **160** in its raised dashed line position of FIG. **7**. Upon movement of one of the containers C along the vibratory platform **14** with the contents thereof in an unsettled condition and with the top of the container raised somewhat above the sidewalls, the leading edge of the container engages the roller end **120** of the limit switch arm **118**. At this point, the container is approximately three-fourths of the way beneath the compressing head which is traveled downwardly against the top of the container incident to actuation of the limit switch **117**. The jacks are controlled to exert approximately from 30 to 50 pounds per square inch of compressive force against the top of the container C thereby to provide a further settling effect upon the contents so that the top of the container is substantially flattened. With containers having flaps which are glued or otherwise adhesively secured in closed position, the compressive force assures proper affixing of the flaps in place. As the containers continue their movement by the carrier chains **92** of the first form, they slide easily under the stationary roller frame **130** to maintain the tops in a substantially flat condition.

After the container C is discharged from the vibratory platform **14**, the limit switch arm **118** is released and permitted to swing upwardly into the path of container travel for engagement with the next succeeding container while the power jacks are deactivated and effective to return the compressing head **160** upwardly to its dashed line position of FIG. **7**. The next succeeding container is then permitted to travel along the vibratory platform without any restriction from the leading end of the side rails **162** of the compressing head until reaching the limit switch arm **118**. The stabilizer arms **175** serve as a safety device for the somewhat fragile rod ends of the power cylinders in the event that the compressing head should remain in its lower position and is struck by an expanded or unclosed container. In this event, the stabilizer arms preclude any damage to the cylinders and have sufficient strength to constrain the container against the force of the carrier chains **92** which are protected by the usual shear pin devices to preclude breakage.

There has thus been provided an apparatus and method which are highly effective in settling packing fruit in closed containers in a rapid and reliable manner and which minimizes waste of shipping space.

Although the invention has been herein shown and described in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus. Having described my invention, what I claim as new and desire to secure by Letters Patent is:

I claim:

1. An apparatus for settling the contents of lidded containers comprising means for moving the containers along a predetermined path, and means engaging the containers from above and below while traversing said path vertically compressing said containers and vertically vibrating the containers while so compressed.

2. The apparatus of claim **1** in which the container engaging means includes a weighted cover gravitationally supported on the containers while they traverse said path.

3. The apparatus of claim **2** in which the cover has a series of rollers in engagement with the containers.

4. The apparatus of claim **1** in which the container engaging means includes a substantially vertically movable platform supporting the containers from below.

5. The apparatus of claim **4** in which vertical movement is imparted to the platform by a plurality of spaced vibratory devices.

6. The apparatus of claim **4** in which the platform has associated therewith a plurality of rotary eccentric weights driven at substantially the same rate of speed for vibrating the platform.

7. The apparatus of claim **6** in which the weights are rotated in opposite directions.

8. The apparatus of claim **4** in which the platform has a low friction surface for sliding of the containers therealong.

9. An apparatus for settling the contents of lidded containers comprising means for moving the containers along a predetermined path, a vibratory substantially vertically movable platform supportably engageable with the containers from beneath said path, an upper compressing head disposed above said path, and powered means operatively connected to said upper head for reciprocating the same between a lower container engaging position and an upper retracted position.

10. The apparatus of claim **9** in which said upper head has a plurality of rollers engageable with the containers during their movement along said path when the head is disposed in its lower position.

11. The apparatus of claim **10** including automatic control means disposed in said path having controlling connection to said powered means for actuating the same to lower the head incident to the passage of a container along said path.

12. The apparatus of claim **10** including an elongated stationary upper roller head disposed in substantially coplanar trailing relation to said reciprocating head when in its lower position to maintain said containers in compressed condition throughout their extent of travel along the path.