Dec. 7, 1954 P. ZENLEA 2,696,285

APPARATUS FOR ORDERLY ARRANGING BOTTLE CAPS OR THE LIKE

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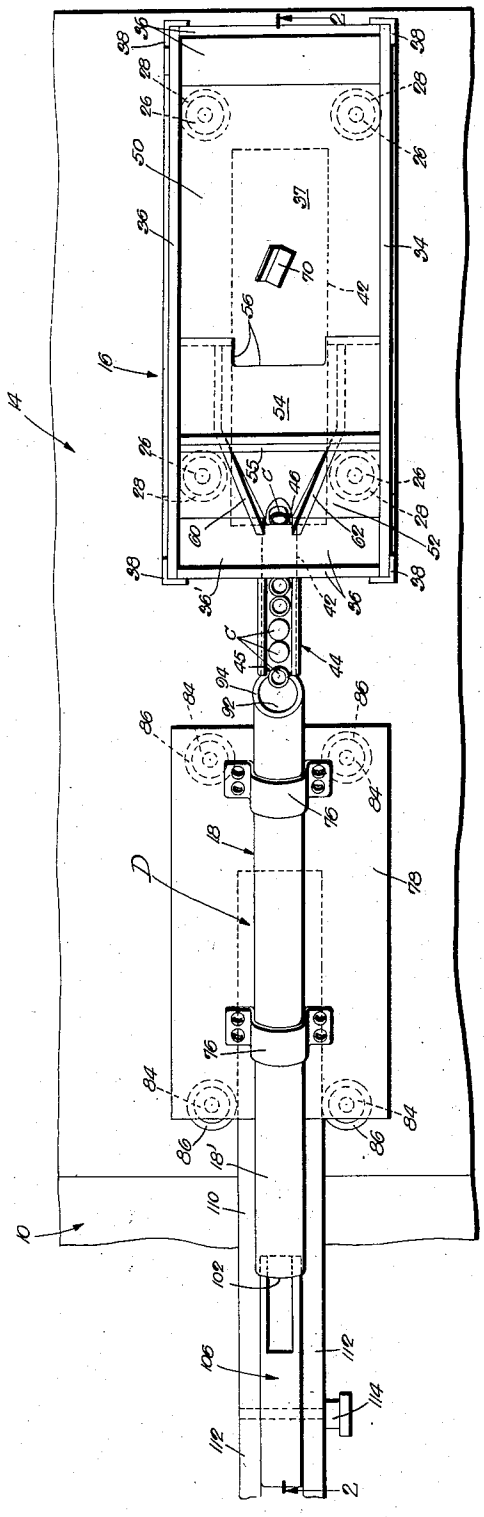

Fig. 1

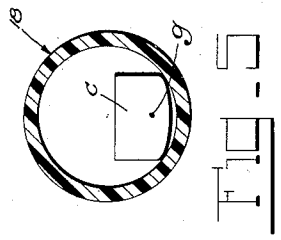

Fig. 5

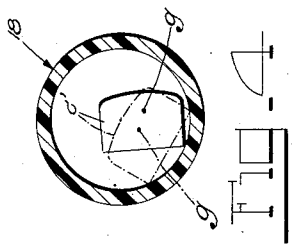

Fig. 4

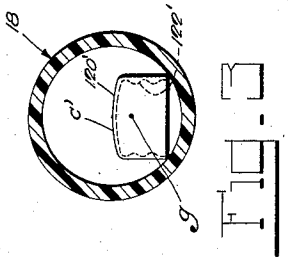

Fig. 3

INVENTOR.
Perry Zenlea
BY Edwin Levicoh +
Harry Cole
Attorneys.

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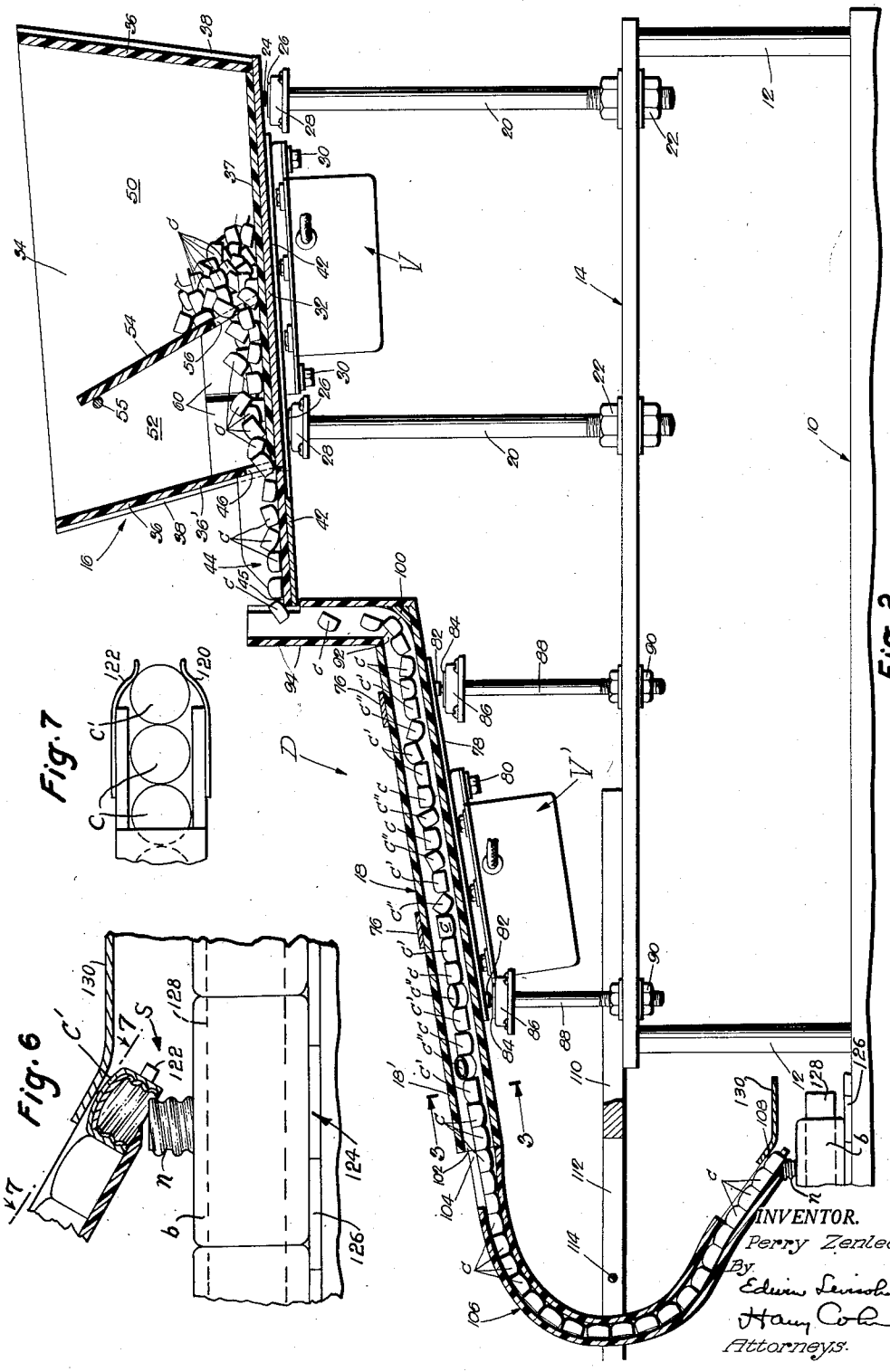

Fig. 2

Fig. 7

Fig. 6

INVENTOR.
Perry Zenlea
By Edwin Levisohn
Harry Cohen
Attorneys.

United States Patent Office

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APPARATUS FOR ORDERLY ARRANGING BOTTLE CAPS OR THE LIKE

Perry Zenlea, Forest Hills, N. Y.

Application December 1, 1949, Serial No. 130,543

5 Claims. (Cl. 193—43)

This invention relates to apparatus for, and a method of, arranging articles, especially bottle caps or the like.

It is an object of the present invention to provide apparatus for arranging bottle caps or similar cup-shaped articles from a dumped supply thereof in predetermined orderly disposition, without subjecting them to any considerable jars in the course of their arrangement.

It is a more particular object of the present invention to provide apparatus of this type in which highly polished, light-weight metal caps, such as are used for closing perfume bottles, for instance, are arranged in orderly disposition without becoming marred in any way.

It is another object of the present invention to provide apparatus of this type in which the caps are orderly arranged by supporting them on a curved surface on which they may readily turn over into correct disposition with their centers of gravity lowermost, i. e., with their bottoms down, and by subjecting them to vibration of such small amplitude and high frequency that they barely rub and never mar each other, yet are compelled to turn into correct disposition on the curved supporting surface unless they are already correctly disposed thereon.

It is another object of the present invention to provide apparatus of this type in which the curved supporting surface for the caps is formed by the interior wall of a tube which is in alignment with, and slightly inclined toward, a chute, and which is itself vibrated and imparts its vibrations to the caps therein so that the latter are, solely by the vibrations imparted thereto, advanced in the tube in a substantially continuous motion toward and into the chute in which they are guided to a station at which they may be applied to bottles.

It is another object of the present invention to provide apparatus of this type which is very simple in construction, yet reliable in operation, and which affords ready inspection of the caps in the course of their orderly arrangement for the detection and ready removal of any cap or caps that may be misarranged and has no further opportunity to become properly arranged.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 is a fragmentary top plan view of apparatus embodying the present invention;

Fig. 2 is a section, partly in elevation, of the apparatus, the section being taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged section taken on the line 3—3 of Fig. 2;

Figs. 4 and 5 are sections similar to Fig. 3, showing a cap to be arranged in a certain part of the apparatus in different positions therein;

Fig. 6 is a side elevation partly in section, of a part of the apparatus; and

Fig. 7 is a view taken on the line 7—7 of Fig. 6.

Referring to the drawings, the reference numeral 10 designates a main support or table on which is mounted a raised platform 14 through intermediation of a plurality of upright posts 12. Arranged above the platform 14 is a hopper 16 and a cap-arranging device D. Dumped into the hopper 16 may be a supply of bottle caps *c*, for instance, for their orderly arrangement in the present apparatus to be ultimately applied to bottles, preferably in the same apparatus. Since the hopper 16 is, in accordance with the present invention, vibrated substantially

vertically for the continuous discharge therefrom of the caps *c* therein, the same is resiliently mounted at its bottom on upright posts 20 which are, in turn, mounted at 22 on the platform 14. Conveniently, the hopper 16 is mounted at 24 on rubber or like resilient pads 26 in castings 28 on the top ends of the posts 20, respectively. The hopper 16 is vibrated by any conventional, preferably electrically operated vibrator V which is suitably mounted at 30 on the bottom of the hopper 16. The hopper 16 is, in the present instance, provided with a bottom wall 32 of sheet metal, for instance, and side and end walls 34 and 36, respectively, which are preferably made of transparent plastic. Preferably, the bottom wall 32 of the hopper is lined with a plastic sheet 37. The side and end walls 34 and 36 of the hopper 16 may conveniently be mounted on corner angles 38 which are, in turn, mounted in any suitable manner on the bottom wall 32.

Suitably secured to, and extending forwardly from, the bottom wall 32 of the hopper 16 is a supporting plate 42 on which is suitably mounted a guide 44 in which caps leaving the hopper 16 through a discharge opening 46 in the end wall 36′ thereof are directed toward and into the device D. The guide 44 may be generally U-shaped in cross-section so as to compel the discharged caps *c* to pass in single file therethrough (Fig. 1). For ready inspection of the caps *c*, the guide 44 is, like the side and end walls of the hopper 16, preferably made of any suitable transparent plastic material. For the ready discharge of the caps *c* through the opening 46 in the vibrating hopper 16, the latter is with its bottom wall 32 slightly inclined to a horizontal plane as shown in Fig. 2. The guide 44, which vibrates with the hopper 16, is likewise inclined to a horizontal plane to compel the caps *c* therein to move toward the discharge end 45 thereof. Further, the hopper 16 is divided into main and auxiliary compartments 50 and 52, respectively, by a transverse partition 54 (Fig. 2) which has an opening 56 for the passage of caps *c* from the main compartment 50 to the auxiliary compartment 52. The partition 54 rests on the bottom of the hopper 16 and also against a transverse brace 55 in the latter, and is otherwise suitably mounted in the hopper. The opening 56 in the partition 54 is of a height to permit the simultaneous passage therethrough of only a few superposed caps, but may be of a width transversely of the hopper to permit the simultaneous passage therethrough of a larger number of side-by-side arranged caps (Fig. 1). By these provisions, the caps moving into the auxiliary compartment 52 are prevented from piling up therein and, instead, are compelled, by the vibration impulses imparted to them by the hopper 16, to arrange themselves in a single layer. Further, the caps *c* in the auxiliary compartment 52 of the hopper are, soon after their passage through the opening 56 in the partition 54, directed into single file by upright walls 60 and 62 which are located in the auxiliary compartment 52 and converge toward the discharge opening 46 in the manner shown in Fig. 1. The discharge opening 46 in the hopper 16 is of such dimensions as to permit the passage therethrough of only a single cap *c* (Figs. 1 and 2). Suitably carried on the bottom of the main compartment 50 of the hopper, preferably near the opening 56 in the partition 54, is an obstacle 70, presently in the form of an angle (Fig. 1), which serves to prevent caps in the main compartment from jamming in front of, or in, the opening 56 in the partition 54, as will be readily understood. Thus, the caps *c* in the main compartment 50 of the hopper 16 will, under the vibration impulses imparted to them by the latter, pass in a steady flow to and through the opening 56 in the partition 54 into the auxiliary compartment 52, wherein they rearrange themselves in a single layer and are directed into single file prior to their passage from the hopper through the discharge opening 46 therein. The amplitude and frequency of the vibrations of the hopper 16 are such as to cause the described discharge of caps from the latter and their substantially continuous travel through the guide 44 without marring them in any way.

The cap-arranging device D is in the present instance, in the form of a tube 18 which is made of preferably transparent plastic material, and conveniently mounted, as by straps 76, on a supporting plate 78. The tube 18, which receives the caps *c* as they are discharged from the

hopper **16** and leave the guide **44**, is, for the correct arrangement of the caps therein vibrated similarly as, but separately from, the hopper **16**. To this end, there is suitably mounted at **80** on the bottom surface of the support plate **78** a vibrator V' which may be of the same type as the vibrator V for the hopper **16**. In order that the vibrations imparted by the vibrator V' to the tube **18** will not be transmitted to the rest of the apparatus, the support plate **78** is preferably resiliently mounted, similarly as the hopper **16**. Thus, the support plate **78** is at its bottom mounted at **82** on rubber or like resilient pads **84** in casings **86** on the top ends of upright posts **88**, respectively, which are suitably mounted at **90** on the platform **14**. Moreover, the support plate **78** and tube **18** thereon are, for inducing the caps *c* in the latter to move therethrough in a steady flow, inclined to a horizontal plane similarly as the hopper **16** and guide **44** (Fig. 2). The inlet end **92** of the tube **18** has a tubular upward extension **94** into which gravitate the caps *c* as they leave the guide **44** (Fig. 2). To prevent the caps from jamming at the inlet end **92** of the tube **18** and to assure their uninterrupted progress from the tube extension **94** into the tube **18**, there is provided at their junction a smoothly curved fillet **100** (Fig. 2).

As will be described hereinafter, the caps *c* in the tube **18** pass therethrough in single file and, unless they are already correctly disposed therein with their bottoms down, are in the course of their passage therethrough turned over into correct disposition, so that the caps *c* are unfailingly in correct disposition as they leave the tube **18** at the discharge end **102** thereof. The discharge end **102** of the tube **18** is in alignment with the inlet end **104** of a chute **106** which is curved downwardly as shown in Fig. 2, so that the caps *c* therein at and near the discharge end **108** thereof are disposed with their bottoms up for their successive removal from the chute **106** and application to the threaded necks of bottles which may pass underneath the chute **106**.

With reference to Figs. 2, 6, and 7, the chute **106** is at the discharge end **108** open at the top to afford access thereat to the foremost caps in the chute for the removal of any misarranged, or defective cap. The caps *c* are held against gravitation from the chute by the resilient gates **120** and **122** which are in the form of arcuate leaf springs secured to the opposite side walls of the chute. The gates **120** and **122** project forwardly from the discharge end of the chute so as to retain the foremost cap in the position best shown in Fig. 6 in which it is in the path of, and will be picked up by, the neck N of the next bottle to pass the station S at which the bottle is closed. A cap thus picked up by the neck of a bottle is in position thereon ready to be turned into tight closing engagement therewith at a subsequent station (not shown). While the gates **120** and **122** will yield outwardly and permit the transfer of each foremost cap from the chute onto the neck of each passing bottle, they will immediately after the passage of a cap *c'* close on the next following cap in the chute and thus hold the remaining caps therein from escaping through the discharge end.

The bottles *b* are placed on the conveyor **124** at a loading station and are carried on said conveyor through the transfer station S. The conveyor **124** may be of any suitable construction and in the illustrated embodiment said conveyor is of the endless chain type of which the usual pivotally connected links carry plates **126** that are arranged to form a flat continuous surface in the top run of the conveyor on which the bottles *b* will be properly supported. The bottles placed on the top run of the conveyor are held in line and guided by opposite guide rails **128**, one of which is shown in the drawings. In order to prevent the transferred cap on any bottle on the conveyor **124** to drop from the neck thereof, there is provided a retainer bar **130** which bears against the transferred caps with such a light force as safely to prevent their escape from the respective bottle necks without in any way impeding the forward progress of the bottles on the conveyor. The retainer bar **130** may be secured to the apparatus in any conventional manner.

The chute **106**, which may be of rectangular cross-section so as to receive a single line of correctly disposed caps *c* with a sliding fit, may be mounted on a forwardly extending plate **110** on the platform **14**, conveniently by being clamped between slightly resilient prongs **112** of the plate **110** by means of screws **114** of which one is shown in the drawings.

The bottle caps to be arranged in the present apparatus may be of any conventional kind, in fact cup-shaped articles other than bottle caps will be correctly arranged in the present apparatus. However, the present apparatus is especially suitable and advantageous for the correct arrangement of bottle caps which will readily become marred even on slight impact with other caps or objects. Thus, the present apparatus is especially advantageous for the arrangement of caps which are used for certain kinds of perfume bottles, for instance, and which comprise relatively thin-walled cups **120'** of externally plated and highly polished aluminum and inserted threaded metallic liners **122'**, respectively (Fig. 3). Caps of this latter type will never become marred in the course of their arrangement in the present apparatus, because they are for their arrangement subjected only to vibrations which will never jar them or throw them against each other or any other object to the extent where they would become marred.

As the discharge caps *c* drop off the guide **44** into the tube **18**, all of them will arrange themselves successively in a single line, and part of them, such as the caps *c'* (Fig. 2), will be positioned with their bottoms up, while most of the remaining caps will be correctly positioned, i. e., with their bottoms down. Some of the caps, such as the caps *c''* in the present instance in Fig. 2, will, in the course of their travel through the tube **18** and through pressure from adjacent caps *c*, be upset from either bottom-down or bottom-up position, but will in the course of their continued travel through the tube **18** be correctly positioned before leaving the latter and entering the chute **106**.

Considering first the caps *c'* in the tube **18** which are incorrectly positioned therein with their bottoms up, it will be noted in Fig. 3 that the cap *c'* is in the tube **18** in a state of equilibrium from which it will soon, under the substantially vertical vibration impulses imparted to it by the tube, be displaced and turn over into correct disposition (Fig. 5) in the course of which the cap *c'* may assume the momentary progressive positions shown in dot-and-dash lines and full lines, respectively, in Fig. 4. Obviously, the center of gravity *g* of the vibrating cap *c'* is, on the slightest displacement of the latter from the position of Fig. 3, instrumental in setting up a rotary moment in the cap, clockwise in the present instance as viewed in Figs. 3 and 4, and this rotary moment will, under the vibration impulses of the cap, exert itself until the center of gravity *g* of the cap is substantially lowermost, i. e., when the cap *c'* is correctly positioned with its bottom down (Fig. 5). Thus, most, if not all, of the incorrectly positioned caps *c'* in the tube **18** will, during their travel through a portion only of the latter, become correctly positioned therein. However, in order to prevent even a single cap *c* among the many caps in the tube **18** from reaching the discharge end of the latter in incorrect bottom-up position or any other position in which it would not freely enter the chute **106** and cause a jam at the inlet end **104** of the latter, a substantial end length **18'** of the tube projects forwardly from the support plate **78**. This projecting end length **18'** of the tube **18** is, under the vibration impulses imparted to the tube and by virtue of the inherent resiliency of the plastic tube material, additionally whipped vertically to such an extent that any incorrectly positioned cap therein will without fail flip over into correct position for the same reasons which compel incorrectly positioned caps in the remainder of the tube to turn over into correct position therein. Thus it may be mentioned by way of example, but not as a limitation, that excellent results have been obtained by leaving substantially one third of the length of the tube **18** beyond the vibrator V' projecting forwardly from the support plate **78**. Inasmuch as reactive forces from the interior wall of the vibrating tube **18** are also instrumental in setting up the turning moments in incorrectly positioned caps therein, it is obvious that for the success of the instant method of correctly arranging caps there are limitations imposed upon the internal diameter of the tube **18** as compared to the dimensions, and especially the outside diameters of the caps *c*. Thus, caps will not right themselves into bottom-down position in a tube which, in comparison to the outside diameters of the caps therein, has such a large inside diameter that the wall portion thereof which is bridged by a cap is much flatter than the wall portion of the tube bridged by the cap in Fig. 3, regardless of the amplitude and frequency of the vibrations of the tube. As already mentioned, momentarily upset caps in the tube **18**, such as the caps *c''*,

will in the course of their continued travel through the tube and by the vibration impulses imparted to them by the latter, arrange themselves in bottom-up or bottom-down position and, if then arranged in bottom-up position, subsequently rearrange themselves in correct bottom-down position, as will be readily understood. Upsetting of the caps in the tube **18**, such as the caps *c''* therein, is to a large extent determined by the inclination of the tube **18**, and the inclination of the latter is selected so as to have a minimum number of these upset caps in the tube while caps travel through the latter at a speed consistent with the demand for correctly arranged caps by a cap-applying device (not shown).

While I have shown and described the preferred embodiment of my invention, it will be understood that various changes may be made in the present invention without departing from the underlying idea or principles of the invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:

1. Apparatus for arranging a series of cup-shaped articles with their closed bottom ends down and open top ends up, comprising a cylindrical tube of slightly resilient material, a support on which a length of said tube is mounted so that a substantial end length of the latter projects freely beyond said support, said support being so arranged that said tube is axially slightly inclined to a horizontal plane with said end length thereof lowermost, and said tube being adapted for the reception and support of a plurality of articles in single file with either of their ends down and having an internal diameter such that any article disposed in said tube with either of its ends down contacts said tube with peripherally opposite portions only of its downwardly disposed end, and means for imparting to said support substantially vertical vibrations of such amplitude and frequency as to induce in the articles disposed in said tube with their bottom-ends up turning moments, respectively, which will invert them into correct position in said tube with their bottom ends down, and further to induce motion of the articles in said tube toward the end of said end length of said tube with the aid of gravitational forces, said tube end length being by virtue of its resiliency and positioning and under the vibration impulses imparted to said tube by said support, vibrated at a greater amplitude than the tube length on said support to correctly arrange any articles in said end length that enter the latter incorrectly arranged.

2. Apparatus for arranging a series of cup-shaped articles with their closed bottom ends down and open top ends up, comprising a longitudinally extending generally straight member having an inner surface for the support of a plurality of articles, said surface being cross-sectionally curved uniformly for the length of said member so that all articles thereon are disposed in single file longitudinally of said surface and any article may be supported thereon on the peripherally opposite portions of either of its ends, and means for imparting to said surface vibrations in a direction laterally thereof and of such amplitude and frequency as to induce in the articles disposed in bottom-up position on said surface turning moments, respectively, which will invert them into correct bottom-down position on said surface, said member being longitudinally inclined to a horizontal plane to induce motion of the articles thereon towards the lower end of said member under the vibration impulses imparted to them by said member, and a chute in alignment with said end of said member in which articles from said surface are in their bottom-down position and single-file arrangement receivable with a sliding fit.

3. Apparatus for arranging cup-shaped articles with their closed bottom ends down and open top ends up, comprising a reclining generally straight cylindrical tube in which may be supported a plurality of articles in single file with either of their ends down, the internal diameter of said tube being such that any article disposed therein with either of its ends down contacts said tube with peripherally opposite portions only of its downwardly disposed end, means for imparting to said tube vibrations in a direction laterally thereof and of such amplitude and frequency as to induce in the articles disposed in said tube with their bottom ends up turning moments, respectively, which will invert them into correct position in said tube with their bottom ends down as said articles progressively travel along the inside of said tube, and a support on which a length of said tube is mounted so that a substantial end length of the latter projects freely beyond said support, said tube end length being by virtue of its positioning and under the vibration impulses imparted to said tube, vibrated at a greater amplitude than the tube length on said support.

4. Apparatus for arranging a series of cup-shaped articles with their closed bottom ends down and open top ends up, comprising a cylindrical tube which is axially slightly inclined to a horizontal plane and in which may be supported a plurality of articles in single file with either of their ends down, the internal diameter of said tube being such that any article disposed therein with either of its ends down contacts said tube with peripherally opposite portions only of its downwardly disposed end, means for imparting to said tube substantially vertical vibrations of such amplitude and frequency as to induce in the articles disposed in said tube with their bottom ends up turning moments, respectively, which will invert them into correct position in said tube with their bottom ends down as said articles progressively travel along said tube, and further to induce motion of the articles in said tube toward the lower end thereof with the aid of gravitational forces, and a chute in alignment with said lower tube end and dimensioned to receive with a sliding fit the articles from said tube in their correct bottom-down position and single-file arrangement.

5. Apparatus for arranging a series of cup-shaped articles with their closed bottom ends down and open top ends up, comprising a cylindrical tube of slightly resilient material, a support on which a length of said tube is mounted so that a substantial end length of the latter projects freely beyond said support, said support being so arranged that said tube is axially slightly inclined to a horizontal plane with said end length thereof lowermost, and said tube being adapted for the reception and support of a plurality of articles in single file with either of their ends down and having an internal diameter such that any article disposed in said tube with either of its ends down contacts said tube with peripherally opposite portions only of its downwardly disposed end, and means for imparting to said support substantially vertical vibrations of such amplitude and frequency as to induce in the articles disposed in said tube with their bottom-ends up turning moments, respectively, which will invert them into correct position in said tube with their bottom ends down, and further to induce motion of the articles in said tube toward the end of said length of said tube with the aid of gravitational forces, said tube end length being by virtue of its resiliency and positioning and under the vibration impulses imparted to said tube by said support, vibrated at a greater amplitude than the tube length on said support to correctly arrange any articles in said end length that enter the latter incorrectly arranged, and a chute in alignment with said tube end length and dimensioned to receive with a sliding fit the articles from said tube in their correct bottom-down position and single-file arrangement.

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