

July 25, 1967

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3,332,668

CONTAINER SHAKING METHOD AND MACHINE

Filed Jan. 28, 1966

6 Sheets-Sheet 1

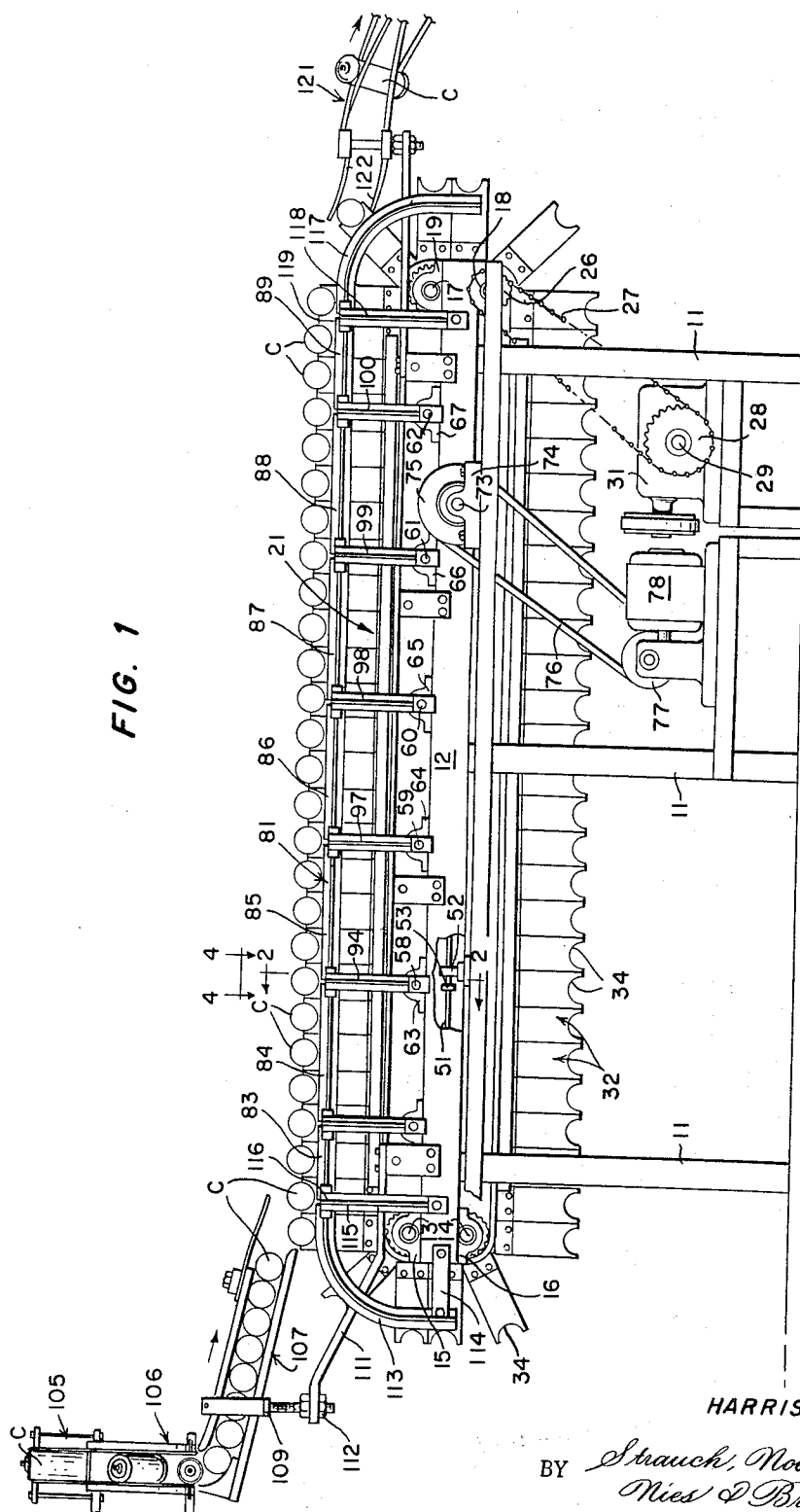


FIG. 1

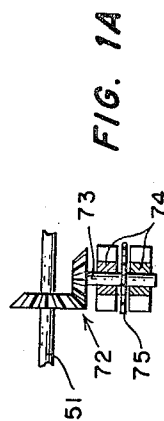


FIG. 1A

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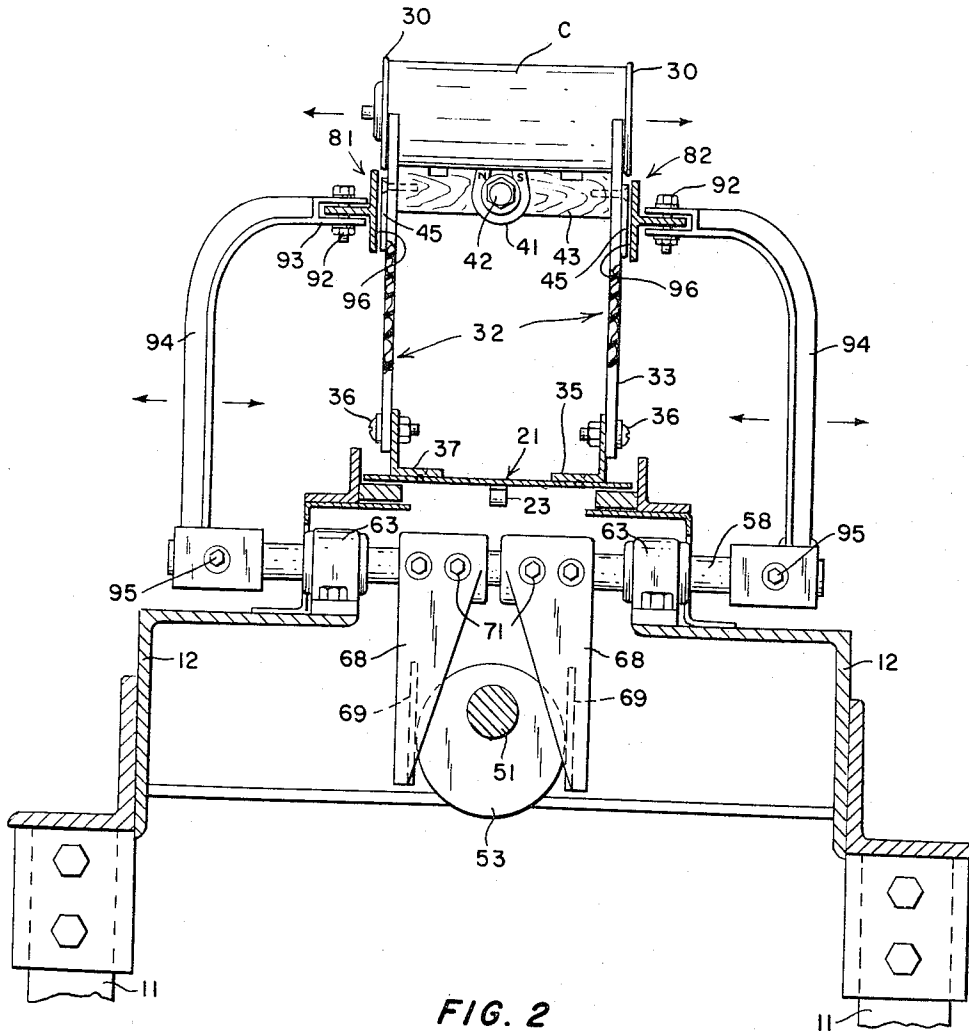
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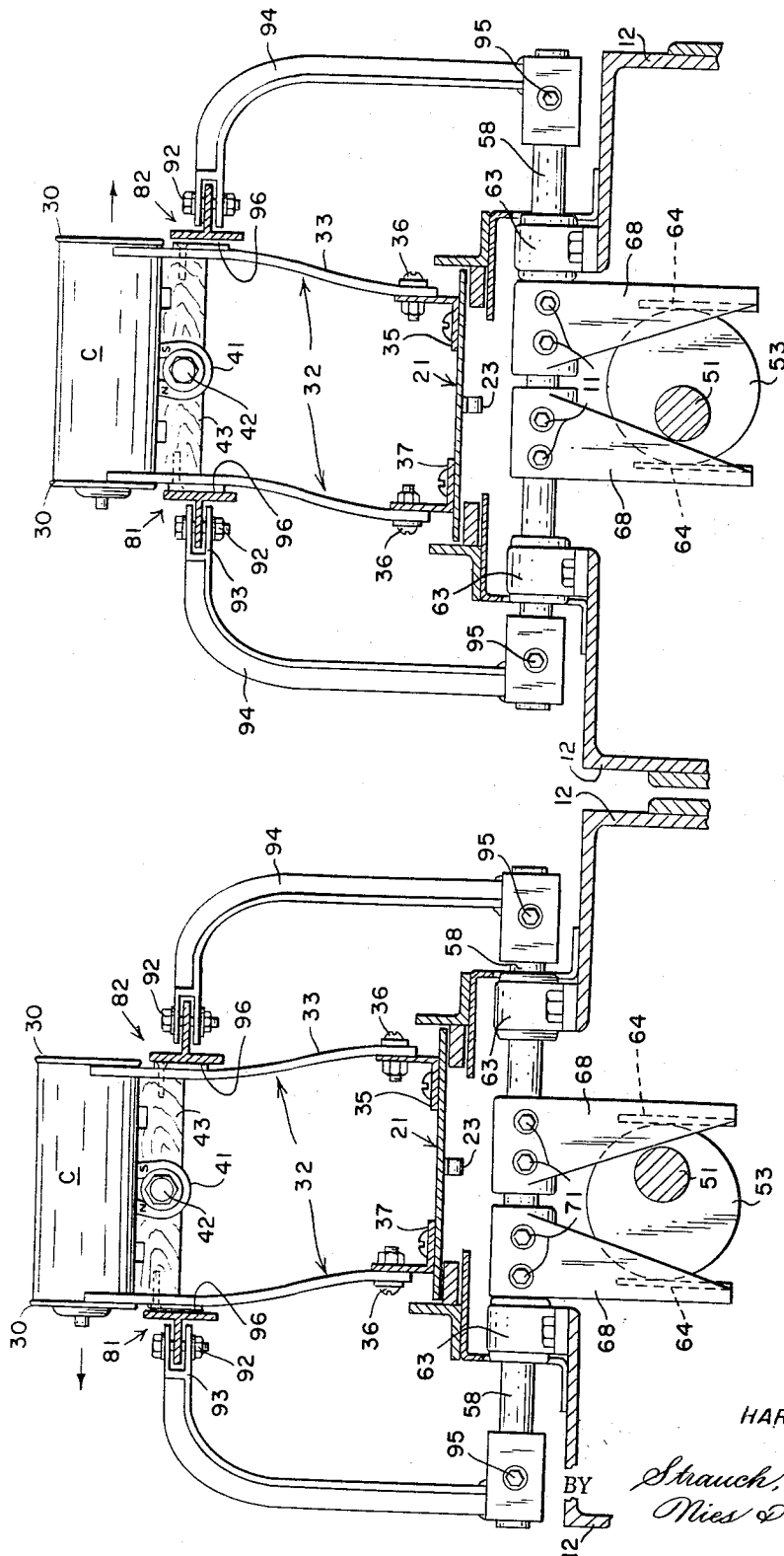


FIG. 2B

FIG. 2A

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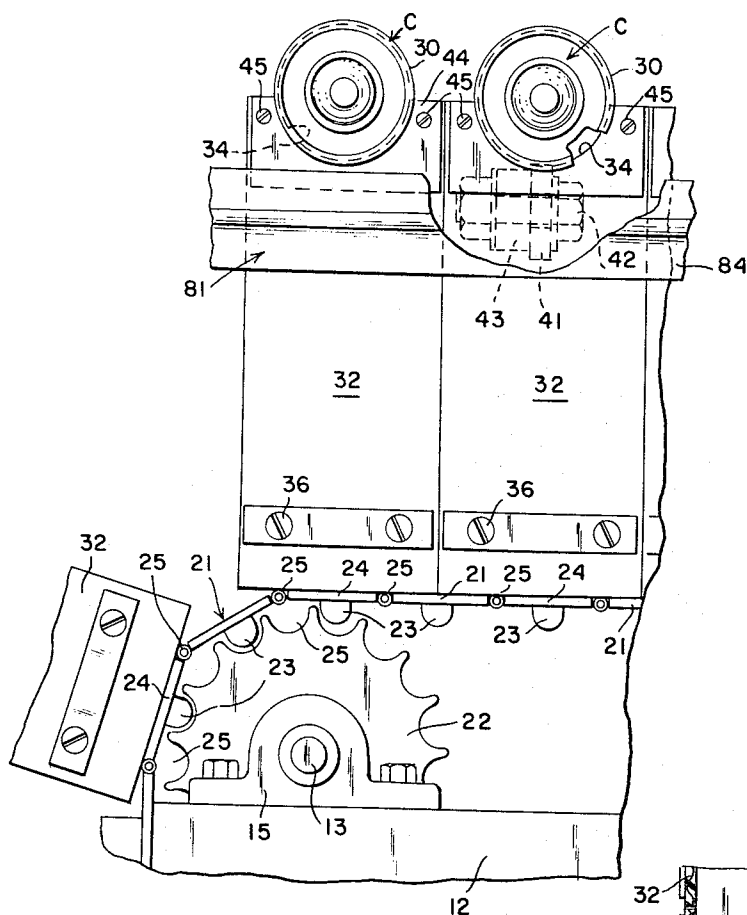


FIG. 3

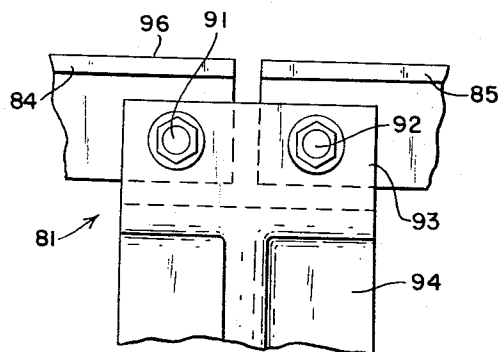


FIG. 4

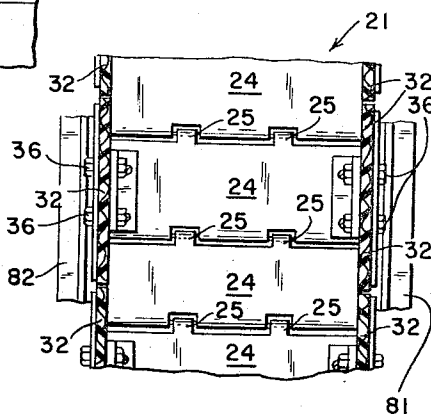


FIG. 5

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CONTAINER SHAKING METHOD AND MACHINE

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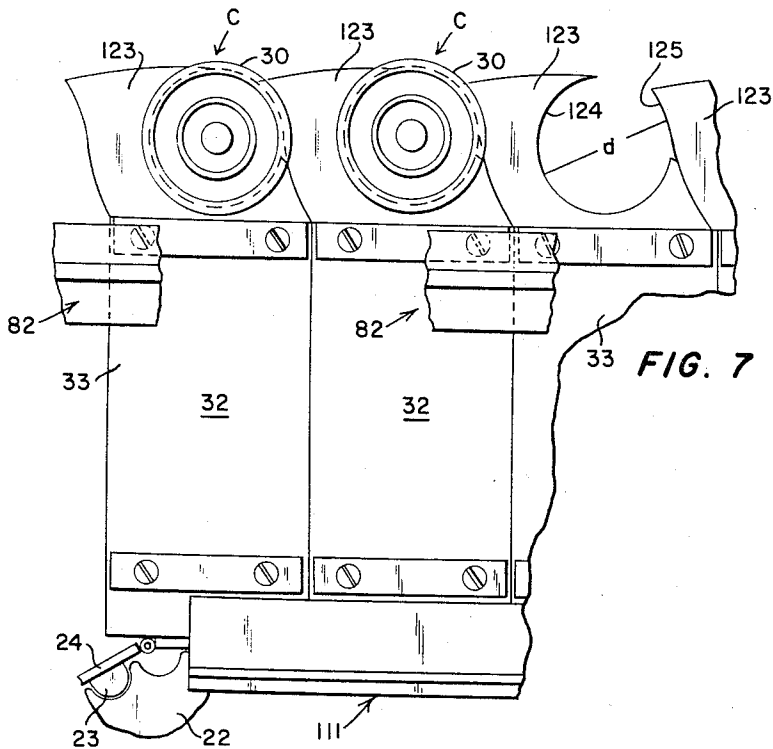


FIG. 7

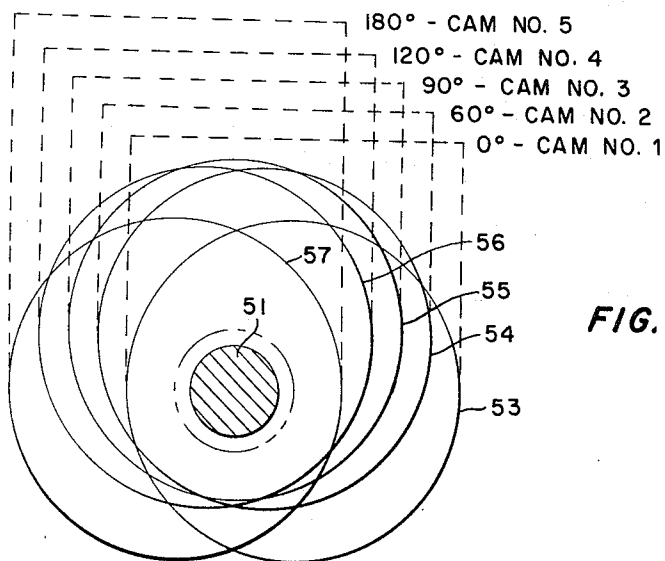


FIG. 6

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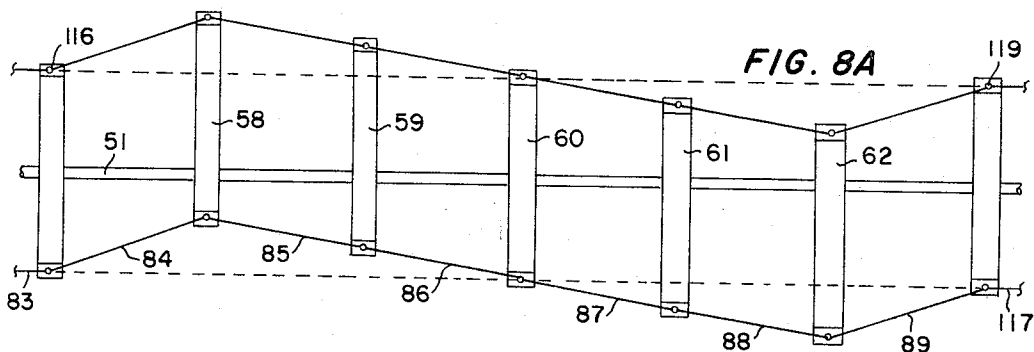
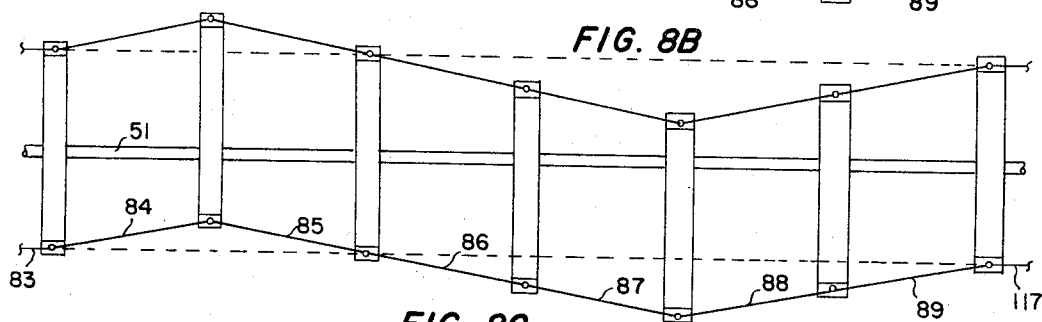
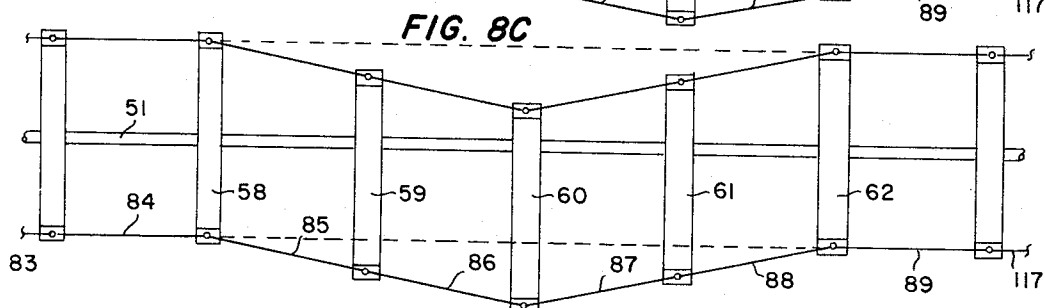
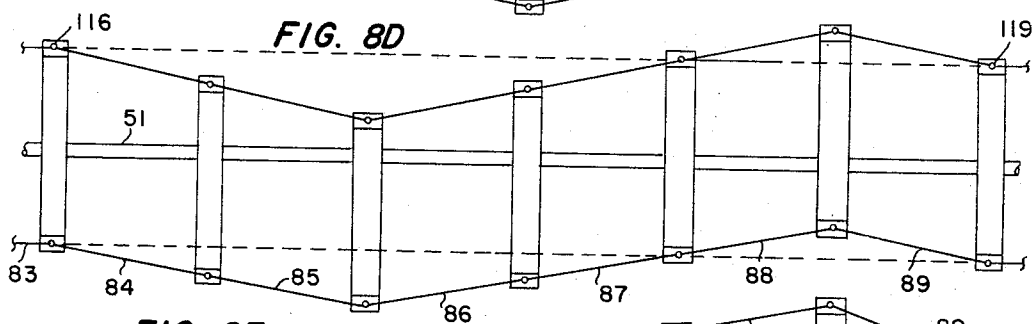
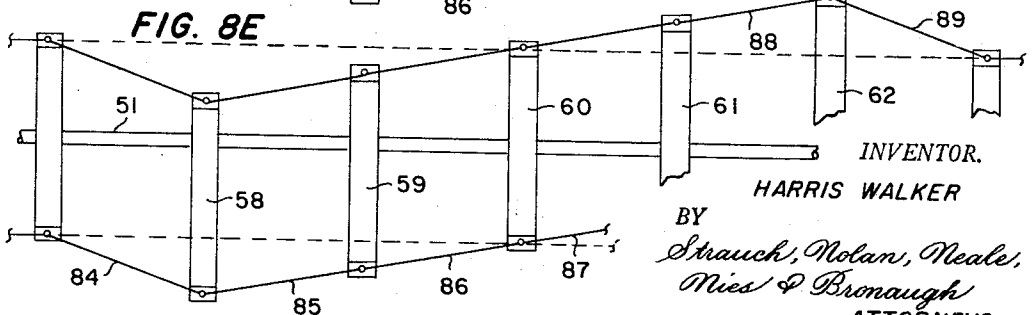
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CONTAINER SHAKING METHOD AND MACHINE

Filed Jan. 28, 1966

6 Sheets-Sheet 6



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3,332,668 CONTAINER SHAKING METHOD AND MACHINE

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Filed Jan. 28, 1966, Ser. No. 523,706
16 Claims. (Cl. 259—59)

This invention relates to a method and a machine for shaking containers such as closed and sealed aerosol cans to obtain desired admixture of the contents, and is particularly directed to novel arrangements for conveying the containers along a path while shaking them violently in a predetermined manner.

The present invention in its preferred embodiment will be described for the adequate shaking of containers of the aerosol type after the containers have been filled with their contents and while they are being conveyed toward a further operational station such as for packing.

The usual aerosol can is charged with the requisite amount of liquid and vehicle gas in separate operations at the filling machine, with the result that as the filled and sealed can leaves the filling machine the contents may exist therein in mainly separate liquid and gas phases. This is objectionable because if the can passes to the ultimate user in this state, and he attempt to discharge the contents without first sufficiently violently shaking the can to convert the contents to an emulsion condition, mainly gas only will discharge and most of the desired treatment liquid will remain in the can and may never be wholly dispensed.

The foregoing problem has been appreciated for some time and machines and expedients have been proposed and built in attempts to solve it. It is known that if just after filling the can is shaken sufficiently violently to emulsify the contents, then even though the phases may reparate somewhat during storage and before consumer operation, only a slight shaking by the consumer is needed to remulsify the contents. Therefore these machines all propose to adequately shake the filled sealed container just after filling, but while some of them accomplish the general purpose they usually involve special handling of the containers which slows or interrupts the production line, or they are so complex or expensive as to introduce prohibitive cost factors.

A common objection encountered in most prior container shaking machines is that unbalanced forces produced by the necessarily powerful mechanisms during the shaking operation result in the necessity for extremely rigid support structures and usually the transmittal of undesirable vibrations to the floor and surrounding equipment.

The present invention provides for the first time a simple relatively inexpensive and reliably operating machine which will violently shake the containers as they are conveyed at normal speed away from the filling machine, without accompanying undesirable vibration and without interruption to production schedules, and it is the major object of the invention to provide such a machine.

Another object of the invention is to provide a novel method of shaking containers wherein a row of containers is moved in a changing direction path while said containers are vigorously shaken back and forth laterally of said path.

A further object of the invention is to provide a novel container shaking machine wherein the filled sealed containers are deposited upon flexible mounts on a moving conveyor and these mounts are flexed at predetermined speed and in controlled direction to produce desired violent shaking of the container.

Another object of the invention is to provide a novel

container shaking machine wherein successive containers are deposited upon spaced flexible supports of a moving conveyor and flexibly connected sectional pusher bars are cam operated against the flexible supports in a pattern to violently move the containers back and forth as they move through a predetermined path on the conveyor.

Another object of the invention is to provide a container shaking machine wherein the forces exerted for shaking the containers back and forth are so balanced that vibration is minimized and the machine need not be specially anchored to the supporting floor.

Further objects will appear as the description proceeds and the annexed drawings wherein:

FIGURE 1 is a side elevational view illustrating a container shaking according to a preferred embodiment of the invention;

FIGURE 1A is a fragmentary view in section showing the cam shaft drive;

FIGURE 2 is an end elevation mainly in section substantially along line 2—2 of FIGURE 1, showing container shaker conveyor details;

FIGURES 2A and 2B are sections similar to FIGURE 2, showing the cam action in actuating the conveyor during container shaking;

FIGURE 3 is an enlarged fragmentary side elevation at one end of the conveyor partly broken away to show details and showing the flexible container supports on the conveyor;

FIGURE 4 is an enlarged fragmentary top plan view looking in the direction of line 4—4 in FIGURE 1 showing the flexible interconnection of the pusher bars and the cam operated arms that laterally displace the pusher bars;

FIGURE 5 is a fragmentary top plan view showing part of the container conveyor including the hinged nature of the flexible support mounting plates;

FIGURE 6 is an end elevation partly in section diagrammatically showing the cam shaft and relative cam locations therealong;

FIGURE 7 is a fragmentary side elevation similar to FIGURE 3 showing a structure for handling all types of containers such as aluminum or other non-magnetic cans; and

FIGURES 8A—8E diagrammatically illustrate the serpentine distribution of the container shaking action along the conveyor.

FIGURE 1 shows the machine as comprising a stationary support structure 11 arising from the floor, and this support has horizontal parallel rail sections 12 at opposite sides of the machine.

Four conveyor belt drive and support shafts are mounted in transverse parallel relation above and below rail sections 12. At the left end of the machine in FIGURE 1, where the containers are fed onto the conveyor, upper and lower stub shafts 13 and 14 are mounted in vertical alignment in bearing blocks 15 and 16 respectively. At the other end of the machine upper and lower stub shafts 17 and 18 are mounted in vertical alignment in upper and lower blocks 19. The corresponding bearing blocks at each end are suitably mounted on the rail sections 12 in transverse alignment.

Shafts 13 and 17 have their axes in the same horizontal plane and the top flight of endless conveyor belt 21 runs horizontally between them. As shown in FIGURE 3, shaft 13 carries intermediate its ends a sprocket 22 having a toothed periphery meshing with lugs 23 on the conveyor belt. Each of the other shafts 14, 17 and 18 carries a similar sprocket meshed with lugs 23 along the conveyor belt.

Preferably, as shown in FIGURES 3 and 5, the conveyor belt is sectional and comprises a series of identical rectangular flat metal plates 24 having parallel hinge

connections 25 along adjacent lateral edges and one lug 23 is carried by the underside of each plate 24.

Lower rear stub shaft 18 carries a drive sprocket 26 meshed with a chain 27 extending from drive sprocket 28 on the output shaft 29 of the electric motor and gear reduction unit 31 suitably mounted on support 11. Thus motor unit 31 serves to continuously drive the endless belt over the path defined by the stub shaft sprockets, the upper horizontal flight of belt 21 moving from left to right in FIGURE 1.

Conveyor belt 21 is provided with a series of special container mounting devices. As shown in FIGURES 2, 3 and 5, each alternate plate 24 has secured to it two laterally spaced identical laterally flexible container mounting members 32 disposed at opposite sides of the conveyor belt. Each associated pair of mounting members 32 comprises, when the plate 24 is in the upper horizontal flight of the conveyor belt, an upright supporting socket arrangement for a container C.

Each mounting member 32 preferably comprises a self supporting sheet 33 of relatively stiff rubberized fabric or the like formed at its upper end with a concave usually semi-circular can receiving open socket 34. Each member 32 is secured at its lower end to plate 24 as by an angle iron 35 and bolts 36. The lower end of angle 35 may be welded to plate 24 or secured by screws 37. In any event each laterally associated pair of members 32 is adapted to mount a container C with its axis horizontal and normal to the direction of movement of the conveyor top flight, the lateral spacing between members 32 being such that the ends of the cylindrical can body will fit snugly into the aligned sockets 34 just inwardly of the usual enlarged can end beads 30.

Members 32 are removable from the conveyor and replaceable by similar different size can supports.

As shown best in FIGURES 3 and 5, the dimension of each member 32 in the direction of conveyor movement is equal to that of two plates 24, so that each member 32 extends about halfway over the top of the conveyor belt plate 24 next to the plate 24 carrying that member. In this way, see FIGURE 3, the members 32 which on each side are longitudinally aligned in horizontal planes do not interfere with each other in passing over the sprockets on the stub shafts, but they become disposed closely edge to edge at the top flight of the conveyor belt.

While the containers C may remain in their sockets by gravity or friction during the shaking, it is preferable to use some added holding means, and for this purpose a permanent magnet 41 is adjustably secured as by a bolt assembly 42 upon a wooden or like transverse insulating bridge 43 suitably secured at opposite ends to the members 32 on each plate 24. Each magnet 41 is disposed to lie in central aligned relation between each laterally associated pair of sockets 34, to attract and hold cans of steel or other magnetic material in sockets 34.

Screws 45 secure shield plates 44 of metal to the outer sides of each flexible sheet 33 just below the sockets 34 for reducing wear by the pusher bars to be described.

A horizontal cam shaft 51 extends the length of the machine, being suitably supported in a series of bearing blocks 52 on the frame midway between the sides of the conveyor belt. Shaft 51 carries an axially spaced series of identical cams 53-57, here five, that are successively angularly related as shown in FIGURE 6 for a purpose to appear.

A series of parallel horizontal transverse push rods 58-62, one for each cam on shaft 51, extend across the machine above shaft 51 and below the top flight of the conveyor belt, with their opposite ends slidably mounted in bearing blocks 63-67, respectively, fixed on rails 12.

FIGURE 2 shows one of these rods 58 in enlarged detail. A pair of depending cam followers 68 rigid with rod 58 have their parallel box faces 69 engaging oppo-

site sides of cam 53. By means of set screws 71, cam followers 68 can be relatively adjusted along rod 58 to accommodate different throw cams on shaft 51. As cam-shaft 51 rotates about its axis, rod 58 reciprocates back and forth at right angles to conveyor movement in a predetermined path with a predetermined stroke. Shaft 51, as shown in FIGURE 1A, is continuously driven as by a bevel gear set 72 connecting it to stub shaft 73 journaled in a bearing block 74 fixed on one support rail 12 and carrying a sprocket 75. A chain 76 connects sprocket 75 to a sprocket 77 on the output shaft of an electric motor driven gear reduction unit 78.

Cams 53-57 are substantially equally spaced along shaft 51, with each cam disposed in the same cooperative association with its adjacent push rod 58-62, respectively, just as illustrated in FIGURE 2.

Along each side of the top flight of conveyor belt 21, parallel flexible pusher bar units 81 and 82 extend longitudinally adjacent the upper ends of flexible elements 33 at a level adjacent the sockets 34 but sufficiently therebelow not to contact the containers C mounted on members 32.

Referring to FIGURE 1, pusher bar unit 81 comprises a series of pusher bars 84-89 all disposed at the same vertical level. FIGURE 4 illustrates how these pusher bars at each side are flexibly connected end to end, with sufficient longitudinal spacing between them to permit their relative inclination in the horizontal direction. The adjacent ends of bars 84 and 85 in FIGURE 4 are connected by parallel pivot assemblies 91 and 92 to the head 93 of a vertically disposed pusher arm 94 which has its lower end adjustably secured (FIGURE 2) as by set screw 95 to an end of push rod 58.

As shown in FIGURE 2, the lower end of arm 94 is secured to rod 58 a sufficient distance outwardly of bearing block 63 to permit reciprocation of the rod by cam 53, and the upper end of arm 94 is curved inwardly to dispose bifurcated head 93 to embrace longitudinal ribs on the outer sides of the pusher bars. This locates push bar face 96 in a substantially vertical plane parallel to and extending closely along the row of upright container supports 32 just opposite smooth metal shield plates 45.

A similar pusher arm 94 is attached to rod 58 at the other side of the conveyor and this arm is pivotally connected to and supports opposite ends of pusher bar unit 82 in the same manner as on the other side.

In the same manner similar pusher arms 97-100 are mounted on the opposite ends of push rods 59-62 respectively and are pivotally connected to the ends of adjacent pusher bars 85-89, with the result that due to the relative angular positions of cams 53-57 all of the parallel pairs of pusher bars 83-89 are relatively angularly displaced, and this relative displacement changes as camshaft 51 rotates to effect back and forth reciprocation of the push rods 58-62.

As each push rod 58-62 reciprocates it causes engagement of the associated pusher bar faces 96 with the cam mounts 32 at one side or the other of the conveyor to shift the containers C back and forth in a horizontal direction, with all the while the conveyor belt moving left to right in FIGURE 1 with the outer surfaces of members 32 sliding along the engaged pusher bar faces. Referring to FIGURE 1 it will be noted that each pusher bar 84-89 is longitudinally rigid and bridges a number of supports 32 so that a sinuous motion is imparted to the cam supports along the length of the conveyor.

Referring to FIGURE 1, the filled containers C from the filling machine approach the shaking machine in upright single file on a horizontal conveyor as indicated at 105. Suitable guide means is provided at 106 for turning the containers toward a horizontal position and delivering them to an inclined chute 107 from which they drop into the conveyor sockets 34 as each pair of supports 32 turns to upright position in passing over sprocket 22. The rate of gravity feed of containers C rolling down chute

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107 is correlated to the liner speed of conveyor 21 so that each successive set of sockets 34 receives a container. If desired feed control means can be provided to space the entry of containers C to the conveyor 21, but details of such are not part of the present invention.

Chute 107 is mounted on a bracket 109 upstanding from the end of a rigid longitudinal rail 111 comprising part of support structure 11. A bracket height adjustment is provided at 112.

At the left end of the machine in FIGURE 1, an arcuate arm 113 secured to rail 12 as by bracket 114 arises at each side of the conveyor to be rigidly secured to the upper end of a vertical arm 115 fixed to rail 112. Pusher bar 84 at each side has its left end pivotally secured at 116 to the adjacent end of bar 83 which here is a rigid longitudinal continuation of the upper end of bar 113.

At the right end of the machine in FIGURE 1, an arcuate arm 117 is rigidly secured at its upper end to vertical fixed arm 118 secured to rail 12, at each side of the conveyor. The right end of pusher bar 89 is pivotally attached at 119 to fixed arm 118.

A container receiving and guiding device indicated at 121 has fixed fingers 122 extending into the path of the arriving containers at the right end of the top flight of the conveyor 21, whereby each container C in turn is extracted from the conveyor as the supports 32 start to swing downwardly about sprocket shaft 17. The details of this extraction device comprise no part of the present invention.

FIGURE 7 shows an embodiment wherein containers of non-magnetic material such as aluminum or plastic may be handled. Here the supports 32 on opposite sides of the conveyor, instead of being formed with upwardly open semicircular recess sockets such as at 34 in FIGURE 3, have the longitudinal side edges of adjacent supports formed with cooperating socket structure. Thus, each sheet 33 here has an upwardly projecting section 123 formed along one edge with a circularly curved recess 124 that opens both upwardly and in the direction of the next adjacent support, and the edge of that adjacent support is formed with similarly curved recess 125 facing recess 124. Thus, recesses 124 and 125 are on opposite sides of each projection 123.

Preferably recesses 124 and 125 correspond to the can diameter D so that when two adjacent support members have their upper ends spaced apart as when they pass over sprocket 22 a can may be dropped freely into recess 124 and then, when the adjacent supports are upright along the horizontal top flight of the conveyor, the can body is clamped laterally between surfaces 124 and 125. The distance between the upper edges of recesses 124 and 125 is less than the can diameter, so that the can is retained therein during shaking. Of course in this embodiment the magnet 41 and its support bridge 43 are omitted.

Operation

The upright filled and sealed cans C arrive on the conveyor system 105 and are deposited in horizontal condition on the moving top flight of conveyor 21, where each can has its opposite ends disposed in a pair of laterally associated sockets 34 and a holding magnet 41 (or the coating recesses 124 and 125 in the FIGURE 7 embodiment, or a combination of both if desired) holds the can against accidental displacement from the conveyor. It has been determined that shaking the container with its axis horizontal is best.

Referring to FIGURES 2, 2A and 2B, it will be seen that as the cam shaft 51 continuously rotates the upper ends of the flexible supports 32 engaged by the pusher bars are reciprocated back and forth in a horizontal direction. The stroke of this lateral movement in the preferred embodiment is about two inches, and the speed of shaft 51 is high and preferably sufficient to reciprocate the cans on their horizontal axes at a frequency between three hundred and four hundred and fifty cycles per minute. 75

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The optimum frequency is about three hundred and fifty cycles per minute for most aerosol type containers. The frequency of shaking can be reduced somewhat if the amplitude is increased.

Referring to FIGURES 6 and 8A-E, it will be seen that while the points 116 and 119 at opposite ends of the conveyor remain in the same position, the relative angularity of cams 53-56 is such that the cans C move forwardly in a changing direction serpentine path in the horizontal plane as they are conveyed from one end of the machine to the other in FIGURE 1, all the while undergoing the above described violent shaking back and forth. The effect of this serpentine motion is to dynamically counterbalance forces set up in the plane of motion of the cans by the reciprocating can masses since at all times the total mass of containers moving in one direction laterally of the longitudinal center of the conveyor is about equal to the total mass of containers moving in the opposite lateral direction. This practically eliminates vibration due to the energy supplied to effect the violent can shaking, and thus enables the machine to be lightly constructed and supported on the floor with only conventional holding means.

The parallel pusher bar sets 84-89 at opposite sides of the conveyor assume changing relatively inclined positions during the foregoing operation, their surfaces 96 slidably engaging supports 32 as the latter move along the top flight of the machine.

In a machine of the above construction and mode of operation the contents of an aerosol can may be reduced to a single phase in about fifteen seconds, so that conveyor 21 may be run at a very high speed which will not impede the production line.

FIGURE 6 shows the preferred relative angular arrangement of the cams on shaft 51. Where five cams are used the two end cams 53 and 57 are fixed 180° apart on the shaft, the middle cam 55 is 90° spaced between them, and the two intermediate cams 54 and 56 are spaced 30° on either side of the middle cam. Other cam arrangements may be provided for different patterns, but the foregoing is preferred because of the advantageous force distribution.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A method of shaking filled and sealed containers to effect admixture of their contents which comprises the steps of disposing a succession of said containers in a row with their axes extending horizontally laterally of said row, advancing said row of containers along a path and simultaneously violently shaking longitudinally spaced groups of said containers along the row back and forth in opposite directions laterally of said path.

2. The method defined in claim 1, wherein said path is substantially serpentine.

3. The method defined in claim 1, wherein substantially equal masses of said containers are always moving in opposite directions laterally of said path.

4. Apparatus for shaking filled containers comprising means for conveying in a desired direction in a substantially horizontal plane a row of said containers arranged substantially horizontally side by side, laterally movable means operative upon said conveying means for vigorously shaking said moving containers repeatedly back and forth in said plane substantially at right angles to their path of movement through said apparatus, and means for controllably continuously varying said path between its ends

in the direction of said shaking for counterbalancing reaction to forces created by said shaking means comprising means in said laterally movable means for simultaneously oppositely displacing longitudinally spaced groups of containers along said row.

5. Apparatus for shaking filled containers comprising means for conveying in a desired direction in a substantially horizontal plane a row of said containers arranged substantially horizontally side by side, laterally flexible container supports on said conveying means, and laterally reciprocal pusher means operatively connected to said supports along said path for vigorously reciprocating said moving containers repeatedly back and forth in said plane substantially at right angles to their path of movement through said apparatus.

6. In the apparatus defined in claim 5, said pusher means comprising pusher members distributed along said path adjacent said flexible container supports, and means for cyclically relatively laterally displacing said pusher members laterally of said path.

7. Apparatus for shaking filled containers comprising means for conveying in a desired direction in a substantially horizontal plane a row of said containers arranged substantially horizontally side by side, means operative upon said conveying means for vigorously shaking said moving containers repeatedly back and forth in said plane substantially at right angles to their path of movement through said apparatus, and means for controllably continuously varying said path between its ends in the direction of said shaking for counterbalancing reaction to forces created by said shaking means, said conveying means comprising an endless conveyor having a top flight moving horizontally in said desired direction, and container supporting means on said conveyor comprising for each container a pair of laterally aligned flexible supports.

8. In the apparatus defined in claim 7, each of said flexible supports comprising a sheet of self supporting material that is relatively rigid in the direction of conveyor movement.

9. In the apparatus defined in claim 8, cooperating means on the upper portions of longitudinally adjacent supports along the conveyor defining container receiving and retaining sockets.

10. In the apparatus defined in claim 7, means on the upper end of each laterally aligned support defining a container receiving socket.

11. In the apparatus defined in claim 10, magnetic means for retaining said containers in said support sockets.

12. In the apparatus defined in claim 5, said containers being reciprocated back and forth at the rate of between 300-450 times per minute as they travel along said path.

13. Apparatus for shaking filled containers comprising means for conveying in a desired direction in a substantially horizontal plane a row of said containers arranged substantially horizontally side by side, means operative upon said conveying means for vigorously shaking said moving containers repeatedly back and forth in said plane substantially at right angles to their path of movement through said apparatus, and means for controllably continuously varying said path between its ends in the direction of said shaking for counterbalancing reaction to forces created by said shaking means, said conveying means comprising laterally flexible container supports disposed along said path, and said shaking means comprising at least one longitudinally flexible pusher bar unit extending along said path for operative engagement with said supports.

14. In the apparatus defined in claim 13, said pusher bar unit comprising a series of pusher bars flexibly connected end to end, and said shaking means further comprising means for selectively moving said pusher bars into engagement with said flexible supports in a predetermined pattern.

15. In the apparatus defined in claim 14, said shaking means further comprising a series of longitudinally spaced angularly displaced cams operatively connected to said pusher bars.

16. In the apparatus defined in claim 15, said cams being mounted in longitudinally spaced relation on a common cam shaft extending longitudinally of said conveying means, and motion transmitting mechanism connecting each cam to a flexible connection between adjacent pusher bars.

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