July 31, 1962 S. T. CARTER 3,047,032

CONTAINER FILLING APPARATUS

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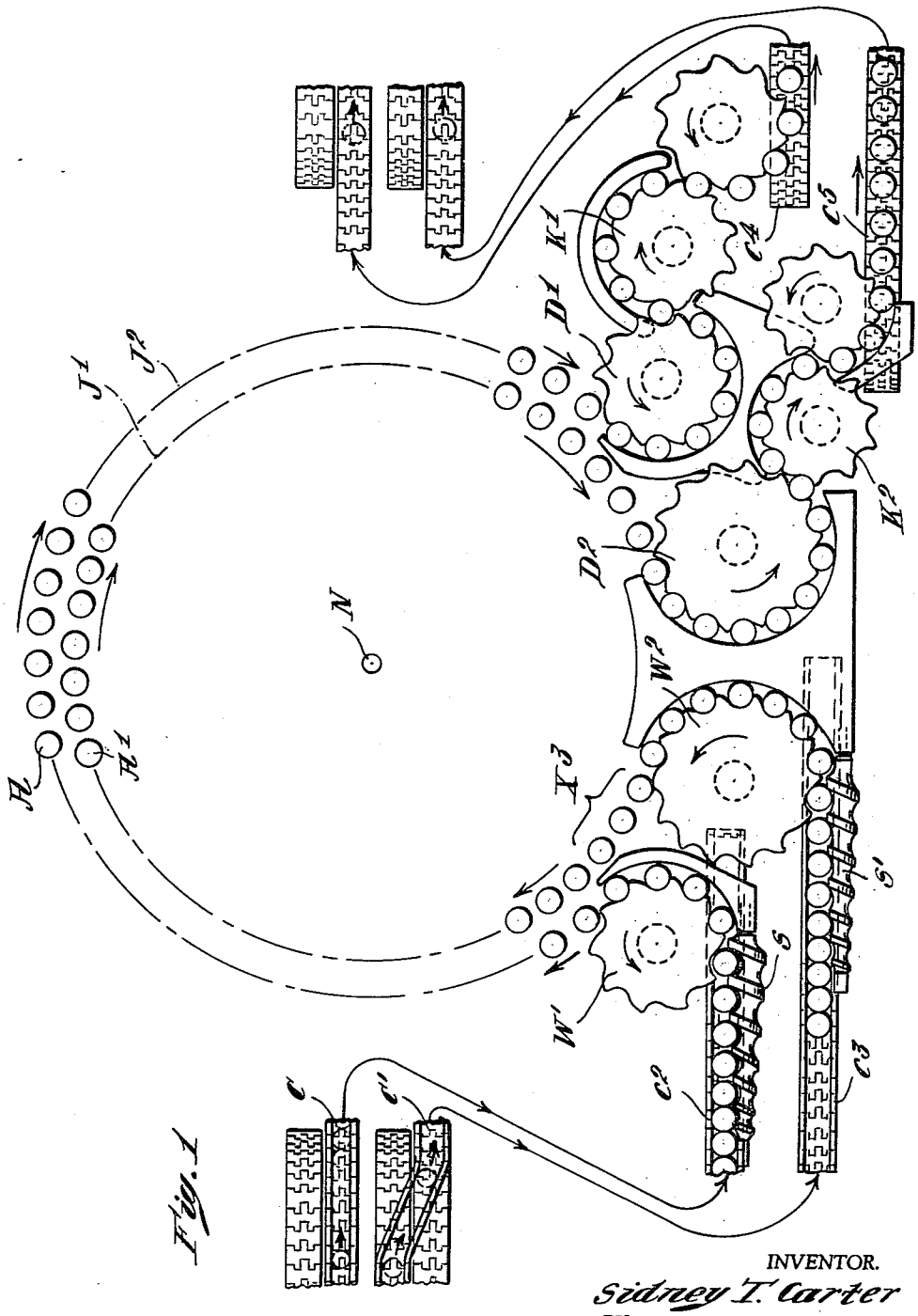


Fig. 1

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CONTAINER FILLING APPARATUS

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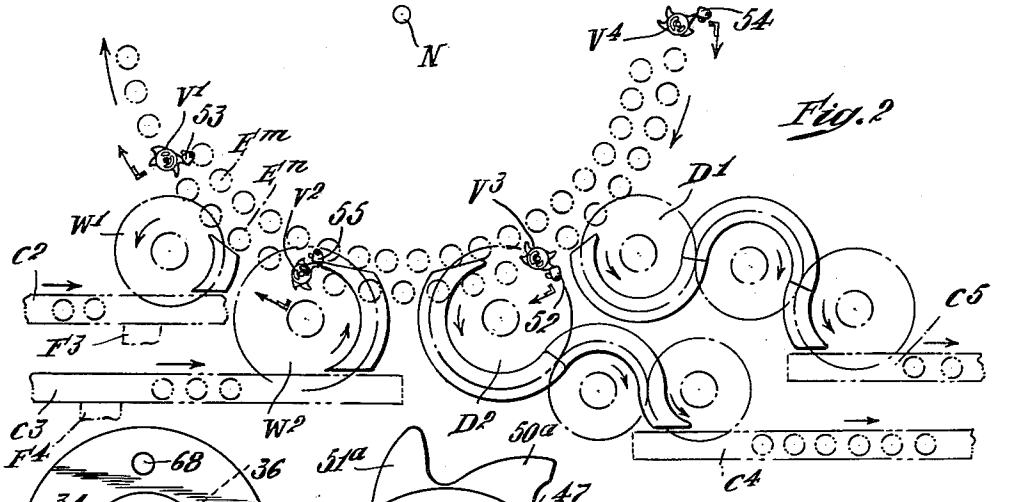


Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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CONTAINER FILLING APPARATUS

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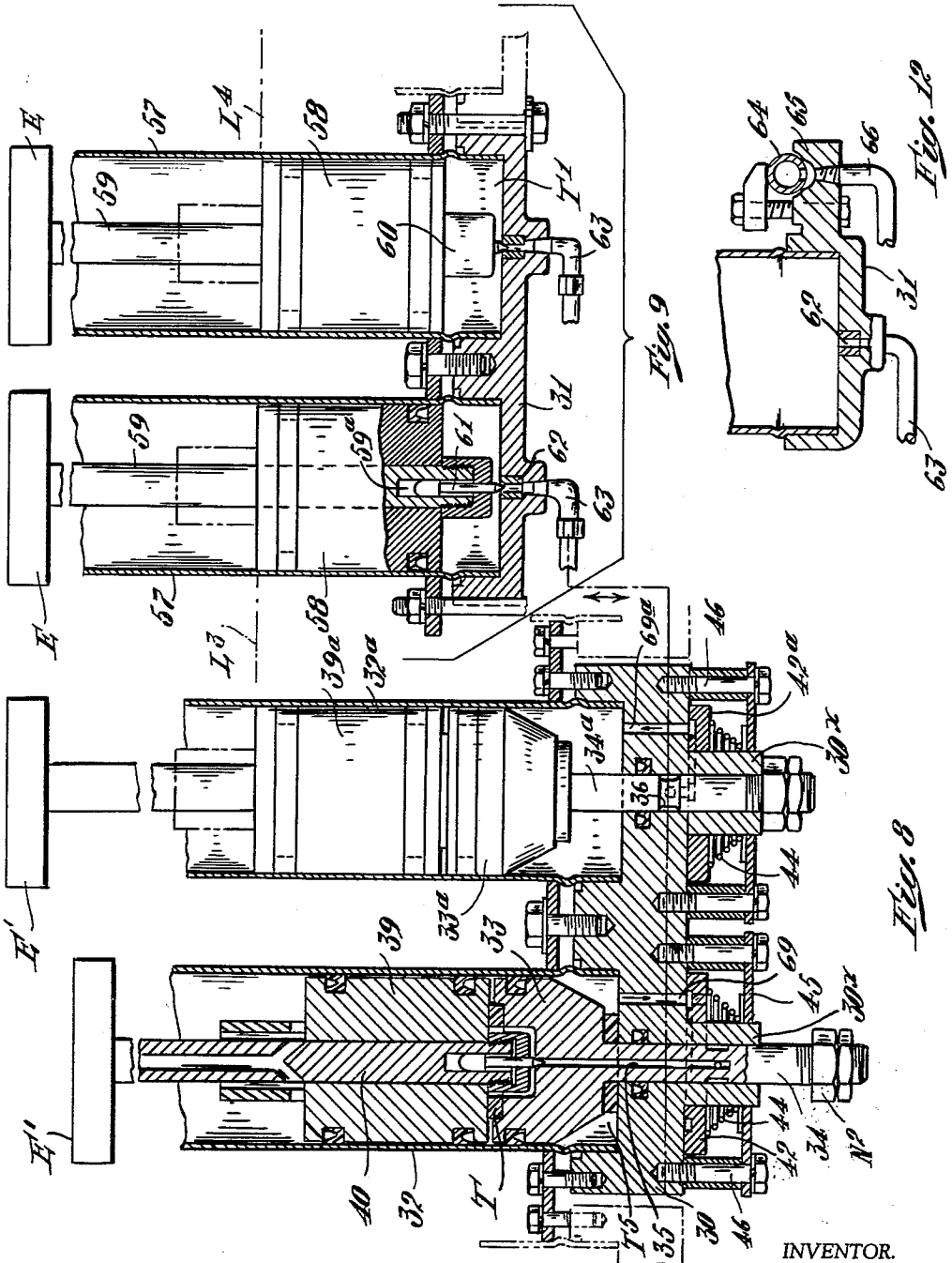


Fig. 9

Fig. 12

Fig. 8

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CONTAINER FILLING APPARATUS

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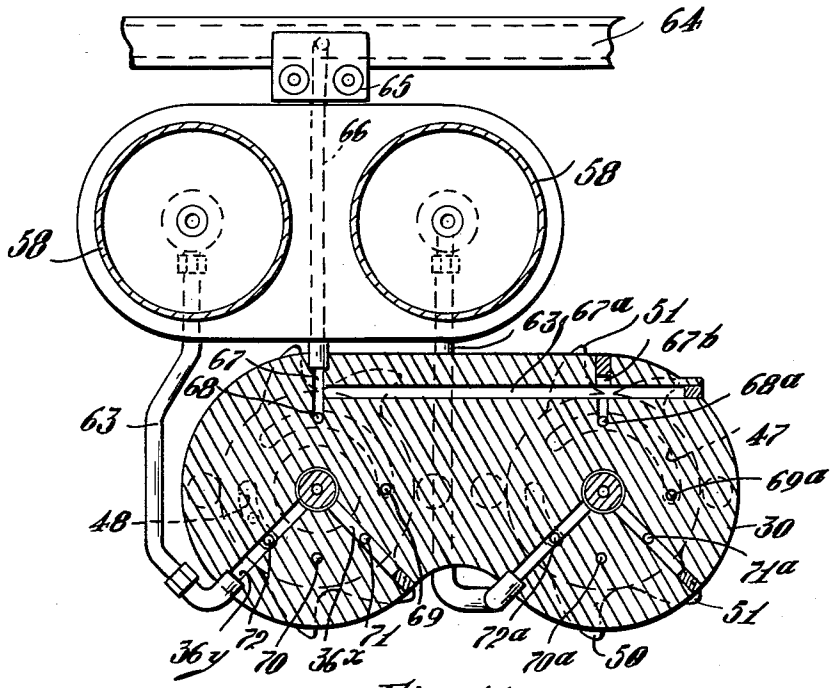


Fig. 11

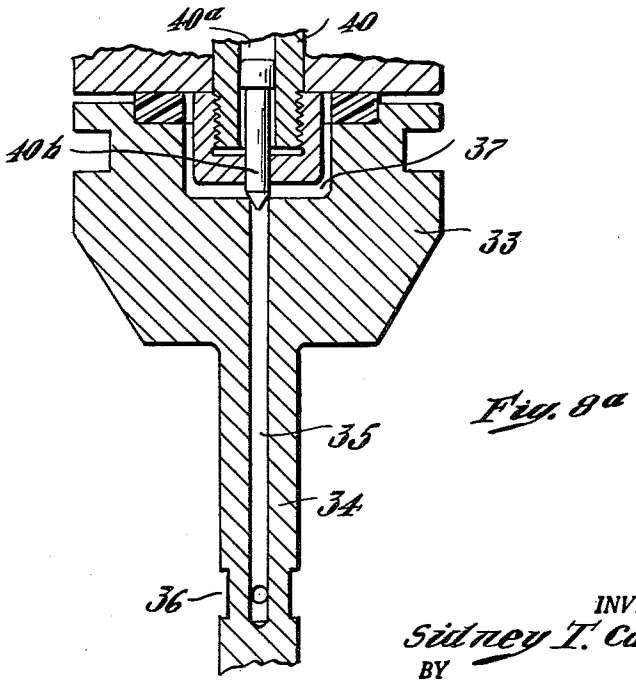


Fig. 8a

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CONTAINER FILLING APPARATUS

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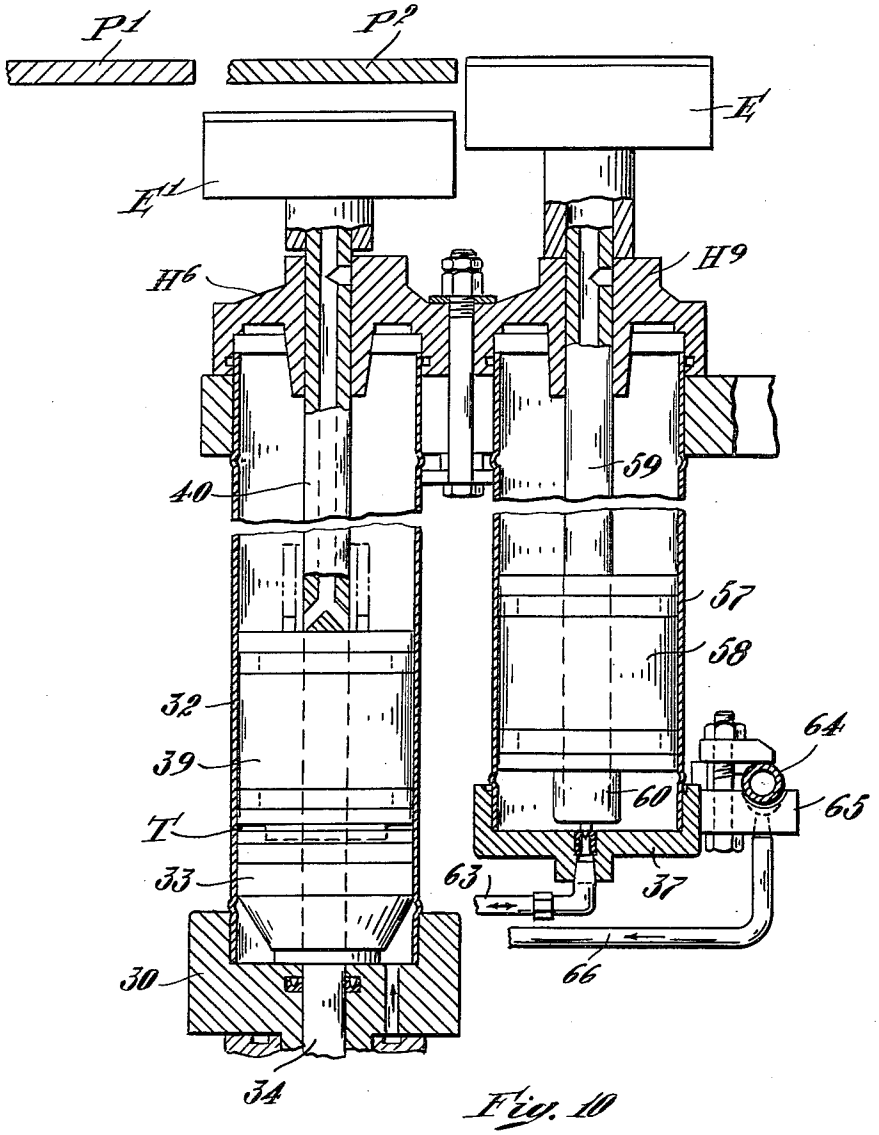


Fig. 10

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CONTAINER FILLING APPARATUS

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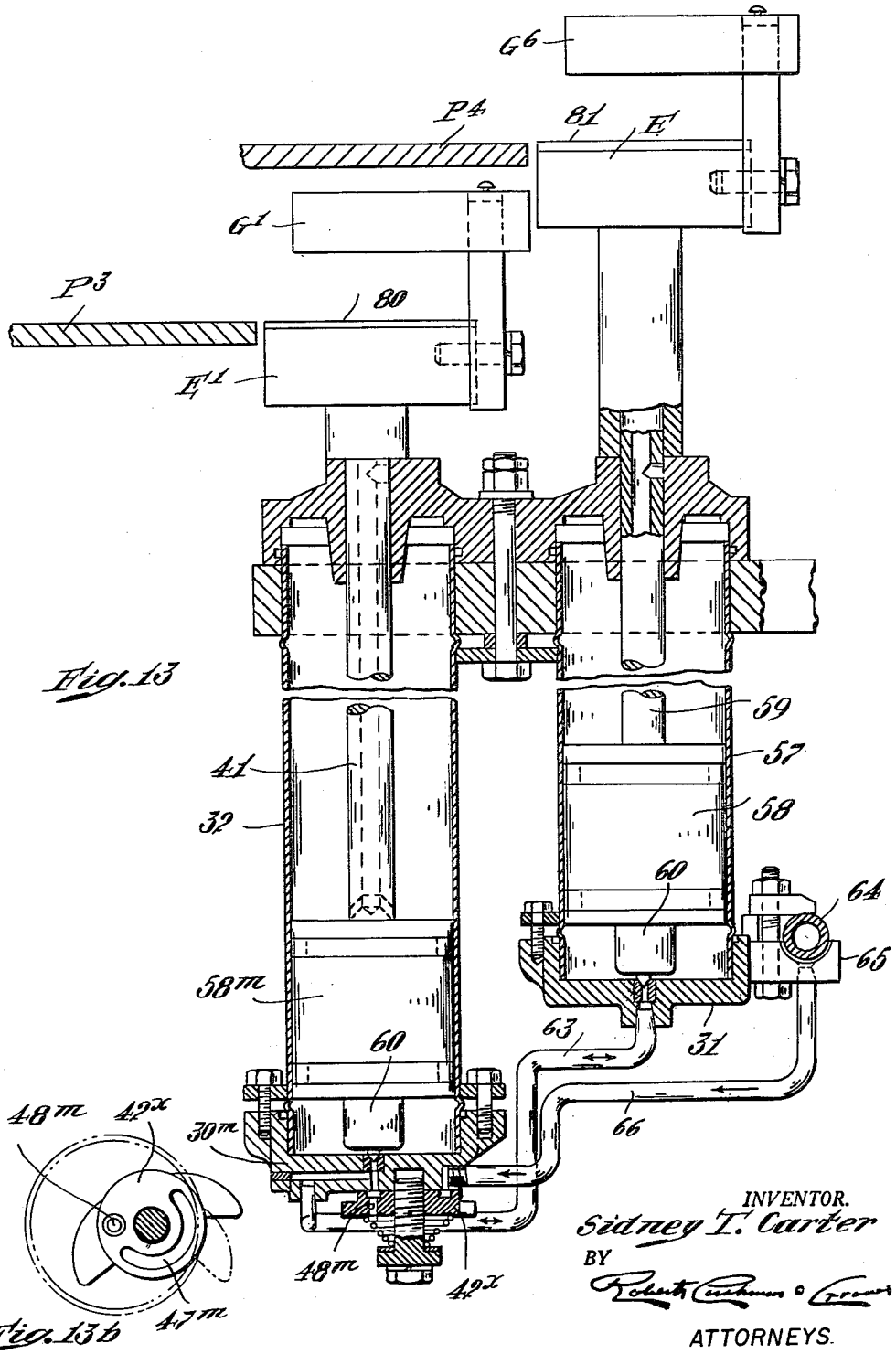


Fig. 13

Fig. 13b

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CONTAINER FILLING APPARATUS

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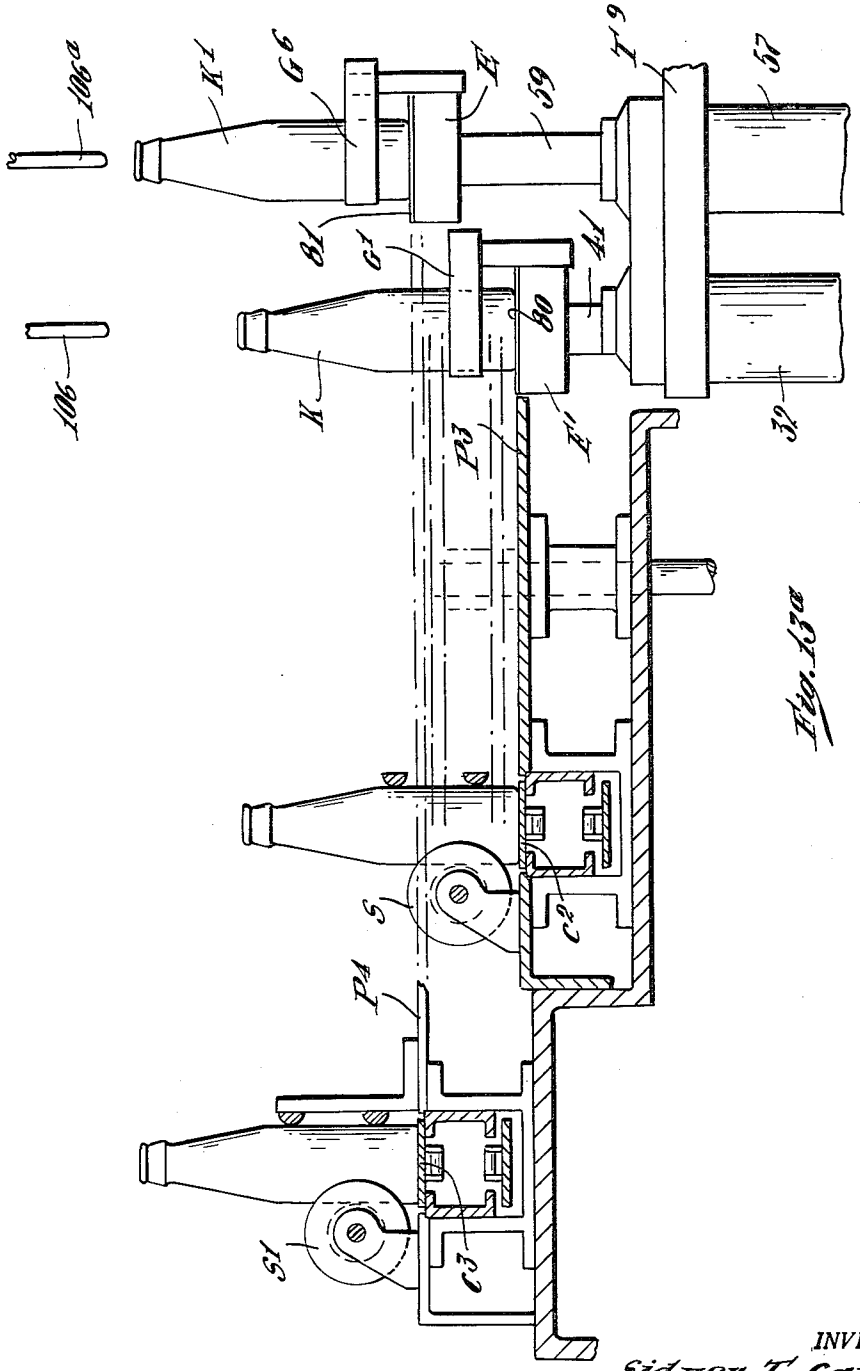


Fig. 13a

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CONTAINER FILLING APPARATUS

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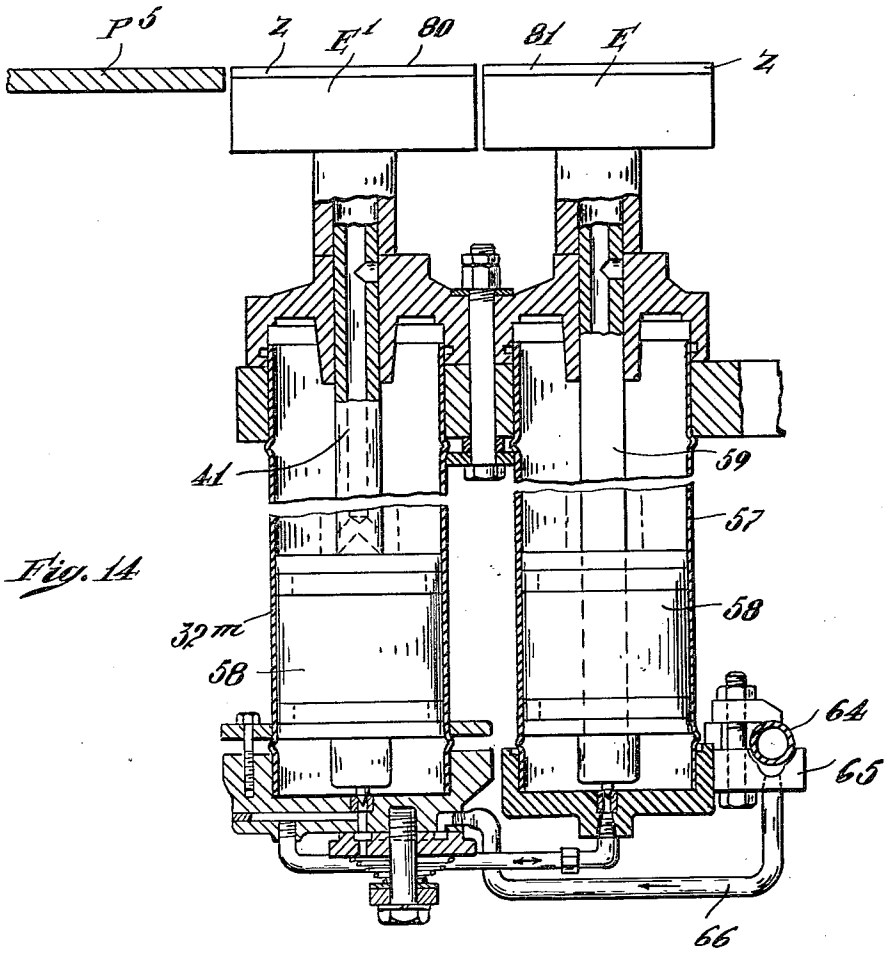


Fig. 14

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CONTAINER FILLING APPARATUS

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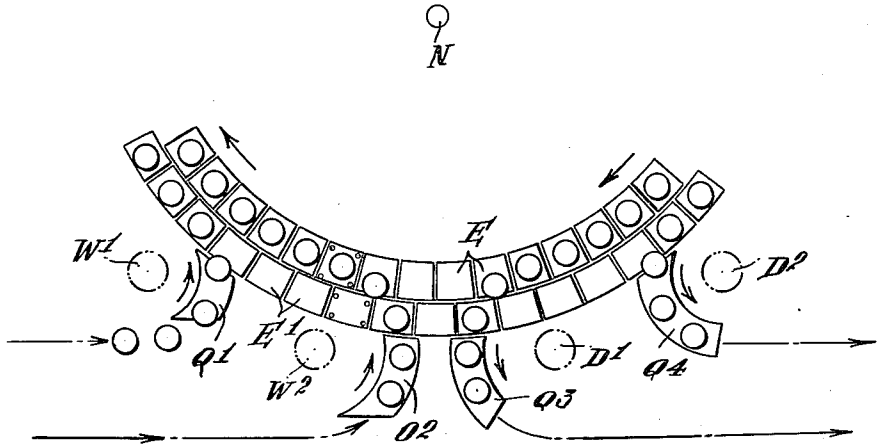


Fig. 15

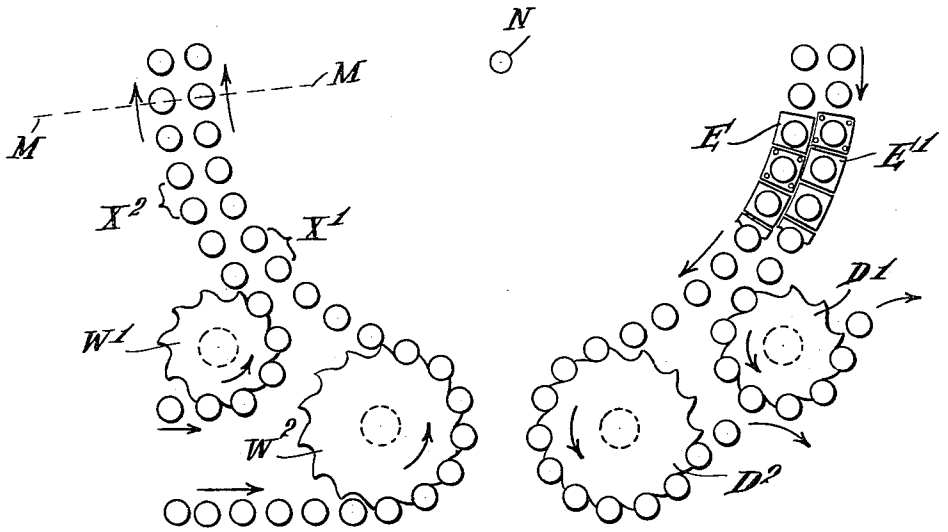


Fig. 16

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CONTAINER FILLING APPARATUS

Filed April 13, 1959 11 Sheets-Sheet 10

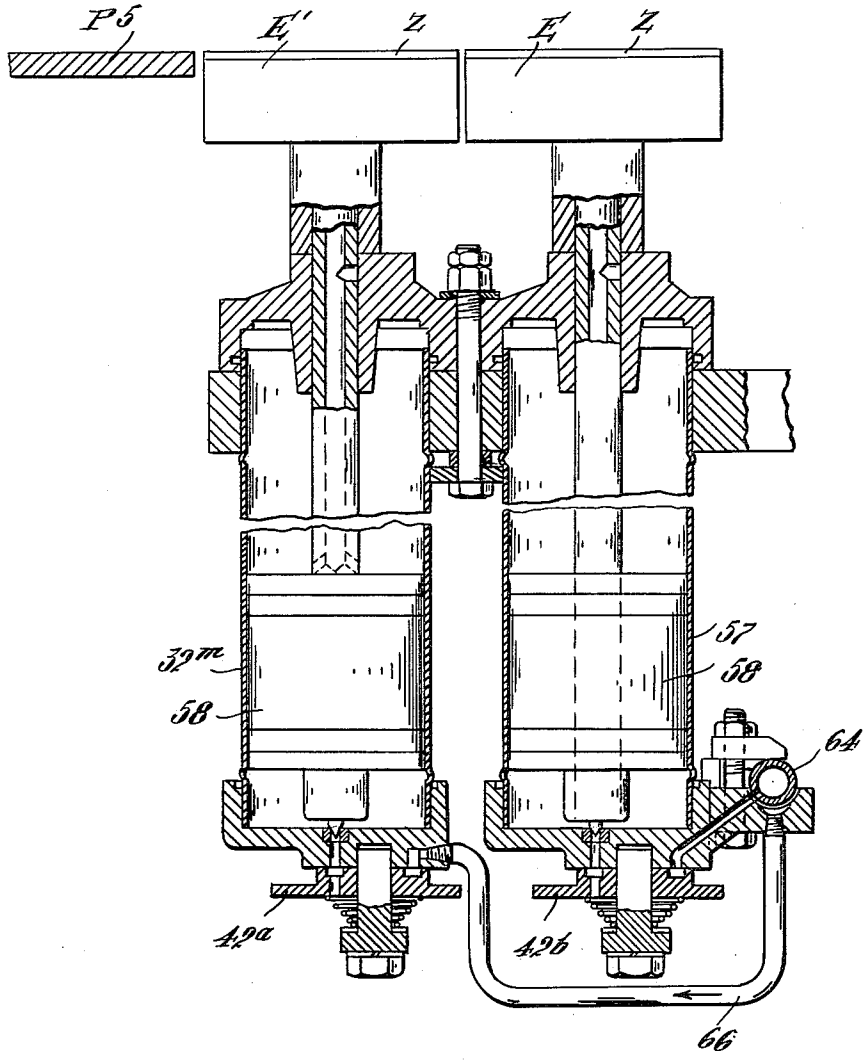


Fig. 17

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CONTAINER FILLING APPARATUS

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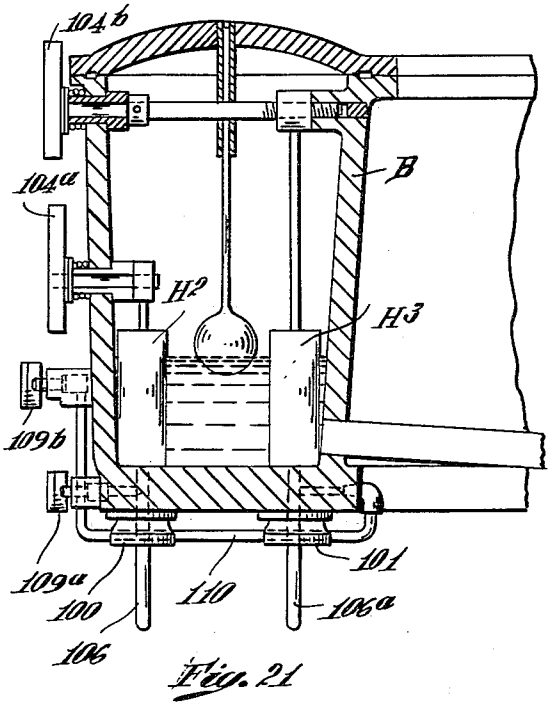


Fig. 21

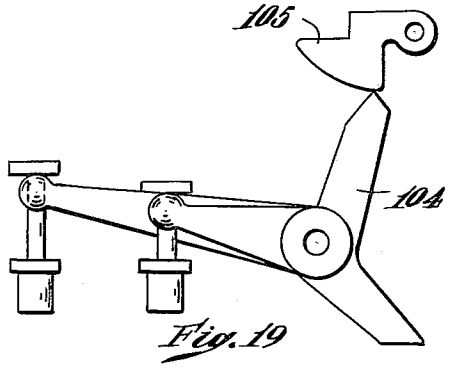


Fig. 19

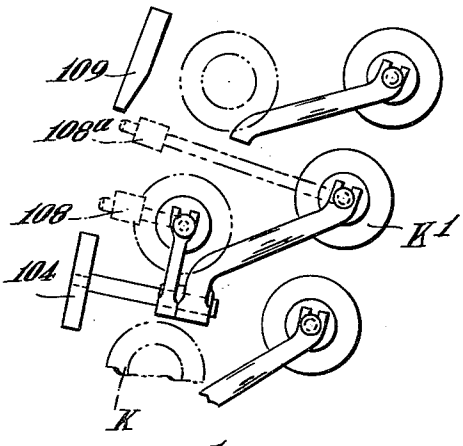


Fig. 20

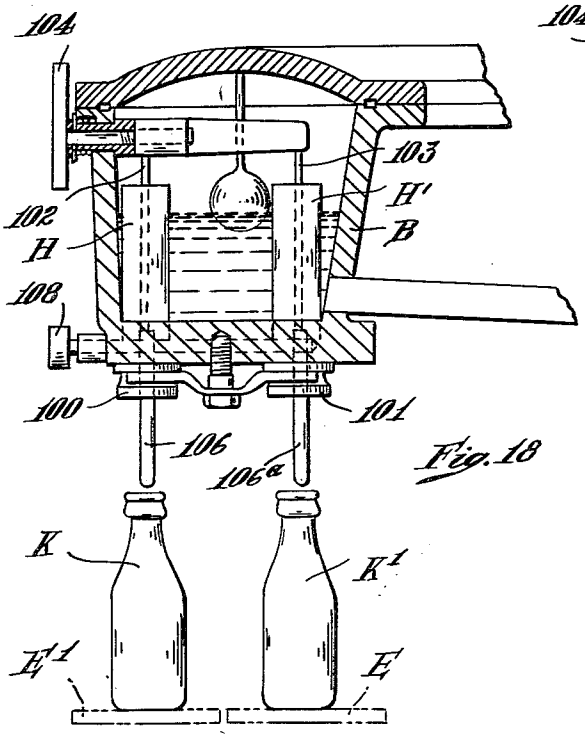


Fig. 18

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United States Patent Office 3,047,032 Patented July 31, 1962

3,047,032

CONTAINER FILLING APPARATUS

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Filed Apr. 13, 1959, Ser. No. 806,128
23 Claims. (Cl. 141—99)

This invention pertains to apparatus for filling containers, for example, but without intended limitation, to apparatus for filling beverage bottles, and relates more particularly to a machine of that kind which includes a rotary table by which the bottle is carried while it is being filled.

Heretofore the usual practice has been to dispose the bottles upon the table in such a way as to form a single row concentric with the table, the machine also including a single row of filler heads operative simultaneously to discharge fluid from an elevated "bowl," into each of the several bottles forming such a row, as the table rotates. Since increase in the speed of rotation of the table results in increasing the centrifugal force tending to tip the bottles and introduces difficulties in properly delivering the bottles to and in removing them from the table and since the rate at which fluid may be delivered into a bottle is definitely limited by practical considerations, the output of the machine depends primarily upon the number of bottles which, at any given moment, are in process of being filled. Attempts to provide increased production have heretofore usually been directed to enlarging the diameter of the table thereby to increase the number of bottles constituting such a single annular row, but such an increase in the diameter of the machine has practical limitations, for example, the requirement for a large floor area and, because of the heavy load which is rotated, the necessity of heavier construction with costs which mount in an increasing ratio, as well as the requirement for a more powerful drive motor, and so forth.

In machines of this general type, it is customary to support each bottle upon an individual platform or stirrup with provision for moving the stirrup vertically so that it may be held at a suitable relatively low level to permit the bottle, without interference from the filler head, to be slid laterally from a stationary support or "dead plate" onto the stirrup carried by the rotating table, and then for raising the stirrup to move the bottle up in coaxial relation with one of the filler heads so as to enter the vent tube into the bottle neck and hold the top of the bottle against the centering cup during the filling operation and, when the bottle has received the desired amount of fluid, then to move the stirrup downwardly so as to disengage the bottle neck from the cup and vent tube and to place the bottom of the bottle at the level of the stationary dead plate onto which the bottle may be slid laterally from off the stirrup and, from the dead plate, delivered to a suitable conveyor or the like.

As the bottles are delivered to the table and removed therefrom by mechanical means, it is clear that a substantial arc of the circumference of the table must be reserved for these devices, and that within the confines of this arc there is a gap in the row of bottles upon the table. Obviously, the length of this gap should be kept as small as possible in order that the row of bottles which are being filled may comprise as large a number as possible and thus the bottle-delivering and removing devices should be compact and still capable of performing their intended functions.

It has heretofore been proposed to increase the capacity of the machine without unduly increasing its diameter, by arranging the bottles on the table to form two or more concentric rows; but, since those bottles which are to constitute an inner row must cross the track

of the bottles forming the outer row as they are delivered to the table and likewise must cross the path of the bottles of the outer row as they are removed from the table, such a solution of the problem has not been generally adopted, first, because any such arrangement as has heretofore been suggested so much increases the gap in the outer row of bottles for the accommodation of the additional transfer mechanism as largely to nullify the advantages theoretically to be gained by arranging the bottles in a multiple of rows, and also because the movement of the bottles across the path of the bottles forming the outer row has involved difficulties in the control of the bottles, particularly as it has seemed necessary to dispense with the customary upstanding bottle-gripping device of the outer row of bottle-elevating stirrups.

The present invention has for a principal object the provision of a filling machine of the general type above referred to, but having provision for increasing the production of the machine without unduly increasing its diameter, as compared with machines of the same type and of conventional dimensions. A further object is to provide a machine of the above type of such novel design as to make it practical to revolve a plurality of concentric rows of bottles about a vertical axis and simultaneously to fill bottles comprised in both rows.

A further object is to provide a filling machine of the above type wherein the bottles to be filled are arranged in concentric rows, and wherein each bottle is carried bp an individual vertically movable stirrup provided with a bottle-gripping device, and with provision whereby bottles may be supplied to and removed from an inner row without interfering with the gripping device of the stirrups which carry the bottles forming the outer row. A further object is to provide a filling machine of the above type wherein a plurality of concentric rows of stirrups support the bottles while they are being filled, and with means for delivering bottles to and for removing them from the stirrups of both rows, and having means whereby the stirrups of the outermost row are moved to an abnormally low position, after the bottles have been removed therefrom, to permit their gripping devices to pass below the means for delivering and removing bottles from the inner row or rows.

It is desirable to keep the filling machine fully supplied with bottles while in operation; and a further object is to provide for driving the machine at varying speeds with automatic control means of a type such that the speed of the machine will be reduced automatically in response to a reduction in the rate at which bottles are fed to the machine. A further object is to provide a filling machine of the class described wherein the table is provided with two concentric rows of bottle-supporting stirrups and with fluid pressure motors for moving the stirrups of both rows from bottle-receiving level to bottle filling level, and wherein the motor means for moving the outer row of stirrups is so devised, as at times, to move the stirrups of the outer row below the bottle-receiving level. A further object is to provide a filling machine of the above type wherein each bottle-supporting stirrup of a given row is raised or lowered by motor means comprising a cylinder having therein two independently movable pistons, one of which constitutes a movable floor for the cylinder, and means for admitting pressure fluid independently to the space immediately beneath each respective piston. A further object is to provide a filling machine of the above type such that production may be increased from 1.4 to 1.7 times that of a customary machine while running at the same speed as the latter, and without unduly increasing the diameter of the machine. A further object is to provide a machine of the above type wherein the rotary table carries two concentric rows of bottle-supporting stir-

rups, but wherein the feed level of the outer row is below the feed level of the inner row so far that the stirrups of the outer row, when at their bottle-receiving level, may pass beneath the bottle-delivery means for the inner row, and with motor means operative to move both rows of stirrups to the same filling level. A further object is to provide a machine of the above type wherein the table carries two concentric rows of bottle-supporting stirrups, and with motor means operative to move the stirrups of both rows from the same bottle-receiving level up to the same bottle-filling level, and with the means for delivering the bottles to and for discharging them from the stirrups of the inner row arranged to move the bottles transversely across the stirrups of the outer row while the latter are at the bottle-receiving level—the customary bottle gripper being omitted from the stirrups of the outer row so that the bottles may move transversely across said stirrups in moving toward or from the stirrups of the inner row.

A further object is to provide a filling machine of the above type wherein the rotating table carries two concentric rows of bottle-supporting stirrups, but wherein the axes of the motor cylinders of the outer row are spaced apart the same distance as those of the inner row thereby making it possible to increase the number of stirrups in the outer row, and with independent valve means for controlling the admission and release of pressure fluid from the motor cylinders of the inner and outer rows, respectively, as well as for the valves which control the delivery of fluid by the filler heads. A further object is to provide, in a machine of the above type, novel and improved means for actuating the charging valves of the filler heads. Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a diagrammatic plan view generally illustrative of apparatus in accordance with one embodiment of the present invention, and showing the course of bottles received in two rows upon independent supply conveyors and as delivered in two separate rows to other conveyors;

FIG. 2 is a fragmentary diagrammatic plan view of a machine according to the same embodiment of the invention, indicating the positions of the several cams which control the admission to and discharge of pressure fluid from the motors which raise the bottle-supporting stirrups of the concentric rows carried by the rotating table;

FIG. 3 is a bottom plan view, with certain parts in horizontal section, showing the seat surface with which the motor control valve cooperates;

FIG. 4 is a plan view, with certain parts in horizontal section, of the control valve associated with one of the outer cylinders, showing it in the position which it occupies for positioning the bottle-supporting stirrups of both inner and outer rows at the level for discharging bottles;

FIG. 5 is a plan view of the same valve as that shown in FIG. 4, but in the position which it occupies in order that the stirrups of the outer row may occupy an abnormally low position such that they pass the feed devices and the delivery devices for the inner row;

FIG. 6 is another plan view of the same valve, showing it in the position which it occupies in order that the bottle-supporting stirrups of both rows may be located to receive bottles;

FIG. 7 is a plan view of the same valve in the position which it occupies in order that the stirrups of both rows may be elevated to the bottle-filling position;

FIG. 8 is a fragmentary vertical section on the plane of the axes of a pair of stirrup-actuating motors of the outer row—the piston in the left-hand cylinder occupying the position which results from the setting of the control valve, as shown in FIG. 5, while the piston in the right-hand cylinder is shown as occupying the position which results from the setting of the control valve as shown in FIG. 4;

FIG. 8*a* is a fragmentary section, in substantially the same plane as FIG. 8, but to larger scale, showing the lower part of the left-hand motor cylinder;

FIG. 9 is a section similar to FIG. 8, but showing a pair of adjacent motor cylinders of the inner row and with their pistons in the positions which they occupy in response to the setting of the control valve as shown in FIG. 4;

FIG. 10 is a fragmentary vertical section on a radial plane through the axes of adjacent cylinders of the inner and outer rows, respectively, and with their respective pistons arranged as results from the setting of the control valve as shown in FIG. 5;

FIG. 11 is a fragmentary section, partly in a horizontal plane through the lower portions of a pair of adjacent motor cylinders of the inner row, and partly in a horizontal plane through the base block upon which the corresponding cylinders of the outer row are mounted, and showing in dotted lines the control valves position as they are in FIG. 4, and illustrating the connections for supplying pressure fluid to the several cylinders;

FIG. 12 is a fragmentary diametrical section through the lower portion of one of the motor cylinders of the inside row and showing the connections for supplying pressure fluid to the cylinder;

FIG. 13 is a view generally similar to FIG. 10, but showing a modified construction, wherein the bottle-supporting stirrups of the inner and outer rows are arranged at different levels when receiving bottles from the supply;

FIG. 13*a* is a fragmentary radial section through the outer part of the rotating table, illustrating the arrangement of FIG. 13, and also including the feed conveyor and spacer screws, and showing the relative location of the filler heads;

FIG. 13*b* is a diagrammatic plan view showing a control valve useful in the arrangement of FIG. 13;

FIG. 14 is a view generally similar to FIG. 10, but illustrating a further modification wherein the bottle-supporting stirrups of both the inner and outer rows are located in the same horizontal plane in receiving and discharging bottles, and wherein provision is made for moving the bottles across the bottle-supporting stirrups of the outer row in placing them on or removing them from the stirrups of the inner row;

FIG. 15 is a fragmentary diagrammatic plan view showing the apparatus of FIG. 14, but to smaller scale;

FIG. 16 is a fragmentary plan view similar to FIG. 15, but illustrating a further modification wherein the bottle-supporting stirrups of the outer row are spaced apart circumferentially of the table the same distance as those of the inner row, thus providing for a larger number of the bottle-supporting stirrups in the outer row than in the inner row;

FIG. 17 is a view generally similar to FIG. 10, but illustrative of the arrangement of FIG. 16, it being noted that with this arrangement it is necessary to provide separate control valves for the cylinders of the outer and inner rows;

FIG. 18 is a fragmentary radial section showing the arrangement for actuating the filling and snift valves when adjacent bottle-supporting stirrups of the inner and outer rows are in the same radial planes, as illustrated, for example, in FIG. 1;

FIG. 19 is a fragmentary side elevation showing the actuating levers for operating the filler valves of the arrangement in FIG. 18;

FIG. 20 is a fragmentary diagrammatic plan view illustrating the arrangement for actuating the snift valves of the device of FIG. 18; and

FIG. 21 is a fragmentary radial section, for example in the plane of the line M—M of FIG. 16, but to larger scale, showing a portion of the bowl of the machine and the control arrangements for the filling and snift valves,

which is required when the bottle-supporting stirrups of the inner and outer rows are not in the same radial plane.

Referring to FIG. 1 of the drawings, there is diagrammatically illustrated a filling machine embodying the general principles of the present invention, but without attempt to illustrate the details of construction. Thus the characters C and C′ may be considered to represent conveyors upon which articles, for instance bottles, are conducted from two bottle washing machines to the feeding conveyors C^2 and C^3, respectively, of the filling machine of the present invention. Associated with each of these feeding conveyors C^2 and C^3 there is an article-spacing screw S and S′ respectively, which deliver the bottles to start wheels W^1 and W^2, of conventional type, having peripheral pockets which receive the bottles from the spacer screws. As shown, the star wheel W^1 has ten article-receiving pockets and the star wheel W^2 has fourteen article-receiving pockets. Associated with these two star wheels there are fixed guides of generally conventional type, and also stationary supports or "dead plates" (not indicated in FIG. 1), over which the bottles slide as they are moved by the star wheels after leaving the conveyors C^2 and C^3. The star wheels are so relatively arranged, in connection with their associated guides, as to deliver the bottles to the rotating horizontal table of the machine (whose center of rotation is indicated at N), so that they form two concentric rows with the centers of the bottles of the respective rows travelling along the arcuate paths J^1 and J^2. While passing along these arcuate paths, the articles of both rows are simultaneously filled with the desired filling material, by means of generally conventional type (not shown in FIG. 1); and after having been filled, the articles which travel along the outer path J^2 are removed from that path by the star wheel D′ and its associated guide, onto a stationary support or dead plate; and into the field of action of a star wheel K^1 which forms an element of a crowning machine. The bottles are then delivered by another star wheel to the conveyer C^4, by means of which they may be conducted to a pasteurizer or the like. In the same way, the articles which have been travelling along the inner arcuate path J^1 are removed from that path by the star wheel D^2 and are delivered by the latter to the star wheel K^2 of a crowning machine. The bottles are then delivered from the wheel K^2 by another star wheel and by the latter to the conveyor C^5 which carries these bottles to the same pasteurizer. As shown, the star wheels W^1 and D^1 have the same number of article-receiving pockets and likewise the star wheels D^2 and W^2 have the same number of article-receiving pockets. Moreover, in the arrangement shown in FIG. 1, the arc connecting the centers of adjacent articles of the outer row J^2 is of the same angular extent as the arc connecting adjacent articles of the inner row J^2; or, in other words, the articles of the outer row, which is of greater radius than the inner row, are spaced further apart on centers than those of the inner row.

Referring to FIG. 2, wherein the character N again indicates the center of rotation of the customary horizontal table on which the articles are supported while being filled, the character E^m indicates the position of a bottle resting upon one of the vertically movable stirrups E of the inner row (FIG. 10), upon which the bottles are mounted while being moved along by the table, while the character E^n represents the position of a bottle resting upon a similar article-supporting stirrup E^1 of the outer row (FIG. 10). While, as suggested, the stirrups of both rows are carried by a simple rotating table, it is to be understood that they may be otherwise supported to revolve in concentric paths about a vertical axis, and that the term "table" is employed in a broad sense as referring to any supporting structure which turns about a vertical axis. The star wheels for delivering the articles to the two rows of stirrups and for removing them therefrom are indicated by the characters W^1, W^2, D^1, D^2, as above described. It will be noted, by reference to FIGS. 1 and 2, that, in order that the star wheel W^2 may function, in the intended manner, to deliver articles onto the stirrups E of the inner row, it is necessary that the star wheel W^2 overlap the path J^2 along which the stirrups E^1 of the outer row travel; and likewise, that the star wheel D^2, which takes the articles from the stirrup E of the inner row, must likewise overlap the path J^2 of motion of the stirrups of the outer row. In a machine of this kind it is desirable that the articles of both rows be supported at the same level while they are in the field of operation of the filling means, and that, as is customary in machines of this general type, the articles be raised (after having been placed upon their supporting stirrups) to the filling level and then, after having been filled, that they again be lowered preparatory to removing them from the supporting stirrups. Ordinarily, in the customary single-row machines, the dead plates which support the articles while they are being placed upon and removed from the stirrups are at the same horizontal level—the stirrups being held at this level while the articles are being slid onto and off of them, but being raised and kept at the upper level while the articles are travelling through the filling zone. Desirably, a variable speed motor (not shown) is employed for driving the machine.

As indicated in FIG. 2, microswitches F^3 and F^4 may be associated with the feed conveyors C^2 and C^3, respectively, and arranged to modulate the motor circuit, for example, in a manner similar to that disclosed in the patent to Carter, No. 2,866,534, December 30, 1958, whereby the speed of revolution of the rows of article supports may be varied in accordance with the rate at which articles are supplied by the feed conveyors.

In accordance with a preferred embodiment of the present invention, the stirrups E′ of the outer row, after the articles which they carry have been taken off by the star wheel D^2, are depressed to an abnormally low level so that they may pass, without interference, beneath the star wheels D^2 and W^2 and their associated dead plates and fixed guides—the stirrups E^1 then again being elevated to the normal article-receiving low level just before they reach the star wheel W^1 for the reception of articles from the latter.

In machines of this general type, the article-supporting stirrup may be raised from the low level to the high filling level by means of a fluid-pressure motor, for example, a cylinder containing a piston, and with provision for supplying compressed air at the proper time for raising the piston and for exhausting the air at the proper time to permit the piston to descend. This arrangement is employed in the machine of the present invention, with provision whereby the motor means which raises the stirrups E′ of the outer row are capable of moving these stirrups from the normal low level (at which they receive and discharge articles) to the high or filling level, and also to an abnormally low level while the stirrups are passing the star wheels D^2 and W^2. On the other hand, the motor means for raising and lowering the stirrups E of the inner row may be of generally conventional type and designed to move the stirrups from the normal low position to the high or filling position, and then back to the normal low position, but not to the abnormally low position of the outer stirrups. Motor means for accomplishing this result, together with desirable controlling valves, is illustrated in FIGS. 3 to 12 of the drawings.

Referring to FIG. 8, the numeral 30 indicates a supporting block (which is one of a series which is mounted upon the marginal portion of the rotating table) which carries the vertical cylinders 32 and 32*a* of the motors for moving two adjacent stirrups E′ of the outer series; while the numeral 31 (FIG. 9) indicates a similar block also mounted upon the rotating table, inwardly of the block 30, and which carries the motor cylinders 57 for oper-

ating a pair of adjacent stirrups E of the inner row. As shown, the block **30** is at a lower level than block **31**. The cylinders **32** and **32***a* are provided with the lower pistons **33** and **33***a* respectively. The piston **33** has a downwardly directed rod or stem **34** which passes down through a vertical bore in the block **30**—the block having a downwardly directed tubular boss **30***x* which provides an extended bearing for the rod **34** as the latter moves up or down. Upward motion of the piston **33** is limited by the contact of a nut N^2, carried by the lower end of the piston rod, with the lower end of the boss **30***x*. It will be understood that the piston **33***a* in the cylinder **32***a* will have a similar piston rod **34***a* and will be guided in the same manner as the rod **34**.

The piston rod **34** has an axial bore or passage **35** which, as best shown in FIG. 8*a*, communicates at its lower end with a circumferential groove **36** in the outer surface of the piston rod **34**. At its upper end, the bore **35** opens into a cavity **37** at the center of the piston **33**. Within the cylinder **32**, above the piston **33**, there is a second piston **39** having a piston rod **40** which extends upwardly through the upper part of the cylinder **32** and up through a guide bore in the cylinder head H^6 (FIG. 10) and to whose upper end there is secured one of the stirrups E′ of the outer row. The piston rod **40** is provided at its lower end with a chamber **40***a* (FIG. 8*a*), and within this chamber there is arranged to slide a valve member **40***b* which projects downwardly below the lower surface of the piston **39** so that, as the piston **39**, in moving downwardly approaches the piston **33**, the valve member **40***b* enters the upper end of the passage **35** in the lower piston and thus closes said passage, thus preventing escape of air from the space T (FIG. 8) between the opposed surfaces of the pistons. This arrangement thus provides for the retention of a cushion of air between the pistons so as to lessen the shock as the upper piston moves downwardly toward the lower piston.

At the underside of the block **30**, there is arranged a control valve **42** by means of which the admission to and discharge of air from the cylinder **32** is automatically controlled. The valve **42** is of the general type such as had customarily been employed in machines of this class, comprising a disc of metal having a smoothly finished upper surface which contacts the finished undersurface of the block **30**, the disc (FIGS. 4 to 7) having a central aperture **43** which receives the downwardly directed boss **30***x* of the block, the latter forming a pivotal axis about which the disc may turn. A compression spring **44** (FIG. 8) embraces the boss **30***x* and exerts upward pressure against the underside of the valve disc—the lower end of this spring resting upon a yoke **45** whose ends are connected to the block **30** by bolts **46**. The valve disc has an arcuate slot or opening **47** (FIG. 4) of substantial length at one side of its central opening **43** and a second arcuate slot **48** of lesser length at the other side of its central opening. The disc is provided at one side (adjacent to slot **48**) with outwardly projecting ears **50** and **51** (FIG. 4) and at the opposite side (adjacent slot **47**) with a second pair of ears **51***a* and **50***a*—these ears being designed to contact certain cams **52**, **53**, **54** and **55** (FIGS. 2, 4, 5, 6, and 7), suitably located, as hereafter described, about the circumference of the rotating table and which are thus operative to turn the valve discs to the proper positions, as the table rotates, to control the flow of compressed air to and its release from each respective cylinder. As here illustrated (FIGS. 4 to 7), each of these cams **52**, **53**, etc. is pivoted upon a stud **50***m* and is urged, by means of a tension spring **56**, toward a fixed stop member **57**, the cams thus being yieldable to some extent as they are contacted by the projecting ears of the valve disc.

As above noted, the block **31** (FIG. 9) carries a pair of cylinders **57**, within which are arranged pistons **58** having piston rods **59**, upon whose upper ends are mounted the stirrups E of the inner series, it being understood that the block **31**, with its pair of cylinders, is one of a series of such blocks which are arranged in a circle upon the rotating table. The piston rods **59** extend upwardly through the heads H^9 (FIG. 10) of the cylinders **57** and at their lower ends are provided with chambers **59***a* (FIG. 9) in which slide valves **61** which are operative, as the pistons **58** move toward the lower ends of their cylinders, to close the upper ends of the passages in the block **31** which communicate with the fluid conduits **63**. These conduits **63** extend from the block **31** to the block **30**, as illustrated in FIG. 11, as will be more fully described hereafter. Each valve **42** controls the admission of air to and its release from an outer cylinder **32** and a corresponding inner cylinder **57**. An air supply pipe **64** (FIGS. 10, 11 and 12) extends circumferentially of the table, being conveniently supported by brackets **65** projecting from the block **31**, and having branches **66** extending to each of the blocks **30**.

Referring to FIG. 11, the pipe **66** is shown as communicating with a horizontal port or passage **67** in the block **30**—this port communicating at its inner end with a vertical passage **68** in the block, and also with a horizontal passage **67***a*, extending within the block **30** to a horizontal passage **67***b* which communicates with a vertical passage **68***a* in the block. The block **30** is also provided with a vertical passage **69** (FIGS. 3, 8 and 11), which opens into the lower end of the cylinder **32** in the space T^5 below the piston **33**. It also has a passage **70** (FIGS. 3 and 11) which extends downwardly from the space T^5 beneath the piston **33** and is open to the atmosphere at its lower end; and it has a still further passage **72** (FIGS. 3 and 11) which communicates with a radial passage **36***y* in the block which leads from the channel **36** in the periphery of the piston rod **34**, while a second radial passage **36***x* leads from this channel **36** to the vertical passage **71**. The block **30** also has passages **69***a*, **70***a* and **71***a*, radial passages **36***x* and **36***y*, and a passage **72***a*, severally corresponding to the passages above described. (It may be noted that the pipes **63** above described always communicate with the outer ends of the radial passage **36***y*.)

Referring to FIG. 2, the several valve-actuating cams are shown and the corresponding positions of the valves, namely, the position V^1, at which the valve is set to cause the motors to raise the stirrups of both the inner and outer rows to the upper or filling level; the position V^4, at which the valve is set to cause the motors to move the stirrups of both the inner and outer rows down to the normal low level, at which the filled containers are removed from the stirrups of both rows; the position V^3, at which the valves are so set as to cause the stirrups of the outer row to move down to the abnormal low position at which they may pass beneath the star wheels D^2 and W^2; and the position V^2, at which the valves are set to cause the motors to raise the stirrups of the outer set up to the normal low level at which articles are delivered to the stirrups.

In FIG. 9 the broken lines L^3—L^4 indicate the level of the upper surfaces of the pistons **58** which actuate adjacent stirrups of the inner row when these stirrups are at the normal low level to receive or to discharge the articles which are to be filled. In FIG. 8, the upper surface of the upper piston **39**a in cylinder **32***a* is shown at the same level as the upper surfaces of the pistons **58** shown in FIG. 9. The upper piston **39**, as shown in FIG. 8, has its upper surface at an abnormally low level, that is to say, lower than the upper surface of the piston **39***a*, but in actual operation the upper surfaces of these two pistons of the outer row would always be in the same horizontal plane. As shown at the right-hand side of FIG. 8, the bottom piston **33***a* has been raised, above the lower end of its cylinder, by the introduction of compressed air beneath it, and is supporting the upper piston **39***a* at the level L^3—L^4 just above referred to. Such position, of all four pistons, with their upper surfaces at nor-

mal low level L^3—L^4, is that which results from the setting of the valve at the point V^2 (FIG. 2), and which correspond to the position of the valve illustrated in FIG. 6. As thus positioned, air from the supply has entered the vertical passage 68 in the block 30 and has been conducted, by the large arcuate slot 47 in the valve disc, to the port 69 and has been conducted up into the lower part T^5 of the cylinder 32 and has thus raised the lower piston 33 in this cylinder to the position of the piston 33*a*, as illustrated at the right-hand side of FIG. 8. At the same time, the shorter arcuate slot 48 of the valve has provided communication between the radial passage 36*y* and the port 72 which leads to the atmosphere. This also places the space T' in the lower end of the cylinder 58 of the inner row, and the axial passage 35 in the lower piston 33 of the outer row in communication with the atmosphere. Thus the space below each piston 58 is exhausted to the atmosphere and likewise the space T between the upper and lower pistons of the cylinders of the outer row. The pistons 58 of the inner row and the pistons 39 of the outer row are consequently at level L^3—L^4. In dropping to these positions, the valves 61 and 40*b* close the air discharge passages just before the pistons reach their lowest point, thus cushioning the downward motion of the pistons. The parts now remain in this position with the stirrups of both the inner and outer rows at the article-receiving level L^3—L^4, so that they are properly positioned to receive articles from the star wheels W^1 and W^2. The stirrups of both rows now advance with the rotating table to the position V^1 (FIG. 2), at which point the cam 53 turns the valve disc 42, of each succession block 30, to the position shown in FIG. 7. In this position air is still furnished from the supply through the passage 68, the arcuate slot 47 and the passage 69 to the lower end of the cylinders 32 of the outer row, so that the lower piston 33 still occupies the position indicated at 33*a* (FIG. 8), but, at the same time, because of the new location of the arcuate slot 47, air under pressure is also furnished to the passage 71, from which it flows along the radial passage 36*x* to the groove 36 in the piston rod 34 and thence upwardly through the axial passage 35 (FIG. 8) in the piston 33 to the space T between the lower piston 33 and the upper piston 39. At the same time, air flowing from the groove 36 passes through the radial passage 36*y* (FIG. 11), to the pipe 63, and thus into the lower part of the cylinder 57. Thus the upper piston 39 in the cylinder 32 of the outer row is raised and, at the same time, the piston 58 in the cylinder of the inner row is raised—the upward motion of the several pistons being such as to move the stirrups of both the inner and outer rows up to the filling level. The parts remain in this position until the valve 42 has been brought around to the position V^4 (FIG. 2), whereupon the cam 54 turns the valve to the position illustrated in FIG. 4. In this position, the arcuate slot 47 in the valve is still so located as to supply air to the port 69, thus keeping the lower piston 33 of the outer row in its upper position, as shown at the right-hand side of FIG. 8, but air has been cut off from passage 71 at this time and the shorter arcuate slot 48 has been so positioned as to connect the radial passage 36*y* (FIG. 11) with the port 72, thus permitting air to exhaust from the space T between the upper and lower pistons of the outer cylinders and from the space beneath the pistons 58 of the inner cylinders. The upper pistons 32 and 32*a* of the outer row and both pistons 58 of the inner row now drop down until their upper surfaces are at the level L^3—L^4 (FIG. 9), thus lowering their stirrups to the position proper for the discharge of the articles from their stirrups by the star wheels D^1 and D^2.

At the point V^3 (FIG. 2), the valve 42 is moved by the cam 52 so that the valve assumes the position shown in FIG. 5, wherein the arcuate slot 47 of the valve no longer connects the supply passage 68 with the port 69 which leads to the lower end of the cylinder of the outer row. At the same time the shorter arcuate slot 48, while still continuing to connect the radial passage 36*y* with the port 72 (leading to the atmosphere) also connects the port 70, which leads from the lower end T^5 of the outer cylinder 32, with port 72 and thus to the atmosphere. Thus air is exhausted from beneath the lower pistons 33 and the latter drop, permitting the upper pistons 39 in the outer cylinders to drop to the position shown at the left-hand side of FIG. 8. However, the pistons 58 remain at normal low level. At this position, the stirrups E^1 of the outer row are positioned, relatively to the stirrups E of the inner row, as shown in FIG. 10. In this view, the dead plates P^1 and P^2, over which the articles are slid onto and off from the stirrups of the outer and inner rows, are shown in their relation to the upper surfaces of the stirrups as the latter are travelling from the position V^3 to the position V^2 in FIG. 2; and it will be noted that while the upper surfaces of the stirrups E of the inner row still remain at the level of the upper surfaces of the dead plates, the upper surfaces of the stirrups E' of the outer row are below the dead plates so that they can pass the latter without interference.

At the point V^2 the cam 55 again moves the valve disc 42 to the position shown in FIG. 6, where air is again admitted to the lower end of the cylinders of the outer row, thus restoring the bottom pistons 33*a* to the position shown at the righthand side of FIG. 8, and so raising the upper piston in each of the outer cylinders until its upper surface is at the level L^3—L^4 with the upper surfaces of the stirrups E' at the same level as those of the stirrups E of the inner row and in readiness to receive articles from the star wheels.

FIG. 13 which is generally similar to FIG. 10, illustrates a modified construction wherein the numeral 32 designates a motor cylinder of the outer row and the numeral 57 indicates a corresponding motor cylinder of the inner row, it being noted that the cylinder 32 is longer than the cylinder 57. The latter cylinder has a single piston 58 like the piston 58 above described, and in this arrangement the cylinder 32, of the outer row, has but a single piston 58*m* like the piston 58 but the stroke of piston 58*m* is substantially greater than that of piston 58. The cylinder 32 is mounted upon a base block 30*m* and the cylinder 57 is mounted on a base block 31, these blocks being carried by the rotary table T^9 (FIG. 13*a*). Compressed air is supplied by the pipe 64 carried by brackets 65 projecting from the blocks 31 of the inner cylinders, and an air supply pipe 66 connects the pipe 64 with a chamber within the base block 30*m*. A rotary valve 42*x* (FIGS. 13 and 13*b*) is arranged beneath the base block 30*m*, this valve being provided with an arcuate air supply slot 47*m* and an exhaust port 48*m*.

In this arangement the dead plate P^3, across which the bottles are moved as they are delivered to the stirrup E' of the outer row, is substantially (for example three inches) below the dead plate P^4 across which the bottles move as they are delivered to the stirrup E of the inner row. The stirrup E^1 has the upper surface 80 upon which the bottles stand, and a bracket carried by the stirrup supports the customary bottle gripper G' at an elevation above the surface 80. This gripper may be of rubber or other suitable resilient material, and is designed partly to embrace the bottle so as to prevent it from tipping or moving off center relatively to the stirrup as the bottle is carried around by the table. The difference in level of the dead plates P^3 and P^4 is such as to permit this elevated gripper G' to pass beneath the dead plate P^4 without interference. The stirrup E of the inner row has the upper bottle-supporting surface 81, and above this a bottle gripper G^6 like that carried by the stirrup of the outer row.

With both pistons 58 and 58*m* at the lower ends of their respective cylinders, as shown in FIG. 13, the surfaces 80 and 81 of the respective stirrups are in position to receive bottles from the dead plates P^3 and P^4, respectively, or to discharge them onto the dead plates. The feed conveyors C_2 and C_3 are at levels (FIG. 13*a*) corresponding

to the dead plates P^3 and P^4, respectively. In this arrangement, the stirrups would have only two positions, namely the down position, (FIGS. 13 and 13*a*) wherein their upper surfaces **80** and **81** are flush with the upper surfaces of the dead plates P^3 and P^4 respectively, and an up position (not illustrated), wherein both stirrups are disposed at the filling level with the vent tubes **106** and **106***a* (FIG. 18) of the filler heads projecting down into the bottles. In this arrangement (as referred to the plan view of FIG. 2), only two valve-actuating cams would be employed, that is to say, a cam located at the position V^4 and a second cam located at the position V^1. As the valve **42***x* (FIG. 13*b*) passes the cam at position V^4, it will be actuated to permit air to exhaust from the lower ends of both cylinders, so that the pistons **58** and **58***m* will drop to the lower ends of their cylinders and the stirrups E and E′ will be held in their lowermost position, at which the bottles carried by the stirrups may be diverted by the star wheels onto the dead plates P^4 and P^3, respectively. The stirrups will continue in this down position (the stirrups E′ with the bottle-gripper G′ passing below the dead plate P^4 and star wheels D^2 and W^2), until the valve reaches the position V^1, whereupon the stirrups E and E^1, having now received bottles from the star wheels W^2 and W^1, respectively, will be elevated again to the filling position. While this arrangement permits the employment of bottle guards G′ on both the inner and outer rows of stirrups, it has the disadvantage that it requires that the conveyor apparatus be arranged at two different levels.

FIG. 14 illustrates another arrangement, wherein the bottles forming the inner row must cross the stirrups of the outer row as they are placed on their stirrups or removed therefrom. This latter arrangement is diagrammatically illustrated in plan view in FIG. 15, wherein the inner stirrups are indicated at E and the outer stirrups at E′. As may be seen in FIG. 15, the stirrups of the inner and outer rows are staggered relatively to each other. By so staggering the stirrups of the inner and outer rows it is possible to hold the pitch diameter of the rotating table to a minimum. The star wheel whose hub is indicated at W′ is that which, with the assistance of the fixed dead plate Q^1, delivers bottles to the outer row of stirrups, and the star wheel D^2, with the assistance of the fixed dead plate Q^4, removes bottles from the outer row of stirrups. The star wheel W^2, assisted by the fixed dead plate Q^2, places bottles on the stirrups of the inner row and the star wheel D^1, assisted by the fixed dead plate Q^3, removes bottles from the inner row of stirrups. In FIG. 14 two motor cylinders **32***m* and **57** (of the outer and inner rows, respectively) are illustrated, these cylinders being substantially alike and each having a single piston **58** which, by means of the piston rods **41** and **59**, respectively, raise and lower the stirrups E and E^1. While the pistons **58** are at the lower ends of their cylinders as shown in FIG. 14, the upper surfaces **80** and **81**, respectively, of both stirrups are at the level of the upper surface of the dead plate P^5, across which the bottles are moved as they are delivered to the stirrups and removed therefrom. In this arrangement, the upper surfaces of the stirrups E′ and E may be of wear-resistant material, for instance, plates Z of nylon or wear-resistant metal. In this arrangement, a single valve, like the valve **42***x* (FIGS. 13 and 13*b*) may be employed, and which is operative simultaneously to admit air to the lower ends of the two cylinders for raising the stirrups E and E′ to the bottle-filling positions and for simultaneously exhausting air from the cylinders to permit the stirrups to descend to the position indicated in FIG. 14. This offers a simple construction and therefore less expensive to produce.

In all of the arrangements previously described, the arc connecting the axes of adjacent stirrups of the outer row is bisected by a radial line passing through the axis of the intervening stirrup of the inner row. With such a uniform angular spacing, it is possible, as above described, to control the operation of a motor cylinder of the inner row by the same valve which controls a corresponding cylinder of the outer row; and, in the same way, the filling and snift valves of a filler head for a bottle of the outer row may be controlled by the same cams which control the corresponding valves of the filler head for a bottle of the inner row. Thus, as illustrated in FIG. 18, the annular bowl B carries the centering cups **100** and **101** for bottles K and K′ of the outer and inner rows—shown standing upon the stirrups E′ and E. Within this bowl B conventional filler heads H and H′ are arranged, these filler heads including valve stems **102** and **103**, respectively, which are actuated by the lever **104** (FIGS. 18 and 19) which, by contact with a cam **105**, as the table revolves, operates the filling valves at the proper time. As illustrated, the filler heads comprise the vent tubes **106** and **106***a* which extend down into the bottles when the bottles have been raised by the elevation of the stirrups E′ and E. Each of the filler heads also comprises a snift valve which, after the bottle has been filled, is opened to reduce the pressure in the bottle to atmospheric. As illustrated in FIG. 20, each snift valve for a filler head H of the outer row is provided with a lever arm **108** which, by contact with a cam **109**, as the table rotates, opens that particular snift valve. In the same way, the snift valve of each filler head H′ of the inner row is provided with a lever arm **108***a* which, by contact with the same cam **109**, opens that particular snift valve. The arrangement for actuating the filler and snift valves, as just described, is useful, as above suggested, in those forms of the apparatus, for example, as illustrated in FIG. 1, wherein the arc connecting the centers of adjacent bottles of the outer row is of the same number of degrees as the arc which connects the centers of adjacent bottles of the inner row; for in that arrangement it is permissible to employ a single cam for controlling the filler heads of the outer and inner rows.

In the modified arrangement illustrated diagrammatically in plan in FIG. 16, and in vertical section in FIG. 17, and which in other respects may be like that illustrated in FIG. 14, for example, the bottles are delivered to the outer row E′ of stirrups by the star wheel W′ and to the stirrups E of the inner row by the star wheel W^2, and are removed from the stirrups E′ of the outer row by the star wheel D^1 and from the stirrups E of the inner row by the star wheel D^2. A glance at FIG. 2 will make it evident that the number of bottles in the outer row, extending from the cam **53** to the cam **54** constitutes the greatest number of bottles of the outer row which can be filled during a single revolution. In the arrangement of FIG. 16, the stirrups E and E′ of the two rows are so located that the arc connecting the centers of adjacent bottles of the inner row, as indicated by the bracket X′ (FIG. 16), is equal to the arc connecting the centers of adjacent bottles of the outer row, as indicated by the bracket X^2 (FIG. 16). This arrangement reduces the spacing between the bottles of the outer row, as compared with that of the apparatus illustrated in FIG. 2, and thus makes it possible to place more bottles in the outer row between the cams **53** and **54** than in the arrangement of FIG. 1. However, this arrangement means that the radial relationship of motor cylinders of the inner and outer rows will vary from point to point about the table. Thus, while for example, at the radial line M—M, the inner and outer stirrups are on the same radius of the table, those at either side of said line are not on the same radius. Thus, as illustrated in FIG. 17, it is necessary to supply separate valves **42***a* and **42***b* for controlling the admission to and release of pressure fluid from the cylinders **32***m* and **57**, with cams (not shown) properly located to actuate these valves at the desired time. Moreover, in an arrangement such as that of FIG. 16, wherein the arcuate distance between the centers of bottles of the outer row is equal to the arcuate distance between the centers of bottles of the inner row, it is not practical to actuate the filler heads for both rows by means

of the same cam. Thus, as illustrated in FIG. 21, wherein the bowl B is provided with the filler heads H^2 and H^3, corresponding to the outer and inner rows of bottles, respectively, there is provided a lever **104***a* for actuating the filler valve of the head H^2, and a second lever **104***b* for actuating the filler valve of the head H^3; and in this arrangement two cams, each corresponding to the cam **105** of FIG. 19 will be arranged respectively at different elevations, for actuating the levers **104***a* and **104***b*. Likewise, the snift valves for the filler heads H^2 and H^3 are actuated, respectively, by cams **109***a* and **109***b*, which are also located at different elevations—the snift valve which is controlled by the cam **109***b* being suitably connected by a pipe **110** which extends beneath the bowl B to the filler head H^3.

As above noted in referring to the apparatus of FIG. 2, actual filling of a bottle takes place along an arc between the points V^1 and V^4. In a single row commercial-type machine, this arc may be of the order of 244°—the remainder of the 360° being employed in moving the bottles from the supply conveyor to the filling level and in moving the filled bottle from the filling level to the delivery conveyor. For any given machine this filling arc remains constant regardless of the size of bottle being filled. Thus the angular velocity of the table must be varied, since a large bottle must traverse this filling arc at a less angular velocity than a small bottle. It might appear that by the addition of a second row of stirrups, as above described, the production of the machine at any given angular velocity would be doubled, but this is not true because, in order to provide space for the additional star wheels W^1 and D^1 (as illustrated, for example, in FIG. 2), the filling angle, that is to say, the arc between the points V^1 and V^4, must be reduced, for instance to an arc of the order of 204°. This further means that, because of the shortening of the filling arc, the speed of the table must be reduced in order to deliver the same quantity of liquid into a given bottle as would be received by a bottle in a single row machine in traversing the longer filling arc. In the machine as here illustrated in FIG. 2, for example, the net increase in production, as compared with a single row machine of approximately the same table diameter, is thus about **1.67**.

Merely as a means of arriving at a comparison between the production of the machine of the present invention and a well-known type of single-row commercial machine having fifty filler valves, such a machine, in use for filling 32-ounce bottles and with a filling arc of 244°, may be able to fill 160 bottles per minute with a speed of 3.2 r.p.m. of the rotating table, which means 18.75 seconds per revolution and a time of 12.7 seconds while the bottle travels through the filling arc.

As compared with this and referring to a machine like that illustrated in FIG. 2 and provided with one hundred filler valves and wherein the bottle travels through a filling arc of 204° in 12.7 seconds—268 bottles per minute may be filled with the table turning at 2.68 r.p.m. Thus this shows an increase of 1.67 in production, while, at the same time, providing for a relatively low angular velocity of the table, which, for reasons above pointed out, is very desirable.

Summing up the advantages of the machine of the present invention, there results an increase in production which may be from 1.4 to approximately 1.7 and at a lesser angular velocity of the table; it eliminates the use of a bottle combiner in the feed conveyor system and the use of a bottle divider in the discharge conveyor system; it permits an increase in production without substantial increase in floor space; in certain embodiments of the invention, provides a choice of working levels; and in a preferred embodiment provides an arrangement wherein the control of the motors for the stirrups of both inner and outer rows is accomplished by the same valve, thus avoiding costly duplication of parts.

While certain desirable embodiments of the invention have been illustrated and described by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the scope of the appended claims.

I claim:

1. A filling machine of the kind which comprises article supports arranged in concentric rows and revolving at the same angular velocity about a vertical axis, each support being of a size to hold a single article and being movable up and down, an apparatus comprising a frame, stationary plates carried by the frame, said plates having horizontal surfaces, all in the same horizontal plane, along which articles may slide in moving onto or off of the supports, article-transfer means operative to deliver articles to and for removing articles from the supports of both rows, power-actuated means for moving the supports of both rows vertically, said power-actuated means being operative to dispose the supports of both rows simultaneously at a receiving-discharging level or alternatively to dispose the supports of both rows simultaneously at a filling level, and, at times, to disposed the supports of the outer row, only, at a third level such that they freely pass the article-transfer means without interference with the latter, and means for automatically controlling the operation of said power-actuated means.

2. A filling machine according to claim 1, further characterized in that the supports of the outer row at least have upstanding article-steadying brackets and the power-actuated means comprises an individual fluid-pressure motor for moving each of the supports, of the respective rows, both up and down, the fluid-pressure motors of the outer row being so constructed and arranged as, at times, to position the supports of the outer row at a level so low that their brackets pass the horizontal plates and article-transfer means without interference.

3. In a filling machine, in combination, two concentric rows of vertically movable article supports and means for revolving both rows at the same angular velocity about a vertical axis, each support being of a size such as to hold but one article, means operative to feed articles to the supports of the outer row as they move along a predetermined arc of their path of revolution, means operative to remove articles from the supports of the outer row as they move along another arc of their path of revolution, said arc being spaced from the first-named arc, means operative to feed articles to and to remove them from the supports of the inner row as they move along an arc of their path of revolution, which is located between the means for feeding and removing articles to and from the supports of the outer row, automatic means operative to position all of the supports of both rows at a level at which the articles mounted thereon are filled as they are moved along, means whereby all of the supports of both rows are positioned at a second level at which they may receive articles from the feeding means and at which articles may be removed therefrom, and means whereby empty supports of the outer row only may be placed at a third level such that they may pass so far below the means for feeding articles to and removing articles from the supports of the inner now and the dead-plates associated therewith as to avoid possibility of contact.

4. A filling machine of the kind in which an article to be filled moves uninterruptedly along an arcuate path while it receives its intended contents, and wherein, while moving along said path the article is raised from a relatively low level to a higher level, at which it remains while being filled, and, when filled, is moved to a lower level, and comprising two concentric arcuate rows of vertically movable article supports, each designed to hold but one article, motor means including an independent pressure-fluid motor for moving each individual support up and down, means operative to move empty articles onto the supports of both respective rows while they are at a receiving-discharging level which is relatively low as

compared with the filling level, means for delivering filling material into the articles constituting both of said arcuate rows while the supports of both rows are at the same high or filling level, and means operative to remove filled articles from both rows of supports while they are all at said receiving-discharging level, and wherein the means for delivering the articles to the supports and for removing the articles from the supports comprises dead plates and star wheels, characterized in that the motor means for moving the supports is so constructed and arranged as to move the empty supports of the outer row only, after the filled articles have been removed therefrom, to a level below the receiving-discharging level such that they may pass below the dead plates and star wheels which appertain to the inner row without interference.

5. A filling machine of the kind which comprises a rotary carrier, and wherein an article to be filled is moved by said carrier along an arcuate path while it receives its intended contents, and wherein, while moving along said path, the article is raised from a relatively low level to a higher level at which it remains while being filled and, when filled, is then moved to a lower level, and which comprises concentric arcuate rows of vertically movable article supports mounted on said carrier, each support being designed to hold but one article, motor means including an independent pressure-fluid motor for moving each individual support up and down, means operative to move empty articles onto the supports of both respective rows while they are at a receiving-discharging level, means for delivering filling material into the articles constituting both of said arcuate rows while the supports of both rows are at a high or filling level which is higher than the receiving-discharging level, and means operative to remove filled articles from both rows of supports while they are at the receiving-discharging level, each pressure-fluid motor comprising a cylinder and a piston therein having an upwardly extending rod which carries one of the article supports, means whereby the pistons which move the article supports of the inner row are caused to move their supports between the receiving-discharging level and the filling level, and means whereby the pistons which move the supports of the outer row, only, are operative alternatively to position said supports at the aforesaid levels and, also at a level below the receiving and discharging level.

6. A filling machine of the kind in which an article to be filled moves along an arcuate path while it receives its intended contents, and wherein, while moving along said path, the article is raised from a relatively low level to a higher level at which it remains while being filled and, when filled, is then moved to a lower level, and wherein such articles, arranged in two concentric arcuate rows, are carried by individual article supports, motor means including a pressure-fluid motor for moving each individual support up and down, means operative to move empty articles onto the supports of both respective rows while they are at a relatively low level, means for delivering filling material into the articles constituting both of said arcuate rows while the supports of both rows are at a high or filling level, and means operative to remove filled articles from both rows of supports, each pressure-fluid motor comprising a cylinder and a piston therein having an upwardly extending rod which carries one of the article supports, and means whereby the pistons which move the article supports of the inner row are caused to move their supports between a receiving-discharging level and a filling level, and means whereby the pistons which move the supports of the outer row are operative alternatively to position said supports at the aforesaid levels and, also at a level below the receiving and discharging levels, the cylinder of the motor which moves a support of the outer row being longer than the cylinder of the motor which moves a support of the inner row, piston-supporting means operative, at times, to hold the piston of each motor of the outer row at such an elevation above the bottom of its cylinder that the article support which is carried by said piston will be at the same receiving-discharging level as a support of the inner row, said piston-supporting means being operative, at times, to permit the piston in the longer cylinder to move downwardly until its article support is below the receiving-discharging level.

7. A filling machine according to claim 6, wherein the piston-supporting means in the motor cylinder of the outer row comprises a second piston located below the first piston, and means for admitting pressure fluid beneath said lower piston thereby to hold the latter at a level such as to sustain the first-named piston at the elevation necessary to hold its article support at the receiving level.

8. A filling machine according to claim 6, wherein a single valve is operative to control the admission of pressure fluid to the lower end of the longer cylinder and also, at times, to the space between the first and second pistons within said cylinder.

9. A bottle filling machine of the kind wherein a table rotates about a vertical axis and carries a plurality of concentric rows of bottle supports, each support being movable up and down, and being designed to hold but a single bottle, means for holding each support at a high or filling level while the support is moving along a predetermined arc of its travel with the table, means operative to hold the supports of both rows at the same receiving level while moving through another arc and at the same discharge level while moving through still another arc, and means operative to hold the supports of the outer row, only, at a level below said receiving and discharge levels while moving along another arc of travel, and means operative to place bottles upon the supports of both rows while the latter are at the receiving level and for removing bottles from both rows while they are at the discharge level, the means which is operative to hold the supports of the outer row, only, at a level below the receiving and discharge levels being so constructed and arranged that the supports, when empty, pass beneath the means for placing the bottles upon and for discharging bottles from the supports of the inner row.

10. A filling machine according to claim 9, comprising dead plates at the receiving and discharging levels, respectively, for supporting articles while they are sliding onto and from off the supports, the means which is operative to move the supports of the outer row, when empty, at a level below the receiving and discharge levels being so constructed and arranged that said supports of the outer row, only, pass beneath the dead plates appertaining to the inner row without contacting the latter.

11. A filling machine according to claim 9, wherein each support is provided with a bracket carrying a gripper member, located above the level of its bottle-supporting surface, for steadying the bottle as the latter is moved along, and wherein the machine includes dead plates at the receiving and discharge levels, and star wheels for moving articles from the dead plates onto the supports of both rows and for removing articles from the supports of both rows onto the dead plates, further characterized in that the means which is operative to hold the supports of the outer row, only at a level below the receiving and discharge levels is so constructed and arranged as to move them in a path such that the gripping member of each support of the outer row passes without interference beneath the dead plates and star wheels appertaining to the inner row.

12. A filling machine of the kind wherein individual supports, each designed to hold a bottle while the latter is being filled, are arranged to form inner and outer concentric rows which revolve about a vertical axis, and having feed means for sliding bottles onto the supports of both rows and discharge means for sliding bottles from off the supports of both rows, each of the supports having a smooth wear-resistant upper layer of nylon over which a bottle may slide, and dead plates associated with the feed means and with the discharge means, respectively,

said dead plates having horizontal surfaces over which the bottles slide in moving toward and from the supports, and wherein the supports of each respective row are, at times, at the level of the corresponding dead plate and, at times, at the same high filling level, an independent motor which moves each respective support from one of said levels to the other, characterized in that the motors which move the supports of the outer row are so constructed and arranged as, at the proper time, to move the supports of the outer row to such another level, below that of the dead plates appertaining to the inner row, as to permit said supports of the outer row to pass beneath the last-named dead plate without contacting the latter.

13. A filling machine of the kind wherein two concentric rows of article supports are revolved about a vertical axis, and which includes means for filling articles carried by the supports of both rows as said supports traverse a predetermined arc, less than 260°, of their paths of revolution, and means adjacent to said paths and intermediate the ends of said arc for supplying articles to and for discharging articles from the supports of both rows, in combination, an individual motor for moving each support of each row up and down while it is traversing said paths, each motor comprising a cylinder having at least one piston therein, the cylinders of the motors for moving the supports of one of said rows having therein a second piston below the first piston, and valve means operative, at a predetermined point in the revolution of the support, for admitting pressure fluid to the cylinders of the outer row, thereby to raise the lower piston and so move the upper piston and its support upwardly.

14. A filling machine according to claim 13, comprising valve means operative, at a predetermined point in the revolution of the support, to admit pressure fluid to the space between the pistons in the cylinders of the outer row, thereby to move the upper piston with its support relatively to the lower piston.

15. A filling machine according to claim 13, wherein all of the motors of the outer row have cylinders provided with two pistons, and wherein, for each of said motors of the outer row, there is a single control valve which is operative to control the admission of pressure fluid to the space between the pistons in a cylinder of the outer row and also to the lower end of an adjacent cylinder of the inner row.

16. A filling machine according to claim 13, wherein cylinders provided with two pistons are associated with the supports of the outer row only, and cylinders having single pistons therein are arranged for moving the supports of the inner row.

17. A filling machine according to claim 12, wherein the supports of the inner row are disposed at a higher elevation than those of the outer row when in position to receive articles or to discharge articles, and dead plates located at the levels of the inner and outer rows, each of said supports being provided with an elevated article gripper designed to keep the article properly positioned on the support as the latter moves along its path of revolution, the supports of the outer row being at such a level, when they are empty, as to permit them, with their article grippers, to pass beneath the dead plate across which articles pass in moving onto or off the supports of the inner row, and means for moving the supports of both rows to the same elevation while the articles are being filled.

18. A filling machine of the kind wherein article supports are arranged in concentric rows and revolve at the same angular velocity about a vertical axis, devices operative to fill articles carried by the supports of both rows simultaneously while they are moving along a predetermined arc of their path of travel, and devices located at another arcuate portion of said path of travel to guide articles onto and off of the supports of both rows, characterized in having means operative to move the supports of the outer row, while they are empty, in a path such as to avoid contact between said supports and the article-guiding means appertaining to the inner row, further characterized in that the article supports of the two rows are so circumferentially spaced apart that the number in the outer row exceeds the number in the inner row.

19. A filling machine of the kind wherein article supports are arranged in concentric rows and revolve at the same angular velocity about a vertical axis, devices operative to fill articles carried by the supports of both rows simultaneously while they are moving along a predetermined arc of their path of travel, and devices located at another arcuate portion of said path of travel to guide articles onto and off of the supports of both rows, characterized in having means operative to move the supports of the outer row, while they are empty, in a path such as to avoid contact between said supports and the article-guiding means appertaining to the inner row, further characterized in that the article supports of both rows are so circumferentially spaced apart that the arcuate distance between adjacent bottles carried by the supports of both rows is the same.

20. In a filling machine, in combination, two concentric rows of article supports and means for revolving both rows at the same angular velocity about a vertical axis, means operative to feed articles to the supports of the inner row as they move along a predetermined arc of their path of revolution, and means operative to remove articles from the supports of the inner row as they move along another arc of their path of revolution, means operative to feed articles to and remove them from the supports of the outer row, and means operative to move the supports of the outer row, while empty, along a path which avoids the field of action of the means for feeding articles to or for delivering articles from the supports of the inner row, means for revolving the article supports at different angular velocities, and automatic means for controlling the speed of revolution of the article supports in response to the rate at which articles are fed to the machine.

21. A filling machine according to claim 19, wherein the devices which are operative to fill articles carried by the supports are concentric rows of filler heads, the filler heads of the inner and outer rows being spaced apart to correspond to the spacing of the supports of the inner and outer rows, and means for moving the supports of both rows simultaneously into cooperative relation with the filler heads of the corresponding rows and for simultaneously moving them away from the filler heads of the corresponding rows.

22. A filling machine according to claim 19, wherein the arcuate distance between the centers of adjacent supports of the outer row is the same as that between adjacent supports of the inner row, and wherein the means for filling articles carried by the supports comprises two concentric rows of filler heads, the filler heads of the inner and outer rows, respectively, being spaced apart to correspond to the spacing of the supports of the inner and outer rows, each filler head comprising a filling valve and a snift valve, and separate cams for actuating the filler and snift valves of the heads of the inner and outer rows, respectively.

23. A filling machine of the kind wherein two concentric rows of article supports revolve about a vertical axis, each of a size to receive but a single article, the supports of the inner and outer rows being movable up and down independently, stationary guide means providing receiving and delivery guide surfaces over which articles may slide in moving onto or off of the supports of the inner row; means for feeding articles to and for removing them from the supports of the outer row; means for positioning the supports of both rows at a filling level above that of said stationary guide surfaces while the articles are being filled and for positioning the supports of the inner row, at least, so that their article-receiving faces are flush with said re-

ceiving and delivery guide surfaces, respectively, while articles are being moved onto and off of the supports of the inner row, and for causing the supports of the outer row, when empty, to move in a path such as to avoid contact between said supports and the stationary guide means, the means for so moving the supports comprising a fluid motor for each individual support, a valve for controlling the admission of pressure fluid to and its release from each of said motors, and valve-actuating devices so spaced apart, circumferentially about the rotating table, that, as the latter turns, the valves are actuated in sequence to move the supports up and down at the proper times.

References Cited in the file of this patent

UNITED STATES PATENTS

2,333,545	Meyer	Nov. 2, 1943
2,775,269	Breeback	Dec. 25, 1956

FOREIGN PATENTS

766,962	Great Britain	Jan. 30, 1957