A modular system (2) for filling and seaming a plurality of containers (4) moving in parallel linear rows (16) using a plurality of modules wherein each module comprises container filling apparatus (6), lid placing apparatus (8) and lid seaming apparatus (10).
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*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.
APPARATUS AND METHOD FOR PROVIDING
SEALED CONTAINERS FILLED WITH A LIQUID

This invention relates generally to the filling and seaming of containers with a liquid and is particularly directed to a modular system for filling and seaming a plurality of containers with a liquid such as a carbonated beverage such as beer.

Beverage containers, such as beverage cans, are filled with beverages such as beer, soft drinks, etc., in a container filling machine just prior to the application of a lid thereto in a seamer machine which lid is then sealed to the filled container while in the seamer machine. In order to increase productivity, container filling machines have been designed to operate at relatively high speeds. Typical high speed container filling machines are capable of filling containers at a rate of between 500 to 2000 cans per minute.

One of such types of container filling machines is schematically illustrated in U.S. Patent No. 4,664,159 to L.M. Dugan. Due to the centrifugal force generated by the high speed rotation of the container filling machine, it is necessary to provide each container with a height that is greater than that required to hold the amount of
liquid to be contained therein. Even with an excess height there is a problem with beer being spilled out of the containers as the container filling machine rotates. During the rotation of the container filling machine, it is necessary to open and close a valve used to fill the containers. This requires one cam to open the valve and another cam to close it. When it is necessary to replace these cams, the entire container filling machine has to be stopped. It is usual to shut down a container filling machine on an annual basis for overhaul which causes the container filling machine to be idle for about two weeks. Every time it is necessary to repair a part of the container filling machine, it is necessary to shut down the complete operation.

This invention provides a modular system for filling and seaming a plurality of containers moving in parallel linear directions using a plurality of modules wherein each module comprises container filling apparatus; lid placing apparatus and lid seaming apparatus.

In a preferred embodiment of the invention, a plurality of empty containers are moved by conventional conveyor means to converging apparatus where they are formed into a single-file relationship in parallel rows. The empty containers move into contact with a screw-type conveyor having a thread having a gradually increasing pitch until successive containers are spaced a fixed distance apart. The pitch of the thread then remains constant as the containers are moved through a plurality of operations as described below. The containers are moved by the screw conveyor over a stationary surface.
The container filling apparatus of each module comprises a housing removably mounted at a relatively fixed location. Movable valve means are located in the housing and preferably comprise a rotatable member having a transverse bore extending therethrough. Adjustment means are mounted in the transverse bore and are moved to form a cavity of a desired volume, such as 8, 12, or 16 ounces. The adjustment means comprise a plug having an O-ring in contact with the sidewall defining the bore. The plug has valve means, such as a float valve, mounted therein (for purposes described below) and moves with the plug. The outer surface of the rotatable member is cylindrical and fits closely into a cylindrical bore in the housing. An exit passageway is formed in the lower portion of the housing and has a first portion in fluid communication with the cylindrical bore in the housing and a second enlarged portion to the container. If desired, sealing means, such as a silicone seal, may surround the second enlarged portion. The second enlarged portion has a configuration similar to an end portion of the container so that the container may be moved upwardly and be located within the second enlarged portion to be in a position to be filled with a liquid, such as beer. The rotatable member moves between a first location having filling means to fill the cavity and a second location where the liquid is deposited into a container. The filling means comprises a header having the liquid under pressure which is about 15 to 40 psi when the liquid is beer. A tube extends between and is connected to the header and a filling passageway in the housing which passageway has an opening
in the cylindrical bore of the housing. When in the first location, the transverse bore in the rotatable member is aligned with the filling passageway so that the liquid can flow into the cavity. In a preferred embodiment of the invention, when the rotatable member is in the first location, the plug is at a higher elevation than the filling passageway so that as the cavity is being filled, any gaseous materials therein will be moved through the valve means in the plug and exit through a vent passageway in the housing.

In operation, the rotatable member is moved to the first location. When the rotatable member is in the first location, the first opening of the exit passageway is in a sealed relationship with the cylindrical outer surface of the rotatable member. A first container is moved upwardly into a sealed relationship with the second enlarged opening of the exit passageway. A vacuum tube in the housing operates to reduce the pressure in the first container to about 11.5 psi. A purge tube in the housing then purges the first container using a gaseous material, such as carbon dioxide, under pressure of about 15 to 40 psi. A vent tube in the housing allows exhaust of the purged gaseous material. The valving of the vacuum tube, purge tube and vent tube are closed to allow the container to be pressurized to about 15 to 40 psi. The rotatable member is then rotated to the second location whereat the liquid therein is deposited into the first container. The filled first container is moved downward and the screw conveyor moves the filled container to a location under the lid placing apparatus and at the same time moves a second
container under the container filling apparatus. After the lid has been placed on the first filled container and the second container has been filled, the screw conveyor moves the first container under the lid seaming apparatus, the second container under the lid placing apparatus and a third container under the container filling apparatus. After the lid has been seamed on the first container, the lid placed on the second container and the third container has been filled, the screw conveyor operates to move the filled and sealed first container onto a transfer conveyor for movement to other operations, the second container under the lid seaming apparatus, the third container under the lid placing apparatus and a fourth container under the container filling apparatus. It is understood that, in a continuous operation, the container filling apparatus, the lid placing apparatus and the lid seaming apparatus operate simultaneously.

In another preferred embodiment of the invention, the movable valve member moves in a linear direction.

Illustrative and presently preferred embodiments of the invention are shown in the accompanying drawings in which:

Fig. 1 is a perspective view of the apparatus of this invention;

Fig. 2 is a top plan view of a portion of a conveyor system used in this invention;

Fig. 3 is a schematic illustration of one module of this invention;

Fig. 4 is a view of a portion of Fig. 3 with the valve at the discharge location;

Fig. 5 is a top plan view of a portion of Fig. 3 with parts removed;
Fig. 6 is a schematic illustration of another embodiment of the container filling apparatus of this invention;

Fig. 7 is a side elevational view with parts in section of another preferred embodiment of the invention with the valve member in a filling location; and

Fig. 8 is a view similar to Fig. 7 with the valve member in a discharge position.

In Fig. 1, there is illustrated a modular filler-seamer system 2 wherein a plurality of parallel rows of containers 4 are moved beneath container filling apparatus 6, lid placing apparatus 8 and lid seaming apparatus 10.

The system for forming the parallel rows of containers 4 is illustrated in Fig. 2 and comprises a moving conveyor 12 for moving a plurality of containers into a plurality of forming means 14 which forms the plurality of containers into parallel rows 16. As the containers 4 are formed into the parallel rows 16, they move over a plurality of stationary plate members 18 having a smooth planar upper surface. As the container 4 are formed into the parallel rows 16, they move over a plurality of stationary plate members 18 having a smooth planar upper surface. As the container 4 move over each stationary plate member 18, they move into contact with a screw conveyor 20 having a thread 22 having a gradually increasing pitch until the containers 4 are spaced apart a desired predetermined distance at which time the pitch remains constant so that successive containers 4 are equally spaced apart as indicated at 24. In the preferred embodiment, the containers 4 are spaced apart a distance so
that one turn of the screw conveyor 20 will move a container 4 from beneath the container filling apparatus 6 to the lid placing apparatus 8, from the lid placing apparatus 8 to the lid seaming apparatus 10 and from the lid seaming apparatus 10 to a transfer conveyor 26, Fig. 3. The screw conveyor 20 has an arcuate surface 28 extending between the thread 22 to mate with the outer surface of the containers 4. A guide rail 30 maintains the containers 4 against the arcuate surface 28 to move the containers 4 over the stationary plate member 18.

A module 40 for the modular filler-seamer system 2 is schematically illustrated in Fig. 3. The container filling apparatus 6 comprises a housing 42 having a generally rectangular shape and a cylindrical bore 44 extending partially therethrough. Movable valve means are provided and comprise a rotatable member 46 having a transverse bore 48 extending therethrough. Adjustment means are provided and comprise a plug 50 slidably mounted in the transverse bore 48 so as to form a cavity 52 having a desired volume, such as 8, 12 or 16 ounces. Valve means 54, such as a float valve, are mounted in the plug 50 for movement therewith. The plug 50 can be dimensioned to form its own seal against the sidewall of the transverse bore 48 or an O-ring (not shown) can be located between the plug and the sidewall of the transverse bore 48. A fill passageway 56 is formed in the housing 42 and is in alignment with the transverse bore 48 when the cavity 52 is being filled, as illustrated in Fig. 3. A tube 58 extends between and is connected to the fill passageway 56 and a beverage header 60 having a beverage, such as beer, contained
therein under pressure.

An exit passageway is formed in the housing 42 and comprises a first portion 62 having a cross-sectional configuration similar to the transverse bore 48 and a second portion 64 having a cross-sectional configuration similar to that of the end portion of a container 4. If desired, the second portion 64 may comprise a silicone seal. A vacuum opening 66 is located in the first portion 62 and is connected through a valve control to a vacuum tube 68. A carbon dioxide opening 70 is located in the first portion 62 and is connected through a control valve to a tube 72 having carbon dioxide under pressure contained therein. A vent passageway 74 in the housing 42 is connected through a control valve to a vent tube 76. A pusher 78 moves through an opening 80 in the stationary plate 18 to upwardly move a container 4 into the second portion 64.

When the screw conveyor 20 moves a container 4 under the lid placing apparatus 8, a sensor 82 detects its presence and functions to place a lid 84 on the container 4. When the screw conveyor 20 moves a container 4 under the lid seaming apparatus 10, a pusher 86 moves through an opening 88 in the stationary plate 18 to upwardly move a container 4 in position so that lid seaming mechanism will seam the lid 84 on the container 4.

The operation of a module 40 is illustrated in Figs. 3 and 4. The filling of the cavity 52 is illustrated in Fig. 3. The rotatable member 46 is moved by suitable mechanism (not shown) so that the transverse bore 48 is aligned with the filling passageway 56. The beverage flows from the beverage header
60 through the tube 58 to fill the cavity 52. As the beverage flows into the cavity 52, it forces any gaseous materials in the cavity 52 through the valve means 54 and out through the vent passageway 74. At the same time, the pusher 78 moves a container 4 into contact with the second portion 64. The container 4 is then subjected to conventional operations prior to being filled. A solenoid valve (not shown) operates to connect the vacuum opening 66 to the vacuum tube 68 to removed air from the container and lower the pressure in the container 4. The vacuum is then cut off and another solenoid valve (not shown) connects the carbon dioxide opening 70 to the tube 72 so that carbon dioxide under pressure flows into the container 4. The valves are then closed to allow the pressure in the container to be raised to between about 15 to 40 psi. The rotatable member 46 is then moved until the transverse bore 48 is aligned with the first portion 62. As the transverse bore 48 moves over the first portion 62, the beverage in the cavity 52 flows into the container 4. At the same time, a lid 84 is placed on a filled container 4 and a lid 84 is seamed on a filled container 4.

Another embodiment of the invention is illustrated in Fig. 6. The apparatus in Fig. 6 differs from that illustrated in Figs. 3 and 4 in that the fill passageway 92 is located adjacent to the top of the housing 42 and a relatively short tube 94 connects the beverage header 60 to the fill passageway. Also, the plug 50 does not have the valve means 54.

In Figs. 7 and 8, there is illustrated another preferred embodiment of the invention wherein the movable valve member moves in linear
directions. Parts in Figs. 7 and 8 corresponding to those in Figs. 1-6 have been given the same reference numerals. The apparatus in Figs. 7 and 8 would replace the container filling apparatus of Figs. 1 and 6.

The container filling apparatus 6 in Figs. 7 and 8 comprises a housing 102 mounted by suitable means (not shown) at a fixed location. The housing 102 has a longitudinally extending bore 104 formed therein. Movable valve means are provided and comprise a member 106 mounted for linear sliding movement in the bore 104. A rod 108 is connected to the member 106 and is reciprocated in the directions indicated by the arrow 110 by reciprocating apparatus 112. The housing 102 has a removable cover plate 114 so that the member 106 may be inserted into the bore 104. The member 106 has a cavity 116 formed therein which has a volume corresponding to that of the container 4. The housing has a fill passageway 118 formed therein. A tube 120 connects the header 60 to the fill passageway 118. An exit passageway is formed in the housing 102 and has a first portion 122 similar to the wall 124 and a second portion 126 having a configuration similar to that of the end portion of a container 4.

In operation, the reciprocating apparatus 112 moves the member 106 so that the cavity 116 is located under the fill passageway 118 so that it is filled with a beverage from the header 60. The reciprocating apparatus 112 then moves the member 106 until the cavity 116 is located over the first portion 122 to fill the container with the beverage.
CLAIMS

1. Apparatus for use in providing sealed containers filled with a liquid comprising:
   a housing;
   moving means for moving a plurality of container in at least one linear direction and passing under said housing;
   movable valve means mounted in said housing and having at least one cavity formed therein;
   said movable valve means moving between a first location at which said cavity is filled with liquid and a second location at which said liquid is deposited into one of said plurality of containers beneath said cavity;
   lid placing means for placing a lid on each of said containers having said liquid therein; and
   lid seaming means for seaming said lid to each of said containers.

2. Apparatus as in claim 1, wherein:
   said lid placing means being located along said at least one linear direction.

3. Apparatus as in claim 2, wherein:
   said lid seaming means being located along said at least one linear direction.

4. Apparatus as in claim 1, wherein:
   said containers at said housing, said lid placing means and said lid seaming means being spaced apart the same predetermined distance.

5. Apparatus as in claim 1, and further comprising:
   adjustment means for controlling the volume of said cavity.

6. Apparatus as in claim 5, wherein said adjustment means comprises:
said movable valve means having a bore extending therethrough; and
a plug movably mounted in said bore.

7. Apparatus as in claim 1, and further comprising:
said cavity having at least one open end and at least one partially closed end;
said at least one open end being located closer to said container beneath said housing than said at least one partially closed end when said cavity is at said first location; and
valve means in said cavity for permitting discharge of gaseous materials from said cavity during said filling thereof with said liquid.

8. Apparatus for use in providing sealed containers filled with a liquid comprising:
a plurality of housings;
moving means for moving a plurality of containers in a plurality of linear directions and passing under said plurality of housings;
movable valve means in each of said housings;
each of said movable valve means having a cavity formed therein;
each of said movable valve means moving between a first location at which said cavity is filled with liquid and a second location at which said liquid is deposited into one of said containers beneath said cavity;
a plurality of lid placing means for depositing a lid on each of said containers having said liquid therein; and
a plurality of lid seaming means for seaming said lid on each of said containers having said liquid therein.
9. Apparatus as in claim 8, wherein:
   one of said plurality of lid feeding means being located in each of said linear directions.

10. Apparatus as in claim 9, wherein:
    one of said plurality of lid seaming means being located in each of said linear directions.

11. Apparatus as in claim 8, wherein:
    said containers at said housing, said lid placing means and said lid seaming means being spaced apart the same predetermined distance.

12. Apparatus as in claim 8, and further comprising:
    adjustment means for controlling the volume of each of said cavities.

13. Apparatus as in claim 12, wherein said adjustment means comprises:
    each of said movable valve means having a bore extending therethrough; and
    a plug movably mounted in said bore.

14. Apparatus as in claim 8, wherein:
    each of said movable valve means comprises rotatable valve means; and
    said plurality of linear directions are in a parallel relationship.

15. Apparatus as in claim 8, and further wherein:
    each of said movable valve means are reciprocated in linear directions; and
    said plurality of linear directions of said containers are in parallel relationship.

16. Apparatus for filling containers with a liquid comprising:
    a housing;
moving means for moving a plurality of containers in at least one linear direction and passing under said housing;

movable valve means mounted in said housing and having at least one cavity formed therein; and

time.

said movable valve means moving between a first location at which said cavity is filled with liquid and a second location at which said liquid is deposited into one of said containers.

17. Apparatus as in claim 16, and further comprising:

said cavity having at least one open end and at least one partially closed end;
said at least one open end being located closer to said container beneath said housing than said at least one partially closed end when said cavity is at said first location;

and

time.

valve means in said at least one partially closed end for permitting discharge of gaseous materials from said cavity during said filling thereof with said liquid.

18. Method for providing sealed containers filled with a liquid comprising:

moving a plurality of containers in at least one linear direction;

stopping the movement of said plurality of containers so that at least one of said plurality of containers is at a container filling location;

providing a movable valve means having at least one cavity formed therein;

moving said movable valve means to a first location at which said cavity is filled with a liquid;
moving said movable valve means to a second location at which said liquid in said cavity is deposited into said container; simultaneously placing a lid on at least one of said plurality of containers having said liquid therein; and simultaneously seaming said lid to at least another of said plurality of containers having said liquid therein to form a sealed container filled with said liquid.

19. Method as in claim 18, and further comprising:

forcing gaseous materials from said cavity as said cavity is being filled with said liquid; and

venting said gaseous materials forced from said cavity to atmosphere.

20. Method as in claim 19, and further comprising:

placing said lid on said at least one of said plurality of containers having said liquid therein and sealing at least another of said plurality of containers having said liquid therein while said movement of said plurality of containers is stopped.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER


According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)


Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search 13 JULY 1993

Date of mailing of the international search report 16 AUG 1993

Authorized officer HORACE M. CULVER

Telephone No. (703) 368-1867

Form PCT/ISA/210 (second sheet) (July 1992)
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<td>X</td>
<td>US, A, 2,965,141 (Hoyer) 20 December 1960, (Discloses an apparatus and method for use in providing containers 41 filled with a fluid. The apparatus comprises a housing (13); a table means for moving the containers (41) under the housing; and movable valve means (14) mounted in the housing. The valve means (14) comprises a plurality of cavities or bores (25) each having a plug 26 therein. The valve means is movable between the position shown in Figure 2 at which the cavity is filled from a reservoir (31), to the position shown in Figure (3) where the cavity is emptied into the container (41). The volume of the cavity is &quot;adjusted&quot; as the plug (26) moves downward.)</td>
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<td>Y</td>
<td>US, A, 3,533,216 (Lange) 13 October 1970, (Discloses an apparatus for filling a plurality of containers (P) as they are moved by moving means 17 linearly and in parallel arrangement through means (23) for filling a container; means (74) for applying a lid; and means (57) for seaming the lid.)</td>
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<td>A</td>
<td>US, A, 2,245,287 (Minard) 10 June 1941 (Discloses a rotatable valve member.)</td>
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<td>A</td>
<td>US, A, 2,404,232 (Hunter) 16 July 1946 (Discloses a device for separating containers into a plurality of rows.)</td>
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<td>A</td>
<td>US, A, 3,626,997 (Whitaker et al.) 14 December 1971 (Discloses a dispensing valve having an air opening (49). The opening is not a vent valve, but allows a blast of air for the purpose of expelling the contents.)</td>
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<td>US, A, 3,953,957 (Brothers et al.) 04 May 1976 (Discloses a seaming means 50.)</td>
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<td>A</td>
<td>US, A, 4,373,560 (Elsworth) 15 February 1983 (Discloses a plurality of filling heads and means for moving containers linearly through the heads.)</td>
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<td>A</td>
<td>US, A, 4,586,545 (Marchadour) 06 May 1986 (Discloses a horizontally movable valve.)</td>
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<td>A</td>
<td>US, A, 4,778,079 (Judex) 18 October 1988 (Discloses a dispensing means comprising a valve body (1) having a plurality of bores (5) therethrough. Plugs (6) can be adjustably positioned in the bore. The valve pivots 90 degrees from the position shown in Figure 1 to a vertical position whereat the contents of the bores 5 are dispensed.)</td>
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<td>A</td>
<td>US, A, 4,842,026 (Nordmeyer et al.) 27 June 1989 (Discloses a dispensing valve having a rotatable member. Although the reference does not disclose a vent valve for the cavity 38, a cleaning fluid inlet 33 is provided.)</td>
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B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

53/471, 202, 282, 284.5, 503, 151, 473; 141/5, 258, 259, 260, 266, 177.