Feb. 9, 1937. C. W. SOUTHER 2,070,301

VACUUM FILLING MACHINE

Filed Sept. 16, 1935 4 Sheets-Sheet 1

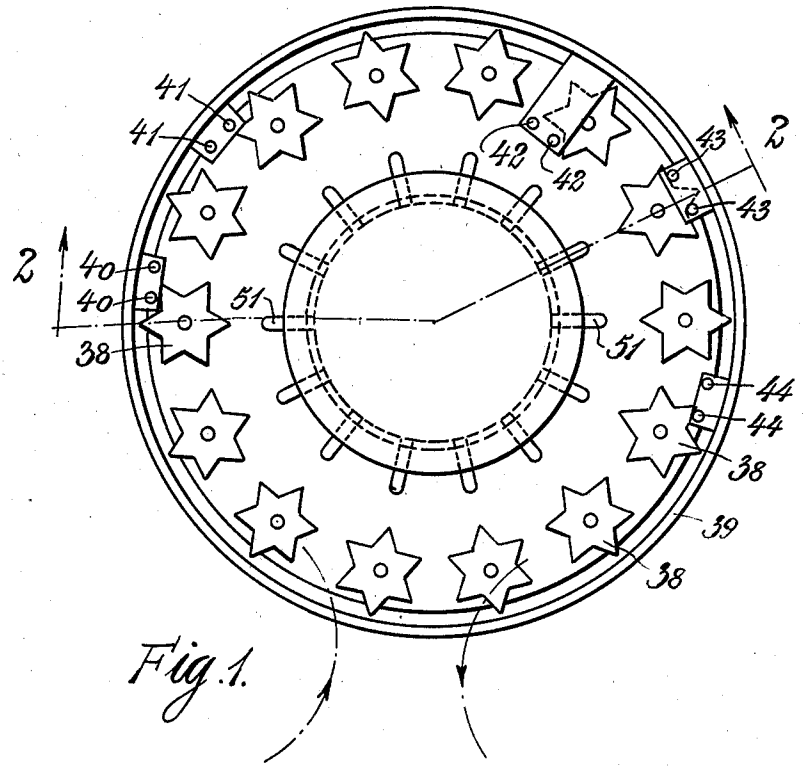



Fig. 1.

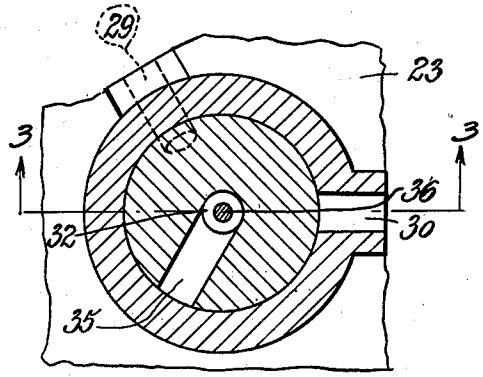



Fig. 4.

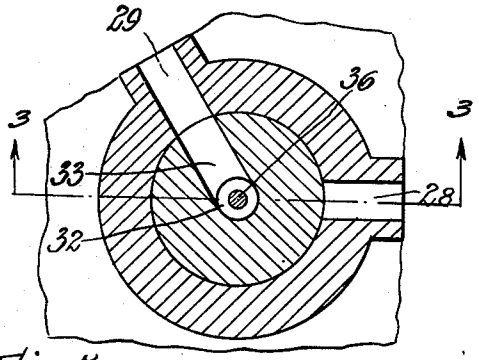



Fig. 5.

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VACUUM FILLING MACHINE

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Fig. 2.

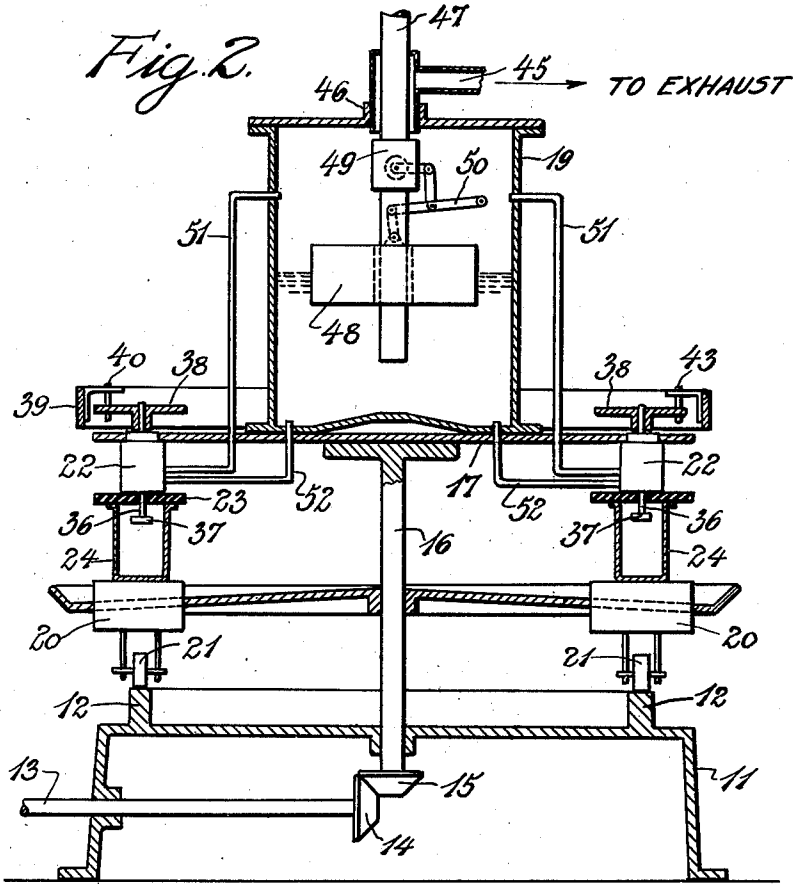
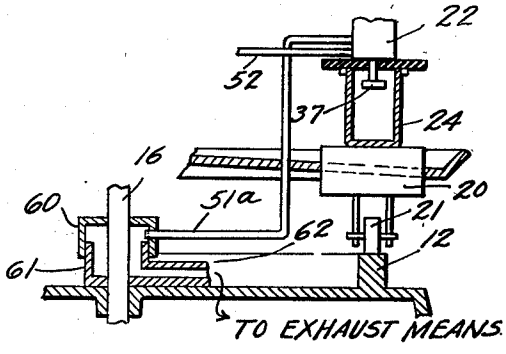



Fig. 7.




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VACUUM FILLING MACHINE

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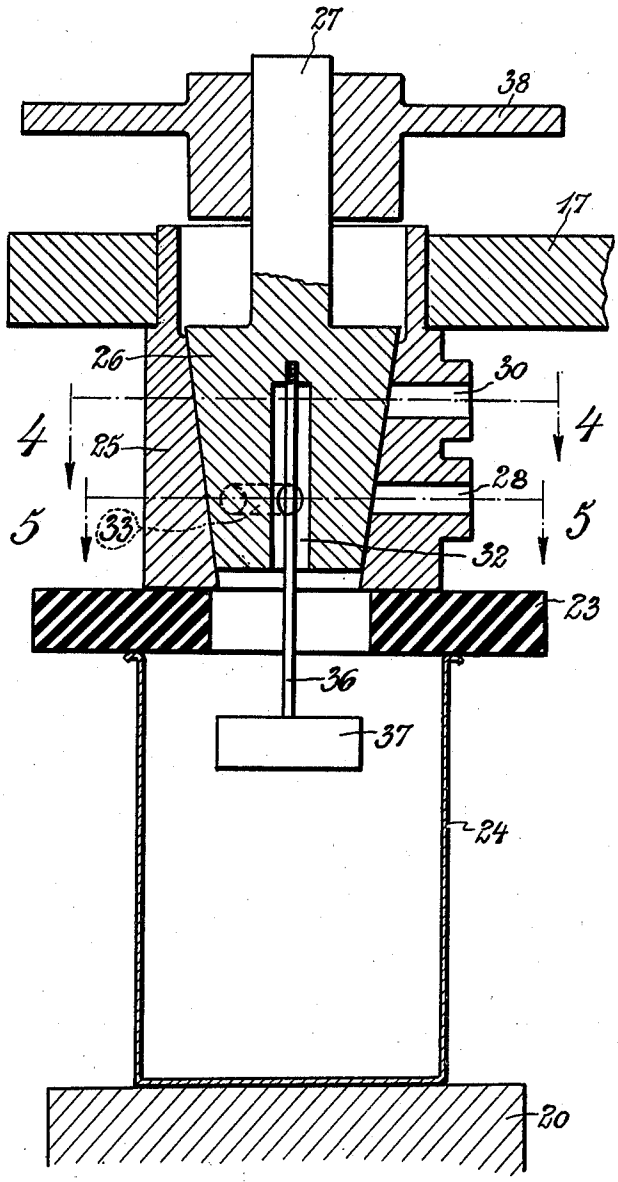



Fig. 3.

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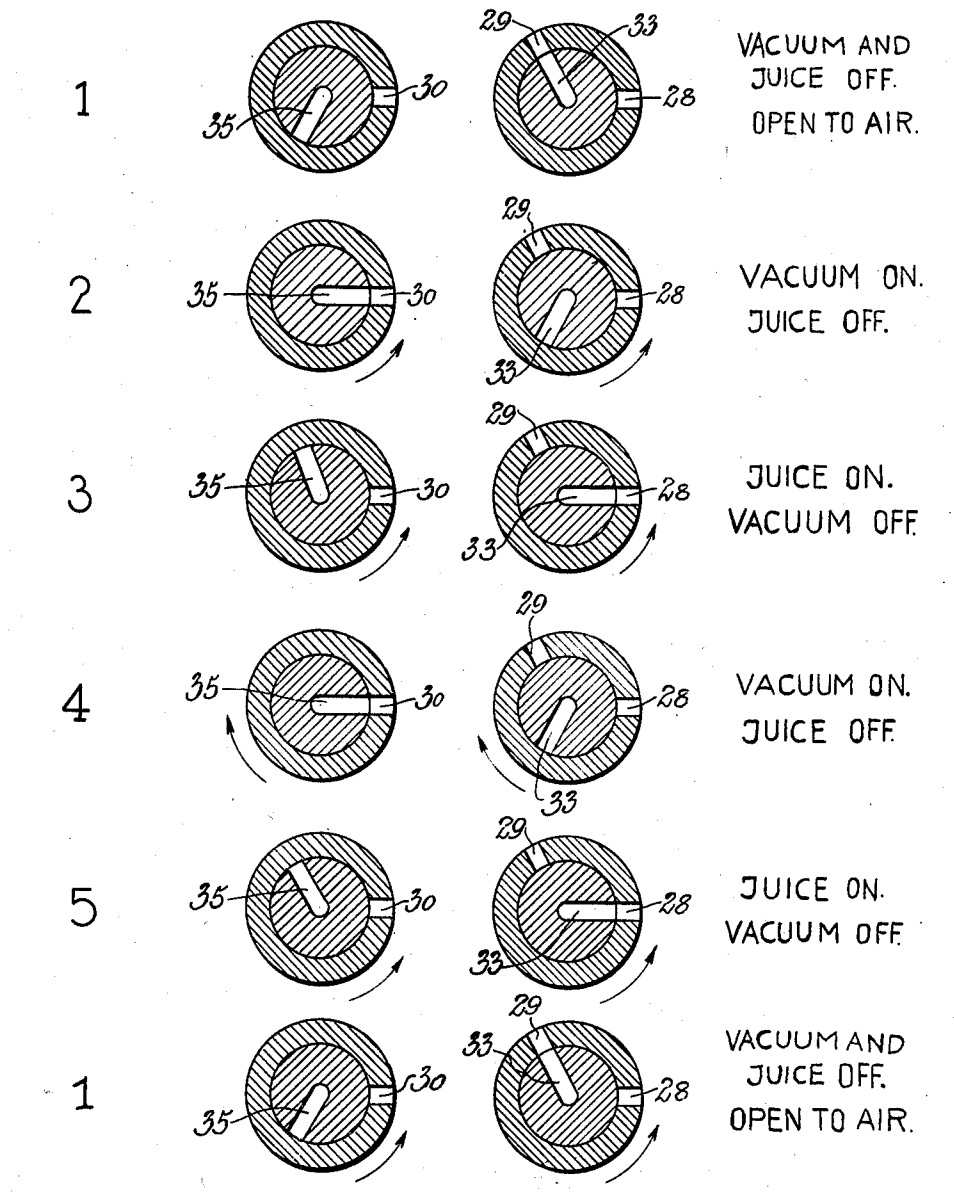



Fig. 6.

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# UNITED STATES PATENT OFFICE

2,070,301

## VACUUM FILLING MACHINE

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Application September 16, 1935, Serial No. 40,755

10 Claims. (Cl. 226—116)

My invention relates to vacuum filling-machines, for filling deaerated liquids into cans.

Heretofore, in machines of this sort, it has been customary to place, over the top of the container to be filled, a pad or stopper carrying one or more pipes for the ingress of the liquid with which the container is to be filled, and for the egress of the air from within the container. In some cases these pipes were placed one within the other, so as to make a single entry through the pad. In some cases the two pipes were joined just above the pad; or, to effect the same purpose, both entered the liquid reservoir of the filling-machine, but separately, and usually at different levels. The art of exhausting and filling the container by means of a hermetic pad placed over the top of the container is an old and varied one; and yet, in spite of many ingenious variants, has never been wholly successful.

There was an early device which partially exhausted the container, but left the reservoir under atmospheric pressure, which pressure thus forced the liquid into the container. The air conduit was connected to a vacuum system, and a complicated arrangement of valves and traps was employed to prevent the excess liquid, when the container became filled, from being sucked into the vacuum system through the air conduit.

More recently, refinements in the deaeration of liquid food products have necessitated that the liquid be protected from exposure to, or reentry of, air, from the time of deaeration until the liquid had been filled into the container. This has necessitated maintaining the liquid under a fairly high vacuum in the reservoir of the filling-machine, and then filling it into a container initially subjected to the same fairly high vacuum. The container must be evacuated before the liquid inlet is opened, so that there will be no air-pressure within the container to blow back through the liquid inlet, thus reaerating the deaerated liquid.

The evacuation pipe may pass directly from the filling pad to the vacuum system; or preferably to the space above the liquid in the reservoir, and thence to the vacuum system. This latter arrangement produces initially a balanced pressure in the reservoir and in the container, so that the liquid can flow by gravity from the former to the latter.

The production and maintenance of this balanced pressure is essential to the even and uniform filling of successive containers; for obviously any excess of pressure in a container over that in the reservoir will tend to prevent the liquid from flowing into it; and, if this back-pressure varies from one container to the next, the fill of the containers will vary.

The production of this balanced pressure has always proved to be simple enough of attainment. But its maintenance has heretofore run up against the following insuperable dilemma.

If the evacuation pipe be closed during the ingress of the liquid, the residual air in the container will be entrapped at the top of the container, together with any air which may leak in between the pad and the edge of the container. This leakage is likely to be considerable, because of the difficulty of securing a perfect seal between the pad and the frequently slightly irregular edge of the tin.

On the other hand, if the evacuation pipe be left open during the ingress of the liquid; then, if the evacuation pipe leads direct to the vacuum system, liquid is certain to be sucked into it, thus damaging the pump, interfering with its proper and complete functioning, and wasting the liquid; whereas, if the evacuation pipe leads to the reservoir, mixed air and liquid find their way therethrough to mingle with the deaerated air in the reservoir, and thus ruin its deaeration.

The above triple dilemma has been only partially solved by complicated systems of traps and valves.

It is accordingly the principal object of the present invention to provide a simple and uncomplicated machine which shall automatically exhaust the air from the cans to be filled, and shall then automatically fill the cans uniformly, without reaerating the liquid in the system, and without sucking the liquid into the vacuum part of the system.

My invention consists in the novel parts, and in the combinations and arrangements thereof, which are defined in the appended claims.

Throughout the description, the same reference-number is applied to the same member or similar members.

Figure 1 is a plan view of my revolving filling-machine.

Figure 2 is a vertical section of my machine, taken along the lines 2—2 of Figure 1.

Figure 3 is an enlarged vertical section of one of the valves shown solid in Figure 1, taken along the lines 3—3 of Figures 4 and 5.

Figure 4 is a horizontal section of this valve taken along the line 4—4 of Figure 3.

Figure 5 is a horizontal section of this valve taken along the line 5—5 of Figure 3.

Figure 6 is a diagrammatic representation of

the five successive positions of both levels of my valve, throughout the cycle of operation of my machine.

Figure 7 is a vertical section of part of a variant of my machine, the rest of which is as shown in Figure 2.

Beginning with Figure 2, we see that 11 is a pedestal, carrying an annular cam rail 12. 13 is the main drive-shaft from a motor (not shown). By means of bevel gears 14 and 15, this shaft transmits its rotation to a vertical shaft 16, which turns the table 17 and a spillage-tray 18. This table carries a reservoir 19.

Through the spillage-tray, there reciprocates vertically a plurality of can-supports 20. Each can-support is itself supported on a roller 21, which at appropriate portions of the rail 12, raises the can-support.

Depending from the table 17, and corresponding in number and position to the can-supports 20, are a plurality of valve-mechanisms 22, each carrying a sealing-pad 23.

Except between the two small arrows of Figure 1, which indicate the ingress of an empty can to the filler and the egress of a filled can therefrom (which ingress and egress may be effected in any conventional manner not shown), the cam rail 12 is of sufficient height to hold the can 24 in sealing contact with its pad 23.

For the detail of a valve-mechanism 22, turn now to Figures 3, 4 and 5, in which 23 is the sealing pad, 25 the valve-seat, 26 the valve, and 27 the valve-stem. Hole 28 is for the admission of juice, hole 29 is for the admission of air, and hole 30 for the extraction of air, i. e., is the vacuum line.

The valve has an axially located vertical hole 32, and connecting therewith a horizontal hole 33 to contact selectively juice-hole 28 and air-hole 29; and a horizontal hole 35 to contact the vacuum-hole 30.

In the axial center of vertical hole 32, there is secured a rod 36 carrying a headspace-gauge 37, the object of which is to displace sufficient liquid to secure a uniform headspace in the cans.

Each valve-stem 27 carries a star-wheel 38, which serves to revolve the valve to its various positions.

Turning to Figure 1, we see that a ring 39, which does not revolve with the table, supports successive pairs of pins 40, 41, 42, 43 and 44, to contact the points of the star-wheels 38, and thus operate the valves.

Although it forms no part of the present invention, and so is neither shown nor described, it should be remarked that it is customary to have each star-wheel 38 so connected to its corresponding pad 23, that it will remain below the level of the pins, unless there is a can beneath the pad in question, lifting up the pad, and hence lifting up the star-wheel. The object of this provision is obvious, namely to prevent the exhausting of the air from nothing, and the filling of juice into nothing, when there is no can there.

Reverting now to Figure 2, we shall consider the reservoir 19. Pipe 45, which does not revolve, enters the top of the reservoir through air-tight packing 46; it leads to a vacuum pump (not shown). Pipe 47, which does not revolve, enters the top of the reservoir through a sealed contact with pipe 45; it leads from a source of juice (not shown).

A float 48, controlling the main juice-valve 49, by means of linkage 50, maintains the juice at a constant level within the reservoir.

From the top of the reservoir 19, a vacuum-pipe 51 leads to vacuum hole 30 of each valve-mechanism 22.

From the bottom of the reservoir 19, a juice-pipe 52 leads to juice-hole 28 of each valve-mechanism 22.

Now comparing Figures 1 and 6, we shall see how my apparatus operates.

The empty can 24 enters at the small entering arrow of Figure 1. The table rotates clockwise in that figure. The cam-rail 12 slopes upward, forcing the can into sealing contact with pad 23, and lifting the star-wheel 38 into the level of the pins.

The valve is in position 1 of Figure 6: open to the air, and closed to both vacuum and juice.

As the star 38 passes pins 40, they engage two of its points, and thereby rotate it 120° counter-clockwise.

The valve is now in position 2 of Figure 6: closed to the air and to the juice, but open to evacuation.

By the time that the star 38 reaches pins 41, the can 24 has been evacuated to the same degree as the reservoir 19. As the star passes pins 41, they engage two of its points, and thereby rotate it 120° counter-clockwise.

The valve is now in position 3 of Figure 6: closed to the air and to evacuation, but open to the juice, which flows in. As the juice enters, it relieves the vacuum, and sets-up the back-pressure, which was the source of trouble in the prior-art, but before this back-pressure becomes serious, we reach pins 42.

These pins, it will be noticed, unlike the other pairs of pins, are inside the circle of travel of the star-wheels. Accordingly they turn the star-wheel backward again (i. e., clockwise) to valve-position 4, which is exactly like position 2, thus temporarily shutting off the juice, and permitting further evacuation until the pressure balance is restored.

Then pins 43 turn the valve to position 5 of Figure 6, again shutting off evacuation, and admitting the balance of the juice to the can.

When the can is filled clear up to the pad 23, no more juice can enter.

Pins 44 then turn the valve to position 1 of Figure 6: juice and vacuum both off, and can open to the air, thus relieveing the suction on the pad, and permitting the can to lower, as the cam-rail 12 presently drops. The liquid level in the can then falls by the amount displaced by head-space-gauge 37, thus avoiding spillage.

The filled can is then carried off at the outgoing small arrow of Figure 1.

It will thus be seen that, without ever having both vacuum and juice on at the same time, nevertheless my invention in an unexpectedly simple manner solves the dilemma presented at the beginning of this specification.

The cams are filled uniformly. There is no reaeration of juice. No juice finds its way into the vacuum system.

Various modifications are rendered possible in my invention, which would not be possible in the prior art. For example vacuum-pipe 51, inasmuch as it never sucks-in any juice might well run, as shown in Figure 7, direct to the vacuum-pump (not shown), rather than to the top of the reservoir 19. But it is convenient to have it run to the top of the reservoir, for two reasons: (1) my arrangement facilitates equalizing the pressure in the can to that in the reservoir; and (2),

in a revolving filler, my arrangement eliminates the necessity of more than one stuffing-box **46**.

It is to be understood that the alternative routing of pipe **51** (shown as **51***a* in Figure 7) and there shown as applied to only one such pipe, would be similarly applied to every other pipe **51**. Also, in view of the fact that part of the machine rotates and part does not, it will be necessary for this pipe to pass to the exhaust means through a stuffing-box. One such is conventionally shown, in which **60** revolves with shaft **16**, and **61** remains stationary with base **11**, and from which pipe **62** leads to the exhaust means (not shown).

When, in the claims, I refer to preventing the liquid from completely filling the reservoir, and to a certain line as entering the reservoir above the liquid level thereof, this requirement would be satisfied if we were to consider a portion of pipe **47** as constituting a part of the reservoir. In such event, although the reservoir proper might completely fill, nevertheless a given maximum level could be maintained in pipe **47**, and pipe **45** and line **51** could enter pipe **47** above that level.

Having now described and illustrated one form of my invention, I wish it understood that my invention is not limited to the specific arrangement of parts hereinbefore described, or even to the variants suggested, except insofar as such limitations are specified in the appended claims.

I claim:

1. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir, and for preventing the liquid from completely filling the reservoir; means for exhausting the reservoir means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit connecting the valve to the reservoir above the liquid-level therein; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and automatic means for successively, with respect to each container to be filled, sealing the container, setting the valve to its three positions, in the following order, namely 1, 2, 3, 2, 3, 1, and then unsealing the container.

2. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir, this same means preventing the liquid from completely filling the reservoir; means for exhausting the headspace above the liquid-level in the reservoir; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve; a conduit connecting the valve to the air; a vacuum conduit connecting the valve to the reservoir above the liquid-level therein; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; and a conduit connecting the valve to the sealed container.

3. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir, and for preventing the liquid from completely filling the reservoir; means for exhausting the reservoir; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit connecting the valve to the reservoir above the liquid-level therein; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; and a conduit connecting the valve to the sealed container.

4. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir, and for preventing the liquid from completely filling the reservoir; means for exhausting the reservoir; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit connecting the valve to the reservoir above the liquid-level therein; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and means for carrying containers progressively through the machine, and as each container progresses, for successively sealing the container, setting the valve to its three positions, in the following order, namely: 1, 2, 3, 2, 3, 1, and then unsealing the container.

5. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit directly connecting the valve to the exhausting means; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and automatic means for successively, with respect to each container to be filled, sealing the container, setting the valve to its three positions, in the following order, namely: 1, 2, 3, 2, 3, 1, and then unsealing the container.

6. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; means, at a level below the level of the liquid in

the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit directly connecting the valve to the exhausting means; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and means for carrying containers progressively through the machine, and as each container progresses, for successively sealing the container, setting the valve to its three positions, in the following order, namely: 1, 2, 3, 2, 3, 1, and then unsealing the container.

7. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit connected to the valve, and exhaustible by the exhausting means; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and automatic means for successively, with respect to each container to be filled, sealing the container, setting the valve to its three positions, in the following order, namely: 1, 2, 3, 2, 3, 1, and then unsealing the container.

8. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere; a valve, having three selective positions, namely, (1) open to the air conduit hereinafter described and closed to the liquid conduit hereinafter described and to the vacuum conduit hereinafter described, (2) open to the vacuum conduit and closed to the air and liquid conduits, and (3) open to the liquid conduit and closed to the air and vacuum conduits; a conduit connecting the valve to the air; a vacuum conduit connected to the valve, and exhaustible by the exhausting means; a liquid conduit connecting the valve to the reservoir below the liquid-level therein; a conduit connecting the valve to the sealed container; and means for carrying containers progressively through the machine, and as each container progresses, for successively sealing the container, setting the valve to its three positions, in the following order, namely: 1, 2, 3, 2, 3, 1, and then unsealing the container.

9. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; vacuum conduit, connectible to the reservoir, and exhaustible by the exhausting means; means at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere, and having at least one passage therethrough; a liquid conduit, running from the reservoir, below the liquid level therein, and connectible to a passage through the container-sealing means; a vacuum conduit, connectible to a passage through the container-sealing means, and exhaustible by the exhausting means; and means repetitively successively connecting one and then the other of the two conduits to a passage through the container-sealing means, whereby the container is repetitively exhausted to a pressure less than the pressure at the outlet of the liquid conduit.

10. In a machine for filling liquid into containers, the combination of: a reservoir for holding liquid under a partial vacuum; means for admitting liquid to the reservoir; exhausting means; a vacuum conduit, connectible to the reservoir, and exhaustible by the exhausting means; means, at a level below the level of the liquid in the reservoir, for sealing a container against the atmosphere, and having at least one passage therethrough; a liquid conduit, running from the reservoir, below the liquid level therein, and connectible to a passage through the container-sealing means; a vacuum conduit, connectible to a passage through the container-sealing means, and exhaustible by the exhausting means; and means repetitively successively connecting and disconnecting the vacuum conduit to and from a passage through the container-sealing means, whereby the container is repetitively exhausted to a pressure less than the pressure at the outlet of the liquid conduit.

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