June 26, 1928. 1,675,208

H. F. BROADHURST

APPARATUS FOR FILLING CONTAINERS

Filed Nov. 12, 1923 4 Sheets-Sheet 1

Fig. 1.

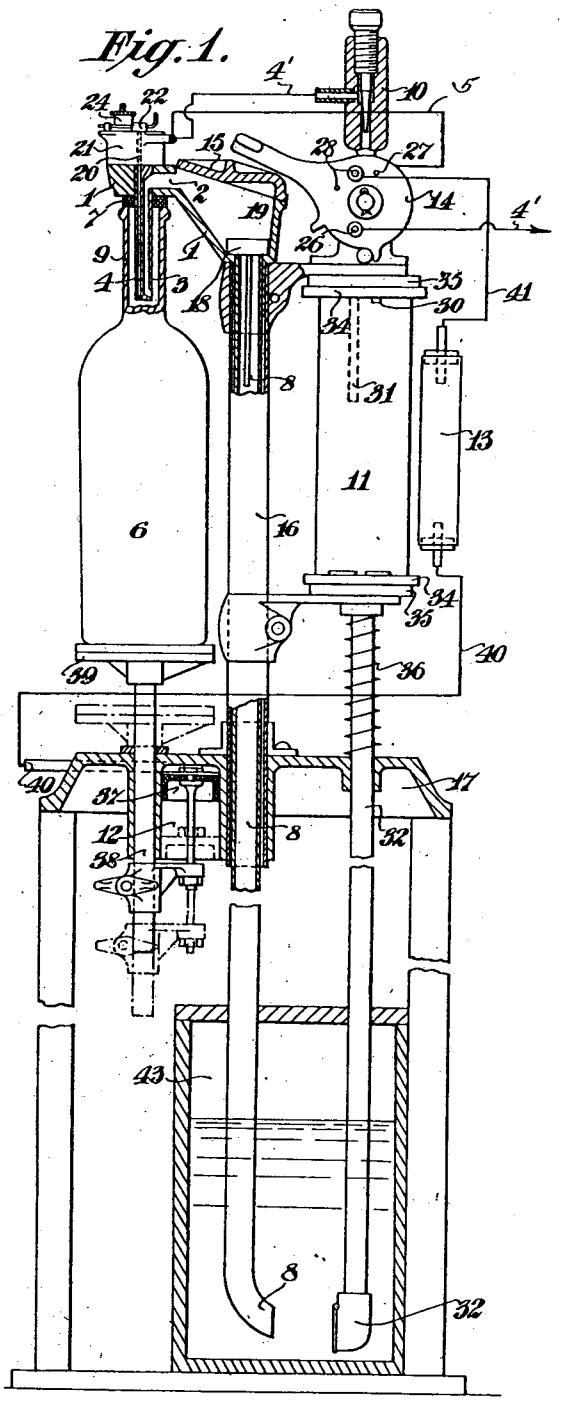


Fig. 2.

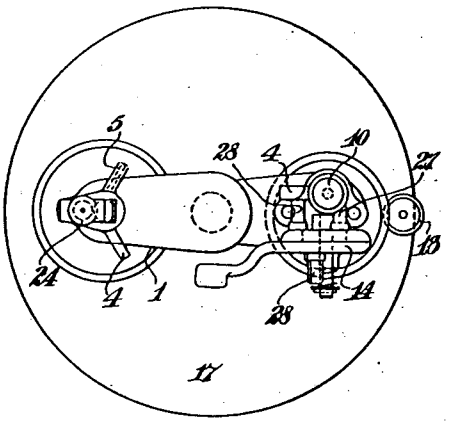


Fig. 3.

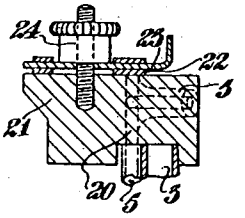
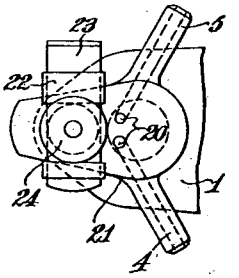


Fig. 4.



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Fig.5.

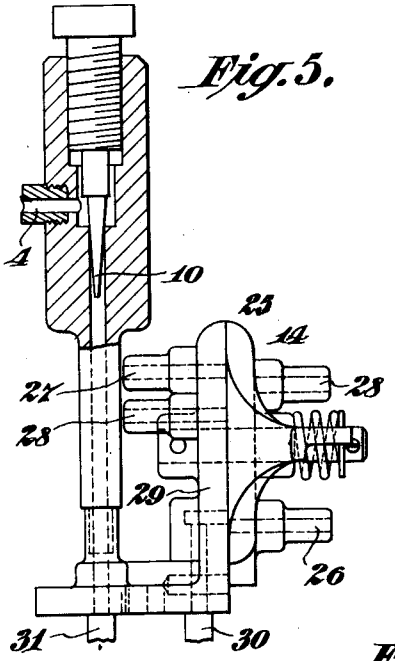


Fig.6.

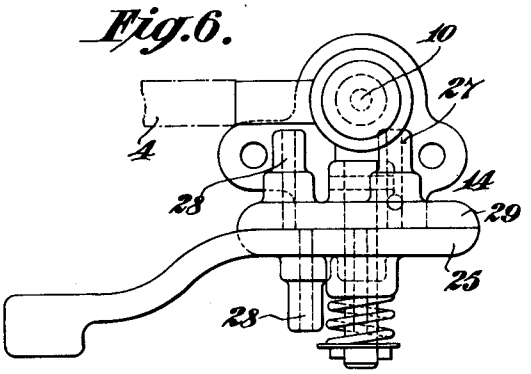


Fig.7.

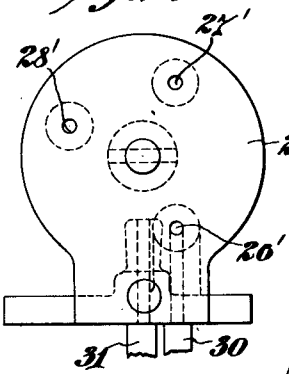


Fig.8.

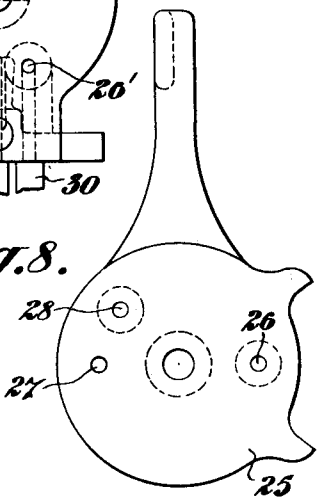
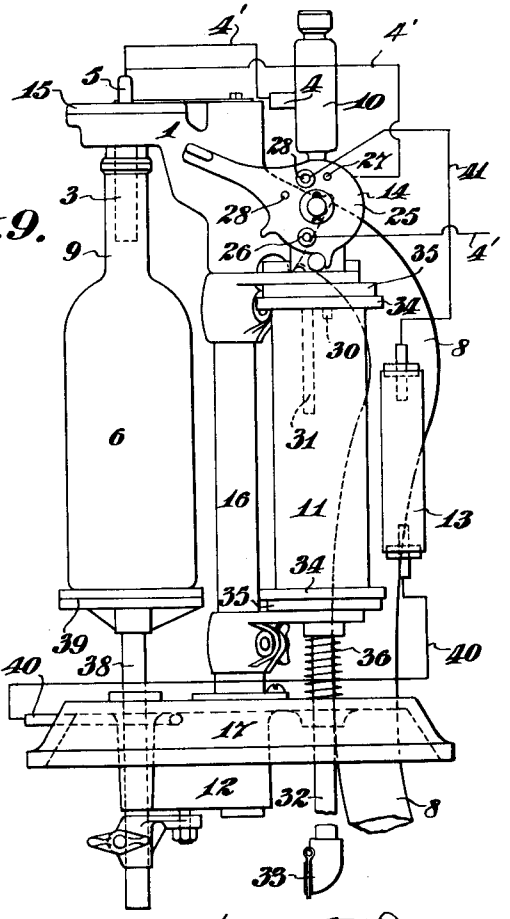


Fig.9.



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APPARATUS FOR FILLING CONTAINERS

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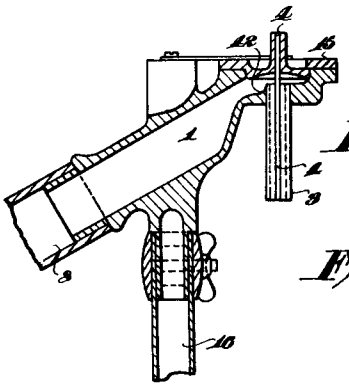


Fig. 10.

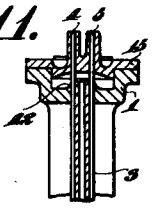


Fig. 11.

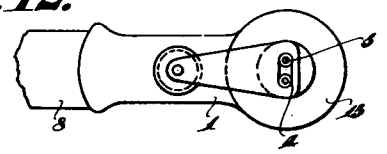


Fig. 12.

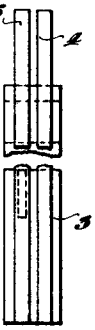


Fig. 13.



Fig. 14.

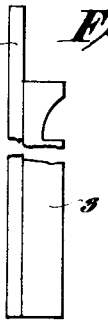


Fig. 15.



Fig. 16.

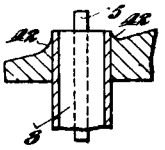


Fig. 17.

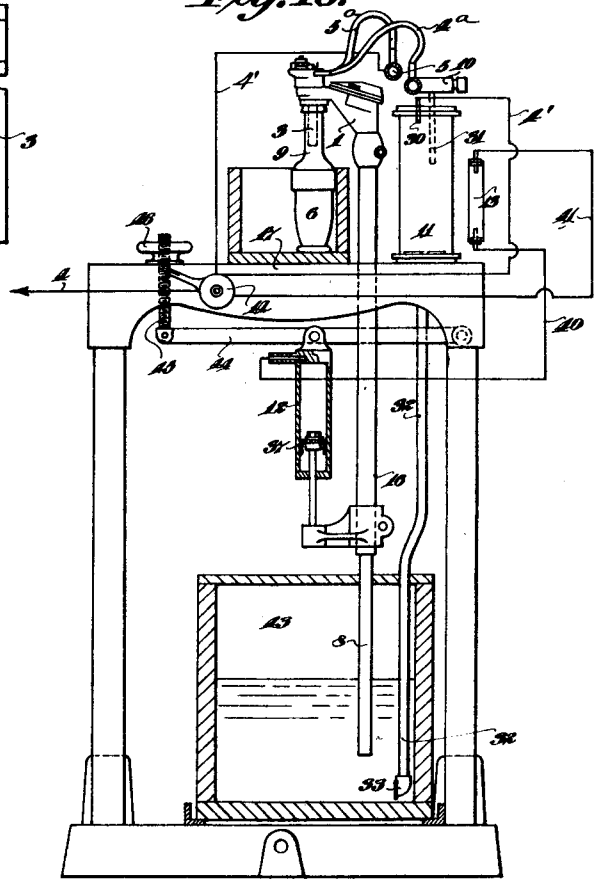


Fig. 18.

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APPARATUS FOR FILLING CONTAINERS

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Fig. 19.

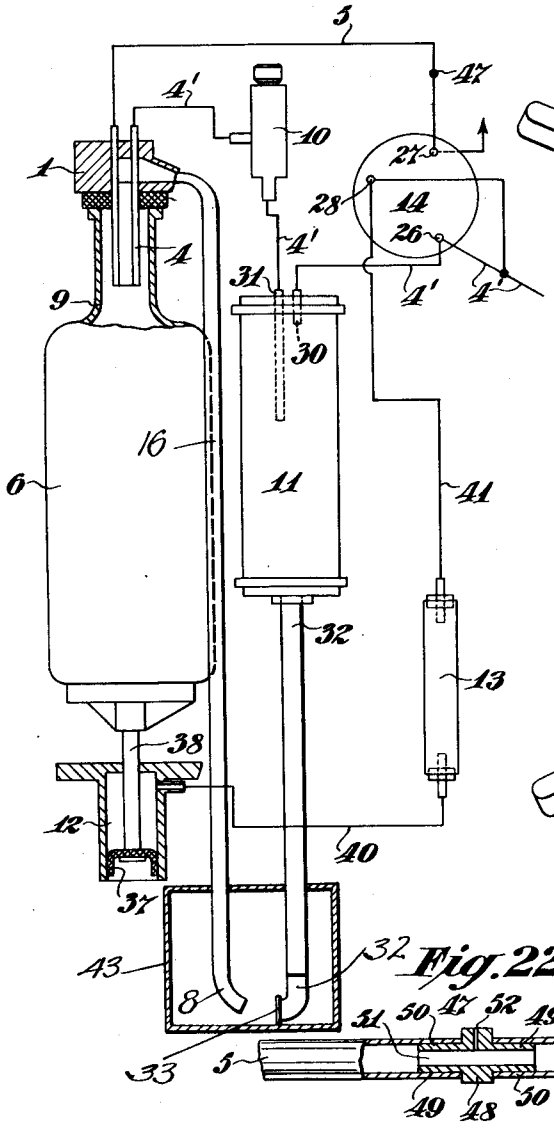


Fig. 20.

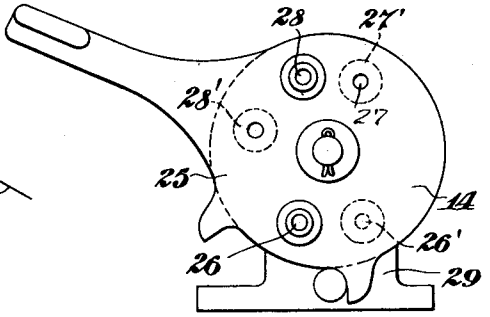


Fig. 21.

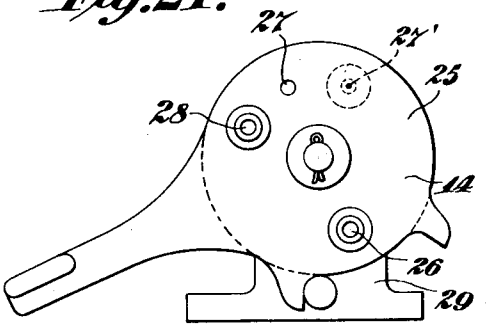


Fig. 22.

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UNITED STATES PATENT OFFICE.

HERBERT FREDERICK BROADHURST, OF LONDON, ENGLAND.

APPARATUS FOR FILLING CONTAINERS.

Application filed November 12, 1923, Serial No. 674,380, and in Great Britain and France November 18, 1922.

This invention relates to an apparatus for filling bottles, tins, or other receptacles by difference of pressure, and is of the kind wherein filling is effected by removing air from the bottle by suction through a nozzle, connected to both an exhauster, a liquid supply vessel and also to atmosphere.

In an apparatus of the above nature, it has been proposed to employ a nozzle having two tubes adapted to pass into the neck of the bottle and sealed air-tight thereto by a soft washer, and a connection adapted to be opened from atmosphere, after the bottle is filled, into one of the tubes, preferably the liquid conduit. This connection admits air to the liquid stream when the nozzle and the bottle are being separated, so that the liquid below this connection to atmosphere or between it and the bottle will flow into the bottle. With this arrangement the bottle is first sealed and the atmospheric connection closed to establish the flow of the liquid under suction into the bottles, and when the bottle is full and the filling nozzle raised, parting the column of liquid by the admission of air through the atmospheric connection must allow the pipes passing through the neck of the bottle to drip when the nozzle is raised, because the whole of the liquid in the two tubes forming the nozzle has to drip out by gravity only under the small head due to the length of the nozzle only.

Further, it has been proposed to employ three separate tubes all communicating with the interior of the bottle, viz:—vacuum, suction and breaker pipes.

The purpose of the vacuum pipe is to withdraw air from the bottle.

The purpose of the breaker pipe is to admit air to the interior of the bottle after the vacuum is shut off when the bottle is filled and so break the vacuum, correct the level and drain off both the vacuum and filling pipes before the nozzle is raised in the bottle.

According to the present invention, and in conjunction with the vacuum, suction and breaker pipes aforesaid, use is made of a pin-hole vent located at any suitable point in the breaker pipe to effect the breaking of vacuum in the whole of the breaker pipe at the moment liquid touches the filling nozzle; a regulating or choker valve to regulate the flow of air to be drawn from the bottle to be filled; an intercepter to trap liquid picked up by the vacuum pipe; a pneumatically operated device for inserting the filling nozzle into the bottle; a filtering device to give visible indication of liquid leakage to said pneumatic device; and a single flat-faced oscillatory valve for controlling the working of the aforesaid.

Figure 1 is a side view, partly in section, and partly in elevation, of an apparatus in accordance with the present invention for filling a single bottle at a time, and having a filler head suitable for all thin liquids and the thicker liquids as far as cream.

Figure 2 is a plan view of the apparatus shown in Figure 1.

Figure 3 is a sectional detail view, of part of the filler head, hereinafter referred to.

Figure 4 is a plan view of said detail, but shown in its open position.

Figure 5 is a side view of the flat face semi-rotary control valve, showing also, in section, the choker valve.

Figure 6 is a plan view thereof.

Figure 7 is a view illustrative of the working face of the fixed part of said valve.

Figure 8 is a view illustrative of the working face of the movable part of said valve.

Figure 9 is a side view of an apparatus, the same having a filler head for use in filling powders, applicable also for use for very thick liquids, such as creams.

Figures 10 and 11 are vertical sectional views of the filler head shown in said Figure 9.

Figure 12 is a plan view of said head.

Figure 13 is a front view, Figure 14 a plan view, and Figure 15 a side view of the compound nozzle of the head shown in Figures 1 to 4, drawn to an enlarged scale.

Figure 16 is a sectional plan view of the nozzle shown in Figures 10, 11 and 12 drawn to an enlarged scale.

Figure 17 is an enlarged detail view of the upper end of said nozzle.

Figure 18 is a side view partly in section of a complete apparatus with a filler head similar to that shown in Figure 1 showing the means for raising and lowering the filler head.

Figure 19 is a diagrammatic view illustrative of the main connections of the apparatus.

Figure 20 is a front view of the semi-rotary control valve in its "off" position.

Figure 21 is a similar view, but illustrative of the "on" position of said valve.

Figure 22 is a sectional view illustrative

of the pin-hole vent or permanent leak hereinafter referred to.

Like numerals of reference indicate corresponding parts in the several figures.

Referring first to Figures 1 and 2 of the drawings illustrative of the application of the three separate tubes aforesaid, the apparatus consists of a head 1 provided with a nearly horizontally disposed filling tube 2 which terminates in a vertically disposed nozzle 3 adapted to be inserted into the neck of a bottle to the level to which said bottle is to be filled.

Beside the nozzle, is a small tube 4, termed the vacuum tube, and also another small tube 5, termed the breaker tube, which just reaches a short distance into the neck of the bottle 6. Round these tubes 3, 4, 5 is arranged a soft washer 7, of india-rubber or any suitable material, to make an air-tight joint on the top of the bottle.

The filling tube 2 is carried in its nearly horizontal position until clear of the bottle, and then continues as a suction pipe 8 downwardly into a supply tank, which is situated at a lower level than the bottle or bottles to be filled, the vacuum tube 4 being connected up to a pump by which as much of the atmospheric pressure as may be required can be removed from the bottle or the like.

The action is a follows:—The nozzle 3 of the filling tube 2 is inserted into the neck 9 of the bottle 6, as in Figure 1, washer 7 seating on the mouth of said bottle, which is supported in any suitable manner. The breaker tube 5 is closed to atmosphere, i. e., the air lock, by an arrangement of valve hereinafter described. The pump is then set going and, through the vacuum tube 4, removes pressure from inside the bottle 6, and also from the filler tube 2, causing liquid from the supply tank to rise in the suction pipe 8 and to run through the filling tube 2 into the bottle.

When the level of the liquid reaches the end of the vacuum tube 4, no more air can be withdrawn from the bottle, and a small quantity of liquid is drawn up by and into the vacuum tube 4. The vacuum tube 4 is then shut off from the pump, by an arrangement of valve hereinafter described, said valve, being located some distance away from the nozzle, and the breaker tube 5 opened to atmosphere, breaking the vacuum in the neck of the bottle, with the result that the column of liquid in the suction pipe falls back into the supply tank, drawing back any slight excess of liquid in the neck of the bottle and all the liquid in the filling tube 2 and nozzle 3, leaving the level of liquid in the bottle exactly at the level of the bottom of the nozzle of the filling tube, at the same time any liquid which has entered the vacuum tube is drawn towards the pump, and is intercepted or trapped and removed in the manner hereinafter described so that when the nozzle is lifted out of the neck of the bottle there is no drip and the bottle is filled cleanly to an exact level.

Any number of bottles can be connected to vacuum and breaker tubes, common to all, and will operate simultaneously, and even if some bottles fill before others, none can overfill and all will fill to the same level, provided all nozzles are of the same length. A cracked bottle will not fill, the only effect being to waste the vacuum on the nozzle of that bottle, the other botles filling as usual, this action forming an automatic test of the condition of said bottles.

A suction pipe, common to all, can be used for a number of nozzles, i. e. filling tubes, but it is preferable to have a suction tube for each, so that each bottle is siphoned off to the level of its filling tube, and this tube itself emptied by an independent column of liquid.

A pressure below atmosphere in the bottles need not be employed, as it is obvious that the apparatus works by difference of pressures, and both the bottle pressure and the supply pressure may be above atmosphere, so that this apparatus can be used for bottling gaseous liquids, which have to be filled against a counterpressure.

In this case the liquid is contained in a receiver at pressure, and may be arranged above or below the bottles, and is controlled by a suitable valve.

The action is as follows:—When the nozzles are in the bottles, counterpressure, equal to the pressure in the receiver, is admitted through the breaker tubes. The liquid from the receiver is turned on, the breaker tubes closed, and then the counterpressure lowered by means of the vacuum tubes until the liquid flows into the bottles up to the end of the vacuum tubes, counterpressure equal to the receiver, if the receiver is situated below the bottles, or above the pressure in the receiver if the receiver is above the bottles, is turned on again through the breaker tubes, driving the liquid back out of the nozzles again and into the suction tubes, leaving the bottles filled up to the level of the filling nozzles.

Exactly the same action applies to powders, which can be drawn into any containers, by vacuum or by difference of pressures as described, with a closed and dustless circuit, with the addition, in some cases, of agitators or vibrating devices, as usually obtains to keep the powder moving and free from packing.

Referring now to the arrangement of the complete apparatus shown in Figures 1 to 8 of the drawings, 1 is a hollow filler head with downward inclined walls thereto, 10 is the choker valve, 11 is the intercepter, 12 is the pneumatic device for raising and low-

ering the bottle 6, 13 is the filtering device, and 14 represents as a whole, the flat faced oscillatory control valve, 3 represents the nozzle of the head 1, 4 the vacuum tube, and 5 the breaker tube.

In the hollow head 1, which is provided with a removable cover 15, and is carried by a hollow standard 16 mounted on a base plate 17, there is arranged a float 18 whose stem depends into supply (suction) pipe 8 which extends down through the hollow standard 16 and base plate 17. The object of this float valve is to constitute a closure of the supply pipe 8 after the head 1 itself is drained out. It will be noted that it is necessary after filling each bottle to drain the head to prevent dripping back from the nozzle 3, but it is not necessary to empty the supply pipe 8, and, if it is allowed to run empty, time is taken up in filling it again before the next bottle can be filled, and the float 18 keeps the liquid ready, behind the nozzle, which then instantly starts filling when the control valve 14 is operated. It is necessary that this closure be in the form of a float, and the action is that while filling it floats in the top of the space 19 provided in the head 1, and after filling it does not close the supply pipe 8 until the liquid level in the head has fallen sufficiently to allow it, the float, to rest on the top of the supply pipe.

To provide a means for readily cleaning out the vacuum and breaker pipes, 4 and 5 respectively, vertically disposed holes 20 are formed through a boss 21 at the top of the head 1 and the nipples where said vacuum and breaker pipes 4 and 5, which are shown in detail in Figures 13, 14 and 15, branch out, as shown most clearly in Figures 3 and 4, said holes 20 being covered by a rubber pad 22 carried by a rotatably mounted plate 23, held in covered position by means of a screw nut 24, Figure 4, showing the padded plate swung clear of said holes 20 for the insertion of a wire therethrough.

14, Figures 5, 6, 20 and 21 represents the flat face oscillatory valve, the same consisting of a movable member 25 provided with suitable ports 26, 27, 28 to register with ports 26′, 27′, 28′ in the fixed member 29 of the valve, ports 26 and 28 in the movable part of said valve being connected to vacuum pipe line 4′, and ports 27 and 27′ in both parts of said valve connected to breaker pipe 5, and bottle lifting device 12 hereinafter described, the ports in the moving member of the valve being so arranged that either vacuum, atmosphere, pressure of air or gas is connected up by the movement of said valve to the connections aforesaid.

It is obvious that extra ports can be added at any position in the working face to couple it to connections for gas or air pressure, atmospheric pressure or any degree of vacuum or any combination as required for the purpose of pneumatic control of filling.

The above described oscillatory valve is used to open the vacuum supply or any sort of gas pressure into the intercepter 11, the purpose of which intercepter is to trap liquid which is picked up by the vacuum pipe when the bottle is filled. This intercepter consists of a cylindrical glass vessel with a pipe connection 30 into it from the valve 14, and a connection 31 out of it going to the vacuum tube 4 of the nozzle 3, and pipe 32 going out of it at the bottom and provided with an automatic foot valve 33, see Figure 1, the purpose of which pipe and foot valve is to return any liquid trapped to the supply tank when vacuum is off.

This intercepter 11 consists of a plain glass cylinder with soft packing joints 34 top and bottom, and a spring or screw or other means pressing the flanges 35 and packings 34 against the ends of the cylinder, and in the arrangement in question a spring 36 is shown for this purpose.

The action is as follows:—Vacuum, admitted by the control valve, draws the foot valve shut, and draws the air out of the bottle to be filled by means of the vacuum pipes. When the bottle is filled up to the end of said pipe no more air can be drawn from the bottle, and liquid is picked up by said pipe and discharged into the intercepter. When vacuum is broken in the bottle to be filled by means of the breaker pipe, the air rushing up the vacuum pipe to break the vacuum in the intercepter clears all liquid out of the vacuum pipe and so prevents, by the inrushing air, any dripping. When the intercepter has been let down to atmospheric pressure by the inrushing air, the liquid in the intercepter will then flow down the pipe connected to the bottom of it and through the foot valve thereof, so emptying said intercepter.

In the breaker pipe 5 itself, see Figure 19, there is provided at any suitable point a pin-hole vent or permanent leak 47 which has the effect of breaking vacuum in the whole of the breaker pipe 5 at the moment the liquid touches the filling nozzle 3. The whole vacuum line from the vacuum tube 4 through the valve 14 and interconnected choker valve 10 and intercepter 11 to the pump is designated 4′.

That is to say, the pin-hole vent or permanent leak 47 serves the following objects:—(1) it reduces vacuum in the breaker pipe 5 and prevents the vacuum in said pipe 5 drawing up liquid thereinto when the liquid touches the end of the nozzle; (2) it reduces the excess vacuum in the neck 9 of the bottle 6 when the liquid touches the end of the nozzle 3 and prevents the liquid rising above the end of the nozzle 3, which it otherwise would do; and thirdly,

when the liquid touches the end of the nozzle it provides for a supply of air into the neck of the bottle, and this air is removed by the vacuum pipe and in passing up said vacuum pipe has the very valuable effect of reducing the amount of liquid picked up by the vacuum pipe and passed over to the intercepter.

It is to be understood that the vent must be smaller than the vacuum pipe in order to obtain the necessary reduction of pressure in the bottle.

The pin-hole vent or permanent leak, indicated as a whole by the reference numeral 47, consists as shown in Figure 22, of a hardened steel union 48 with reduced ends 49 for the reception of the ends 50 of the breaker pipe 5, said union 48 having a straight-through bore 51 and a pin-hole 52 bored through the one wall of the thickened part of the union 48 and at right angles thereto.

In the pipe connection 31 going from the intercepter 11 to the vacuum pipe 4 of the nozzle 3 there is arranged the regulating or choker valve 10 of the needle valve type, Figures 1, 2, 5 and 6. The purpose of this valve 10 is to regulate the flow of air drawn from the bottle 6 to be filled so that the liquid will enter said bottle as fast as the air is drawn out therefrom, and the vacuum is never more than sufficient to just raise the liquid, the supply of which is always located below the filling head, and cause it to flow into said bottle. This is important, as if excessive vacuum be employed the liquid will not stop at the end of the filling nozzle 3, but will continue to fill and flow partly up the outside of said nozzle.

This excess of liquid level is corrected when the breaker pipe 5 opens as any excess level of liquid is siphoned off down the supply 8, of the nozzle 3, but if excess level wets the outside of said nozzle 3 and the inside of the neck 9 of the bottle 6, this would be objectionable with heavy or sticky liquids.

This regulating or choker valve 10 also very greatly reduces the amount of liquid which is picked up by the vacuum pipe 4 when the bottle is full because the restricted area through said valve 10 does not allow the liquid to pass as fast as the flow of air from the bottle.

The raising of the bottle 6, in order to insert the filling nozzle 3 into the neck thereof, is effected by means of the plunger 37 of a cylinder 12, Figure 1, said plunger being connected to the tail end of a rod 38 vertically slidable in the table 17, said rod having at its upper end a platform 39 for the reception thereon of the bottle 6. Normally said platform 39 rests on the table 17 but on vacuum being applied by way of pipe 40, see also Figure 19, the plunger and with it the rod 38 and platform 39 is drawn upwards so that the neck 9 of the bottle 6 engages over the filling nozzle 3 and against the soft washer 7, and, on the vacuum being broken said plunger, platform and bottle descend, by their own weight, till clear of the filling nozzle, allowing the bottle to be removed.

The pipe connection 40, Figure 19, of the lifting cylinder 12 is connected to the filter 13, said filter 13, which is connected by pipe connection 41 to port 28 of the control valve 14 and thence to vacuum pipe connection 4, consisting of a glass tube with plugged ends, filled with bottom wool, said filter giving, by discolouring, a visible indication of any leakage, if such occurs.

Referring now to the arrangement of apparaus shown by Figures 9 to 16 of the drawings. The general arrangement and working is similar to that of the arrangement shown in Figures 1 to 8 and Figure 19, but the head 1 which is so designed that the whole of the liquid drains back from the nozzle 3 directly the breaker pipe 4 is open to atmosphere, as also obtains in the head 1 shown in Figure 1 of said figures, is now made of a straight through or stream line form and is particularly applicable, after the removal of the foot valve, for use in filling powders instead of thin liquids, but said head is also applicable for use when filling very heavy liquids such as creams.

With this form of head the supply pipe 8 is now connected to the end of the straight through of said head, and the removable cover 15 of said head 1 is now provided with upstanding nipples which carry the vacuum and breaker tubes, 4 and 5 respectively, thus enabling said vacuum and breaker tubes being easily withdrawn for cleaning purposes. Further, the upper end of the nozzle 3 now stands partly up the inside of the head 1, or the casting itself can be brought up in a sharp ridge 42 or both arangements may be used together, as shown more clearly in Figure 17, to provide a drainage or backward fall of liquid to the supply pipe 8 so that any liquid, which in the case of thick liquids may be a considerable amount and which might remain on the inside of the head, drains away to the supply pipe 8 instead of falling back down the nozzle 3.

Referring now to the arangement of apparatus shown in Figure 18 illustrating the manner of raising the filler head 1 instead of the bottle 6. In this form of arrangement, the hollow standard 16, carrying the filler head 1, is now slidable through the table 17, and at its lower end is connected to the plunger 37 of the lifting cylinder 12, the supply pipe 8, carried by said slidable standard 16, dipping into the suply tank 43, the intercepter, choker valve and the control valve being mounted in any suitable position

on the table 17, said choker valve, as well as the breaker pipe, being connected to the filler head 1, by flexible pipes, 4ª and 5ª, respectively to accomodate the rise and fall of said filler head. 47 represents the pin-hole vent or leakage to breaker pipe 5, said vent also being shown at 47 in the movable part of the control-valve 14, see Figures 20 and 21.

The cylinder 12 is, at its upper end, pivotally connected to a bar 44 which by one end is pivotally connected to the table 17 and by its other end pivotally connected to the lower end of a screw 45 provided with adjusting nut 46 thereon so that by screwing up or down said nut 46, the height of the cylinder 12 is varied with consequent variation in the lift of the filling head 1 to suit different height of bottles to be filled.

Vacuum is first put on the cylinder 12, drawing up plunger 37 so lifting the head 1. The bottle 6 is then placed in required position and the vacuum broken to cylinder 12, whereupon plunger 37 and head 1 fall, inserting nozzle 3 into the neck 9 of said bottle 6 which is then filled in the manner previously set forth. After breaking vacuum in bottle, vacuum is then put on the lifting cylinder again to raise the head and allow of the removal of the bottle.

I claim:—

1. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling tube, a vacuum tube and breaker tube, a holder for the material to be supplied to said containers, piping between said holder and the filling head, an intercepter device including a one way pipe leading to said holder, a control valve, piping between said control valve and the intercepter device and piping between said intercepter device and the vacuum tube of the filling head, a vented pipe line between the valve device and the breaker tube of the filling head, fluid-pressure operated means for bringing the filling head and container into filling relation, and a pipe line between said valve and said last mentioned means and including a filter device.

2. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling tube, a vacuum tube and a breaker tube, a holder for the material to be supplied to the containers, piping between said holder and the filling head, a float valve inside of said filling head and constituting a closure for the said piping, and means for controlling the operation of said vacuum tube and breaker tube thereby to control movement of material from the holder to the container being filled.

3. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle and vacuum and breaker tubes, said filling head having openings communicating with the vacuum and breaker tubes, and a rubber pad carried by said head and removably held down over said holes to provide means for either closing said holes or opening the same thereby to permit cleaning out of the vacuum and breaker tube passages, piping connections for the vacuum and breaker tubes, and a control valve for controlling the movement of a fluid medium in the vacuum and breaker tubes thereby to cause the material with which the containers are to be filled to pass through the filling nozzle of the filling head.

4. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle, a vacuum tube and a breaker tube, a control valve, a vented pipe line establishing communication between the breaker tube and the valve, a pipe line establishing communication between the vacuum tube of the filling head and the valve and said pipe line having arranged therein an intercepter device and a choker valve for regulating the cross sectional area of said piping, and means controlled by said first mentioned valve for bringing the filling head and the container in filling relation.

5. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle, a vacuum tube and a breaker tube, a control valve, a vented pipe line establishing communication between the breaker tube and the valve, a pipe line establishing communication between the vacuum tube of the filling head and the valve and said pipe line having arranged therein an intercepter device and a choker valve for regulating the cross sectional area of said piping, said control valve comprising a flat-faced body provided with ports and an oscillatory member also provided with ports to register with the ports on the flat-faced body, and means controlled by said first mentioned valve for bringing the filling head and the container in filling relation.

6. In an apparatus for filling containers, by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle, a vacuum tube and a breaker tube, a holder for the liquid to be supplied to said containers, a supply pipe between said holder and the filling head, a float valve in said pipe, a vacuum pipe line including a trap communicating with said vacuum tube of the filling head and also having throttling means therein, a breaker pipe line having an atmospheric breaker port, a valve for controlling the

vacuum line and the breaker line, and means also controlled by said first mentioned valve for bringing the container and the filling head into filling relation.

7. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle, a vacuum tube and a breaker tube, a holder for liquid to be supplied to the filling head, a container supporting platform arranged between the filling head, means for raising and lowering the platform, a control valve, vented piping between said control valve and the breaker tube, vacuum piping between the control valve and the vacuum tube of the filling head, and vacuum tubing between the control valve and said means for raising and lowering the platform.

8. In an apparatus for filling containers by differential pressures, the combination of a filling head including a container entering portion having a filling nozzle, a vacuum tube and a breaker tube, a holder for liquid to be supplied to the filling head, a container supporting platform arranged beneath the filling head, means for raising and lowering the platform, a control valve, vented piping between said control valve and the breaker tube, vacuum piping between the control valve and the means for raising and lowering the platform, and a filter arranged in said last named vacuum pipe line having means to give a visible indication of liquid leakage, if any, to said platform raising and lowering means.

In testimony whereof I have affixed my signature hereto this 2nd day of November 1923.

HERBERT FREDERICK BROADHURST.