

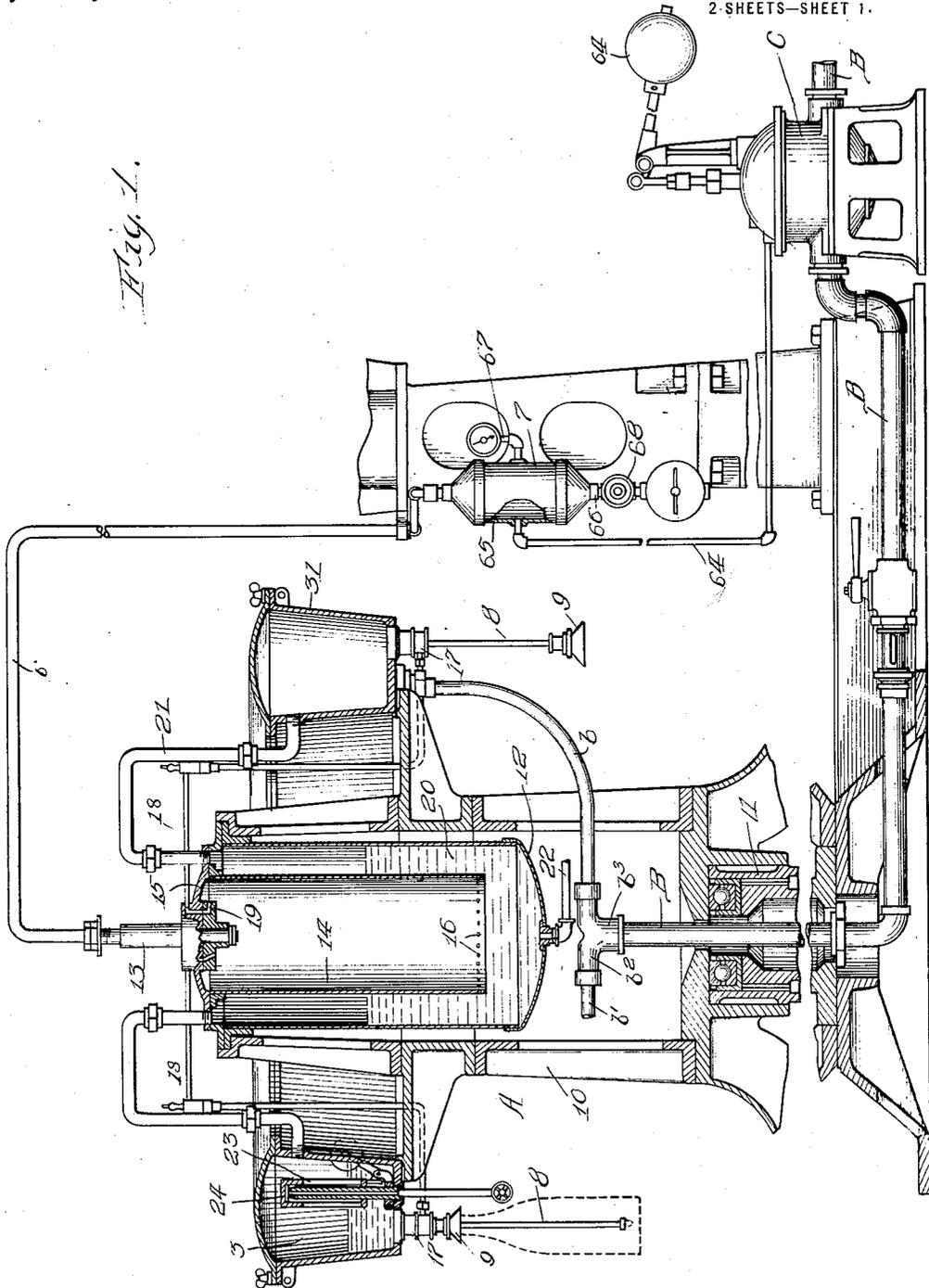
H. M. SMITH.  
 METHOD OF FILLING CARBONATED BEVERAGES IN RECEPTACLES.  
 APPLICATION FILED MAY 18, 1916.

1,275,622.

Patented Aug. 13, 1918.

2 SHEETS—SHEET 1.

*Fig. 1.*



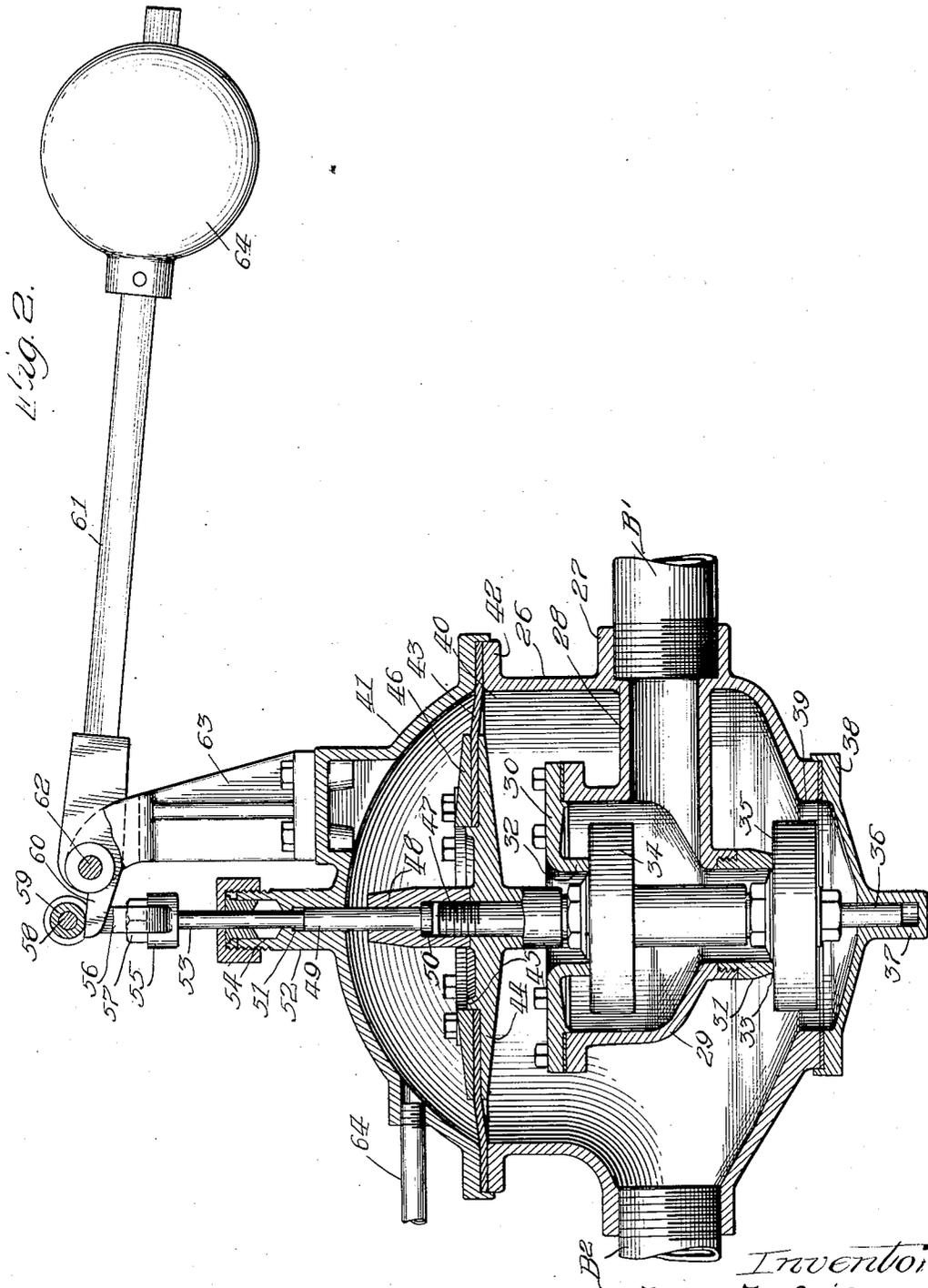
Witness:  
*H. L. Farrington*

Inventor  
*Horace M. Smith*  
 By *Robert H. Sanderson*  
*W. C. Atty.*

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Witness:  
*R. F. Farrington*

Inventor:  
*Horace M. Smith*  
 By *Robert H. Hubbard* Attorney  
*His Atty.*

# UNITED STATES PATENT OFFICE.

HORACE M. SMITH, OF CHICAGO, ILLINOIS, ASSIGNOR TO LIQUID CARBONIC COMPANY,  
OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF FILLING CARBONATED BEVERAGES IN RECEPTACLES.

1,275,622.

Specification of Letters Patent. Patented Aug. 13, 1918.

Application filed May 18, 1916. Serial No. 98,299.

*To all whom it may concern:*

Be it known that I, HORACE M. SMITH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Filling Carbonated Beverages in Receptacles, of which the following is a specification.

In ordinary practice the carbonated liquid is led from the carbonator in which it is highly charged with carbonic acid gas to a filling tank, and from the latter by a series of filling tubes to the bottles or other receptacles in which the liquid is to be stored, and it being desirable to retain as nearly as possible all of the gas in the liquid, the latter is maintained under pressure from the time it leaves the carbonator until the filling of the particular receptacle is completed to prevent foaming and the escape of the gas. For this purpose it has been common to supply gas or air under pressure to the filling tank where the pressure is maintained continuously, and also to the bottle or other receptacle to be filled to which latter the counterpressure is admitted before the liquid, and therefore presents a resistance to the entrance of the latter into the receptacle. Obviously for securing the best results the counter-pressure against which the liquid is fed must not be so high as to prevent the flow of liquid, and yet must be maintained as near the pressure of the gas in the liquid and under which the liquid is forced as is consistent with the flow of the latter. The pressure in the filling tank should be just a trifle less than that of the liquid entering the tank from the carbonator, and the counter-pressure in the bottle or other receptacle being filled should be just a little less than the pressure of the liquid entering the same due to the weight of the column of liquid in the filling tube, (or, more accurately speaking, between the levels of the liquid in the receptacle and tank respectively) combined with the gas pressure in the filling tank.

Prior to my invention a filling machine has been devised for filling bottles with carbonated beverage, which is well adapted to maintain the proper difference in pressure between the filling tank and the bottle being filled. An example of such a machine is shown in the accompanying drawings and briefly described hereinafter as a part of the preferred construction in which my inven-

tion is employed. Difficulty has been encountered heretofore, however, in machines of this character in maintaining the most advantageous pressure relation between the counterpressure air or gas used in the filling tank and receptacle on the one hand, and the liquid coming from the carbonator on the other, because the pressure of the liquid coming from the carbonator as well as the counterpressure in the filling tank and receptacle varies from time to time for reasons which it is not necessary here to state. The tendency of the gas to leave the liquid increases rapidly with the increase of content of gas and hence the difficulty above described comes the more important the more highly charged the liquid to be filled. Heretofore therefore it has been customary to employ a carbonator charging the liquid at a relatively low pressure and convey the liquid with as little change of pressure as possible to the filling tank and receptacle under the counterpressure referred to above.

It is the object of my invention to provide a method for very materially increasing the pressure of the gas retained in the liquid in the receptacles into which it is filled. With this in view I carbonate the liquid at a very high pressure, say fifty pounds or more, and on its way to the filling machine pass it through a pressure reducer by which the pressure is reduced to approximately 25 pounds, the whole apparatus from the carbonator to and including the filling machine being so constructed as to provide as uniform a flow as possible and as slow as is consistent with the proper speed of operation of the filling machine proper, care being taken to avoid unnecessary choking of the flow and cutting or agitation of the liquid. Furthermore, in order to maintain the difference between the pressure of the liquid and the counterpressure air introduced into the filling tank and receptacle as small as is consistent with the proper flow of the liquid and as uniform as possible I control the pressure regulator according to the pressure of the counterpressure air so that the pressure of the liquid beyond the pressure reducer rises and falls with the rise and fall of the pressure of the air. Thus the pressure of the liquid is reduced with little or no escape of gas so that it is filled into the receptacles with a content of gas corresponding to a much higher pressure than that of

the liquid or, in other words, in a super-saturated condition.

In the drawings I have shown and in the following specification described in detail, a preferred form of apparatus for practising my invention as applied to the filling of bottles with carbonated beverages. It is to be understood, however, that the specific disclosure is for the purpose of exemplification only, and that the scope of the invention is set forth in the following claims in which I have endeavored to distinguish it from the prior art so far as known to me, without, however, relinquishing or abandoning any portion or feature thereof.

In the accompanying drawings, Figure 1 is a side elevation partly diagrammatic in character of an apparatus for carrying out my invention, parts being shown in vertical section, and Fig. 2 is a vertical section on an enlarged scale of the pressure regulator.

A filling machine A which, except in the respects hereinafter noted, is of a usual design, is supplied by a conduit B with carbonated beverage from a carbonator (not shown), a pressure reducer C being interposed in said conduit for reducing the pressure of the liquid. The filling machine A comprises an annular tank 3 which is supplied from the conduit B with liquid through the branch pipes  $b, b'$ , and is provided with a number of filling tubes 8, with sockets 9, which receive the mouths of the bottles to be filled. The tank 3 is supported on a suitable frame-work 10 upon a standard 11, through the center of which extends the upturned end of the conduit B. The frame 10 is revoluble upon the standard 11 and the branches  $b, b'$  of said conduit are connected thereto by a T  $b^2$  packed at  $b^3$  for rotation relative to the conduit. It will be understood that the frame A carries suitable supports for the bottles by which the latter, after being placed thereon, are successively fed into engagement with the filling tubes, and by raising the latter establish communication between the interior of the bottle and first the counter-pressure air, and second the liquid to be filled in the tank. These features are common to practically all bottle filling machines of this general type.

I have heretofore pointed out that in machines of this character the counter-pressure in the bottle must be just a trifle less than the pressure of the entering column of fluid due to the weight of the latter plus the pressure in the filling tank. In order to secure the proper difference in pressure, the same source of air pressure is connected to the tank and to the bottle to be filled, but the pressure in the tank is reduced with reference to the pressure in the bottle by the weight of a column of water which is equal to the distance between the level to which the bottle is to be filled and the surface of

the water in the tank. In the well-known form of machine illustrated, the air coming from a suitable source through the pipe 6 enters the chamber 12, through the axial tube 13, which is suitably packed in the cap of said chamber to permit the rotation of the latter about said tube without leakage. A coaxial cylindrical sleeve 14 is attached by an airtight joint to the cover 15 of said chamber, and its lower end extends to a point near the bottom of the chamber and may be open or provided with a series of perforations 16 for a purpose which will appear. The heads 17 of the filling tubes are connected by pipes 18, with channels 19 in the head or cap of the chamber, and the latter are open to the interior of the sleeve 14 so that the filling heads 17 receive the full pressure which enters the sleeve 14 through the pipe 6. The upper part of the filling tank is connected to the upper part of the annular chamber 20 surrounding the sleeve 14 by two or more pipes 21 so that the pressure in the tank above the liquid is the same as that within said annular space. Water or other suitable liquid is filled into the lower portion of the chamber 12, through the pipe 22 so that it traps the lower end of said sleeve, the quantity of water or other liquid supplied being such that when the air pressure is turned into the sleeve and drives the water down below the openings 16, or the open end of the sleeve, the column of water in the annular space is just sufficient to balance the column of liquid in the filling tubes when the bottles are filled. In operation air is continuously supplied through the tube 6 to the sleeve 14 in sufficient quantity to just force the water to the level of the openings 16 and bubble up through the annular space 20. Thus there is always a difference in pressure between the interior of the sleeve from which the counter-pressure is transmitted to the bottle and the upper part of the filling tank equal to the pressure of the annular column of liquid in the chamber 12. A standing pipe 23 extending through the bottom of the tank is provided with a cap-valve 24 operated by a float 25 in such manner that when the level of the liquid in the tank sinks below that desired, the valve lifts and permits an exhaust of a portion of the air in the tank, thus relieving the pressure upon the liquid, which consequently flows into the tank raising the level of the liquid therein. All of the above described construction is common in machines now upon the market.

I will now describe the pressure reducer and the means for controlling the same whereby the proper relation is maintained between the counter-pressure in the filling tank and the bottles to be filled on the one hand, and the liquid being put into the bot-

5 tles or receptacles on the other. The pressure reducer comprises a casing 26 of cast iron or other suitable material having an inlet nipple 27 and a conduit 28 communi-  
 10 cating with said nipple, and like the latter formed integral with the casing. The conduit 28 is integrally connected to an enlarged valve chamber 29, which is open  
 15 above and below except for the annuli 30, 31, secured in the respective upper and lower openings and formed with valve seats 32, 33 respectively. In the construction  
 20 shown the upper annulus is bolted and the lower annulus screwed into the chamber 29. A balanced valve comprising the disks 34,  
 25 35, the upper of which engages the valve seat 32, and the lower valve seat 33, is mounted for axial reciprocation into and out of engagement with said valve seats,  
 30 being guided for this purpose by an axial stem 36, engaging a bore 37 in the lower cap-piece 38 of the casing. The casing 26 is formed with a lower opening 39 with  
 35 which said cap engages and a larger upper opening 40, which is covered by a cap 41 between which and the flange 42 on the casing proper is clamped a diaphragm 43. Said diaphragm is secured to the balanced  
 40 valve by means of a disk 44, formed with an annular flange 45 extending through a concentric opening in said diaphragm and into the central opening of an annulus 46, between which and said disk 44 the inner  
 45 edge of said diaphragm is clamped. The diaphragm may be made of rubber or other suitable flexible material to permit a sufficient movement of the valve while at the same time forming a water and airtight  
 50 partition between the interior of the casing 26 and the interior of the cap 41. A threaded bolt 47 extends upwardly through and beyond the disk 44 and receives the nut 48, through which extends the lower end of a threaded rod 49 having a head 50 within  
 55 said nut. The rod 49 is guided in a bore 51, in a boss 52 of cap 41, and the reduced upper end 53 of said rod is packed at 54 to prevent leakage. The upper end of the rod 53 extends through an eye 55 of a yoke 56 and is threaded at its upper end for the  
 60 reception of a nut 57 by which said rod and yoke are secured together. The upper ends of the yoke are connected by a bolt 58 carrying an anti-friction roller 59 which bears  
 65 upon the short arm 60 of a weighted lever 61 fulcrumed on a bolt 62 between the ears of a bracket 63 connected to the cap-piece 41. The weight 64 is adjustable along the lever 61 to vary the upward pull by which  
 the disks of the balanced valve are drawn into contact with their respective seats.

As heretofore stated the pressure reducing valve just described is interposed in the conduit B between the carbonator and the filling machine, the section B' of said con-

70 duit being connected with the carbonator and the section B<sup>2</sup> connected to the filling machine. The space above the diaphragm 43 is connected by a pipe 64 with an enlarged chamber 65 connected to the air supply pipe 6 leading to the chamber 12, and at its other end by pipe 66 with a suitable source of air under pressure. The pipe 64 enters the side of the chamber 65 and the latter may be provided if desired with a  
 75 pressure indicator 67 and valve 68 for throttling the air supply.

The balanced pressure reducing valve disks 34, 35, are urged in the direction of their seat by the counter-weighted lever 61 and by the pressure of the carbonated liquid in the casing beyond said valves, (that is to say, the reduced pressure on the diaphragm). These influences are opposed by the weight of the valve parts and their im-  
 80 mediate connections as well as by the pressure of the counter-pressure air on the diaphragm communicated from the enlarged chamber 65 through the pipe 64. By reason of the enlarged chamber 64 the speed of  
 85 movement of the counter-pressure air supply is so reduced at this point that it does not materially affect the static pressure of the air.

The counter-weight 64 is so adjusted upon 95 the arm 61 in view of the other factors affecting the balanced valve as to maintain a sufficient pressure on the valve under normal operation to reduce the pressure of the liquid coming from the carbonator from a pressure in excess of fifty pounds to about  
 100 twenty-five pounds pressure. The pressure on the valve, however, depends not only on the weight of the parts but, as heretofore pointed out, upon the pressure of the counter-pressure gas or air in the top of the casing and the reduced pressure of the liquid beyond the valve. Consequently, when for any reason the counter-pressure increases the valve is more fully opened and some-  
 105 what less reduction of the pressure of the carbonated liquid is effected thereby, and on the other hand when the counter-pressure decreases the valve approaches its seat slightly thus proportionally reducing the  
 110 pressure of the liquid passing the same beyond the normal. The pressure of the carbonated liquid therefore is regulated by and follows changes in the counter-pressure so that the difference between the two pressures  
 115 is maintained constant. It is therefore possible to always automatically maintain the maximum counter-pressure which can be employed without stopping the flow of the liquid and the filling proceeds smoothly and  
 120 regularly and without foam or escape of carbonic acid gas notwithstanding the high state of supersaturation of the liquid.

By thus carbonating at a relatively high pressure and reducing the pressure of the 130

carbonated beverage but maintaining at all times the proper relation between the counter-pressure and the pressure of the liquid being filled by governing the latter from the former, avoiding any agitation of the liquid, providing for a free and unobstructed movement of the liquid at a low rate of speed and avoiding any choking effect because of restricted passages, I am able to fill the liquid in the receptacles in a most satisfactory condition of supersaturation with little or no loss of the gas contained therein.

I claim:

1. A process of carbonating and filling liquids which consists in carbonating the liquid under a pressure higher than that ultimately desired, passing the liquid continuously through a pressure reducer and into the receptacles to be filled in a smooth stream of such minimum diameter at every

point of its course as to avoid release of the dissolved gas and maintaining the amount of gas dissolved substantially undiminished thereby producing supersaturation, and maintaining pressure upon the liquid throughout its passage from the pressure reducer to the receptacle.

2. A process of carbonating and filling carbonated liquids which consists in carbonating the liquid at a pressure in excess of that ultimately required, maintaining a counter-pressure in the receptacles to be filled by continuously supplying counter-pressure gas thereto, passing the carbonated liquid through a pressure reducer to the receptacles to be filled, thereby reducing the pressure to that desired, and controlling the extent of pressure reduction from the pressure of the counter-pressure gas.

HORACE M. SMITH.