M. STÜHLER.

APPARATUS FOR CARBONATING LIQUIDS.

APPLICATION FILED JULY 9, 1913.

1,126,662.

Patented Jan. 26, 1915.

Fig. 1

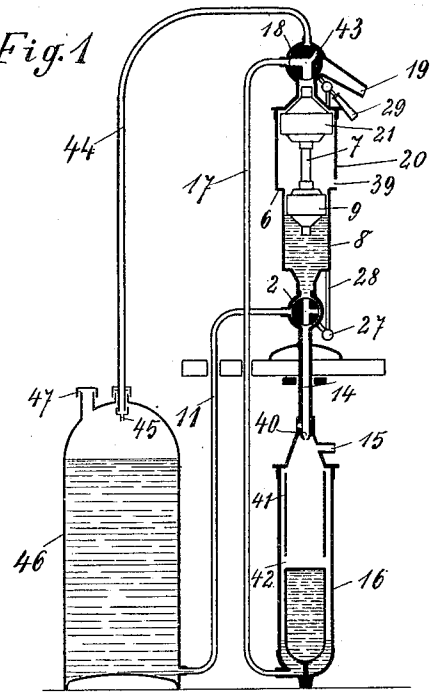


Fig. 2

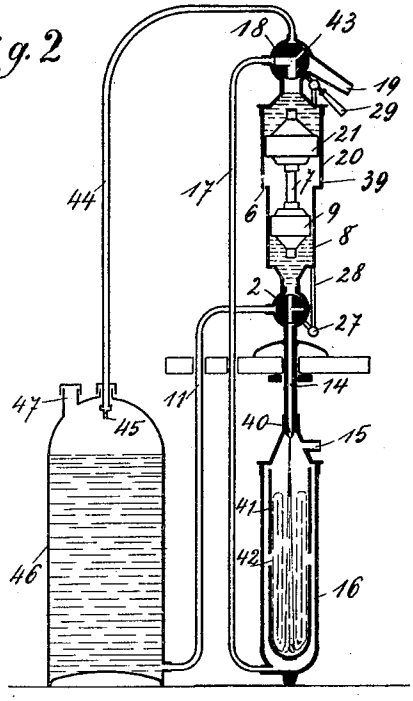


Fig. 3

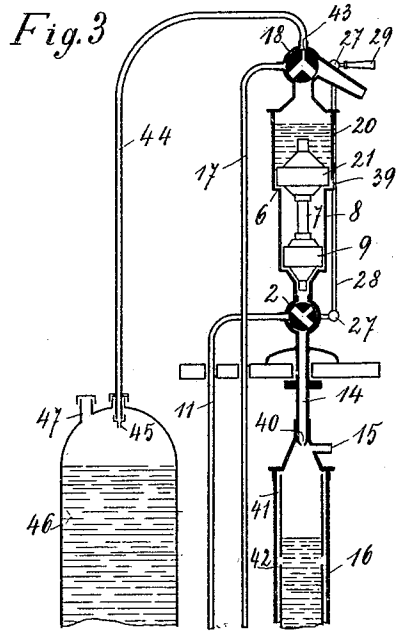
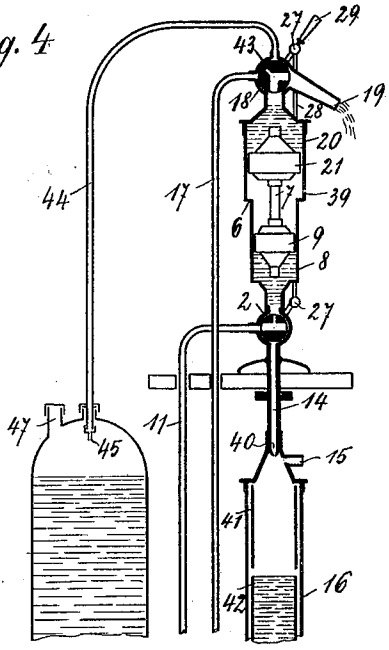


Fig. 4



Witnesses:

Nikolaus Mayer

Carl Thiegen

Inventor:

Martin Stühler.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MARTIN STÜHLER, OF COLOGNE, GERMANY.

APPARATUS FOR CARBONATING LIQUIDS.

1,126,662. Specification of Letters Patent. Patented Jan. 26, 1915.

Application filed July 9, 1913. Serial No. 778,048.

To all whom it may concern:

Be it known that I, MARTIN STÜHLER, a citizen of the German Empire, and residing at Cologne-on-the-Rhine, Germany, have invented certain new and useful Improvements in Apparatus for Carbonating Liquids, of which the following is a specification.

My invention relates to a device for automatically producing, and for directly discharging for retail purposes, liquids containing carbonic acid, *i. e.* carbonated, or the so-called aerated, liquids, the unabsorbed gases being utilized as the actuating medium.

A primary object of my invention is to provide a device, which, in so far as it is provided with the necessary uncarbonated water, automatically produces aerated drinks quite independently of the pressure of a water-supply, and delivers these drinks directly to the glass or vessel of the person desirous of partaking of them. The said device comprises a piston-member whose stroke in one direction is brought about by the full pressure of the gases, and in the reverse direction by the expansion pressure of them.

To this and other ends, my invention consists in the construction, arrangement and combination of parts described hereinafter and pointed out in the claim.

One embodiment of my invention is illustrated by way of example in the accompanying drawing, wherein—

Figures 1 to 4 are diagrammatic vertical sections of the device, and for the sake of clearness, the valves of the device are shown as spigot-cocks and all the connecting ducts are shown in one plane.

In this drawing: Fig. 1 shows the beginning and Fig. 2 the continuation of the downward, full-pressure stroke; Fig. 3 shows the position of the parts for allowing the gas above the piston to expand and act on the supply of liquid to be carbonated, and Fig. 4 shows the piston-member on its upward stroke.

Referring to the drawing, the uncarbonated water cylinder 8 is connected to the larger, aerated-water cylinder 20 by means of an annular intermediate wall 6, the whole thus constituting a differential cylinder system; the uncarbonated water piston 9 is connected to the larger, aerated-water piston 21 by means of a common piston rod 7, this whole thus constituting a differential piston system. From the uncarbonated water cylinder the duct 14 runs downwardly to the mixing vessel 16 which is provided at its upper end with a nozzle 40 and in its cylindrical portion with an inside vessel 41, the latter having two opposite apertures 42. At the upper portion of the mixing vessel is also arranged a supply pipe 15 for the carbonic acid gas and, at the lower portion of this vessel, a pipe 17 is connected which runs to the aerated-water cylinder, and which is employed partly for the prepared aerated water and partly for carbonic acid gas. Moreover, a closed reservoir 46, which receives the uncarbonated water, is fitted below with a pipe 11 running to the uncarbonated water cylinder, and above not only with a pipe 44, which, coming from the aerated-water cylinder is fitted with a non-return valve 45 but also with an inlet 47 for filling purposes which is securely closed. All the ducts and pipes except the inlet duct 15 for the carbonic acid gas can be alternately opened and closed by means of two multiple-way cocks 2, 18, which control the differential piston system. These two cocks are operatively coupled by means of parallel cranks 27 and a bar 28, and can therefore be simultaneously actuated by a handle 29. The three-way cock 2 connects the uncarbonated water cylinder 8 alternately with the mixing vessel 16 or with the reservoir 46. The four-way cock 18 connects the aerated-water cylinder 20 alternately either with the mixing vessel 16, or with the reservoir 46, or with the discharge duct 19. In the lowest and front portion of the aerated-water cylinder, a circular aperture 39 is arranged in order, firstly, that air can be admitted or expelled when the volume of the chamber between the pistons changes owing to movements of the latter, secondly, that liquid can escape which possibly leaks past the pistons, and thirdly, that the piston may be seen from outside when it reaches its lowest position.

The mode of operation of the device is as follows: When the handle is placed in its depressed position, as seen in Fig. 1, the

downward, full-pressure stroke of the pistons begins. The three-way cock 2 has closed the reservoir water-pipe 11 and connected the uncarbonated water cylinder 8 with the mixing vessel 16. The four-way cock 18 has closed both the discharge duct 19 and the reservoir gas-pipe 44, and has connected the mixing vessel 16 with the aerated-water cylinder 20. Both the mixing vessel and the aerated-water cylinder have the full pressure of the carbonic acid gas, and this pressure also prevails in the uncarbonated water cylinder. Since however the area of the upper piston is greater than that of the lower one, the piston-member will move, and, owing to the resistance of the nozzle 40, will produce in the uncarbonated water cylinder a pressure which is higher than the full pressure of the carbonic acid gas, the value of this higher pressure being determinable from the ratio of the areas of the pistons after due deduction is made for friction. The uncarbonated water therefore enters the mixing vessel, and issues from the nozzle 40 in the form of a jet, whereby this water becomes saturated in the inside vessel 41. On the handle being first moved into the said position any solid aerated water at the bottom of the mixing vessel, *i. e.* the remainder of that water which was completely saturated when the previous injection in the mixing vessel occurred, is lifted in the pipe 17 in a solid stream by the gas pressure admitted through the pipe 15 and is supplied to the aerated water cylinder 20; this aerated water is followed by both liquid and unabsorbed gas which flow up the pipe 17 until the piston descends and the pressure above the liquid in the cylinder 20 equals the pressure in the vessel 16. Since the same effects occur each time the pistons descend, there is always the same quantity of prepared aerated water in the aerated-water cylinder 20 when the full-pressure stroke of these pistons is completed, and, above this water, there is always the same amount of carbonic acid gas. As soon as the piston-member has closed the inspection-aperture 39 and so ended its downward stroke, the handle 29 is brought to the horizontal position, as shown in Fig. 3. The duct 14 to the mixing chamber, and the pipe 17 from the latter are now closed, and the passage 43 of the four-way cock 18 is now connected to the pipe 44 leading to the reservoir. The full-pressure carbonic acid gas in the aerated-water cylinder therefore expands and gas passes into the reservoir 46 until the pressures are equalized. When the handle 29 is thereupon raised to the position shown in Fig. 4, the upward movement of the pistons begins. The four-way cock 18 has closed both the pipe 17 coming from the mixing vessel and the pipe 44 leading to the reservoir, and has opened the discharge duct 19. The three-way cock 2 has closed the duct 14 to the mixing vessel, and opened the pipe 11 from the reservoir. The uncarbonated water flows from the reservoir 46 owing to the pressure of the expanded gas above it and passes through the pipe 11 into the uncarbonated water cylinder 8. The piston-member therefore rises. The prepared aerated water in the upper cylinder 20 which, after the last movement of the four-way cock, has been wholly relieved of pressure, will now ascend and be slowly discharged through the duct 19.

Since the rigidly connected pistons 21 and 9 move equal distances the volumes swept by the pistons and consequently the volumes displaced are proportional to the areas of the pistons, which areas are inversely proportional to the pressures, due allowance being made for friction. If account is taken of the areas of the pistons and of the area of annular wall 6, *i. e.* the difference of the areas of the pistons, to which difference of area again corresponds the difference of volume (*i. e.* the volume of gas in the aerated water cylinder) or the difference of pressure (*i. e.* the excess pressure in the uncarbonated water cylinder), the generally applicable theoretical relations between the volumes, pressures and piston-areas may be thus expressed:—Volumes and difference of volume, pressures and difference of pressure are proportional to piston-areas and differences of piston-area, due regard being paid to the inversion in the case of the pressures. It is thus possible to so calculate the areas of the pistons that all conditions relating to volume and pressure are taken into account. Other conditions being the same, the speed at which the piston-member descends depends on the cross-section of the nozzle 40, and the speed at which it rises on the cross-section of the pipe 11, which for this reason can be provided with an adjustable throttle valve. The reservoir 46 is filled to the height of the filling inlet 47 before the device is started and, if there are leakages of gas existing or possible, every morning afterward. If it is desired to reduce the stroke of the piston-member and consequently the quantity of uncarbonated water entering the mixing chamber, the upper piston 21 is fitted with a supplementary ring which is fastened below it, and if it is also desired that the piston in the uncarbonated water cylinder shall still fit the lower end of this cylinder closely, the piston rod 7 can be correspondingly lengthened.

I claim:—

In apparatus for carbonating liquid, a casing comprising a larger and a smaller cylinder, the larger cylinder having a discharge duct, a differential piston movable in the cylinders, a mixing chamber having an inlet for carbonic acid gas, a closed reser-

voir for uncarbonated liquid, and means, in the first place, for connecting the lower end of the smaller cylinder and the upper end of the larger cylinder to the mixing chamber; secondly, closing the smaller cylinder and connecting the upper end of the larger cylinder to the upper end of the reservoir; and, thirdly, connecting the lower end of the smaller cylinder to the lower end of the reservoir and the upper end of the larger cylinder to the discharge duct.

In testimony whereof, I affix my signature in the presence of two witnesses.

MARTIN STÜHLER.

Witnesses:
LOUIS VANDORY,
BESSIE F. DUNLAP.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."