June 13, 1950 B. G. COPPING 2,511,529

NOZZLE

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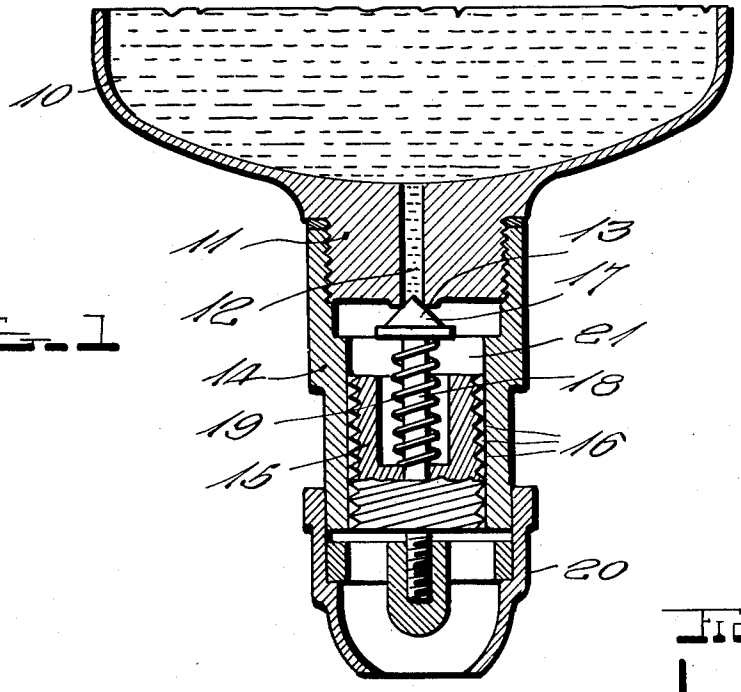


FIG. 1

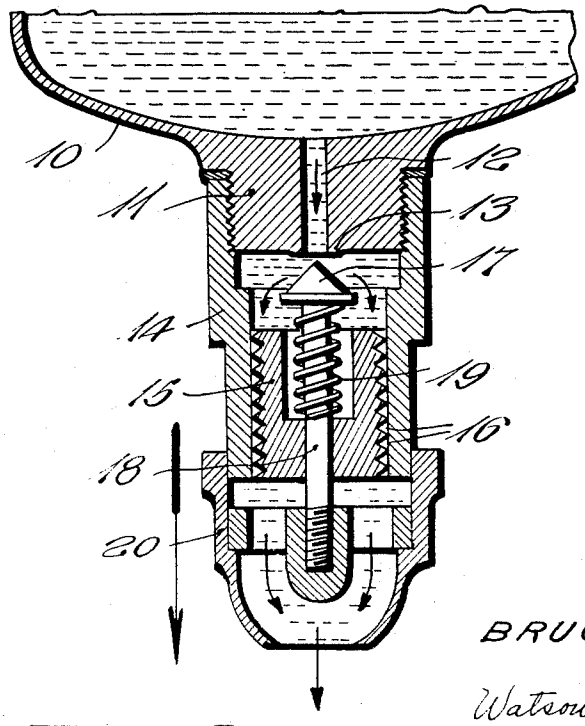


FIG. 2

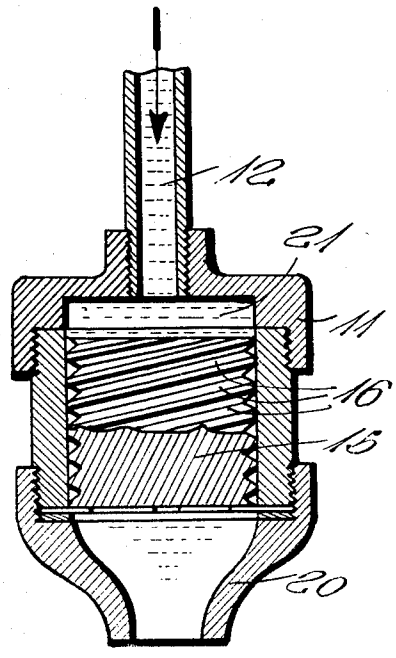


FIG. 3

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2,511,529

NOZZLE

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Application March 31, 1945, Serial No. 585,886

2 Claims. (Cl. 225—21)

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This invention relates to the beverage industry, and has as its primary object the provision of means whereby carbonated water may be dispensed while retaining a very large percentage of the carbonation it originally held within the carbonator itself.

The instant case may be considered a continuation in part of my co-pending application Serial No. 480,108, filed March 22, 1943, now Patent No. 2,495,210, January 24, 1950, for Automatic valve, etc., and my co-pending application Serial No. 513,577, filed December 9, 1943, now Patent No. 2,469,327, May 3, 1949, for Beverage dispensing device.

The first case disclosed the employment of very small capillary spaces, through which carbonated water was forced to flow, said spaces being of the order of .002 inch in width. These very small spaces presented two disadvantages from a practical standpoint: First, it was found difficult to machine passages of this size within the necessary limits of accuracy; and secondly, these very small spaces sometimes became plugged up with foreign mater as found in certain water supplies.

Case Serial No. 513,577 disclosed a capillary nozzle of the so-called grooved type, which type was an improvement over the first, in that it was found possible, by using grooved type passages, to increase the size of the passages from approximately .002 inch to .01 inch, which increase in size was found to be extremely beneficial from a practical operating standpoint, although it was also thought that an even further enlargement of said passages would be most desirable. The present application discloses means for accomplishing this.

An object of my invention is to provide a capillary nozzle which will dispense carbonated water with a minimum loss of carbonation between carbonator and the discharge end of the nozzle.

Another object is to provide such a nozzle which will dispense carbonated water with a minimum of foaming.

Another object is to provide cheapness of construction in such a nozzle.

A still further object is to provide economy of operation and a minimum of working parts in a capillary nozzle.

Another object is to provide a capillary nozzle which will not become stopped up because of the presence of foreign matter in water.

Another object is to provide a nozzle of the instant type, which may be readily cleaned.

These and other objects made apparent during the further progress of this specification are accomplished by means of my multiple-thread, helical capillary nozzle, a full and complete understanding of which is facilitated by reference to the drawing herein, in which:

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Fig. 1 is a vertical cross-sectional view of a nozzle embodying my invention, associated with a source of carbonated water supply;

Fig. 2 is a view similar to Fig. 1, in which the water is flowing through the nozzle; and

Fig. 3 is an enlarged view, principally in vertical cross-section, showing in detail the helical threads of the nozzle structure per se.

As has been previously disclosed, the underlying principle of the capillary nozzle is that the passages are of such design as to use up in friction, substantially all of the pressure energy of the fluid flowing through the nozzle, and to do this while maintaining streamline flow in the fluid. The rate at which the pressure energy of the liquid is used up varies directly as the length of the capillary passage, and inversely as the fourth power of the diameter of the capillary passage. From this, it is apparent that it is mathematically possible, without changing the loss of pressure energy of the liquid, to increase the diameter of the passage, if a compensating increase in the length of the passage is made. It is also apparent that, since the loss of pressure varies inversely as the fourth power of the diameter and directly as the length, a very large increase in length is necessary to permit a small increase in diameter. For example, if it were desired to double the diameter, it would be necesary to increase the length sixteen times to compensate. This has heretofore been found impractical, because of space limitations, but my invention overcomes this difficulty, and permits the use of a long capillary passage within a comparatively small space.

Referring now to the drawing, Fig. 1, 10 is a carbonator filled with carbonated water under pressure, and 11 is a threaded boss at the bottom of said carbonator, said boss having in it a liquid pasage 12, and a valve seat 13. 14 is an outer sleeve, and 15 is the capillary plug upon the surface of which are formed a plurality of V-shaped helical capillary passages 16. Capillary plug 15 is preferably a shrink fit within the outer sleeve 14, and may be permanently retained in the position shown after the shrink assembly.

17 is a valve on the end of a valve rod 18, said valve and valve rod being forced upwardly against the valve seat 13 by means of a valve spring 19.

20 is a nozzle piece which may be screwed onto the lower end of the valve rod 18.

In operating the valve, downward pressure is applied to the upper face of the nozzle piece 20, and the said nozzle piece forced downwardly. Valve rod 18 and valve 17 are simultaneously drawn downwardly against the pressure of spring 19, and valve seat 13 is thus uncovered, which results in carbonated water escaping from carbonator 10, through liquid passage 12 into chamber 21.

From chamber 21, the water passes through V-shaped helical capillary passages 16, and as a result of the fluid friction in these passages, and the change of angular velocity necessitated by the helical shape of the structure, the pressure energy of the liquid is substantially used up, and the carbonated water exits from the lower end of the helical capillary passages at approximately atmospheric pressure, and at relatively low velocity. By this means, there is only very slight tendency to disturb the carbonic acid gas in the liquid, and the carbonated water retains a very large percentage of the carbonation it originally held when within the carbonator itself.

From the discharge end of the helical capillary passages, the water passes through the nozzle piece 20, and thence into a glass or other designated receptacle below.

It will be noted that the arrangement of the capillary passages in the form of a helix has a distinct and new advantage over that described in my original disclosures as referred to heretofore. The prime object of the multiple-thread capillary is to use up the potential energy of the liquid in friction and to avoid as much as possible the conversion of this potential energy into velocity energy. By arranging the capillary passage into a helical shape, the carbonated water, in passing through the passage, is made to travel through a helical path, and as a result there is a constant and substantial change in the angular velocity of the liquid passing through. This change of velocity can only be accomplished through the expenditure of energy, and thus there is being used up a very substantial amount of the energy of the liquid in continuously changing its angular velocity with the resultant setting up of secondary currents in the liquid. Hence, in addition to the energy used up by fluid friction through the passages, the helical capillary uses up a large amount of energy because of its inherent shape.

As stated heretofore, it was previously considered necessary in capillary nozzles to have very small passages, in order to create sufficient friction to use up all of the available energy. The instant invention uses up to a substantial amount of such energy by virtue of the helical shape of the passage, and hence there is less energy left to be used up in friction, and it is accordingly possible to enlarge the size of the capillary passage, while attaining the optimum results of maintaining high carbonation and eliminating foaming at the nozzle. This enlargement of passage is of extreme practical importance, since the larger the passage, the less prone it is to become clogged with foreign matter in the water; the easier it is to clean; and the more readily the device may be initially manufactured in an economic manner.

As stated heretofore the original capillary nozzle, described in my co-pending application first mentioned herein, used passages which were of the order of .002 inch in width. A subsequent improvement, in the form of the so-called "grooved type" of capillary nozzle, as described in my second-mentioned patent application, made it possible to employ passages .01 inch in width. In the present helical capillary nozzle, it has been found practical to increase the size of these passages to .042 inch, this being a substantial improvement over the preceding cases, both from a practical operating and manufacturing standpoint.

At the same time it will be understood that the exact dimensions of the capillary passages, the number of turns, the diameter in which they turn, etc., are dependent upon the conditions prevailing in a particular use application. For example, if employed on a typical soda fountain where the operating pressure of the carbonator may be as high as 150 pounds to the square inch, a somewhat different capillary is indicated to that required on a cup vending machine where the operating pressure of the carbonator may be 60 pounds. To give a practical indication of the nature and size of these passages, however, it may be stated that in a cup machine, the capillary element may consist of three parallel threads having 60° enclosed angle with an altitude of .042 inch and a width at the widest point of the V of .065 inch. The threads are on the outside of a cylinder of approximately 1½ inches O. D.; and the entire capillary element has an actual length in this instance of $\frac{13}{16}$ inch.

No limitation of any kind or nature is intended by examples set forth in this specification, which examples are intended only to effectuate the "clear and complete disclosure" principle embodied in the letter and the spirit of the patent statutes.

The enlarged structure shown in Fig. 3, omits the valve illustrated in Figs. 1 and 2, in order that the basic nozzle structure may be more clearly evident. Control means in the liquid passage 12, or elsewhere, may be employed to govern the flow of fluid to the nozzle, this arrangement being preferable in certain applications.

From the foregoing it is apparent that I have taught a new and improved multiple thread helical capillary nozzle, which uses up the potential energy of carbonated water in friction, and avoids to a large degree the conversion of this potential energy with resultant undesirable foaming and loss of carbonation. That my device is simple in structure, facile of manufacture, efficient in operation, and thoroughly desirable for its intended purposes.

Structures described herein are by way of example, and not intended to imply any limitations whatsoever. The appended claims are to be fairly construed in keeping with my contribution to the art.

I claim:

1. Carbonated water dispensing apparatus comprising in combination, a tank for the storage of a body of carbonated water under pressure, a conduit through which carbonated water may flow from the tank, a valve for controlling the flow of carbonated water through said conduit, and means, positioned posterior to said valve, defining a channel to receive carbonated water issuing from said conduit under tank pressure when the valve is open and to conduct the same to a discharge port open to the atmosphere and from which port the carbonated water may pass directly into a receiving vessel, said channel being substantially uniform in cross section throughout and of such length and cross sectional area that turbulence is substantially prevented, loss

of carbonation minimized and the pressure energy of the carbonated water substantially exhausted in overcoming frictional resistance to flow before it reaches said discharge port, so that the carbonated water is delivered at low velocity and without substantial foaming.

2. Carbonated water dispensing apparatus comprising in combination, a tank for the storage of a body of carbonated water under pressure, a conduit through which carbonated water may flow from the tank, a valve for controlling the flow of carbonated water through said conduit, and means, positioned posterior to said valve, defining a plurality of channels adapted to receive carbonated water issuing from said conduit under tank pressure when the valve is open and to conduct the same to discharge ports open to the atmosphere and from which ports the carbonated water may pass directly into a receiving vessel, each of said channels being substantially uniform in cross section throughout and of such length and cross sectional area that turbulence is substantially prevented, loss of carbonation minimized and the pressure energy of the carbonated water substantially exhausted in overcoming frictional resistance to flow before it reaches said discharge port, so that carbonated water flowing through said conduit and channels is ultimately delivered from said ports in streams which issue at low velocity and without substantial foaming.

BRUCE G. COPPING.

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