

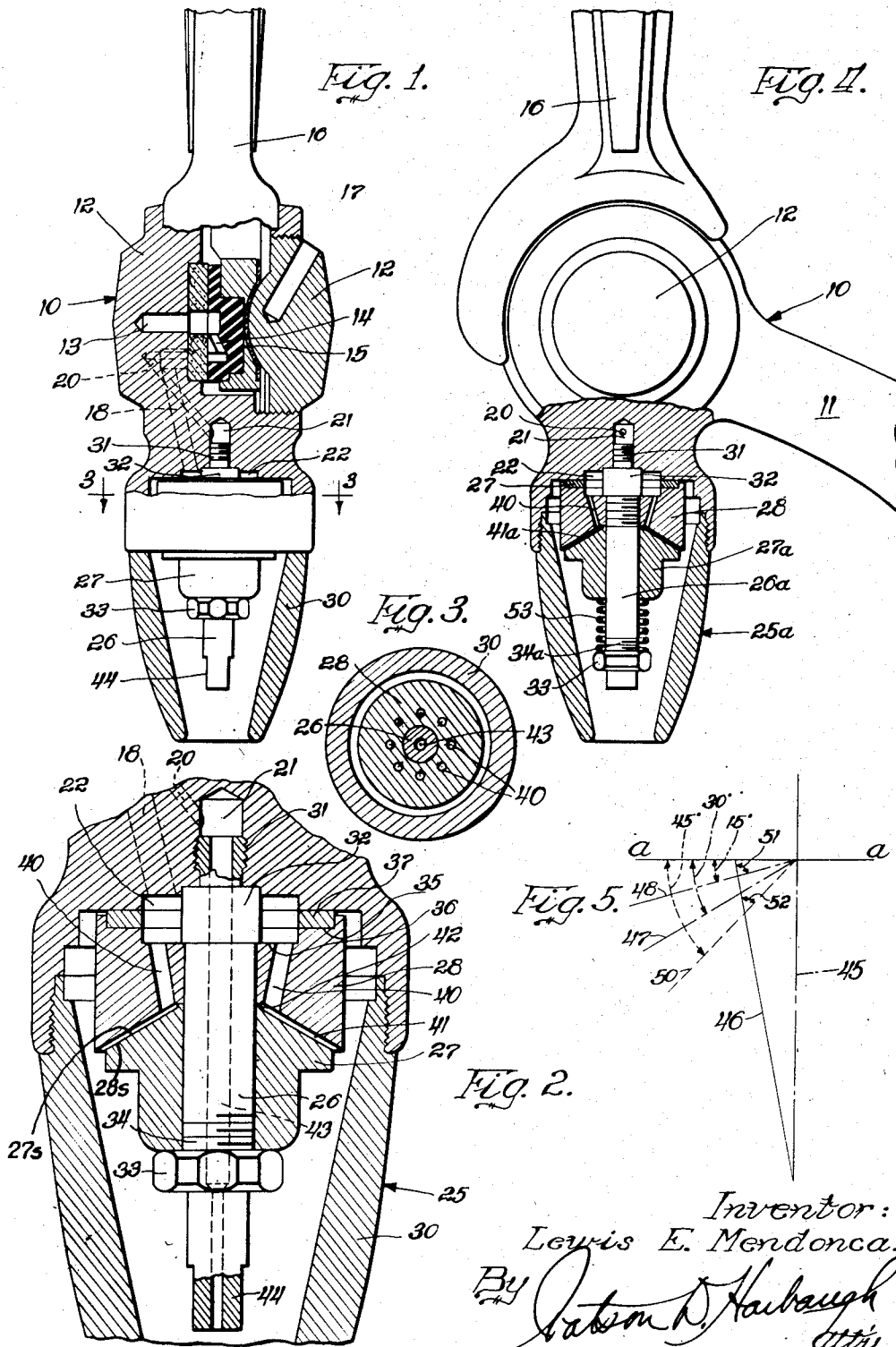
Nov. 3, 1953

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2,657,952

APPARATUS FOR DISPENSING CARBONATED BEVERAGES

Filed June 17, 1948



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UNITED STATES PATENT OFFICE

2,657,952

APPARATUS FOR DISPENSING CARBONATED BEVERAGES

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Application June 17, 1948, Serial No. 33,610

9 Claims. (Cl. 299-107)

1

This invention relates generally to a novel apparatus for dispensing carbonated beverages and more particularly to an improved nozzle or faucet for discharging carbonated water into beverage glasses or cups.

Although the nozzle of this invention is intended primarily for the dispensing of aqueous solutions of carbon dioxide, it also may be employed for other carbonated beverages such as beer, cola or phosphates whether dispensed from a bar or fountain or an automatic vending machine.

In soda fountains and bars where carbonated beverages are dispensed, a carbonating apparatus is usually provided at a point remote from the fountain which serves to prepare a solution of carbon dioxide gas in water. This solution is usually prepared under a gas pressure of approximately seventy-five pounds per square inch and at a relatively low temperature or at a much higher pressure at room temperature. Thus approximately five to five and one-half volumes of carbon dioxide are dissolved in each volume of water. This solution is then conducted through a cooler to a draft arm or faucet from which it is dispensed. At the faucet the pressure of carbonated water is usually somewhat less than the pressure in the carbonator and the temperature is approximately 40° F.

Since the beverage at the nozzle is under a relatively high pressure and, when drawn into the glass is under atmospheric pressure, a considerable pressure reduction occurs during the passage of the beverage through the nozzle and into the glass. The chief problem is to prevent excessive loss of carbon dioxide in accomplishing this pressure drop and in delivering the super saturated solution into the glass. Excessive loss of gas at this time results in a low quality, unpalatable, flat tasting beverage.

In the past, increasing the pressure of carbonation added more gas to the water at the time the solution was formed and insured that even though a substantial amount of gas was lost in the draft arm sufficient remained when the beverage had been mixed. This is uneconomical in that costly carbon dioxide is wasted and also in that more expensive high pressure carbonators must be employed.

Another way in which to increase carbonation up to the draft arm is to place the carbonator inside of a refrigerated space so as to carbonate at a low temperature and thereby increase the amount of carbon dioxide which is dissolved in the water. As in the former case when using

2

an inefficient draft arm, gas is wasted and additional refrigeration must be provided and maintained.

The problem has also been approached from the standpoint of improving the nozzle design of the draft arm so as to reduce the amount of turbulence in the glass as it is filled since it has been observed that the greater the turbulence, the more bubbles of gas are formed and the higher the gas loss. Nozzles heretofore have usually been designed so as to have an outlet port which directs a film of carbonated water radially outwardly along the top of the hollow in the nozzle body which top is gently curved downwardly into the sides of the body. Thus the film flows outwardly and downwardly in contact with the wall of the nozzle body and forms a column of water which passes into the glass.

I have discovered that this is not the best solution to the problem, for the velocity of flow is not reduced soon enough after discharge from the port. When glasses are filled using such nozzles, the velocity of the carbonated water is not checked sufficiently during the time when it is in the nozzle so that excessive turbulence in the glass occurs.

One object of this invention therefore is to provide a novel form of nozzle in which the velocity of the stream is reduced practically simultaneously with the pressure reduction and the velocity of the stream leaving the nozzle is relatively low.

Another object is to provide a nozzle which discharges a saturated fluid under pressure into the atmosphere or receiving vessel while maintaining a saturated condition.

Another object is to provide a nozzle in which the velocity of the stream is reduced before any heat transfer thereto can occur.

Another object is to provide a nozzle which produces an outlet stream having a relatively wide cross section and low velocity.

Another object is to provide a nozzle having a "cone" shaped discharge passage which discharges a thin film of solution directly to the wall of the nozzle, the film striking the wall at a relatively large angle so as to break the velocity of the stream and cause it to change direction.

A further object is to provide a nozzle having an inner wall which is frusto-conical over the entire portion upon which the film flows.

A further object is to provide a nozzle having a discharge opening directing a film of fluid toward the inner wall of the nozzle fluid striking the wall at a substantial angle and the mouth

of the discharge opening being sufficiently close to the wall of the nozzle so that fluid flowing from the opening is not subjected to any substantial pressure drop until it strikes the inner wall of the nozzle and its flow is checked.

A further object of this invention is to provide a nozzle in which the fluid film leaving the discharge opening is varied in thickness according to the rate of fluid flow to maintain the velocity of discharge substantially constant.

Other and additional objects and advantages of this invention will of course present themselves to those familiar with the art on reading the following specification in conjunction with the drawing and the appended claims.

In the drawing:

Fig. 1 is an elevation partially in section showing the construction of a typical draft arm provided with the nozzle of this invention;

Fig. 2 is an enlarged section showing the internal arrangement of the nozzle;

Fig. 3 is a horizontal section taken on line 3—3 of Fig. 1;

Fig. 4 is a side view partially in section of a draft arm similar to that shown in Fig. 1 but provided with a modified embodiment of the nozzle of this invention; and

Fig. 5 is a diagram showing the angular relationship between the discharge opening and the inside wall of the nozzle.

A typical draft arm 10 described and claimed in Patent 2,056,986 for Draft Arm issued to Myron E. Steczynski on October 13, 1936, is partially illustrated in Figs. 1 and 4, and comprises a curving goose-neck 11 having an enlarged portion 12 at its upper end which houses the various valve elements. A conduit (not shown) within the goose-neck 11 conducts carbonated water to a passage 13 in the head portion 12. This passage 13 is in communication with a passage 14 in a rotatable valve member 15 connected to a handle 16. When the handle 16 is in the "off" position as shown in Fig. 4, the passage 14 is in the position shown in Fig. 1 and dead ended against a washer 17. However, when the handle 16 is moved either forwardly or backwardly from the "off" position, the passage 14 is connected to either one of the passages 18 and 20 through openings (not shown) in the washer 17. The passage 20 which is connected to passage 14 when the handle 16 is pushed to the left (as shown in Fig. 4) extends to an axial passage 21 in the lower part of the enlarged head portion 12. The passage 18 which is connected to the passage 14 when the handle 16 is moved to the right from the position shown in Fig. 4 is connected to an annular cutout portion 22 in the lower part of the body 12.

The nozzle 25 comprises a stem 26, a spray guide 27, a collar 28, and an enclosing body or a conical collector 30. The various elements of the nozzle 25 are assembled as shown in Fig. 2. The stem 26 is provided with a thread 31 at its upper end which is screwed into a matching thread in the passage 21, the stem being screwed up tightly so that a shoulder 32 provided thereon lies against the bottom of the head portion 12 forming a seal between the two. The collar 28 and spray guide 27 are mounted on the stem 26 and held in position by a nut 33 which is screwed on to another thread 34 provided on the stem 26. The collar 28 is provided with a pair of annular recesses 35 and 36, a washer 37 being received in the groove 35 and forming a seal between the collar 28 and the body portion 12.

An annular recess 36 the same size as the annular recess 22 is provided in the body portion 12 and the two together form an annular passage which connects the passage 18 to a plurality of passages 40 which extend through the collar 28.

The lower ends of the passages 40 are in communication with a discharge passage 41 formed between the bottom surface 28s of the collar 28 and the upper surface 27s of the spray guide 27 when the two are assembled on the stem 26. The passage 41 is conical in shape, the opposite walls lying parallel to one another. The width of the passage 41 is determined and maintained by a shoulder-like projection 42 provided at the top end of the spray guide 27. By varying the height of the projection 42 it is possible to vary the width and the relative cross sectional area of the passage 41.

The stem 26 is provided with an axial passage 43 whose upper portion is larger than the downstream end thereof. The end of the stem 26 is provided with a flat portion 44 on opposite sides providing a wrenching surface. The body or collector portion 30 of the nozzle 25 is preferably formed of plastic material and is threaded at its upper end for attachment to the body portion 12 of the draft arm 10. It is preferred to make the collector 30 of plastic material for it has been found that when glasses are struck against the plastic surface breakage is less likely to occur than if they strike against an unyielding surface. The inside wall of the collector 30 is frusto-conical in shape, the cone defined having an apex angle of approximately 25°.

The operation of the draft arm 10 is as follows: When the handle 16 is in the "off" position as shown in Fig. 4, the valve member 15 is in the position shown in Fig. 1 and neither of the passages 18 and 20 is connected to the source of carbonated water. When the handle 16 is moved rearwardly, the valve member 15 is rotated so that the passage 14 is in communication with the passage 20 carbonated water then flowing through the passage 20 to the passage 21 and then the axial passage 43 in the stem 26. Thus a jet results which is useful when beverages such as ice cream sodas are prepared. The high velocity of the jet serves to break up masses of solids such as ice cream and causes mixing thereof. However, the water dispensed by the jet has a relatively small amount of carbon dioxide dissolved therein when it has come to rest in the glass for the high velocity and agitation causes excessive bubbles and loss of gas.

When the handle 16 is moved to the forward position, the valve member 15 is moved to such a position that the passage 14 therein is in communication with the passage 18 leading to the annular space 22. Carbonated water, therefore, flows through the passage 18 to the annular space 22 and down the plurality of passages 40 to the discharge passage 41. The plurality of passages 40 are of such a diameter that their combined cross sectional area is approximately four times the flow area of the discharge passage 41 at the point where the passages 40 open into it. Thus no appreciable pressure drop occurs in the draft arm or nozzle prior to the passage of the carbonated water into the conical passage 41. The flow area of the downstream portion of the conical passage 41 is approximately twice as great as that of the upstream portion. Hence, a slight pressure reduction occurs in this passage.

A film of carbonated water still under high pressure emerges from the passage 41 and with-

out changing direction strikes the inner wall of the collector or nozzle body 30. The angle of incidence of this film against the inner wall of the body 30 is quite great. Hence, the film is reflected backwardly upon itself and also downwardly since the angle is less than a right angle.

As the carbonated water passes farther down the nozzle its velocity is further decreased by the frictional drag exerted by the wall of the body 30. Since the velocity is further reduced, the stream area is widened somewhat, and, since the inner walls of the body 30 converge, a stream which is substantially in the form of a column as indicated by broken lines in Fig. 4 emerges from the mouth of the nozzle 25 and falls into the glass (not shown). This stream, because its velocity was reduced while still under pressure and before appreciable heat transfer to it could occur, contains a relatively large amount of carbon dioxide gas. Since the stream is flowing at a relatively low velocity when it reaches the glass less turbulence results than with the higher velocity streams produced by conventional nozzles and less gas is lost.

Since no one can tell actually what occurs within a nozzle of this type, the above description of the operation is largely conjecture and is only included here for the purpose of attempting to explain the improved performance observed.

A draft arm equipped with the nozzle of this invention was connected to a conventional carbonator operating at approximately seventy-five pounds pressure and at a temperature of approximately 40° F. and glasses of water were drawn by moving the handle 16 to the full forward position until the glass was filled and then returning it to the "off" position. The glasses of water thus drawn were then stirred for a period of several minutes, the carbon dioxide evolved being collected and its volume measured. The volumes of gas consistently were over four times the volume of water in the glass ranging from 4.1 to 4.3 volumes. A similar test performed on conventional nozzles produced values as high as 3.9 volumes, but for the most part the volumes were less.

Thus it will be seen that the nozzle of this invention produces a beverage having a higher degree of carbonation than beverages dispensed by conventional nozzles. As has been stated this is important in that the carbonator may be operated at a lower pressure or higher temperature using the nozzle of my invention and still produce the same results as a carbonator at a higher pressure or lower temperature supplying a conventional draft arm or nozzle. Thus a considerable saving in the cost of gas is achieved and less expensive carbonating apparatus may be employed.

In the design of my nozzle certain dimensions and angular relationships have been found to be critical. For example, the slope of the conical discharge passage 41 is preferably approximately 30° from the horizontal. When this slope is less than 15° or greater than 45°, the amount of gas contained in the solution dispensed decreases markedly from the values given above. Similarly, the angle of the inside wall of the nozzle body 30 is preferably about 12° with respect to the axis of the stem 26 although this angle may be varied from approximately 8 to 16° without greatly affecting the result. The critical relationship, however, is the angle of the passage 41 with respect to the inside wall of the body 30

which angle is the angle of incidence of the fluid film on the wall of the nozzle body 30. This angle should be maintained between 57° and 87° preferably having a value of about 72°. If this angle is too small, insufficient braking effect on the velocity of the liquid results producing excessive agitation in the glass. On the other hand, if this angle is too close to a right angle, excessive turbulence occurs within the nozzle which causes gas to be lost from the stream while in the nozzle.

In Fig. 5 the angular relationship of the passage 41 to the inside wall of the nozzle body 30 is shown. The line 45 represents the axis of the stem 26 while the line 46 represents the slope of the inside wall of the nozzle body 30. This line makes an angle of 12° with respect to the line 45. The line 47 represents the preferred angle of the passage 41 while the lines 48 and 50 represent the maximum and minimum values of the slope of the passage 41. Thus it will be seen that the angle of the passage 41 with respect to the side wall may be varied from 15° to 45° inclusive from the horizontal or as shown on the diagram between the angle 51 and the angle 52 as made with the inside surface of the body 30.

Another critical relationship occurs in the relative spacing between the end of the discharge passage 41 and the inner wall of the body 30. If this space is too great or too small the resulting drink is carbonated to a lesser degree. When a passage width in the passage 41 of approximately .005 inch is provided the distance between the mouth of the passage 41 and the inside of the nozzle body 30 should be between $\frac{1}{8}$ and $\frac{1}{2}$ inch for the best results. Thus the distance between the nozzle body 30 and the end of the discharge passage should be approximately 18 or 20 times the width of the passage 41.

In Fig. 4 a conventional draft arm 10 provided with a modified embodiment 25a of the invention is shown. Here all the parts are substantially the same as in the preferred embodiment except that the spray guide 27a is slidably mounted on the stem 26a, a spring 53 being provided between the spray guide 27a and the nut 33 for urging the spray guide 27a upwardly against the collar 28. The spray guide 27a is substantially the same as the spray guide 27 except that the shoulder or projection on the upper end which holds the spray guide 27 away from the collar 28 is not provided. Thus, when the valve 15 is in the "off" position, the spray guide 27a rests against the collar 28. However, when the valve 15 is moved open, pressure of the carbonated water in the passages 40 causes the spray guide 27a to move downwardly compressing the spring 53.

The size of the spring 53 is such that when the valve 15 is open the spray guide 27a will assume a position such that the passage 41a is approximately .005 inch in width. If the valve 15 is less than opened the spray guide 27a moves downwardly to a lesser degree and the passage 41a is less than .005 inch in width. Thus by proper choice of the spring 53 it is insured that the liquid emerging from the passage 41a will have substantially the same velocity regardless of the rate of flow as determined by the setting of the valve member 15, the cross sectional area of the stream being varied to compensate for the decreased rate of flow. The modified embodiment 25a operates substantially the same as the preferred embodiment except for the compensating factor described above.

From the foregoing description it will be seen that a novel nozzle has been provided which sub-

7

stantially improves the quality of the beverage dispensed, which produces a substantial saving in the amount of gas required for carbonation, and which increases the capacity of a given carbonator.

Various changes and modifications such as will present themselves to those familiar with the art may be made in either of the two embodiments disclosed without departing from the spirit of this invention whose scope is defined by the following claims.

What is claimed is:

1. In a nozzle the combination including a stem, a collar having a frusto-conical lower surface received on said stem, a passage through said collar, a spray guide having a frusto-conical upper surface received on said stem slightly spaced from said collar the space between the two forming a second passage which extends downwardly and outwardly from the first mentioned passage, and an enclosing body having an inner wall spaced from the mouth of said second passage, said inner wall extending substantially above the mouth of said second passage.

2. A draft arm nozzle comprising a body, a passage for liquid containing carbon dioxide in said body, a stem depending from said body, a downwardly converging collector surrounding said stem and supported below said body, a collar supported on said stem adjacent said body said collar having a plurality of passages therethrough in communication with said first mentioned passage, a second collar surrounding said stem below said first mentioned collar, a frusto-conical surface on the upper part of said second collar, a complementary diverging surface on the lower part of the first mentioned collar, and means on one of said collars for spacing said surfaces to form a narrow flow area between said surfaces, said flow area terminating adjacent the inner wall of said collector at a point spaced from the top end thereof.

3. A draft arm nozzle comprising a body, a passage for liquid containing carbon dioxide in said body, a stem supported by said body, a hollow collector having a frusto-conical inner wall surrounding said stem and supported below said body, a collar supported on said stem adjacent said body said collar having a plurality of passages therethrough in communication with said first mentioned passage, a second collar surrounding said stem below said first mentioned collar, a frusto-conical surface on the upper part of said second collar, a complementary diverging surface on the lower part of the first mentioned collar, a projection on one of said collars for spacing said surfaces to form a diverging passage between said surfaces, said diverging passage terminating adjacent the inner wall of said collector at a point spaced from the top end thereof.

4. A draft arm nozzle comprising a body, a passage for liquid containing carbon dioxide in said body, a stem threadably supported on said body, a downwardly converging collector surrounding said stem and supported by said body, a collar supported on said stem adjacent said body, an annular recess on the top of said collar in communication with said passage, a plurality of passages through said collar extending from said annular recess to the bottom thereof, a second collar surrounding said stem below said first mentioned collar, a frusto-conical surface on the upper part of said second collar, a complementary diverging surface on the lower part of the first mentioned collar, and means on one of said col-

8

lars for spacing said surfaces to form a narrow flow area between said surfaces, said flow area terminating adjacent the inner wall of said collector at a point spaced from the top end thereof.

5. In a nozzle, the combination including a stem, a collar received on said stem, a passage through said collar, a spray guide received on said stem and supported in spaced relationship with said collar, the space between the two forming a second passage of less cross sectional area at its entrance than that of the outlet of said first passage, said second passage extending downwardly and outwardly from the first mentioned passage, and an enclosing body having an inner wall spaced from the mouth of said second passage and inclined at an angle between 57° and 87° to the line of flow from said second passage, said inner wall extending upwardly a substantial distance above the outlet end of said second passage.

6. In a nozzle, the combination including a stem, a collar received on said stem having a passage for carbonated water therethrough, a spray guide received on said stem below said collar, and a conical collector having an inner wall spaced from said collar, the lower surface of said collar and the upper surface of said spray guide being frusto-conical and slightly spaced apart to define a downwardly diverging passage-way in communication with the first mentioned passage at its upper end, the lower end of the diverging passage-way being spaced slightly from the inner wall of said collector and said inner wall extending upwardly a substantial distance beyond the lower end of said diverging passage-way.

7. A draft arm nozzle comprising a body, a passage for liquid containing carbon dioxide in said body, a stem depending from said body, a downwardly converging collector surrounding said stem and supported below said body, a collar supported on said stem adjacent said body, said collar having a plurality of passages therethrough in communication with said first mentioned passage, a second collar surrounding said stem below said first mentioned collar, a frusto-conical surface on the upper part of said second collar, and a complementary diverging surface on the lower part of said first mentioned collar, said surfaces being spaced apart to define a narrow flow area therebetween and said downwardly converging collector having a frusto-conical inner surface extending substantially above the outlet of said flow area and being spaced slightly outwardly therefrom.

8. A draft arm nozzle comprising a body, a passage for liquid containing carbon dioxide in said body, a stem supported on said body, a downwardly converging collector surrounding said stem and supported by said body, a collar supported on said stem adjacent said body, an annular recess on the top of said collar in communication with said passage, a plurality of passages through said collar extending from said annular recess to the bottom thereof, a second collar surrounding said stem below said first mentioned collar, a frusto-conical surface on the upper part of said second collar, and a complementary diverging surface on the lower part of said first mentioned collar, said surfaces being spaced apart to define a narrow flow area therebetween having an entrance opening of less sectional area than the total flow area of said passages and said downwardly converging collector having a frusto-conical inner surface extending substantially

above the outlet of said flow area and being spaced slightly outwardly therefrom.

9. In a nozzle the combination including a stem, a collar received on said stem, a passage for fluid extending through said collar, a spray guide received on said stem slightly spaced from said collar, the space between the two forming a second passage which extends downwardly and outwardly from the first mentioned passage, said second passage defining a frusto-conical surface, and a collector having a frusto-conical inner wall surrounding said stem and passage, the end of said passage being below the top of said wall and spaced inwardly therefrom.

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15 Number
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