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[54] **CONSTANT PRESSURE, VARIABLE FLOW NOZZLE**

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[51] **Int. Cl.**.....**B05b 1/32**

[58] **Field of Search**.....239/452, 453, 456, 571

[56] **References Cited**

UNITED STATES PATENTS

3,539,112	11/1970	Thompson	239/452
2,568,429	9/1951	Burnam et al.	239/452
2,554,409	5/1951	Holder	239/452
2,582,527	1/1952	Burnett	239/452
2,938,673	5/1960	Allenbaugh	239/456 X

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[57] **ABSTRACT**

A constant pressure, variable flow nozzle is disclosed wherein a flow restricting baffle is automatically positioned by hydraulic means so as to pass only that flow which can be provided at the desired pressure, thereby maintaining effective reach and penetration characteristics of the stream from the nozzle, despite variations in supply. The nozzle contains a hydraulically controlled baffle and is particularly useful as a fire fighting device.

8 Claims, 2 Drawing Figures

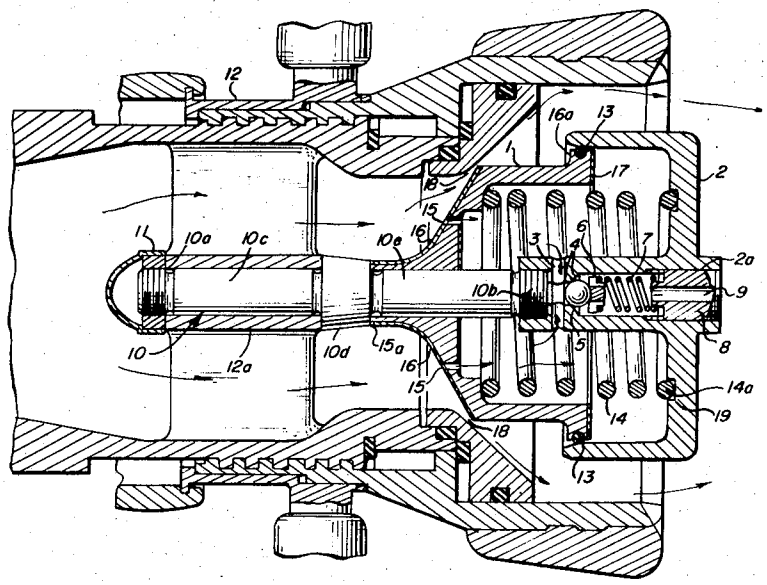


Fig. 1

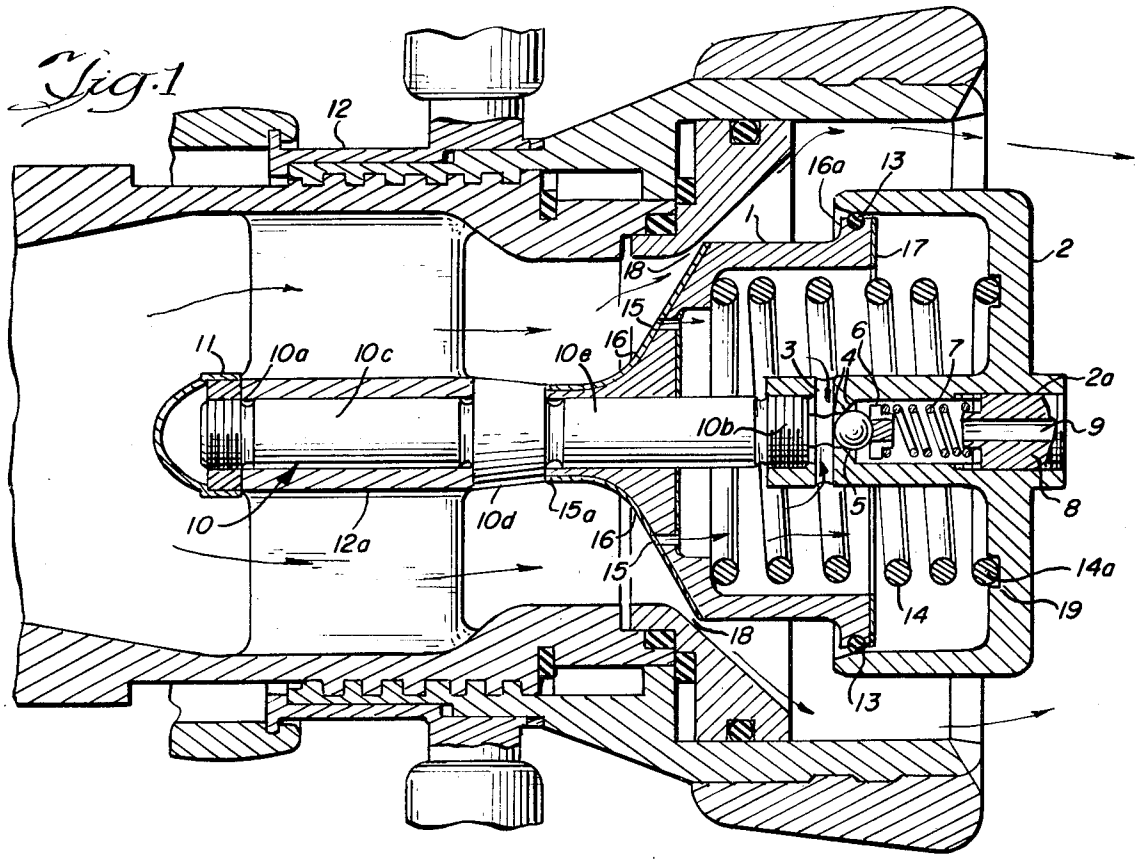
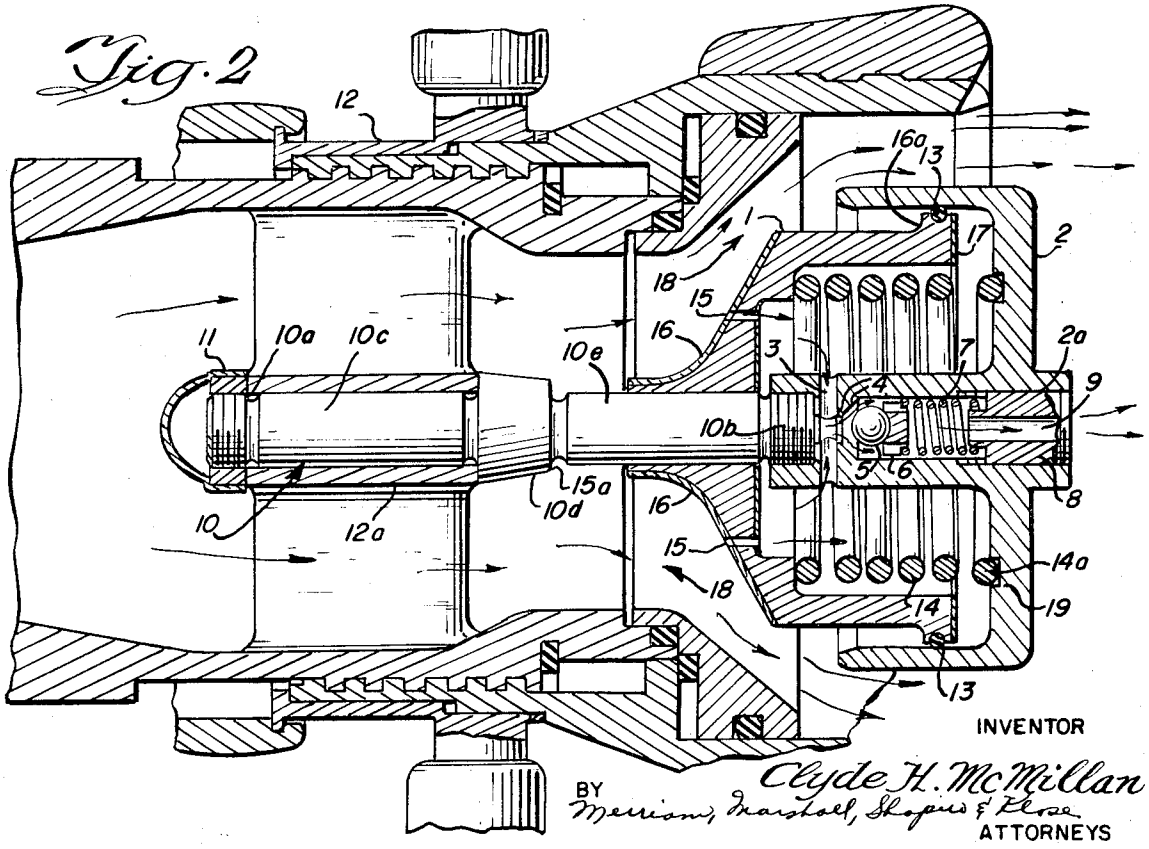


Fig. 2



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CONSTANT PRESSURE, VARIABLE FLOW NOZZLE

The present invention concerns an improved nozzle. In general, it relates to a constant pressure, variable flow nozzle. More particularly, it concerns a nozzle which contains a hydraulically controlled baffle.

Heretofore, various types of nozzles have been employed in combination with other fire fighting equipment to supply water for fighting fires. Variations or changes in the water supply conditions encountered in fighting fires present problems in proper nozzle selection. The water supply available for fighting one fire may be materially different from the water supply available for fighting another fire. For example, in some instances, an ample amount of water under sufficient pressure is available. In other instances only a very limited amount of water is available. In addition, changes in water supply conditions often occur during the course of fighting any particular fire. These latter changes may be caused, for example, by the use of additional fire fighting streams during the course of fighting a fire or by equipment malfunctions such as pumper failure, hose breakage, and the like.

It is important that the nozzles employed with fire fighting equipment be capable of providing satisfactory streams of water even under the varying or changing water supply conditions referred to above. Moreover, it is highly desirable that such nozzles do so automatically, that is, without the necessity for manual adjustment by an operator. Nozzles which do not require manual adjustment by an operator are particularly desirable since such nozzles obviate problems created by operator error or inability due, for example, to poor visibility, etc.

The present invention provides an improved constant pressure, variable flow nozzle eminently suitable for use with fire fighting equipment. The nozzle of the present invention provides a satisfactory stream of water even under water supply conditions heretofore considered as incapable of supplying a satisfactory stream. The nozzle of the present invention provides full utilization of available water supply and automatically compensates for changes occurring in water supply or elevation of nozzle during use. Moreover, the present nozzle automatically provides capabilities heretofore realized only by an operator's correct manual usage of several different size nozzles.

The present invention will now be described by reference to the accompanying drawings.

FIG. 1 is a half sectional view of a nozzle of the present invention in minimum flow configuration;

FIG. 2 is a similar half section showing the nozzle in normal operating configuration.

The nozzle of the present invention comprises a nozzle body **12** provided with baffle-piston **1** and cylinder **2**. Nozzle body **12**, per se, forms no basis of the present invention. Nozzle body **12** comprises a fluid conduit through which fluid flows from left to right as the nozzle is shown in FIG. **1** and FIG. **2**.

Nozzle body **12** may be, for example, a so-called "constant gallonage" fog nozzle body presently available from Elkhart Brass Mfg. Co., Inc., Elkhart, Ind. or Akron Brass Mfg. Co., Inc., Wooster, Ohio. "Constant gallonage" nozzles have the capability of changing the shape or pattern (e.g., from straight-stream to fog pattern) of the stream exiting from the nozzle without changing the flow rate. With such a nozzle, however, flow rate does change considerably with change in pressure.

Cylinder **2** containing baffle-piston **1** is attached to nozzle body **12** by stem **10**. A first stem end **10***a* is threadably attached to acorn nut **11**. A first intermediate section **10***c* of stem **10** between stem end **10***a* and truncated conical section **10***d* is supported by integral support **12***a* of nozzle body **12**. A second stem end **10***b* is threadably attached to cylinder **2**. A second intermediate section **10***e* of stem **10** located between truncated conical section **10***d* and stem end **10***b* is provided with baffle-piston **1**, which slides on stem section **10***e* with a close clearance fit.

Cylinder **2** contains integral valve means **2***a* located about the axis of cylinder **2**. Integral valve means **2***a* comprises fluid passage **3**, valve seat **4**, valve ball **5**, spacer **6**, valve control spring **7** and adjusting screw **8**, containing relief passage **9**.

Baffle-piston **1** slides within cylinder **2**. O-ring **13** provides a hydraulic seal between baffle-piston **1** and cylinder **2**. Spring end **14***a* of return spring **14** may be seated in annular spring seat **19** in cylinder **2**. Return spring **14** urges baffle-piston **1** to slide away from cylinder **2** (to the left as shown in the drawings).

Baffle-piston **1** comprises exterior surface or face **16** and opposing interior surfaces **17**. One or more orifices **15** in baffle-piston **1** provide means for communicating flow and pressure into cylinder **2**. The bulk of fluid entering nozzle body **12** exits from the nozzle by means of annular opening **18** between nozzle body **12** and exterior face **16**. The quantity of flow from the nozzle is determined by the size of annular opening **18**. In the embodiment of the present invention illustrated in FIG. **1** the minimum size of annular opening **18** is determined by the position at which baffle-piston **1** seats, i.e. moves to the left as far as possible. Baffle-piston **1** seats when it slides into contact with truncated conical section **10d**. In other embodiments (not shown) the baffle-piston can be arranged to seat in such a manner that no annular opening is provided until the pressure tends to exceed the predetermined operating pressure of the nozzle.

The operation of the nozzle of the present invention will now be described. At the start of operation water, for example, enters the nozzle at a pressure, for example, of 80 psig which is below the predetermined operating pressure range, for example, 95–105 psig, of the nozzle. Under these conditions, a limited amount of water flows out of the nozzle through annular opening **18** and also flows via orifices **15** into the cylinder **2**. Pressure within nozzle body **12** and cylinder **2** becomes equalized and remains so as long as integral valve **2a** remains closed. The interior surfaces **17** of baffle-piston **1** are greater in projected, or effective area than the effective area of exterior face **16** of baffle-piston **1**, by an amount equal to the area of annular face **16***a*, which is exposed only to atmospheric pressure. As a result, a net force is exerted to the left (as shown in the drawings) on baffle-piston **1**. This force, assisted by spring **14**, retains baffle-piston **1** in a minimum opening position. The pressure at which integral valve **2***a* opens is predetermined and set by adjusting screw **8** acting through control spring **7** and valve spacer **6** on valve ball **5**.

When water pressure furnished nozzle body **12** is increased to the point where the pressure tends to exceed the predetermined operating pressure of the nozzle, such pressure is transmitted through orifices **15** into cylinder **2** where it acts upon integral valve **2***a* causing valve ball **5** to unseat from valve seat **4**. This latter action permits water to flow out relief passage **9**. Since the flow capability of integral valve **2***a* is designed to exceed the flow capability of orifices **15**, pressure within cylinder **2** is maintained at the desired level by flow through integral valve 2a out relief passage **9**. Under these conditions, the increased pressure within the nozzle body **12** tends to create a force on the effective area of exterior face **16** of the baffle-piston **1** which exceeds the opposing force on the interior surfaces **17**. Thus, baffle-piston **1** moves to the right (as shown in the drawings) thereby increasing the size of annular opening **18**. The increased size of annular opening **18** permits a greater quantity of flow through the nozzle. Increased flow through the nozzle tends to reduce the pressure within the nozzle body **12** as a result of the increased friction losses within the nozzle supply system, e.g., hose lines and piping. Thus, provided the pressure at the source of supply exceeds the minimum operating pressure of the nozzle, a steady state flow condition is quickly realized for any flow rate within the operating range of the nozzle.

As supply pressure and flow are further increased, the nozzle of the present invention approaches the operating state illustrated in FIG. 2. Increased supply pressure and flow move the baffle-piston **1** to the right within cylinder **2**, thus increasing the size of annular opening **18**. Water from cylinder **2** is relieved at an appropriate rate by integral valve **2***a* to compensate for increased flow transmitted to cylinder **2** through orifices **15**. Water exiting from integral valve **2***a* through relief passage **9** is introduced into the center of the stream produced by the nozzle and is carried away by the stream.

When water supply pressure and flow are reduced, the action of the nozzle and the direction of travel of baffle-piston **1** are reversed. Under such conditions, movable baffle-piston **1** closes to maintain the desired predetermined operating pressure.

It is apparent from the above that the action of the nozzle of the present invention is fully automatic and is such as to maintain an essentially constant nozzle operating pressure independent of variations in supply, provided supply pressure exceeds a predetermined minimum nozzle operating pressure.

It should also be apparent that the predetermined nozzle operating pressure may be set or determined by resetting a single screw adjustment. The sensitivity of the integral valve may be altered by changing the valve spring to provide, for example, either a more narrow or, on the other hand, a greater operating pressure range for the nozzle.

Nozzles of the present invention have been successfully operated to produce satisfactory streams, both straightstream and fog patterns, where the predetermined nozzle operating pressure was 100 psig (±5 psig) and the water supply rates to the nozzle varied from as little as 125 gallons per minute to as much as 1,200 gallons per minute.

FIG. 1 and FIG. 2 illustrate a preferred embodiment of the present invention in which the baffle-piston has stream shaping characteristics which reduce turbulence within the nozzle. In addition, in the preferred embodiment illustrated an acorn nut is used to help distribute flow smoothly around the baffle support and the baffle stem employs a truncated conical section between the baffle support and the baffle-piston to help further shape flow through the nozzle with maximum efficiency. Modifications and variations within the spirit and scope of the present invention will be apparent to those skilled in the art. For example, the nozzle of the present invention may use various materials of construction for one or more parts; such parts may be provided, for example, with friction reducing or protective coatings. In addition, the integral valve employed may use positioning and retaining means other than an adjusting screw to locate and retain the valve spring and its related parts. Moreover, while the nozzle of the present invention has been described particularly with reference to its use with water for fire fighting purposes, it is apparent that the nozzle may find utility with fluids other than water and for purposes other than fire fighting.

Modifications within the spirit and scope of the present invention as defined by the appended claims are intended to be included.

What is claimed is:

1. An improved nozzle comprising a nozzle body, hydraulic means including a cylinder containing a moveable baffle-piston provided with orifice means, said hydraulic means being adapted to adjust automatically the position of said baffle-piston in said cylinder and with respect to said nozzle body creating a dynamic equilibrium in response to fluid quantity and pressure supplied said nozzle, to thereby provide nozzle pressure maintained at a predetermined, substantially constant level.

2. The nozzle of claim **1** wherein said baffle comprises a face exterior to said cylinder and faces interior to said cylinder, said interior faces having a combined effective surface area greater than the effective surface area of said exterior face.

3. The nozzle of claim **2** wherein said baffle is provided with orifice means providing fluid passageway between said exterior and interior faces.

4. The nozzle of claim **1** wherein said cylinder is provided with integral valve means adapted to relieve said cylinder so as to maintain pressure in said cylinder within a predetermined pressure range.

5. The nozzle of claim **4** wherein said valve means include adjustable screw means for setting said predetermined pressure range.

6. The nozzle of claim **3** wherein the flow capability through said orifice means is exceeded by the flow capability of the integral valve means defined in claim **6**.

7. A fire nozzle comprising a nozzle body including a fluid conduit;

a stem, one end of said stem being attached to said nozzle body and the other end being attached to a cylinder;

a movable baffle-piston adapted to slide within said cylinder and along a section of said stem;

orifice means in said baffle-piston providing a passageway for fluid to flow from said fluid conduit into said cylinder;

hydraulic valve means adapted to permit fluid to flow out from said cylinder when the pressure within said cylinder tends to exceed predetermined pressure;

said baffle-piston being so arranged that its position with respect to said nozzle body defines an annular opening which permits fluid to flow around said piston-baffle and out of said nozzle.

8. A nozzle as defined by claim **7** wherein the size of said annular opening is controlled hydraulically.

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