Feb. 3, 1953 F. WORNALL 2,627,439

HOSE NOZZLE

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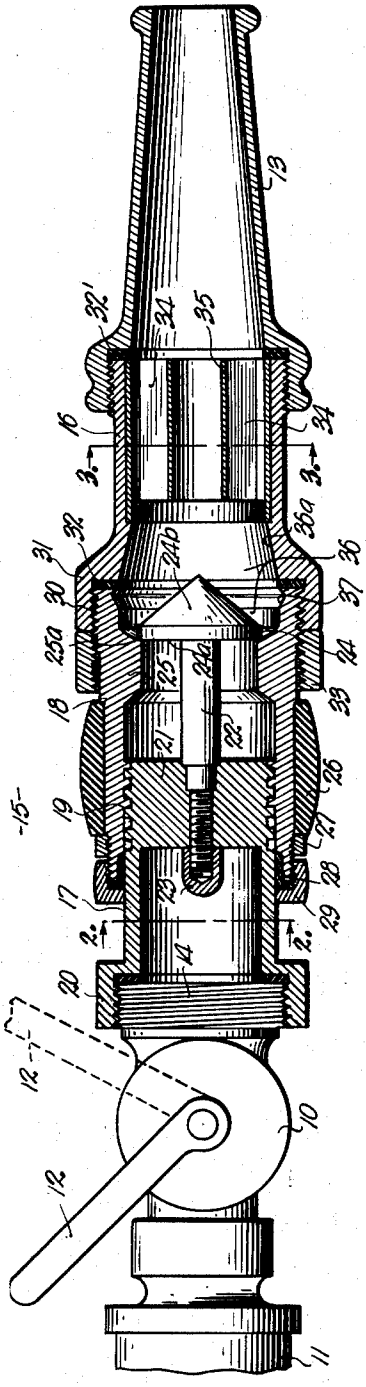

Fig. 1.

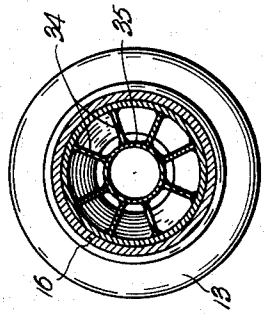

Fig. 3.

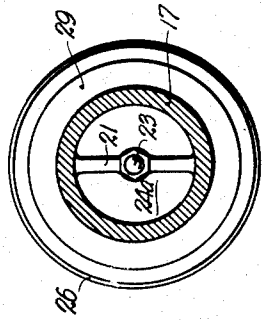

Fig. 2.

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HOSE NOZZLE

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9 Claims. (Cl. 299—150)

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This invention relates in general to hose nozzles and it deals more particularly with fire hose nozzles for controlling water discharge.

An object of the invention is to provide an adjustable nozzle adapted to issue a water stream of optimum character under all conditions of operation encountered in practice.

Another object is to provide an adjustable nozzle adapted to issue any desired character of stream at any desired pressure within a predetermined range, regardless of the water inlet pressure to the nozzle.

A further object is to provide an adjustable fire hose nozzle that can be manned by a single operator without assistance, and with which the best type of stream for any type of fire can be obtained by the operator at will.

Still another object of the invention is to provide a fire hose nozzle with an adjustable valve mechanism in the nozzle for controlling the rate of flow of water therethrough.

A further object is to provide a hose nozzle which may readily be converted for use in issuing either a straight stream or a fog type of stream.

Other and further objects of the invention together with the features of novelty whereby the objects are achieved will appear in the course of the following description.

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals are employed to indicate like parts of the various views.

Fig. 1 is a longitudinal cross section of a nozzle embodying my invention,

Fig. 2 is a transverse cross section taken along the line 2—2 of Fig. 1 in the direction of the arrows, and

Fig. 3 is a transverse cross section taken along the line 3—3 of Fig. 1 in the direction of the arrows.

Referring more particularly to the drawings, the numeral 10 indicates generally a shut off valve of conventional type connected onto the discharge end of a hose 11; the mechanism of this valve has not been detailed since its specific construction forms no part of the present invention, but it will be understood that the valve is opened and closed by a handle 12, adapted to be shifted manually from closed position, shown by solid lines, to open position shown by dotted lines, and vice versa. Under operating conditions the valve is at all times either completely closed or completely opened, it being impractical or impossible under usual line pressures to hold it in any intermediate position.

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Numeral 13 indicates a conventional tapered nozzle tip. This is internally threaded at its large end, and in the usual fire hose nozzle assembly employed in the past, it has been customary to screw the tip directly on the matching externally threaded end 14 of the shut-off valve 10. In an assembly of this kind the firemen manning the nozzle had virtually no control over the stream issuing therefrom, other than could be achieved by the removal of one tip and the substitution of a tip having a different taper and a discharge opening of different size. Some adjustment of the type of stream was possible, of course, by adjusting the pressure on the hose at the hydrant (or at the pumper if the hose was connected to the latter) but in fire fighting a number of hoses ordinarily are connected to the same hydrant or the same pumper, and adjustment of pressure to obtain the desired type of stream at one nozzle inevitably affects one or more of the other hose streams adversely.

Another shortcoming of the conventional nozzle assembly resides in the fact that when the shut-off valve 10 is opened the surge of the stream from the nozzle at full pressure imposes a tremendous backward force on the nozzle—a force so great that in the average case three men are required to hold the nozzle. The backward force continues to a considerable extent throughout the time the valve is open and the volume of water rushing through the nozzle has so much momentum and inertia that it is difficult for them to shift the nozzle, for example, to play the stream from side to side while maintaining it under complete control.

To overcome these difficulties and to obtain other advantages which will be pointed out presently, I have removed the tip 13 from the shut-off valve 10 and have interposed between them a control valve assembly 15 and a stream straightener 16 now to be described.

The control valve comprises a stationary inner barrel 17 and rotatable outer barrel 18, the two being screw threadedly connected as shown at 19 whereby rotation of the outer barrel causes the same to travel axially relative the inner barrel. The inner barrel has an enlarged internally threaded flange section 20 at one end for attachment to the threads 14 of the shut-off valve, and, at the opposite end it has a longitudinal web 21 extending diametrically across the bore of the barrel. This web supports a forwardly projecting stem 22, the rear portion of which is a section of reduced diameter threaded into a tapped hole in the center of the web and secured by a cap nut 23.

At the forward end of the stem, and preferably formed integral therewith, is a stationary valve 24. The rear face 24a of the valve lies in a flat plane perpendicular to the axis of the barrel and, as shown, is adapted to seat about its margin on the forward face 25a of an annular rib or protuberance 25 formed in the bore of the rotatable barrel 18. To facilitate turning the outer barrel (for example, to back the seat 25a away from the valve) a tight fitting rubber sleeve 26 is provided on the exterior of the barrel; secured to the barrel by a retaining nut 27, this may be ribbed longitudinally, knurled or otherwise surface marked to afford a suitable hand grip. A packing gasket 28 between the two barrels held in place by a packing nut 29 prevents leakage of water through the threaded section 19 of the barrels.

The forward end 30 of the rotatable barrel is externally threaded to receive the internally threaded flange 31 of the stream straightener 16. The opposite end of the stream straightener is externally threaded as shown to receive the usual nozzle tip 13. Gaskets 32 and 32' are provided to prevent leakage at the respective joints, and a lock nut 33 is provided to additionally secure the stream straightener to barrel 18.

Essentially, the stream straightener, as its name implies, comprises a set of longitudinal vanes or fins 34 through which the stream passes en route to the tip, the fins being so arranged as to substantially prevent rotation of the stream about its own axis and overcome turbulence of the water resulting from its passage through the control valve 15. Conveniently, the fins may extend radially from a small central tube 35 as shown, but it will be understood that any disposition of the vanes which subdivides the bore into a number of straight parallel passageways (e. g. crossed, vertical and horizontal vanes) will be satisfactory.

Returning to the valve 24, it will be seen that the forward surface 24b is conical and the valve as a whole is disposed in a chamber 36 formed partly in the rotatable barrel 18 and partly in the attached stream straightener. This chamber flares outwardly from the valve seat 25a, then continues for a short distance parallel to the axis of the bore where it joins an annular V-notch 37, the forward face of which is substantially parallel to the forward face 24b of the valve. This notch lies at the end of barrel 18. Proceeding forwardly the valve chamber 36 comprises a tapered bore 36a in the stream straightener, the vanes 34 being disposed in a cylindrical section intermediate the tapered section just mentioned and the tapered passageway formed by the tip 13.

In using the assembly illustrated, the shut-off valve 10 is opened first permitting full line pressure to be imposed on the closed control valve 24. Then the latter valve is opened slowly by the operator, by manually rotating barrel 18 to back the valve seat 25a away from the valve. Because this can be done slowly, it avoids the tremendous surge ordinarily experienced, and the operation can be performed by a single man holding the nozzle. The control valve can be opened to whatever degree is necessary to obtain the type of stream desired, and thus the man at the nozzle can adjust and control the stream regardless of the hydrant or pumper pressure connected to the hose; it is possible, in other words, to have a number of hoses connected to the same hydrant or pumper and yet obtain in each case the type of stream desired regardless of whether the hose in that case is long or short and regardless of whether a light or heavy stream is needed.

Tests show that on an average the best type of stream is developed when the discharge pressure of the stream at the tip is in the neighborhood of 50 p. s. i., and at this pressure, one man can hold and manipulate the nozzle either without assistance or with a minimum of assistance. In the past, for a given hydrant pressure or pumper pressure, the nozzle man could adjust the discharge pressure up and down toward this optimum value only by selecting a tip having a smaller or larger discharge opening; in making such a selection, however, he obviously had no choice as to the volume-carrying capacity of that tip and the carrying distance of the stream. Since water volume and carrying distance are factors of primary importance in fire fighting, these, rather than discharge pressure, customarily have been the determining factors in selecting tip size, and because nozzles therefore have rarely been operated at optimum discharge pressure, two or three men have been necessary at each nozzle. With my arrangement, however, any tip size may be selected and regardless of the tip size or the hose pressure maintained by the hydrant or pumper, optimum discharge pressure at the nozzle can be obtained by proper adjustment of the control valve 15.

It also is possible to produce a fog stream with my nozzle simply by loosening the lock nut 33 and removing the end sections of the nozzle, comprising the stream straightener and nozzle tip. As a matter of fact, a wide variety of streams can be obtained with the latter parts omitted from the assembly. For example, using a hydrant pressure of approximately 150 p. s. i. and a rotatable barrel 18 whose discharge opening is approximately 2 inches in diameter, the following streams are obtained in practice:

1. With the valve seat backed off from the valve 1/8 inch—a comparatively straight, solid stream having minimum turbulence, carrying 70 feet and having a spread of approximately 3 feet diameter at 70 feet.

2. With the valve seat backed off from the valve 1/8 inch—a straight, comparatively solid stream having minimum turbulence, carrying 80 feet and having a spread of 8 feet diameter at 80 feet.

3. With the valve seat backed off from the valve 1/4 inch—a straight, solid stream having minimum turbulence, carrying 140 feet and having a spread of approximately 8 feet diameter at 140 feet.

4. With the valve seat backed off from the valve 3/8 inch—a straight, comparatively solid stream having minimum turbulence, carrying 160 feet and having a spread of approximately 10 feet diameter at 160 feet.

5. With the valve seat backed off from the valve 1/2 inch—a well distributed stream of semi-fog character diverging 40° at the nozzle, carrying approximately 80 feet and having a spread of 25 feet diameter at 80 feet.

6. With the valve seat backed off from the valve 3/4 inch—a well filled fog stream diverging 60° at the nozzle and carrying 65 feet.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinbefore set forth together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

Inasmuch as various embodiments of the invention may be made without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a hose nozzle, a tube connected at its rear end to the discharge end of a hose, said tube having an internal spider carrying a central stem projecting longitudinally beyond the forward end of the tube and terminating in an enlarged valve, the face of the valve nearest said tube being disposed in a flat plane perpendicular to the axis of the tube and the opposite face of the valve tapering forwardly to an apex, an extension tube encircling said stem and valve, said extension tube screw threadedly connected to said first tube whereby rotation of the tubes relative one another causes said extension tube to travel longitudinally relative said stem and valve, said extension tube having an internal annular rib adapted to seat against said flat face of the valve, the bore of said extension tube flaring outwardly from said seat around said valve and terminating at the open end of the tube in an annular V-notch encircling the forward face of the valve, the outer face of said V-notch substantially paralleling said forward face of the valve.

2. In a hose nozzle, a tube connected at its rear end to the discharge end of a hose, said tube having an internal spider carrying a central stem projecting longitudinally beyond the forward end of the tube and terminating in an enlarged valve, the face of said valve nearest said tube being disposed in a flat plane perpendicular to the axis of the tube and the opposite face of the valve tapering forwardly to an apex, an extension tube encircling said stem and valve, said extension tube being screw threadedly connected to said first tube whereby rotation of said tubes relative one another causes the extension tube to travel longitudinally relative said stem and valve, said extension tube having an internal annular rib adapted to seat against said flat face of the valve, the bore of said extension tube flaring outwardly from said seat around said valve and then converging forwardly substantially parallel to the forward face of the valve.

3. In a hose nozzle, a tube adapted to be connected at its rear end to the discharge end of a hose, a second tube co-axial with said first tube, said second tube supported on said first tube for limited movement axially thereof and having its forward end projecting beyond the forward end of said first tube, said second tube having a large bore extending inwardly from its forward end and terminating in an annular shoulder with a smaller bore extending inwardly beyond said shoulder, said shoulder spaced inwardly from the forward end of said second tube by a distance less than the diameter of said larger bore whereby the shoulder and larger bore form the bottom and sides respectively of a relatively shallow pocket at the forward end of said second tube, said first tube having an internal spider carrying a central stem projecting longitudinally through said smaller bore and terminating in an enlarged valve disposed in said pocket, the rear face of said valve adapted to seat on said shoulder when said second tube is advanced axially relative to said first tube and adapted to unseat when the second tube is moved in the opposite direction, the forward face of said valve tapering forwardly to an apex which projects slightly beyond the plane of the forward end of said second tube when the rear face of said valve is seated on said shoulder.

4. A nozzle as in claim 3 wherein said larger bore has an annular V-notch the outer face of which terminates at the extreme forward end of said bore.

5. A nozzle as in claim 4 wherein the outer face of said notch is substantially parallel to the forward face of said valve.

6. In a dual purpose hose nozzle, a tube adapted to be connected at its rear end to the discharge end of a hose, a second tube co-axial with said first tube, said second tube supported on said first tube for limited movement axially thereof and having its forward end projecting beyond the forward end of said first tube, said second tube having a large bore extending inwardly from its forward end and terminating in an annular shoulder with a smaller bore extending inwardly beyond said shoulder, said shoulder spaced inwardly from the forward end of said second tube by a distance less than the diameter of said larger bore whereby the shoulder and larger bore form the bottom and sides respectively of a relatively shallow pocket at the forward end of said second tube, said first tube having an internal spider carrying a central stem projecting longitudinally through said smaller bore and terminating in an enlarged valve disposed in said picket, the rear face of said valve being adapted to seat on said shoulder when said second tube is advanced axially relative to said first tube and adapted to unseat when the second tube is moved in the opposite direction, and an elongated tubular nozzle tip detachably connected to the forward end of said second tube, said tip having a bore whose diameter at the rear end of said tip is substantially the same as the diameter of said large bore, the bore of said tip converging forwardly toward the discharge end of said tip.

7. In a hose nozzle, a tube adapted to be connected at its rear end to the discharge end of a hose, a second tube co-axial with said first tube, said second tube supported on said first tube for limited movement axially thereof and having its forward end projecting beyond the forward end of said first tube, said second tube having a large bore extending inwardly from its forward end and terminating in an annular shoulder with a smaller bore extending inwardly beyond said shoulder, said shoulder spaced inwardly from the forward end of said second tube by a distance less than the diameter of said larger bore whereby the shoulder and larger bore form the bottom and sides respectively of a relatively shallow pocket at the forward end of said second tube, said first tube having an internal spider carrying a central stem projecting longitudinally through said smaller bore and terminating in an enlarged valve disposed in said pocket, the rear face of said valve adapted to seat on said shoulder when said second tube is advanced axially relative to said first tube and adapted to unseat when the second tube is moved in the opposite direction, the forward face of said valve tapering forwardly to an apex which projects slightly beyond the plane of the forward end of said second tube when the rear face of said valve is seated on said

shoulder, and an elongated tubular nozzle detachably connected to the forward end of said tube, said tip having a bore whose diameter at the rear end of said tip is substantially the same as the diameter of said large bore, the bore of said tip converging forwardly toward the discharge end of said tip.

8. A nozzle as in claim 7 wherein the bore of said nozzle tip converges forwardly at an angle oblique to the forward face of said valve.

9. In a hose nozzle, a tube adapted to be connected at its rear end to the discharge end of a hose, a second tube co-axial with said first tube, said second tube supported on said first tube for limited movement axially thereof and having its forward end projecting beyond the forward end of said first tube, said second tube having a large bore extending inwardly from its forward end and terminating in an annular shoulder with a smaller bore extending inwardly beyond said shoulder, said shoulder spaced inwardly from the forward end of said second tube by a distance less than the diameter of said larger bore whereby the shoulder and larger bore form the bottom and sides respectively of a relatively shallow pocket at the forward end of said second tube, said first tube having an internal spider carrying a central stem projecting longitudinally through said smaller bore and terminating in an enlarged valve disposed in said pocket, the rear face of said valve adapted to seat on said shoulder when said second tube is advanced axially relative to said first tube and adapted to unseat when the second tube is moved in the opposite direction, the forward face of said valve tapering forwardly

to an apex which projects slightly beyond the plane of the forward end of said second tube when the rear face of said valve is seated on said shoulder, said larger bore having an annular V-notch the outer face of which is substantially parallel to the forward face of said valve and terminates on the extreme forward end of said bore, and an elongated tubular nozzle tip detachably connected to the forward end of said second tube, said tip having a bore whose diameter at the rear end of said tip is substantially the same as the diameter of said large bore, the bore of said tip converging forwardly at an angle oblique to the forward face of said valve.

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