June 13, 1961 W. S. THOMPSON 2,988,289

HYDRAULICALLY OPERATED FOG NOZZLE

Filed July 22, 1958

Fig. 1.

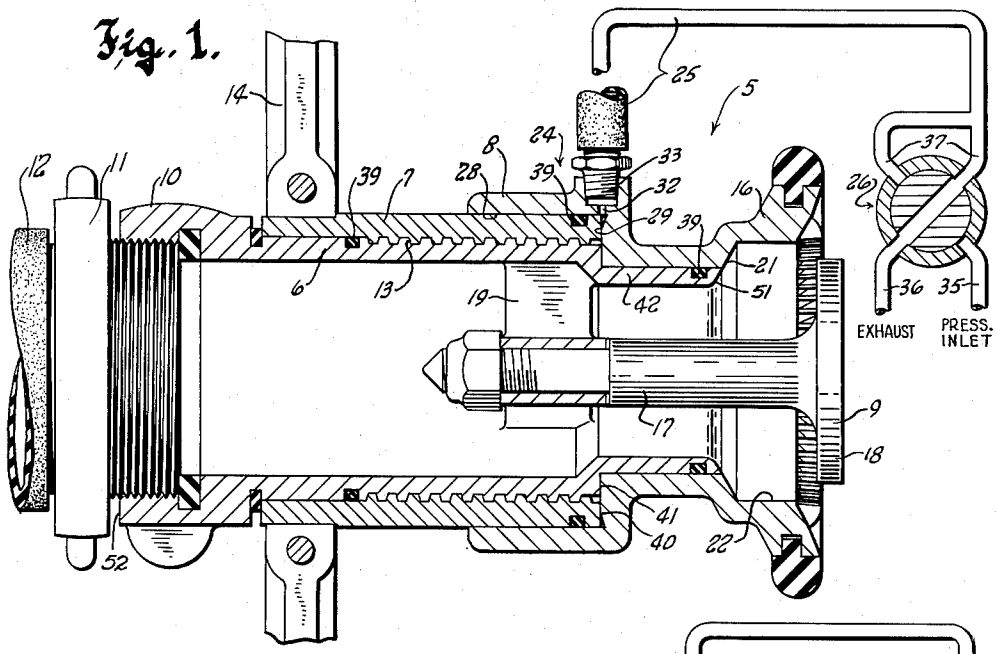


Fig. 2.

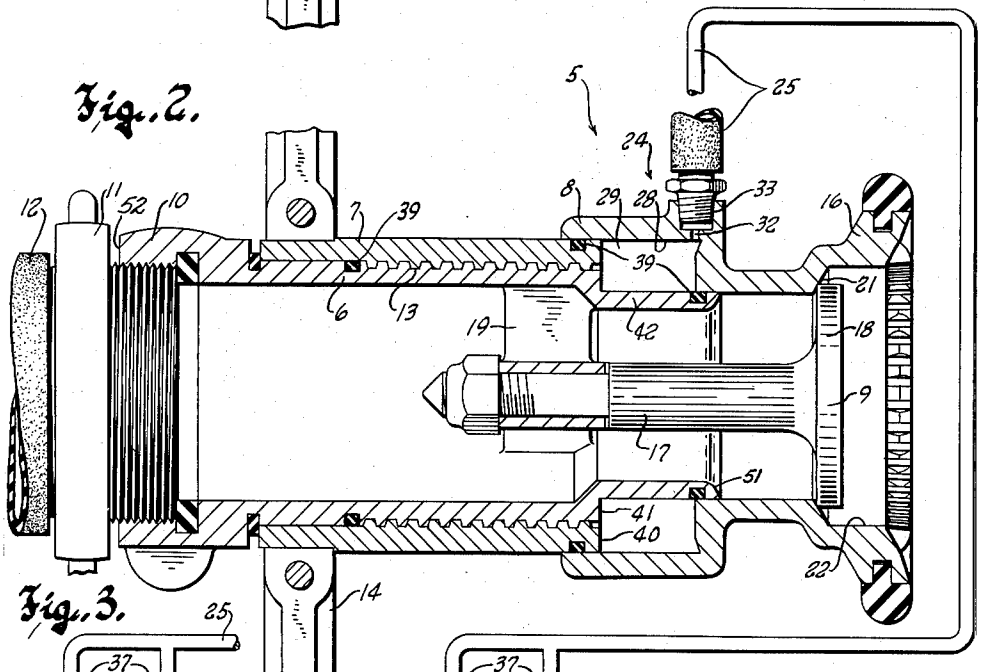
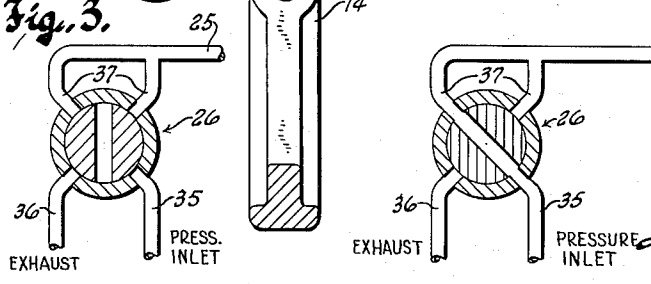


Fig. 3.



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HYDRAULICALLY OPERATED FOG NOZZLE

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This invention relates to firefighting apparatus and refers more particularly to hose nozzles of the type that are adjustable to emit either a solid stream or a wide angled spray. Usually such a nozzle could not be fixed to the top of an extensible ladder because of the need for effecting adjustments to it at the nozzle itself, and, as a result, such nozzles were often not used in situations where they could have been most effective.

The present invention seeks to overcome this objection and, to that end, has as its purpose to provide an improved, adjustable fire hose nozzle which may be remotely controlled to produce the desired type of output.

More specifically, it is an object of this invention to provide a fire hose nozzle of the character described having hydraulic pressure responsive means for adjustment thereof, whereby the nozzle can be conveniently controlled from a remote point and can therefore be mounted on the end of an extensible ladder and regulated from control means located on the ground or on a truck on which the ladder is carried.

Another specific object of this invention is to provide a fire hose nozzle of the character described wherein the reaction force of the stream of water issuing from the nozzle outlet is utilized to effect adjusting axial motion of the outlet section of the nozzle toward the rear thereof, forward motion of the outlet section being effected by hydraulic cylinder and piston means connectible with a source of fluid under pressure through a single pressure fluid line, thus at once simplifying control of the nozzle and providing a "fail safe" feature which assures that water will continue to issue from the nozzle outlet in the event of damage to the pressure fluid line.

It is also a specific object of this invention to provide a remotely controllable fire hose nozzle of the character described which will permit smooth and positive direct manual control of the position of adjustment of the nozzle, with no tendency for the outlet section of the nozzle to move abruptly to one or the other of its extreme positions of adjustment, whether or not pressure fluid is being applied to its hydraulic control mechanism.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a longitudinal sectional view of a fire hose nozzle embodying the principles of this invention, the nozzle being shown in its position of adjustment to produce a wide angle fog spray, and the control valve mechanism for the nozzle being shown more or less diagrammatically;

FIGURE 2 is a view similar to FIGURE 1, but showing the nozzle adjusted to its fully closed position; and

FIGURE 3 is a substantially diagrammatic view of the control valve for the nozzle, shown in its position in

which it holds the nozzle in a desired position of adjustment.

Referring now more particularly to the accompanying drawing, the numeral 5 designates generally the nozzle of this invention, which comprises, in general, an inner tubular member 6 having a front end 51 and a rear end 52, an intermediate tubular member or sleeve 7, an outer tubular member or cuff 8 and a valve element 9.

The inner tubular member 6 of the nozzle is its stationary part, i.e. its main body. On it are mounted all the other parts of the nozzle. Its front end portion 42 is abruptly reduced in diameter, which results in a forwardly facing shoulder 41, and at its rear end it has a coupling element 10 by which the nozzle may be detachably connected to a suitable fitting 11 on the end of a hose 12.

The intermediate tubular member 7 is shorter than the inner body member and encircles the latter, being connected thereto by threads 13 in the manner commonly employed in adjustable fire hose nozzles of this type, so that rotation of the intermediate member relative to the inner body member results in back and forth movement of the intermediate member. A handle 14 fixed to the rear end portion of the intermediate member provides means for turning the same to effect manual adjustment thereof axially along the inner body member. As shown, when the intermediate member or sleeve 7 is in its normal position, its front end 40 is flush with the shoulder 41.

The outer tubular member or cuff 8 slidably encircles the front end portions of both the inner body member 6 and the intermediate member 7, and has at its front an outlet section 16 which at all times projects beyond the front end of the body member to define the mouth of the nozzle. The valve element 9 is mushroom-shaped, comprising a stem 17 with an enlarged head 18 on its front end. The stem of the valve element is secured in the hub of a spider 19 fixed in the open front end of the inner tubular body member 6, from which it projects forwardly to locate the head 18 of the valve element at a fixed distance forwardly of the front end 51 of the body where it cooperates with the cuff 8 to regulate the type of stream pattern issuing from the nozzle.

The bore of the cuff 8 is stepped to provide a small diameter portion 20 which is slidably circumjacent to the front end portion 42 of the nozzle body, a rearwardly opening counterbore 28 in which the front end portion of the sleeve 7 is slidably received, and a large diameter outlet portion 22 in which the valve head 18 is located. The latter portion 22 of the bore forms the mouth of the nozzle and is substantially larger in diameter than the valve head 18 with which it cooperates in the well-known manner, to adjust the pattern of the stream issuing from the nozzle.

At the junction between the bore portions 20 and 22 is an abrupt forwardly facing shoulder 21. In the most forward position of the cuff shown in FIGURE 2, this shoulder 21 seats against the valve head 18 to shut off all flow through the nozzle. In the rearmost position of the cuff defined by the bottom of its counterbore 28 bearing against the shoulder 41, the shoulder 21 is flush with the front end 51 of the nozzle body, as seen in FIGURE 1.

As best shown in FIGURE 2, the length of the uniform small diameter portion 20 of the cuff bore is greater than the distance the valve head 18 is spaced ahead of the front end 51 of the nozzle body so that securement of the valve element to the nozzle body serves to hold the cuff assembled with the body. It is also important to observe that the length of the counterbore 28 is such that when the cuff is in its forwardmost position, shown in FIGURE

2, the counterbore **28** still encompasses a substantial portion of the intermediate member or sleeve **7**.

It is significantly important that the bore of the cuff is at no point smaller than the bore through the body of the nozzle. Hence, the water issuing from the nozzle can exert no forward force upon the cuff. On the contrary, the water issuing from the nozzle at all times imposes a rearward thrust upon the cuff, such rearward thrust being the result of the reaction force of the water upon the cuff and especially upon its abrupt forwardly facing shoulder **21**. Hence, the stream issuing from the nozzle will at all times tend to move the cuff rearwardly.

By virtue of this rearward thrust imposed upon the cuff by the reaction force of the water issuing from the nozzle, remote control of the nozzle may be effected with a single fluid pressure line leading to the nozzle. For this purpose the nozzle is provided with cylinder and piston means, indicated generally by the numeral **24**, connectible by means of a fluid pressure line **25** with a remote source of hydraulic pressure (not shown) through a control valve **26**. Forward movement of the cuff is effected by the cylinder and piston means, while rearward movement thereof is effected by the reaction force of the stream of water issuing from the nozzle, and the control valve **26** determines which of these forces will predominantly act upon the cuff.

The cylinder of the cylinder and piston means is relatively movable and is defined by the counterbore **28** in the rear portion of the cuff, while the piston, which is relatively fixed, comprises the front end **40** of the intermediate tubular member, together with the forwardly facing shoulder **41** on the inner tubular body member. The counterbored rear portion of the cuff has a port **32** therein which opens to its counterbore adjacent to the bottom thereof, and this port is provided with a suitable fitting **33** to which the fluid pressure line **25** is connected.

When fluid under pressure is introduced into the annular chamber **29** conjointly defined by the rear portion of the cuff and the front portion of the inner tubular body member, through the port **32**, such pressure fluid reacts between the bottom of the counterbore and the relatively fixed piston **40, 41**, thus moving the outer tubular member forwardly, overcoming the reaction force exerted thereon by the stream of water leaving the nozzle.

The control valve **26** may be a four-way, two-position type having a pressure fluid inlet **35** connectible with a source of fluid under pressure, an exhaust outlet **36**, and a pair of motor ports **37**, both of which are connected to the line **25** which communicates with the cylinder. In the position of the control valve illustrated in FIGURE 2, one of the motor ports **37** is connected with the pressure fluid inlet **35**, so that fluid under pressure is sent to the cylinder. With the control valve in this position full fluid pressure is being delivered to the cylinder and, as a result, the cuff has been moved to its forwardmost position defined by the engagement of the shoulder **21** with the valve head, closing the nozzle as shown. To open the nozzle, or to move it farther toward its wide angle fog spray position, the control valve is moved to the position shown in FIGURE 1, and held there until the nozzle reaches the desired adjustment. In this case the motor ports are connected with the exhaust outlet, and pressure fluid can flow out of the cylinder as the cuff moves rearwardly in response to the reaction force of the emerging stream against it and especially against its forwardly facing shoulder **21**. To hold the nozzle in any desired position of adjustment the control valve is set in the position illustrated in FIGURE 3, in which communication of the motor ports with both the pressure inlet and the exhaust outlet is blocked, so that the amount of fluid in the cylinder determines the most rearward position in which the cuff will be held by the reaction force of the water thereon.

To assure against fluid pressure leakage, O-rings **39**, or their equivalent, are provided between the front of the sleeve and the rear portion of the cuff, and between the front end of the body and the cuff.

It will be understood that manual adjustment of the nozzle can be effected at any time by rotating the intermediate member by means of the handle **14** to effect forward or rearward axial movement of the sleeve **7** with respect to the body **6**. If there is pressure fluid in the cylinder, movement of the sleeve will be transmitted to the cuff, or vice versa, through the pressure fluid, so that the cuff and the sleeve will maintain the relative positions to which they are adjusted by the hydraulic control valve. Hence, the remote control afforded by control valve **26** can be manually overridden at the nozzle. If there is no pressure fluid in the cylinder the stream of water issuing from the nozzle outlet will force the cuff rearwardly and hold the bottom of its counterbore **28** against the front end **40** of the sleeve. Hence, there will be no tendency for the cuff to move back and forth in response to water pressures thereon.

From the foregoing description, taken in connection with the accompanying drawing, it will be apparent to those skilled in the art that this invention makes possible the complete and accurate adjustment of a fire hose nozzle both directly at the nozzle and at a point far remote therefrom, and that such adjustment may be effected by means of only a single pressure fluid line connected between the nozzle and a simple control valve. It will also be apparent that the hose nozzle of this invention is capable of smooth, precise adjustment, either remotely or manually directly at the nozzle, with no tendency for the nozzle to move out of any position of adjustment to which it may be manually set, and that it has a "fail safe" feature whereby water will continue to issue from the nozzle in the event of a failure or defect in the pressure fluid line.

What is claimed as my invention is:

1. A fire hose nozzle comprising: a tubular body having front and rear ends, the latter having means for attaching the nozzle to a fire hose, the front end portion of the body having a smooth uniform outside diameter; a circular valve head larger in diameter than the outside diameter of said front end portion of the body; means securing the valve head to the body coaxially thereof and at a fixed distance forwardly of its front end; a cuff slidably mounted on the front end portion of the body, the bore of said cuff being stepped and having its smallest diameter portion slidably circumjacent to the smooth uniform outside diameter of the front end portion of the body, and having an outer large diameter portion forming the mouth of the nozzle and surrounding the valve head in spaced relation thereto; an abrupt forwardly facing shoulder in the cuff forming the junction between said small and large bore portions, said shoulder being engageable with the valve head in the forwardmost position of the cuff, to shut off flow through the nozzle; the axial length of the small diameter bore portion in the cuff being greater than the distance the valve head is spaced ahead of the front end of the valve body so that the securement of the valve head to the valve body holds the cuff assembled with the body; all parts of the cuff bore forwardly of said shoulder being at least as large as the maximum diameter of the shoulder so that water leaves the nozzle without imparting forward thrust upon the cuff but on the contrary imparts rearward thrust upon said shoulder thereby tending at all times to slide the cuff rearwardly and hold the shoulder off the valve head; cooperating cylinder and piston means on the rear portion of the cuff and the adjacent portion of the body operable when fluid under pressure is applied thereto to slide the cuff forwardly along the body against the rearward thrust imposed upon the cuff by the stream of water issuing from the nozzle; and means including a port in said cylinder means for supplying fluid under pressure from a remote source thereof to said cylinder and piston means.

2. The fire hose nozzle of claim 1, wherein the cylinder of said cooperating cylinder and piston means comprises a rearwardly opening counterbore in the cuff joined to the small uniform diameter bore portion of the cuff, and wherein the piston of said cooperating means comprises a forwardly facing shoulder on the body closing the mouth of the counterbore.

3. The fire hose nozzle of claim 2, further characterized by the provision of a sleeve encircling and threaded onto the exterior of the body with the front end of the sleeve entering the mouth of the counterbore and forming part of the forwardly facing piston-forming shoulder, the front end of said sleeve being engageable with the

bottom of the counterbore so that by rotation of the sleeve about the body in one direction the cuff may be manually adjusted forwardly on the body against the rearward thrust of the water on the forwardly facing shoulder in the cuff.

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