

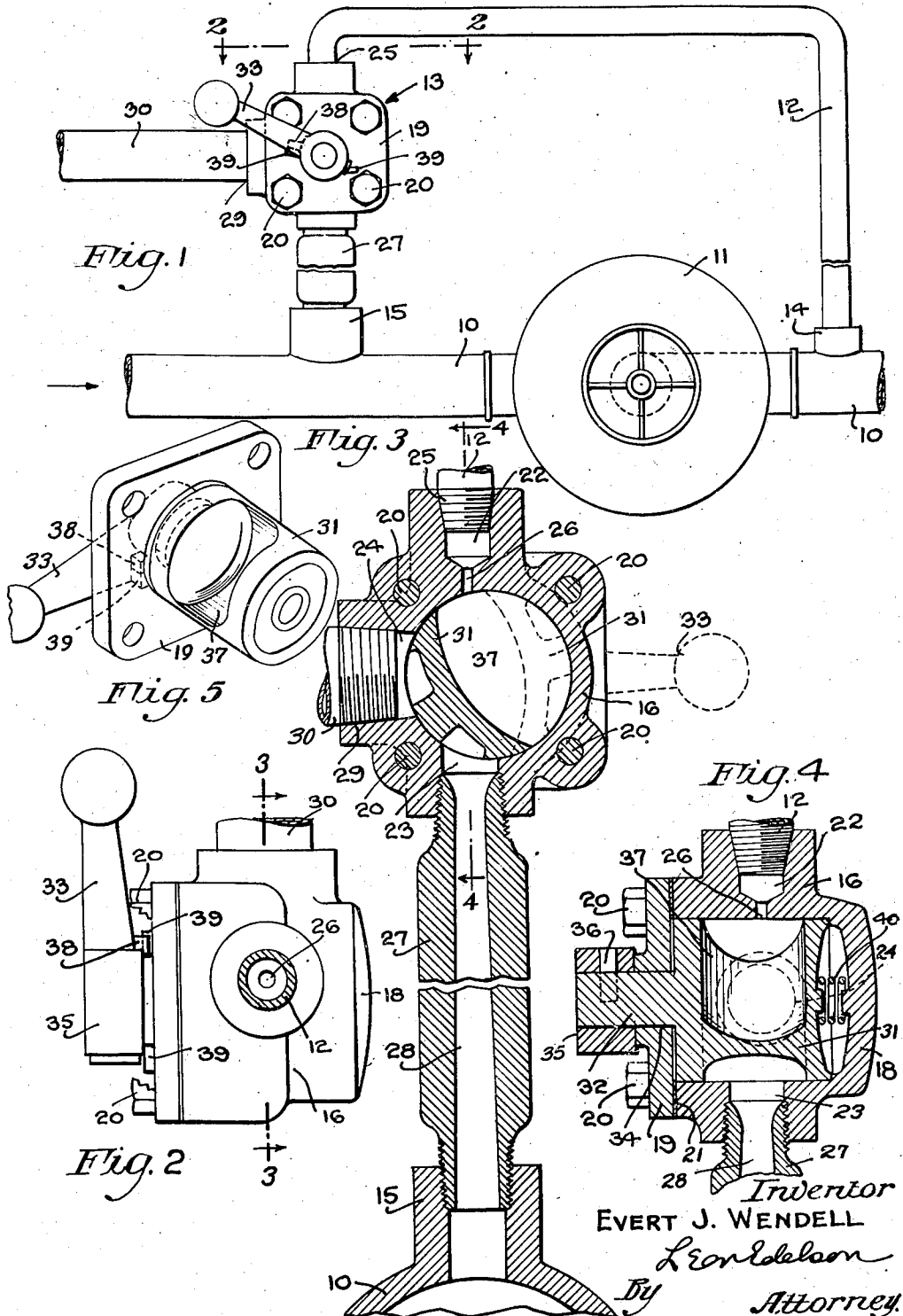
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E. J. WENDELL

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PROPORTIONER

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PROPORTIONER

Evert Jansen Wendell, Wayne, Pa., assignor, by
mesne assignments, to National Foam System,
Inc., Philadelphia, Pa., a corporation of Dela-
ware

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This invention relates generally to apparatus for use in the generation of mechanical or air foam employed in the extinguishment of fires and more particularly to an improved construction of apparatus for introducing a foam stabilizing solution into a stream of water.

In the production of the so-called mechanical or air foam, the usual procedure involves flowing a high velocity stream of water laden with a foam-forming substance through a conduit to a point therein where the stream is finally subdivided or dispersed and where a suitable gas (usually air from atmosphere) is entrained in such manner as to cause a mingling of the liquid and gas as they move in the conduit toward the point of discharge therefrom. Typical of this method of producing mechanical foam is that which is described in United States Letters Patent No. 2,106,043, granted January 18, 1938, and No. 2,198,585, granted April 23, 1940.

In order to insure the production of foam of the desired uniform quality, it is necessary that the rate of introduction of the foam-forming material into the flowing stream of water be proportional to the rate of flow of the water, while in order to insure an adequate projection of the foam from the discharge nozzle it is necessary to maintain a considerable head of pressure upon the water stream. It is among the principal objects of this invention to provide an apparatus by which both of these desired objectives may be secured.

The present systems and apparatus is primarily designed to provide for the continuous production of fire extinguishing foam as well as for effective proportioning of the foam-forming material with the water stream even under conditions where the available source of water is under a pressure normally insufficient to adequately produce foam, and to this end the present invention has as its object the provision of a system in which a booster pump is so employed in conjunction with a foam stabilizer proportioner device as to establish an operating suction in the latter adequate to inject the foam-forming material into the water stream at a rate which is suitably proportioned to the rate of flow of water through the main conduit.

Still other objects and advantages of the present invention, such as the provision of a unit which is exceedingly compact and simple in construction, which is easily operable without requiring the constant attendance of an operator and which is extremely efficient in use,

will appear more fully hereinafter, it being understood that the invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described in detail hereinafter, as shown in the accompanying drawing and as finally pointed out in the appended claims.

In the said accompanying drawing, which illustrates a preferred embodiment of the present invention:

Figure 1 illustrates a system embodying the present invention;

Figure 2 is a top plan view of the proportioner employed in the system taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on line 3—3 of Figure 2;

Figure 4 is a sectional view taken on line 4—4 of Figure 3 but showing the valve plug of the proportioner closed against flow of the foam stabilizing solution therethrough; and

Figure 5 is a perspective view of the valve plug assembly.

Referring now to the drawing and first more particularly to Figure 1 which shows more or less schematically the system of the present invention, it will be noted that this system essentially includes a main conduit 10, a pump 14, a by-pass conduit 12 and a foam stabilizer proportioner 13 by means of which a suitable foam stabilizer solution, derived from a suitable source of supply (not shown), is injected into a stream of water flowing through the main conduit 10. This conduit 10 is connected, at its inlet end, to a suitable source of water supply (not shown), while its opposite or discharge end is connected to a suitable hose (also not shown) through which the water mixed with the foam stabilizer solution is delivered to the point where air is entrained therein and thence discharged in the form of fire extinguishing foam. The manner of and means for effecting the entrainment of air or other gas into the stream of water laden with the foam-forming substance forms no part of the present invention, and, no detailed description thereof will be given herein, the present invention being directed more particularly to the means for introducing into the water stream the requisite quantity of the foam stabilizing solution. It will be understood in this connection that this invention is not limited to the use of any particular type of foam-forming material, and that usually this material is in the form of an aqueous solution of a secondary extract of licorice, of saponin or of other suit-

able substance having the capacity of being foamed when a gas is injected into a solution or suspension thereof.

The pump 11 is connected in the conduit 10 and is so operated by any suitable prime mover or means as to establish a negative pressure or suction on the left hand side thereof and a positive pressure on the right hand side thereof when viewed as in Figure 1, the by-pass conduit 12 being connected, as at 14, to the positive pressure or discharge side of the pump 11, while the discharge end or outlet of the proportioner injector device 13 is connected as at 15 to the intake or suction side of the pump 11.

As appears most clearly in Figures 2 to 4, inclusive, the injector device 13 includes a main body member 16 having an internal, cylindrically shaped chamber 17, one end of which is permanently closed by an end wall 18 formed as an integral part of the main body 16. The opposite or open end of this cylindrically shaped chamber 17 is closed by an end plate 19 suitably secured to the main body 16 by the bolts 20 or other such suitable securing elements. Preferably, a gasket 21 is interposed between the end plate 19 and the body 16 to effectively seal the internal chamber 17 of the injector device.

Provided in the annular wall of the main body member 16 are a plurality of openings respectively constituting the inlet and outlet ports for the injector and the intake port for the foam-forming solution, these ports being respectively indicated by the reference numerals 22, 23 and 24. It will be noted that the intake port 22, which is adapted to be connected, as at 25, to the conduit 12, communicates with the conduit 10 connected to the discharge or pressure side of the pump 11, the said inlet port 22 being in communication with the internal chamber 17 of the main body of the injector device by way of a restricted passage 26. The outlet port 23 of the injector device, which is also in direct communication with the internal chamber 17, is connected to the conduit 10, as at 15, by an injector tube 27, the bore 28 of which is preferably tapered as shown most clearly in Figure 3. The foam stabilizer intake port 24 is connected, as at 29, to a suitable conduit 30 leading to a suitable supply of foam stabilizer solution (not shown).

Snugly fitted within the internal chamber 17 of the main body 16 of the injector device is a cylindrical valve plug 31 from one end of which axially extends an operating stud or shaft 32 to which is secured an operating handle 33. The stud 32 of the valve plug projects through an opening 34 formed in the end plate 19, the stud 32 being of sufficient length to provide a freely extending portion for receiving the hub 35 of the operating handle 33. Preferably, this hub is secured to the shaft 32 by means of a transversely extending pin 36.

The valve plug 31 is provided with a passage 37 extending transversely therethrough, this passage being of such shape and dimension and so arranged relatively to the water inlet and outlet ports 22 and 23 and the foam stabilizer intake port 24, as most clearly appears in Figure 3, that when the valve plug is rotated into the full line position shown in Figure 3, all of said ports are in free communication with each other, while when said valve plug is rotated into the dotted line position shown in Figure 3, the water inlet port 22 is completely closed off from the water

outlet port 23, and the foam stabilizer intake port 24.

Preferably, a compression spring 40 is interposed between the closed end 18 of the valve body 16 and the proximate end of the valve plug 31 so as to provide a frictional resistance against free movement of the valve plug within its enclosing body sufficient to hold the former in any desired position, either fully or partially opened or closed. In order to insure positioning of the valve in its fully opened or fully closed condition, coacting stop elements 38 and 39—39 are respectively provided on the hub 35 of the handle and the end plate 19 of the valve body, it being apparent that the stop elements 39—39 serve to limit the throw of the handle 33 in either of two opposite directions.

In the operation of the system of the present invention, it will be apparent that when the valve handle of the injector device 13 is thrown into the full line positions shown in Figures 1 and 2, in consequence of which the valve plug 31 assumes the dotted line position shown in Figure 3, and assuming that water is being drawn through the conduit 10 by a pump 11, a portion of the water stream so flowing through the conduit will be forced under pressure through the by-pass conduit 12 to and through the injector device 13. The water so by-passed out of the main stream and delivered to the inlet port 22 of the injector device issues from the restricted passage 26 in the form of a high velocity jet and creates a suction in the immediate region of the reduced upper end of the injector tube 27 (viewed as in Figure 3), which is sufficient to induce the flow of foam stabilizer solution through the intake port 24 and into the stream flowing through the tube 27, the foam-forming solution, so mixed with the water, being thus introduced into the main stream on the suction side of the pump 11. The water-stabilizer mixture then passes through the pump and is forced by the latter through the discharge conduit to the point where air is entrained to form the requisite foam. This cycle of operation continues so long as water is delivered through the conduit 10 to the pump and foam stabilizer solution to the injector device.

Should it be desired to shut off the supply of foam stabilizer solution so as to discharge only plain water from the discharge side of the pump 11, the valve handle 33 of the injector device is rotated into the dotted line position shown in Figure 3, with the result that the valve plug will assume the dotted line position shown therein, and in this latter position the delivery of water through the by-pass conduit 12 will be interrupted with corresponding interruption in delivery of the foam stabilizer solution into the main stream of flowing water. Should it be desired to flush the conduit 30 through which foam-forming solution is delivered to the injector device, as when the supply of foam stabilizer solution has been exhausted and it is desired to recondition the conduit 30 for use with a further supply of foam-forming liquid, the plug valve 31 may be rotated by its handle 33 into an intermediate position so as to close off only the outlet port 23. In this latter condition of the valve, water under pressure will be forced by the pump 11 through the by-pass conduit 12 into the interior of the valve body and thence outwardly thereof by way of the port 24 into and through the conduit 30, the latter being thus flushed free of the foam-forming solution by plain water.

The arrangement just described for delivering

water from the by-pass conduit 12 directly into the stabilizer pick-up tube 30, in addition to providing a means for flushing the said tube and so conditioning it for further use, provides the additional important advantage of filling the pick-up tube with water preliminarily to starting the pump 11 for operation of the apparatus. In the use of a suction pump in the manner hereinbefore described for establishing a pressure differential in the main water conduit, care must be taken that no air is drawn into the water line on the suction side of the pump because such introduction of air may result in disrupting the suction which is necessary for satisfactory operation of the pump. To avoid this possibility, particularly when the pump is operating to lift water through a considerable height, the initial step in placing the apparatus in operation is preferably to throw the valve into its intermediate position so as to direct sufficient water into the stabilizer pick-up tube 30 as to completely fill it, whereupon the valve is set as shown in Figure 3 to withdraw this water and then the stabilizer from the pick-up tube by the suction induced in the central chamber of the valve unit, as hereinbefore described. This insures against sucking any air which may be bound in the stabilizer pick-up tube into the suction side of the pump 11.

By proper design of the apparatus, including proper proportioning of the various ports in the injector device, the ratio of the rate of flow of the foam-forming solution to the rate of flow of the main water stream through the main conduit 10 may be predeterminedly established and maintained.

It will be understood, of course, that the invention is capable of various changes and modifications which may be made from time to time without departing from the real spirit or general principles thereof, and it is accordingly intended to claim the invention broadly, as well as specifically, as indicated in the appended claims.

What is claimed as new and useful is:

1. In a system for introducing a solution of foam-forming material into a continuously flowing stream of water comprising a main conduit for said water stream, a pump for establishing a pressure differential in said conduit, a by-pass interconnecting the inlet and outlet sides of said pump, and an injector device connected in said by-pass and adapted for injecting the foam-form-

ing material into the low-pressure portion of said water stream, said device including a chamber having a restricted water inlet port in one wall thereof, a water outlet port in an opposite wall thereof in approximate registry with said inlet port and an intake port for the foam-forming material disposed intermediate said water inlet and outlet ports, the latter being respectively connected to the high and low pressure portions of said water stream whereby the by-passed water flowing between said water ports in the ejector device induces a suction in the chamber of said device for drawing foam-forming material through said intake port, said injector device including also a rotary valve plug fitted in said chamber and operative to interrupt the flow of suction-inducing water to and through said water outlet port and direct it to and through said intake port for the foam-forming material.

2. An ejector device adapted for injecting foam stabilizing solution into a water stream, comprising a chamber having a restricted water inlet port in one wall thereof, a water outlet port in another wall of said chamber in approximate alinement with said water inlet port, said chamber also having a foam stabilizing solution intake port disposed between said water inlet and outlet ports, and valve means in said chamber operative, while in one position, to maintain all of said ports open and in communication with each other, and, while in a second position, to close both the water outlet and stabilizer intake ports.

3. An ejector device adapted for injecting foam stabilizing solution into a water stream, comprising a chamber having a restricted water inlet port in one wall thereof, a water outlet port in another wall of said chamber in approximate alinement with said water inlet port, said chamber also having a foam stabilizing solution intake port disposed between said water inlet and outlet ports, and valve means in said chamber operative, while in one position, to maintain all of said ports open and in communication with each other, and, while in a second position, to close both the water outlet and stabilizer intake ports, said valve means being operative, when in an intermediate position, to close said water outlet port while maintaining said water inlet and stabilizer intake ports both open and in free communication with each other.

EVERT JANSEN WENDELL.