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Hardy et al.

[11] **3,823,876**

[45] **July 16, 1974**

[54] **FOAM DISPERSAL NOZZLE**

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[73] Assignee: **Rockwood Systems Corporation**, South Portland, Maine

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[21] Appl. No.: **316,138**

[52] **U.S. Cl.** **239/504**, 169/15, 239/511

[51] **Int. Cl.** **B05b 1/34**

[58] **Field of Search** 239/504, 511, 513, 265.13, 239/505, 510; 169/15

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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Michael Y. Mar

[57] **ABSTRACT**

A foam dispersal nozzle has a hood enclosure containing two perforated deflectors mounted therein. The deflectors are mounted on a pivot shaft in opposed relationship to each other. An actuator handle extends from the deflectors in pivoting relation about the pivot shaft. The opposed downstream ends of the deflectors have a series of teeth formed therein. The perforations in said deflectors are chamfered to a knife edge at least along the downstream portions thereof. The size of the opening formed between the toothed ends of the deflectors and the angle of attack formed between the deflectors and a fluid stream moving through the nozzle may be varied by operating the actuator handle to pivot the deflectors around the pivot shaft.

6 Claims, 7 Drawing Figures

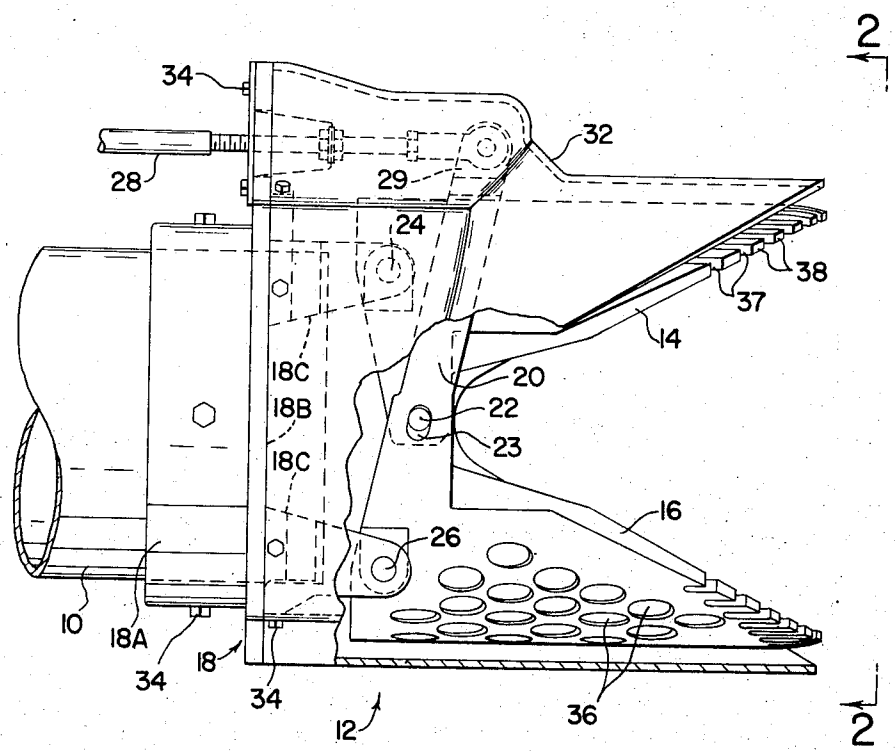


FIG. 1

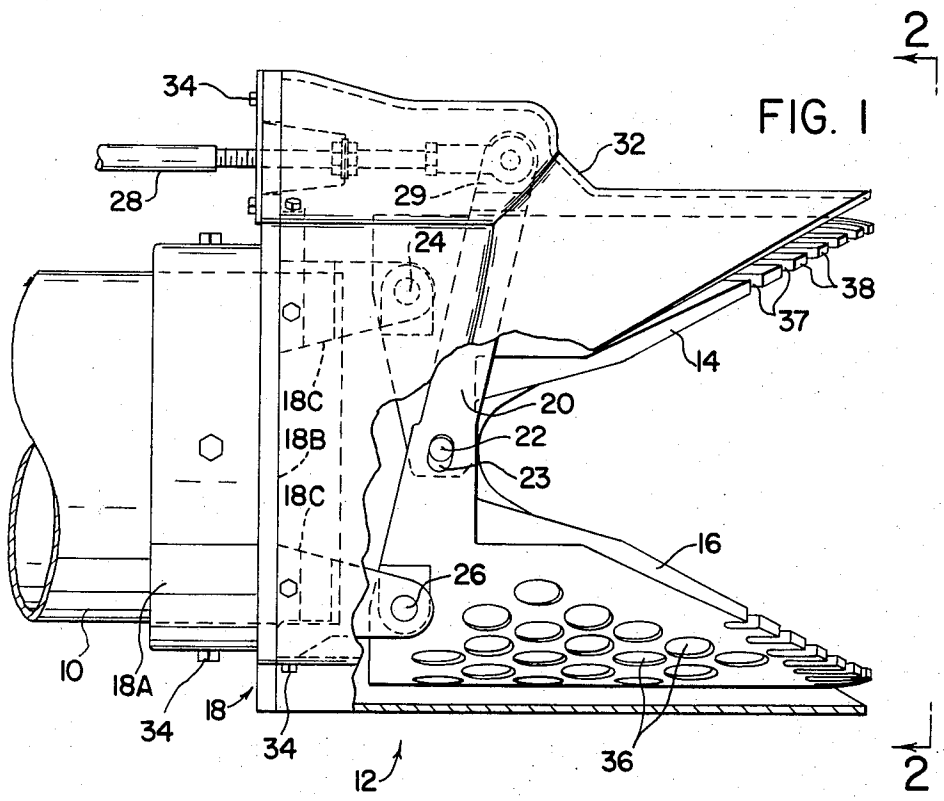

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FIG. 2

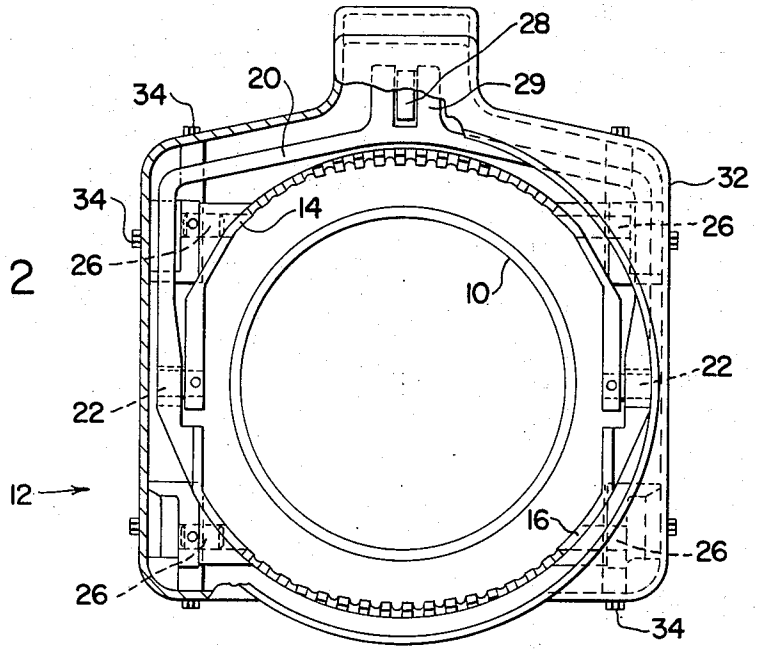
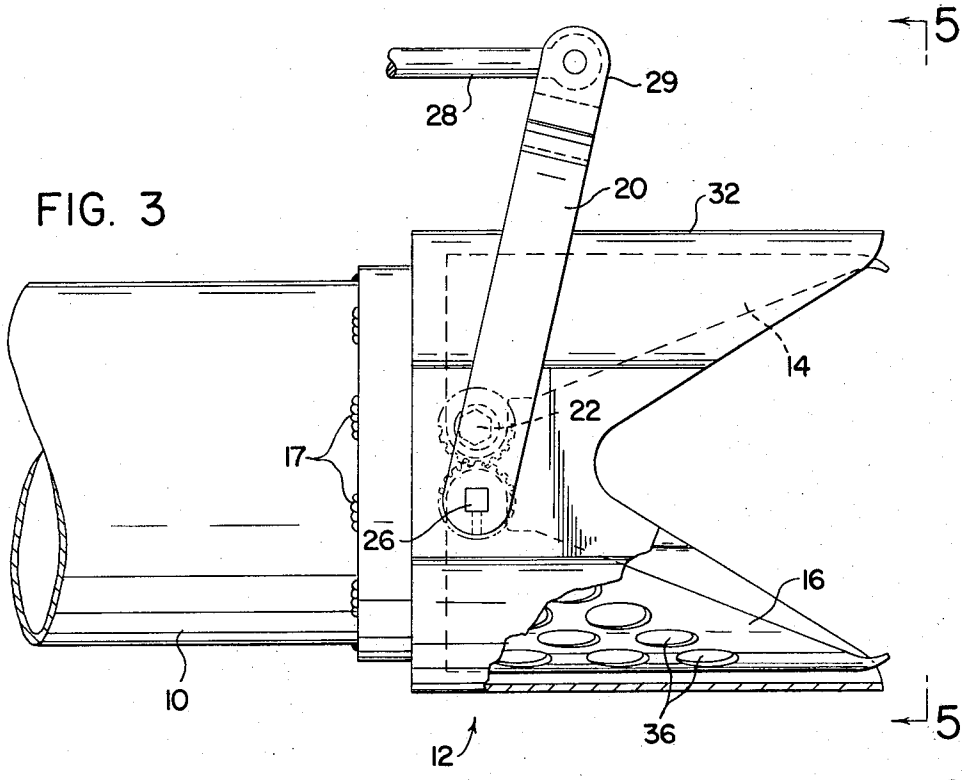

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FIG. 3


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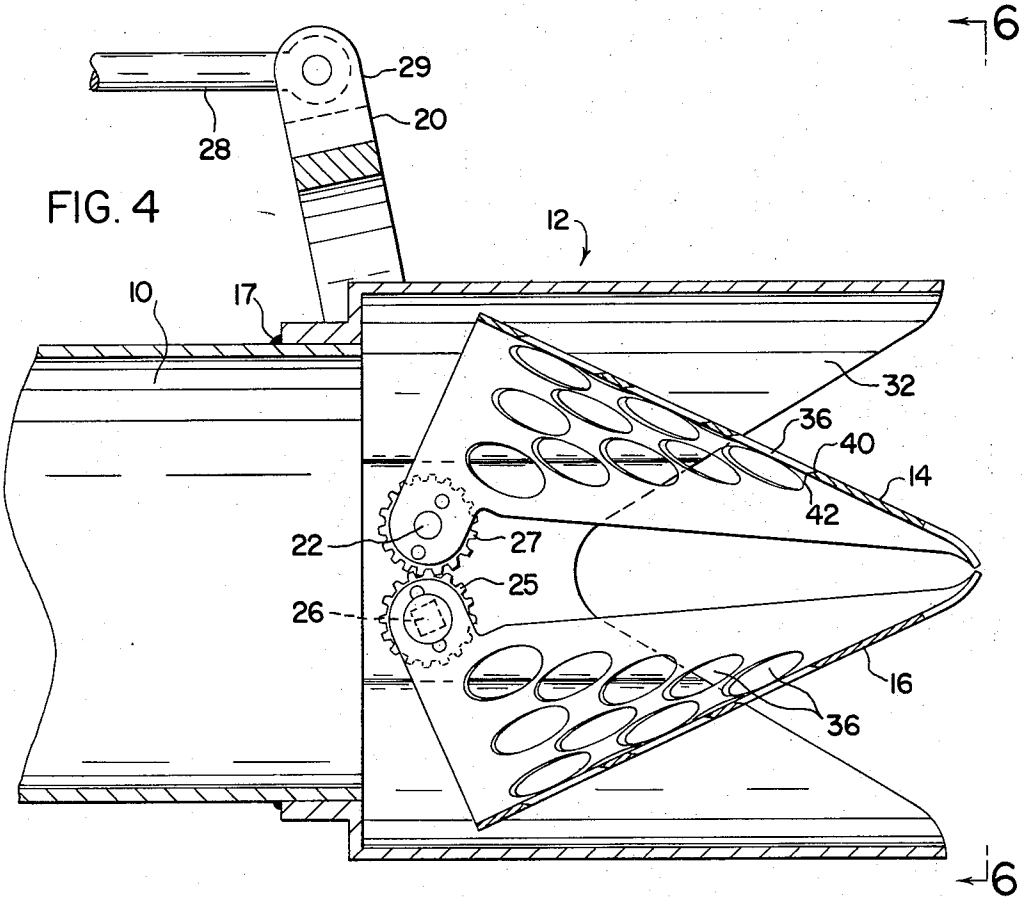

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FIG. 4

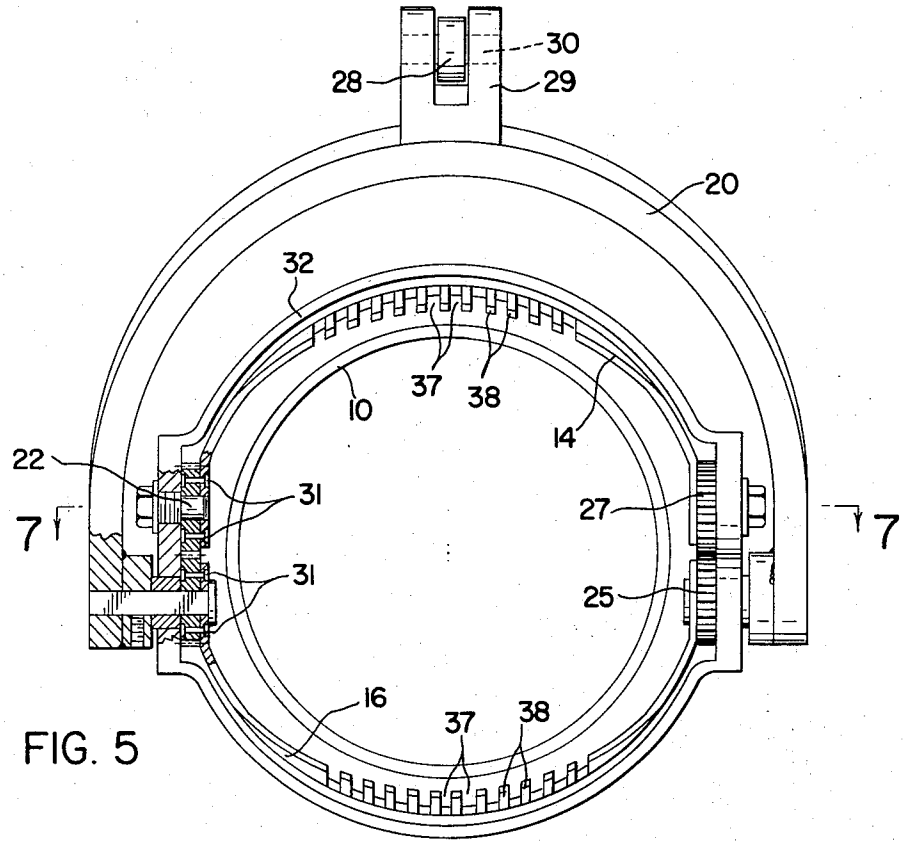

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FIG. 5

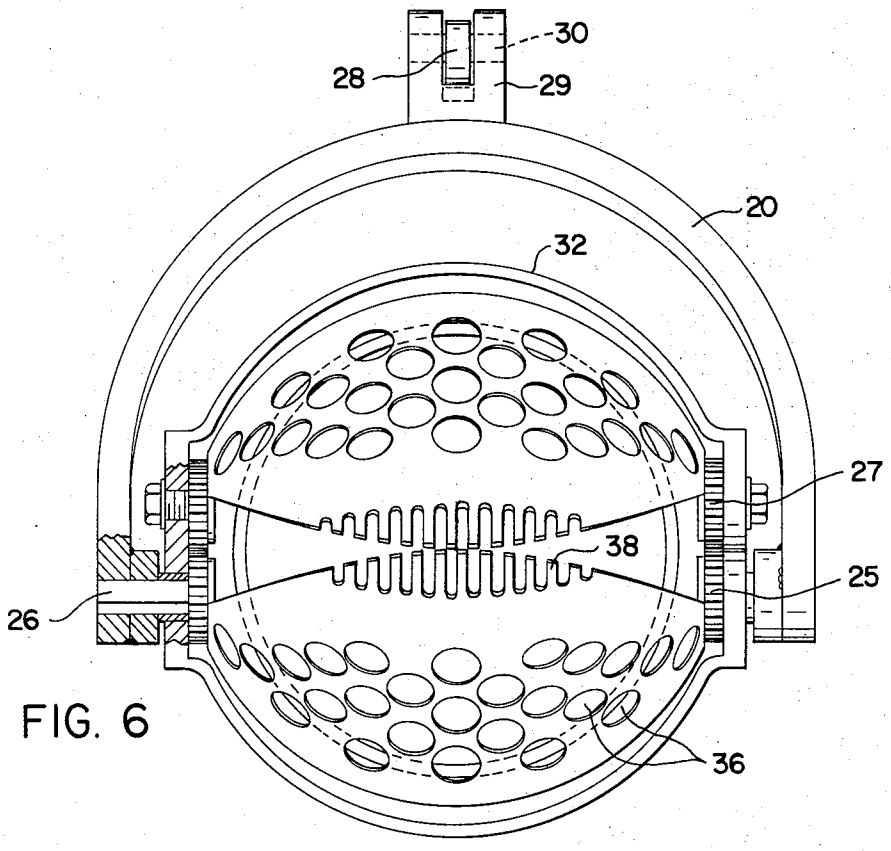
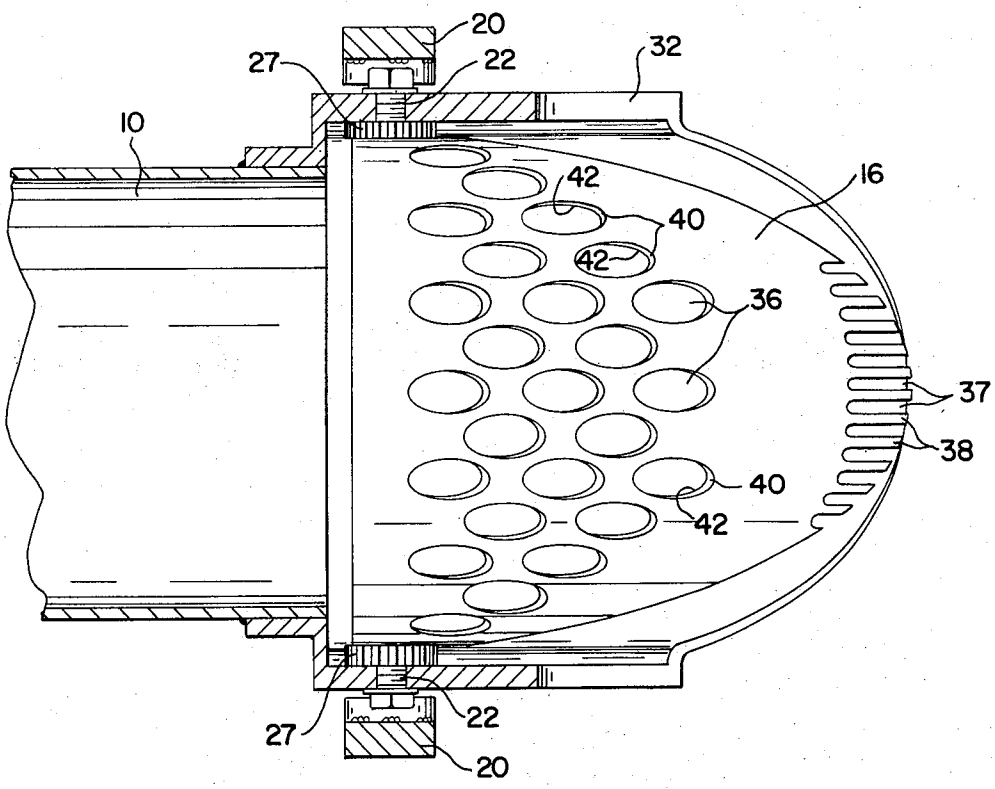

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FIG. 6

FIG. 7



FOAM DISPERSAL NOZZLE

The present invention concerns fluid dispersal nozzles, more particularly dispersal nozzles for foam mixtures used as fire extinguishing agents.

Generally, in accordance with the prior art, foam fire extinguishing agents are dispersed through a foam dispersal tip which provides a restricted opening through which the foam passes under pressure. Normally, the restricted opening is variable in size, being formed between an opposed pair of deflectors. Prior art nozzles are generally of the "duck bill" type, comprising an opposed pair of deflector plates hinged at one end, so that the opening formed between the deflector plates may be varied in size. The deflector plates may also have sidewalls so that each of the opposed plates is shaped somewhat like a scoop or shovel, to form a flow chamber therebetween. The arrangement bears a general resemblance to a duck's bill, hence the name. The slot-like, restricted opening formed between the deflector plates, which opening may be varied in size by pivoting the plates around their hinges, forces the foam passing therethrough into the desired dispersed pattern.

Such prior art foam dispersal tips require a high flow rate of foam at high pressure, and result in a high pressure drop being sustained by the foam passing therethrough.

This high pressure drop, or back-pressure as it is commonly referred to, which is sustained by the foam in passing through the restricted opening causes a reduction in foam expansion due to compression of the air trapped in the foam as it passes through the restricted opening.

Another disadvantage experienced with the high back-pressure prior art dispersal devices is that they tend to provide a nonuniform foam dispersal, with relatively heavy foam build-up as the outsides of the dispersal pattern as compared to the center of the pattern. Further, the dispersal pattern provided by the prior art devices is relatively narrow as compared to that obtained under equivalent conditions with a dispersal nozzle made in accordance with the present invention.

Another disadvantage of prior art dispersal nozzles is that they tend to form relatively large foam particles from the foam mixture passing therethrough, which relatively large particles have a higher impingement velocity on the flame than do smaller size particles. This is due to the relatively high inertia of the large particles as compared to smaller particles ejected from the nozzle at the same initial velocity. The smaller particles decelerate more rapidly, and thus impinge upon the flame at a lower velocity than the large particles. Low velocity impingement is desirable for fire extinguishing purposes.

It is therefore an object of the present invention to provide a fluid dispersal nozzle of novel and simple construction which, as compared to prior art nozzles, results in a reduced back-pressure and avoids excessive compression of the foam passing through the nozzle, provides a wider and more uniform foam dispersal pattern, and provides relatively small foam particles.

It is another object of the present invention to provide a fluid dispersal nozzle which provides the aforesaid advantages over a range of operation from full stream (deflectors wide open) to minimum stream (deflectors fully closed).

In accordance with the present invention, there is provided a fluid dispersal nozzle comprising a hood enclosure, two deflectors mounted within said hood in opposed relationship to each other to define an opening therebetween, the deflectors being mounted to be pivotable with respect to each other about a pivot point so that the size of the opening and the angle formed between deflectors may be varied by varying the relative position of the deflectors about the pivot point, each deflector containing a plurality of apertures formed therein, and each deflector having a series of teeth formed at its downstream end.

(As used in this specification and in the claims, the terms "downstream" and "upstream" refer to the direction of foam liquid travel through the nozzle, "downstream" indicating a point which is nearer the foam discharge end of the nozzle than is an "upstream" point.)

In accordance with one aspect of the present invention, an actuator handle extends from the pivot point, so that operation of the actuator handle will pivot one or both deflectors to vary the angle between the deflectors and the size of the opening formed therebetween.

In accordance with another aspect of the invention, the apertures contained in the deflectors are positioned interiorly of, and are non-contiguous with the periphery of said deflectors, which are smooth-edged except at the downstream portions thereof in which are formed a series of teeth, the teeth of one deflector being in opposed relationship to the teeth of the other.

In accordance with yet another aspect of the invention, the apertures in the deflectors are chamfered to form a knife edge at least along the downstream portions of the peripheries of the apertures.

In operation, the foam or other liquid passing through the nozzle is dispersed into the desired spray pattern by a portion of the total liquid passing through the deflector apertures which, assisted by the chamfered knife edges, shear the liquid into a series of thin streams which are directed according to the angle at which the perforated deflectors are positioned relative to the flow of liquid through the nozzle. Another portion of the total liquid flow passes through the teeth formed in the downstream edges of the deflectors. If the deflectors are opened sufficiently wide, yet another portion of the total liquid flow would pass through the restricted opening formed between the two deflectors.

By utilizing the apertured deflectors to adjust the foam pattern by shearing the liquid into fine streams and deflecting the streams at the desired angle, the back-pressure behind the deflectors is greatly reduced as compared to conventional deflector plates which direct the entirety of the fluid flow through the restricted opening formed between the downstream portion of the respective deflector plates. The reduced back-pressure reduces the compression of the foam, so that very little of the air in the foam is forced out of the foam as it passes through the dispersal nozzle, compared to the amount of air forced out of the foam by the conventional prior art nozzle. Consequently, the expansion of the delivered foam is much greater than that obtained with an equivalent foam mixture delivered through prior art nozzles. The reduction in foam expansion sustained by being dispersed through a noz-

zle in accordance with the present invention is only about one-third of that sustained with prior-art deflector plate nozzles.

Because of the even spacing of the apertures and the reduced back-pressure, the nozzle of the present invention permits a wider spray pattern to be employed without sacrificing uniformity of distribution of the foam over the entire pattern. Prior art dispersal nozzles tend to cause excessive foam build-up at the outsides of wide spray patterns.

The deflector apertures which shear the stream of liquid foam into a plurality of smaller streams, result in smaller foam particles being formed, which particles have a lower speed after discharge (due to more rapid deceleration in the air) than the larger particles formed by the prior art nozzles, and thereby impinge upon the flame at a lower velocity, which is advantageous for fire fighting purposes.

The present invention may be better understood by referring to the following detailed description of specific embodiments thereof and to the accompanying drawings illustrating the same wherein;

FIG. 1 is a side view in elevation, with parts broken away, of a liquid dispersal nozzle comprising a preferred embodiment of the present invention, showing also a portion of the liquid conduit to which the nozzle is affixed; and with the deflectors in full open position;

FIG. 2 is a view taken along lines 2—2 of FIG. 1, partly broken away;

FIG. 3 is a view similar to that of FIG. 1, showing a second preferred embodiment of the invention with the deflectors in the full open position;

FIG. 4 is a section view taken along the longitudinal center line (the axis of liquid travel through the conduit and nozzle) of the nozzle of FIG. 3, with the deflectors in the full closed position;

FIG. 5 is a view taken along line 5—5 of FIG. 3;

FIG. 6 is a view taken along line 6—6 of FIG. 4; and

FIG. 7 is a view taken along line 7—7 of FIG. 5.

Referring now to FIGS. 1 and 2, a fluid conduit 10 has fixed thereto a nozzle, generally indicated at 12. Nozzle 12 has an upper deflector 14 and a lower deflector 16, each of which are mounted on a deflector bracket 18. Deflector bracket 18 is affixed to the end of fluid conduit 10 in liquid flow communication therewith, by mounting screws 19, which pass through the collar portion 18A of deflector 18. The face portion, 18B, of deflector 18, has lugs 18C projecting therefrom.

Lower deflector 16 has an actuator handle 20 extending upwardly and over upper deflector 14, as is best seen in FIG. 2. Upper deflector 14 and lower deflector 16 are each pivotably mounted on the lugs 18C of deflector bracket 18 by, respecitvely, pivot pins 24 and 26. Upper deflector 14 and lower deflector 16 are pivotably connected to each other by pivot pins 22, which are journaled through the base of actuator handle 20 in slot opening 23.

A control rod 28 is attached to a boss 29 on the upper portion of actuator handle 20 by means of a connector pin 30.

The entire nozzle assembly is contained within hood enclosure 32, which is affixed to deflector bracket 18 by means of mounting screws 34.

FIGS. 3 through 7 show various views of an embodiment of the invention somewhat different in construction from that shown in FIGS. 1 and 2. However, the apertures in the deflectors, and the teeth formed at the downstream ends thereof, are substantially identical in both cases.

Referring particularly now to FIGS. 4 and 7, wherein the details of the apertures and teeth are best seen, lower deflector 16 and upper deflector 14 are both seen to contain a series of apertures 36 more or less regularly distributed over their surfaces. The downstream end of deflectors 14 and 16 each contain a series of deep, narrow grooves 37 which form a series of teeth 38 therebetween. Apertures 36 are formed in an elliptical shape, with the downstream edge of the aperture being chamfered to provide a surface 40 which terminates in a knife edge 42. (Best seen with reference to FIG. 4.)

In operation, a rearward (towards the left hand side of the drawing of FIG. 1) pull on control rod 28 causes upper deflector 14 and lower deflector 16 to rotate about pivot pins 22 so that the downstream ends of deflectors 14 and 16 move towards each other. By setting control rod 28 in an appropriate position, any desired degree of opening between upper deflector 14 and lower deflector 16 from the full open position (shown in FIG. 1) to a full closed position in which the downstream tips of the deflectors are in contact, may be set. A conventional handle and locking means (not shown) affixed to the end of control rod 28 serves to permit easy adjustment and locking of the deflectors in any position.

As upper deflector 14 and lower deflector 16 are pivoted so that their downstream ends approach each other, i.e., towards a closed position, liquid foam flowing through fluid conduit 10 impinges upon the deflectors 14 and 16 and a part of the foam passes through apertures 36. The liquid foam is consequently sheared into a series of relatively thin streams, the shearing effect of the apertures on the fluid foam being assisted by knife edge 42 at the downstream edges of apertures 36. Another portion of the liquid foam passes through teeth 38 in deflectors 14 and 16 and is thereby sheared into another series of thin, liquid streams. When the foam deflectors are in an open position, a remaining portion of the liquid foam flows through the aperture formed between the downstream or teeth ends of the deflectors.

Varying the angle formed between the deflectors, in addition to varying the size of the opening formed between the downstream, toothed ends of the deflectors, also varies the angle formed between the deflectors and the over-all direction of flow of the liquid foam through the nozzle. (This over-all direction of liquid flow may be described as generally along the common longitudinal axis of the liquid foam conduit and the nozzle.) Therefore, the angle which the sheared streams of liquid emerging from the deflector apertures make with the longitudinal centerline of the conduit and nozzle may be varied and set as desired by the operator. Therefore, by adjusting the angle between the upper deflector 14 and lower deflector 16 suitably, the spray pattern and angle of dispersion of the liquid foam passing therethrough may be regulated as desired by the operator. At the full open position, a relatively vertically deep, horizontally narrow pattern of foam will emerge; in the fully closed position a relatively vertically shal-

low, horizontally wide fan-shaped foam pattern will emerge.

Because the adjustment in foam dispersal is attained by shearing the liquid foam stream into smaller liquid streams rather than by compressing the entire stream through a single restricted slot-like opening, the back-pressure on the foam liquid passing through the nozzle is greatly reduced with the attendant advantages hereinabove mentioned.

Referring now to FIGS. 3 through 7 inclusively, another preferred embodiment of the invention is shown wherein parts similar to those shown in FIGS. 1 and 2 are designated with the same numbers used to designate those parts in FIGS. 1 and 2. A nozzle indicated generally at 12 is fixed in flow communication engagement with a fluid conduit 10. The nozzle or, more precisely, the hood enclosure 32 thereof, is welded to fluid conduit 10 as indicated by weld spots 17. Upper deflector 14 and lower deflector 16 are mounted on respectively, pivot pins 24 and 26 in pivotable relation to hood enclosure 32.

Actuator handle 20 is also pivotably mounted on pivot pins 26, which extend for this purpose through and beyond hood enclosure 32 (FIGS. 5 and 6). Pivot pins 26 have affixed to the inner ends thereof drive gears 25. Pivot pins 24 have affixed to their inner ends driven gears 27. Gears 25 and 27, as best seen in FIG. 5, are held in fixed, non-rotatable relation with their respecitve deflectors 14 and 16 by pin rivets 31.

As best seen in FIG. 3 (and also in FIGS. 5 and 6) the shafts of pivot pins 26 are square in cross-section, so that movement of actuator handle 20 will rotate drive gear 25 about an axis of rotation passing through the longitudinal axis of pivot pin 26. Drive gear 25 will in turn rotate driven gear 27 in an opposite direction. Accordingly, movement of control rod 28 in a forward direction (towards the right in FIG. 3) will move upper deflector 14 and lower deflector 16 towards the full open position shown in FIG. 3. Rearward movement of control rod 28 will rotate gears 25 and 27 in a direction which moves deflectors 14 and 16 towards the full closed position shown in FIG. 4. FIG. 5 shows a front end view of the nozzle in the full open position of FIG. 3, and FIG. 6 is the same view in the full closed position of FIG. 4.

It will be obvious that the positioning of control rod 28 at a position intermediate the two extremes shown respectively in FIGS. 3, 5 and FIGS. 4, 6, will position the deflectors in an intermediate position.

While generally the liquid which will be passed through the foam dispersal nozzle will be of any of the conventional and known liquid foam fire fighting agents, other liquids such as water may be utilized.

The following shows the results of tests comparing one of the two described preferred embodiments of the invention with a conventional dispersal nozzle identical in every respect to the preferred embodiment nozzle, except that the conventional nozzle lacked the apertures 36 of the preferred embodiments, and had instead solid wall deflectors.

Test Results

Approximate force required to close deflectors against flow of:	A	B
Water	18 lbs.	30 lbs.
Liquid foam	28 lbs.	50 lbs.

A=Nozzle of FIGS. 3–7.
B=Conventional nozzle.

While the invention has been described in detail in connection with a preferred embodiment thereof, numerous modifications and alterations thereto will become apparent to those skilled in the art upon a reading and understanding of the foregoing, which modifications and alterations nonetheless are within the spirit and scope of the described invention. For example, any suitable pivot mounting means of which the illustrated pivot pins are simply one example, may be employed to mount the deflectors in pivotable relationship to the hood enclosure, and any suitable means to effectuate pivoting of said deflectors, of which the illustrated respective, passed gears and sliding pin embodiment are simply two examples, may be employed to effectuate selection and holding of the size (and angle) of opening between the deflectors.

It is intended to include all such modifications and alterations within the scope of the appended claims.

What is claimed is:

1. A fluid dispersal nozzle comprising first and second deflectors journaled on pivot mounting means and positioned in opposed, spaced-apart relation to define between said deflectors a fluid flow path having a fluid inlet formed between the respective upstream portions of said deflectors and a fluid outlet formed between the respective downstream portions of said deflectors,

means to rotate said deflectors about said pivot mounting means to change the size of said fluid outlet by adjusting the distance across said fluid flow path between said respective downstream portions,

a plurality of apertures contained in said deflectors and,

a plurality of teeth formed in said downstream portions of said deflectors, and

a hood enclosure enclosing said deflectors and having a mouth opening aligned with said fluid outlet.

2. The nozzle of claim 1 wherein said deflectors are positioned so that in a full closed position said downstream portions of said first and second deflectors are in contact one with the other.

3. A fluid dispersal nozzle comprising first and second deflectors journaled on pivot mounting means and positioned in opposed, spaced-apart relation to define between said deflectors a fluid flow path having a fluid inlet formed between the respective upstream portions of said deflectors and a fluid outlet formed between the respective downstream portions of said deflectors,

means to rotate said deflectors about said pivot mounting means to change the size of said fluid outlet by adjusting the distance across said fluid flow path between said respective downstream portions,

a plurality of apertures contained in said deflectors, at least the downstream portions of said apertures

being chamfered to form a knife edge facing upstream,

a plurality of teeth formed in said downstream portions of said deflectors, and

a hood enclosure enclosing said deflectors and having a mouth opening aligned with said fluid outlet.

4. A fluid dispersal nozzle comprising first and second deflectors journaled on pivot mounting means and positioned in opposed, spaced-apart relation to define between said deflectors a fluid flow path having a fluid inlet formed between the respective upstream portions of said deflectors and a fluid outlet formed between the respective downstream portions of said deflectors,

means to rotate said deflectors about said pivot mounting means to change the size of said fluid outlet by adjusting the distance across said fluid flow path between said respective downstream portions,

a plurality of apertures contained in said deflectors,

a plurality of teeth formed in said downstream portions of said deflectors,

a hood enclosure enclosing said deflectors and having a mouth opening aligned with said fluid outlet, and

a mounting bracket to which said first and second deflectors are connected by said pivot mounting means, said mounting bracket having a collar portion adapted to receive one end of a foam fluid conduit in fluid sealing relationship with said mounting bracket, and a face portion adapted to have said hood enclosure mounted thereon in fluid sealing relationship.

5. A fluid dispersal nozzle comprising first and second deflectors journaled on pivot mounting means and positioned in opposed, spaced-apart relation to define between said deflectors a fluid flow path having a fluid inlet formed between the respective upstream portions of said deflectors and a fluid outlet formed between the respective downstream portions of said deflectors,

means to rotate said deflectors about said pivot mounting means to change the size of said fluid outlet by adjusting the distance across said fluid flow path between said respective downstream portions, said means including an actuator handle connected to said deflectors and structurally associated therewith whereby movement of said handle rotates said deflectors about said pivot mounting means,

a plurality of apertures contained in said deflectors,

a plurality of teeth formed in said downstream portions of said deflectors,

a hood enclosure enclosing said deflectors and having a mouth opening aligned with said fluid outlet.

6. The nozzle of claim **5** further including a remote control rod attached to said actuator handle whereby movement of said control rod moves said actuator handle to rotate said deflectors about said pivot mounting means.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,823,876 Dated July 16, 1974

Inventor(s) John C. Hardy and A. Brian Stevens

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Under "References Cited", "Urquart" should be --Urquhart--;

Column 6, line 31, "fluid" should be --foam--,

line 54, "fluid" should be --foam--;

Column 7, line 8, "fluid" should be --foam--;

Column 8, line 3, "fluid" should be --foam--.

Signed and sealed this 29th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents