United States Patent [19]

Allard

[11] **3,904,126**

[45] **Sept. 9, 1975**

[54] **FIRE SPRINKLER**

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[73] Assignee: **International Telephone and Telegraph Corporation**, Nutley, N.J.

[22] Filed: **Oct. 11, 1973**

[21] Appl. No.: **405,604**

[52] **U.S. Cl.** **239/502**; 169/37; 239/518

[51] **Int. Cl.** **B05b 1/26**

[58] **Field of Search** 239/502, 518, 521, 522, 239/590.5; 169/26, 37, 38, 16, 66, 68

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[57] **ABSTRACT**

An improved thermally responsive sprinkler having a discharge nozzle for controlled distribution of a fluid in a confined area. The sprinkler is normally mounted on a vertical side wall having a nozzle with an appropriate orifice extending therethrough. A plurality of deflectors having substantially wedge shapes are disposed in the fluid discharge path. The wedge deflectors have their leading edges disposed at a substantially zero angle of attack relative to the fluid discharge path; the wedge deflectors are diametrically positioned and effect the desired controlled distribution of the fluid. Each deflector is fixedly attached to a separate yoke member mounted to and extending axially from the nozzle. The improved structure permits the fabrication of a relatively thin line fire sprinkler producing an acceptable fluid distribution pattern when mounted on a side wall.

11 Claims, 5 Drawing Figures

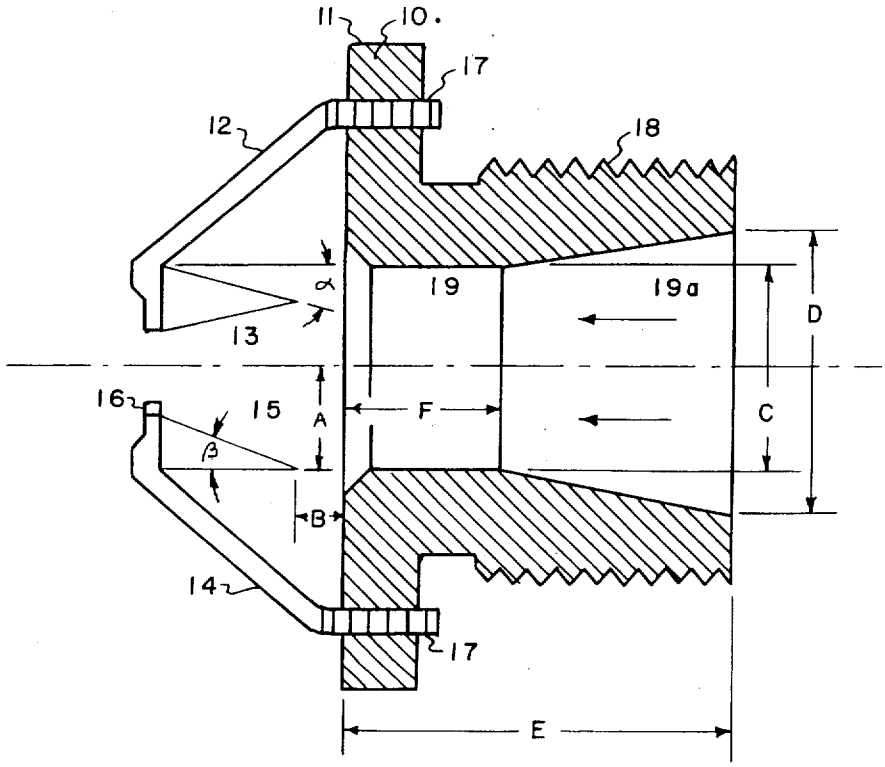


Fig. 1

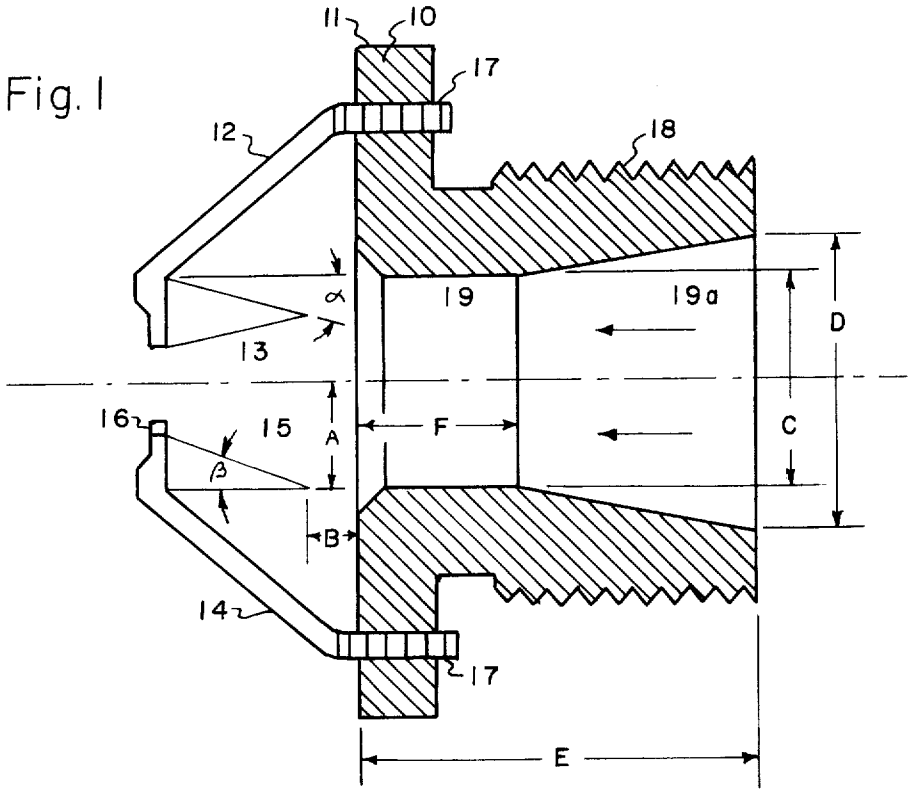


Fig. 2

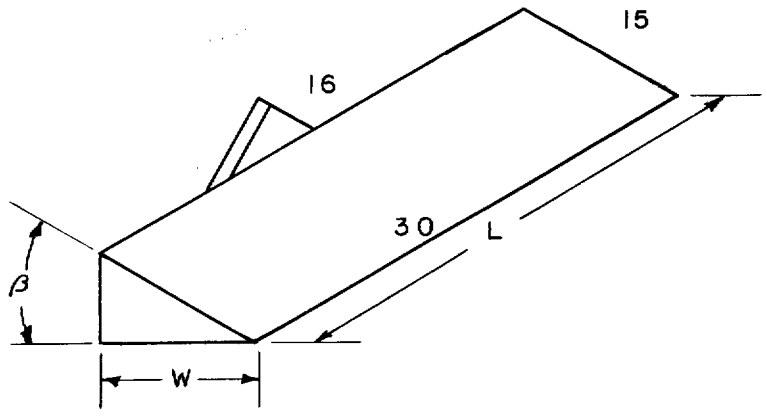


FIG. 3

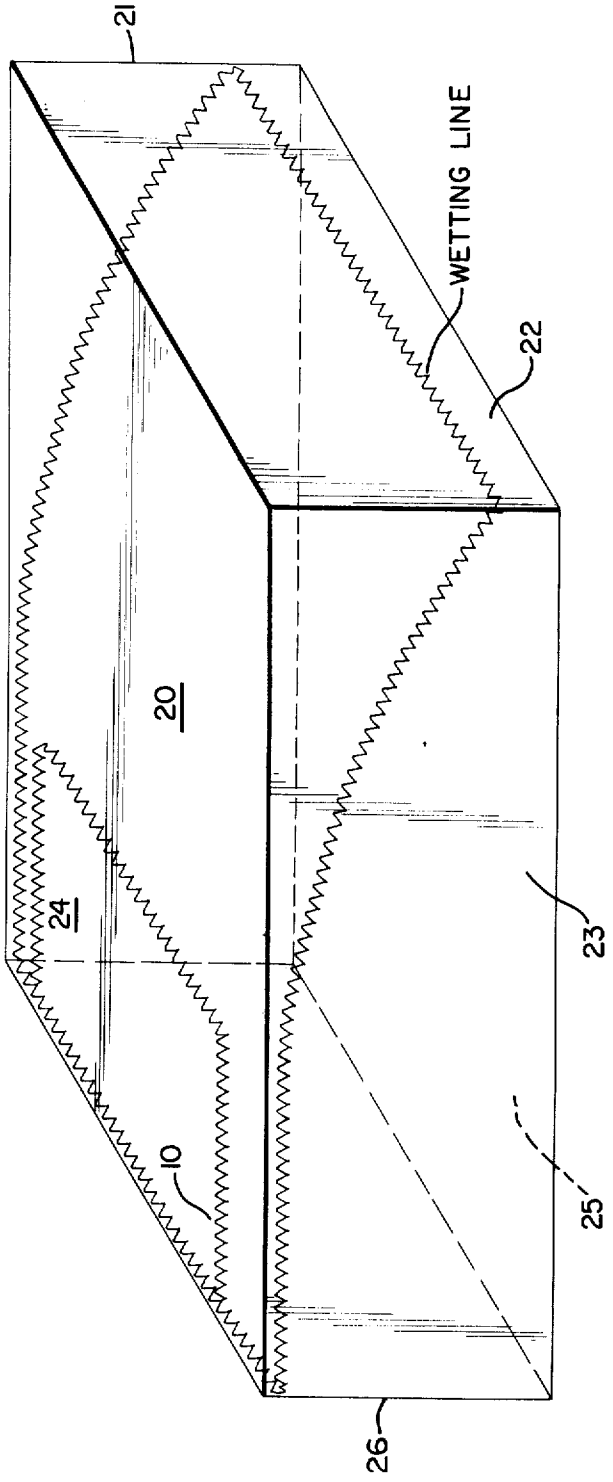


FIG. 4

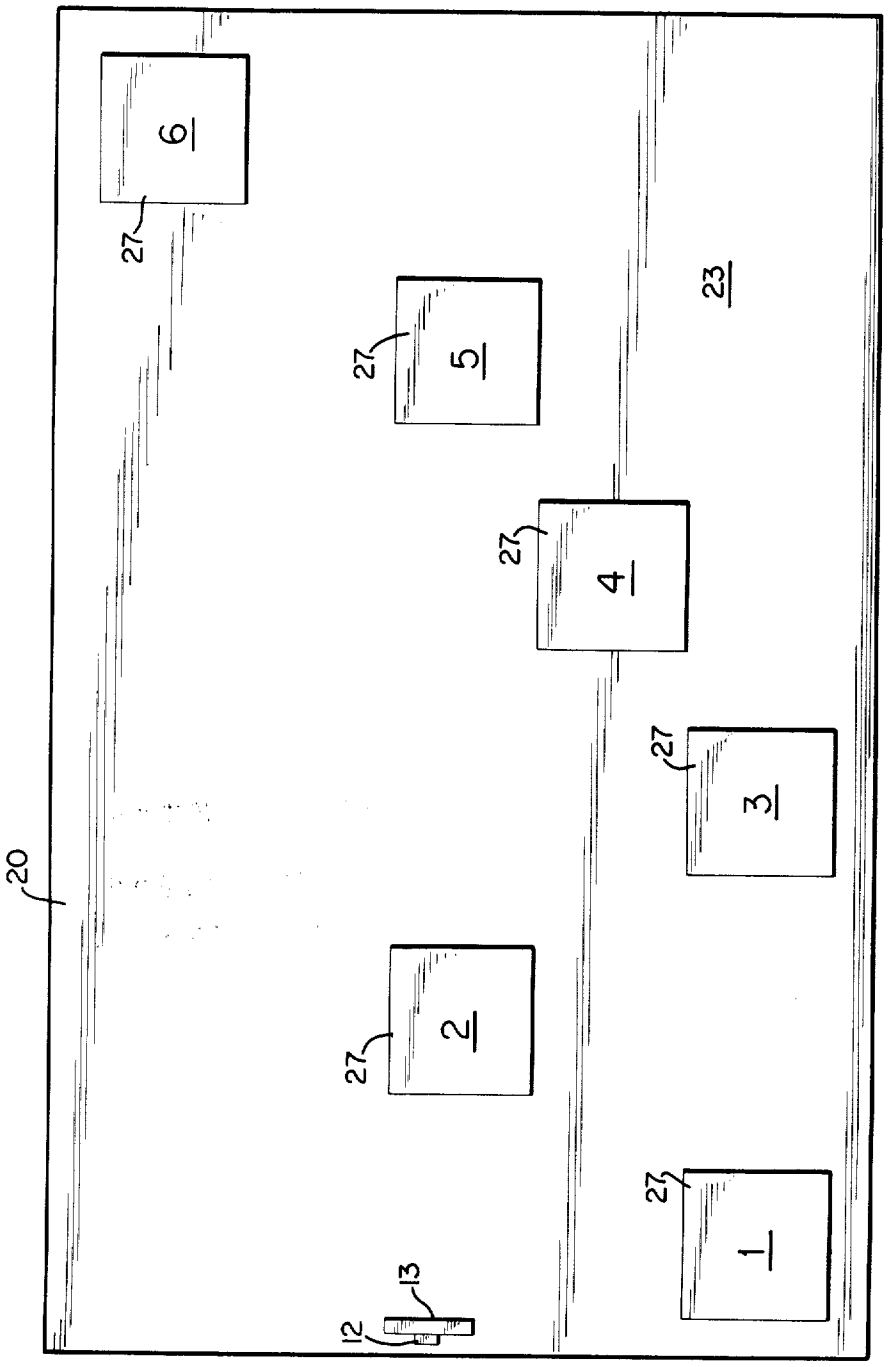
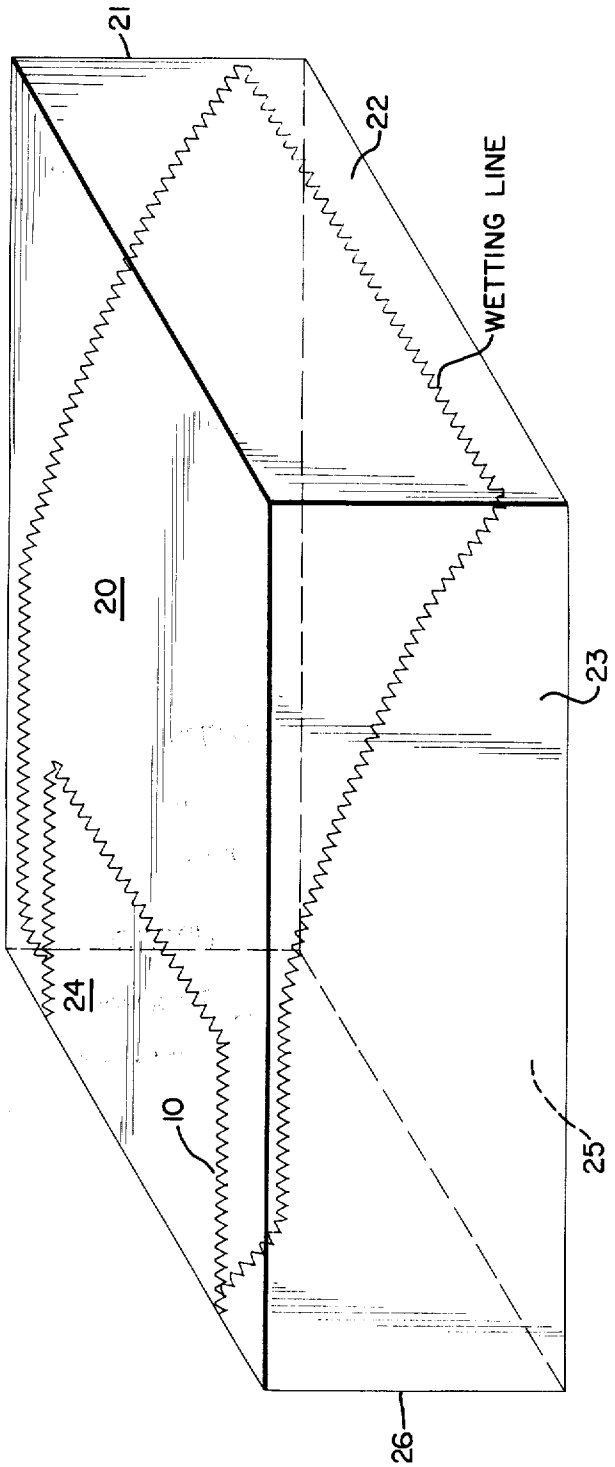


FIG. 5



FIRE SPRINKLER

BACKGROUND OF THE INVENTION

This invention relates to an improvement in automatic thermally actuated sprinklers, and is particularly concerned with an improved vertical wall mounted sprinkler providing an acceptable fluid discharge distribution pattern. While the present invention is capable of use in a number of other applications, it is intended primarily for use in fire sprinkler systems and is therefore described in such context.

In the design and marketing of fire sprinkler systems, it is of essential and primary importance that the device meet or exceed standards established for the wetting of surfaces necessary to the extinguishment of existing or incipient fires. In the achievement of this goal, prior art devices have employed the pendent or upright type sprinkler extending vertically from the ceiling or the wall of the enclosure to be protected.

A primary objection to this prior art apparatus resides in the fact that a plurality of sprinklers are usually required to effectively protect the enclosure. Further, the prior art sprinklers are conspicuous and detract from modern architectural designs.

Concrete ceilings prohibit, for all practical purposes, the use of the above-mentioned ceiling sprinklers, and a side wall mounting requires the use of elbow connections.

It is, therefore, an object of the present invention to provide a thermally actuated fire sprinkler which provides a more efficient and effective distribution of fire extinguishing fluid.

It is a further object of the present invention that the inventive sprinkler be mounted normal to a side wall of the enclosure to be protected thereby eliminating the need for elbow joints.

It is a further object of the present invention that only a small portion of the sprinkler, the deflection nozzle, protrudes from the side wall in an effort to maintain the esthetic qualities of the enclosure.

Another object of the present invention is to provide a fire sprinkler having a relatively narrow transverse dimension.

SUMMARY OF THE INVENTION

In furtherance of the stated objects and improvements, the present invention contemplates a sprinkler providing a controlled distribution of fluid in a confined enclosure. It comprises a nozzle having an orifice through which the fluid is discharged under pressure. Deflector means of substantially wedge shape are disposed in the discharge path of the fluid. The deflector means includes a leading edge formed at the narrow included angle having a substantially zero angle of attack relative to the discharged fluid. The deflector means effects the desired controlled distribution and are supported in the path of the fluid by yoke means operatively associated with the nozzle.

In another aspect of the improvement provided by the present invention, the deflector means comprises two wedge shape members substantially diametrically positioned in the path of the fluid discharging from the nozzle. Each wedge member is individually supported by separate yoke members fixedly mounted to and extending from the nozzle and configured to place the wedge members in the path of the fluid. In this configuration, the angle of attack of the respective leading edges of the wedge members is approximately zero and the narrow included angle of each is in a range between approximately 10° and approximately 60°.

For a better understanding of the present invention together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings; its scope is pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial cross-sectional side elevational view of the present invention;

FIG. **2** is a perspective view of a typical wedge shaped member;

FIG. **3** is a schematic pictorial representation of a wetting pattern produced by a particular embodiment of the present invention;

FIG. **4** is a plan view of a flat pan distribution of fluid produced by the same inventive embodiment as FIG. **3**; and

FIG. **5** is a schematic pictorial representation of a wetting pattern produced by another embodiment of the present invention.

The drawings are intended to be illustrative of the invention and not delimiting of its scope. Conventional symbols are used where appropriate, and the same numbers are used to identify similar parts in the various views.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, there is displayed a typical embodiment of the improved nozzle-deflector portion **10** of the present invention. A nozzle member **11** is normally threadably engaged by means of thread portion **18** to a thermally actuated fluid control valve or line. The thermally responsive portion of the sprinkler is described in copending application Ser. No. 336,849, filed Feb. 28, 1973 now U.S. Pat. No. 3,834,463 and entitled "Sensitive Sprinkler" and assigned to the assignee of the present invention. Nozzle **11** is of standard design including a shank section about which periphery threaded portion **18** is formed and an integral flange member extending axially and radially beyond the diameter of the shank section.

The fluid, indicated by arrows, passes through the internal chamber of nozzle **11**, the dimensions and geometry of which chamber are designed to produce desired flow characteristics. That portion **19***a* of the internal chamber communicating with the fluid source is of frusto-conical shape having its largest diameter D at the input end and the smaller diameter C at its exit. The discharge orifice portion **19** is of cylindrical shape smoothly intersecting with the walls of frusto-conical portion **19***a*. The diameter of orifice **19** is, of course, the same diameter C. Thus, the fluid entering frusto-conical portion **19***a* ultimately exits through orifice **19** into the enclosure.

Extending substantially axially from the flange of nozzle **11** is the yoke means including yoke members **12** and **14**. Yoke members **12** and **14** are attached to nozzle **11** by serrated portions at their respective ends engaging complementary through holes in nozzle **11** flange. The complementary through holes are of selected dimension so as to provide the appropriate interference when crimped or fastened to yoke members **12** and **14** thus providing a locking function. It should be

noted that yoke members **12** and **14** and wedge members **13** and **15** protrude from the wall.

Yoke members **12** and **14** generally extending axially are inclined toward the center line of nozzle **11** thereby placing wedge members **13** and **15**, respectively, in diametrically opposed positions in the path of the fluid discharged through orifice **19**. Wedge member **15** is shown as having a leading edge formed by narrow included angle β disposed at a zero angle of attack α relative to the fluid discharged from orifice **19**. The leading edge is dislocated from the center line of orifice **19** by a distance A and from the plane of orifice **19** by a distance B.

To better appreciate the configuration of wedge members **13** and **15**, reference is had to FIG. **2** showing a perspective view of a typical embodiment. A leading edge **30** having a length L is formed by the intersection of the wedge surfaces determinative of narrow included angle β. Length L is determined both by orifice **19** size as well as the fluid distribution pattern desired and may be altered significantly to meet operating exigencies. The thickness W is shown as a constant throughout the length L. Again, however, thickness W may be varied as may the included angle β. By utilization of such variations, it is possible to refine the geometry of the distribution pattern. Protuberances **16** of substantially triangular shape are shown as extending above the top surface of wedge member **15** and are typical of the devices employed to further alter the distribution pattern. It should be noted that protuberances **16** may take on a variety of shapes and its shape is not limited to that of triangular. These alterations and modifications, however, are not considered necessary in the achievement of the principal goals and objectives of the present invention but are intended only as refinements thereto.

Wedge member **13** is arranged similarly to member **15** except that its angle of attack α of the leading edge is shown as slightly greater than zero. In addition, the dimensions A and B from the center line and discharge plane or orifice **19**, respectively, are of slightly different dimension. These dimensional alterations are in many applications necessary to achieve the performance parameters required within a particular enclosure for which protection is sought. The means of attachment of wedge shape members **13** and **15** to yoke members **12** and **14**, respectively, are not of critical importance and may be achieved by welding, brazing, soldering, riveting, or threadable engagement. It is only necessary that the composite structure be of sufficient integrity to remain in the desired position during discharge of fluid through orifice **19**. Yoke members **12** and **14** are advantageously formed from rod stock but again may be formed of other materials having sufficient strength so as to permit that minimum dimensioning necessary to avoid disruption of the pattern provided by deflector means **13** and **15**.

It is noted that depending upon the desired distribution pattern, either a single deflector wedge or a plurality may be utilized in furtherance of the present invention. It is considered well within the knowledge of those of ordinary skill in the art when employing the teachings of this invention to arrive at the deflector means array most appropriate to providing required operational characteristics. It is further pointed out that substantially variant yoke means may be employed, for example, yoke members **12** and **14** need not be attached to nozzle **11** flange but may be suitably engaged to other portions of the sprinkler assembly and even may be rotatably engaged so that the action of the discharge fluid causes placement of wedge members **13** and **15** in the path of the discharge fluid. This latter approach in certain instances may allow for a design having further decreased transverse dimension and thus more esthetically pleasing.

In considering operation of this novel sprinkler arrangement as well as typical configurations, recourse is had to the following examples:

EXAMPLE I

(See FIG. 1)

Nozzle Dimensions
C approximately 0.51 inch
D approximately 0.75 inch
E approximately 0.62 inch
F approximately 0.20 inch
Wedge **13** Dimensions
L = 1.6 inches
W = 0.40 inch
$\beta = 20.5°$
A = 18/64 inch
B = 17/64 inch
$\alpha = 0°$
Wedge **15** Dimensions
L = 1.6 inches
W = 0.40 inch
$\beta = 29°$
A = 23/64 inch
B = 17/64 inch
$\alpha = 0°$
Fluid Pressure
40 PSI
Results

FIG. **3** shows the wetting pattern achieved after a ten minute test in an enclosure **20**. The improved sprinkler **10** of the present invention wetted side walls **21** and **23**, vertical wall **22**, near wall **26**, ceiling **24** and floor **25** in accordance with the pattern indicated by the wetting line indication of FIG. **3**. Near wall **26** was 95% wet at the end of the test. FIG. **4** demonstrates the results of the standard flat pan pattern test similarly showing the improved operational performance of the present invention with respect to prior art devices. Six flat pans **27** are placed in the positions indicated in FIG. **4**. Table I shows the amount of water gathered at each flat pan **27** in terms of total volume of water and gallons-per-minute per square foot.

Table I

3' × 3' Pan	1	2	3	4	5	6
Vol. of Water Collected (Gals.)	3.29	5.49	4.87	7.21	6.33	1.92
Gallons-Per-Minute Per Sq. Ft.	.036	.061	.054	.080	.070	.021

EXAMPLE II

(See FIG. 1)

Nozzle Dimensions
(Same as Example I)

Wedge **13** Dimensions
L = 1.6 inches
W = 0.40 inch
$\beta = 20.5°$
A = ¼ inch
B = 1/**32** inch
$\alpha = 0°$
Wedge **15** Dimensions
L = 1.6 inches
W = 0.40 inch
$\beta = 29°$
A = 21/**64** inch
B = 1/**8** inch
$\alpha = 0°$
Fluid Pressure
40 PSI
Results

The wetting pattern shown in FIG. **5** demonstrates the improved performance of the present invention. The wetting line indicates those portions of side walls **21** and **23**, far wall **22**, near wall **26** and ceiling **24** wetted by the improved sprinkler **10** during a 10 minute test. Near wall **26** achieved 95% wetting and side walls **21** and **23** achieved 84% wetting.

As demonstrated by the foregoing examples represented in FIGS. **3**, **4** and **5**, the present invention achieves an improved fire sprinkler producing controlled fluid distribution patterns meeting requisite standards of operation. It further provides a device of reduced transverse dimension, in the examples shown being no greater than approximately 1½ inches from the entry port of nozzle **11** to the end of yoke members **12** and **14**. This novel structure permits its utilization in vertical side wall mountings substantially hidden to the viewer. The distribution patterns are readily modified to meet the varying dimensions of room configurations as well as to conform to variation in code requirements.

Thus, there is provided an improved thermally responsive sprinkler utilizing wedge shape deflectors in the path of fluid ejected from a nozzle to provide a controlled distribution of fire extinguishing fluid. The design is comprised of mechanically simple parts, economical of fabrication and reliable in operation.

While there has been described what are at present considered to be the preferred embodiments of the invention, it is obvious to those of ordinary skill in the art that various changes and modifications may be made. Therefore, it is intended that the appended claims cover all such changes and modifications as fall within the scope of the invention.

I claim:

1. A fire extinguishing apparatus for providing controlled distribution of a fluid within an enclosure having substantially vertical side walls, comprising:

a source of said fluid;

a nozzle having an orifice therethrough mounted in at least one of said side walls through which said fluid is discharged under pressure, said nozzle having a substantially horizontal axis;

deflector means coupled to said nozzle; and

yoke means operably associated with said nozzle for disposing said deflector means in the path of said fluid discharge for effecting said controlled distribution whereby a fire in said enclosure is extinguished.

2. A fire extinguishing apparatus according to claim **1** wherein said deflector means comprises at least one wedge-shaped deflector disposed in said fluid discharge path.

3. A fire extinguishing apparatus according to claim **2**, wherein said deflector means includes a plurality of wedge-shaped members, each member having a narrow included angle greater than approximately 10° and less than approximately 60° and each member having a leading edge having an angle of attack less than approximately 20°.

4. The sprinkler of claim **2**, wherein said deflector means consists of two wedge shape members substantially diametrically positioned in said fluid discharge path.

5. The sprinkler of claim **3**, further including protuberances extending above the top surface of said deflector means for altering the fluid distribution pattern.

6. The sprinkler of claim **3**, wherein one of said wedge shape members has a narrow included angle of approximately 29° and the other wedge shape member has a narrow included angle of approximately 20.5°; and both said wedge shape members have an angle of attack of approximately 0°.

7. The sprinkler of claim **5**, wherein said leading edges are axially displaced less than approximately 0.30 inch from said orifice and transversely displaced less than approximately 0.31 inch from said orifice center line.

8. The sprinkler of claim **6**, wherein said wedge members have a length of approximately 1.6 inches and a width of approximately 0.40 inch.

9. The sprinkler of claim **7**, wherein said transverse dimension is less than approximately 1.25 inches, and said pressure is approximately 40 pounds per square inch.

10. The sprinkler of claim **1**, wherein said nozzle is within said wall and only said yoke means and said deflector means extend beyond the plane of said wall.

11. The sprinkler of claim **17**, wherein said nozzle has an inlet orifice threadably engaged to a thermally actuated fluid source, said inlet orifice diameter is approximately 0.75 inch and said nozzle internal through passage comprises a first frusto-conical portion smoothly connecting to a cylindrical portion forming said orifice, said cylindrical portion having an axial length of approximately 0.20 inch and said frusto-conical portion having an axial length of approximately 0.42 inch.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,904,126

DATED : September 9, 1975

INVENTOR(S) : Roger L. Allard

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

Claim 11, line 1, change "17" to --7--.

Signed and Sealed this

Thirteenth Day of *September 1977*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

LUTRELLE F. PARKER
Acting Commissioner of Patents and Trademarks