United States Patent [19]

Livingston

[11] **3,831,681**

[45] **Aug. 27, 1974**

[54] **FIRE PROTECTION SYSTEM UTILIZING MODULAR COMPONENTS**

[75] Inventor: **William L. Livingston,** Sharon, Mass.

[73] Assignee: **Factory Mutual Research Corporation,** Norwood, Mass.

[22] Filed: **July 23, 1973**

[21] Appl. No.: **381,764**

[52] U.S. Cl. **169/16,** 239/207, 239/209, 285/197

[51] **Int. Cl.** **A62c 37/02**

[58] **Field of Search** ..... 239/207–209, 239/542, 547; 169/1 R, 1 A, 1 B, 2 R, 5, 16, 17; 285/156, 197; 239/124, 127

[56] **References Cited**

UNITED STATES PATENTS

495,402	4/1893	Dugger	239/208 X
1,246,798	11/1917	Thompson	169/16
1,804,742	5/1931	Campbell	239/547
2,157,274	5/1939	Williams	285/156
2,309,099	1/1943	Crampton et al.	285/156
2,544,176	3/1951	Palmer	285/197 X
3,362,730	1/1968	St. Clair et al.	285/197 X
3,702,159	11/1972	Livingston	169/5

Primary Examiner—Lloyd L. King
Assistant Examiner—Andres Kashnikow
Attorney, Agent, or Firm—Lane, Aitken, Dunner & Ziems

[57] **ABSTRACT**

A fire protection system in which a plurality of spaced parallel branch conduits extend perpendicular to a plurality of spaced parallel cross-main conduits and are connected thereto to form a network adapted to be supported in an elevated position in a substantially horizontal plane in an area to be protected by fire. Each cross-main conduit is formed by a relatively long tubular portion and a plurality of relatively short tubular portions integral with the long tubular portion and extending perpendicular thereto. The relatively short tubular portions register with the long tubular portion and are spaced apart along the length thereof for the purpose of connecting to the branch conduits, and a plurality of discharge heads are connected to the branch conduits for discharging extinguishant.

4 Claims, 4 Drawing Figures

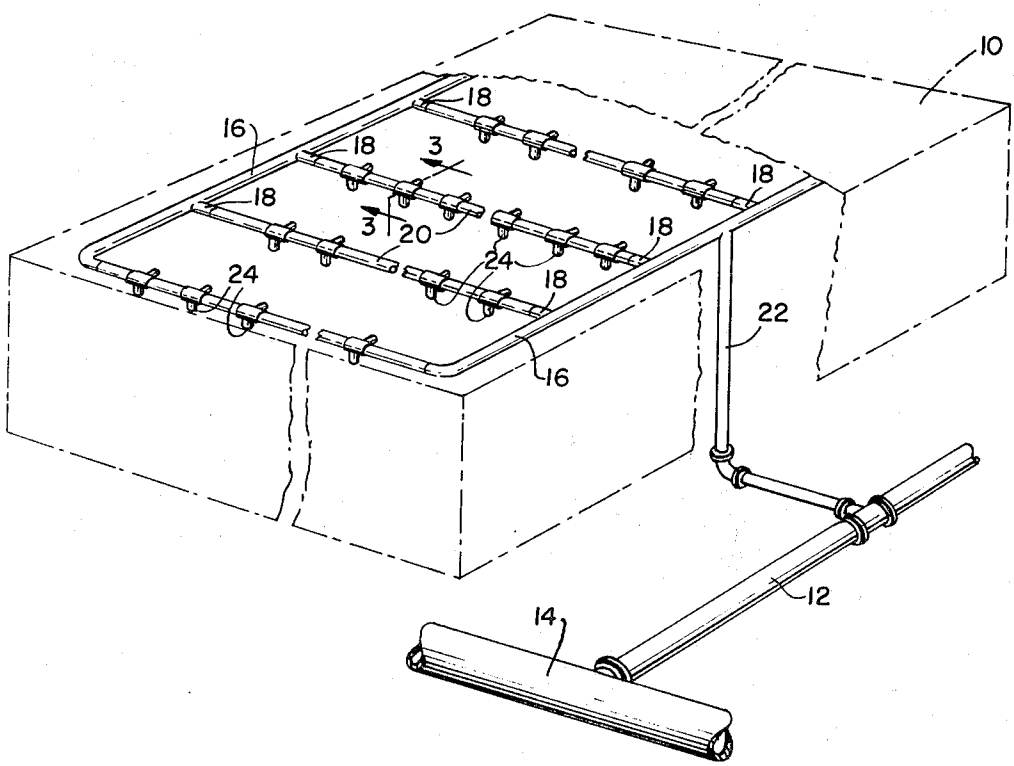


FIG. 1.

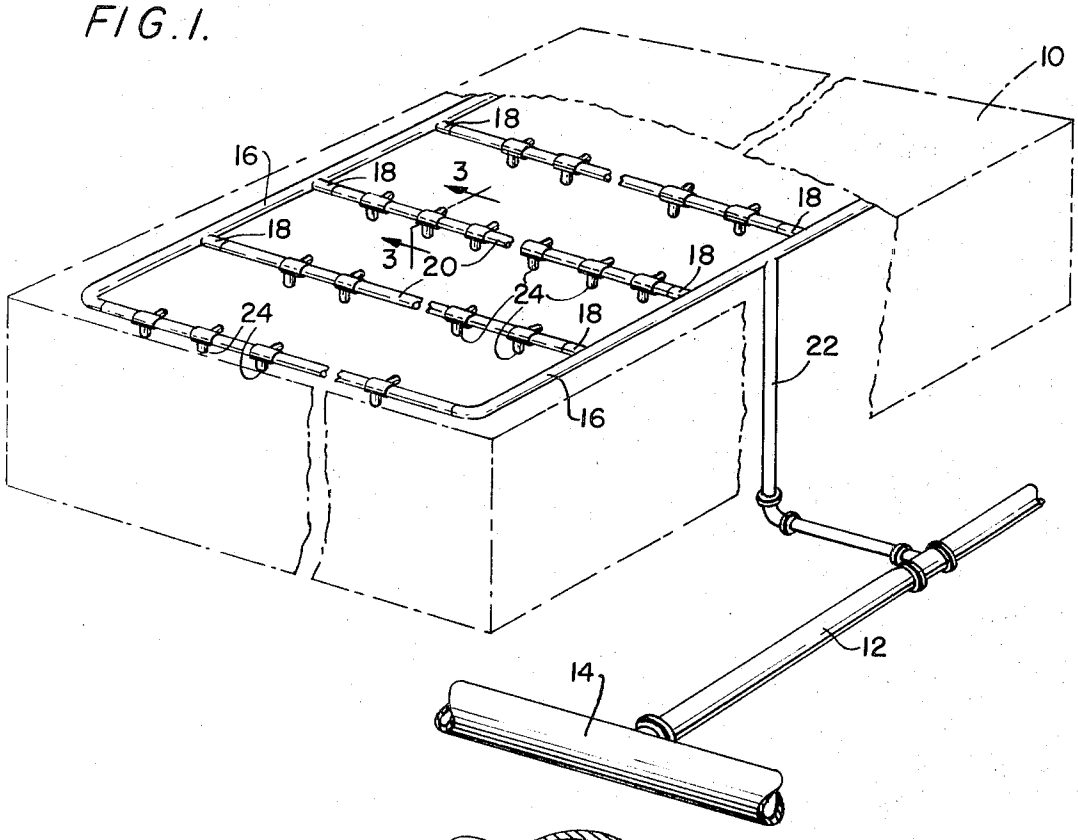
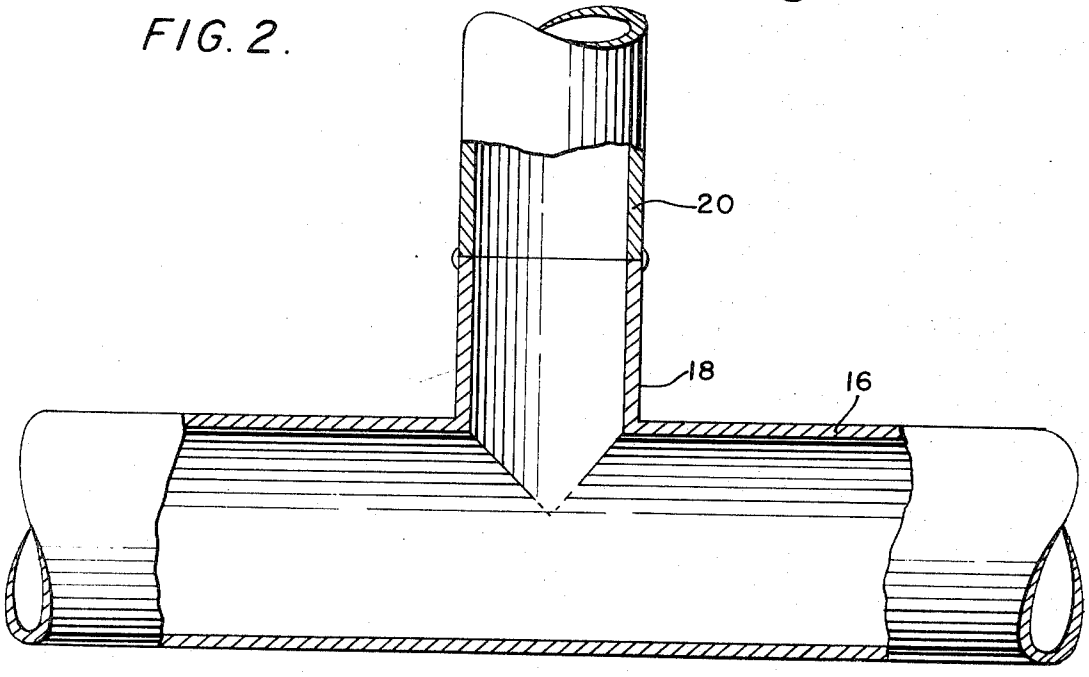


FIG. 2.



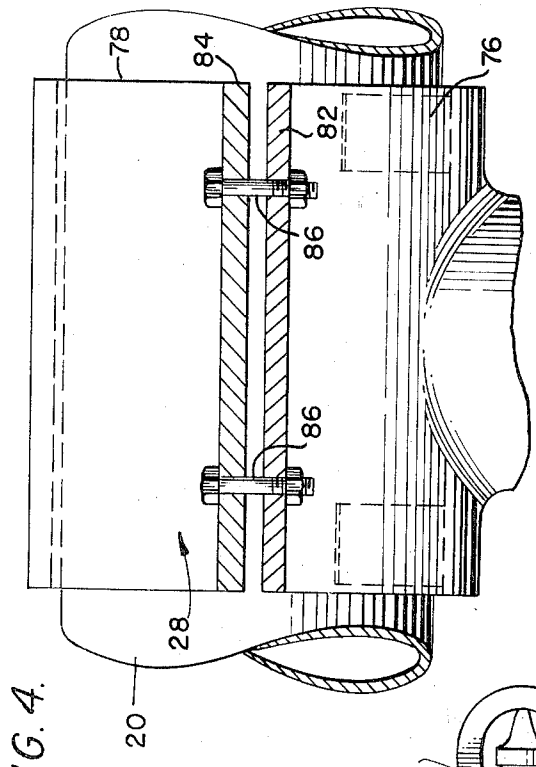

78
84
76
82
86
86
28
20

FIG. 4.

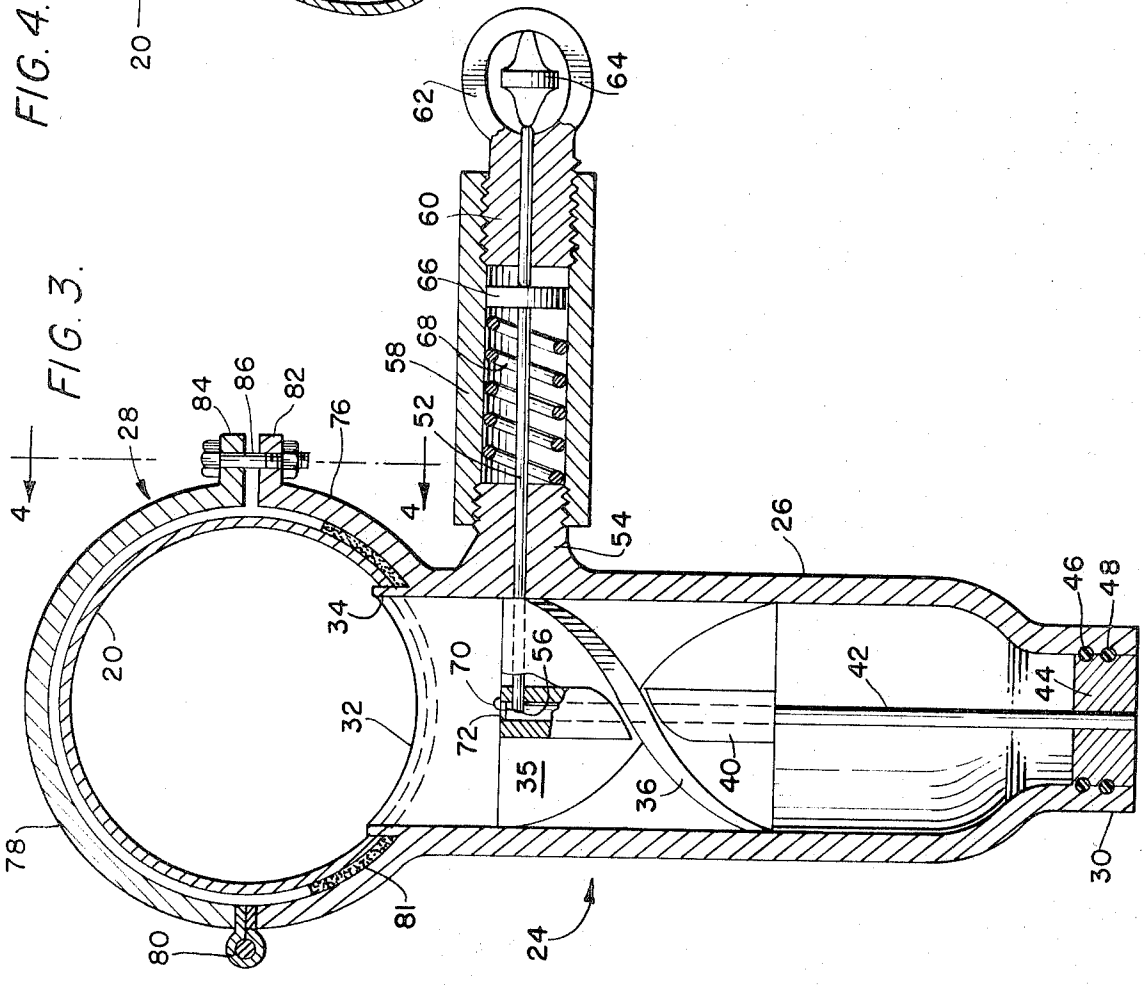

62
64
60
66
68
58
52
84
86
82
76
28
4
4
54
26
46
48
34
20
56
70
42
44
32
72
35
36
40
78
81
80
24
30

FIG. 3.

FIRE PROTECTION SYSTEM UTILIZING MODULAR COMPONENTS

BACKGROUND OF THE INVENTION

This invention relates to a fire protection system and, more particularly, to a fire protection system formed by a plurality of modular components.

In applicant's U.S. patent application Ser. No. 375,946, filed July 2, 1973, and assigned to the same assignee as the present invention, a fire protection system is disclosed having a continuous loop piping network formed by a plurality of spaced parallel cross-main conduits and a plurality of spaced parallel branch conduits connected between the cross-main conduits. In this manner, upon a head or heads on a particular branch conduit opening, fluid is supplied to the heads by a substantial portion of the entire network including both of the cross-main conduits. Among other advantages, this arrangement enables a relatively low flow rate to occur through each cross-main conduit and each branch conduit that does not have an open head, resulting in a relatively low friction loss. Therefore, in addition to enabling relatively low capacity conduits to be utilized, the system permits branch conduits of the same size to be incorporated in a vast majority of installations.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a fixed fire protection system which incorporates all the advantages of the above-mentioned system and, in addition, is formed by a minimum of standard components and can be installed in a relatively simple and easy manner.

It is a still further object of the present invention to provide a discharge head for use in the above system.

Towards the fulfillment of this and other objects, the system of the present invention comprises at least two spaced, parallel cross-main conduit members, each being formed by a relatively long tubular portion and a plurality of relatively short tubular portions integral with said long tubular portion and extending perpendicular thereto, said relative short tubular portions registering with said long tubular portions and being spaced apart along the length thereof, a plurality of spaced parallel branch conduits extending perpendicular to said cross main conduit members, each branch conduit being connected to two relative short tubular portions of two adjacent cross-main conduit members to form a network adapted to be supported in an elevated position in a substantially horizontal plane in an area to be protected by fire, said branch conduits each having a plurality of spaced openings formed through the wall thereof, supply means for supplying a source of extinguishant to said network, and a plurality of discharge heads connected to said branch conduits and each having an inlet registering with a corresponding opening in said branch conduits, said heads being normally closed and being adapted to selectively open and discharge said extinguishant.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the fire protection system of the present invention shown installed in a building;

FIG. 2 is an enlarged, fragmentary, partial cross-sectional, partial elevational view of a portion of the conduit system used in the system of the present invention;

FIG. 3 is an enlarged vertical sectional view taken along the line 3—3 of FIG. 1, and depicting the discharge head of the present invention; and

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawings, a building **10** is shown in phantom lines which is equipped with a fire protection system embodying features of the present invention. A buried feed main **12** is disposed adjacent the building and is connected to a source of extinguishant, such as a municipal water supply line **14**, for delivering extinguishant, such as water, thereto.

The system of the present invention comprises a pair of spaced, parallel cross-main conduits **16** extending longitudinally with respect to the area to be protected in the building, with each cross-main conduit having a plurality of spaced, relatively short, tubular portions **18** extending perpendicularly thereto. The tubular portions **18** register with their respective cross-main conduits **16**, to one side thereof and are spaced apart an equal distance, with each tubular portion of one cross-main conduit being aligned with a corresponding tubular portion **18** of the other cross-main conduit. A plurality of spaced parallel branch conduits **20** extend perpendicular to the cross-main conduits **16** and register with two aligned tubular portions **18** of the respective conduits **16** to form a continuous network of conduits. A riser **22** connects the feed main **12** to one cross-main conduit **16** to supply water to the network formed by the conduits **16** and **20**.

The details of a cross-main conduit **16** and its connection with a branch conduit **20** are shown in FIG. **2**. In particular, the tubular portion **18** is formed integral with the cross-main conduit **16** and has a diameter slightly smaller than that of the cross-main conduit. The branch conduits **20** are of a diameter identical to that of the tubular portions **18** and may be attached thereto by welding as shown or by any other conventional mechanical connection.

It can be appreciated that, as a result of the foregoing, the entire network is formed by conduits of only two sizes. This, of course, eliminates the need for "tee" fittings and the attendant cutting and sizing normally associated with these type of installations.

A plurality of spaced discharge heads, preferably in the form of direct discharge nozzles **24**, are connected in a spaced relation, along each branch conduit **20**, with one nozzle being shown in detail in FIG. **3**. In particular, each nozzle **24** comprises a cylindrical body member **26** having a clamp assembly **28** formed on its upper end as viewed in FIG. **3**, and a lower end portion **30** which defines an outlet orifice of a reduced cross-section. The body member **26** has an inlet **32** which registers with an identically sized opening formed through the wall of the branch conduit **20**, with a lip **34** being formed on the inner wall of the body member **26** which extends through the latter opening and into the conduit **20**.

A pair of spiral vanes **35** and **36** are fixed within the body member **26** for imparting a swirling motion to

water flowing downwardly therethrough in a conventional manner. The vanes **35** and **36** support a hollow central hub **40** which, in turn, slidably supports a rod **42** having a plug **44** fixed on its lower end. A pair of sealing rings **46** and **48** are positioned about the periphery of the plug **44** and sealingly engage the inner wall of the body member **26** near the lower end portion **30**, to prevent the flow of water from the outlet.

The rod **42** is latched in the position shown in FIG. **3** by a rod **52** which extends slidably through an externally threaded boss **54** projecting from the side of the body member **26.** One end of the rod **52** extends through the vane **35** and the wall of the central hub **40** into a slot **56** in the rod **42** to latch it in the position shown in FIG. **3.**

A sleeve **58** is threaded on the end of the boss **54.** The outer end of the sleeve is closed off by an externally threaded stub shaft **60** having a ring or yoke **62** thereon. The rod **52** slidably extends through the stub shaft **60** and the other end of the rod engages a conventional thermal fuse element **64** positioned within the ring **62.** The fuse element **64** prevents movement of the rod **52** to the right as viewed in FIG. **3,** until the heat of a fire fuses the element **64** so that it collapses. Since the element **64** is the standard type commonly used in conventional sprinkler heads now on the market, it will not be described in greater detail.

The rod **52** has a piston head **66** mounted thereon which slidably engages the internal wall of the sleeve **58.** A spring **68** is positioned between the boss **54** and the piston head **66** to bias the piston head and the rod **52** to the right with a predetermined biasing force.

With this arrangement, the piston head **66** and the rod **52** will be driven to the right under the action of the spring **68** upon the fuse element **64** collapsing in response to the heat of the fire, and thus unlatch the rod **42.**

A thread **70** is provided which has one end fastened to the upper end of the rod **42.** The thread **70** extends through an opening **72** formed in the upper vane **35,** and the other end of the thread is fastened to the top surface of the latter vane. The above-mentioned fastening may be achieved in any conventional manner, such as by the use of epoxy or the like. The thread is preferably of a nylon material and its length is selected so that it will have a slight slack therein in the deactivated position of FIG. **3** to avoid any unwanted tension being placed thereon due to slight dimensional variations of the other components of the nozzle.

It is understood that the nozzle **24** can take other forms within the scope of the invention, such as a conventional sprinkler head in which a deflector plate is disposed adjacent the outlet for breaking up the spray, or such as that disclosed in application Ser. No. 346,454, filed by Karol Zenker on Mar. 30, 1973, or that disclosed in application Ser. No. 366,740, filed by the present inventor on June 4, 1973. Both of these applications are assigned to the assignee of the present invention and their respective disclosures are hereby incorporated by reference.

Referring to FIGS. **3** and **4,** the clamp assembly **28** consists of a lower clamp portion **76** integral with the body member **26** and an upper clamp portion **78** pivotally connected to the lower clamp portion about a hinge assembly **80.** A gasket **81** extends between an outer surface portion of the conduit **20** and the inner wall of the clamp portion **76** to seal against leakage. A pair of lips **82** and **84** protrude from the clamp portions **76** and **78,** respectively, and are adapted to be connected together by means of a plurality of bolts **86** extending through aligned openings in the lips and secured by nuts **88.** In this manner, the lower clamp portion **76** provides support for the relatively thin-walled branch conduit **20,** while the upper portion permits the nozzle **24** to be connected to, and disconnected from, the branch conduit with relative ease.

In operation, the nozzles **24** are installed in a space relation along the branch conduit **20** in the conduit shown in FIGS. **3** and **4,** i.e., with the rod **42** latched in the body member **26** by the rod **52,** and with the thread **70** fixed to the rod **42** and the vane **35.** If the fusible link **64** of any nozzle **24** is thermally actuated in response to an elevated temperature in its vicinity, the tension of the spring **68** causes the rod **52** to release the rod **42** from its latched condition. The water pressure in the body member **26** acting on the inner end face of the plug **44** forces it downwardly as viewed in FIG. **3,** and causes a tension to be applied to the thread **70** in direct proportion to the amount of pressure. The thread **70** can be designed to fail, or break, in response to a precise predetermined pressure, which will release the rod **42** and therefore the plug **44,** and permit them to be discharged outwardly from the body member **26.** If the water pressure is not sufficient to break the thread **70,** the plug **44** will not be expelled from the body member **26** despite release of the fuse element **64,**

It can be appreciated that, upon one or more nozzles **24** being actuated by virtue of their fuses **64** melting and their threads **70** breaking to permit the discharge of water therefrom, water is supplied to the open nozzle through its corresponding branch conduit **20** via both cross-main conduits **16,** which, in turn, are supplied with water by the remaining branch conduits **20.** As a result, a relatively low flow rate occurs through each cross-main conduit **16** and each branch conduit **20** that does not have an open nozzle **24** thereon, resulting in relatively low friction losses. Also, since the pressure drop will be relatively low from branch conduit to branch conduit, yet will be relatively high down each individual branch conduit that has one or more nozzles that open, the above-mentioned pressure floor will insure that no more than a predetermined, relatively low, number of nozzles will be opened on a given branch conduit. This, of course, enables relatively low capacity, or low diameter, branch conduits and cross-main conduits to be utilized, when compared to a conventional system having a single, centrally located cross-main conduit, as discussed above.

According to another feature of the present invention, the branch conduits **20** can be formed of stainless steel or schedule **10** carbon steel which, in addition to having a relatively low coefficient of friction, are light in weight and thus further facilitate installation.

As an example of the sizes of the system of the present invention, the branch conduits **20** can extend for 600 feet between the cross-mains and can consist of 15 units of 40 feet per unit which are welded, or otherwise mechanically connected, at their ends. The cross-main conduits **16** can be approximately 250 feet in length with both the cross-main conduits and the branch conduits **20** having relatively small diameters such as 3¾ **inches and** 2½ inches, respectively, and being formed

of relatively thin walls such as .05 inches and .0375 inches in thickness, respectively.

It can be appreciated that the system of the present invention is much easier to install when compared to systems of the prior art. For example, the relatively small diameters and thin walls of the conduits **16** and **20** enables them to be easily transported to, and handled at, the job site. Also, the conduits **16** and **20** can be assembled in the job site without the need for tee shape fittings, etc. Further, the holes in the wall of the branch conduits **20** for receiving the discharge nozzles **24** may be cut at the job site by conventional tubing cutters, etc., and the nozzles installed in a relatively short period of time by means of the clamp assemblies **28.** Also, the system of the present invention does not have to be pre-engineered which, of course, reduces the design and engineering costs.

It is understood that several variations may be made in the foregoing without departing from the scope of the present invention. For example, several cross-main conduits may be provided in a spaced relationship, with the relatively short tubular portions thereof extending from both sides thereof for connection to the branch conduits.

Of course, other variations of the specific construction and arrangement of the fire protection system disclosed above can be made by those skilled in the art without departing from the invention as defined in the appended claims.

I claim:

1. A fire protection system comprising at least two spaced, parallel crossmain conduits, a plurality of relatively short tubular connector members integral with said cross-main conduits and extending perpendicular thereto, said connector members registering with said cross-main conduits and being spaced apart along the length thereof, a plurality of spaced parallel branch conduits extending between adjacent cross-main conduits and perpendicular thereto, each of said branch conduits being connected to two connector members of the adjacent cross-main conduits to form a co-planar network of conduits adapted to be supported in an elevated position in a substantially horizontal plane in an area to be protected by fire, a riser conduit connected to one of said conduits for supplying extinguishant to said conduits, and a plurality of discharge heads connected to said branch conduits and each having an inlet registering with a corresponding opening in said branch conduits, said heads being normally closed and being adapted to selectively open, said branch conduits and said cross-main conduits extending substantially horizontal so that extinguishant is supplied to an open head by both adjacent cross-main conduits and the branch conduit to which the head is connected.

2. The system of claim **1** wherein said branch conduits are of the same diameter.

3. The system of claim **2** wherein said cross-main conduits are of the same diameter.

4. The system of claim **1** wherein said heads engage their respective branch conduits and include clamping means for supporting said heads relative to said conduits.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,831,681 Dated August 27, 1974

Inventor(s) WILLIAM L. LIVINGSTON

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

Column 4, line 11, change "conduit" (second occurrence) to read -- condition --.

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.