

[54] FIRE PROTECTION SYSTEM HAVING A CONTINUOUS LOOP PIPING NETWORK

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[22] Filed: July 2, 1973

[21] Appl. No.: 375,946

[52] U.S. Cl. 169/16

[51] Int. Cl. A62c 35/00

[58] Field of Search 239/207-209, 239/279; 169/1 R, 1 A, 1 B, 2 R, 5, 16, 17

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[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. A plurality of discharge heads are connected to the branch conduits and are spaced along the lengths thereof with the heads being normally closed and being adapted to selectively open and discharge extinguishant supplied thereto from both of the cross-main conduits.

7 Claims, 4 Drawing Figures

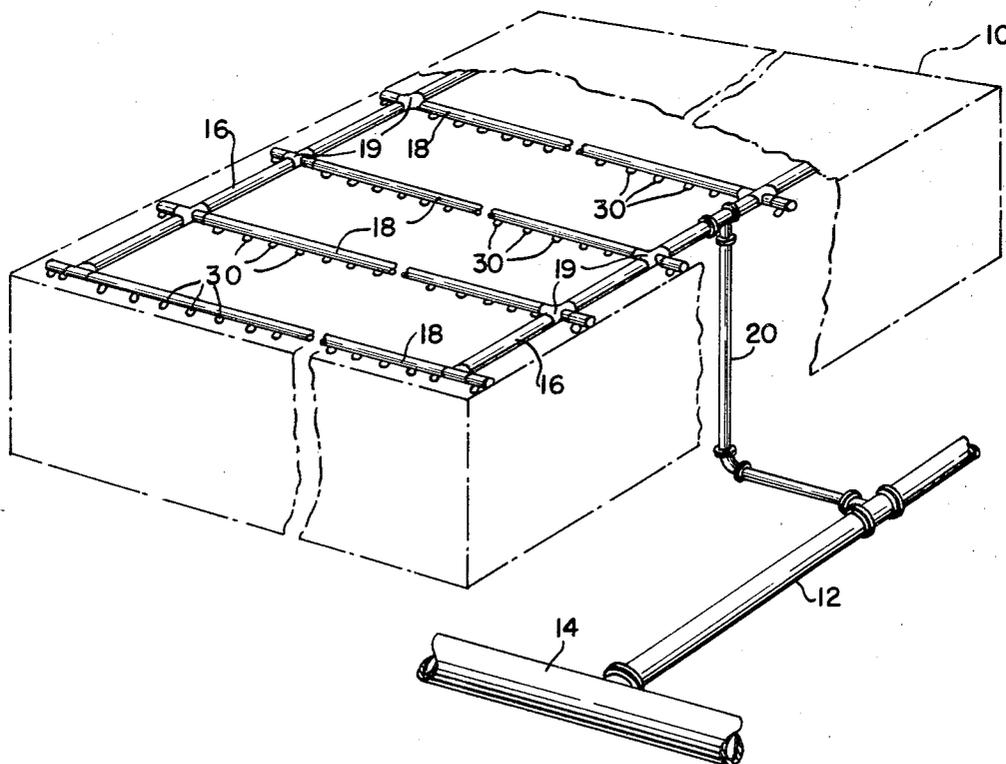


FIG. 1.

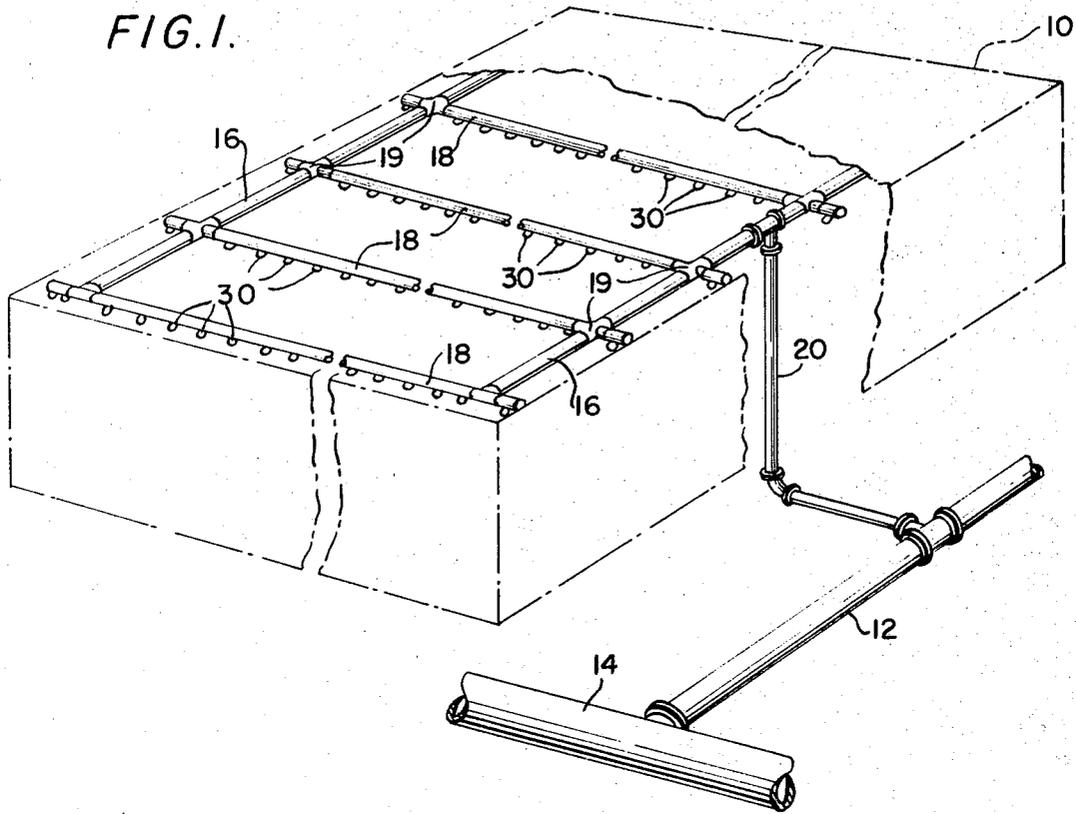


FIG. 2.

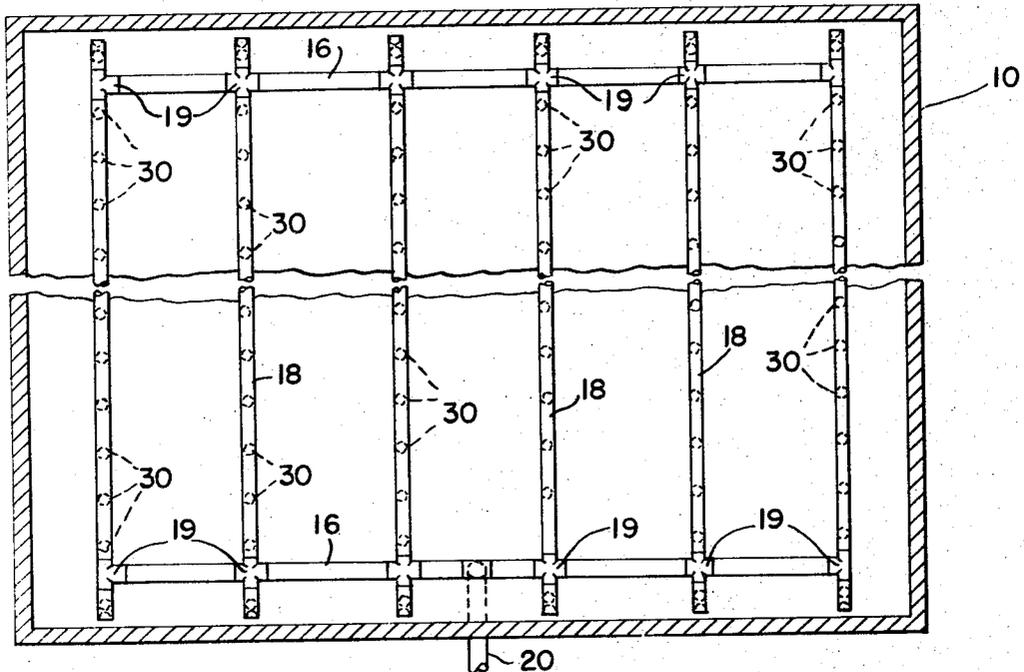


FIG. 3.

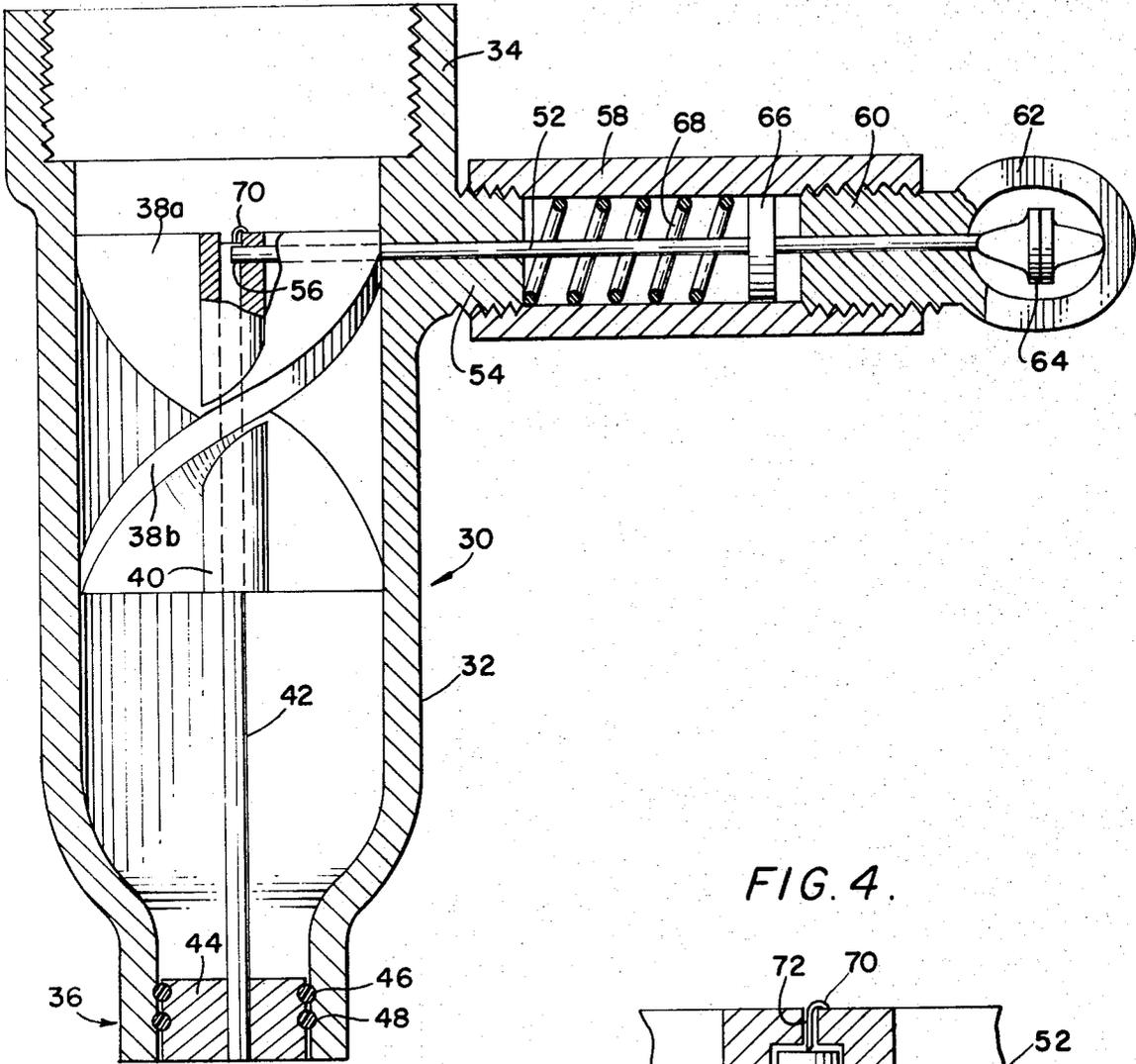
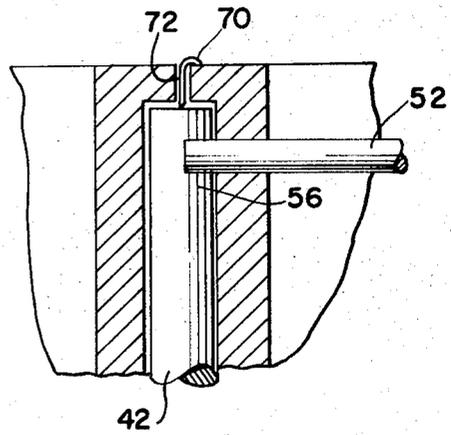


FIG. 4.



FIRE PROTECTION SYSTEM HAVING A CONTINUOUS LOOP PIPING NETWORK

BACKGROUND OF THE INVENTION

This invention relates to a fire protection system, and more particularly, to a fixed fire protection system employing a plurality of conduits interconnected in a manner to form a continuous network for distributing the extinguishant.

A vast majority of fixed fire extinguishing systems in use today employ a vertical conduit or riser which connects the source of extinguishant, usually a municipal water supply or the like, to what is commonly referred to as a cross-main, which is a horizontally extending pipe of a relatively large diameter directly connected to the riser and extending longitudinally down the central portion of the area to be protected from fire. A plurality of branch conduits extend perpendicular to, and are connected at their ends to both sides of, the cross-main conduits, with the conduits being supported in an elevated position in the space to be protected. A plurality of spaced sprinkler heads are mounted on the branch conduits and are adapted to selectively open in response to a predetermined fire condition to permit the discharge of extinguishant, usually in the form of water, through the riser, the cross-main conduit and the branch conduit to which the open head is connected.

In conventional designs of this type, the cross-main conduit is of a relatively large diameter, and each branch conduit has a varying diameter extending from a relatively large diameter at the end thereof connected to the cross-main conduit, to a relatively small diameter at the other end thereof, in order to accommodate the relatively high flow required near the cross-main conduit and the relatively low flow required toward the end of the branch conduits.

However, several disadvantages result from this type of arrangement. For example, the sizes of the cross-main and the branch conduits vary with each installation depending on the particular area to be protected, the particular flow rates desired, and the particular pressure of the source of extinguishant, etc. This, plus the fact that branch conduits of varying diameters are used in the same installation and that each branch conduit itself has a varying diameter along its length, as discussed above, makes it extremely difficult to design a standard system for a given area since there are so many variables. As a result, each installation must be "custom" designed, which considerably adds to its cost.

Another disadvantage of these type prior art systems is that when a head of a particular branch conduit opens, the extinguishant flows through only the cross-main conduit and the one branch conduit while no flow occurs through the branch conduits having heads which are not opened. Therefore, the cross-main conduit and each of the branch line conduits must have a relatively large capacity since they must carry all of the flow from the riser to the open head. Due to this relatively high flow rate through each conduit, relatively large pressure losses occur in the conduits.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a fire protection system in which the branch

conduits are of substantially the same diameter to enable the systems to be pre-engineered and eliminate custom designing.

It is a further object of the present invention to permit a fire extinguishing system of the above type in which the diameter of the cross-main conduits and the branch conduits are relatively small and do not vary along their lengths, to further add to the advantages discussed above.

It is a still further object of the present invention to provide a fire protection system in which the flow rates through the conduits are relatively low to eliminate relatively high pressure losses in the system.

Toward the fulfillment of these and other objects, the fire protection system of the present invention comprises at least two spaced parallel cross-main conduits, a plurality of spaced, parallel branch conduits of substantially the same diameter, each of said branch conduits extending perpendicular to said cross-main conduits and connected thereto, said conduits forming a network adapted to be supported in an elevated position in a substantially horizontal plane in an area to be protected by fire, a supply conduit having one end connected to one of said conduits and the other end adapted for connection to a source of extinguishant, and a plurality of discharge heads connected to said branch conduits and spaced along the lengths thereof, said heads being normally closed and being adapted to selectively open and discharge said extinguishant, said open heads being supplied with extinguishant from both of said cross-main conduits.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 2 is a plan view of the system of FIG. 1;

FIG. 3 is a cross-sectional view of a discharge head utilized in the system of FIGS. 1 and 2; and

FIG. 4 is a partial enlarged view of the discharge head of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, 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 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, and a plurality of spaced parallel branch conduits 18 extending perpendicular to the cross-main conduits 16. A plurality of connectors 19 connect the conduits 18 to both of the conduits 16 in a manner to communicate the respective conduits and thus form a continuous network. It is noted that the end portions of each of the branch conduits 18 overlap, or extend outwardly, from the cross-main conduits 16. A riser 20 connects the feed main 12 to one cross-main conduit 16 at approximately its center to supply water to the network formed by the conduits 16 and 18.

A plurality of discharge heads 30, preferably in the form of direct discharge nozzles are connected to the

branch lines 18 and extend in a spaced relation along the lengths thereof. Referring to FIGS. 3 and 4, each nozzle 30 comprises a cylindrical body 32 having an upper end portion 34 which is internally threaded for connection to a corresponding fitting (not shown) formed on the branch conduits 18, and a lower end portion 36 which defines an outlet orifice of a reduced cross-section. A pair of spiral vanes 38a and 38b are fixed within the body 32 for imparting a swirling motion to water flowing downwardly therethrough in a conventional manner. The vanes 38a and 38b 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 32 near the lower end portion 36, 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 32. One end of the rod 52 extends through the vane 38a 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. 1.

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.

As better shown in FIG. 4, 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 38a, 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 FIGS. 3 and 4 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 30 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 ap-

plications are assigned to the assignee of the present invention and their respective disclosures are hereby incorporated by reference.

In operation, the nozzles 30 are installed in a spaced relation along the branch lines 18 in the condition shown in FIGS. 3 and 4, i.e., with the rod 42 latched in the body member 32 by the rod 52, and with the thread 70 fixed to the rod 42 and the vane 38a. If the fusible link 64 of any nozzle 30 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 to free the discharge end of the body member 32. The water pressure in the body member 32 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 32. If the water pressure is not sufficient to break the thread 70, the plug 44 will not be expelled from the body portion 32 despite release of the fuse element 64 and the fusible nut 76.

It can be appreciated that, upon one or more nozzles 30 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 head through its corresponding branch line via both cross-main conduits 16, which, in turn, are supplied with water by the remaining branch conduits 18. As a result, a relatively low flow rate occurs through each cross-main conduit 16 and each branch conduit 18 that does not have an open head 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 heads that open, the above-mentioned pressure floor will insure that no more than a predetermined, relatively low, number of heads 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.

Furthermore, it can also be appreciated that, by virtue of the fact that the diameter of each branch conduit can be constant along its entire length, that the branch conduits can all be of the same, or substantially the same diameter, and that the cross-main conduits can be of the same, or substantially the same diameter, the system can be pre-engineered for a given area, without the need for custom calculations for each installation. As a result of this, the only "trimming" or fine adjustments necessary may be made at the riser, by either changing the size thereof or employing a valve therein to control the flow to the system.

As an example of the relative dimensions of the components of the system of the present invention, the riser and cross-main conduits would each be 4 inches in diameter while each branch line would be 2 1/2 inches in diameter. Thirty discharge heads would be connected to each branch line with the maximum flow rate through the system being 1,000 gallons per minute and the system pressure being such that the minimum dis-

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charge rate from each head is 100 gallons per minute. It is noted that, in this example, the 2 1/2 inches diameter of the branch lines results in each having a capacity less than that necessary to maintain a fluid pressure at each of the heads connected thereto of at least 7 pounds per square inch, when all of the heads are open. This is important in the sense that a great majority of the conventional systems discussed above are designed so that the fluid pressure in each head is greater than 7 pounds per square inch under the above circumstances.

It can be appreciated that several variations may be made in the foregoing without departing from the scope of the invention. For example, although only two cross-main conduits 16 are shown in the example, several more may be added if the area of the building to be protected so dictates.

Of course, other variations of the specific construction and arrangement of the 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 a plurality of spaced, parallel branch conduits, at least two spaced parallel crossmain conduits extending perpendicular to said branch conduits and connected thereto to form a co-planar network of conduits, a single supply riser having one end connected to one of said crossmain conduits and the other end adapted for connection to a source of extinguishant, the other crossmain conduit being supplied with extinguishant from said one cross-main conduit via said branch conduits, means for supporting said network of conduits in a substantially hori-

zontal plane in an elevated position in a space to be protected by fire, and a plurality of discharge heads connected to said branch conduits and spaced along the lengths thereof, said heads being normally closed and being adapted to selectively open and discharge said extinguishant in a generally downwardly direction, said open heads being supplied with extinguishant from both of said crossmain conduits via the branch lines on which said open heads are mounted.

2. The system of claim 1 further comprising control means for selectively opening said heads in response to a predetermined fire condition occurring in said space.

3. The system of claim 1 further comprising control means for selectively opening said heads in response to a predetermined extinguishant pressure occurring at each head.

4. The system of claim 1 wherein said cross-main conduits are of the same diameter.

5. The system of claim 1 wherein the diameter of each of said branch conduits is constant along the entire length thereof.

6. The system of claim 1 wherein the size of each branch conduit is such that its capacity is less than that necessary to maintain a fluid pressure at each open head connected thereto of at least seven pounds per square inch, when all of the heads connected thereto are open.

7. The system of claim 6 wherein said supply riser is connected to said one cross-main conduit intermediate the ends thereof and between the points of connection of said one cross-main conduit with at least two of said branch conduits.

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