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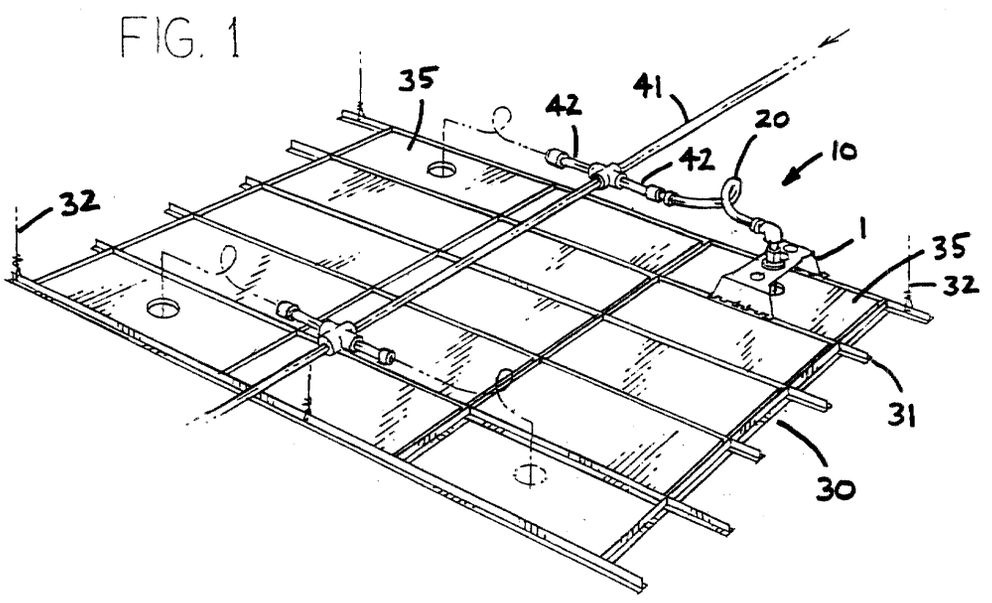
## (54) Fire suppression method and apparatus

(57) A fire suppression method and apparatus has a sprinkler head support bracket which is installable immediately above a ceiling tile. The support bracket is configured with a plurality of openings such that multiple locations for the sprinkler head may be used and the exact "center of tile" installation of the sprinkler head can be accomplished with a wide variety of suspended ceiling assemblies and sprinkler heads. The support bracket rests on grid support members and arches over the ceiling tile. Hold down clips are provided to maintain the bracket in position relative to the grid support members.

A pipe clamp is provided which is insertable within the bracket to retain a drop nipple within it. The drop nipple is adjustable relative to the horizontal to move it upwardly or downwardly relative to the ceiling tile.

The opposite end of the flexible armover connector is attached to an adapter nipple. The adapter nipple is formed from a single piece of black steel material. The adapter nipple has a central tubular portion to either end of which extends an opposing external threaded end portion. Inwardly of one end portion is an internal chamfer.

FIG. 1

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## Description

### FIELD OF THE INVENTION

**[0001]** This invention relates generally to devices and methods which may be used for the suppression of fires, including fire suppression systems which utilize a plurality of sprinkler heads mounted within a suspended ceiling assembly. More particularly, this invention relates to a method for installing sprinkler heads in a "center of tile" array such that the exact "center of tile" installation is accomplished regardless of the location of the supply or feeder lines in relation to the sprinkler heads which are attached to those lines. It also relates to an apparatus or assembly for effecting the exact "center of tile" location and installation of those sprinkler heads in a wide variety of suspended ceiling assemblies and sprinkler head styles. It also relates to a clip-like device which is used to quickly and removably fasten a metal flange of the apparatus to the T-bars of a suspended ceiling assembly. It also relates to a special pipe connector or adapter nipple which is utilized within a fire suppression system to facilitate the secure and water tight connection of a flexible connecting hose to the fire suppression system.

### BACKGROUND OF THE INVENTION

**[0002]** The use of water to suppress or extinguish fires is a concept as old as fire itself. And, quite probably as long as it has inhabited dwellings, mankind has long searched for the best way to effect the distribution of water within dwellings where the risk of death and destruction from fire is ever present. For many years, fire suppression systems which are installed in buildings have been comprised of a number of water supply lines installed above a suspended ceiling grid, the same type of grid which normally conceals other building utilities such as heating and cooling ducts, electrical supply lines and lighting fixtures, among other things. The water supply lines, in turn, are functionally adapted to supply water to sprinkler heads which are actuated by heat sensing means. This is, without question, old art.

**[0003]** In the experience and observations of the inventor of the present invention, the modem day suspended ceiling assembly typically consists of an array of standard 2' by 2' acoustically dampening ceiling tiles. Occasionally, the ceiling tiles are configured in a 2' by 4' tile array. Such tiles, of either the 2' by 2' or the 2' by 4' configuration, may be further constructed to give the appearance of even smaller tile configurations. That is, the 2' by 2' tiles may be sculpted to appear as though much smaller, e.g. 1' by 1' or even 6" by 6" or 3" by 3", tiles are being used. It is generally recognized that the smaller the dimension of the individual tiles, including an "apparent" smaller dimension of a larger tile which seems to be made of many smaller tiles, results in a more elegant aesthetic appearance and one which is sought after by building owners and architects alike. Another reality of modern building design is the fact that building owners and architects often specify that sprinkler heads be located on a "center of tile" basis. That is, the exact vertical centerline of the sprinkler head must protrude literally through the lengthwise and widthwise center of a given standard tile. Or, in the case of sculpted tiles, the exact vertical centerline of the sprinkler head protrudes through that part of the tile at which the center of a smaller dimensioned tile portion lies. The theory is that this "center of tile" appearance is more aesthetically pleasing and acceptable to the eye.

**[0004]** In the experience of this inventor, the "center of tile" requirement always increases installation costs and causes great problems for the installers of the concealed fire suppression system. One principal problem is that the "as built" placement of sprinkler heads within the ceiling array most often misses the exact "center of tile" -- a situation which requires the installer of the fire suppression system to shut down and drain the fire suppression system in order to adjust the connecting supply pipes by changing their angle relative to the ceiling grid, by cutting the pipes to shorten them or by altogether removing, recutting and then reattaching them because the pipe was too short in the first instance. This is an extremely labor-intensive activity which results in higher costs and leaves an owner's property unprotected from fire while exact "center of tile" installation is pursued.

### SUMMARY OF THE INVENTION

**[0005]** It is, therefore, a principal object of this invention to provide a new, useful and uncomplicated method and apparatus for effecting the exact "center of tile" installation of sprinkler heads in a suspended ceiling assembly which reduces installation costs and eliminates the need for repeated system shut downs. It is another object of this invention to provide such a method and apparatus which requires only a minimal number of elements and which provides means to effect this exact "center of tile" installation with a wide variety of commercially available ceiling tiles and sprinkler heads. It is yet another object of this invention to provide such a method and apparatus whereby the location of the sprinkler head can be accomplished in almost any exact "center of tile" location within such ceiling tiles while using a universal sprinkler head locating mechanism. It is still another object of the present invention to provide such a method and apparatus which allows for precise placement of the sprinkler head which requires a minimum number of steps to use in the field. It is still another object of the present invention to provide such a method and apparatus which allows for prefabrication of standard parts which are readily usable in the field throughout a wide variety of installation situations and which requires a minimum of effort on the part of the user to install any of them.

**[0006]** The present invention has obtained these ob-

jects. It provides for a fire suppression apparatus which has a sprinkler head support bracket which is installable immediately above a ceiling tile. The support bracket is configured with a plurality of openings such that multiple locations for the sprinkler head may be used and the exact "center of tile" installation of the sprinkler head can be accomplished with a wide variety of suspended ceiling assemblies and sprinkler heads. The support bracket rests on the grid support members of the ceiling tile assembly and arches over the ceiling tile. A pipe clamp is provided which is insertable within the bracket to retain a drop nipple within it. The drop nipple is adjustable relative to the horizontal to move it upwardly or downwardly relative to the ceiling tile. In this fashion, the vertical location of the sprinkler head can be adjusted depending upon the elevation of the ceiling tiles and the style of sprinkler head used. The drop nipple is attached to a flexible armover connector which allows for an almost infinite number of locations that can be used to connect the drop nipple to the supply line of the fire suppression system.

**[0007]** The present invention also provides for a spring-like retention clip, the major portion of which is formed, in the preferred embodiment, from a single piece of metallic material. The retention clip has a central saddle-like portion from which extend two opposing and functionally cooperating clip legs. The clip legs also include leg extension members which are functionally adapted to extend through an opening in a support bracket located above a ceiling tile T-bar. Each leg extension member includes, at the lowermost portion thereof, a hook portion. The hook portion of each leg extension member functionally cooperates with the other to firmly and releasably grasp an annular or flat flange found at the uppermost portion of the T-bar. In this fashion, the retention clip is used to affix the support bracket, as described above, to the grid support members of the ceiling tile assembly.

**[0008]** The present invention also provides for an adapter nipple which is formed, in the preferred embodiment, from a single piece of black steel material. The adapter nipple has a central tubular portion to either end of which extends an opposing external threaded end portion. Inwardly of one end portion is an internal chamfer. This chamfer is functionally adapted to engage a male member of the flexible armover connector, which male member has a mating external chamfer and a female threaded nut.

**[0009]** The foregoing and other features of the method and apparatus of the present invention will be further apparent from the detailed description which follows.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** FIG. 1 is a perspective view looking downwardly on the grid of a typical suspended ceiling array and showing a fire suppression device constructed in accordance with the present invention and incorporated therewith.

**[0011]** FIG. 2 is an enlarged and partially cross-sectioned left side elevational and exploded view of the fire suppression device shown in FIG. 1.

**[0012]** FIG. 3 is an enlarged front and right side perspective view of the fire suppression device shown in FIG. 1.

**[0013]** FIG. 4 is a top plan view of the device shown in FIG. 3.

**[0014]** FIG. 5 is a right side elevational view of the fire suppression device shown in FIG. 3.

**[0015]** FIG. 6 is a top plan view of the fire suppression device looking downwardly on a 2' by 2' ceiling tile grid and showing various locations for the device atop the grid.

**[0016]** FIG. 7 is a top plan view of the fire suppression device shown in FIG. 6 and showing multiple possible locations for the device in 2' by 4', 2' by 2', 1' by 1', 6" by 6" and 3" by 3" ceiling tile configurations.

**[0017]** FIG. 8 is a front elevational view of a retention clip constructed in accordance with the present invention and shown in its normally closed position.

**[0018]** FIG. 9 is a left side elevational view of the clip shown in FIG. 8.

**[0019]** FIG. 10 is a front elevational view of the clip shown in FIGS. 8 and 9 and showing, in phantom view, the clip in its opened position.

**[0020]** FIG. 11 is a front elevational view of the clip shown in FIGS. 8 - 10 and showing the lowermost portions of the clip in grasping relation to the uppermost portion of the T-bar of a ceiling tile grid.

**[0021]** FIG. 12 is a side cross-sectional view of an adapter nipple constructed in accordance with the present invention as used with a flexible connecting hose.

**[0022]** FIG. 13 is an enlarged side cross-sectional view of the adapter nipple shown in FIG. 12.

**[0023]** FIG. 14 is a front elevational view of the adapter nipple shown in FIG. 13.

## DETAILED DESCRIPTION

**[0024]** Referring now to the drawings in detail, FIG. 1 shows a fire suppression device constructed in accordance with the present invention. The preferred embodiment of the device includes a fire suppression assembly, generally identified 10, which includes a main support bracket 1. The main support bracket 1 of the assembly 10 effectively straddles or arches over a ceiling panel 35 contained within a suspended ceiling grid 30. In the preferred embodiment, the main support bracket 1 is constructed of a single piece of sheet metal material. In the experience of this inventor, a 16 gauge hot rolled sheet metal is adequate for this construction. The main support bracket 1 rests upon and is supported by the cross-wise and intersecting tile support T-bars 31 of the ceiling grid 30. These tile support T-bars 31 really form the main support of the suspended ceiling array and are

supported by a plurality of grid suspension wires 32. Situated immediately above the ceiling grid 30 is a main water supply line 41. The main water supply line 41, in turn, feeds a plurality of branch lines 42. It is primarily the branch lines 42 which are connected to the sprinkler heads 40 of the assembly 10. See FIG. 2.

**[0025]** As alluded to earlier in the specification, the connection between the branch lines 42 and the sprinkler heads 40 of the fire suppression system has heretofore been a "hard piped" connection. That is, the branch line 42 is connected to a short riser nipple pipe which is connected to an armover pipe, which is connected to a drop-down feeder pipe or drop nipple (not shown) which is connected to the sprinkler head 40. These are the pipes which are required to be disconnected, relocated, possibly re-cut, and then reattached when the exact "center of tile" installation has not been achieved upon initial installation. The fire suppression assembly 10 of the present invention includes a flexible armover generally identified 20, the qualities and features of which will be described in greater detail further in this detailed description.

**[0026]** The fire suppression assembly 10 also includes, starting from the bottom of the assembly (see FIG. 2) and working upwardly, a concentric reducing coupling 12, a drop nipple 15, a depth setting pipe clamp 25, and a 90° elbow 11. The concentric reducing coupling 12 essentially allows connection of the sprinkler head 40 to the bottom of the drop nipple 15. The drop nipple 15 is also threaded at its uppermost portion 16 such that it can also be attached to the 90 ° elbow 11. The drop nipple 15 is functionally adapted to be slidably received by the depth setting pipe clamp 25. The drop nipple 15 also includes pipe markings 19, the function of which will also be discussed later in this detailed description. The precise location of the drop nipple 15 within the depth setting pipe clamp 25 can be fixed by virtue of a set screw 50 which is located within the hexagonal top portion 26 of the depth setting pipe clamp 25. Immediately below the hexagonal top portion 26 of the depth setting pipe clamp 25 is a shoulder and flange portion 27. The flange portion 27 is functionally adapted to rest upon and be supported by the top surface of the central portion 5 of the main support bracket 1. The shoulder portion is received by any one of the holes 2a, 2b, 2c, 2d defined within the top portion 5 of the main support bracket 1. Extending below the shoulder portion 27 of the depth setting pipe clamp 25 is a threaded bottom portion 28. The threaded bottom portion 28 is functionally adapted to extend through any one of the holes 2a, 2b, 2c, 2d defined within the top portion 5 of the main support bracket 1. The threaded bottom portion 28 allows the depth setting pipe clamp 25 to be removably secured to the main support bracket 1 by virtue of a lock nut 24.

**[0027]** In the preferred embodiment, the drop nipple 15 has a series of depth-setting markings 19 defined along one side of the nipple 15 such that the location of the sprinkler head 40 can be precisely located relative to the horizontal. In the experience of the inventor, this feature allows the user to pre-set the depth of the drop nipple 15 within the pipe clamp 25 while allowing for different elevations of the ceiling tile 35 and various styles of sprinkler heads. See FIG. 5. The top or upper end 16 of the drop nipple 15 is attachable to a 90° elbow 11. The 90° elbow 11, in turn, is attachable to the second end 23 of a flexible armover 20. The other or the female swivel end, generally identified 22, of the armover 20 is attachable via the use of an adapter nipple, generally identified 90, to a branch line pipe 42 situated above the ceiling tile grid 30. See FIG. 12. The details of this attachment will be explained later in this detailed description. In the preferred embodiment, the flexible armover 20 may be constructed of a number of commercially available flexible hoses including, but not limited to, metal, teflon, rubber, plastic or any combination of these materials. The important feature of the preferred embodiment is that the armover 20 be flexible and readily locatable relative to the main support bracket 1 without the need to disable the fire suppression system or alter any of its components.

**[0028]** The main support bracket 1 is held in place by virtue of a plurality of hold down clips, generally identified 50, which are functionally adapted to protrude through slots 9 which are defined in the outwardly extending support members 7 of the bracket 1. These hold down clips 50 are removably attachable to the uppermost portion 37 of the ceiling tile support T-bar 31. See FIG. 11. FIG. 8 shows, in greater detail, a retention clip 50 constructed in accordance with the present invention. In the preferred embodiment, the retention clip 50 includes a central saddle-like portion 59. Extending downwardly from the sides of the central portion 59 of the clip 50 is a pair of clip legs 52, 53. The central portion 59 and the clip legs 52, 53 are functionally adapted to be constructed from a single piece of spring-like metallic material. With this construction, the clip legs 52, 53 are spring-biased toward one another to provide a grasping effect between them. At the bottommost portion of each leg 52, 53 is a leg extension member 62, 63, respectively, and a pair of curled retention members 56, 57, respectively. The curled retention members 56, 57 are functionally adapted to receive the lowermost portions 82 of a pair of clip handles 81. The clip handles 81 are the means by which the clip legs 52, 53 may be urged apart by the user. See FIG. 10. This function will be more apparent later in this detailed description. The lowermost portion of the leg extension members 62, 63 include a pair of complimentary hook members 72, 73, respectively. The hook members 72, 73 are functionally adapted to effectively "hook" the uppermost flange portion 37 of a ceiling grid T-bar 31. See FIG. 11.

**[0029]** The location of the main support bracket 1 atop a typical 2' by 2' ceiling tile array 30 is shown in FIG. 6. As shown, at least six different locations for the bracket 1 can be achieved with a connection to a single branch

line 42. Referring now to FIG. 7, it will be observed that at least fifteen (15) different locations for the bracket can be achieved within a single 2' by 2' ceiling tile 35 with a connection to a single branch line 42 and at least thirty-one (31) different bracket locations can be achieved within a single 2' by 4' ceiling tile 35. Furthermore, and in a ceiling tile array 30 in which a 2' by 4', 2' by 2', 1' by 1', 6" by 6" or 3" by 3" ceiling tile configuration is utilized, at least one hundred sixty seven (167) different locations can be realized simply by changing the selection of the different holes 2a, 2b, 2c, 2d defined within the main support bracket 1.

**[0030]** FIG. 12 shows an adapter nipple, generally identified 90, constructed in accordance with the present invention. In the preferred embodiment, the adapter nipple 90 is functionally adapted to be engaged by the flexible hose 20. The adapter nipple 90 includes an annular pipe 91. The pipe 91 has a longitudinal center line, a first pipe end 93 and second pipe end 94. The first pipe end 93 includes an untapered externally threaded portion 113. Similarly, the second pipe end 94 also includes an externally threaded portion 114, but this pipe end 94 is tapered by 1°. The first pipe end 93 includes an internal chamfer 95 which, in the preferred embodiment, is cut at a 30° angle relative to the longitudinal center line of the adapter nipple 90. The second pipe end 94 does not include a chamfer at that end.

**[0031]** The chamfer 95 of the first pipe end 93 is functionally adapted to engage a like mating internal chamfer 126 at the female swivel end 22 of the flexible hose 20. The flexible hose 20 includes a corrugated stainless steel hose 21 with stainless steel braiding. The flexible steel hose 21 is retained within a fitting collar 123 by means of a continuous weld 122. The fitting collar 123 is reduced down to a fitting neck 124 from which extends the male end 125. Surrounding the male end 125 of the flexible hose 20 is a female nut 115 which includes an internal threaded portion 116 which is engageable with the external threaded portion 113 of the first pipe end 93. In this fashion, the chamfer 126 of the male end 125 of the flexible hose 20, which chamfer 126 is also cut at a 30° angle relative to the longitudinal center of the male end 125, is engageable with the chamfer 95 of the first pipe end 93. In the preferred embodiment, the adapter nipple is more particularly described as a 0'-3" long sch. 40 (ASTM A53) black steel pipe nipple (NPT XNPT) with internal chamfer at one end 30° from longitudinal center line of pipe.

**[0032]** In application, the user of the method and apparatus of the present invention locates that portion of the ceiling grid 30 at which the "center of tile" installation is to be accomplished. It is contemplated by the inventor that the individual components of the assembly 10 reach the installer in a preassembled condition, with the exception of the main support bracket 1 and the hold down clips 50. The installer, knowing the type of ceiling tile 35 which is to be installed and also knowing the type of sprinkler head which is to be installed, sets the drop nipple 15 depth relative to the pipe clamp 25 by utilizing the pre-printed markings 19 on the drop nipple 15. The pipe clamp 25 is then secured within one of the holes 2a, 2b, 2c, 2d of the support bracket 1 and the assembly 10, including the bracket 1, is connected to the branch line 42. The entire assembly 1 is then secured and held in place above the grid 30 by use of a nylon strap (not shown). In this fashion, the assembly 10 is out of the way and ready for hydrostatic testing. Following testing of the fire suppression system, the ceiling tile installer comes in to install the ceiling tiles 35 which is followed by the fire suppression system installer coming back to set the brackets 1 on top of those ceiling tiles 35 which are to receive the sprinkler heads 40 according to design. In the preferred embodiment, the bracket 1 relies upon a plurality of outwardly extending support members 7 and upon a plurality of downwardly extending support members 8, both sets of which extend from the legs 6 of the main support bracket 1, to support it. See FIG. 2. Finally, two or four hold down clips 50 are then installed which protrude through slots 9 in four of the outwardly extending support members 7 of the main support bracket 1 (see FIGS. 2 and 5) and attach to the ceiling tile support T-bars 31. More specifically, the bracket 7, or at least that portion of the bracket 7 which overlays the T-bar 31, includes an aperture 9. It is this aperture 9 which provides access to the T-bar flange 37 for the user. The user then inserts the leg extension members 62, 63 of the clip 50 through the bracket aperture 9 and urges the clip handles 81 towards one another. In this fashion, the leg extension members 62, 63 are urged away from each other to the point that the hook portions 72, 73, respectively, thereof can fit over the flange 37. The user then relaxes the clip handles 81, allowing them to move away from each other which, in turn, allows the leg extension members 62, 63 to move towards one another and firmly grasp the T-bar flange 37. This action is repeated to fasten other clips 50 to other T-bars 31 of the suspended ceiling grid. To remove the clip 50 from the T-bar 31, the reverse action is required. The number of hold down clips 50 is determined by the type of sprinkler head 40 used and the maximum system pressure provided. Twisting of the flexible armover 20 is avoided and the bracket 1 remains in place.

**[0033]** It is also to be emphasized that the ceiling tile pattern provided, e.g. 24" x 48"; 24" x 24"; 12" x 12"; 6" x 6"; 3" x 3", determines which of the plurality of holes 2a, 2b, 2c, 2d defined within the top portion 5 of the main support bracket 1 will be used for locating the depth setting pipe clamp 25 therewithin. That is, the user will have a plurality of holes 2a, 2b, 2c, 2d from which to select when locating the pipe clamp 25 within the top portion 5 of the main support bracket 1. This feature is also one which allows for accurate pre-setting of the pipe clamp 25 within the bracket 1 when the installer knows which ceiling tile configuration is used. Rotation of the bracket 1 by 180° allows for a wide variety of hole selections within the bracket 1 to accomplish this.

**[0034]** From the foregoing, it will be apparent that there has been provided a new, useful and uncomplicated method and apparatus for effecting the exact"center of tile" installation of sprinkler heads in a suspended ceiling tile grid, which apparatus requires only a minimal number of elements; which provides means to effect this exact "center of tile" installation with a wide variety of commercially available ceiling tiles and sprinkler heads and where the location of the sprinkler head can be accomplished in almost any exact "center of tile" location within such ceiling tiles while using a universal sprinkler head locating bracket; which allows for exact placement of the sprinkler head while requiring a minimum number of steps to use in the field; which allows for prefabrication of standard parts which are readily usable in the field throughout a wide variety of installation situations and which requires a minimum of effort on the part of the user to install them, all at a reduced cost.

**[0035]** The principles of this invention having been fully explained in connection with the foregoing, I hereby claim as my invention:

## Claims

1. For use in a fire suppression system, said system being located at and above a grid (30) of like-dimensioned ceiling tiles (35) and ceiling tile support T-bars (31) and having at least one fixed fluid supply line (41) and a plurality of sprinkler heads (40) for dispersing fluid at and below said ceiling tile grid (30), an apparatus for locating sprinkler heads (40) within the ceiling tile grid (30) which comprises

   means for locating a sprinkler head (40) at the exact center of the dimensional profile of a ceiling tile (35) contained within the grid (30),
   means for adjustably setting the depth of the sprinkler head (40) relative to said ceiling tile (35), and
   a flexible hose (20) connecting the sprinkler head (40) to said fixed fluid supply line (41).

2. The sprinkler head locating apparatus of claim 1 wherein said sprinkler head locating means comprises a sprinkler head support bracket (1) which is functionally adapted to overlay a ceiling tile (35) within the grid (30) and to be supported by two opposing ceiling tile support T-bars (31) to either side of said tile (35).

3. The sprinkler head locating apparatus of claim 2 wherein said sprinkler head support bracket (1) includes a plurality ofholes (2a, 2b, 2c, 2d) defined within said bracket (1), said holes (2a, 2b, 2c, 2d) corresponding to the exact center of the dimensional profile of a ceiling tile (35).

4. The sprinkler head locating apparatus of claim 3 wherein said depth setting means includes a drop nipple (15) connected to said sprinkler head (40) and further includes a drop nipple pipe clamp (25) which is functionally adapted to be supported within any one of the holes (2a, 2b, 2c, 2d) defined within said sprinkler head support bracket (1), said drop nipple (15) being movable within said drop nipple pipe clamp (25) whereby the position of the sprinkler head (40) may be variably adjusted relative to the ceiling tile (35).

5. The sprinkler head locating apparatus of claim 4 wherein said flexible hose (20) comprises a metallic hose with a braided metallic sleeve.

6. The sprinkler head locating apparatus of claim 5 wherein said flexible hose (20) comprises a rubber hose.

7. The sprinkler head locating apparatus of claim 1 wherein said ceiling tile (35) is comprised of like-dimensioned geometrical subdivisions and said sprinkler head locating means further includes means for locating a sprinkler head at the exact center of any of such geometrical subdivisions.

8. The sprinkler head locating apparatus of claim 7 wherein said sprinkler head locating means comprises a sprinkler head support bracket (1) which is functionally adapted to overlay a ceiling tile (35) within the grid (30) and to be supported by two opposing ceiling tile support T-bars (31) to either side of said tile (35).

9. The sprinkler head locating apparatus of claim 8 wherein said sprinkler head support bracket (1) includes a plurality of holes (2a, 2b, 2c, 2d) defined within said bracket (1), said holes (2a, 2b, 2c, 2d) corresponding to the exact centers of the geometrical subdivisions of said ceiling tile (35).

10. The sprinkler head locating apparatus of claim 9 wherein said depth setting means includes a drop nipple (15) which is functionally adapted to be connectable to a sprinkler head (40) and further includes a drop nipple pipe clamp (25) which is functionally adapted to be supported within any one of the holes (2a, 2b, 2c, 2d) defined within said sprinkler head support bracket (1), said drop nipple (15) being movable within said drop nipple pipe clamp (25) whereby the position of the sprinkler head (40) may be variably adjusted relative to the ceiling tile (35).

11. The sprinkler head locating apparatus of claim 10 wherein said flexible hose (20) comprises a metallic hose with a braided metallic sleeve.

**12.** The sprinkler head locating apparatus of claim 11 wherein said flexible hose (20) comprises a rubber hose.

**13.** A method for locating sprinkler heads (40) used in a fire suppression system, said system being located at and above a grid (30) of like-dimensioned ceiling tiles (35) and ceiling tile support T-bars (31) and having at least one fixed fluid supply line (41) and a plurality of sprinkler heads (40) for dispersing fluid at and below said ceiling grid (30), which comprises the steps of

providing a means for locating a sprinkler head (40) at the exact center of the dimensional profile of a ceiling tile (35) contained within the grid (30),
providing means for adjustably setting the depth of the sprinkler head (40) relative to said ceiling tile, and
providing a flexible hose (20) for connecting the sprinkler head (40) to said fixed fluid supply line (41).

**14.** The method of claim 13 further including the step of providing a ceiling tile (35) having like-dimensioned subdivisions and the step of locating a sprinkler head (40) at the exact center of any of such geometrical subdivisions.

**15.** The method of claim 14 wherein said sprinkler head locating step comprises providing a sprinkler head support bracket (1) which is functionally adapted to overlay a ceiling tile (35) within the grid (30) to be supported by two opposing ceiling tile support T-bars (31) to either side of said tile (35), said support bracket (1) having a plurality of holes (2a, 2b, 2c, 2d) defined within said bracket (1) which correspond to the exact center of the dimensional profile of a ceiling tile (35) and which correspond to the exact centers of the geometrical subdivisions of said ceiling tile (35).

**16.** The method of claim 15 wherein said depth setting means providing step includes providing a drop nipple (15) and connecting said drop nipple (15) to said sprinkler head (40) and further includes providing a drop nipple pipe clamp (25), said drop nipple pipe clamp (25) being functionally adapted to be supported within any one of the holes (2a, 2b, 2c, 2d) defined within said sprinkler head bracket (1), said drop nipple (15) being movable within said drop nipple pipe clamp (25) whereby the position of the sprinkler head (40) may be variably adjusted relative to the ceiling tile (35).

**17.** The method of claim 16 wherein said hose providing step includes providing a metallic hose (20) with a braided metallic sleeve.

**18.** The method of claim 17 wherein said hose providing step includes providing a rubber hose (20).

**19.** A retention clip (50) for use in a fire suppression system which comprises

a resilient clip body (59), said clip body (59) including a pair of resilient clip legs (52,53),
a pair of resilient retention members (62, 63 ) extending from said clip legs (52, 53), said clip legs (52, 53) being biased toward one another, and
means (81) for moving said clip legs (52, 53) and said retention members (62, 63) away from one another.

**20.** The retention clip (50) of claim 19 wherein said retention members (62, 63) are generally coplanar with and extend in a coplanar fashion from said clip legs (52, 53).

**21.** The retention clip (50) of claim 20 wherein said retention members (62, 63) include a distal hook portion (72, 73), said hook portion (72, 73) being functionally adapted to releasably grasp a surface (37).

**22.** The retention clip (50) of claim 21 wherein said retention member movement means (81) includes a pair of gripping members (81) whereby the retention members (62, 63) are movable away from one another when said gripping members (81) are moved towards one another.

**23.** A retaining clip (50) for use in securing a generally horizontal flat piece of material (7) to a generally vertical piece of material (31) underlying it which comprises

a main body member (59), said body member (59) comprising a generally flat piece of resilient metal material,
a first leg extending (52) downwardly from said main body member (59), said first leg (52) comprising a generally flat piece of resilient metal material integral with said main body member (59) and having a distal portion (56),
a second leg (53) extending downwardly from said main body member (59), said second leg (53) comprising a generally flat piece of resilient metal material integral with said main body member (59) and having a distal portion (57),
a first retention member extending from the distal portion (56) of said first leg (52),
a second retention member (63) extending from the distal portion (57) of said second leg (53),

means (59) for biasing said first retention member (62) and said second retention (63) member towards one another, and
means (81) for moving said legs (52, 53) and said retention members (62, 63) away from one another.

**24.** The retention clip (50) of claim 23 wherein each of said retention members includes a distal hook portion, said hook portions being functionally adapted to oppose one another for releasably grasping an object therebetween.

**25.** The retention clip (50) of claim 24 wherein said retention member movement means includes a pair of gripping members whereby the retention members are movable away from one another when said gripping members are moved towards one another.

**26.** A retention clip (50) for use in securing a support bracket (7) located above a ceiling tile T-bar (31), said T-bar (31) having an annular or flat flange (37) at an uppermost portion of the T-bar (31), which comprises

a main spring-like body member (59), said body member (59) comprising a generally flat piece of resilient metal material,
a first leg (52) extending downwardly from said main body member (59), said first leg (52) comprising a generally flat piece of resilient metal material which is formed integral with said main body member (59) and having a distal portion (56),
a second leg (53) extending downwardly from said main body member (59), said second leg (53) comprising a generally flat piece of resilient metal material which is formed integral with said main body member (59) and having a distal portion (57),
a first retention member (62) extending from the distal portion (56) of said first leg (52),
a second retention member (63) extending from the distal portion (57) of said second leg (53),
means (57) for biasing said first retention member (62) and said second retention member (63) towards one another, and
means (81) for moving said legs (52, 53) and said retention members (62, 63) away from one another.

**27.** The retention clip (50) of claim 26 wherein each of said retention members (62, 63) includes a distal hook portion (72, 73), said hook portions (72, 73) being functionally adapted to oppose one another for releasably grasping the uppermost flange (37) of said T-bar (31) therebetween.

**28.** The retention clip (50) of claim 27 wherein said retention member movement means (81) includes a pair of gripping members (62, 63) whereby the retention members are movable away from one another when said gripping members (81) are moved towards one another.

**29.** An adapter nipple (90) for use in a fire suppression system assembly (10) which has a water supply line (41), a sprinkler head (40) and a flexible hose (20) disposed therebetween, said hose (20) having a female swivel end (22), which comprises

an annular pipe (91),
a first pipe end (93), and
an internal chamfer (95) at said first pipe end (93) whereby the
adapter nipple (90) is engageable with the internal male
chamfer (126) of said female swivel end (22).

**30.** The adapter nipple (90) of claim 29 wherein said annular pipe (91) has a longitudinal center line and the internal chamfer (95) at said first pipe end (93) is at a 30° angle relative to the longitudinal center of said pipe (91).

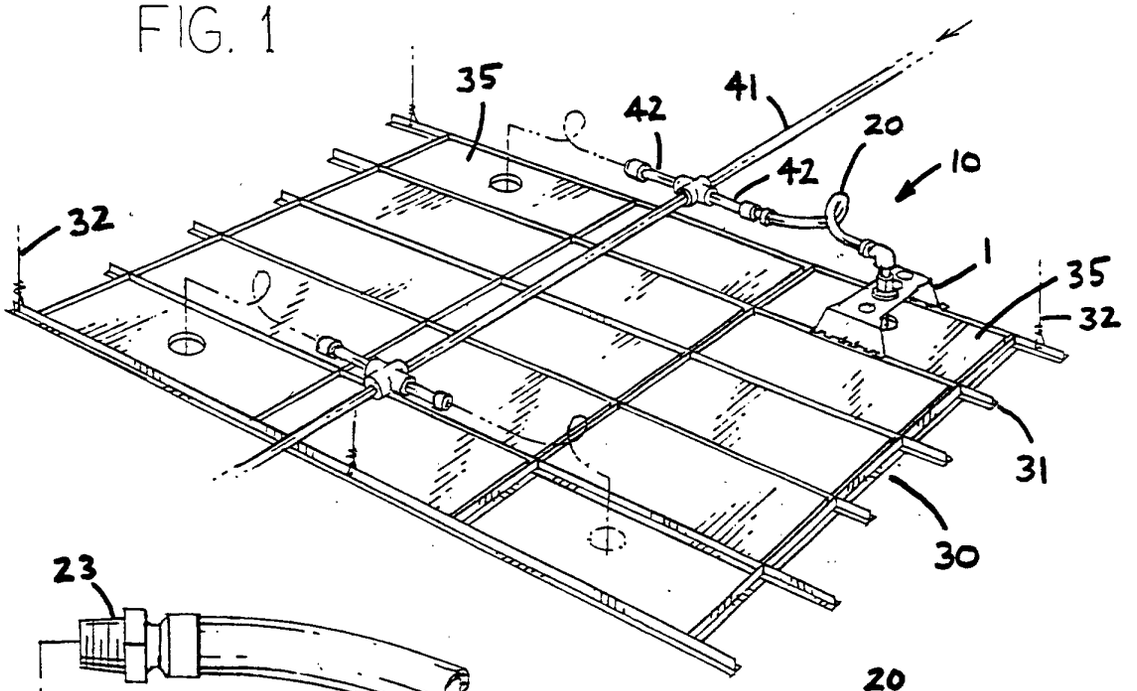
**31.** For use in a fire suppression system, said system including a flexible hose (20) for providing water flow therethrough and said flexible hose (20) includes an externally chamfered male end (126) within a retention nut (115), an adapter nipple (90) which comprises

an annular pipe nipple (91),
a first pipe nipple end (93),
an external threaded portion (113) at said first pipe nipple end (93), and
an internal chamfer (95) at said first pipe nipple end (93) whereby the first pipe nipple end (93) is engageable with the internal male chamfer (126) of said female swivel end (22) of the flexible hose (20) when the retention nut (115) is secured over the external threaded portion (113) of said first pipe nipple end (93).

**32.** The adapter nipple (90) of claim 31 wherein said annular pipe nipple (91) has a longitudinal center line and the internal chamfer (95) at said first pipe end (93) is at a 30° angle relative to the longitudinal enter of said pipe (91).

**33.** The adapter nipple (90) of claim 32 wherein said flexible hose (20) has a longitudinal center line and the internal male chamfer (126) within the female swivel end (22) of said flexible hose (20) is at a 30° angle relative to the longitudinal center of said hose (20).

FIG. 1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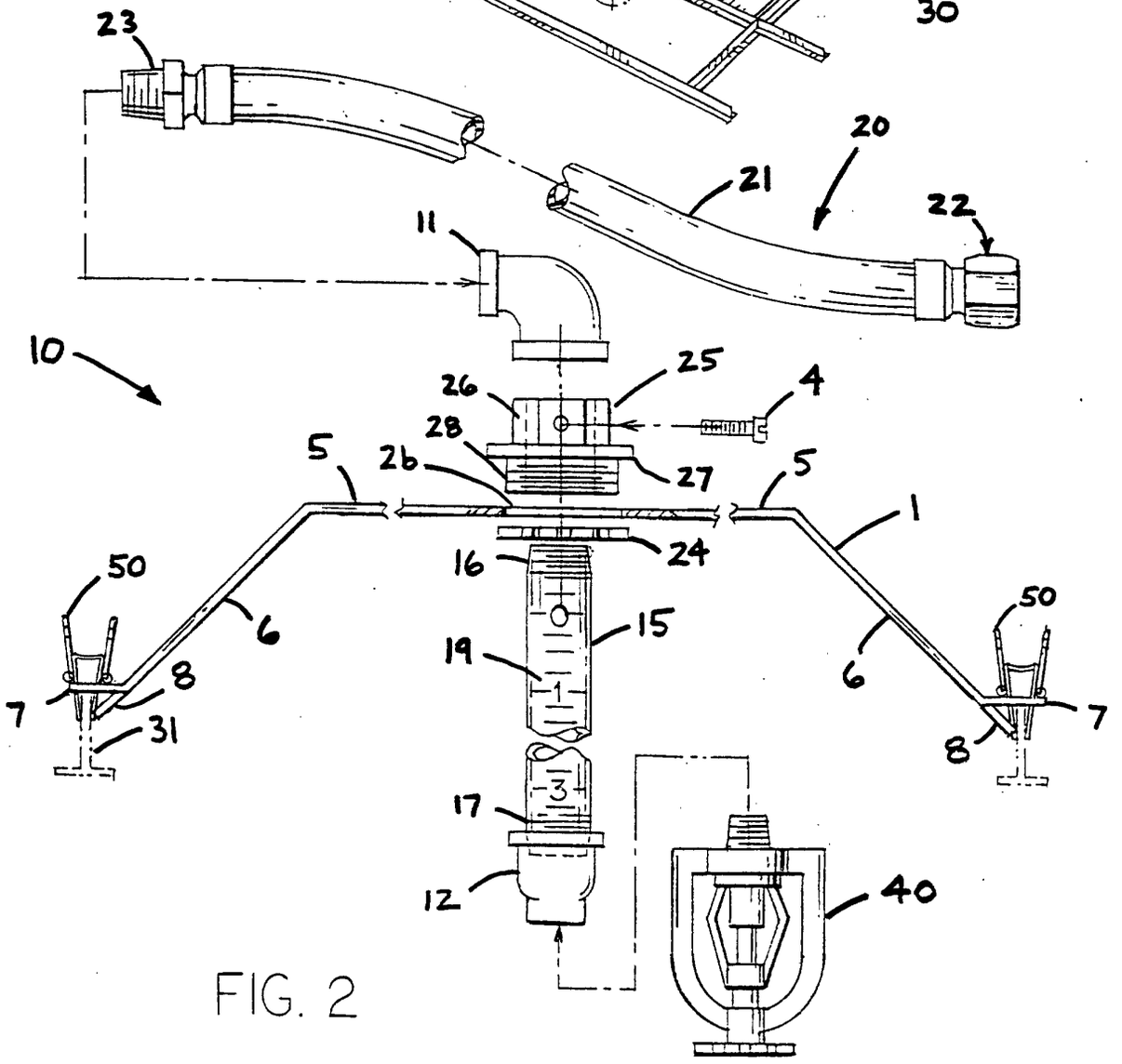
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FIG. 2

FIG. 3

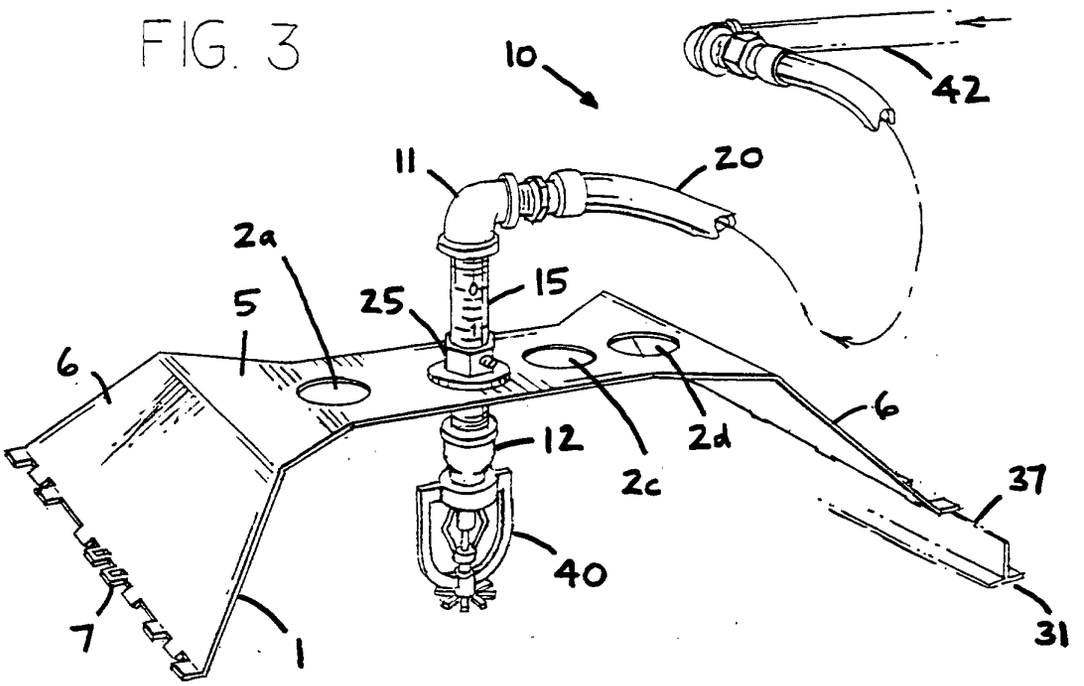
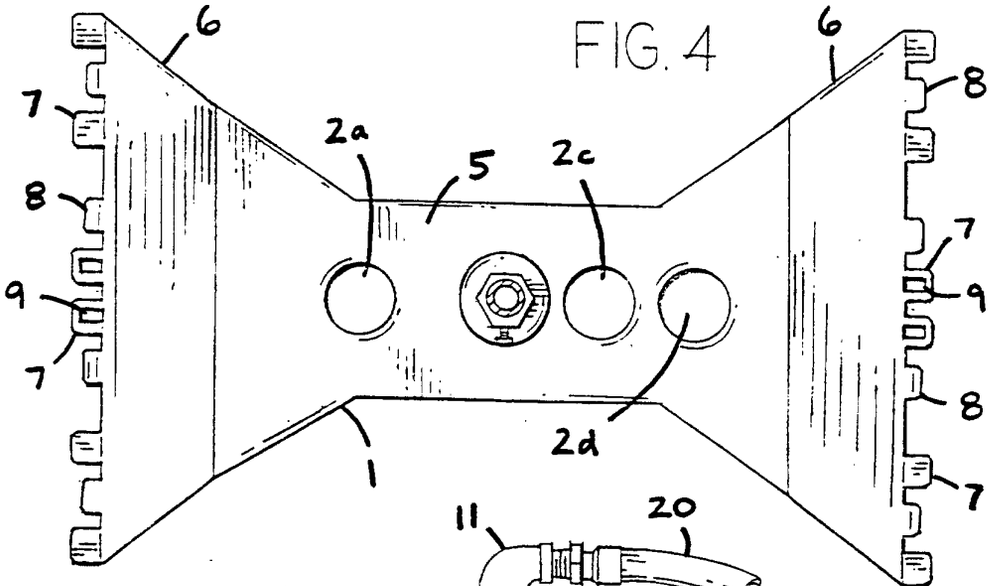



FIG. 4



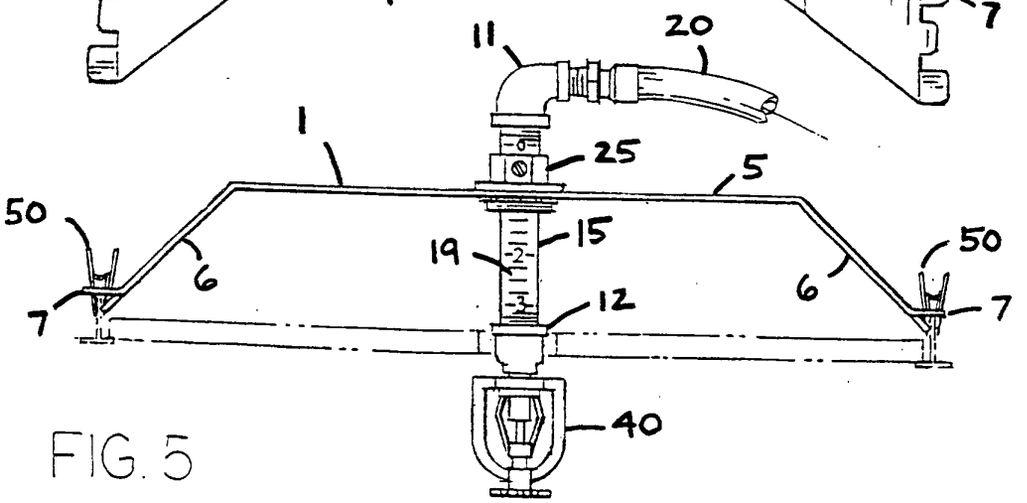




FIG. 5

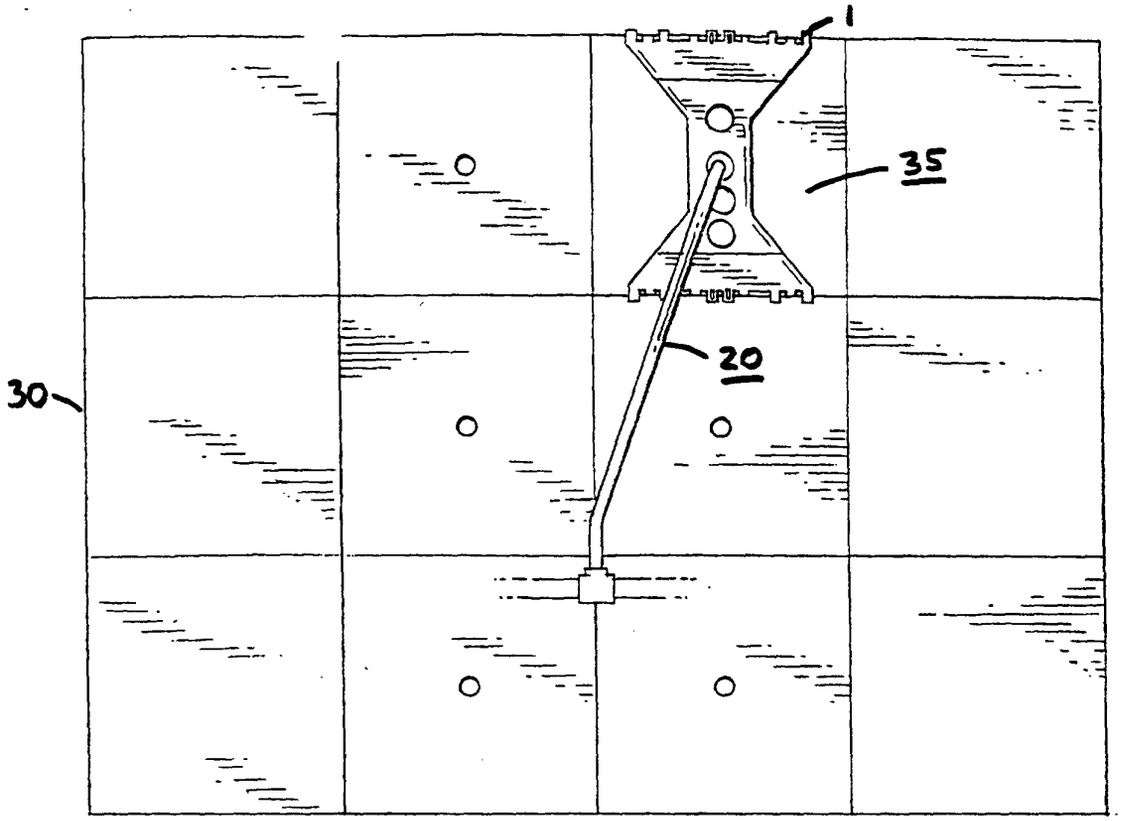



FIG. 6

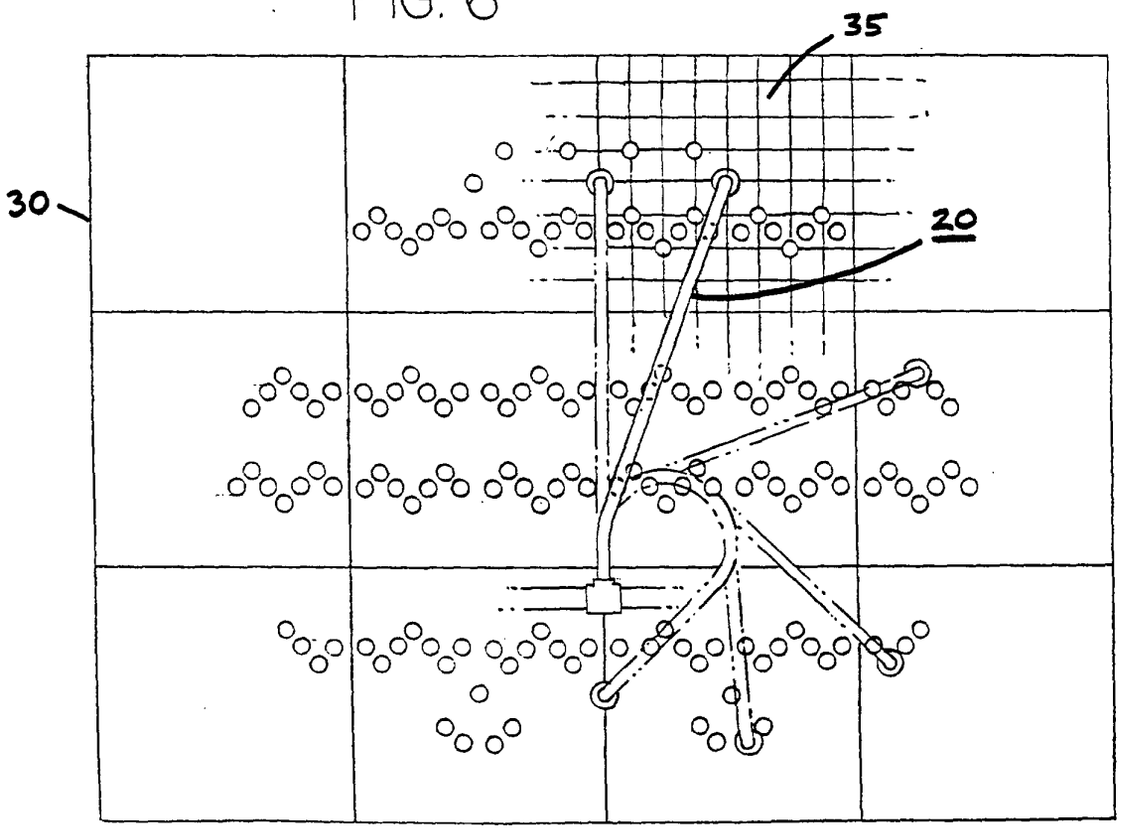



FIG. 7

FIG. 8

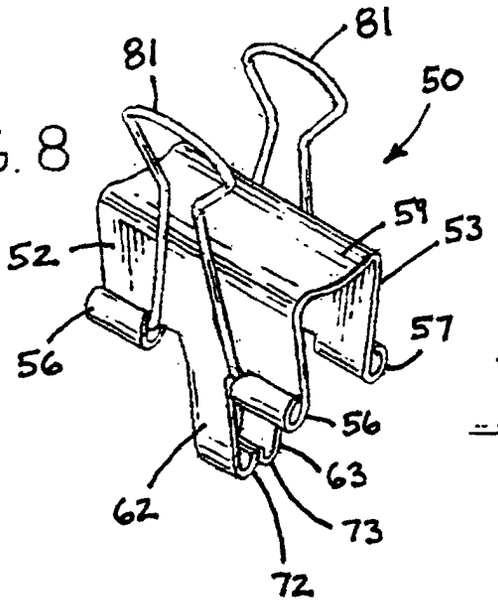
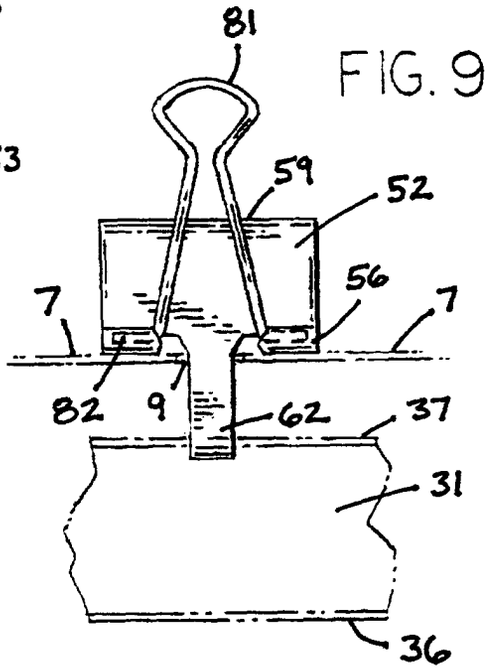



FIG. 9



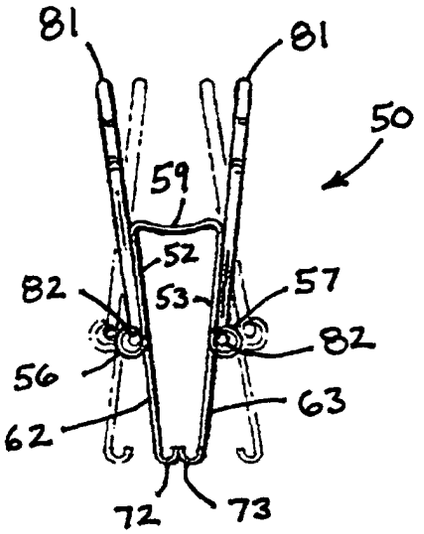




FIG. 10

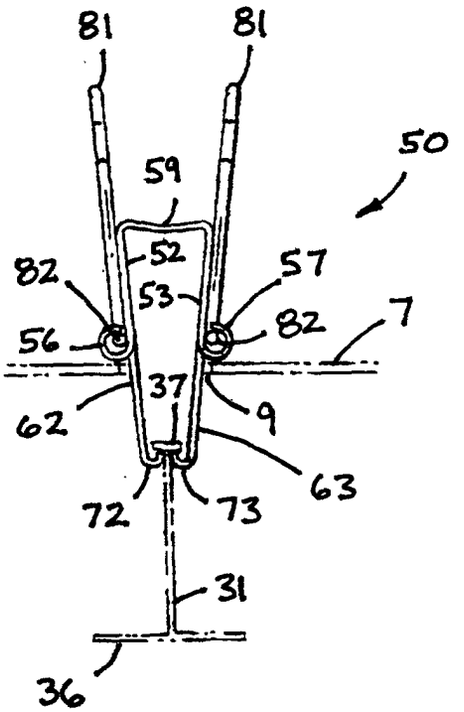
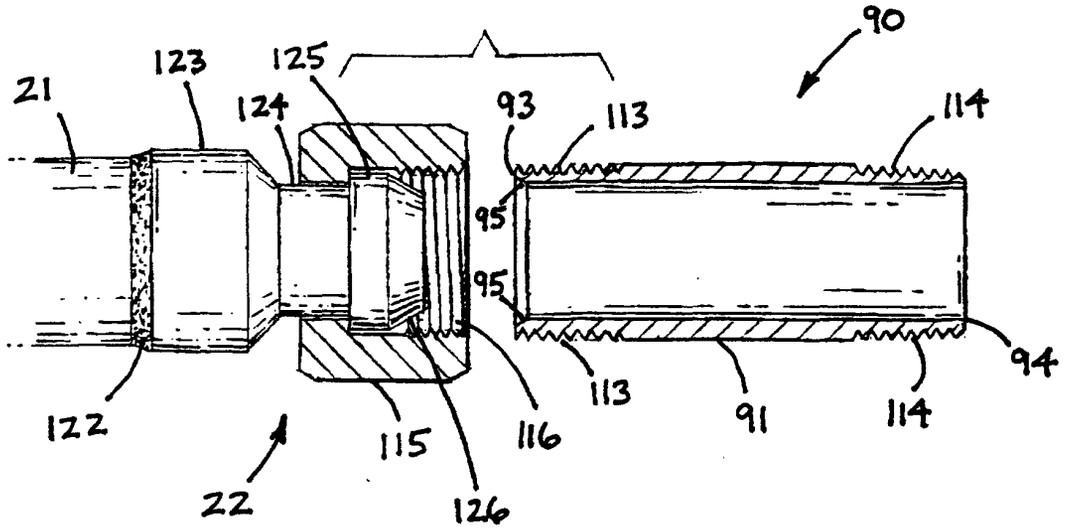



FIG. 11

FIG. 12



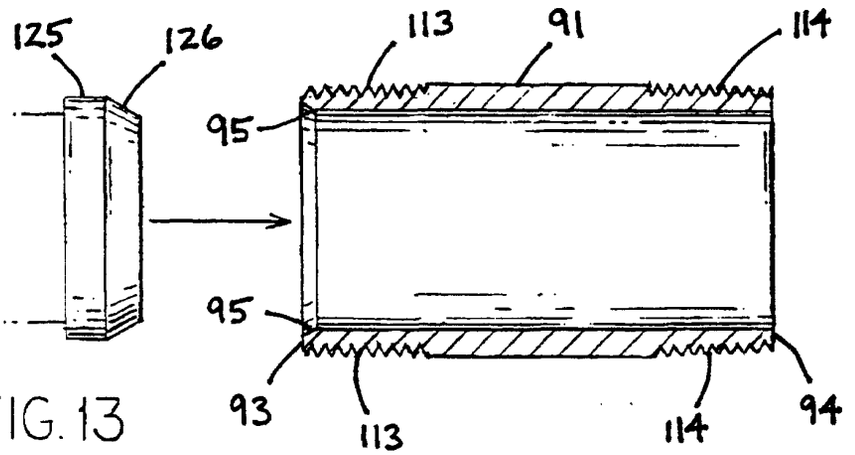




FIG. 13

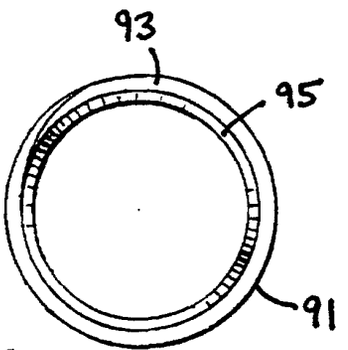



FIG. 14

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 00 10 6256

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 26 October 2000 | Triantaphillou, P |

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Application Number
EP 00 10 6256

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 26 October 2000 | Triantaphillou, P |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 10 6256

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82