March 2, 1948. A. N. FRICK 2,437,156

METHOD AND APPARATUS FOR COOLING BY EVAPORATION

Filed July 11, 1942 2 Sheets-Sheet 1

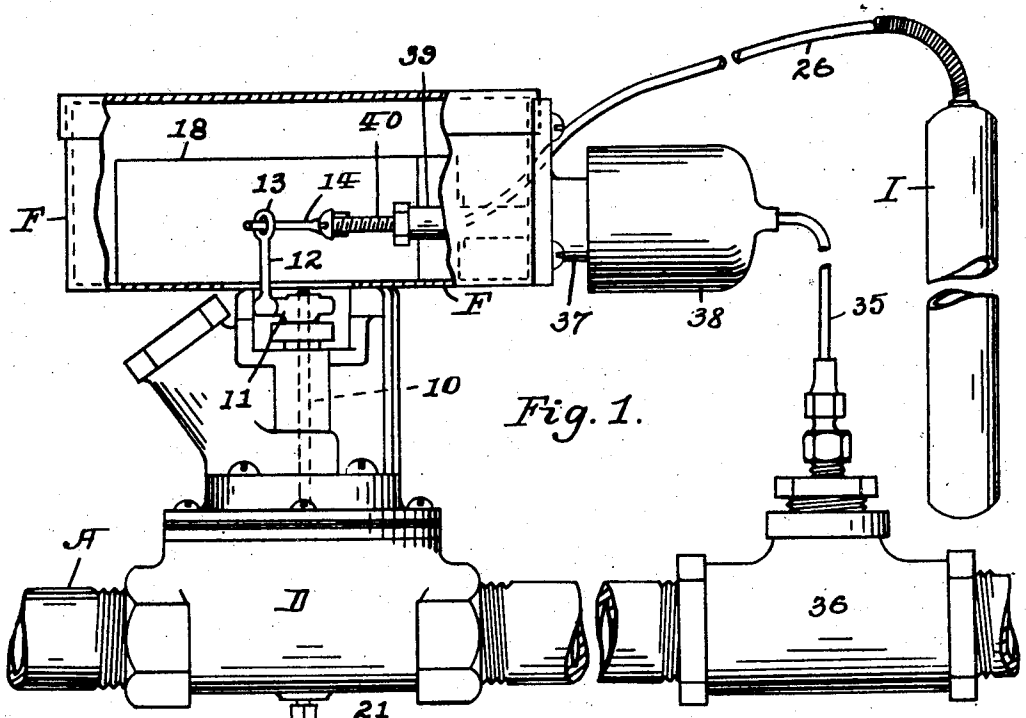


Fig. 1.

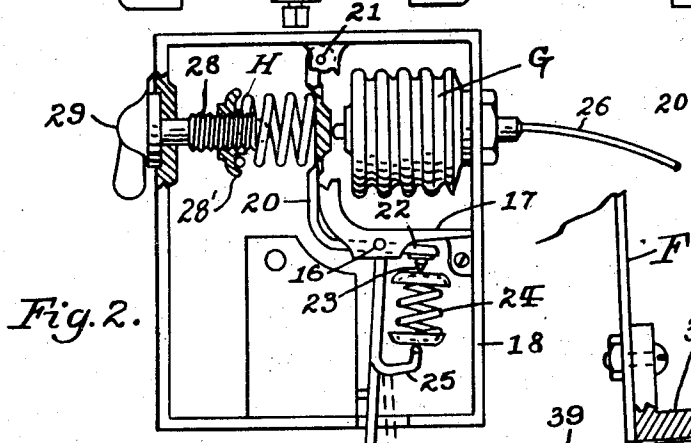


Fig. 2.

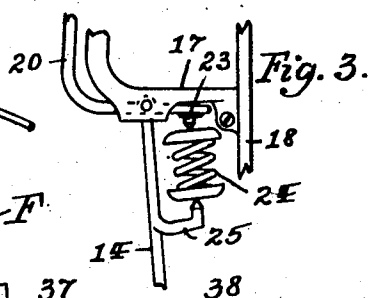


Fig. 3.

INVENTOR.
Albion N. Frick,
BY
Attorney.

March 2, 1948. A. N. FRICK 2,437,156

METHOD AND APPARATUS FOR COOLING BY EVAPORATION

Filed July 11, 1942 2 Sheets-Sheet 2

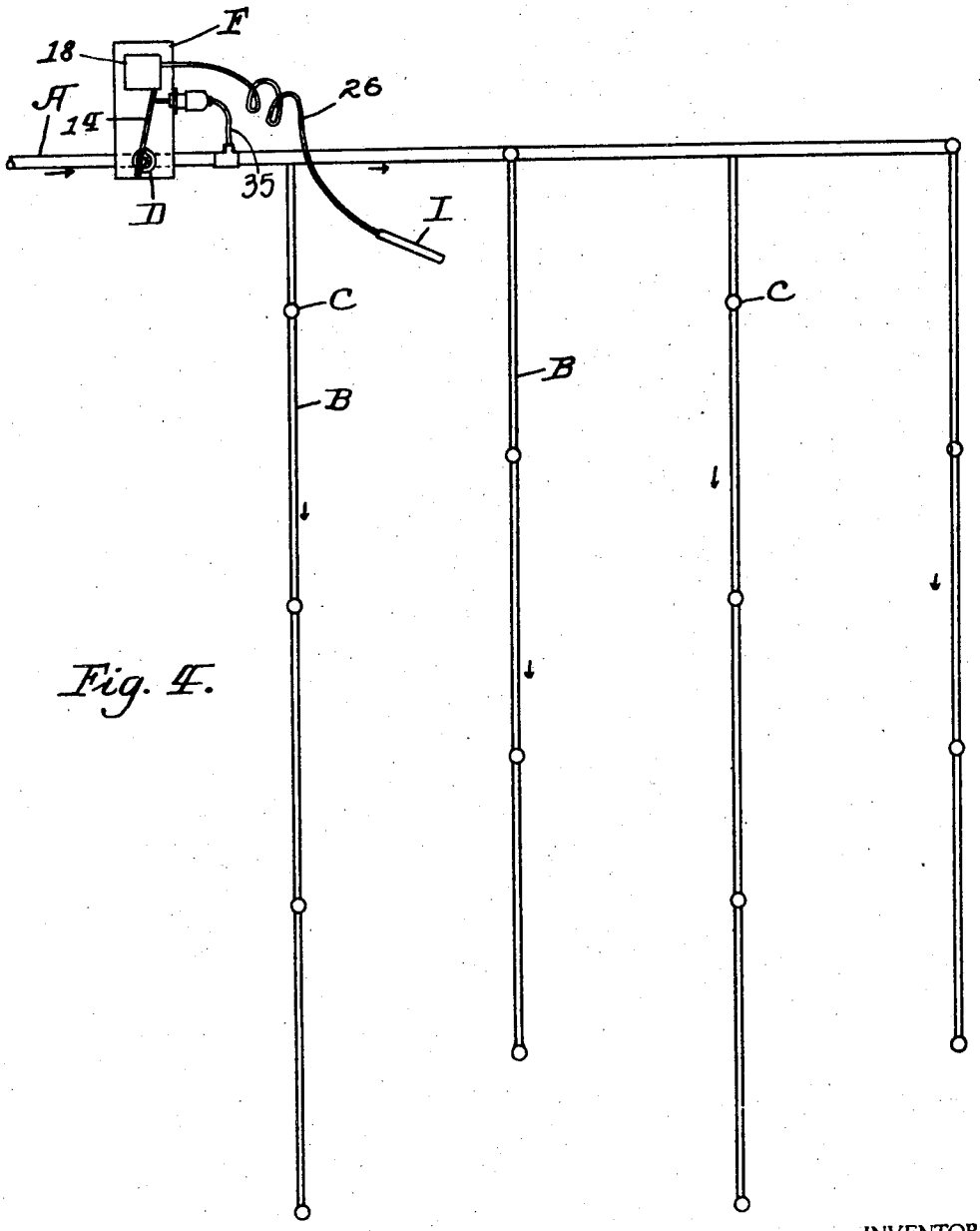


Fig. 4.

INVENTOR.
Albion N. Frick
BY
Attorney

Patented Mar. 2, 1948 2,437,156

UNITED STATES PATENT OFFICE

2,437,156

METHOD AND APPARATUS FOR COOLING BY EVAPORATION

Albion N. Frick, Los Angeles, Calif., assignor to Frederick G. Bradbury, Los Angeles, Calif.

Application July 11, 1942, Serial No. 450,625

3 Claims. (Cl. 62—6)

1

My invention relates to the method and valve control means for cooling by evaporation and more particularly to the operation of sprinkler systems such as are used for various purposes such as for cooling surfaces by evaporation. A particularly desirable use for the invention is the cooling of roofs of buildings in air conditioning and the cooling of petroleum storage tanks for reducing or preventing loss of petroleum products caused by evaporation.

An advantage attained by my invention is the elimination of all electrical or power apparatus used in the control means whereby fire hazard is reduced to a minimum. Among further advantages are a saving in the amount of water or other liquid used, the substantial elimination of wear, maximum simplicity and minimum expense of construction, and increased effectiveness and dependability in operation.

Further objects and advantages of the invention will be apparent from the following specification.

In the accompanying drawings, forming part of this specification, Fig. 1 is an elevational view illustrating my improved valve control in connection with a liquid supply line such as is used in an evaporation sprinkler system and showing my improved control applied thereto; Fig. 2 is a plan of a portion of the control mechanism shown in Fig. 1, the main valve being shown in normal "off" position; Fig. 3 is a plan of a detail showing the manner in which the valve operating arm is actuated, and Fig. 4 is a diagrammatic plan of an evaporative sprinkler system showing my improved valve control applied thereto.

Referring to Fig. 4 of the drawings, I have illustrated a sprinkler system of ordinary construction equipped with my invention, A indicating a main feed duct for fluid, such as water, under pressure and B the lateral ducts of properly proportioned sizes, in which sprinkler heads C of usual type are shown suitably spaced to produce an evenly distributed spray when in use. D is the main control valve in the main supply line which is of suitable construction, whereby its rotative valve stem 10 (see Fig. 1) is easily rotated to close and open. This valve functions to control the supply of liquid at comparatively high pressure, such as about 100 pounds to the sprinkler system, the laterals in turn operating at reduced pressure such as about 50 pounds. The valve stem has an operating arm 11, which carries a standard 12 on its free end having an eye 13 on its upper end with which a control arm 14 movably engages.

2

A suitable container F is rigidly mounted upon the main valve. Through a suitable slot 15 in the floor of the container the standard 12 is freely swung by the control arm 14. The control arm 14 is tiltable by the pivot 16 on a supporting loop 17, which is rigidly attached to the wall of a suitable casing 18 which is mounted rigidly in the container F. The control arm is compensated so as to open and close the main valve easily either way in a horizontal plane. A stirrup 20 is pivoted by a pintle 21 on one end of the supporting loop 17 and has its free end 22 provided with a laterally pointed pivot 23 which engages the one end of an expansion spring element 24. The opposite end of the spring element 24 is pivoted against the pointed end of a laterally extending impelling arm 25 on one side of the operating arm 14. The stirrup has a slight rocker movement, the arrangement of the parts and particularly the pivots being such that in one position of the rocker member the spring element urges the operating arm 14 to swing in one direction to open the valve and when swung into reverse position the spring 24 urges the operating arm in reverse direction to close the valve.

The pivoted end of the stirrup is swung to actuate the control arm 14 and valve D by a temperature controlled expansion element G on one side and a counteracting adjustable spring element H, impressed against the opposite side. The temperature controlled element G as shown comprises a fluid actuated expansion bellows mounted in the casing 18 and having its impelling end directed against one side of the pivoted end of the stirrup to swing the control arm 14 into valve opening position as indicated by broken lines when energized through increase of temperature. The temperature controlled element is connected by tubing 26 with a thermobulb I suitably located in proximity to the sprinkler system and the surface to be cooled so as to be influenced by variable controlling temperature and cause the opening of the main valve at a predetermined temperature. The counteracting adjustable spring element consists of an expansive spring which is impressed adjustably by a nut 28' on the threaded stem 28 against the spring. Said stem is journaled in the wall of the casing 18. A hand operable lever element 29 on the threaded stem 28 enables an operator to adjust the spring element H and regulate the apparatus to cause the closing of the main valve by the thermostat at a predetermined temperature. In this manner the controlling means may be regulated to function within a definite limit of temperature either way

which I have chosen to term the dominant range of temperature. This range in practice has usually approximated about seven degrees but may be varied.

The apparatus thus far described is suitable to control in the usual manner the operation of a sprinkler system such as shown in Fig. 4 by the thermobulb I, according to the temperature of the atmosphere in the vicinity of the surface being cooled by evaporation, such control however is inefficient and only partially effective.

It is well understood by those who are familiar with the art of air conditioning that by the evaporation of liquid such as water furnished by a shower or spray during the first instant of contact between the liquid and the surface being treated, the greatest amount of evaporation transpires and that the continued supply of liquid furnished by the shower evaporates more slowly and requires a larger amount of liquid to accomplish a given amount of evaporation and cooling. By the use of my invention I have applied this successive flash principle to a sprinkler system whereby the number of showers during a given period is multiplied through the functioning of a thermostatically controlled quick acting valve. In this manner evaporation is augmented accompanied by increased cooling of the surface being treated and a reduced amount of liquid is required.

To accomplish this improved result I have applied an auxiliary, hydraulically operated shut off to the main valve which in no way affects the action of the thermostat but which successively closes and permits the reopening of the valve during the dominant range of temperature. This shut off consists of a hydraulically actuated bellows J or other suitable actuating element which is connected to the sprinkler supply duct A beyond the control valve D by the tubing **35** and coupling **36** so as to cause the expansion or contraction of the bellows by variations of liquid pressure in the sprinkler system. The hydraulic bellows J is mounted on the container F by the support **37** and by the removable cap **38** in which the bellows is rigidly secured. A reciprocable shaft **39** is mounted on the free end of the bellows and slides freely longitudinally through the support **37** and wall of the container F and carries an adjustable end bolt **40** on its outer end which is juxtaposed to the control arm **14** so as to periodically close and release the valve D, by the action of the actuating element J.

Operation

My improved sprinkler system is adapted to be located upon the roof and walls or tops of buildings or structures of any kind, for sprinkling such surfaces with a shower of water or other liquid, which, upon evaporation will cool said surfaces. The non-inflammable gas controlled thermostat bulb I is placed in a convenient spot close to the sprinkler system where it is exposed to the effect of the outside atmosphere. Upon the temperature of the atmosphere in the vicinity of the sprinkler system increasing to a point at which it is desirable to cool the surfaces, the gas in the thermostat bulb expands causing the operating arm to be swung into valve opening position through the action of the expansion element G, whereupon a spray of water or other liquid admitted from the supply line is precipitated upon the surfaces to be cooled by evaporation. The pressure of the liquid fed by the main valve increases and is transmitted hydraulically to and expands the actuating bellows J and through the

action of the plunger shaft **39** closes the supply valve. During the opening of the valve a flash spray or shower is precipitated and by flash evaporation cools the surface to which the sprinkler system is applied. This in no way affects the action of the thermostat, because the auxiliary shut off operates hydraulically and overcomes the pressure exerted by the thermostatically controlled bellows and throws the valve into "closed" position. As soon as the auxiliary shut off has thrown the valve into its "closed" position, the water or other liquid pressure on the auxiliary shut off bellows fails, by the lowering of pressure of liquid in the sprinkler system and the valve immediately again obeys the thermostat, and reopens. This process is successively repeated until such time as the temperature on the surfaces of the structure is reduced to the ultimate closing point, at which time the thermostat closes the valve and no more action takes place until the surface temperature again reaches the predetermined opening point, at which time the complete cycle again repeats. The successive flash showers or sprays precipitated by the apparatus through the use of the auxiliary control mechanism during the control of the thermostat results in all or nearly all of the water, that falls on a roof or other surface, being evaporated. My improved valve accomplishes this improved result and forms part of my invention as an article of manufacture.

In accordance with the patent statutes, I have described the principles of operation of my invention together with the apparatus by which the invention is carried into use but I desire to have it understood that the construction shown is only illustrative and that the invention can be carried into practice by other means and applied to uses other than those above set forth within the spirit of the invention and within the scope of the following claims.

I claim:

1. The method of cooling a surface by evaporation of a spray of cooling liquid which consists of spraying a thermostatically controlled flow of liquid upon such surface until the temperature influencing the thermostat drops a predetermined amount lower than the opening point, and of successively checking and releasing the spray of liquid in the meantime to cause successive flashes of evaporation of the liquid sprayed upon the surface independently of said thermostatic control.

2. The method of cooling a surface by the evaporation of a spray of cooling liquid, which consists of spraying a thermostatically controlled flow of liquid upon such surface until the temperature influencing the thermostat drops a predetermined amount lower than the opening point, and of successively checking and releasing the spray of liquid in the meantime by changes of hydraulic pressure caused by the release of the spray to produce flashes of evaporation of the liquid sprayed upon the surface being cooled during said period independently of said thermostatic control.

3. Means for cooling surfaces by evaporation of liquid, comprising, a sprinkler system by which a spray of liquid is precipitated upon a surface to be cooled, a valve controlling liquid under pressure supplied to said sprinkler system, valve operating mechanism, a thermostatic element adapted to be located in heat exchange with the surface to be cooled, said element being connected to said mechanism for actuating the same to cause it to urge said valve toward open position or to close the valve as the temperature of said element reaches the top or falls to the bottom respective-

ly of a predetermined temperature range, and means operated by changes in the pressure of the liquid discharged from said valve for opening and closing said valve while said mechanism urges the valve toward open position.

ALBION N. FRICK.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,427,112	Lissauer	Aug. 29, 1922
1,987,948	Smith	Jan. 15, 1935
2,148,413	Labberton	Feb. 21, 1939
2,214,298	Gilbert	Sept. 10, 1940
2,266,321	Holder	Dec. 16, 1941