United States Patent [19]

Pochard

[11] **3,790,082**

[45] **Feb. 5, 1974**

[54] **SPRINKLER**

[75] Inventor: **Michel Adrien Pochard,** Thonon Les Bains, France

[73] Assignee: **Etablissements Carpano & Pons S.A.,** Cluses, France

[22] Filed: **Mar. 15, 1972**

[21] Appl. No.: **234,715**

[30] **Foreign Application Priority Data**

Mar. 30, 1971 France 71.11182

[52] **U.S. Cl.**..... **239/240,** 239/567, 239/DIG. 1

[51] **Int. Cl.**..... **B05b 3/04**

[58] **Field of Search**..... 239/97, 98, 237, 240, 242, 239/567, DIG. 1

[56] **References Cited**

UNITED STATES PATENTS

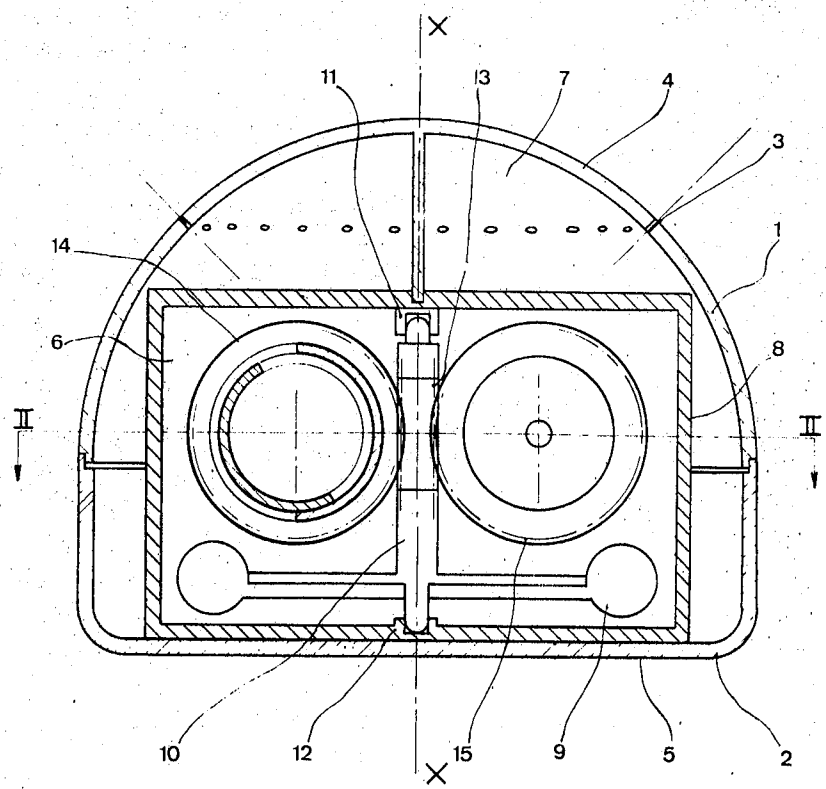
2,253,979	8/1941	De Lacy-Mulhall	239/97 X
3,362,641	1/1968	Barnes	239/97
2,990,120	6/1961	Reynolds	239/97
3,409,227	11/1968	Smith	239/97
3,160,348	12/1964	Hunter	239/240 X

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Michael Y. Mar
Attorney, Agent, or Firm—Robert E. Burns; Emmanuel J. Labato

[57] **ABSTRACT**

A liquid sprinkler comprises a hydraulic turbine driven by a supply of pressurized liquid, the turbine in turn driving two pairs of relatively rotatable coaxial cylinders. Each pair of cylinders comprises a pair of cooperating slots adapted, during relative rotation of the cylinders, to provide a variable passageway for delivering liquid to a respective outlet compartment provided with a set of outlet orifices, the sum of the passageway areas remaining constant to provide a constant overall liquid output, with varying outputs through the orifices of each compartment.

11 Claims, 21 Drawing Figures



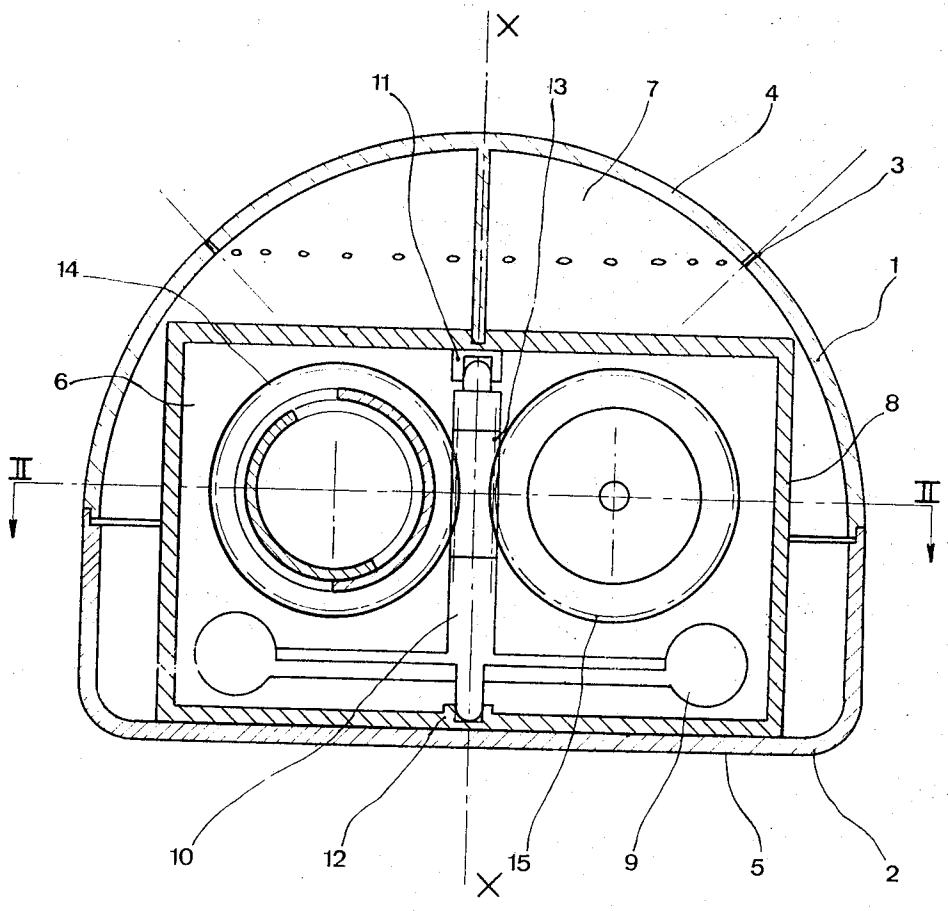


fig 1

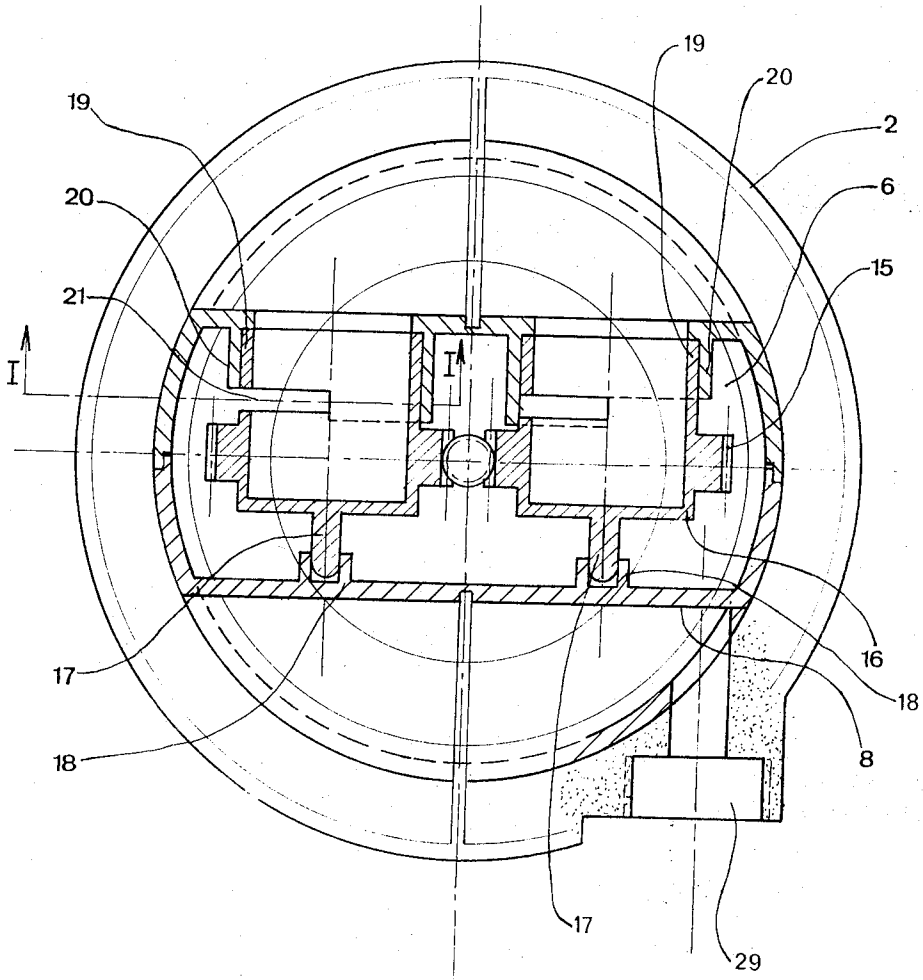


fig 2

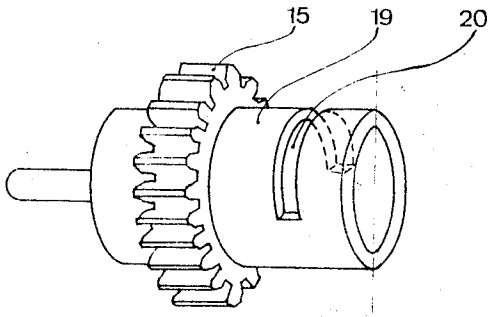


fig 3

fig 4

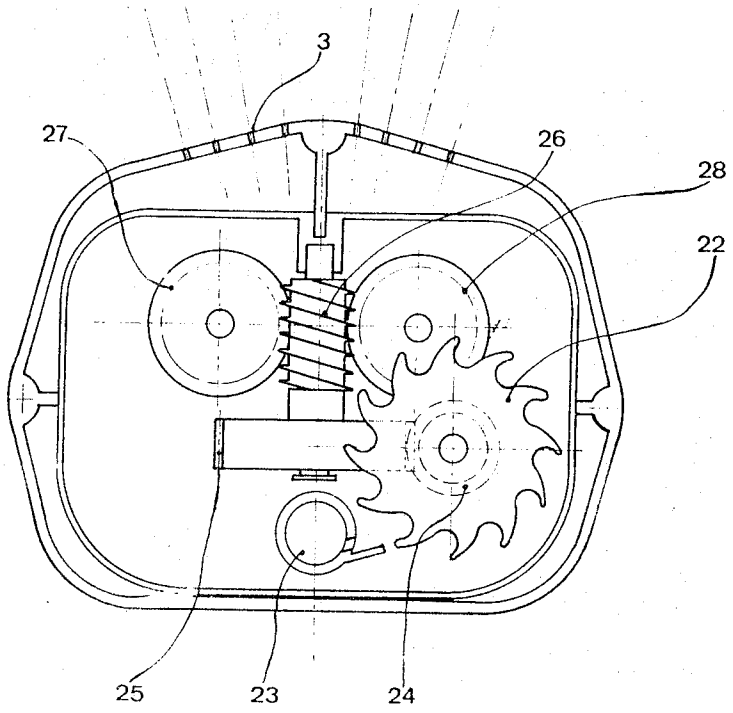


fig 5

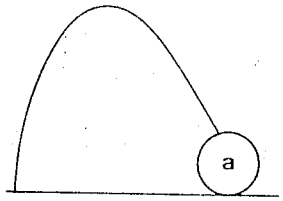
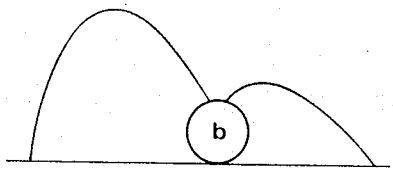


fig 6



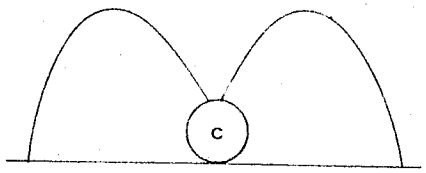


fig 7

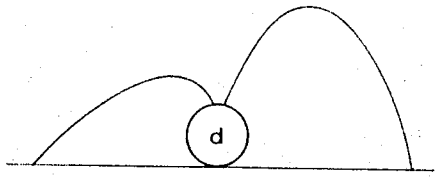


fig 8

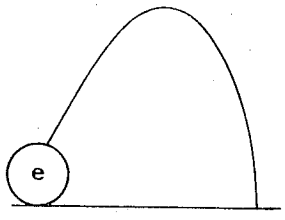
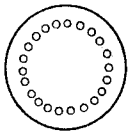
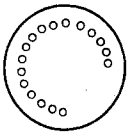
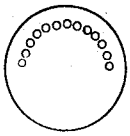


fig 9

fig 10 

 fig 11

Circle

fig 12 

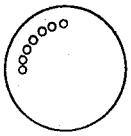
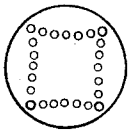
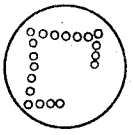
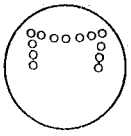
 fig 13

fig 14 

 fig 15

Square

fig 16 

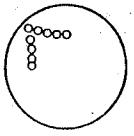
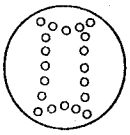
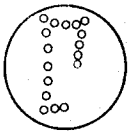
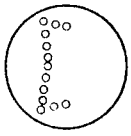
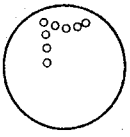
 fig 17

fig 18 

 fig 19

Rectangle

fig 20 

 fig 21

SPRINKLER

BACKGROUND OF THE INVENTION

This invention relates to sprinklers or spraying devices and is concerned with devices for spraying or sprinkling a liquid under pressure over a surface from a stationary or movable station. Such sprinklers are primarily used as irrigation means for diffusing water or any other liquid product for the maintenance of agricultural surfaces, parks, gardens, orchards, sports grounds, golf links, and so on, although these uses are not limiting.

Sprinklers or sprayers should be capable of dispensing a liquid uniformly throughout or over the surface contemplated, but so far only swinging or oscillating devices are capable of accomplishing regular dispersion. Unfortunately, swinging devices of this character are attended by many inconveniences such as dangerous and multifarious projections and the like, a certain fragility due to the overhanding controls of lever arms and other external crank means, and also the necessity of a careful maintenance due to a permanent risk of clogging the mechanisms and a poor protection against mud splashes. However, the major inconvenience is due to their limited field of application since, due to their inherent design, they are suited only for sprinkling rectangular or circular surfaces. For example, if used to sprinkle a corner of a park limited by paths, the devices will also sprinkle the paths, which causes both a waste of the liquid and a nuisance to passers-by.

SUMMARY OF THE INVENTION

An object of the invention is to provide a sprinkling or spraying device which eliminates or reduces the various inconveniences mentioned above.

According to the invention, a device for sprinkling pressurized liquid comprises a body having means for dividing the body into a first chamber and at least one second chamber. The first chamber has an inlet orifice for pressurized liquid, and each second chamber has a plurality of selectively distributed outlet orifices for spraying out liquid in selected directions. The first chamber houses: a rotary turbine driven by pressurized liquid entering the inlet orifice; at least one pair of coaxial cylinders mounted for relative rotational movement to one another; gear means for operatively connecting the turbine to relatively rotate said cylinders; and aperture means in each of said cylinders for providing a variable opening through the pair of cylinders upon relative rotation of the cylinders, said variable opening(s) forming a passageway for liquid from the first chamber to a second chamber.

In one form, this improved device comprises a rigid, projection-free outer casing connected to the feed line, as a rule a flexible spray hose. The mechanism is enclosed completely in said casing and comprises a hydraulic turbine which, through the medium of reduction gears, is adapted to rotatably drive one or a plurality of movable cylinders rotatably mounted in one or a plurality of coaxial stationary cylinders each provided with suitable transverse openings. The successive covering and uncovering of these openings by one another is thus adapted to produce a continuous variation in the water output from each pair of cylinders so that the range of the liquid jets delivered therethrough will vary constantly and regularly. Due to this "sweeping" action, all of the points of the surface contemplated may be sprinkled efficiently.

Care may be taken to avoid undue deceleration and acceleration in the turbine operation, as this would prove detrimental to the device, by providing a constant total external output of the sprinkler notwithstanding the partial momentary output variations for each pair of cylinders. The rule for ideal operation would be that the sum of the partial outputs remain constant, or alternatively that the sum of the partial ranges remain constant.

The sprayed surface may vary considerably at will, since it is subordinate to the number, size, shape and orientation of the orifices formed formed the body of the apparatus. On the other hand, the fact that the liquid output decreases the closer each jet falls to the sprinkler is not an inconvenience, since to the contrary there is a constant adaptation of the amount of water dispensed as a function of the actual sprinkled area.

BRIEF DESCRIPTION OF THE DRAWINGS

A clear understanding of this invention may be obtained from the attached drawings which schematically show, by way of example, two embodi-ments of the invention both adapted to provide a constant total external output. In the drawings:

FIG. 1 is an elevational cross-section of the first embodiment of the sprinkler comprising two pairs of coaxial cylinders having openings in the form of rectilinear slots, the rotation of these cylinders being produced by a single turbine;

FIG. 2 is a cross-section taken along line II—II of FIG. 1;

FIG. 3 is a perspective view of a movable cylinder;

FIG. 4 schematically shows another embodiment of sprinkler comprising two pairs of coaxial cylinders, wherein the operative connection between the turbine and the movable cylinder is provided by means of a gear train;

FIGS. 5 to 9 diagramatically illustrate the evolution in the course of time and of the ranges of various liquid jets issuing from the same apparatus; and,

FIGS. 10 to 21 illustrate a few patterns or arrangements of liquid outlet orifices in the external body.

DESCRIPTION OF THE PREFERRED EMBODIMENTS.

The device illustrated in FIGS. 1 and 2 comprises a dome-like cover 1 and a bottom 2 constituting a hollow outer body of the apparatus. This body comprises an inlet orifice 29 (FIG. 2) for pressurized liquid formed in the bottom 2, and a series of small diameter orifices 3 distributed about the upper surface of the casing 1 as a function of the surface to be sprinkled, the surface 5 of the bottom 2 resting on the ground. The sprinkler may also be buried so that its orifices 3 are flush with the ground surface.

Within the outer body, two independent chambers 6 and 7 are defined by a wall 8. The chamber 6 houses a liquid delivery mechanism including a turbine 9 rotatably mounted on a shaft 10 pivoted in bearings 11 and 12 rigid with the wall 8. Shaft 10 has an intermediate portion 13 cut to constitute a worm meshing, as shown in FIG. 1, with a pair of identical and corresponding helical gear wheels 14, 15 having parallel axis perpendicular to the turbine axis. It can be seen in FIG. 2 that the toothed portion of gear wheel 15 is cut about a hollow

cylinder **16** formed with an in tegral pivot or trunnion **17** journalled in a bearing **18** of wall **8.**

From the foregoing it is apparent that this mechanism is independent of the shape of the sprinkler body; the entire mechanism is enclosed in an independent chamber (**6**) in the apparatus body and under these conditions the only requirement to be met is that the means providing this chamber must be adequately secured in the apparatus.

On the side opposite to the trunnion or pivot **17,** the toothed wheel **15** is formed with a hollow cylindrical extension **19** open on one side; the resulting assembly may be considered to be a movable pinion-cylinder. The aforesaid hollow cylindrical extension **19** revolves freely with its outer surface in a stationary open cylinder **20** rigid with wall **8.**

Cylinders **19** and **20** each comprise a slot **21,** as shown in detail on the movable pinion-cylinder of FIG. **3,** this slot extending over 180° of the cylinder wall.

In FIG. **2,** the left-hand pair of slots are shown exactly coinciding (maximum opening) and the right-hand pair of slots shown diametrically opposed (maximum closure); thus, chambers **6** and **7** communicate through the left-hand assembly with a negligible pressure loss. However, the mechanism is driven continuously by the turbine **9,** since water circulates continuously, but the total external output remains constant. The slots **21** of the two cylinders **19** and **20** will successively and alternately cover and uncover each other thus causing a continuous variation in the cross sectional area of the opening available for the liquid flowing to the outside, from zero output to maximum output. The total output remains constant because the cylinders revolve in opposite directions so that one of them is closed whilst the other is opened, the total area of the two openings thus forming an overall passageway of constant area at any time. The turbine therefore revolves at a constant speed which ensures a regular operation of the apparatus. The gradual overlapping of the two slots can be clearly seen in FIG. **1,** in which the left-hand pair of cylinders is shown in cross section taken along the line I—I of FIG. **2.**

The chamber **7** is separated along the axis X—X of FIG. **1** into two compartments by a partition integral with the cover **1.** Each of these compartments communicates with the open side of a respective one of the two pairs of cylinders, and the orifices **3** are equally distributed on either side of said partition. Such a partition is necessary, considering the constant total output of the cylinder outlets to provide the desired variation in the jet ranges, each compartment being variably supplied in the course of time, thus producing the desired variation in the jet ranges. During assembly of the apparatus, the cylinders are arranged such that the constant opposition is obtained between them in order to provide, for instance, a zero output on one side at the same time as a maximum output on the other side. The alternating and pulsatory jet produced uniformly sweeps the entire surface to be sprinkled and produces a particularly attractive aesthetic effect. A suitable easily varied adjustment of the outputs, of the sprinkled area, and of the rate of operation of the assembly, are obtained at will simply by maneuvering the liquid supply valve or tap.

In the embodiment of sprinkler illustrated in FIG. **4,** a turbine **22** supplied with liquid through an orifice **23** of a liquid supply hose is rigid with a worm **24** meshing with a gear wheel **25.** This wheel **25** is angularly solid with another worm **26** meshing in turn with a pair of respective pinions of movable cylinders **27** and **28.** The speed of turbine **22** is thus reduced through two successive worm gears and this is particularly advantageous when the liquid is supplied at a relatively high pressure.

The number, dimensions, shape and orientation of the orifices **3** through which the liquid is sprayed may be selected to obtain any desired spray jets and effects, these orifices being arranged on either side of the partition. FIGS. **10** to **21** diagrammatically illustrate examples of several orifice patterns, which may be circular, semi-circular, three-quarters or one quarter of a circle, rectangular, square, or parts of a rectangle or square. Thus, for example, using a "three-quarter" pattern permits the sprinkler to be used at the corner of a house; a "half-rectangle" permits use of the sprinkler along one side of a wall, and so on.

If desired, more than two sets of cylinders, or only one set, may be provided without departing from the basic principle of the invention and at the cost of only minor modifications, a substantially constant total output being preferably arranged so as to avoid any disturbance of the regular operation of the turbine. A number of interchangeable covers may also be contemplated so that the pattern and shape of the sprinkled jets can be modified at will.

The output variation means according to this invention have been described with reference to an arrangement comprising movable cylinders revolving in stationary cylinders, but the reverse arrangement, i.e. movable cylinders disposed externally of stationary cylinders, may also be used, or possibly even two cylinders rotating in opposite directions or in the same direction at different rates. Moreover, any suitable shapes may be given to the cylinder apertures, such as triangular slots, various holes, lozenge or diamond shaped apertures, and so on. A triangular slot permits of accelerating the reduction or increase of the liquid outputs in a manner more than proportional to the rate of rotation of the mechanism. Similarly, the diameter of the various cylinders may be determined with a view to modifying the possible ratios of the openings as a function of the angle of rotation of the cylinders.

It is clear that the sprinkler device according to the invention could be used fixed, or from a moving station.

The devices constructed according to the invention are applicable to many uses, provided sufficient supply of pressure is employed. Thus, use for the cooling of surfaces by spraying, the application of anti-freeze means, as fire-protection devices, for the decoration of parks, gardens and pools, for water displays, as well as for the dispensing of dissolved manure, the phytosanitary treatment of vegetables and plants, or the improvement of soils, as games, and so on, may be contemplated.

What is claimed is:

1. Device for sprinkling pressurized liquid, comprising a body, means for dividing the body into a first chamber and at least two second chambers, said first chamber having an inlet orifice for pressurized liquid, and said at least one second chamber having a plurality of selectively distributed outlet orifices for spraying out liquid in selected directions, said first chamber housing:

a. a rotary turbine driven by pressurized liquid entering the inlet orifice;

b. at least two pairs of coaxial cylinders mounted for relative rotational movement to one another and each associated with one second chamber;

c. gear means for operatively connecting the turbine to relatively rotate said cylinders; and

d. aperture means in each of said cylinders for providing a variable opening through each pair of cylinders upon relative rotation of the cylinders wherein the sum of said variable openings remains constant at any moment, said variable openings forming a passageway for liquid from the first chamber to each second chamber.

2. Device according to claim **1,** in which each pair of cylinders comprises a rotary inner cylinder and a stationary outer cylinder.

3. Device according to claim **1,** comprising a plurality of interchangeable parts individually detachably securable to said body, each of said parts comprising a plurality of said selectively distributed outlet orifices.

4. Device for sprinkling pressurized liquid, comprising a body, means for dividing the body into a first chamber and at least one second chamber, said first chamber having an inlet orifice for pressurized liquid, and said at least one second chamber having a plurality of interchangeable parts individually detachably securable to said body and each of said parts comprising a plurality of selectively distributed outlet orifices for spraying out liquid in selected directions, said first chamber housing:

a. a rotary turbine driven by pressurized liquid entering the inlet orifice;

b. at least one pair of coaxial cylinders mounted for relative rotational movement to one another;

c. gear means for operatively connecting the turbine to relatively rotate said cylinders; and

d. aperture means in each of said cylinders for providing a variable opening through the pair of cylinders upon relative rotation of the cylinders, said variable openings forming a passageway for liquid from the first chamber to a second chamber.

5. Device according to claim **4,** in which each pair of cylinders comprises a rotary inner cylinder and a stationary outer cylinder.

6. Device according to claim **4,** comprising at least two pairs of coaxial cylinders, each pair of cylinders being associated with respective second chamber.

7. Device according to claim **6,** in which the number of pairs of cylinders and the disposition of their respective aperture means are such that the sum of said variable openings remains constant at any moment.

8. A device for sprinkling liquid comprising: means defining at least one first chamber having means therein defining a plurality of selectively distributed apertures opening into the atmosphere; and means defining a second chamber containing therein rotary turbine means receptive or pressurized liquid supplied thereto during use for rotating in response thereto and means for providing a constant supply of liquid to said first chamber comprising means defining at least two variable cross-section apertures between said first and second chambers varying in operation and providing liquid communication therebetween and means responvsive to the rotation of said rotary turbine means for varying the cross-section of said variable apertures to effect a constant sum of the cross-sections of said variable apertures at any given time.

9. A device according to claim **8,** wherein said means defining each of said variable apertures comprises two coaxial cylinders mounted for rotational movement relative to each other and each having means therein defining two openings alignable with each other.

10. A device according to claim **9,** wherein the outer one of said two coaxial cylinders is stationary and the inner one is rotatable.

11. A device according to claim **8,** wherein said means defines two first chambers each in communication with said second chamber through one of said variable apertures.

* * * * *