Aug. 22, 1967 M. F. DUERKOB 3,337,133

FOUNTAIN AND VALVE AND SPRAY APPARATUS THEREFOR

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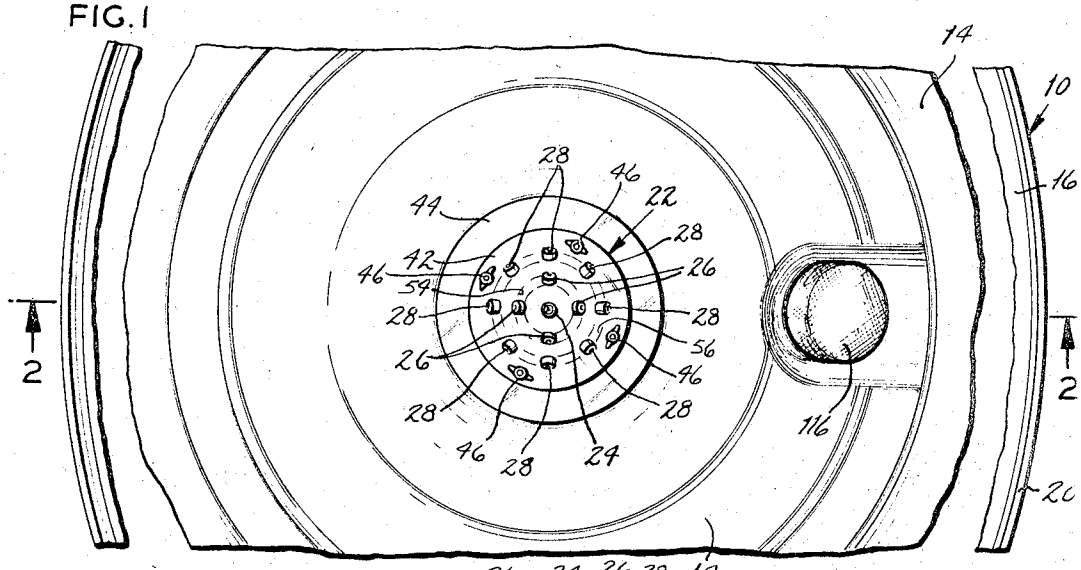
FIG. 1



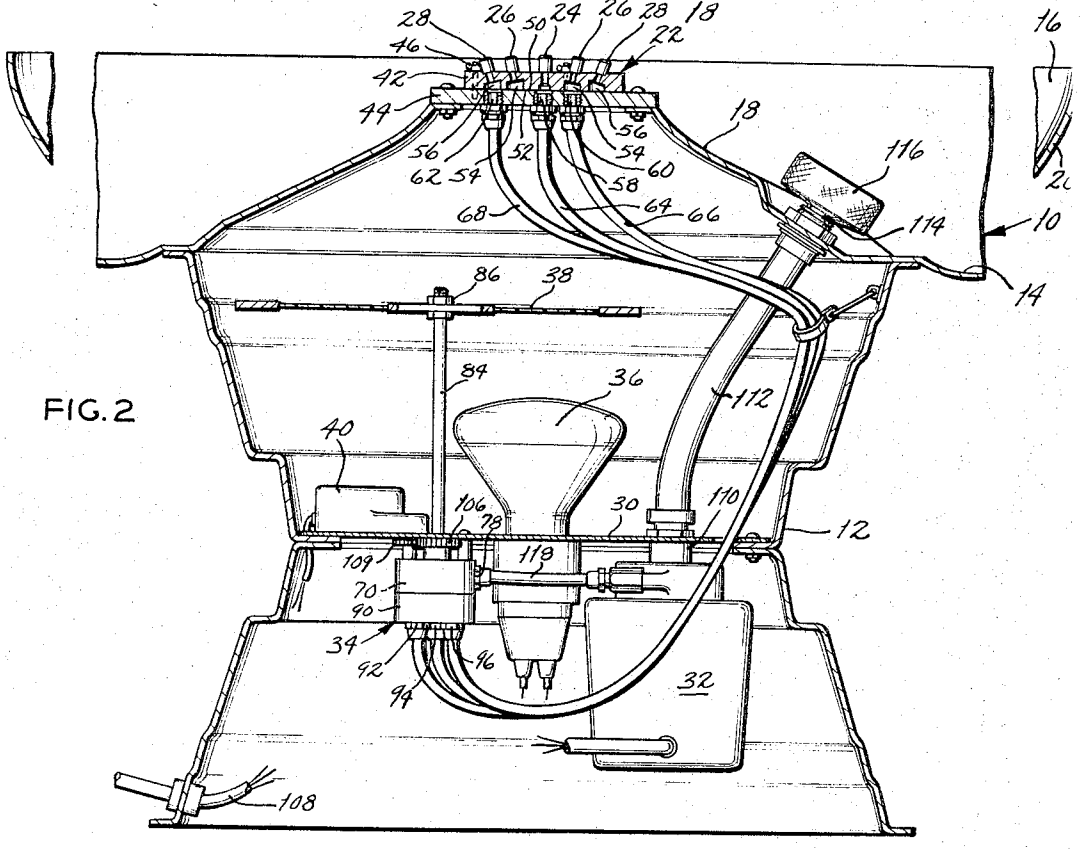


FIG. 2

INVENTOR
MANFRED F. DUERKOB
BY Jerome A. Gross,
ATTORNEY

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FOUNTAIN AND VALVE AND SPRAY APPARATUS THEREFOR

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FIG. 3

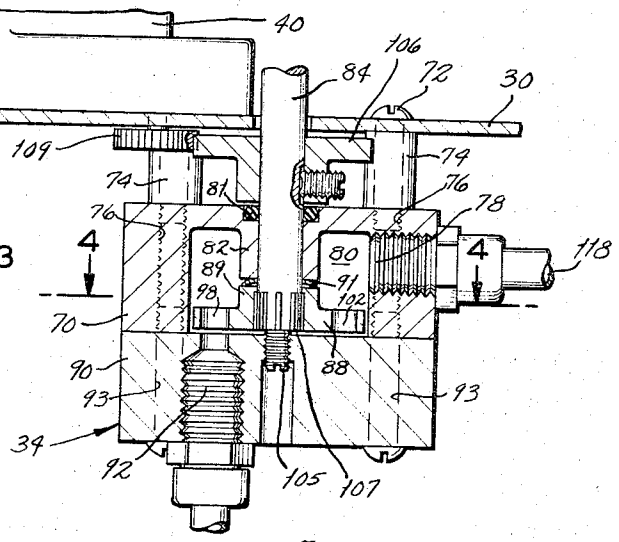

FIG. 4

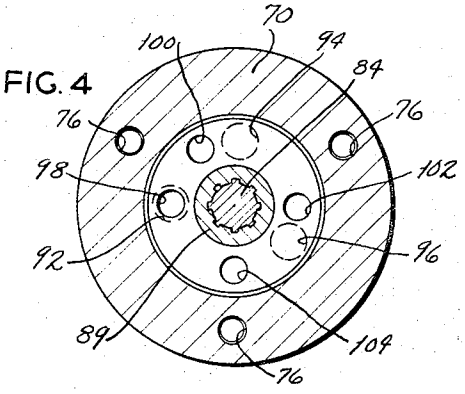

FIG. 5

DEG.	C	I	O	PATTERN	COLOR
0					
30	1	2	3		AMBER
60					
90	4	1			
120					GREEN
150			2		
180	3	4			
210			1		RED
240					
270		3			
300	2		4		BLUE
330					
360	1				

INVENTOR
MANFRED F. DUERKOB
BY Jerome A. Gross,
ATTORNEY

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3,337,133

FOUNTAIN AND VALVE AND SPRAY APPARATUS THEREFOR

Manfred F. Duerkob, 7301 Whitehaven, St. Louis, Mo. 63123

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10 Claims. (Cl. 239—18)

The present invention relates generally to an improved ornamental fountain, and more particularly to the combination therein of a unique spray head and water-distribution valve especially adapted for use with a self-contained portable fountain of the general type.

Heretofore, a satisfactory variety of fountain spray patterns was obtained generally only where a complex and costly water-distribution system, including numerous conduits, valves, connectors, etc., was employed. Where it was especially desired to attain a completely self-contained, portable fountain, spray patterns suffered from lack of variety and insufficient illumination. In addition, fountains of this general type required separate power sources for varying the distribution of water and continuously changing the colored lighting for the spray patterns.

Therefore, among the objects of the present invention are the provisions of an illuminated, ornamental fountain and component parts therefor wherein: the initial production costs and subsequent maintenance costs are minimal; a satisfactory number of spray patterns may be provided with relatively uncomplicated parts and mechanisms; the same power source used to vary the water distribution to the several spray nozzles is utilized to change the colored lighting projected upon the spray patterns; the illumination of the spray patterns, by means of a light source housed within the fountain itself, is greatly enhanced; and a predetermined restricted flow to the fountain nozzle maintains a minimum spray height.

These objects (as well as others apparent herein) are achieved generally by providing a hollow pedestal, which supports a basin. The basin serves as a water-tight top for an upper mechanism-housing portion of the pedestal and includes an outer saucer-like portion and an inner annular wall-like member, at the center of which is mounted my novel light-transmitting spray head. Flow conduits within the light-transmitting spray head connect the spray nozzles with distribution outlets of my novel rotary-type water-distribution valve, which in turn is connected to a recircuating pump housed within the pedestal below the basin.

A light source is also housed in the pedestal beneath the light-transmitting head. Interposed between the light source and the light-transmitting head is a color wheel type disc having a shaft mechanically interconnecting it with the water-distribution valve. An electric motor powers the shaft to synchronously drive the rotary-type valve and the color wheel.

My novel spray head includes inner and outer plastic plates which meet at mating surfaces, provided with conduit grooves which distribute the flow of water between flow-inlets in the inner plate and arrays of spray nozzles in the outer plate.

My novel water-distribution valve includes a distribution chamber in a main body portion, an outlet plate, and a rotor which is positioned in the water-distribution chamber and is rotatably secured to a drive shaft. The rotor and outlet plate have a plurality of flow-passages and flow-outlets so spaced radially from the shaft that, upon rotation of the shaft, the rotor flow-passages are brought into and out of flow communication with the flow-outlets of the outlet plate, to provide varying flows to the several flow inlets of the spray head.

Utilization of the present invention will be apparent to

those skilled in the art from the following disclosure of a preferred embodiment as illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view, partially broken away, of the ornamental fountain of the present invention;

FIG. 2 is a cross-sectional view of the ornamental fountain of FIG. 1 taken along the line 2—2;

FIG. 3 is an enlarged vertical cross-section of the water distribution valve included in FIG. 2;

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

FIG. 5 is a table showing diagrammatically the individual and composite spray patterns and intervals.

The pedestal and basin

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 an ornamental, portable fountain, generally designated **10**. The fountain **10** includes a vacuum-formed, polystyrene pedestal **12** having a hollow interior in which all of the working mechanisms for the fountain are contained and a heavy plastic basin **14** which forms a water-tight top for the pedestal **12**. The basin **14** includes an outer saucer-like portion **16** and an inner annular wall-like member **18** which rises slopingly inward and upward from the bottom of the basin and terminates slightly below the level of the rim **20** of the saucer-like portion **18**. The basin **14** is filled with water between its saucer-like portion **16** and the annular wall-like member **18**, the preferred water level being slightly above the top of the wall-like member **18**.

The nozzle arrays

At the center of the annular wall-like member **18** there is mounted a light-transmitting spray head, generally designated **22**. In the embodiment illustrated, there are provided three concentric nozzle arrays projecting upward from the upper surface of the spray head **22**. The central nozzle array **24** consists of a single nozzle which directs a spray of water vertically from the spray head **22**. The inner nozzle array **26** consists of several nozzles positioned in circular fashion and concentric with the central nozzle **24**. The individual nozzles of this array are directed to spray water upwardly and somewhat outwardly. The outer nozzle array **28** likewise consists of several similarly positioned nozzles. It is concentric with the inner and central nozzle arrays **24**, **26**. Each nozzle is directed to spray water upward and substantially outward and into the basin **14**.

The internal mechanisms

Referring now to FIGS. 1 and 2, there is provided a support shelf **30** which mounts the working mechanisms of the ornamental fountain **10** within the hollow pedestal **12** between its bottom and the basin **14**. Such working mechanisms include a recirculating motor driven pump **32**, a rotary-type water-distribution valve generally designated **34**, a light source **36**, a color wheel **38** including segments of differently colored high temperature acrylic material, and a small geared electric motor **40**.

The spray head

Referring particularly to FIG. 2 and the structural details of the light-transmitting spray head **22**, there are provided outer and inner clear plastic plates **42** and **44** respectively. The plates **42**, **44** are generally circular, the inner plate **44** being of somewhat larger diameter so that it may be bolted to the upper portion of the wall-like member **18**. The outer plate **42** is secured to and in contact with the inner plate **44** by wing screws **46** so that it may be readily removed for cleaning. The outer and inner plate surfaces so secured together are referred to as the

mating surfaces **50** and **52**, respectively. Where they mate, concentric passages are provided for feeding water to the several nozzles of the nozzle arrays **26**, **28**. In the particular embodiment shown, the outer plate **42** has in its surface **50** circular grooves **54** and **56** which communicate with the lower ends of nozzles of the inner and outer nozzle arrays **26** and **28** respectively. In radial registration with the three arrays the inner plate **44** is provided with three flow-inlets **58**, **60** and **62** having metal fittings threaded within them. The flow-inlet **58** leads the flow of water from a conduit **64** through its fitting and directly to the central nozzle **24**, while the flow-inlets **60** and **62** direct the flow of water from conduits **66** and **68** through their fittings and into the circular grooves **54** and **56** respectively.

The water-distribution valve

The rotary-type water-distribution valve **34** includes a hollow cylindrical body portion **70** which is secured to the under side of the support shelf **30** by bolts **72** inserted through spacing sleeves **74** and turned into threaded bores **76** within the wall of the body portion **70**. In its side it has a flow-inlet **78** which opens into a central water-distribution chamber **80**; also it has a centrally positioned bearing boss **82** presented downwardly. Passing through an O ring **81**, recessed in the upper surface of the body portion **70**, and extending downwardly through the bearing boss **82** and the chamber **80** is a shaft **84**. The shaft **84** is secured to the color wheel **38** at its upper end by means of a connection **86**. This positions the color wheel **38** between the light source **36** and a light-transmitting spray head **22**. The shaft **84** is rotatably mounted within the bearing boss **82** and at its lower end is secured by a tight splined connection to the valve outlet plate **90**. by a tight splined connection to a disc-like valve rotor **88** which rotates within the chamber **80** adjacent to the valve outlet plate **90**. The valve rotor **88** has an upwardly presented central boss **89** which is held separated from the body portion boss **82** by a cupped spring washer **91**.

The valve outlet plate **90** is bolted to the valve body portion **70** through plate bores **93** in registration with the lower ends of the bores **76** in the wall of the body portion **70**. The outlet plate **90** shown has three flow-outlets **92**, **94** and **96** spaced radially outwardly from the rotatable shaft **84**, and angularly from each other, FIGS. 2, 4. These flow-outlets **92**, **94** and **96** are connected in flow communication with the flow-inlets **58**, **60** and **62** of the spray head **22** by means of the conduits **64**, **66** and **68**.

The valve rotor **88** shown has four flow-passages **98**, **100**, **102** and **104** which are spaced radially from the rotatable shaft **84** a distance which corresponds to the spacing of the flow-outlets **92**, **94** and **96** of the outlet plate **90**. The flow-passages **98**, **100**, **102**, **104** are angularly spaced from each other so that depending upon the angle of rotation of the rotor **88** with respect to the outer plate **90**, a predetermined correspondence with the flow-outlets **92**, **94** and **96** will be obtained. Water flows through either a single flow-outlet at the outlet plate **94** or through any number of various combinations of the flow-outlets.

While the flow-outlets and flow-passages referred to may be of such shape as desired, I prefer to utilize circular outlets and passages, whose diameter is roughly equal to a 30° chord at their radial distance from the shaft. Each rotor flow-passage may thus be considered as passing twelve different stations on each cycle of rotation.

In the combination illustrated of three flow-outlets **92**, **94**, **96** with four rotor flow-passages **98**, **100**, **102**, and **104**, I use the following combination of angular spacings:

The three flow-outlets at 0°, 90° and 210°; and the four flow-passages at 0°, 60°, 180° and 270°. This combination yields the variation of spray patterns shown in FIG. 5 hereafter referred to.

The valve rotor **88** has its under surface spaced to provide tolerance between the outlet plate **90**, and tolerance between the periphery of the valve rotor **88** and the inner wall surface of the body portion **70** of the valve **34** is also provided. This tolerance allows sufficient spacing between the valve parts to permit a desirable restricted flow of water from the valve inlet **78**, through the water-distribution chamber **80**, and around the peripheral portions of the valve rotor **88** to the flow-outlets **92**, **94** and **96**, even though none of the flow-passages are in registration with the flow-outlets. Thus a single constant delivery pump **32** may be used, without undue back-pressure. Furthermore, for aesthetic reasons it may be desired to provide at least a minimum height of spray from each outlet at all times. For this purpose I provide means for adjustment of this spacing. An adjustment screw **105** in the center of outlet plate **90** bears upwardly against the inner shaft end **107** within the valve body **70**. The cupped spring washer **91** biases the shaft downwardly in opposition to the screw **105**. In this manner a controllable flow of water is delivered to the flow-outlets to maintain sprays of a minimum height at the nozzle arrays **24**, **26** and **28**.

Electric motor and pump mechanisms

The electric motor **40** which is mounted on the support shelf **30** has an output shaft (not shown) which is mechanically coupled through a spur gear **109** to a meshing drive gear **106** secured to the shaft **84**. Upward and downward spacing of the shaft by the adjusting screw **105** does not substantially affect the meshing of these gears.

A suitable electrical cable **108** is led in through a side opening in the hollow pedestal **12** to supply electrical power to the pump **32**, the electric motor **40** which drives the valve and color wheel, and the centrally positioned light source **36**.

A bracket **110** mounts the recirculating pump **32** to the support shelf **30**. Preferably the recirculating pump **32** is a motor driven, constant-delivery vane-type pump having its inlet connected through a curved hose **112** to a recirculating flow-inlet **114** located in the sloping portion of the wall-like member **18**. A screen-type filter **116** is set within the recirculating flow-inlet **114** to assure that debris which might fall into the basin **14** is prevented from being introduced into the working mechanisms of the ornamental fountain **10**. The pump outlet is connected by means of a conduit **118** to the flow-inlet **78** of the water-distribution valve **34**.

Operation

Initially the upper basin **14** is filled with water. The location of the recirculation flow-inlet **114** in the upwardly and inwardly sloping wall-like member **18** and the curved hose **112** prevent cavitation of the pump **34** at start-up. As the basin is gradually filled, air that otherwise would be entrapped is permitted to escape from the recirculation pump **32** and its connecting hose **112**.

After the basin is filled with water, the electrical cable **108** may be connected to a source of electrical energy, such as a typical **115** volt electrical outlet. When the electricity is applied to the vane-type pump **32**, water is drawn through the hose **112** and delivered through the conduit **118** to the flow-inlet **78** of the water-distribution valve **34**. Simultaneous with the energization of the pump **32**, electricity is supplied to the electric motor **40** so that it drives the gear **106** to initiate the rotation of the valve rotor shaft **84**. Rotation of the shaft **84** produces synchronous rotation of the valve rotor **88** and the color wheel **38**. Water delivered to the water-distribution valve **34** through its flow-inlet **78** enters the water-distribution chamber **80** from whence (except for the controlled restricted flow to all outlets as heretofore described) it passes through the flow-passages **98**, **100**, **102** and **104** of the rotating rotor **88** as they are brought into registration with the correspondingly spaced flow-outlets **92**, **94** and **96** of the outlet plate **90**. The water emerging from the outlets is delivered to the nozzle arrays, **24**, **26** and **28** either singly or in combination depending upon the

particular registration of the flow-passages of the rotor **88** with the flow-outlets of the plate **90**.

A typical timed program for the spray patterns is illustrated by the table of FIG. 5, in which the letters C, I and O designate respectively the flow-outlets **92, 94** and **96** which connect respectively to the central nozzle array **24**; the inner ring nozzle array **26**; and the outer ring nozzle array **28**. Further the numbers **1, 2, 3,** and **4** refer to the first, second, third, and fourth rotor flow-passages **98, 100, 102** and **104** respectively. With the rotor **88** and outlet plate **90** initially positioned as shown in FIG. 4, only the central nozzle **24** will be spraying (not taking account of the minimum flow to all nozzles); and the central nozzle will then reach maximum height. This results because only the flow-passage **98** of the rotor **88** is in flow communication with the flow-outlet **92** of the plate **90**. Shortly after the rotor **88** has begun rotating in the clockwise direction, flow-passages **100** and **102** are brought into registration with outlets **94** and **96**, respectively. This permits water to flow from the water-distribution chamber **80** to the flow-outlets **94** and **96** and thence to the nozzle arrays **26** and **28**. Thus, upon a 30° angular movement of the rotor, by the motor **40** and its attendant gears, all three nozzle arrays are in operation. During the subsequent 30° interval the central nozzle turns off as passage **98** rotates beyond the fixed flow outlet **92**. However, the inner and outer nozzle arrays **26, 28** continue to provide sprays of maximum height because the flow-passages **100** and **102** remain in registration with the flow-outlets **94** and **96**. After rotation through 60° none of the flow-passages **98, 100, 102** or **104** are in registration with the flow-outlets **92, 94** or **96**. Even so, the tolerance between the parts of the water-distribution valve **34** permits water to be sprayed from all the nozzles at the adjusted minimum height. Further rotation of the rotor **88** and its flow-passages through 360° provides the sequence of spray patterns illustrated diagrammatically under the column labeled "pattern" of FIG. 5.

If, when one or only a few nozzles are flowing, they spray to an excessive height, this may be reduced by turning the adjustment screw **105** to increase the spacing of the valve rotor **88** from the valve outlet plate **90**. Such adjustment will divert a larger part of the flow to those nozzle arrays not then directly fed by the valve rotor.

Many modifications and variations are possible in view of the above teaching. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

I claim:

1. A spray head for an ornamental fountain, comprising

outer and inner light-transmitting plates meeting at mating surfaces,

a plurality of nozzle arrays mounted onto the outer of said plates and spaced from the other,

the inner of said plates including a plurality of spray head flow-inlets,

said mating surfaces of said plates including conduit groove means interconnecting each of said flow-inlets with one of said nozzle arrays,

whereby said light-transmitting plates may be readily separated to permit cleaning of said groove means, spray head flow-inlets, and nozzle arrays.

2. For use with an ornamental fountain, the apparatus comprising

a spray head including

outer and inner light-transmitting plates meeting at mating surfaces,

a plurality of nozzle arrays mounted onto the outer of said plates and spaced from each other,

the inner of said plates including a plurality of spray head flow-inlets,

said mating surfaces of said plates including groove means interconnecting each of said flow-inlets with one of said nozzle arrays, together with

a light source beneath said spray head,

a valve including

a body portion having an inlet and a water-distribution chamber communicating therewith, said body portion rotatably mounting a shaft therein,

an outlet plate fixedly secured to said body portion of said valve and having a plurality of flow-outlets spaced from said rotatable shaft and spaced angularly from each other,

a valve rotor rotatably secured to said shaft within said water-distribution chamber of said body portion and adjacent to said outlet plate, said rotor having a plurality of flow-passages spaced from said shaft a distance substantially corresponding to the spacing of said flow-outlets of said outlet plate,

means to impart rotation to said valve shaft,

means to supply said valve inlet with water under pressure, and

means connecting each of said flow-outlets of said valve in water-flow communication with said flow-inlets of said spray head,

whereby water-flow out of said respective nozzle arrays will rise and fall as said flow-passages of said rotor come into registration with said flow-outlets connected to said nozzle array flow-inlets.

3. A spray head for an ornamental fountain, comprising

outer and inner plastic light-transmitting plates meeting at mating surfaces, and secured to each other by means to permit ready separation thereof,

a plurality of concentric nozzle arrays mounted onto the outer of said plates and spaced radially from the other,

the inner of said plates including a plurality of spray head flow-inlets,

said mating surfaces of said plates including circular groove means having the same radial spacing as said nozzle arrays and inter-connecting each of said flow-inlets with one of said nozzle arrays,

whereby said light-transmitting plates may be readily separated to permit cleaning of said groove means, spray head flow-inlets, and nozzle arrays.

4. For use with an ornamental fountain, the apparatus comprising

a spray head including

outer and inner plastic light-transmitting plates meeting at mating surfaces, and secured to each other by means to permit ready separation thereof,

a plurality of concentric nozzle arrays mounted onto the outer of said plates and spaced radially from each other,

the inner of said plates including a plurality of spray head flow-inlets,

said mating surfaces of said plates including circular groove means having the same radial spacing as said nozzle arrays and interconnecting each of said flow-inlets with one of said nozzle arrays, together with

a light source beneath said spray head,

a valve including

a body portion having an inlet and a water-distribution chamber communicating therewith, said body portion rotatably mounting a shaft therein,

an outlet plate fixedly secured to said body portion of said valve and having a plurality of flow-outlets spaced radially from said rotatable shaft and spaced angularly from each other,

a valve rotor rotatably secured to said shaft within said water-distribution chamber of said body portion and adjacent to said outlet plate, said rotor having a plurality of flow-passages spaced radially from said shaft a distance substantially correspond-

ing to the radial spacing of said flow-outlets of said outlet plate,

means to impart rotation to said valve shaft,

means to supply said valve inlet with water under pressure, and

means connecting each of said flow-outlets of said valve in water-flow communication with said flow-inlets of said spray head,

whereby water-flow out of said concentric nozzle arrays will rise and fall as said flow-pasages of said rotor come into registration with said flow-outlets connected to said nozzle array flow-inlets.

5. A valve of the type for use in distributing the flow of water, including

a body portion having an inlet connectable to a source of water under pressure and a water-distribution chamber communicating therewith, said body portion rotatably mounting a shaft therein,

an outlet plate fixedly secured to said body portion of said valve and having a plurality of flow-outlets spaced outward from said rotatable shaft and spaced angularly from each other, and

a valve rotor rotatably secured to said shaft within said water-distribution chamber of said body portion and adjacent to said outlet plate, said rotor having a plurality of flow-passages spaced from said shaft a distance substantially corresponding to the spacing of said flow-outlets of said outlet plate, said flow-passages being angularly spaced from each other partly in and partly out of correspondence with the angular spacing of the flow-outlets,

whereby on rotation of said shaft water is delivered by said flow-passages of said valve rotor to said flow-outlets of said fixed outlet plate singly and in combination at varying flow rates as the several flow-passages come into and out of registration with said flow-outlets, the valve rotor having a plate-like surface spaced sufficiently from the outlet plate to permit restricted flow between the adjacent surfaces of said plates,

whereby a restricted flow of water is delivered to all of said flow-outlets when no rotor flow-passage is in registration with a flow-outlet.

6. For use with an ornamental fountain, the apparatus comprising

a spray head including

outer and inner light-transmitting plates meeting at mating surfaces,

a plurality of nozzle arrays mounted onto the outer of said plates and spaced from each other,

the inner of said plates including a plurality of spray head flow-inlets,

said mating surfaces of said plates including groove means interconnecting each of said flow-inlets with one of said nozzle arrays, together with

a light source beneath said spray head,

a valve including

a body portion having an inlet and a water-distribution chamber communicating therewith, said body portion rotatably mounting a shaft therein,

an outlet plate fixedly secured to said body portion of said valve and having a plurality of flow-outlets spaced from said rotatable shaft and spaced angularly from each other,

a valve rotor rotatably secured to said shaft within said water-distribution chamber of said body portion and adjacent to said outlet plate, said rotor having a plurality of flow-passages spaced from said shaft a distance substantially corresponding to the spacing of said flow-outlets of said outlet plate, said flow-passages being angularly spaced from each other partly in and partly out of correspondence with the angular spacing of the flow-outlets,

means to impart rotation to said valve shaft,

means to supply said valve inlet with water under pressure, and

means connecting each of said flow-outlets of said valve in water-flow communication with one of said flow-inlets of said spray head,

whereby on rotation of said shaft water is delivered by said flow-passages of said valve rotor to said nozzle arrays singly and in combination at varying flow rates as the several flow-passages come into and out of registration with said flow-outlets.

7. The fountain apparatus as defined in claim 6, further comprising

a rotatable color wheel disposed intermediate said spray head and said light source, and

means to rotatably drive said color wheel synchronously with said valve rotor.

8. The fountain apparatus as defined in claim 7, wherein

said means to rotatably drive said color wheel synchronously with said valve rotor is a connection fixedly securing said color wheel to said valve shaft.

9. A valve of the type for use in distributing the flow of water, including

a body portion having an inlet connectable to a source of water under pressure and a water-distribution chamber communicating therewith, said body portion rotatably mounting a shaft therein,

an outlet plate fixedly secured to said body portion of said valve and having a plurality of flow-outlets spaced outward from said rotatable shaft and spaced angularly from each other, and

a valve rotor rotatably secured to said shaft within said water-distribution chamber of said body portion and adjacent to said outlet plate, said rotor having a plurality of flow-passages spaced from said shaft a distance substantially corresponding to the spacing of said flow-outlets of said outlet plate, said flow-passages being angularly spaced from each other partly in and partly out of correspondence with the angular spacing of the flow-outlets,

the valve rotor having a plate-like surface spaced sufficiently from the outlet plate to permit restricted flow between the adjacent surfaces of said plates.

together with means to adjust the spacing of said valve rotor surface from the outlet plate,

whereby to provide controlled restricted flow to all of said flow-outlets regardless whether any rotor flow-passage is in registration with a flow-outlet.

10. The valve as defined in claim 9,

said shaft having an inner end within said valve,

said means to adjust including screw means in the outlet plate bearing axially against said shaft inner end, and

spring means to bias said shaft in opposition to said screw means.

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EVERETT W. KIRBY, *Primary Examiner.*