Dec. 20, 1966 KOREICHI KAWAMURA ETAL 3,292,861

CONTROL DEVICE OF DYNAMIC OPERATION AND COLORED ILLUMINATION OF WATER FOUNTAINS IN SYNCHRONISM WITH MUSIC

Filed Nov. 17, 1964 3 Sheets-Sheet 1

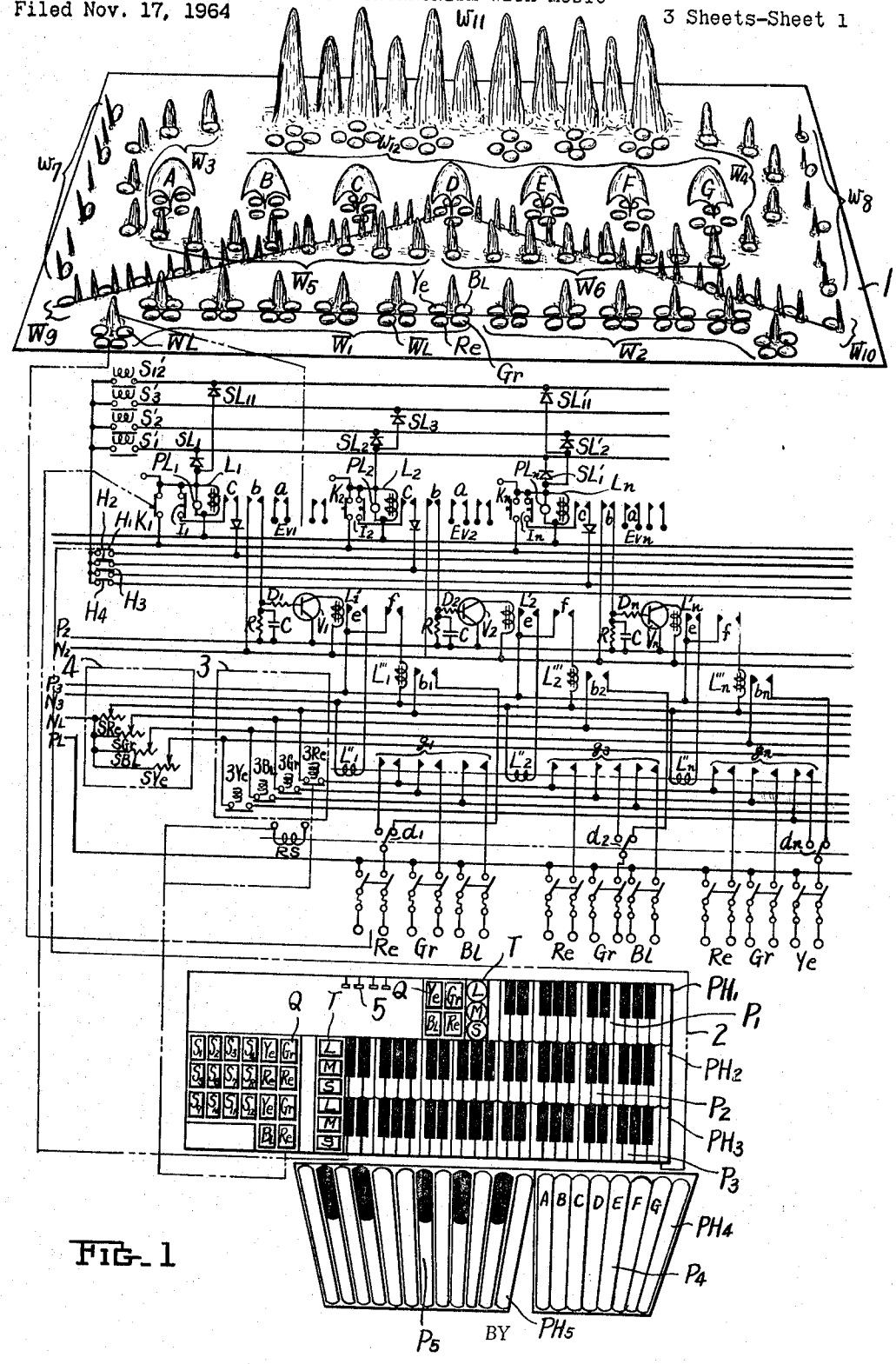


FIG. 1

Dec. 20, 1966 KOREICHI KAWAMURA ETAL 3,292,861
CONTROL DEVICE OF DYNAMIC OPERATION AND COLORED ILLUMINATION OF WATER FOUNTAINS IN SYNCHRONISM WITH MUSIC
Filed Nov. 17, 1964
3 Sheets-Sheet 2

FIG. 2B

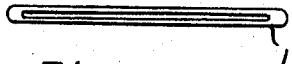


FIG. 2A

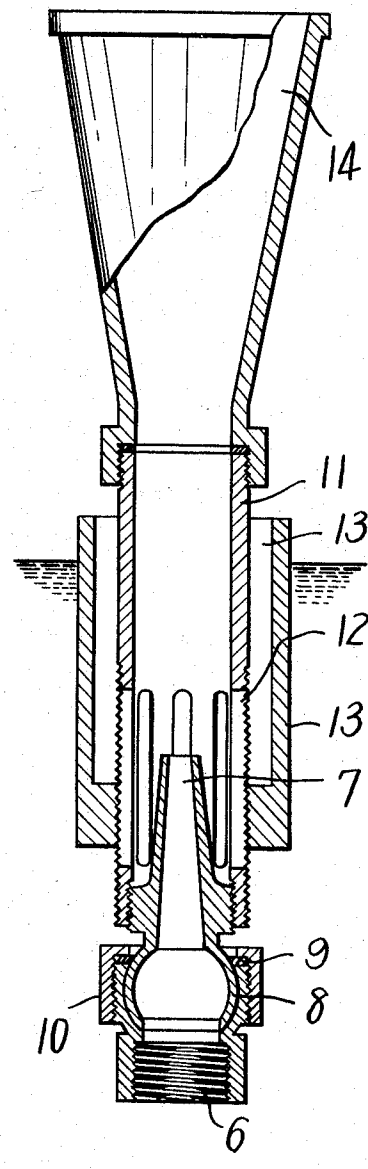
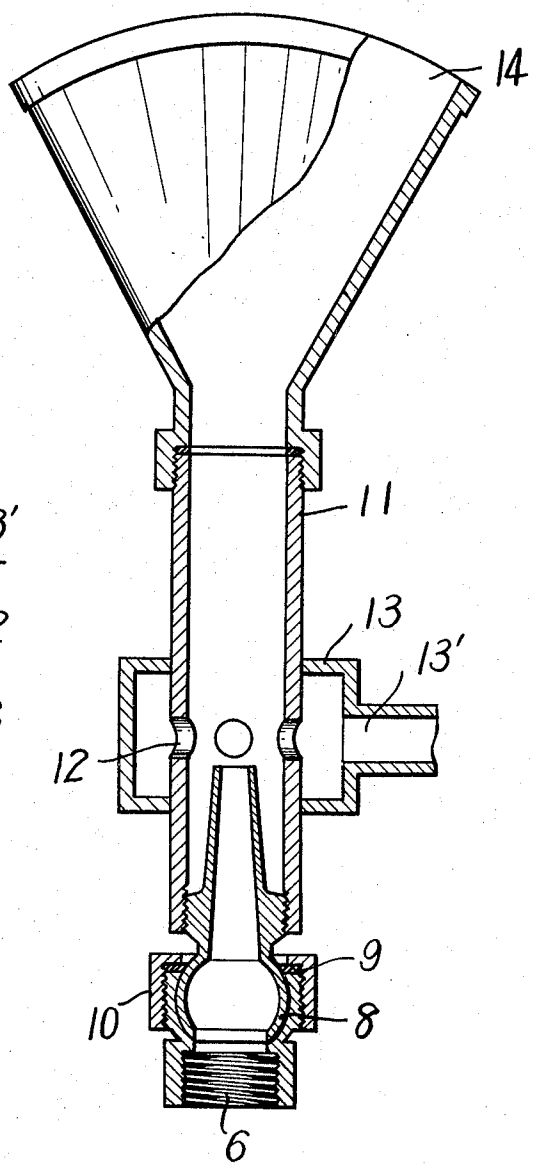


FIG. 3B

FIG. 3A



Dec. 20, 1966 KOREICHI KAWAMURA ETAL 3,292,861

CONTROL DEVICE OF DYNAMIC OPERATION AND COLORED ILLUMINATION OF WATER FOUNTAINS IN SYNCHRONISM WITH MUSIC

Filed Nov. 17, 1964 3 Sheets-Sheet 3

FIG. 4

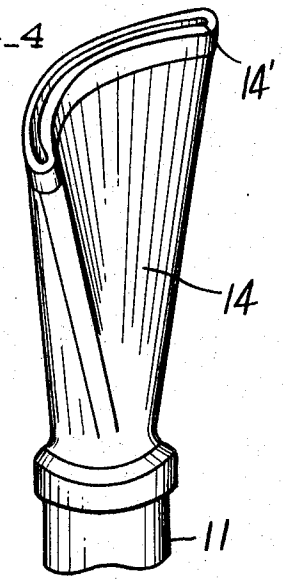


FIG. 5

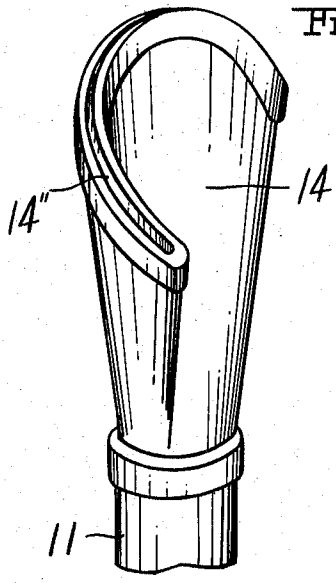


FIG. 6

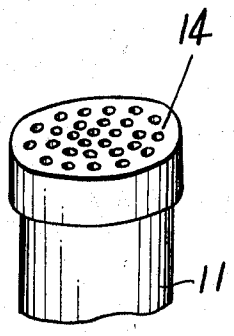


FIG. 7A

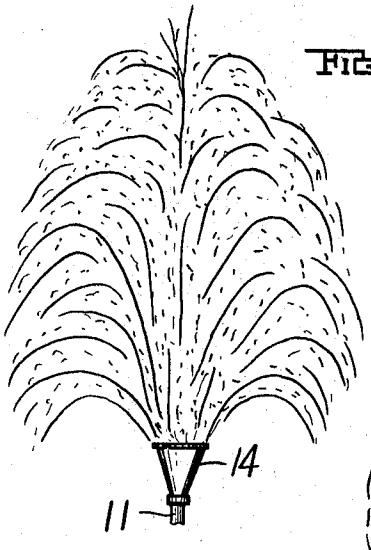


FIG. 7B

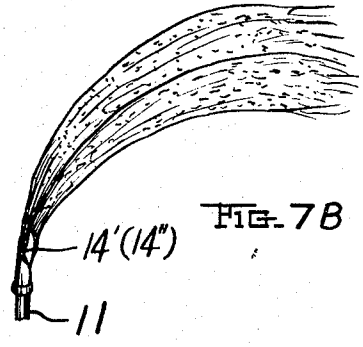
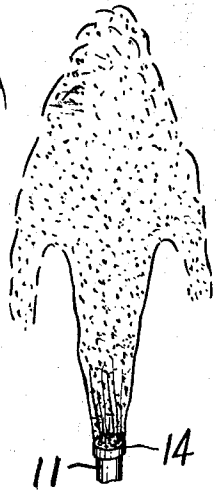


FIG. 7C



United States Patent Office 3,292,861 Patented Dec. 20, 1966

3,292,861

CONTROL DEVICE OF DYNAMIC OPERATION AND COLORED ILLUMINATION OF WATER FOUNTAINS IN SYNCHRONISM WITH MUSIC

Koreichi Kawamura, Yoshiko Kawamura, and Koichi Kawamura, all of 66 Jyomyoji, Kamakura, Japan

Filed Nov. 17, 1964, Ser. No. 411,858
5 Claims. (Cl. 239—17)

This invention relates to automatic control devices for water fountains, and more particularly to an automatic control device for producing performance and colored illumination of water fountains responsive to performance of music.

The principal object of the invention is to provide an automatic control device comprising keys and pedals similar to those of a piano and an organ and other co-operating instruments to produce the performance of water fountains by changing dynamic operation of water fountains through selecting suitable nozzles of water fountains in synchronism with a musical performance, varying the illumination of water fountains in conformity with said mechanical performance thereof, and making combinations of said water fountains at will.

According to the automatic control device of the invention, an overall musical production including performance of water fountains consisting of a number of individual water fountain nozzles laid out in water fountain ponds can be conducted by controlling the dynamic operations and colored illumination of water fountains and by making suitable combinations of water fountains, thus controlled responsive to a given musical performance. Thereby a visual expression of a delicate atmosphere of a given music will be realized in a cubistic and colorful manner within water fountain ponds. Thus not only the effectiveness of the water fountain performances is increased but also the musical performance itself is made more impressive.

The automatic control device for water fountains of the invention comprises a performance mechanism similar to that of a piano or an organ consisting of multi-staged keys, pedals, and control push buttons; control circuits for mechanical operation which control magnetic valves and pumps to supply water to water fountain nozzles by means of respective relays; time delaying circuits for maintaining illumination of an ejected water column until said water column disappears completely after a stop signal for the water supply to said water column is given; control circuits for illumination which are adapted to vary the coloring and brightness of said illumination; and combining means to select suitable combinations of water fountains thus controlled and to change said selected combination. Thereby locations of water columns, dynamic operations of ejected water columns and colored illuminations thereof are varied in synchronism with a given musical performance. In order to materialize the impression of a musical performance as a visual expression of water fountains in water fountain ponds, for instance to represent a symphony, various different types of water fountain nozzles will be installed to represent instruments such as contrabasses and drums, or musical expressions such as the first melody, the second melody, obligato, spaces, etc. An operating board consisting of rows of keys like those of a piano, stop pedals like those of an organ and volume controlling devices is installed to control said nozzles in synchronism with a musical performance. The key board, for instance, will be divided into three rows, of which the first row represents contrabasses, the second row the first and second melodies, and the third rows obligato and others. While music is played by operating the keys and pedals of the operating board

thus constituted, the impression of said musical performance is reflected in the performance of the water fountains by producing the dynamic operations and colored illumination of each water jet of the fountain and the combination thereof in synchronism with said musical performance.

Accordingly, the individual nozzles of water jets of fountains, which are located in water fountain ponds and controlled by said control circuits for mechanical operation, are so adjusted beforehand as to produce suitable dynamic water column forms and variation in colored illumination respective to sound levels, sound frequencies, intervals, and other musical elements of said musical performance.

For a better understanding of the invention reference is made to the accompanying drawings, in which

FIG. 1 shows general arrangement of fountain control mechanism, electric control circuit and the fountain pond embodying the invention,

FIGS. 2–A, 2–B and 3–A, 3–B are sectional views and end views respectively of two different fountain nozzle devices to be used in the invention,

FIGS. 4 to 6 are perspective views of curved nozzle elements corresponding to FIGS. 2 and 3 and a cylindrical nozzle having multiholes respectively, and

FIGS. 7–A, 7–B and 7–C are perspective views of different configurations of the fountains obtainable by the nozzles as shown in FIGS. 4 to 6 respectively.

In these drawings, the same or similar parts are shown by the same reference numeral.

Referring to FIG. 1, which illustrates a water fountain pond, a number of groups of water fountains installed in the pond, a typical illumination means, electrical control circuits, an operative means or a performance mechanism, and wiring for connecting said means, **1** is a water fountain pond having a plurality of water fountain groups W_1, W_2, . . . W_{11}, which comprise a plurality of individual water fountain elements having mouth pieces such as shown in FIGS. 4, 5 and 6. In order to give a dynamic form of water column as shown in FIGS. 8–A, 8–B and 8–C, each individual water fountain structure is constructed as shown in FIGS. 2–A, 2–B and 3–A, 3–B and fitted with a mouth piece as illustrated in FIGS. 4 to 6. Thereby each individual water fountain will be operated in a manner to be explained later so that the impression of a given musical performance will be materialized in the overall dynamic operation and colored illumination of water fountains in the pond.

Referring to FIGS. 2–A, 2–B and 3–A, 3–B, which illustrate examples of individual water fountain structure embodying the invention, **6** is a water supply tube, **7** an ejection nozzle, **8** a ball joint, **9** a packing, **10** a union unit, **11** a water-guide cylinder, having air inlet openings **12**, fixed to the nozzle **7** and enclosing it, **13** a hood having intake opening **13'**, fitted to cover the cylinder **11**, and **14** a mouth piece fixed to the cylinder **11** and having a straight flattened outlet opening to form a fountain having the configuration as shown in FIG. 7–A.

In FIGS. 4 and 5, the mouth pieces **14** having a curved narrow outlet opening **14'** or **14''** respectively are shown, to form a fountain having the configuration as shown in FIG. 7–B, and FIG. 6 shows a cylindrical mouth piece **14** having multiple small holes to form a fountain having the configuration as shown in FIG. 7–C.

Colored illumination lamps to light water columns ejected from individual nozzles in a group of water fountain nozzles are represented by W_L, and for each individual water fountain nozzle a colored illuminating means consisting of light bulbs equipped with one of a group of colored filters red *Re*, green *Gr*, blue *Bl* and yellow *Ye*, or a light bulb equipped with a group of colored filters in an exchangeable manner, and said colored illuminat-

ing means W_L, are placed close to the water surface of the pond to illuminate each water fountain column in such a manner as to give a visual impression suitable to the accompanying music by controlling the on-off and brightness thereof.

The operating board **2** of the water fountains is shown in the lower portion of FIG. 1. P_1, P_2 and P_3 are water fountain selecting keys for each water fountain group, and P_4 and P_5 are similar selecting pedals. Holding keys PH_1, PH_2 and PH_3, and holding pedals PH_4 and PH_5, which are located at the extreme right of each key row and each pedal row, respectively, are intended to hold the operations of water fountain groups corresponding to each key row or each pedal row. Coloring selection switches Q for each water fountains group are provided to choose coloring of colored illuminating means W_L which project colored light rays to illuminate the fountain water columns, and T are regulating buttons to adjust the height of ejected water columns.

On the extreme left of the operating board **2**, there are provided operating buttons S_1, S_2 . . . , and S_{12} for relays to compose proper combinations of water fountains.

Key switches K_1, K_2, . . . K_n in the control circuits cooperate with each key or pedal on the operating board to operate nozzles of corresponding water fountains. Relays L_1, L_2, . . . L_n are energized by means of key switches K_1, K_2, . . . K_n respectively. EV_1, EV_2, . . . EV_n show terminals of solenoid valves connected to contacts *a* of relays L_1, L_2, . . . L_n, and said solenoid valves regulate the water supply to water fountain nozzles. In order to adjust the height of water columns ejected from said water fountain nozzles, there are provided suitable water flow control means (not shown) in said water supply tubes to water fountain nozzles, and said water flow control means are controlled by said regulating buttons T to adjust the height of ejected water columns. To indicate operating conditions of the relays, pilot lamps PL_1, PL_2, . . . PL_n are connected in parallel to each relay L_1, L_2, . . . L_n. Time delay circuits D_1, D_2, . . . D_n are connected to contacts *b* of said relays L_1, L_2, . . . L_n, and each time delay circuit comprises a resistor R, a condenser C and a transistor V, and said resistor R and said condenser C are connected in parallel to give a predetermined time constant suitable for the desired time delay. Time delaying relays L'_1, L'_2, . . . L'_n are connected to transistors V in each said time delaying circuit, and contacts *e* of said time delaying relays operate holding relays L''_1, L''_2, . . . L''_n to hold contacts groups g_1, g_2, . . . g_n of light bulbs W_L for projecting colored illuminations to water fountain columns, and contacts *f* of said time delaying relays operate coloring relays L'''_1, L'''_2, . . . L'''_n. Said time constant defined by the parallel circuit consisting of a resistor R and a condenser C should be selected sufficiently long to maintain the projection of colored illuminations to water columns until said water columns fade out completely after stop signals are given to the water supply for said water columns. Said coloring relays are to provide a specific water fountain with a single specific color of the illumination of the water columns thereof when coloring selection relays **3** are not energized.

The coloring selection relay **3** consists of individual color relays such as **3***Re*, **3***Gr*, **3***Bl*, and **3***Ye*, which are connected to corresponding colored light bulbs by way of contacts g_1 of the holding relays L''_1, L''_2, . . . L''_n.

When the coloring selection relay **3** is operated by pushing coloring selection switches Q which are provided for each water fountain group and located on the operating board **2**, the coloring of the illumination for all water columns of the selected water fountain groups is immediately changed into the selected color by simultaneous operation of a coloring change-over relay RS with one of said individual color relays such as **3***Re*, **3***Gr*, **3***Bl* or **3***Ye*.

A brightness adjusting rheostat means **4** consists of individual rheostats SRE, SG*r*, SB*l* and SY*e* corresponding to red, green, blue and yellow light bulbs which are connected in series to said individual color relays **3***Re*, **3***Gr*, **3***Bl* and **3***Ye* respectively. The brightness adjusting rheostat means **4** is adjustable by turning the knob **5** on the operating board **2**.

In the automatic control device thus constructed, if a key or a pedal, one of P_1 to P_5, is operated responsive to a musical performance, that key switch which is connected to said operated key or pedal will be closed. For the purpose of explanation, suppose the key switch K_1 is closed. By closing K_1, the relay L_1 is energized to close the contact *a* which energizes the solenoid valve EV_1 in turn, thus water is supplied to the corresponding nozzle and ejected therefrom as a water fountain column. The contact of the relay L_1 is also closed to energize the time delay circuit D_1 and hence the time delay relay L'_1 is energized. Since there is a time delay circuit comprising R and C having a predetermined time constant, which is connected to the input side of the transistor V_1, the operation of the relay L'_1 will be maintained until the related water column completely disappears. When the contacts *a* and *f* of the relay L'_1 are closed upon energization thereof, the holding relay L''_1 and the coloring relay L'''_1 will be energized causing contacts g_1 and a contact b_1 to close.

There are a set of colored light bulbs consisting of R*e*, G*r*, B*l* and Y*e* for each group of water fountains, and one of which is selected to be the predetermined color of said group, the circuit of which can be traced from one terminal of said selected colored light bulb, through one contact of the coloring changover relay, contact b_1 of the coloring relay L'''_1, an individual brightness adjusting rheostat corresponding to said selected color and a power source means, to the other terminal of said selected colored bulb. The circuit for each colored light bulb other than said selected one in said set can be traced from one terminal of the colored light bulb, through the other contact of the coloring change-over relay, one of the contacts g_1, an individual color relay corresponding to the color of the light bulb, an individual brightness adjusting rheostat corresponding to the same color, and a power source means, to the other terminal of the light bulb.

In the circuit of FIG. 1, if the contact b_1 of the color relay is closed, the red light bulb will project an alluminating light to light up the related water column, the brightness of which is set by adjusting rheostat SR*e*. Such illumination is continued even after the key switch K_1 is opened, until the related water column is completely faded, and thereafter the circuit of the light bulb R*e* is opened when the relay L'_1 is deenergized.

By operating the keys and pedals of the operating board, the dynamic operation of the water columns and the illumination thereof will be varied responsive to the musical performance. To change the coloring of the illumination, while the predetermined color of the group is used, the coloring selective button Q is pressed, and then the coloring selective relay **3** and the coloring change-over relay R*s* are energized simultaneously. Thereby the circuit for the predetermined color of the group by way of the contact b_1 of the color relay L'''_1, is opened at the coloring switch over relay R*s* and the circuit for the desired color, selected by pressing the corresponding selection button, is completed from the power source means to the light bulb. Thus the coloring of the illumination of water columns of the water fountain group concerned will be changed into the desired color simultaneously.

The adjustment of the brightness of the illumination can be done by adjusting the resistance of the rheostat **4** by turning the knob **5** located on the operating board **2**. When one or more of the holding keys and pedals PH_1 to PH_5 are operated, the circuit of the corresponding relays among L_1 to L_n will be maintained as energized by the operation of corresponding key switches among K_1 to K_n which are located in the rows of operated hold-

ing keys or pedals. Such a holding of the circuit is effected by means of switches H which cooperate with the holding keys and pedals, and release of such holding circuits is effected by opening normally-closed switches I. There are holding circuit contacts C between said two kinds of switches H and I which are connected in series thereto and controlled by the relays $L_1, L_2 \ldots L_n$.

In order to actuate certain groups of water fountains without operating keys or pedals thereof while the other groups of water fountains, combination relays $S'_1, S'_2, \ldots S'_n$ are provided between the power source and each of relays $L_1, L_2, \ldots L_n$ by way of suitable combinations of rectifiers SL. By pressing desired operating buttons of $S_1, S_2, \ldots S_n$, corresponding ones of said combination relays $S'_1, S'_2, \ldots S'_n$ are energized and thereby corresponding desired group of water fountains will be actuated and the dynamic picture of the entire assembly of water fountains will be varied without operating any key or pedal.

For instance, if combination relays S'_1 or S'_{12} is energized by pressing corresponding push-buttons while the group of water fountains corresponding to the key switch K_1 is operating, then the circuit of the relay L_n is energized via selenium rectifiers SL'_1 or SL'_{11} in the same manner as if the key switch K_n were closed. Thus a dual water-columns operation or a multi-columns operation of the water fountains will be effected.

The mechanism of the water fountains of the invention is as described in the foregoing, and by actuating operating means similar to those of a piano or an organ, such as rows of keys and pedals, a wide variety of dynamic operation and colored illumination of water fountains placed in water fountain ponds can be obtained, and said variation can be done in synchronism with a musical performance. Besides, the colored illumination of water fountains is so made as to maintain said colored illumination until related water columns are completely faded. Thereby the productive effects of the operation of water fountains is improved substantially.

What we claim is:

1. An automatic control device for water fountains comprising, in combination, an organ-type console including, as manually operable components, finger operated keys, foot operated pedals, and keyboard controls; a plurality of individual water fountain nozzle structures arranged in plural groups and operable to discharge water columns therefrom; individual electrically operable means controlling the supply of water to each respective group of nozzle structures; illumination means, variable as to brightness and color, adjacent each nozzle structure group and selectively operable to illuminate the water columns discharged therefrom at a selected brightness and with a selected color; respective first relay means controlling operation of said electrically operable means to supply water to the respective groups of nozzle structures for discharge of water columns from the latter; first control circuits connecting said console to said first relay means to activate said electrically operable means in accordance with selective manual operation of fountain controlling console components; second control circuits connecting said console to said illumination means to activate said illumination means, as to brightness and color, in accordance with selective manual operation or illumination brightness and color selecting console components; second relay means operated responsive to operation of said first relay means to energize said illumination means; and time delay circuit means connected between said first relay means and said second relay means and maintaniing said second relay means operated to energize said illumination means during a time delay corresponding to the decay time of water columns upon interruption of a water supply to a respective group of nozzle structures responsive to "stop" operation of the associated first relay means.

2. An automatic control device for water fountains, according to claim 1, wherein said water fountain nozzle structure comprises a nozzle connected to a water supply pipe, a water-guide cylinder, having air inlet openings, fitted to the outside of said nozzle, a hood, having an air intake opening, fitted to the outside of said water-guide cylinder and a mouth piece fixed to the top of said water-guide cylinder.

3. An automatic control device for water fountains, according to claim 2, wherein said mouth piece has a straight flat outlet opening.

4. An automatic control device for water fountains, according to claim 2, wherein said mouth piece has an arcuate and narrow outlet opening.

5. An automatic control device for water fountains, according to claim 2, wherein said mouth pieces comprise a cylindrical cap having multiple small holes.

References Cited by the Examiner

UNITED STATES PATENTS

1,401,608	12/1921	Kingsley	84—464
1,728,860	9/1929	Hector	84—464
1,977,997	10/1934	Patterson	84—464
2,868,055	1/1959	Simos	239—16
3,165,966	1/1965	Pribyl	84—464
3,228,278	1/1966	Wortman	84—464

EVERETT W. KIRBY, *Primary Examiner.*