Nov. 6, 1934. G. H. LELAND 1,979,477

SPRINKLING SYSTEM

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Fig. 1.

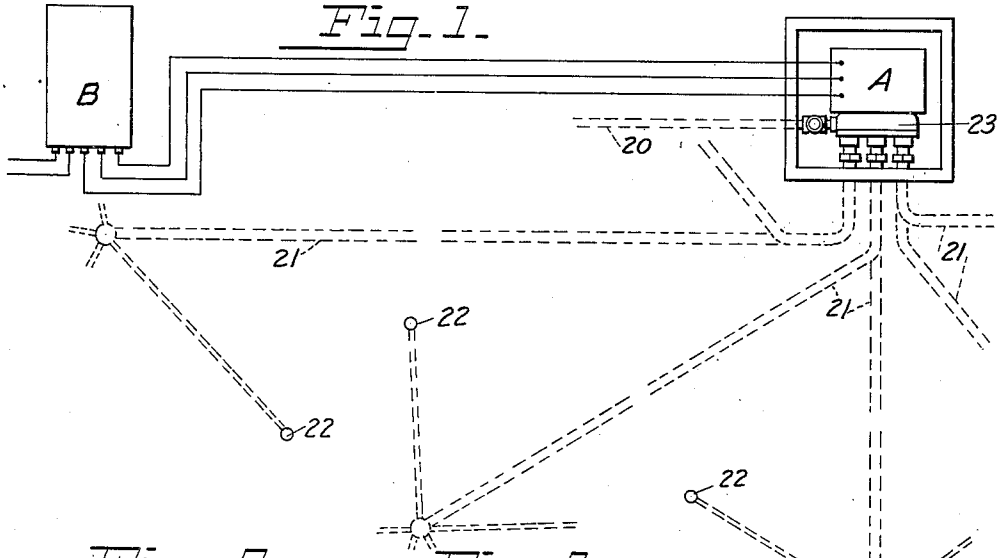


Fig. 2.

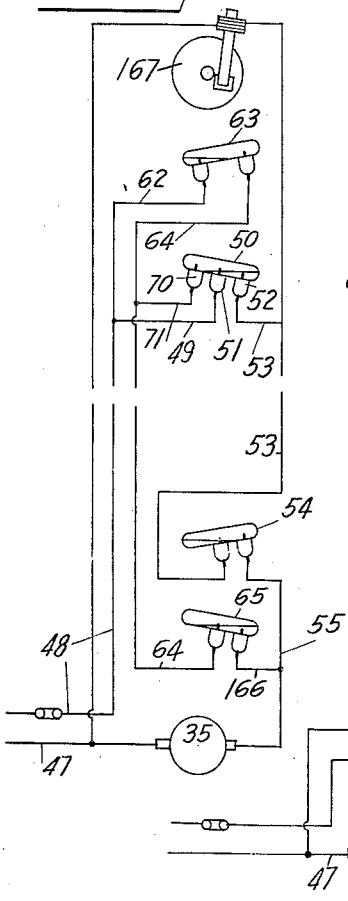


Fig. 3.

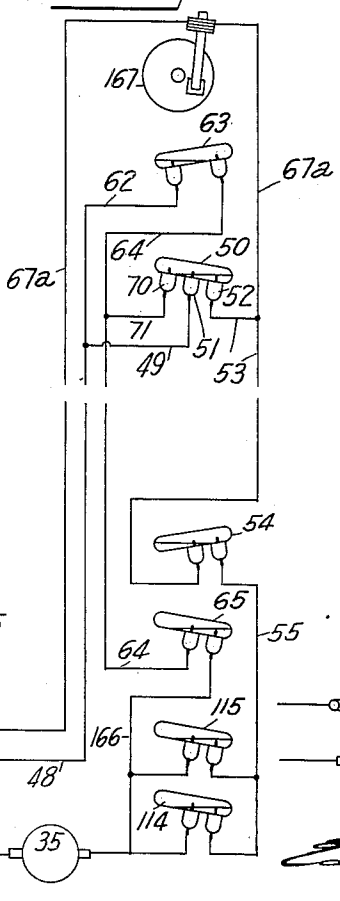
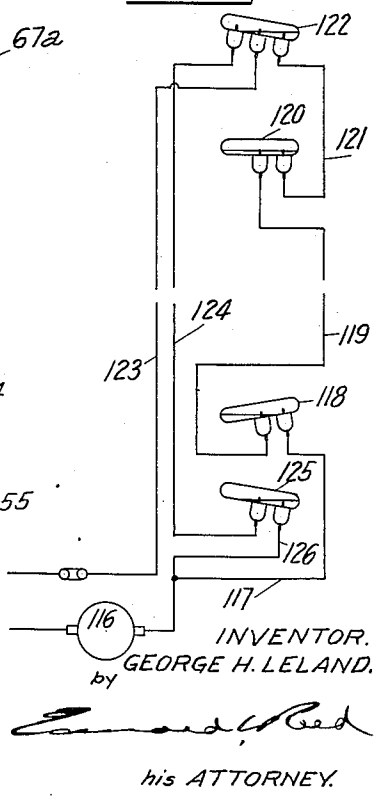


Fig. 4



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SPRINKLING SYSTEM

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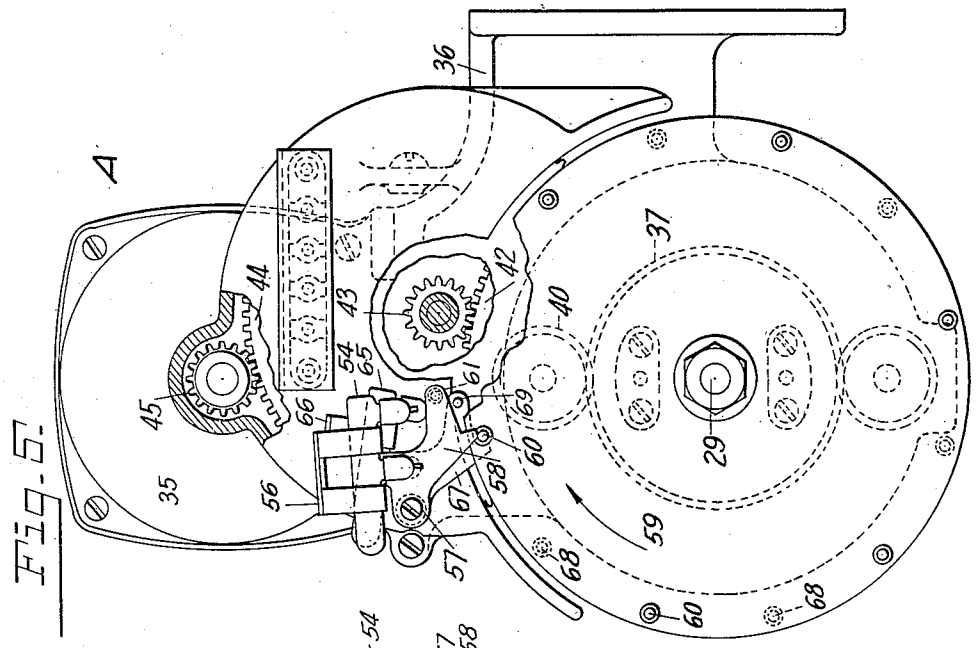

Fig. 5.

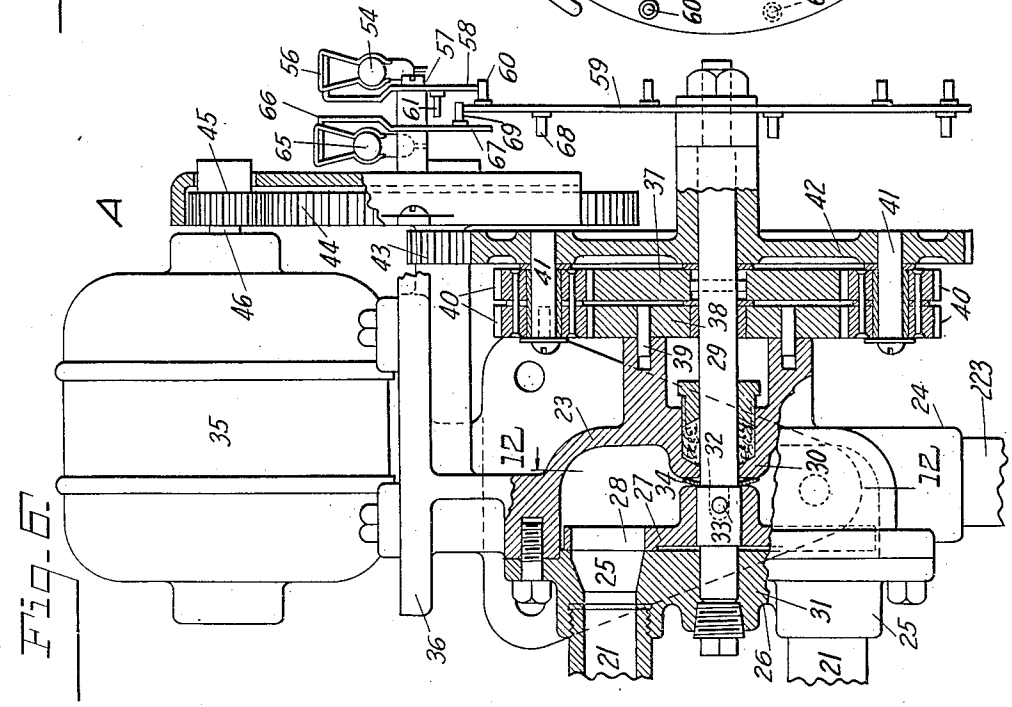

Fig. 6.

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SPRINKLING SYSTEM

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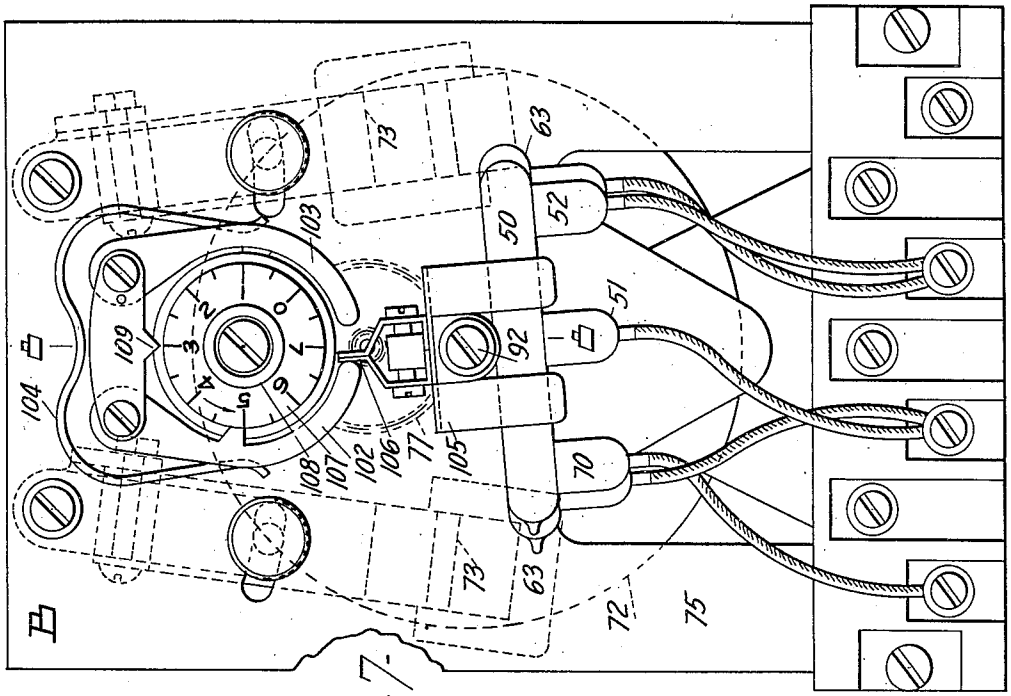

Fig. 7.

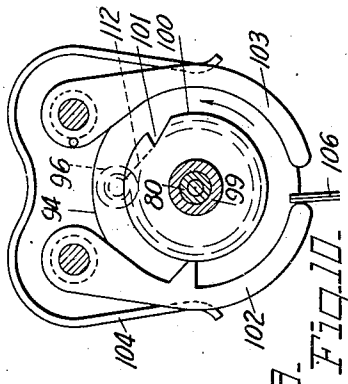

Fig. 10.

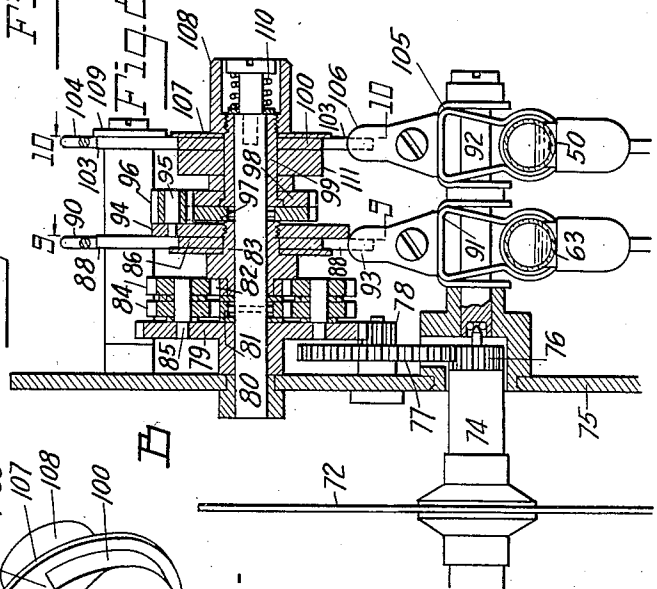

Fig. 8.

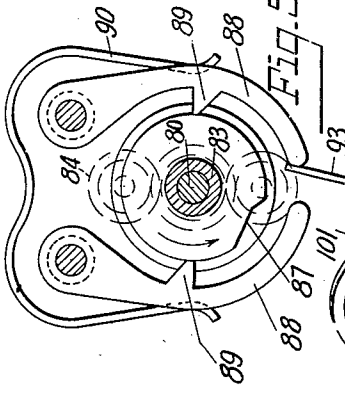

Fig. 9.

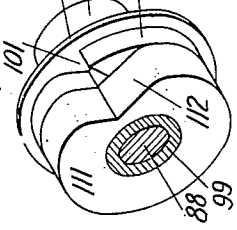

Fig. 11.

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SPRINKLING SYSTEM

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Fig. 14.

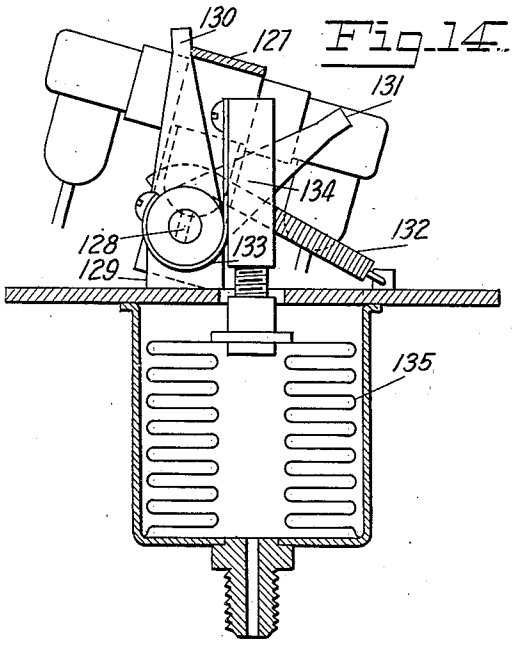
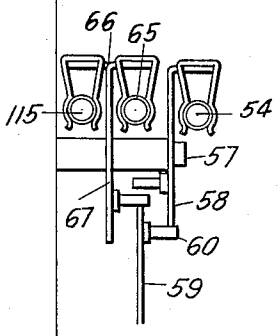


Fig. 15.



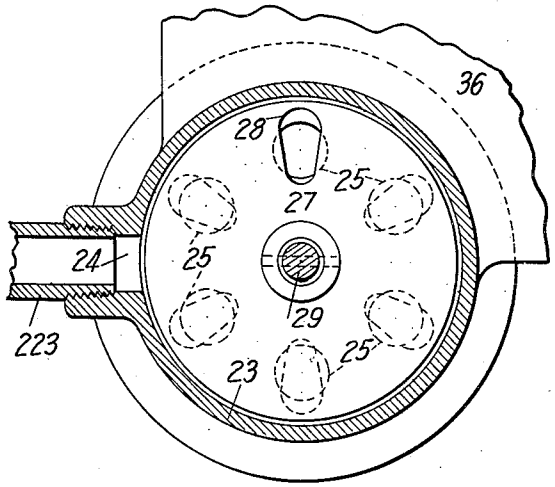


Fig. 12.

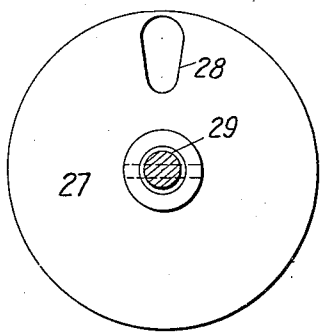


Fig. 13.

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Patented Nov. 6, 1934

1,979,477

UNITED STATES PATENT OFFICE

1,979,477

SPRINKLING SYSTEM

George H. Leland, Dayton, Ohio, assignor of one-half to The Leland Electric Company, Dayton, Ohio, a corporation of Ohio

Application May 23, 1932, Serial No. 612,949

29 Claims. (Cl. 137—139)

This invention relates primarily to a sprinkling system but may be applied to other liquid distributing systems where similar problems are encountered.

It is common practice to equip large lawns with permanently installed sprinkler heads which are connected by underground pipes with a source of water supply, the sprinkler heads being sufficient in number and so arranged as to sprinkle the entire lawn. Where an ample supply of water at a constant pressure is available all the sprinkler heads may be operated simultaneously, but in many cases, particularly in suburban districts, either the water supply or the pressure in the system is insufficient to operate all the sprinkler heads at the same time and it is necessary to connect them in groups and to operate the groups successively, and this greatly prolongs the time required to sprinkle the entire lawn. Ordinarily the connections between the several groups of sprinkler heads and the main supply pipe are controlled by hand valves and the attention of an operator is required over a long period of time to cause the several groups of sprinkler heads to operate in succession and to so time the operation of each group that all parts of the lawn will receive substantially the same amount of water.

One object of the present invention is to provide a sprinkling system of this type with automatic operating mechanism to successively connect the several groups of sprinkler heads with the source of water supply and to cause each group to operate for a predetermined period of time.

A further object of the invention is to provide such a sprinkling system with motor operated mechanism for successively connecting the several groups of sprinkler heads with the main supply pipe, and with means for stopping the motor when the system as a whole has been operated for a predetermined period of time or through a predetermined number of cycles.

A further object of the invention is to provide such a motor operated mechanism with means to insure the disconnection of all groups of sprinkler heads from the supply pipe when the motor is stopped at the end of the predetermined sprinkling period.

A further object of the invention is to provide such a sprinkling system which will be controlled by the pressure in the supply line to maintain a connection between the supply line and one group of sprinkler heads until the pressure falls below normal, to then close the valve and, when the pressure has been restored to normal, to connect the supply line with another group of sprinkler heads.

A further object of the invention is to provide such a sprinkling system with means for closing the valve and maintaining the same closed during a temporary drop in pressure in the supply line.

Other objects of the invention will appear as the apparatus is described in detail.

In the accompanying drawings Fig. 1 is a diagrammatic lay-out of a part of a sprinkler system embodying my invention; Fig. 2 is a circuit diagram for the preferred embodiment of the invention; Fig. 3 is a circuit diagram of a system having means for closing the valve during temporary low pressure; Fig. 4 is a circuit diagram for a system in which the sprinkling periods are controlled by the pressure in the supply line; Fig. 5 is a front elevation, partly broken away, of the distribution controlling mechanism; Fig. 6 is a side view of a mechanism shown in Fig. 5, partly in section and partly in elevation; Fig. 7 is a front elevation of the starting and timing mechanism; Fig. 8 is a section taken on the line 8—8 of Fig. 7; Fig. 9 is a section taken on the line 9—9 of Fig. 8; Fig. 10 is a section taken on the line 10—10 of Fig. 8; Fig. 11 is a detail view of the setting cam for the timing mechanism; Fig. 12 is a section taken on the line 12—12 of Fig. 6, through the valve ; Fig. 13 is a detail of the movable valve member; Fig. 14 is a sectional view, partly in elevation, of a pressure operated valve actuating device; and Fig. 15 is a detail view of a modified arrangement of the motor switches.

The system here illustrated comprises a distributing unit, indicated by the letter A in Figs. 1, 5 and 6, and a timing unit, indicated by the Letter B in Figs. 1, 7 and 8. The distributing unit comprises a valve which is connected with a supply pipe 20 and with a plurality of branch pipes 21, each of which is further divided and is connected with a plurality of distributing heads 22. Usually the distributing unit is mounted in a pit below the surface of the lawn and the controlling unit is located at a point more or less remote therefrom, as in the basement of a house. The valve may be of any suitable character which will successively connect the several branch pipes with the supply pipe. As here shown, it comprises a casing 23 having an inlet 24 which is connected with the supply pipe 20 and having a plurality of outlets 25 which are connected with the respective branch pipes 21. Preferably, the several outlets are formed in the front wall 26 of the casing, which is removable to permit ac-

cess to be had to the interior of the casing. Interposed between the inlet and the outlets is a rotatable valve member which is here shown as a disk 27 having a single port 28 arranged to be moved successively into register with the outlets 25, these outlets being arranged in annular series about the axis of the valve disk. The inner surface of the front wall 26 of the casing constitutes the valve seat against which the adjacent face of the valve disk bears. The valve disk is mounted on a shaft 29 which is journaled in bearings 30 and 31 in the casing. The pressure of the water on the rear side of the valve member or disk may be sufficient to hold the same tightly in engagement with its seat but I prefer to apply spring pressure to the valve member to insure its being held tightly on its seat. I have therefore loosely mounted the valve disk on the shaft 29 and have provided the hub of the disk with a short slot 32 into which projects a pin 33 carried by the shaft, so that the disk is caused to rotate with the shaft but may have a limited movement lengthwise thereof. A concave resilient disk 34 is interposed between the hub of the disk and the bearing 30 to press the disk toward its seat.

The valve may be driven from any suitable source of power but preferably it is driven by an electric motor which may be connected therewith in any suitable manner. As shown in the drawings, a motor 35 is mounted on a bracket-like frame 36 which supports the several parts of the distributing unit. It is, of course, necessary to greatly reduce the speed of the motor as applied to the rotary valve member and, in the present instance, I have employed a planetary speed reducing mechanism which comprises a gear 37 rigidly secured to the shaft 29 and a second gear 38 loosely mounted about the shaft 29 and held against rotation, as by means of pins 39 extending through the gear and into a fixed part of the structure. These gears are of the same diameter but have a different number of teeth. Preferably the gear 37, which is secured to the shaft, has one tooth more than the gear 38. Meshing with the gears 37 and 38 are two pair of pinions 40, the pinions of each pair being rigidly connected one to the other and mounted on a stud 41 carried by a gear 42 which is rotatably mounted on the shaft 29 and is of a diameter substantially greater than the diameter of the gears 37 and 38. This gear 42 meshes with a pinion 43 with which is rigidly connected a gear 44 which meshes with a pinion 45 on the shaft 46 of the motor 35. It will be apparent, therefore, that the gear 42 is driven at a much reduced speed and that the gear 37 will be advanced a distance of one tooth only for each complete rotation of the gear 42.

The motor 35 is directly connected with one side, or conductor, 47 of the power line and is connected with the other side 48 of the power line through certain controlling devices. In the present construction these connections are such as to constitute an operating circuit. As shown in Fig. 2 the line 48 is connected by a conductor 49 with a cut-off switch 50 which is here shown as a three-contact mercury tube switch, the central contact 51 being connected with the conductor 49 and one end contact, 52, being connected by a conductor 53 with a controlling switch 54, which is shown as a two-contact mercury tube switch, this switch being connected by a conductor 55 with the motor. These several conductors and switches constitute the operating circuit for the motor, that is, the circuit which causes the operation of the motor to advance the valve from one position to another. The switch 54 is so controlled that it will be opened when the valve is moved to an open position, that is, to a position which will connect the supply pipe 20 with one of the several branch pipes. The switch will be retained in this open position until further movement has been imparted to the valve, after a predetermined period of time constituting a sprinkling period, and will then be closed to complete the circuit through the motor and cause the valve to be advanced to another open position. It will be noted that the cut-off switch 50 is normally closed and that the switch 54 controls the operating circuit. As shown in Figs. 5 and 6 the switch 54 is supported by a bracket 56 on a stud 57 carried by the frame which supports the distributing unit. This supporting bracket has a depending part 58 which constitutes a trip arm and is adapted to be actuated by a controlling device which is here shown as a disk 59 rigidly secured to the valve shaft 29, and therefore driven by the motor, and having a series of studs 60 projecting from one face thereof, corresponding in number to the number of outlets in the valve and spaced equal distances apart. The arrangement of the studs is such that when the port 28 of the movable valve member is moved into register with one of the outlets 25 the corresponding stud 60 of the controlling device will engage the trip arm 58 and tilt the valve 54 to its open position, thus stopping the motor with the valve in sprinkling position. Inasmuch as the motor and valve stop as soon as the switch is opened it will be apparent that the controlling device will remain in engagement with the trip arm and hold the valve open until the controlling device is again actuated to release the switch and permit the same to close. It will be noted that the switch supporting bracket is pivoted near one end thereof so that the switch moves by gravity to its closed position, this movement being limited by a pin 61 in the bracket which engages the periphery of the disk 59.

A suitable timing device is provided for causing the controlling device to be advanced after a predetermined sprinkling period and thus cause the motor to move the valve to connect the next succeeding outlet with the supply pipe. In the present instance, the timing device also constitutes a starting device and imparts initial movement to the motor sufficient to actuate the controlling device far enough to cause the controlling switch 54 to be closed. For this purpose the motor 35 is provided with a starting and timing circuit which comprises a conductor 62 connected with the line 48 and with one contact of a two-contact mercury tube switch 63, the other contact of which is connected by a conductor 64, switch 65 and conductor 166 with the motor, the conductor 166 being shown as connected with the operating circuit between the motor and the controlling switch 54. The switch 65 is normally closed and has no part in the starting of the motor. The starting and timing switch 63 has its contacts arranged near the respective ends of the tube so that the circuit will be opened through that switch when the latter is tilted in either direction and will be closed only when the tube is in a substantially horizontal position. The switch is preferably operated from a suitable motor, such as an induction motor 167, which operates continuously and oscillates the switch

from one position to another. The driving mechanism, which will be hereinafter described, operates very slowly and as it moves the switch across its horizontal position the contacts will be connected for a brief interval which, however, will be sufficient to cause the motor 35 to actuate the shaft 29 and move the controlling device 59 out of engagement with the trip arm for the controlling switch, thereby closing the operating circuit and causing the motor to continue in operation until another stud 60 of the controlling device has engaged the trip arm and opened the controlling switch. The speed at which the starting and timing switch 63 is operated may be varied to provide any desired interval between the closings of that switch. For example, it may be driven at such a speed that it will make one complete oscillation in ten minutes, thus providing a five minute interval between each successive closing thereof, and causing each branch pipe to remain in communication with the main supply for a five minute period.

The mechanism will continue to operate until the circuit through the motor has been permanently interrupted. This, of course, may be done manually but in the present construction the cut-off switch 50 is time operated, being preferably operated from the motor that operates the starting and timing switch. This motor may be set to cause the cut-off switch to open after a predetermined period of time, say four hours, or after a predetermined number of cycles or revolutions of the valve member. When the cut-off switch is tilted from the position shown in Fig. 2 it will break the circuit between the conductors 49 and 53 and thus open the operating circuit and stop the motor. It is important, however, that when the motor is permanently stopped the valve should be in its closed or neutral position, that is, the port 28 of the movable valve member should be located between two of the outlets, and it is for this purpose that the switch 65 has been interposed in the starting and timing circuit. This switch 65 is controlled in accordance with the movements of the valve member 27 so that it will be open when the port 28 of the valve member is in a neutral position and will be closed when that port is moved into line with one of the outlets. The switches 65 and 54 cannot both be opened at the same time. In the present construction the switch 65 is carried by a bracket 66 mounted on the stud 57, alongside the switch 54, and provided with a trip arm 67 arranged in the path of a series of studs 68 carried by the disk 59 of the controlling device and projecting from that face of the disk opposite the studs 60. The studs 68 are also equal in number to the outlets and are so arranged that they will engage the trip arm 67 and open the switch 65 when the valve is in a neutral position. When the stud 68 moves out of engagement with the trip arm 67 the switch 65 will move by gravity to its closed position, this movement being limited by a pin 69 carried by the arm 67 and adapted to engage the periphery of the disk 59. The second end contact 70 of the cut-off switch 50 is connected by a conductor 71 with the starting and timing circuit between the starting and timing switch 63 and the switch 65. As has been stated, the switch 65 is closed when the switch 54 is opened. Consequently if the cut-off switch is actuated to open the operating circuit while the valve is in sprinkling position it will at the same time close the lower part of the starting circuit, through the switches 50 and 65, thereby causing the motor to continue to operate until the valve is moved to a neutral position and the switch 65 is opened, the opening of the switch 65 permanently stopping the motor. It will be noted that the timing motor is connected in a circuit 67*a* leading from the motor operating circuit, beyond the cut-off switch 50, to the line 47. Therefore, when the cut-off switch is opened as above described the circuit will be broken through the timing motor. When the operation of the mechanism is to be again initiated the cut-off switch is moved to its closed position and the controlling switch 54 having been closed prior to the opening of the switch 65, the closing of the cut-off switch 50 will complete the circuit through the motor and set the mechanism in operation. It will be apparent that the switch 65 will be opened and closed during each movement of the valve member from one position to another, but as long as the cut-off switch is in a position to close the operating circuit this movement of the switch 65 is an idle movement and has no affect on the operation of the mechanism.

As has been stated, the timing mechanism may be of any suitable character but, in the present instance, I have employed an induction motor of the disk type, this motor comprising the usual disk 72 and magnets 73. The shaft 74 which carries the disk 72 is rotatably mounted in a suitable frame, a portion of which is shown at 74, and one end of the shaft carries a pinion 76 which meshes with a gear 77 having rigidly secured thereto a pinion 78 which in turn meshes with a gear 79 rotatably mounted on a stationary shaft 80. Rigidly secured to the shaft 80 is a pinion 81 and rotatably mounted on the shaft 80 is a second pinion 82 which is rigidly secured to the end of a sleeve 83 rotatably mounted on the shaft. The pinions 81 and 82 are of the same diameter and have different numbers of teeth, the pinion 82 preferably having one more tooth than the pinion 81. Meshing with the respective pinions are two pairs of planetary pinions 84, the pinions of each pair being rigidly connected one to the other and carried by a stud 85 mounted in the gear 79, thus causing the motor to drive the sleeve 83 at a very low rate of speed. Rigidly secured to the sleeve 83 is a cam 86 which, in the present instance, has a single notch 87 in the peripheral surface thereof. Pivotally mounted above the cam and extending about the same are two curved actuating arms 88 each of which has a nose or projection 89 adapted to enter the recess 87 in the cam once during each rotation thereof. A spring 90 acts on the arms 88 to hold the same in contact with the cam and to actuate the same when one of the projections 89 enters the recess 87. The lower ends of the arms 88 are spaced a short distance apart. The starting and timing switch 63 is carried by a bracket 91 pivotally mounted on a stud 92 arranged beneath the shaft 80 and this bracket has a trip arm 93 which extends upwardly between the ends of the actuating arms 88. Consequently when the nose of one of the arms 88 enters the recess in the cam that arm will actuate the switch and move the trip arm into a position to be actuated by the other arm 88 when the cam has completed another half rotation. The recess in the cam is so shaped that the switch will move slowly across its horizontal position.

Rigidly mounted on the sleeve 83, adjacent to the cam 86, is a disk 94 which carries near its outer edge a stud 95 on which is mounted a pinion 96. This pinion meshes with two gears 97 and 98, the gear 97 being rigidly secured to the shaft

80 and the gear 98 being secured to a sleeve 99 which is rotatably and slidably mounted on the shaft 80. The gear 98 has one more tooth than the gear 97. Consequently, the sleeve 99 may be rotated at a much lower rate of speed than is the cam 86. Rigidly secured to the sleeve 99 is a cam 100 having a recess 101 which controls the operation of a single actuating arm 102 similar to the actuating arms 88. A second arm 103 is shown but this arm is fixed against movement and, in the present instance, merely forms a support for one end of the spring 104 which actuates the arm 102. The cut-off switch 50 is supported on the stud 92 by a bracket 105 having a trip arm 106 arranged in the path of the arm 102. Consequently when the recess 101 of the cam 100 is moved into line with the nose of the actuating arm 102 the cut-off switch will be actuated to open the operating circuit. The sleeve 99 is provided with a dial 107 and with an actuating knob 108 by means of which the sleeve may be moved axially to draw the gear 98 out of mesh with the pinion 96, and thereby permit the sleeve and dial to be rotated until a given designation on the dial registers with the fixed pointer 109. The sleeve is then released and is returned by a spring 110 to its operative position. The cam and the dial being rigidly secured to the sleeve 99 the setting of the dial will space the notch 101 in the cam a fixed distance from the nose on the actuating arm, this distance being indicated by the marking on the dial, which marking may represent hours, the number of cycles of operation or the like. Consequently the continued operation of the induction motor will slowly return the cam and dial to their normal positions and when they reach those positions the actuating arm 102 will operate to open the cut-out switch. Attached to the inner side of the cam 100, and formed integral therewith if desired, is an extension cam 111 of a diameter corresponding to the diameter of the cam 100 but having a notch 112 the wall of which slopes gradually in a reverse direction, that is, slopes past the abrupt face in the cam 100. When the sleeve 99 has been moved outwardly to withdraw the gear 98 from the pinion 96 the nose of the actuating arm will engage the extension cam 111 and because of the sloping wall of the recess 112 the cam may then be easily rotated to force the arm 102 outwardly and when the dial has been set, and the sleeve is to be returned to its normal position, the nose of the arm will rest upon the surface of the cam extension which is flush with the adjacent surface of the cam 100, thus permitting that cam to move into engagement with the nose on the actuating arm.

In some instances a sprinkling system of this type operates under conditions where the water supply and pressure are ample so long as the whole supply is available to the sprinkler system but if some other outlet from the source of supply is opened during the operation of the sprinkler system the pressure will drop to such an extent that the sprinklers will not operate properly. Where sprinkler heads of the pop-up type are employed a certain definite pressure is required to move the same to operative position. I have therefore provided means for discontinuing the operation of the sprinkler system when the water pressure drops below a predetermined point and holding the same inoperative until the pressure has been restored to normal. For this purpose I employ a supplemental pressure operated switch. The arrangement shown in Fig. 3 is identical with that shown in Fig. 2, with the exception that I have added two switches, one a pressure operated switch 114 and the other a switch 115 which is controlled in accordance with the movements of the valve. The switch 114 is connected in the operating circuit between the controlling valve 54 and the motor 35 and is so controlled by the pressure in the supply line that when that pressure is normal the switch 114 will be closed but when the pressure drops below a predetermined point that switch will open and thus break the circuit through the motor. The switch 115 is connected between the conductor 55 of the operating circuit and the conductor 66 of the timing circuit and comprises a mercury tube switch which, in the present instance, is mounted on the same supporting bracket 66 that carries the switch 65, as shown in Fig. 15, the arrangement being such that the switch 115, as well as the switch 65 will be normally closed but will be opened when the valve is moved to a neutral position. In the normal operation of this arrangement current will flow from the switch 54 through either or both of the switches 114 and 115 to the motor. If the pressure drops below a predetermined point during a sprinkling period, that is, while the switch 54 is open, the switch 114 will be opened but this will have no immediate effect upon the system as the sprinkling will continue until the timing switch 63 closes the starting circuit through the switch 65 to the motor, thus actuating the controlling device to cause the switch 54 to be closed. The timing switch will immediately open but the switch 54 having been closed current will flow from that switch through the switch 115, which is at that time closed, to the motor and the motor will continue to operate until the valve is moved to a neutral or closed position, at which time both the switch 115 and the switch 65 will be opened and the motor stopped, thereby terminating the operation of the system until the pressure is restored to normal. It will be noted that when the motor was finally stopped the switch 54 was closed. Consequently when the pressure is restored to normal and the switch 114 moved to its closed position the mechanism will resume its normal cycle of operations. It will be apparent that the sprinkling may continue for some little time after the drop in pressure but the pressure valve is so set that it will open before the pressure has dropped to such a point as to render the system completely inoperative.

There are other conditions of operation in which a water supply and pressure sufficient to operate the system cannot be maintained for any considerable period of time. For example, the system may be connected with a tank in which the water is stored under air pressure and the capacity of the pump which delivers the water to the tank may be less than the requirements of the system. When the tank is pumped up to capacity pressure it will operate the system for a period of time, say from five to ten minutes, before the pressure will drop to a point where the system will not properly operate. To take care of such a situation I have provided another embodiment of the invention which is of such a character that the operation of the sprinkling mechanism will be interrupted at intervals to permit the pressure in the line to be restored to normal. This may be accomplished by inserting in the operating circuit and in the starting circuit a switching device which is so controlled as to maintain the operation of the sprinkling mechanism while there is sufficient pressure in the line and to

then interrupt the sprinkling operation until the pressure is again built up. Such a switching device may be actuated by any suitable means at any suitable intervals but I prefer to actuate the switching device by pressure controlled mechanism and thus cause the intervals to be directly controlled by the pressure in the line. Such a system is shown in Fig. 4, where the operating circuit for the valve actuating motor 116 consists of a conductor 117 leading from the motor to a controlling switch 118, a conductor 119 leading from switch 118 to a cut-off switch 120, a conductor 121 leading from the cut-off switch to a pressure operated switch 122 and a conductor 123 leading from the pressure operated switch to the power line. The starting circuit comprises a conductor 124 leading from the pressure operated switch to a switch 125 and a conductor 126 leading from the switch 125 to the motor. The controlling switch 118 is similar to the switch 54 above described and is controlled in the same manner, that is, it is moved to its open position when the valve is in sprinkling position. The cut-off switch 120 is normally closed and may be moved to its open position either by timing mechanism such as above described, or manually. The switch 125 in the starting circuit is similar to the switch 65 and is controlled in the same manner, that is, it is normally closed but is opened when the valve is in its closed or neutral position. The pressure operated switch 122 is controlled according to the pressure in the supply line and is operated by mechanism which will move it to a position to close the operating circuit when the pressure rises to a predetermined point, say for example, fifty pounds, and will move it to a position to open the operating circuit and close the starting circuit when the pressure drops to a predetermined point, say thirty pounds. With the switches in the position shown in Fig. 4 the controlling switch 118 is open and therefore the valve is in sprinkling position. The sprinkling operation will continue until the pressure falls to the lower level at which time the switch 122 will be tilted to open the operating circuit, independently of switch 118, and to close the starting circuit, through the switch 125. The switch 125 being closed at the time the switch 122 is shifted current will flow through the motor and the latter will operate until the valve is moved to its closed position at which time the switch 125 will open and the motor will stop. This operation of the motor will cause the controlling switch 118 to be closed but inasmuch as the operating circuit is broken at the pressure switch the motor will remain idle until the pressure has again reached the higher level and the pressure switch is again tilted to open the starting circuit and close the operating circuit. Thus the length of each sprinkling period is determined by the pressure in the line and following each interruption of the sprinkling, due to a fall in pressure, the valve is actuated to connect another branch pipe with the supply pipe so that when pressure again rises another group of sprinkler heads will operate.

The pressure valves of the system shown in Figs. 3 and 4 may be operated in any suitable manner but in Fig. 14 I have shown one type of mechanism which may be utilized to operate either of these valves. As there shown, the switch 122 is mounted in a bracket 127 which is pivotally mounted on a shaft 128. The shaft is rotatably mounted in suitable bearings 129 and has rigidly secured thereto two arms 130 and 131 which are spaced one from the other and arranged on opposite sides of the cross bar of the bracket. A spring 132 connected with the shaft tends to rotate the same in a direction to cause the arm 130 to engage the bracket and move the switch in one direction, in the present instance to a position to close the starting circuit. The shaft is also connected by a flexible strap 133 with a plunger 134 which is connected with a sylphon 135, the sylphon being in communication with the supply line. Consequently as pressure rises in the system the sylphon will operate to cause the arm 131 to engage the bracket and tilt the switch to a position to open the operating circuit and close the starting circuit, when applied to the system shown in Fig. 4. The tube supporting bracket is so mounted that it will be held by gravity in either position to which it has been moved. Consequently as the pressure drops the switch will remain stationary until the arm 130 again engages the bracket and moves the same in the other direction.

Whlie I have shown and described certain embodiments of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, and power operated means for actuating said valve, mechanism to control the operation of said valve comprising two separately operable devices, means for operating one of said devices in timed relation to said valve to cause the operation of said valve by said actuating means to be interrupted when said valve is in a position to connect one of said branch pipes with said supply pipe, and means operating independently of said valve to actuate the other of said devices to cause the first mentioned device to be moved to a position to cause said actuating means to moved said valve to a position to connect another branch pipe with said supply pipe.

2. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, and power operated means for actuating said valve, mechanism to control the operation of said valve comprising two separately operable devices, means operated by said actuating means in timed relation to said valve to cause one of said devices to interrupt the operation of said valve by said actuating means when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, and means for actuating the other of said devices to cause said actuating means to operate independently of the first mentioned device for an interval sufficient to move the first mentioned device to a position to cause the continued operation of said actuating means.

3. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, a motor to operate said valve, a controlling device driven by said motor and having means to interrupt the operation of said valve by said motor when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, and means to cause said motor to move said controlling device to a

position to cause said valve to be again actuated by said motor.

4. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, a motor to operate said valve, a controlling device connected with said valve and having means for interrupting the operation of said motor when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, and means to cause said motor to operate for a brief interval only and to move said controlling device to a position to cause the continued operation of said motor.

5. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, a motor to operate said valve, a controlling device driven by said motor and having means to interrupt the operation of said valve by said motor when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, means to cause said motor to move said controlling device to a position to cause said valve to be again actuated by said motor, and time controlled means to interrupt the operation of said motor after a predetermined period of time.

6. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, a motor to operate said valve, a controlling device driven by said motor and having means to interrupt the operation of said valve by said motor when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, means to cause said motor to move said controlling device to a position to cause said valve to be again actuated by said motor, time controlled means to interrupt the operation of said motor after a predetermined period of time, and means controlled by said controlling device to prevent the operation of said motor from being interrupted until said valve is in a position to disconnect all of said branch pipes from said supply pipe.

7. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, a controlling switch connected in circuit with said motor, a controlling device driven by said motor and having means to open said controlling switch when said valve is moved to a position to connect one of said branch pipes to said supply pipe, a normally open starting switch connected in circuit with said motor independently of said controlling switch, and automatically operated means to close said starting switch while said controlling switch is open and thereby cause said controlling device to be actuated to cause said controlling switch to be closed, and to then open said starting switch.

8. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, a controlling switch connected in circuit with said motor, a controlling device driven by said motor and having means to open said controlling switch when said valve is moved to a position to connect one of said branch pipes to said supply pipe, a normally open starting switch connected in circuit with said motor independently of said controlling switch, automatically operating means to close said starting switch while said controlling switch is open and thereby cause said controlling device to be actuated to cause said controlling switch to be closed, and to then open said starting switch, a normally closed switch connected in circuit with said motor, time controlled means for breaking the circuit for said controlling switch and closing the circuit for said normally closed switch, and means for opening said normally closed switch when said valve is in position to disconnect all of said branch pipes from said supply pipe.

9. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipe successively with said supply pipe, an electric motor for operating said valve, a controlling switch connected in circuit with said motor, a controlling device driven by said motor and having means to open said controlling switch when said valve is moved to a position to connect one of said branch pipes to said supply pipe, a normally open starting switch connected in circuit with said motor independently of said controlling switch, automatically operating means to close said starting switch while said controlling switch is open and thereby cause said controlling device to be actuated to cause said controlling switch to be closed and to then open said starting switch, a normally closed switch connected in circuit with said motor, time controlled means for breaking the circuit for said controlling switch and closing the circuit for said normally closed switch, and means controlled by said controlling device for opening said normally closed switch when said valve is closed.

10. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, a switch to control the operation of said motor, a controlling device for said switch actuated by said motor and so arranged that when said valve is in a position to connect one of said branch pipes with said supply pipe said switch will be open, a second switch connected with said motor independently of the first mentioned switch, and means for closing said second switch at intervals to actuate said motor and said controlling device to cause the first mentioned switch to be closed and to then open said second switch.

11. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, an operating circuit for said motor, a starting circuit for said motor, and means operated in timed relation to said valve to open said operating circuit when said valve is in a position to connect one of said branch pipes with said supply pipe, and means operated at predetermined intervals to close said starting circuit, to close said operating circuit and to then open said starting circuit.

12. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, an operating circuit for said motor, a starting circuit for said motor, controlling means operated by said motor to open said operating circuit when said valve is in a position to connect one of said branch pipes with said supply pipe, a timing motor, and means operated by said timing motor to close said starting circuit

after said operating circuit has been opened, and to cause said motor to actuate said controlling means to cause said operating circuit to be closed and to then open said starting circuit.

13. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, an operating circuit for said motor, a starting circuit for said motor, controlling means operated by said motor to open said operating circuit when said valve is in a position to connect one of said branch pipes with said supply pipe, a timing motor, means operated by said timing motor to close said starting circuit after said operating circuit has been opened, and to cause said motor to actuate said controlling means to cause said operating circuit to be closed and to then open said starting circuit, a third circuit for the first mentioned motor, means controlled by said timing motor to open said operating circuit and close said third circuit, and means controlled by said first mentioned motor to open said third circuit when said valve is in a position to disconnect all of said branch pipes from said supply pipe.

14. In a mechanism of the character described, a valve casing having an inlet and a plurality of outlets, a rotatable valve member interposed between said inlet and said outlets and having a port to connect said inlet successively with said outlets, an electric motor to rotate said valve member, an operating circuit for said motor, a switch in said operating circuit, a starting circuit for said motor, two switches connected in series in said starting circuit, a controlling device operated by said motor in timed relation to said valve member and having means to open the switch in said operating circuit and to hold the same open when the port in said valve member registers with one of said outlets, and also having means to open one of the switches in said starting circuit when said port in said valve member is in a neutral position, mechanism for closing the second switch in said starting circuit while the switch in said operating circuit is open and thereby actuate said controlling device to cause said switch in said operating circuit to be closed, time controlled switch mechanism for opening said operating circuit independently of the first mentioned switch therein and for closing said starting circuit through the first mentioned switch therein and independently of the second switch in said starting circuit.

15. In a mechanism of the character described, a valve casing having an inlet and a plurality of outlets, a rotatable valve member interposed between said inlet and said outlets and having a port to connect said inlet successively with said outlets, an electric motor to rotate said valve member, an operating circuit for said motor, a switch in said operating circuit, a starting circuit for said motor, a starting switch in said starting circuit, a controlling device operated by said motor in timed relation to said valve member and having means to open the switch in said operating circuit and hold the same open when the port in said valve member registers with one of said outlets, and a motor for closing said starting switch while the switch in said operating circuit is open and thereby actuating said controlling device to cause said switch in said operating circuit to be closed.

16. In a mechanism of the character described, a valve casing having an inlet and a plurality of outlets, a rotatable valve member interposed between said inlet and said outlets and having a port to connect said inlet successively with said outlets, an electric motor to rotate said valve member, a tiltable switch connected in circuit with said motor and having a trip arm to tilt the same, a switch controlling device rotatable by said motor in timed relation to said valve member and having parts to engage said trip arm and tilt said switch to its open position, said parts being arranged to engage said trip arm whenever the port in said valve member registers with one of said outlets, a starting switch connected in circuit with said motor independently of said tiltable switch, a timing motor to close said starting switch, and a normally open tiltable switch in circuit with said starting switch and having a trip arm, said switch controlling device having parts arranged to engage the trip arm of the last mentioned tiltable switch and close the same when the port in said valve member is in a neutral position.

17. In a mechanism of the character described, a valve casing having an inlet, and a plurality of outlets, a rotatable valve member mounted in said casing between said inlet and said outlets and having a port arranged to register successively with said outlets, an electric motor operatively connected with said valve member, an operating circuit for said motor, a starting circuit for said motor, normally closed switches in the respective circuits, a controlling device connected with said valve member and having means to open the switch in said operating circuit when the port in said valve member registers with one of said outlets and to open the switch in said starting circuit when said port is in a neutral position, a second switch in series with the first mentioned switch in said starting circuit, a two-way switch connected with said operating circuit and with the first mentioned switch in said starting circuit and supported normally in a position to close said operating circuit, a timing motor, means controlled by said timing motor to close said second switch in said starting circuit after the first mentioned switch in said operating circuit has been opened, thereby actuating said controlling device to cause the switch in said operating circuit to be closed, and means controlled by said timing motor to cause said two-way switch to open said operating circuit and close said starting circuit through the first mentioned switch therein, whereby said valve operating motor will continue to operate until said valve has been moved to a neutral position.

18. In a sprinkling system or the like, a supply pipe a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipes, pressure controlled means to move said valve to a position to connect one of said branch pipes with said supply pipe and to maintain said connection during normal pressure in said supply pipe, to close said valve when the pressure in said supply pipe falls to a predetermined point and to move said valve to a position to connect another branch pipe with a supply pipe when the pressure in said supply pipe is restored to normal.

19. In a sprinkling system or the like, a supply pipe a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipes, a motor to operate said valve, a controlling device to stop said motor when said valve has been moved to a position to connect one of said branch pipes with said sup-

ply pipe, and pressure operated means to cause said motor to close said valve when the pressure in said supply pipe drops to a predetermined point and to cause said motor to move said valve to a position to connect another branch pipe with said supply pipe when the pressure in said supply pipe is restored to normal.

20. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipes, an electric motor to operate said valve, an operating circuit and a starting circuit for said motor, a switch in said operating circuit, means operated by said motor in timed relation to said valve to open said switch when said valve is in a position to connect one of said branch pipes with said supply pipe and to cause said switch to be closed when said valve moves beyond said position, pressure operated mechanism to open said operating circuit and close said starting circuit when the pressure in said supply pipe falls below a predetermined point and thereby cause the switch in said operating circuit to be closed, and to open said starting circuit and close said operating circuit when said pressure is restored to normal.

21. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, a motor to operate said valve, a controlling device to stop said motor when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, pressure operated means to cause said motor to close said valve when the pressure in said supply pipe drops to a predetermined point and to cause said motor to move said valve to a position to connect another branch pipe with said supply pipe when the pressure in said supply pipe is restored to normal, a switch in said operating circuit to open that circuit independently of the first mentioned switch and said pressure operated means, a normally closed switch in said starting circuit, and means to open the last mentioned switch when said valve is moved to a closed position.

22. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipes, an electric motor to operate said valve, an operating circuit and a starting circuit for said motor, a switch in said operating circuit, means operated by said motor in timed relation to said valve to open said switch when said valve is in a position to connect one of said branch pipes with said supply pipe and to cause said switch to be closed when said valve moves beyond said position, switch means connected with said operating circuit and said starting circuit independently of the first mentioned switch, and means to operate said switch means at intervals to open said operating circuit and close said starting circuit and to then open said starting circuit and close said operating circuit.

23. In a mechanism of the character described, a valve casing having an inlet and a plurality of outlets, a valve member to connect said inlet successively with said outlets, and an electric motor to actuate said valve member, an operating circuit for said motor, a switch in said operating circuit, a starting circuit for said motor, a switch in said starting circuit, a controlling device operated by the motor in timed relation to said valve member and having means to open the switch in said operating circuit and hold the same open when said valve member is in a position to connect said inlet with one of said outlets and to open the switch in said starting circuit when said valve member is in a neutral position, switch means connected in said operating circuit and said starting circuit independently of the first mentioned switches, and means to actuate said switch means at intervals to cause said operating circuit to be opened and said starting circuit to be closed at said switch means and to then open said starting circuit and close said operating circuit at said switch means.

24. In a sprinkling system, or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, an operating circuit for said motor, a starting circuit for said motor, means operated in timed relation to said valve to open said operating circuit when said valve is in a position to connect one of said branch pipes with said supply pipe, means operated at predetermined intervals to close said starting circuit, to close said operating circuit and to then open said starting circuit, and a pressure operated switch in said operating circuit to open the same when the pressure in said supply pipe falls below a predetermined point.

25. In a sprinkling system or the like, a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, an electric motor for operating said valve, an operating circuit for said motor, a starting circuit for said motor, means operated in timed relation to said valve to open said operating circuit when said valve is in a position to connect one of said branch pipes with said supply pipe, means operated at predetermined intervals to close said starting circuit, to close said operating circuit and to then open said starting circuit, a pressure operated switch in said operating circuit to open the same when the pressure in said supply pipe falls below a predetermined point, a switch connecting said operating circuit with said starting circuit to maintain said motor in operation after said pressure operated switch has been opened, and means for opening the last mentioned switch when said valve is moved to its closed position.

26. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, and power operated means for actuating said valve, mechanism to automatically control the operation of said valve, comprising means to interrupt the movement of said valve by said actuating means when said valve has been moved to a position to connect one of said branch pipes with said supply pipe, and a second power operated device operating at the end of a predetermined interval after the movement of said valve has been interrupted to cause said actuating device to again actuate said valve and move the same to a position to connect another of said branch pipes with said supply pipe.

27. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, and a motor to operate said valve, controlling mechanism comprising a device to cause said valve to be operated by said motor and to interrupt the

movement of said valve when the latter is in a position to connect one of said branch pipes with said supply pipe, and a power operated device operating independently of the first mentioned device and at predetermined intervals to cause said first mentioned device to be moved to a position which will cause said valve to be again operated by said motor.

28. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes and a multi-port valve to connect said branch pipes successively with said supply pipe, means to cause said valve to be moved to a position to connect one of said branch pipes with said supply pipe and to retain the same in said position, other means to cause said valve to be moved from said position in a direction to interrupt said connection, and means controlled by said movement of said valve to cause the first mentioned means to then operate to cause said valve to be moved to a position to connect the succeeding branch pipe with said supply pipe.

29. In a sprinkling system or the like comprising a supply pipe, a plurality of branch pipes, a multi-port valve to connect said branch pipes successively with said supply pipe, and power operated means for actuating said valve, controlling mechanism comprising a device connected with said valve for movement in unison therewith and arranged to interrupt the operation of said valve by said actuating means when said valve has been moved to a position to connect one of said branch pipes with said supply pipe and to cause said actuating means to again actuate said valve after initial movement has been imparted to said valve, and means operating independently of the first mentioned device for causing said actuating means to impart initial movement to said valve and to said first mentioned device.

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