Oct. 30, 1934. F. REINECKE ET AL 1,978,435

ELECTRICALLY CONTROLLED IRRIGATING APPARATUS

Filed April 2, 1928 2 Sheets-Sheet 1

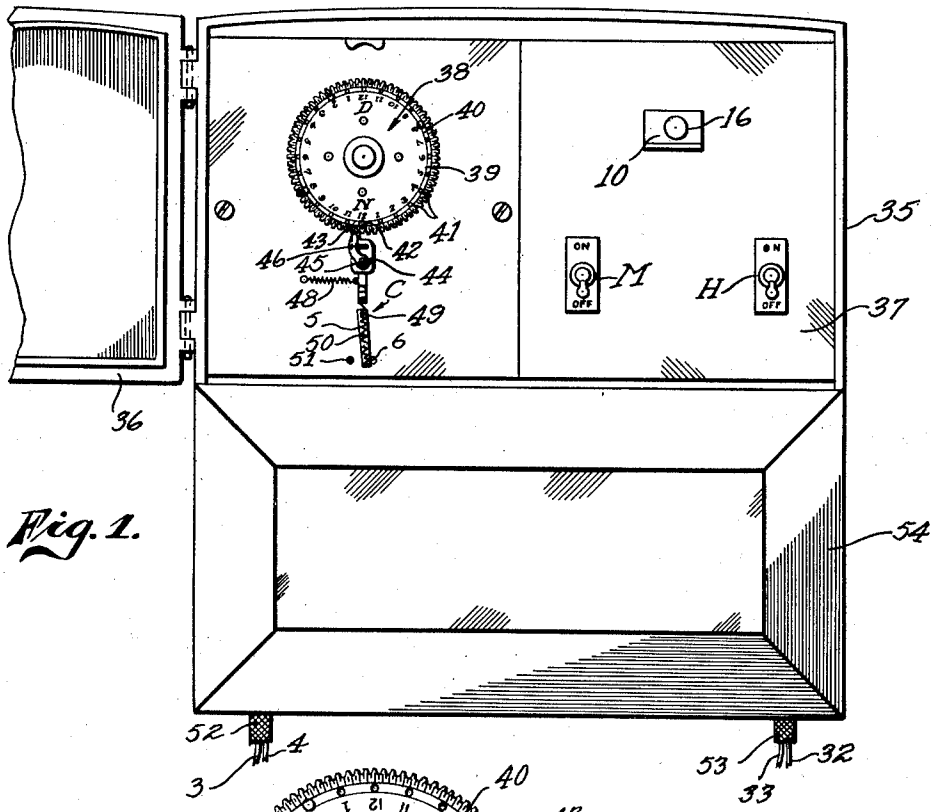


Fig. 1.

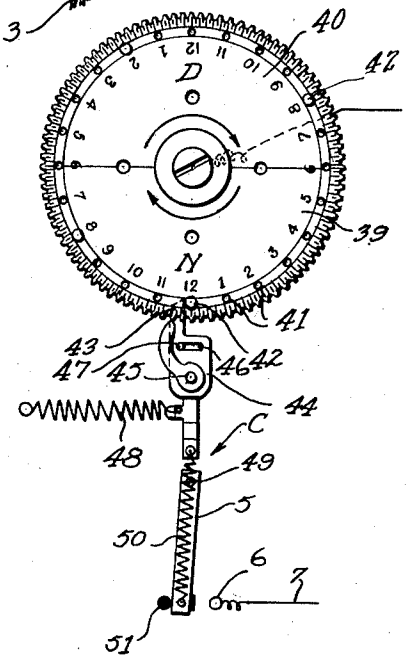


Fig. 2.

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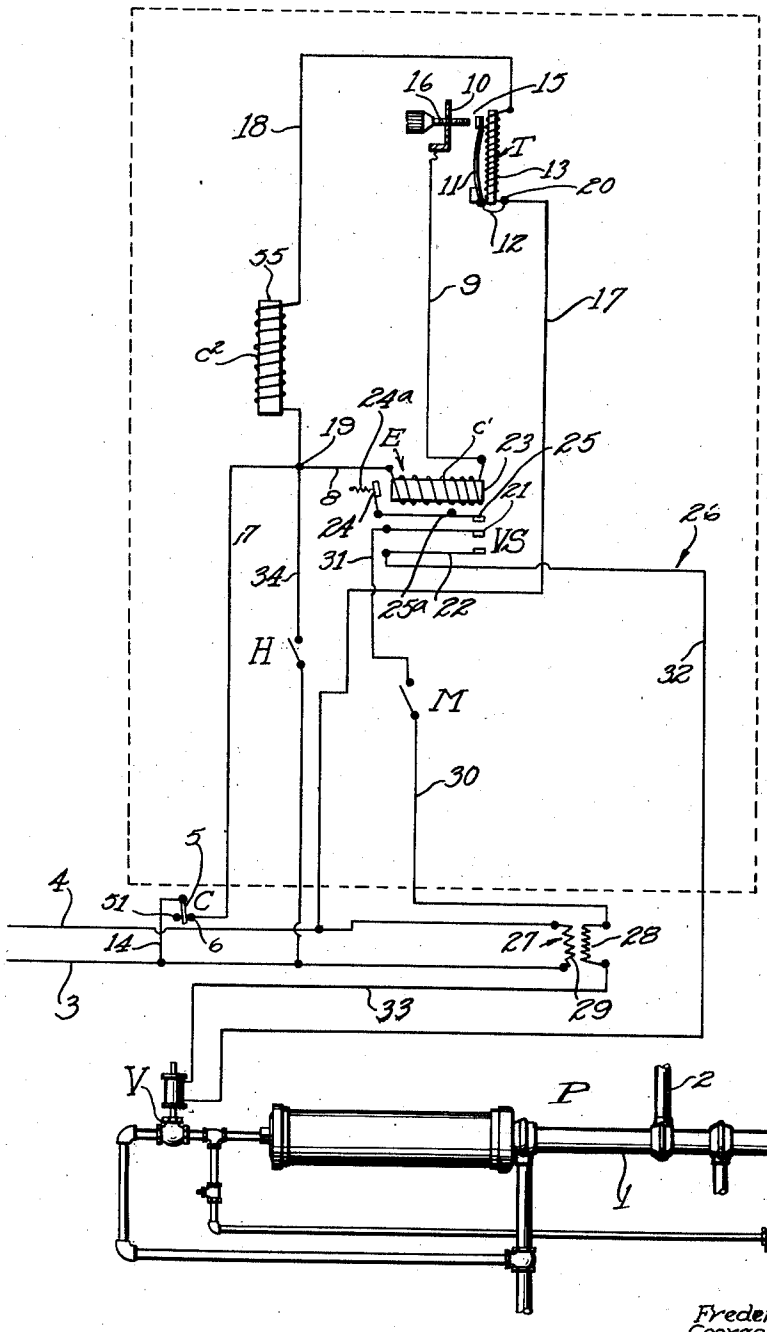


Fig. 3.

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UNITED STATES PATENT OFFICE

1,978,435

ELECTRICALLY CONTROLLED IRRIGATING APPARATUS

Frederick Reinecke and George D. Phillips, Los Angeles, and Maurice Gillern, Arcadia, Calif.; said Phillips and said Gillern assignors to said Reinecke

Application April 2, 1928, Serial No. 266,846

9 Claims. (Cl. 161—7)

This invention relates to irrigating or sprinkling systems. These systems employ a system of pipes which carry the water to the sprinklers. When these sprinkling systems are controlled by hand, it requires the services of a workman to turn the water off and on. As these services are performed during working hours, that is to say, in the day time, the sprinkling occurs at a time of day during which evaporation is considerable, so that a large part of the benefits from the sprinkling is lost.

It has been attempted to employ a clock to effect automatically the turning on or off of the water in such a system. It frequently happens, however, that it is desirable to have the water flowing for a very short period, for example, one minute to three minutes. A clock constructed with means for effecting a control for such a short period can not be procured on the market, and furthermore, it would involve a considerable reconstruction in clock mechanism to provide a clock which could be operated to effect the turning on of the water at a certain time and within one to three minutes effect the turning off of the water.

In other words, even using electric contacts closed by such a clock, the use of this short period would necessitate a great refinement in the construction of such a clock. An electrically operated clock is now available which will operate to close the switch but the dial which effects the closing of the switch moves so slowly that the switch would usually remain closed for about fifteen minutes.

The general object of this invention is to provide an irrigating apparatus which can be used in combination with such a clock and having simple means operating to limit the period during which the irrigating water is turned on.

The invention is particularly applicable in an irrigating system which operates through the agency of an electrically controlled pilot valve, and one of the objects of the invention is to provide simple means for automatically controlling such pilot valve to effect the turning on and off of the water for relatively short periods of time. The apparatus preferably includes an electro-magnet for effecting the closing of the circuit through the pilot valve and also preferably includes a thermostat which automatically opens the circuit and effects the closing of the pilot valve after the lapse of a predetermined period of time. One of the objects of the invention is to provide simple means for maintaining a circuit through the thermostat after the circuit is broken which controls the pilot valve.

Another object is to provide simple means for balancing the resistance of the coil of the electro-magnet so as to prevent the current in the maintaining circuit through the thermostat from injuring the thermostat.

Further objects of the invention will appear hereinafter.

The invention consists of the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient electrically controlled irrigating apparatus.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a front elevation of the casing which carries a clock mechanism and the switches and representing the casing with the door open and broken away.

Figure 2 is a front elevation of the clock dial and clock switch upon an enlarged scale. This figure shows the clock switch in its closed position, whereas Figure 1 shows it in its open position.

Figure 3 is a diagrammatic view indicating the relation of the parts of the apparatus and the wiring for the same and includes a portion of the pipe system with parts broken away.

In practicing the invention, we provide an electrically controlled valve connected with the pipe system. We provide an electric circuit for controlling this valve including a clock with a clock switch controlled by the clock for closing the circuit; and we provide electrically controlled means independent of the clock for automatically opening the circuit after the lapse of a predetermined period. We will now describe the preferred embodiment of apparatus for practicing the invention. Referring particularly to Figure 3, P represents a pipe system including valve mechanism 1 for turning on the water controlled by a pilot valve V. This pipe system includes pipes 2 which lead the water to the irrigation pipes or sprinklers served by the apparatus. The valve V may be of any suitable construction but is preferably of some type which can be opened through the agency of an electro-magnet, but which closes automatically when the electric current ceases to flow. A valve of the type referred to is illustrated in Patent No. 1,633,217, issued to E. E. Littlefield on June 21, 1927.

The type of water valve mechanism 1 which

we prefer to employ is illustrated in the patent to Brooks, No. 1,357,840 issued November 2, 1920.

We provide a clock switch C which is controlled by a clock of any suitable construction. A clock which is suitable for this purpose is an electrically operated clock which is constructed without a spring but which has a balance wheel which is given an impulse from time to time by the passage of an electric current. This clock switch C is located so that it can take current from a conductor 3 which cooperates with a similar conductor 4 to supply current from a service company supplying electricity. While the invention may be adapted to a system employing a direct current, in the present instance, we have described it as applying to an alternating current system. The clock switch C includes a switch lever 5 which in Fig. 3 is illustrated in its closed position, at which time it engages a contact 6. This closes a circuit through conductors 7 and 8 which circuit includes electrical means for effecting the opening of the pilot valve V. This is preferably accomplished through the medium of a valve circuit independent of the conductors 7 and 8 which constitute parts of a setting circuit. This setting circuit further includes an electro-magnet E having a coil c', the said coil being connected by a conductor 9 with a metallic part 10 adjacent to a thermostat T. This thermostat includes a distortion element 11 which is connected by a conductor 12 with the heating element 13 of the thermostat which may be in the form of a coil.

The switch lever 5 may be connected with either side of the electric service line. In the present instance, it is connected by a conductor 14 with the wire 3.

The metallic member 10 and the distortion element 11 constitute a thermostat switch 15 and it should be understood that this switch is normally closed. It preferably includes an adjustable contact 16 in the form of a screw mounted opposite to the end of the distortion element 11. In Figure 3, this switch is represented in its open condition. However, assuming that the switch is in its closed condition, when the clock switch C is closed, the main circuit will be established and current will flow from the line 3 through the clock switch C and through the electro-magnet E and thence through the switch 15 to the conductor 12 from which the current will flow by a conductor 17 to the other line wire 4. This setting circuit includes a branch 18 connected between the conductors 7 and 8 at the point 19 and this branch is connected to the heating coil 13 of the thermostat, which coil is connected at 20 to the wire 17. The branch circuit 18 includes a coil c^2 which performs the function of a balancing coil for the resistance in the coil c' to protect the thermostat coil 13 from burning out when the circuit is open at the thermostat switch 15. In the operation of the apparatus, soon after the clock switch C becomes closed the distortion element 11 will move away from the contact 16 (see Fig. 3) thereby opening the switch 15. When this occurs, current which formerly flowed from the conductor 7 through the conductor 8 and through the coil c' now passes through the branch circuit 18 which leads current through the heating coil 13 to the wire 17, thereby establishing a maintaining circuit or holding circuit for maintaining the thermostat switch 15 in its open condition.

The electro-magnet E operates in any suitable manner to close the circuit through the valve V. In the present instance, this is accomplished by means of a valve switch VS including two spring contacts 21 and 22 that are normally disposed apart. When the current flows through the coil c', its core 23 attracts its armature 24 and a long arm 25 on this armature presses down against the upper contact 21 and forces it against contact 22, thereby closing a valve circuit 26. This valve circuit is energized by means of a transformer 27, the secondary coil 28 of which is connected in the valve circuit 26. The primary coil 29 may be connected up between the conductors or line wires 3 and 4. The valve circuit extends from the coil 28 through a conductor 30 and a main switch M (which is normally closed) and by a conductor 31 to the contact 21. From the contact 22, the current passes by a conductor 32 to the valve, and from the valve the current passes over conductor 33 to the other end of the secondary coil.

It may be desired at times to operate the apparatus independently of the clock for any desired period of time. In other words, it may be desired to control the apparatus by hand. For this purpose we provide a hand switch H which is located in a conductor 34 which leads from the line 3 to the point 19. If this hand switch H is closed, it will be evident that whether the clock switch C is open or closed, current will flow to the point 19 just as though it were supplied from the clock switch. This will energize the electro-magnet E and close the valve circuit.

After the hand switch has remained closed a sufficient length of time to allow the distortion element 11 to open the switch 15, this switch will be opened and the valve switch VS will then open automatically through the cessation of the current in the electro-magnet E.

In practice, the clock and switches may be mounted in a casing 35 such as illustrated in Figure 1. In this view, M and H represent the two switches M and H shown in the diagram. They are mounted on a face plate 37 so that they are exposed when the door 36 of the casing is swung open. The movable contact 16 is also mounted in the face plate 37. When the system is installed, this contact 16 is adjusted so as to regulate the period of time which will elapse before the distortion member 11 will move away from the contact 16 sufficiently to break the circuit at this point. With this arrangement, it will be evident that it is of no consequence whether the distortion member 11 is accurately constructed to have a given movement in a given time.

The clock mechanism includes a dial 38 which makes one revolution every twenty-four hours and the face of this dial is provided with two scales 39 and 40. On the face of the lower half of the dial, as shown in Fig. 2, the letter N is provided which indicates night which extends from six o'clock in the evening to six o'clock in the morning. The other half of the dial is provided with the letter D to indicate day light and bears numbers corresponding with the hours from six in the morning to six in the evening.

The dial is provided with small openings 41 opposite the hour points in which removable pins 42 may be attached.

The switch C is a quick-throw switch and comprises a dog 43 which projects in the path of the pins 42. This switch includes a switch lever 44 carrying the said dog 43 and pivoted on a fixed pin 45. A slot 46 in the lever 44 cooperates with a fixed pin 47 to limit the swinging movement of the lever 44. A spring 48 attached to one side of the lever 44 exerts its force in a direction to

swing the lower end of the lever 44 toward the left. The switch lever 5 is pivoted at 49 and the end of this lever 5 is connected by a spring 50 with the lower end of the lever 44. In Fig. 2 switch lever 5 is shown resting against an insulating stop 51. It will be evident that when the pin 42 strikes the dog 43 it will rock the lower end of the lever 44 toward the right. This will shift the line of pull of the spring 50 to the right of the pivot pin 49 and will pull the lever 5 over against the contact 6.

The electric wires 3 and 4 from the service line pass into one end of the casing at the point 52 and the wires 32 and 33 that extend to the valve V pass out of the casing at the point 53. The lower part 54 of the casing may house the transformer 29 and any other parts of the apparatus.

The coil c^2 may be provided with a core 55 so as to give it substantially the same resistance inductive or otherwise, as the coil c'.

We will now describe briefly the mode of operation of the invention. When the clock switch C is closed the current passes from the line wire 3 through the conductor 14 and through the switch C and conductors 7 and 8 to the electro-magnet E at which point the current passes through the coil c' and thence by the conductor 9 to the switch 15 which is normally closed. The current passes from this switch through conductor 12 to the point 20 and thence by wire 17 to the line wire 4. This energizes the coil c' so that its core 23 attracts the armature 24 which is normally held away from the core by its spring 24a which holds the arm 25 against a fixed stop 25a. As the armature moves toward the core 23, the arm 25 presses contacts 21 and 22 against each other, thereby closing the valve circuit 26 which passes from the contact 22 through conductor 32 to the valve V, returning by wire 33 through the transformer coil 28, wire 30, switch M, (normally closed,) and wire 31 to the contact 21. The current passing through the pilot valve V, opens this valve and turns the water on in the pipe system P.

As soon as the current flowing through the distortion element 11 heats it sufficiently, it will withdraw from the contact 16, thereby opening the switch 15. This will de-energize the electromagnet E and permit the valve switch VS to open. This will cut off the current from the pilot valve V which will then close automatically.

Of course, after switch 15 has been opened, the current will cease to flow through the distortion member 11, but its temperature will be maintained through the medium of the maintaining circuit which receives current from the point 19 through coil c^2, and the conductor 18 so as to supply current to the coil 13 that keeps the distortion member 11 heated. This circuit through the coil 13 will be maintained until the clock 42 releases switch lever 44, whereupon the spring 48 will pull switch lever 5 over against stop 51 and thereby open this circuit at the clock.

The current on this branch circuit returns to the line wire 4 from point 20 over the conductor 17.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and we do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What we claim is:

1. In electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, an electric circuit with means connecting the same with the valve, said circuit including a clock with a switch controlled by the clock for closing the circuit, and a thermostat having a normally closed thermostat switch in the circuit with a distortion element conducting the current and operating to change its shape by the heat generated within it by the current, and thereby open the switch after the lapse of a predetermined period, a heating element adjacent the thermostat element for carrying current after the thermostatic element opens the circuit through the electrically controlled valve, said clock switch operating thereafter to open the circuit through the heating element.

2. In electrically controlled irrigating apparatus, the combination of an electrically actuated pilot-valve for turning on the water in the pipe system, a valve-circuit for the same including a valve-switch, a setting circuit including a clock and clock-switch for closing the setting-circuit, means in the setting circuit for closing the valve-switch, means independent of the clock for opening the setting circuit after the lapse of a predetermined time, and for establishing a holding circuit for keeping the valve circuit open, said clock switch operating to open the holding circuit thereafter.

3. In electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, a circuit including an electro-magnet with a coil, an electrically actuated pilot-valve, a valve-switch for passing current through the pilot-valve, a clock with a clock switch in the said circuit for closing the same, an electrically controlled thermostat operating to effect the opening of the circuit through the pilot-valve after the lapse of a predetermined period, and a conductor including a balancing coil for the first named coil, in circuit with the thermostat for conducting current through the thermostat after the circuit through the first named coil has been broken.

4. In electrically controlled irrigating apparatus, the combination of an electrically actuated pilot-valve for turning on the water in the pipe-system, a valve-circuit for the same including a normally open valve-switch, a setting circuit including a clock and clock-switch for closing the setting circuit, an electro-magnet in the setting circuit including a coil for closing the valve-switch, a thermostat in the setting-circuit operating to open the setting-circuit after the lapse of a predetermined period, and means including a balancing coil for the first named coil, for conducting current through the thermostate to maintain the setting-circuit open.

5. In electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, an electric circuit with means connecting the same with the valve, said circuit including a clock with a switch controlled by the clock for closing the circuit, a thermostat having a normally closed thermostat switch in the circuit with a distortion element conducting the current of the circuit and operating to change its own form by the heat generated within it by the current, and thereby open the switch after the lapse of a predetermined period, said thermostat having a heating element, and automatic means for establishing a holding circuit through the heating element after the thermostat switch has been

opened, to keep the distortion element heated and thereby maintain the circuit open.

6. In electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, an electric circuit with means connecting the same with the valve, said circuit including a clock with a switch controlled by the clock for closing the circuit, a thermostat having a normally closed thermostat switch in the circuit with a distortion element conducting the current of the circuit and operating to change its own form by the heat generated within it by the current, and thereby open the thermostat switch after the lapse of a predetermined period, said thermostat having a heating element, automatic means for maintaining a holding circuit through the heating element after the thermostat switch has been opened, to keep the distortion element heated and thereby maintain the first-named circuit open, said clock switch operating thereafter for opening the holding circuit.

7. In an electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with irrigating pipes, an electric circuit with means connecting the same with the valve, said circuit including a clock with a switch controlled by the clock, a thermostat element conducting the current of the circuit, and operating to change its shape by the heat generated within itself by the current within it and thereby open the circuit through the electrically controlled valve after the lapse of a predetermined period, a heating element adjacent the thermostat element for carrying current after the thermostatic element has opened the circuit through the electrically controlled valve, said clock switch operating first to close the circuit through the thermostatic element and operating thereafter to open the circuit through the heating element, at the clock.

8. In an electrically controlled irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, an electric circuit including a clock with a switch controlled by the clock, a thermostat having a normally closed thermostatic switch in the circuit, said clock operating at a predetermined time to close the said circuit through the thermostatic switch, a relay circuit passing through the electrically controlled valve, means controlled by the first-named circuit for closing the relay circuit to open the valve, said thermostatic switch operating when the same becomes heated, to open the first-named circuit and thereby open the circuit through the electrically controlled valve to effect the closing of the valve, a holding circuit closed by the clock switch at the said predetermined time for maintaining the thermostatic switch in its open condition, said clock switch operating at a later predetermined time to open the holding circuit to restore the thermostatic switch to its normal closed condition.

9. In an electrical irrigating apparatus, the combination of an electrically controlled valve connected with the irrigating pipes, an electric circuit including a main circuit and a branch circuit, said main circuit having means connecting the same with the valve for opening the valve, a clock with a switch having separable contacts in both the circuits, a fixed contact, and a cooperating heat-sensitive flexible switch-member conducting the current of the main circuit and heated thereby, said flexible switch-member cooperating with the fixed contact to break the main circuit when the flexible switch-member is flexed from being heated by the current in the circuit, and thereby effect the closing of the valve, electric heating means in the branch circuit adjacent the flexible switch-member for heating the same, to hold the main circuit open, said clock operating to bring said separable clock switch contacts together to close the circuit through the heat-sensitive switch-member and the branch circuit, and operating later and after the flexible switch-member has opened the main circuit, to separate the clock switch contacts, the separation of said separable clock switch contacts operating to open the branch circuit and thereby permit the flexible switch-member to cool and engage its cooperating fixed contact thereafter without closing the main circuit.

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