Oct. 6, 1964 MINORU TESHIMA 3,151,340

AUTOMATIC WATER-SUPPLY APPARATUS

Filed July 13, 1962 2 Sheets-Sheet 1

FIG. 1

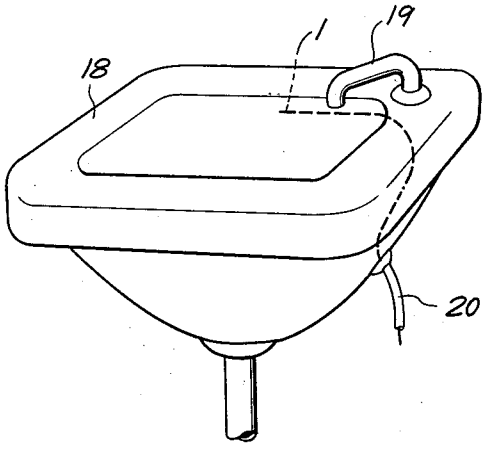
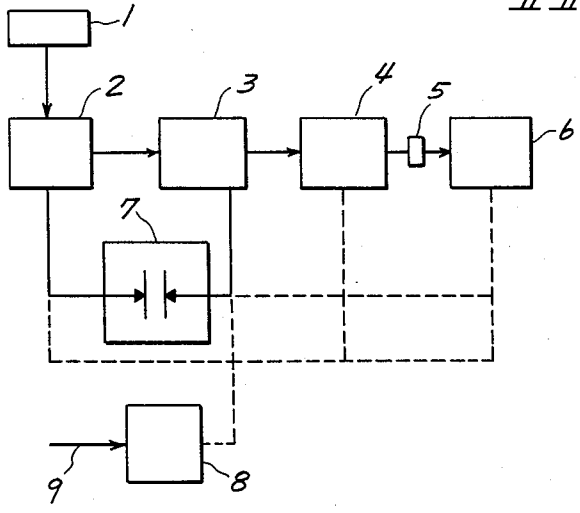


FIG. 2



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FIG. 3

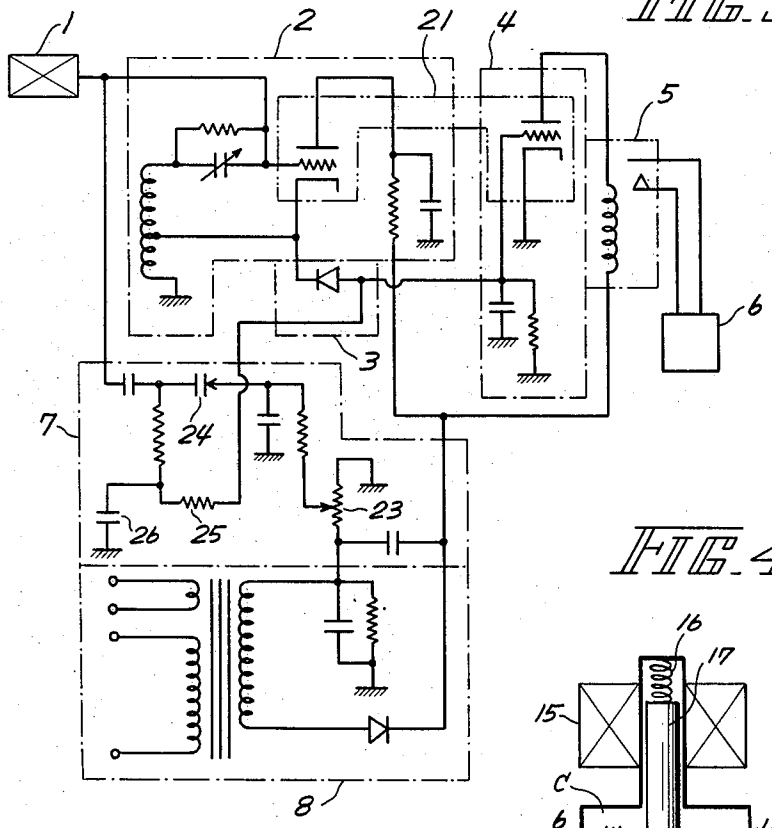
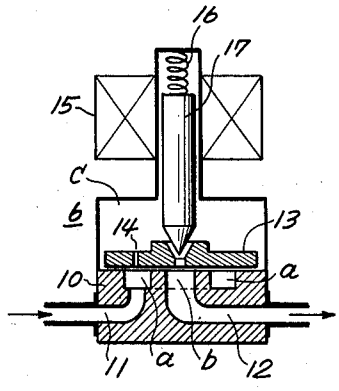


FIG. 4



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AUTOMATIC WATER-SUPPLY APPARATUS

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1 Claim. (Cl. 4—166)

This invention relates to an automatic water-supply apparatus using a high frequency oscillating circuit, in which, if for example washing water is needed, mere positioning a hand near a basin without manually opening a faucet can automatically cause an electromagnetic valve to operate to open a water supply passage, so that water-supply to the basin is automatically initiated.

Briefly stated in accordance with one aspect of this invention, there is provided an automatic water-supply apparatus using a high frequency oscillating circuit, in which a cathode of an oscillating tube of any type of oscillator circuit having an antenna, and a grid of a succeeding amplifier tube are connected to the plus and the minus sides respectively of a rectifier, said antenna being positioned at a location in apparatus such as a basin, which cannot be seen from the outside thereof, the minus side of said rectifier being grounded through a time constant circuit consisting of a resistor and a condenser, said resistor of the time constant circuit being connected through a coupling condenser to the antenna, further an optional potential being impressed to said coupling condenser through a variable capacitance condenser from a fixed bias resistor connected to a minus side of a power rectifier, and an electromagnetic valve being opened and shut by a relay operated by means of said amplifier.

Objects and advantages of this invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

FIG. 1 shows the setting of an antenna in the hand-washing apparatus operated in accordance with this invention;

FIG. 2 is an electric block diagram of this apparatus;

FIG. 3 shows an electric connection in this apparatus; and

FIG. 4 shows a longitudinal sectional view of an electromagnetic valve used in this apparatus.

Referring more particularly to the drawings, the preferred embodiment of this invention will now be described; however, this description will be understood to be illustrative of the invention and not as limiting it to the particular construction shown and described. There is provided a basin **18** usually made of ceramic material. Numeral **19** indicates a metal water-supply faucet having no cock and normally open, which is projectingly mounted for example at the right and rear corner of the brim of the basin. Numeral **1** indicates an antenna located in the inner space of said basin **18** close to the faucet **19** and numeral **20** indicates an antenna lead with insulation coat thereon, which is connected to an oscillating circuit.

Referring now to FIGS. 2 and 3, there are the antenna **1** and an oscillator **2** which may be of any type such as the Hartley type shown here. Numeral **3** indicates a rectifier. Numeral **4** indicates an amplifier. Numeral **21** indicates a duplex triode acting at once as an oscillating tube and an amplifier tube. Numeral **5** indicates a relay. Numeral **6** indicates an electromagnetic valve, of which the electromagnetic solenoid circuit is opened and shut by the relay. Numeral **7** indicates an automatic voltage regulator which so operates that, in case there is a sudden change in electrostatic capacity in the antenna circuit of the oscillator **2**, it alters the cut-off value of a grid and allows current to flow through its plate circuit,

while it does not respond to any gradual change of the electrostatic capacity, so that water flow never takes place unless anyone who needs hand-washing approaches the basin and positions his hand near the faucet.

Numeral **8** indicates a power rectifier to rectify an alternating current to a direct current in case a commercial alternating current power source is used as the power source and numeral **9** indicates a transformer connected to the commercial alternating current source.

FIG. 4 shows an electromagnetic valve **6** used in this apparatus, in which numeral **10** indicates a base portion of the valve, through which is provided an inlet passage **11** ending in an upwardly opened annular channel *a*, and numeral **12** indicates an outlet passage having an upwardly opened inlet port *b*. There is a vertically movable plunger **17** which is pressed downwardly by the action of a spring **16**, which has a conical bottom. An elastic rubber plate **13** is inserted between the base portion **10** and the plunger **17**. A small aperture **14** made in the rubber plate **13** is adapted to be in alignment with the inlet passage **11** and a central conical hole of the rubber plate **13** is adapted to hold the conical bottom of the plunger **17**. The members, the spring **16**, the plunger **17**, and the rubber plate **13**, are enclosed together with a space *c* by a cover extended from the base portion **10**. There is provided an electromagnetic solenoid **15** which may pull up the plunger **17** when energized.

Water admitted into the space *c* through the inlet passage **11**, the annular channel *a*, and the small aperture **14** presses down the rubber plate **13** and blocks the small aperture **14** also acts to block the central conical hole by the action of the spring **16**, so that the water admitted into the electromagnetic valve **6** can not run directly to the outlet passage **12** and consequently water never drips from the faucet **19** above the basin **18** shown in FIG. 1, communicating to this outlet passage **12**.

Now the electric connection of this apparatus will be explained. The oscillator **2** may be of any type such as the Hartley type, or the Colpitts type, or of any other type, and one half of a duplex tube may be used as the oscillating tube of this oscillator, the other half thereof also serving as the amplifier tube of the succeeding amplifier. In FIG. 3, a case where a duplex tube **21** acts at once as an oscillating tube and an amplifier tube is shown.

To the rectifier **8** is connected a fixed bias resistor **23**, with its movable contact being connected to the plus pole of the variable capacitance condenser **24** of the automatic voltage regulator **7**, to which plus pole a desired potential is given in advance. Such an arrangement is coupled with the action of a time constant circuit consisting of a resistor **25** and a condenser **26** as explained hereinafter, so that it is permitted to disable the cut-off action of the amplifier connected to the oscillator and stabilize the oscillator automatically.

The cathode of the oscillator tube of the oscillator **2**, together with a tap of an oscillating coil connected to the grid circuit of the oscillator, is connected to the plus pole of the rectifier **3**, with its minus pole connected to the grid of the amplifier tube of the amplifier **4**. The minus pole of the rectifier **3** and, accordingly, the grid of the amplifier tube of the amplifier **4** are connected to a time constant circuit comprising a condenser **26** with the other pole thereof earthed, and a high resistor **25** connected to the minus pole of the variable capacitance condenser **24**. This minus pole also is connected to the antenna **1** across a coupling condenser. Furthermore, the plus pole of the variable capacitance condenser **24** is connected to the movable contact of the fixed bias resistor **23** of the power rectifier **8** as set forth hereinbefore.

In operation, when anyone goes to the place where the

basin **18** is located and places his hand near the faucet **19** to wash it, the human body, being generally referenced to ground, approaches the antenna **1** so that the electrostatic capacity of the antenna circuit varies.

Therefore the oscillating voltage of the oscillator **2** decreases and the voltage appearing at the minus side of the rectifier **3** approaches zero. Consequently the grid bias voltage impressed to the grid of the amplifier tube of the amplifier **4** is decreased. Thus the cut-off action of the amplifier **4** is stopped and a current passes through the anode circuit of the amplifier **4** to operate the relay **5**, ending in to close the circuit of the electromagnetic solenoid **15** (as shown in FIG. 4). Consequently the plunger **17** is lifted and the central hole of the rubber plate **13** is simultaneously opened, so that the water filled in the space *c* above the rubber plate **13** flows into the basin **18** through the outlet passage **12** and the faucet **19**.

As previously mentioned, there is provided a time constant circuit consisting of a high resistor **25** and a condenser **26** in an automatic voltage regulator **7**, of which the time constant assumes a proper value in about ten seconds. In case the electrostatic capacity of the antenna circuit increases, for example, as a human body approaches the basin **18** to place his hand under the water-supply faucet **19**, such a human action would end within a period of ten seconds in general. Therefore, the variable capacitance condenser **24** and the time constant circuit have not a time to effect their operation as automatic regulator. Consequently, as previously explained, the cut-off action for the amplifier tube of the amplifier **4** is disabled, allowing current to pass through its anode circuit, so that the electromagnetic valve **6** is caused to operate, allowing the apparatus to automatically initiate the flow of water through the faucet **19**. However, a slow variation of the electrostaitc capacity by, for example, lowering of the capacity of the apparatus so far as its variation requires a period over ten seconds, the oscillator **2** substantially controlled by the automatic voltage regulating action continues to oscillate stably.

Although the apparatus according to this invention is comparatively simple in construction, excellent operations and effects can be obtained as explained hereinbefore. Furthermore, there is an extremely superior hygienic advantage in this invention in that it is unnecessary to turn on or off a cock with a dirty and soiled hand each time hand-washing is needed as being in many conventional cock means.

While a particular embodiment of this invention has been illustrated and described, modifications thereof will readily occur to those skilled in the art. It should be understood therefore that the invention is not limited to the particular arrangement disclosed but that the appended claim is intended to cover all modifications which do not depart from the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

An automatic water supply apparatus comprising a capacitance plate antenna oscillating means connected to said antenna and adapted to alter its voltage output in response to change of electrostatic capacitance on said antenna, a water flow control circuit actuated by the output of said oscillating means, a rectifier connected between said control circuit and said oscillating means, a variable capacitor circuit having a variable capacitor one side of which is connected to said antenna, said variable capacitor circuit including a time constant network, consisting of a second capacitor and a resistor, a bias potential source connected to the other side of said variable capacitor, said second capacitor being connected to said one side of said variable capacitor and to a capacitor discharge circuit to which the output of said oscillating means is also connected whereby said means controls the charge and discharge of said second capacitor, a water flow conduit the outlet of which is proximate said plate antenna and in which there is disposed an electromagnetic valve actuable by said control circuit.

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