WATER TEMPERATURE CONTROLLER

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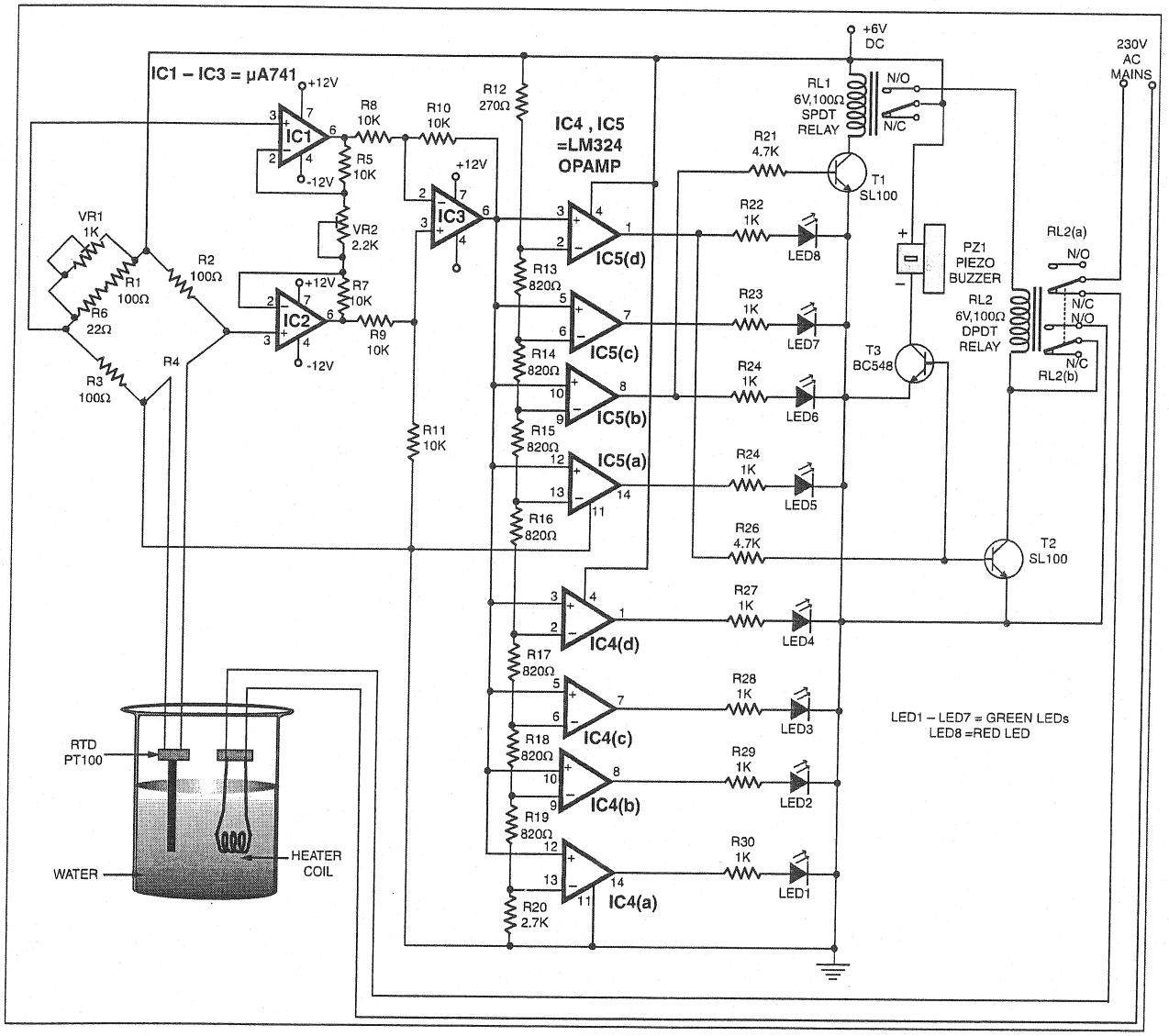
The circuit presented here controls the temperature of water as well as indicates it on an LED bargraph. When the temperature of water is 0o C, none of the bargraph display LEDs glows. But as the temperature starts increasing above approximately 30o C, LEDs from LED1 through LED8 of the bargraph start glowing one after the other. When temperature is around 30oC, only LED1 would be 'on'. For temperature greater than 97dig C, all display LEDs will be 'on'.

To detect the temperature of water, commonly used resistance-temperature detector (RTD) PT100 is used. It is connected to one of the arms of a Wheatstone bridge as shown in the figure RTD PT100 has a resistance of 100 ohms



when surrounding temperature is 0dig C. (To cater to resistance tolerances and calibration, resistor R6 (22-ohm) and 1-kilo-ohm preset VR1 were added at EFY lab. During testing.) Ideally, at 0oC, the bridge has to be in balanced condition and, for other temperatures, the bridge will be unbalanced. The unbalanced voltage of the bridge is converted into suitable value in the range 0V to 5V (corresponding to temperatures 0oC to 100oC, respectively) by the instrumentation amplifier formed by op-amps IC1 through IC3 (uA741). Output of instrumentation amplifier is given to voltage compactors for driving the display LEDs.

Before using this circuit, the following adjustments have to be made. First, immerse the RTD in ice water (0oC) and adjust preset VR1 such that the bridge becomes balanced and the output of IC3 becomes)V. Next, immerse the RTD in boiling water and slightly adjust preset VR2 such that the output of IC3 becomes 6V. Respeat the above two steps four to five times.

To control the temperature of water, 'on'/'off' type controller is used. Lower threshold point is set at 97oC. An electric heater coil is used for heating the water. When power supply is switched 'on', the heater starts heating the water. When temperature reaches 80oC, output of IC5(b) goes 'high'. This turns 'on' relay driver transistor T1 to energise relay RL1. In this state, relay RL2. Relay RL2 in energised state cuts off power supply to the heater coil. Relay RL2, once energised, remains so due to the latching arrangement provided by its second pair of contacts. Simultaneously, the buzzer also sounds, due to forward biasing of transistor T3.

Since the supply to the heater is cut-off, the temperature of water starts decreasing. Gradually, the buzzer goes 'off', as output of IC5(d) goes 'low'. When temperature goes below 80oC, output of IC5(b) goes 'low' to turn 'off' transistor T1 and relay RL1. As a result, the power supply provided to relay RL2 (via RL1 N/O contacts) is cut off and relay RL2 de-energises. This will again turn 'on' the mains electric power supply to the heater coil. Once again, the temperature of water starts increasing and the cycle repeats to maintain water temperature within the limits 80oC to 97oC.

This controller can be used to control the temperature of water in water heaters, boilers, etc. The lower and upper threshold points can be changed by connecting the base terminals of transistors T1 and T2 to different output terminals of voltage comparators (IC4 and IC5). Base terminals of transistors T1 and t2 are meant for lower and upper threshold points, respectively.