CHAPTER 22
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Heat Sensor and Alarm

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INTRODUCTION

A detector has been designed for handicapped persons that senses potentially dangerous, but non-glowing hot surfaces in the living space. The unit is portable and designed to operate from the 120 VAC power mains. It is equipped with both visible and audible warning alarms.

SUMMARY OF IMPACT

The application of this device is to detect when appliances become dangerously hot and may not be visible to persons who are wheelchair bound, or who are visually impaired. An example is a front burner of an electric stove over which a wheelchair bound individual may need to reach. The burner may be hot enough to cause a burn, but not so hot as to be glowing to alert the person of potential danger. Other potentially dangerous hot surfaces include laundry irons and wall-mounted gas-fired space heaters.

TECHNICAL DESCRIPTION

This device has been designed, without a specific client in mind, at the suggestion of the Wyoming Vocational and Rehabilitation Agency. A block diagram of the unit is shown in Fig. 22.1. The sensor is a model 2M broad-spectrum miniature 36-junction thermopile detector donated by the manufacturer (Dexter Research Center, Inc., Dexter, MI) It is packaged in a standard TO-5 can. The sensor acts as a pure resistance and produces no l/f noise, but only the Johnson nose associated with its resistance. A low-noise OP-27 op amp (Motorola, Inc.), using the circuit shown in Fig. 22.2, provides amplification of the sensor output signal. The signal output from the sensor is linear from 1 μW/cm2 to 0.1 W/cm2. The amplifier output voltage is sampled by a voltage comparator circuit that is configured using a 741 op amp. The comparator threshold is set to trigger at 0.25 V, when the hot surface being sensed reaches approximately 120°F. Under the experimental conditions existing during the development of this project, a surface at this temperature generated an output level of 0.25 V from the OP-27 circuit, when the sensor was placed one foot from the hot surface.

When the comparator changes state, a visual and an audible alarm are activated. The visual alarm is simply a light-emitting diode display controlled by a transistor switch. The audible alarm is a pulsed tone generated by a 555 clock chip configured as a triggered multivibrator. When the comparator output goes high, the 555 is enabled and the resulting pulse signal drives a piezoelectric buzzer. The 741 follower shown in Fig. 22.2 is simply a buffer, since the 555 chip does not produce sufficient output current to drive the buzzer directly.

A conventional, transformer-operated, bridge rectifier power supply, as is shown in Fig. 22.3, provides the required ±15 V and + 5 V bias voltages. Voltage regulator ICs are used.

The parts cost, less sensor, was $28.46; with sensor *$63.46.*

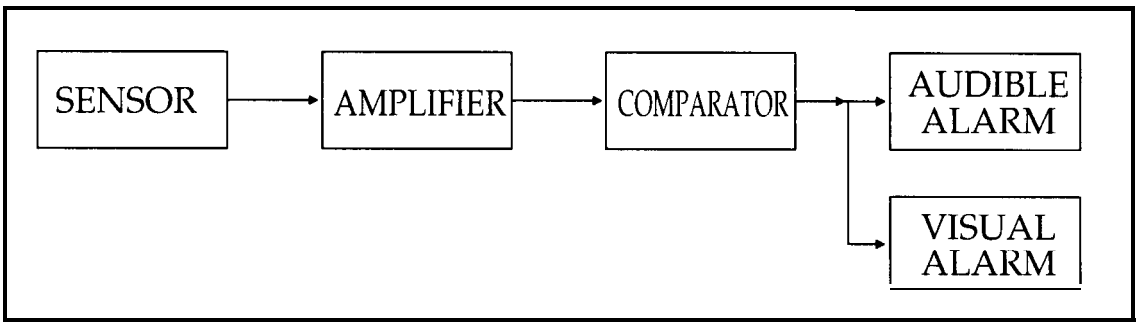

Figure 22.1. Block Diagram of Heat Sensor and Alarm.

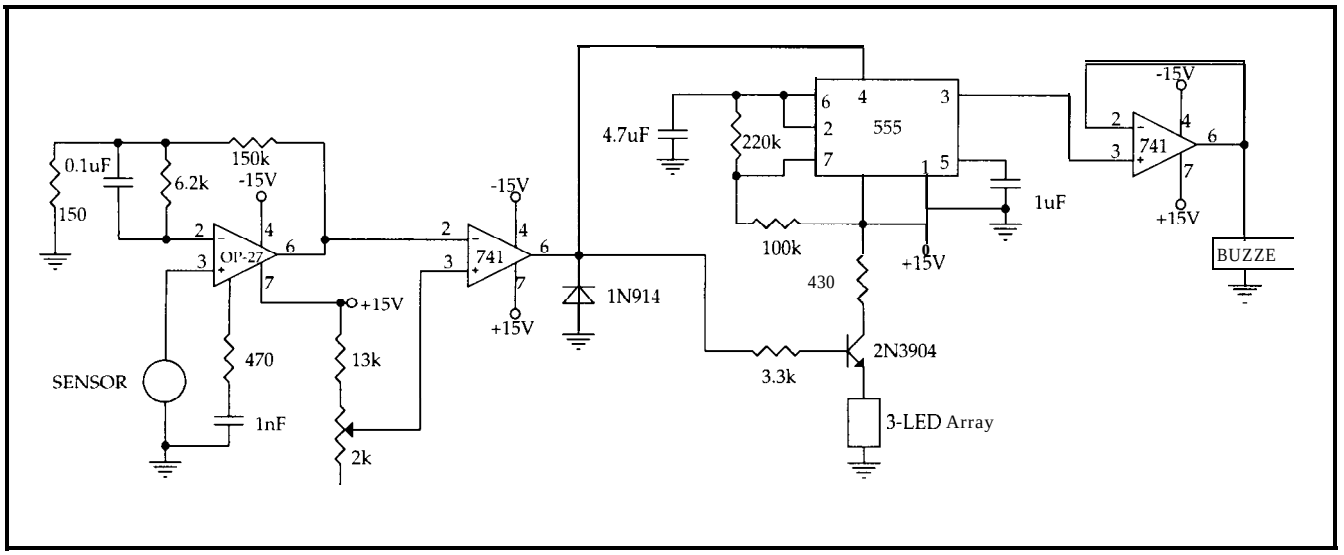

Figure 22.2. Circuit Diagram of Heat Sensor and Alarm.

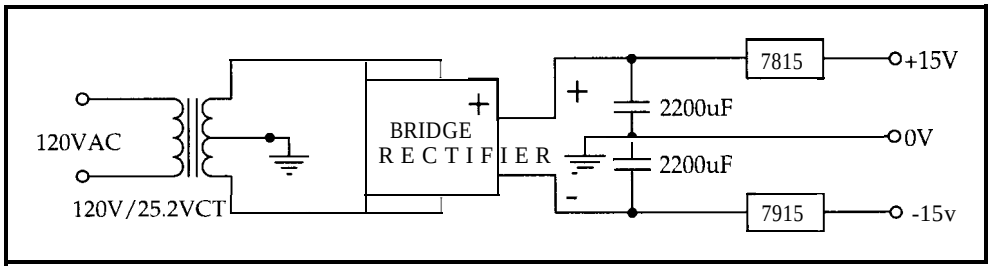

Figure 22.3. Conventional Transformer-Operated Bridge Rectifier Power Supply.