Sonic Applicator
Device Description and Technological Characteristics:

The Clarisonic Sonic Applicator consists of four primary parts: The infuser handle; the charger; the wall-mounted power supply and the fluid dispenser (which contains no electronics). A 127-Hz mechanical oscillation generated inside the infuser is coupled elector-mechanically to a soft applicator tip, upon which a portion of the fluid is dispensed. The applicator tip moves, generally, in and out of the infuser handle enclosure against the user's skin.

Infuser Description:

The oscillating motion is generated by a resonant electromagnetic oscillator in the infuser handle. The motor is controlled by solid-state electronics and powered from two nickel metal hydride rechargeable batteries elsewhere within the handle. Energy for recharging the batteries is transferred from the charger base through a system of induction coils within the infuser handle and the charger base.

The dispenser consists of a button, a mechanical pump and a pouch containing a custom serum. The button is used to activate the pump to dispense the serum. There are no electronics in the dispenser.

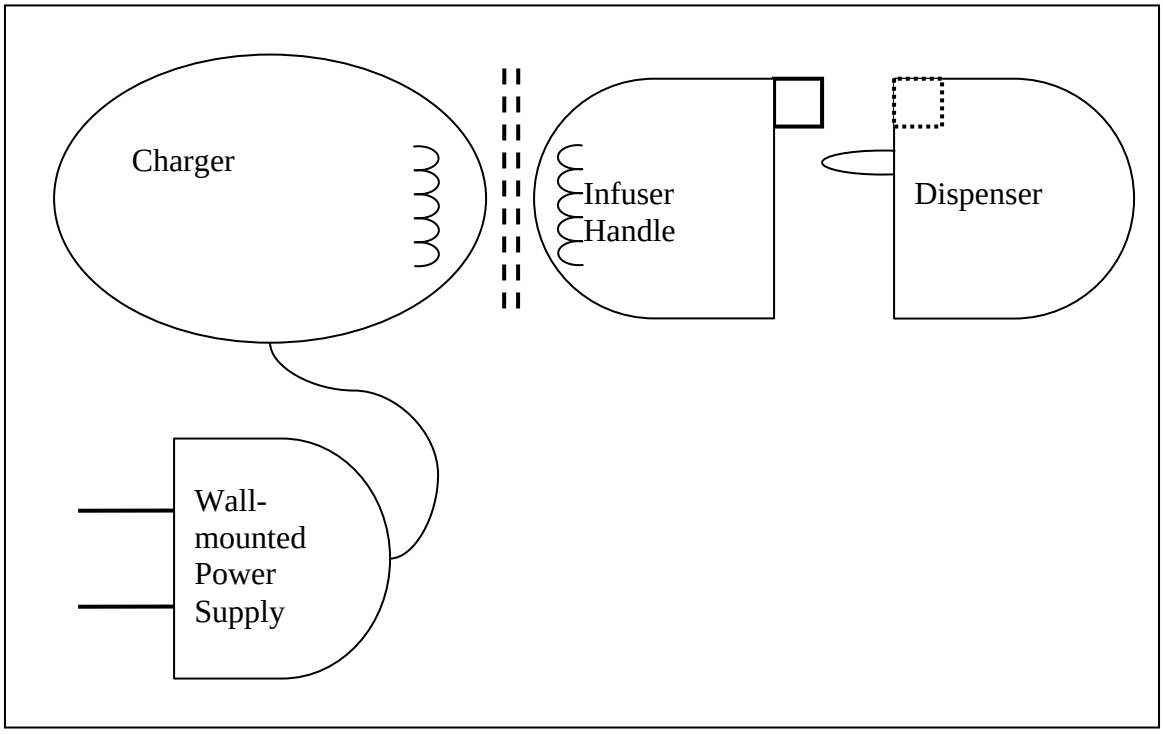

Fig. 1 Sonic Applicator System Block Diagram

Infuser Theory of Operation:

In the following circuit description, parts references are referring to infuser schematic drawing 5106. (See also Figure 2, System Functional Block Diagram)

The infuser consists of a PCBA with the charging coil, an ON/OFF button, an LED, a motor drive circuit and a rechargeable battery. The button is used to turn the motor on and off which drives the applicator tip. The LED is used to indicate the battery charge state. The PCBA has a flash based programmable microcontroller operating with a clock frequency of 4.9152 MHz. During use the microcontroller controls a dual channel MOSFET using a 127 Hz square-wave drive; the two channels are driven 180 degrees out of phase. The microcontroller also functions as an elapsed timer to automatically shut off the motor drive after 30 seconds of use.

The infuser PCBA also includes a 5Vdc boost convertor running at 190 kHz to supply current to the LED and assures that the microcontroller functions over the range of battery voltages seen during use.

Charger Description:

The charger is a contactless inductive charger. Charge energy is inductively transmitted from the charger to the infuser handle for the purpose of recharging the two AAA NiMH batteries located in the infuser handle. The charger does not use a supervisory circuit to control charge current. Instead, the design uses a current limited charging technique wherein the charge currents are held between upper and lower limits that are based on the battery capacity. In addition, user interface LED is used to divert current away from the batteries once they are fully charged to minimize cell heating.

Charger Theory of Operation:

In the following circuit description, parts references are referring to charger schematic drawing 5129.

The charger consists of a common-base Colpitts oscillator. The main resonant parts are the single inductor, L1 and the four capacitors, C3, C4.1, 4.2, and 4.3. The inductor, L1, also acts as the primary coil for a transformer, with the secondary coil located in the handle.

The charger base runs on 12Vdc which is provided by a wall-mounted power supply having any input range from 100-240Vac, 50/60 Hz input, limited by F1. F1 is a Thermal Cut-off and acts as a fuse. R1 and R2 provide the base bias for transistor Q1. Q1 is the only active component, providing the necessary amplification for the oscillator. The resonant frequency of the oscillator is approximately 60 kHz.

The transformer is completed by the secondary coil located in the infuser handle. In order to maximize the coupling, iron ferrite cores are used in both the primary and secondary coils. A resonant capacitor is placed across the secondary coil to maximize power transfer to the infuser handle. The secondary current is rectified by a single Schottky diode between the coil and the two AAA NiMH batteries.

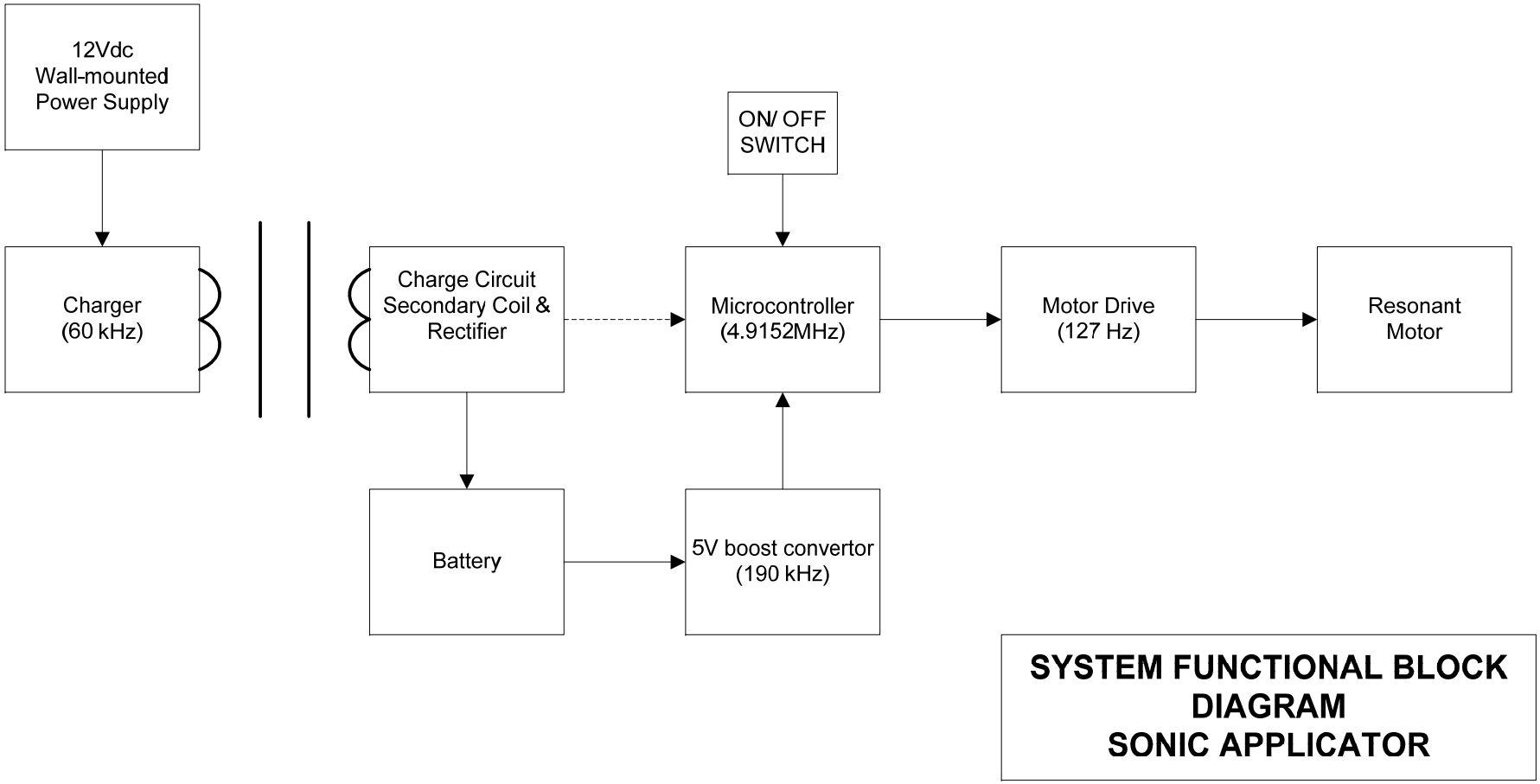
12Vdc
Wall-mounted
Power Supply
ON/ OFF
SWITCH
Charger
(60 kHz)
Charge Circuit
Secondary Coil &
Rectifier
Microcontroller
(4.9152MHz)
Motor Drive
(127 Hz)
Resonant
Motor
Battery
5V boost convertor
(190 kHz)
SYSTEM FUNCTIONAL BLOCK
DIAGRAM
SONIC APPLICATOR

Figure 2