Pacemaker/defibrilator

Lkaa 2012

Pacemaker

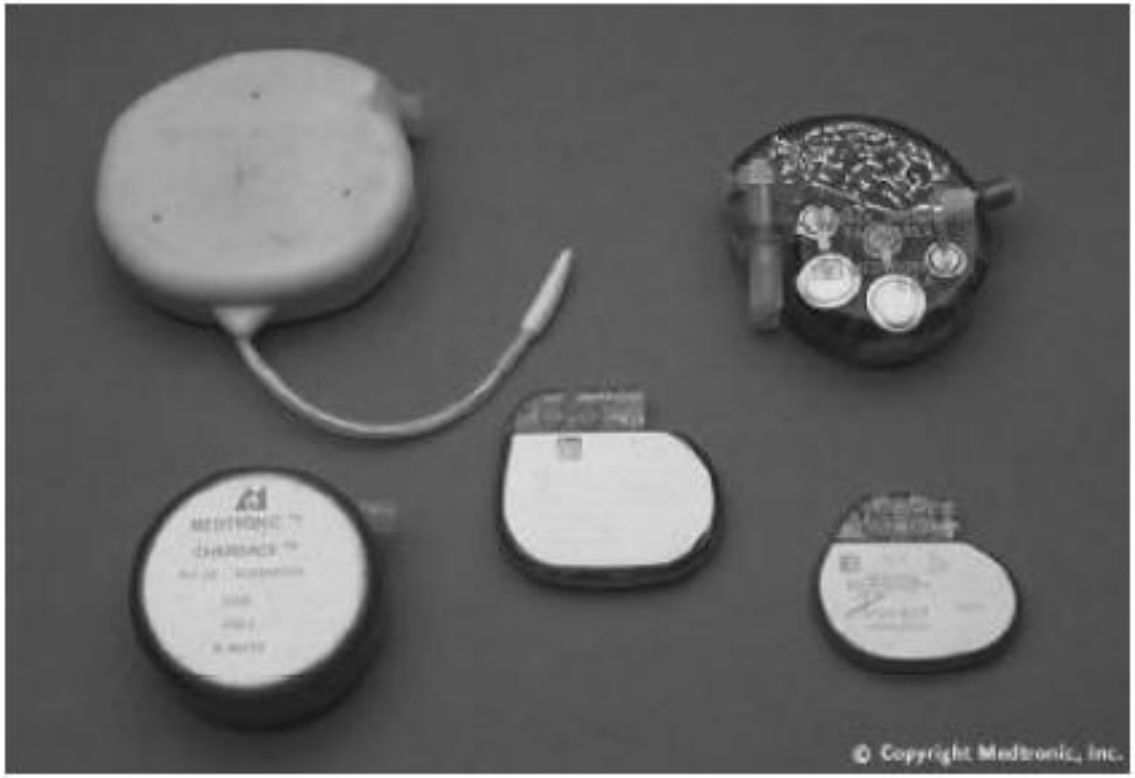


Figure 13.6 Examples of early pacemakers (top row) and metal encapsulated devices (bottom row). The two units on the bottom right are modern pacemakers that are about the size and mass of a pocket watch. (Photograph courtesy of Medtronic Corp.).

Pacemaker

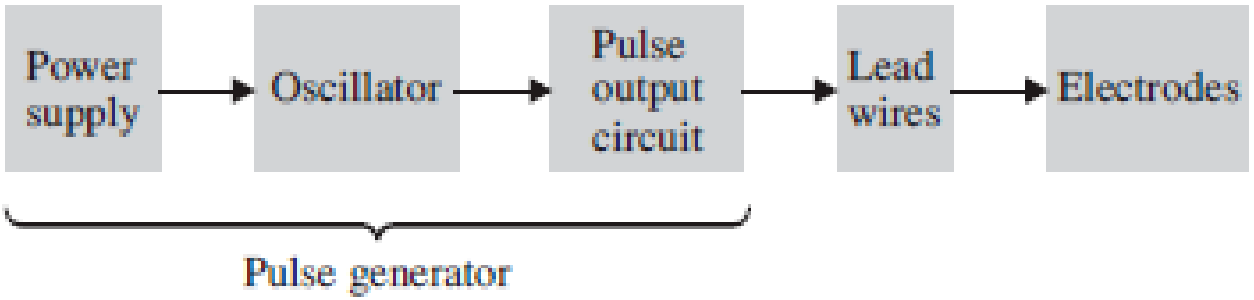


Figure 13.1 Block diagram of an asynchronous cardiac pacemaker

Pacemaker

- Litium batterier
- 5,0 til 5,5V
- 8 til10 mA
- 1,0 til 1,2 ms
- 70 til 90 slag/min

Synkron pacemaker

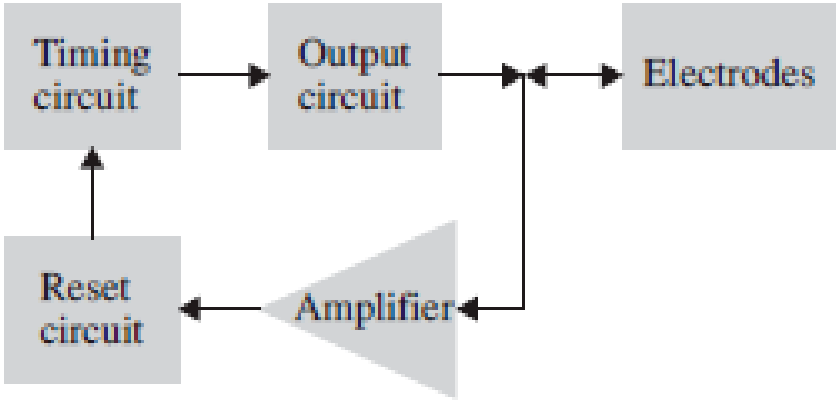


Figure 13.3 A demand-type synchronous pacemaker Electrodes serve as a means of both applying the stimulus pulse and detecting the electric signal from spontaneously occurring ventricular contractions that are used to inhibit the pacemaker's timing circuit.

Atrial synkron

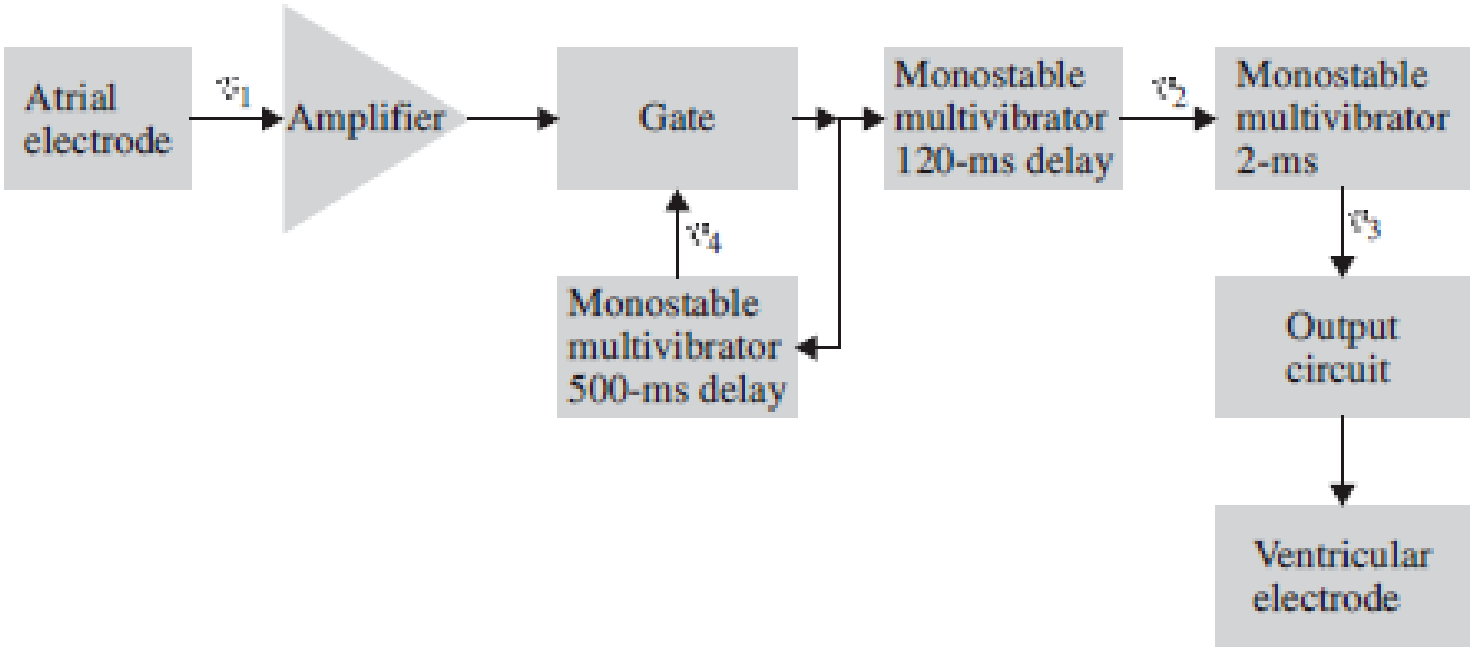
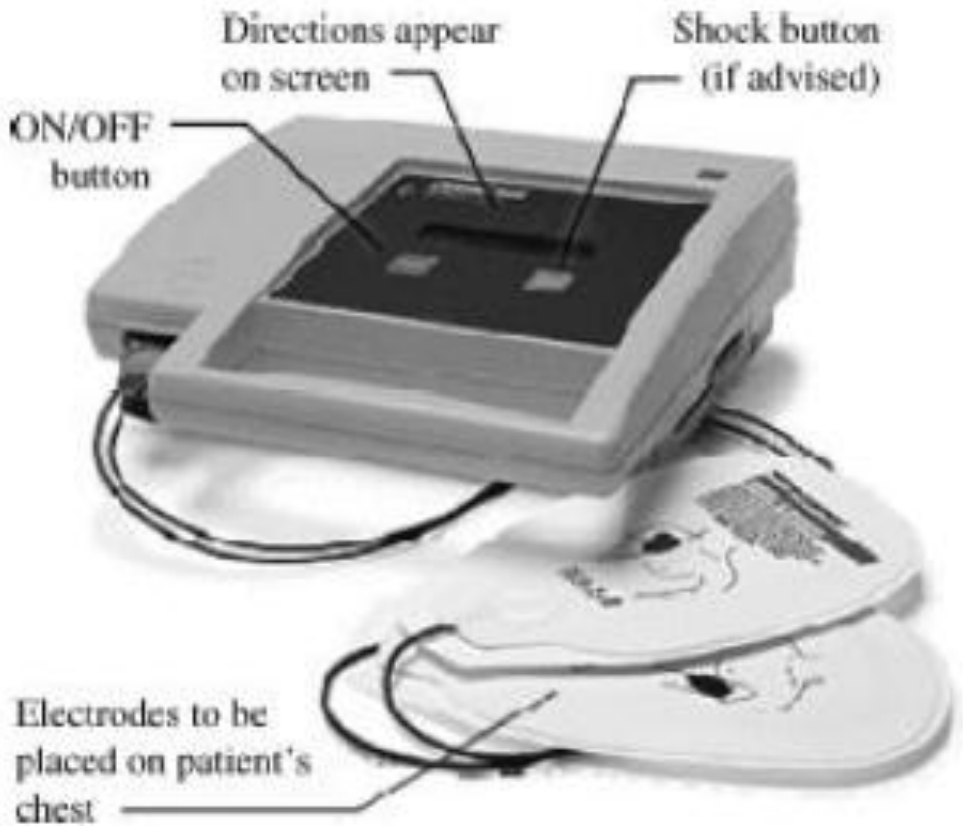


Figure 13.4 An atrial-synchronous cardiac pacemaker, which detects electric signals corresponding to the contraction of the atria and uses appropriate delays to activate a stimulus pulse to the ventricles.

Hjertestarter



Defibrilator

$$E = \frac{Cv^2}{2} \qquad (13.4)$$

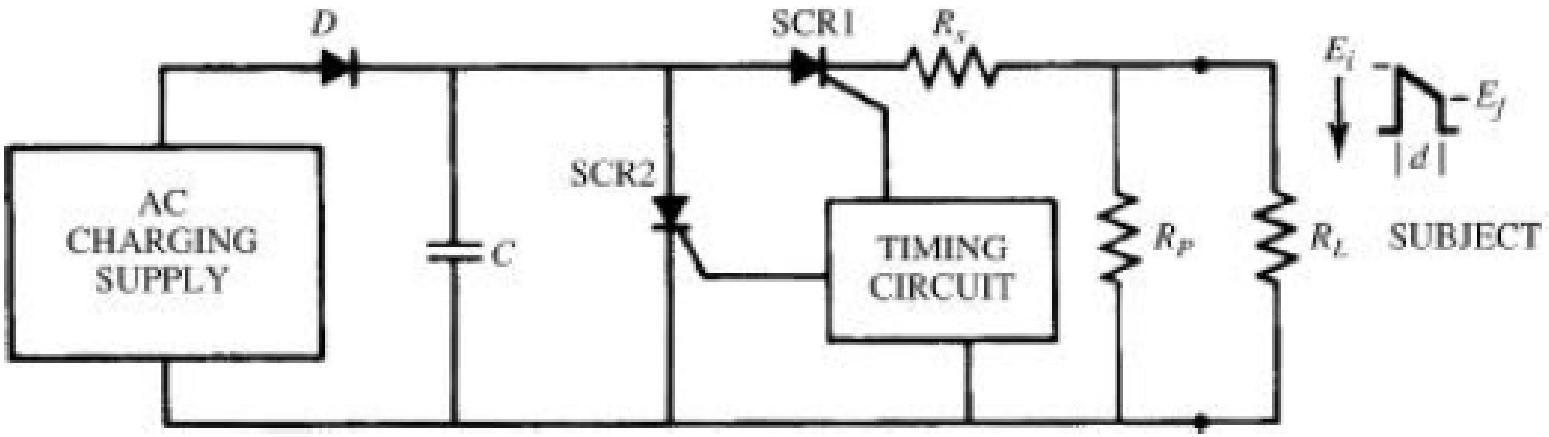


Figure 13.10 The square and trapezoidal waveform defibrillator may have a battery that drives the ac charging supply. Diode D rectifies the ac to charge capacitor C. Series SCR1 is turned on to deliver current to subject R_L. The timing circuit calculates the charge delivered, then after duration d, shunt SCR2 short circuits the charge. [From Geddes (1984).].

$$E = \frac{v^2}{R_L}\int_0^t e^{-\frac{2t}{R_L C}}dt \qquad \text{(E13.7)}$$

90% of this energy will be dissipated by

$$e^{-\frac{2t}{R_L C}} = 0.1 \qquad \text{(E13.8)}$$

or

$$t = R_L C\frac{\ln(0.1)}{2} \qquad \text{(E13.9)}$$

Because t is required to be 8 ms

$$C = -\frac{2t}{R_L[\ln(0.1)]} = \frac{-2 \times 8 \times 10^{-3}\,\text{s}}{100\,\Omega \times [-2.3]} = 69.6\,\mu\text{F} \qquad \text{(E13.10)}$$

(b) We can now determine the voltage to which the capacitor should be charged from (E13.6)

$$v = \sqrt{\frac{2E_t}{C}} = \sqrt{\frac{2 \times 300\,\text{J}}{69.6 \times 10^{-6}\,\text{F}}} = 2,940\,\text{V} \qquad \text{(E13.11)}$$

Cardioverter

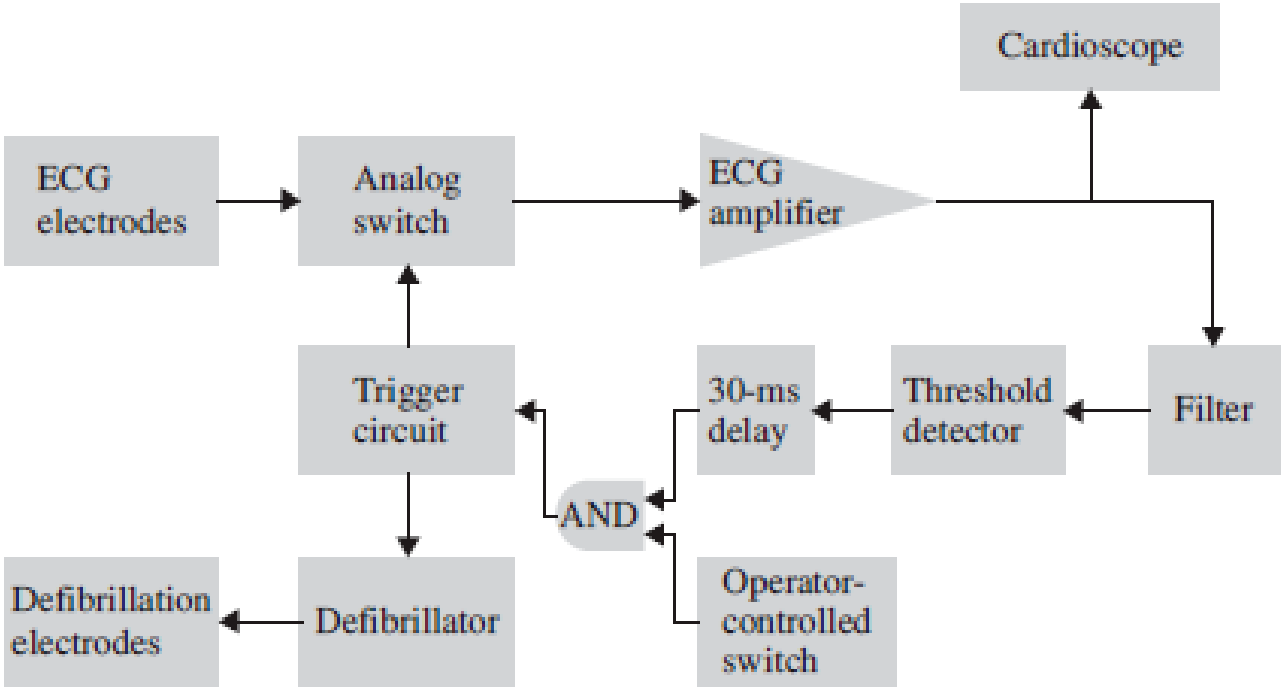


Figure 13.12 In a cardioverter, the defibrillation pulse must be synchronized with the R wave of the ECG so that it is applied to a patient shortly after the occurrence of the R wave.