STAEDTLER® No. 937 811E Engineer's Computation Pad

••41 In the Olympiad of 708 B.C., some athletes competing in the standing long jump used handheld weights called *halteres* to lengthen their jumps (Fig. 9-57). The weights were swung up in front just before liftoff and then swung down and thrown backward during the flight. Suppose a modern 78 kg long jumper similarly uses two 5.50 kg halteres, throwing them horizontally to the rear at his maximum height such that their horizontal velocity is zero relative to the ground. Let his liftoff velocity be $\vec{v} = (9.5\hat{i} + 4.0\hat{j})$ m/s with or without the halteres, and assume that he lands at the liftoff level. What distance would the use of the halteres add to his range?

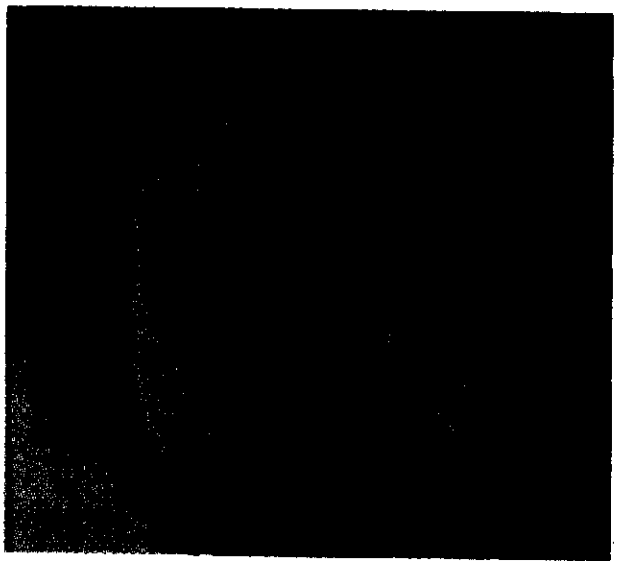
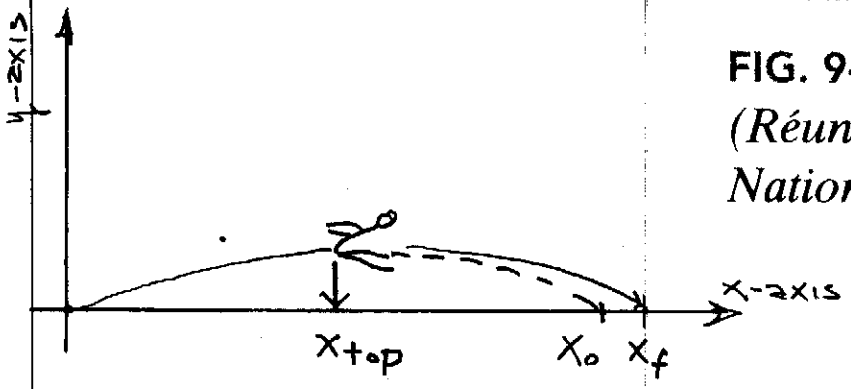


FIG. 9-57 Problem 41. *(Réunion des Musées Nationaux/Art Resource)*



USING THE FACT THAT THE CoM FOLLOWS THE ORIGINAL PARABOLIC TRAJECTORY:

THE ORIGINAL RANGE $= x_0 = 2x_{top}$

$$x_{com} = x_0 = (2m x_{top} + M x_f)/(2m+M)$$

$$\Rightarrow x_f = [(2m+M)(x_0 = 2x_{top}) - 2m x_{top}]/M$$

$$x_f = (2M + 2m)\, x_{top}/M$$

$$x_f = 2x_{top} + \frac{2m}{M} x_{top} = x_0 + \frac{2m}{M} x_{top}$$ ✓