

In the article *The Acceleration Law*, Special Relativity was used to show how various quantities on accelerating objects varied with distance L along the object. There is additional information of interest that is not given in that analysis. To fill in this missing information, consider the rocket shown in Figure 11.

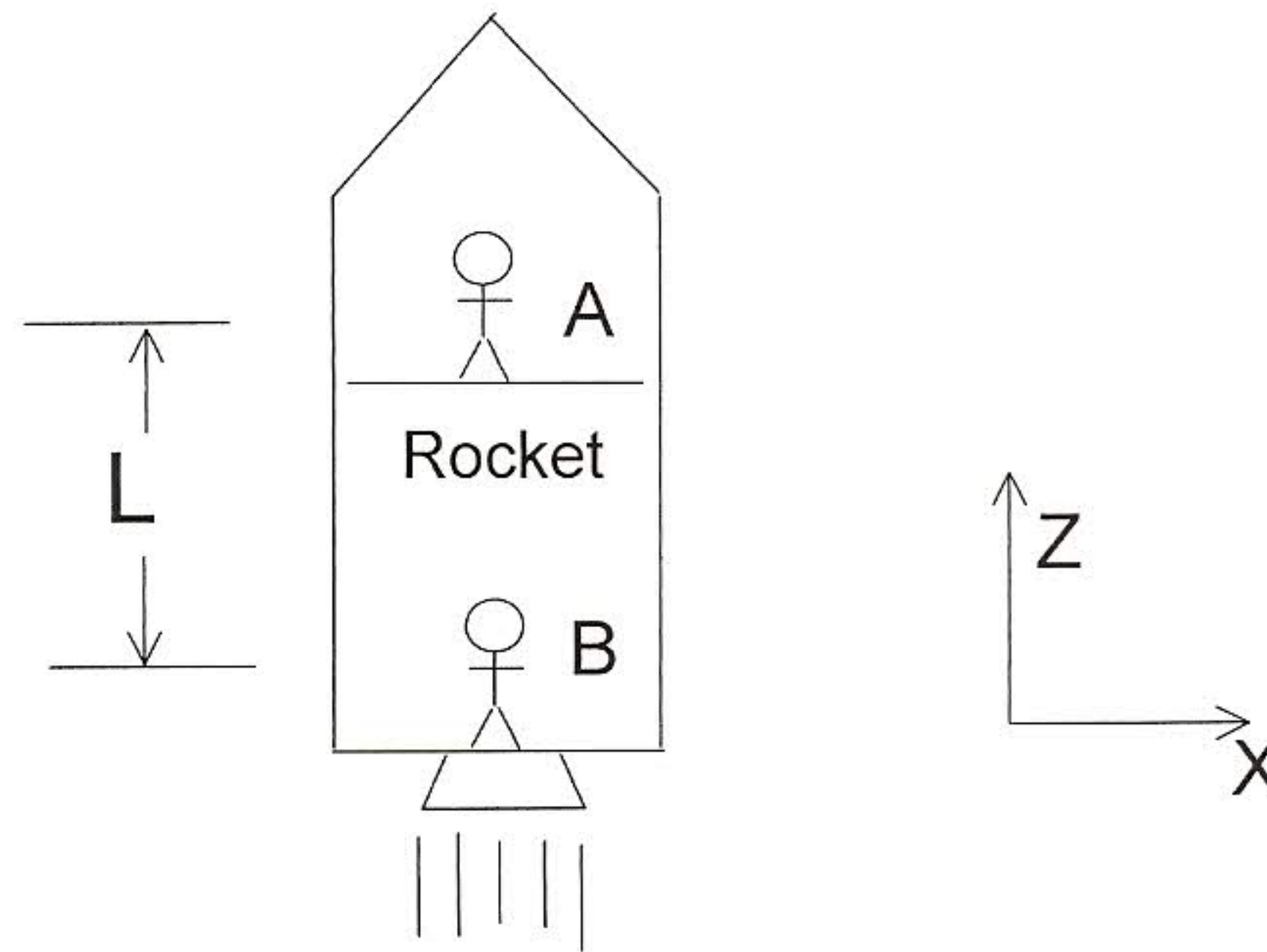


Figure 11

Observer B has acceleration a_B and observer A will have acceleration a_A as defined by (21). A comparison of length dimensions in the “horizontal” direction within the rocket is shown in Figure 12. If, during the acceleration, the observer in reference frame A “drops” a mass down to observer B, it would be expected that the mass would travel straight down in the z direction, not moving to the left or right during the fall. Similarly, two masses dropped from observer A to observer B would both be expected to fall straight (neglecting their small gravitational attraction for each other). But how can the observers be sure that the distance between the masses is the same in frame A at the beginning of the fall and when they arrive in frame B?

The way this is accomplished is to place a spring between the two masses. This spring could be thought of as a measuring device in its undeflected state (the spring has the same undeflected length dx in both reference frames). As the two masses move from frame A to frame B, the amount of energy recovered would be FL for each mass (F is the “weight” of each mass caused by the rocket acceleration and L is the vertical distance between the two reference frames). The energy obtained from the movement of the two masses must follow the Law of Conservation of Energy. If the spring were deflected after the movement, this deflection would result in additional spring potential energy that would not be consistent with the Law of Conservation of Energy. This result can be summarized in the transformation:

$$dx_A = dx_B \quad (40)$$

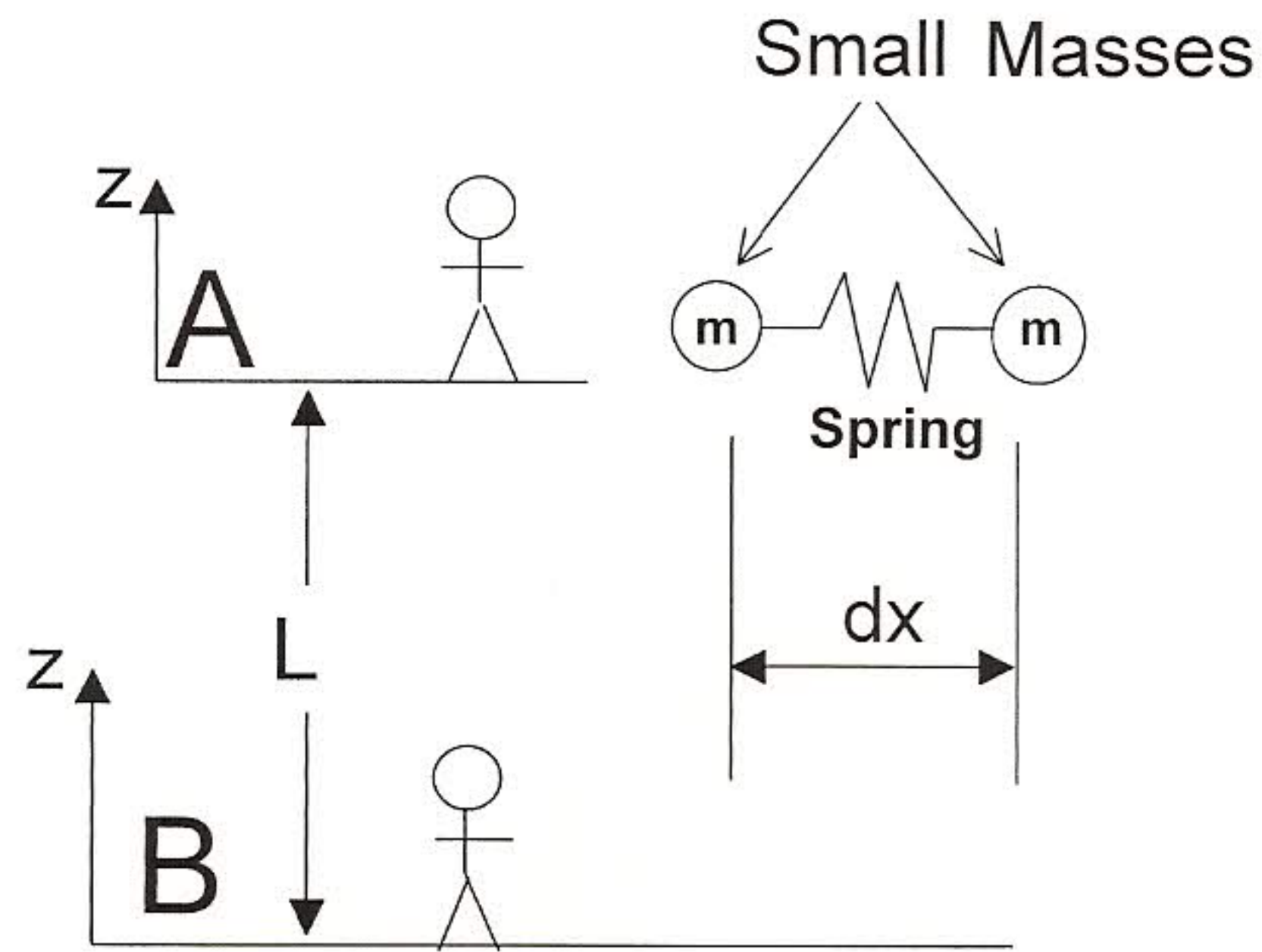


Figure 12

For an experiment showing the relationship of forces applied perpendicular to the acceleration direction, see Figure 13.

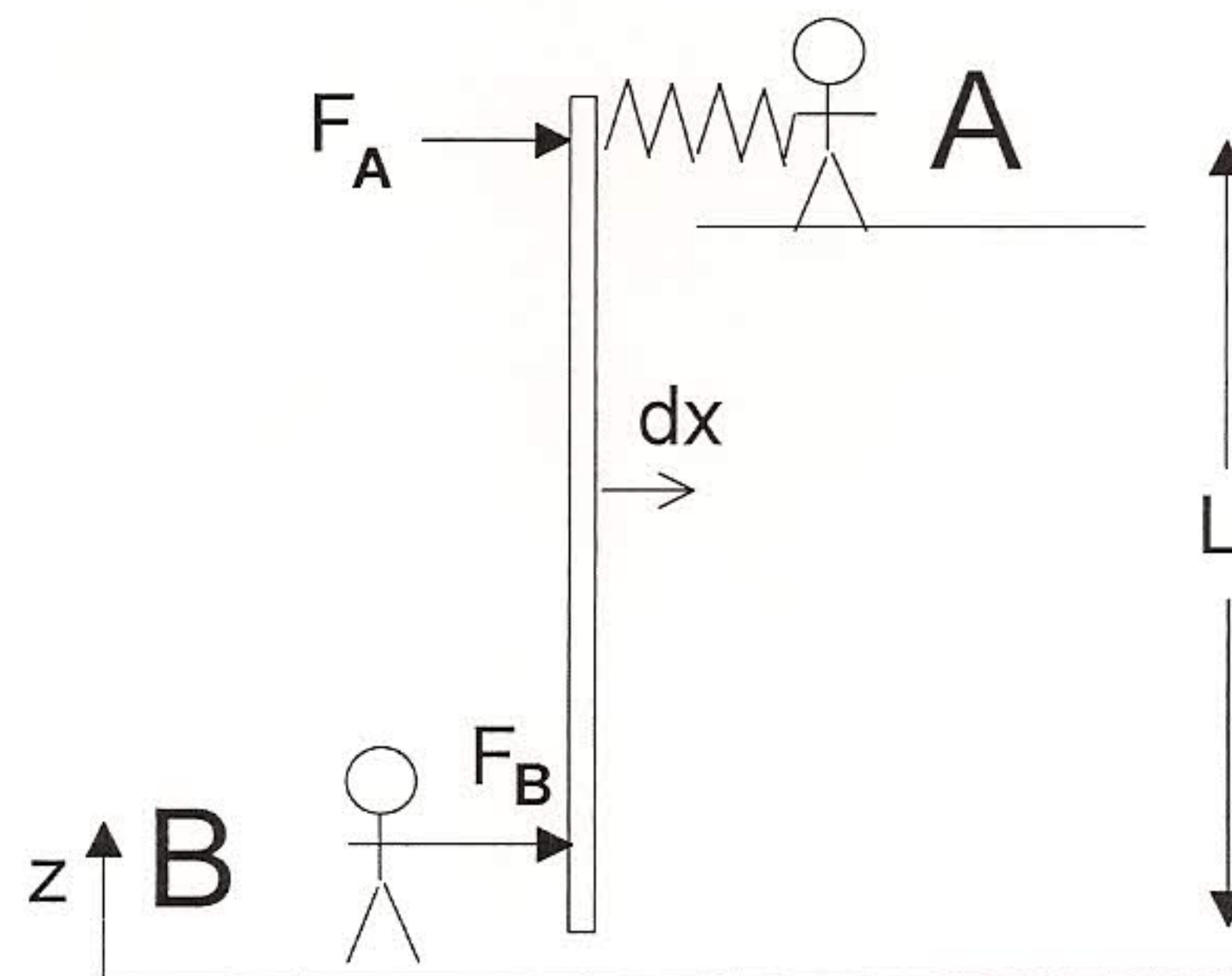


Figure 13

