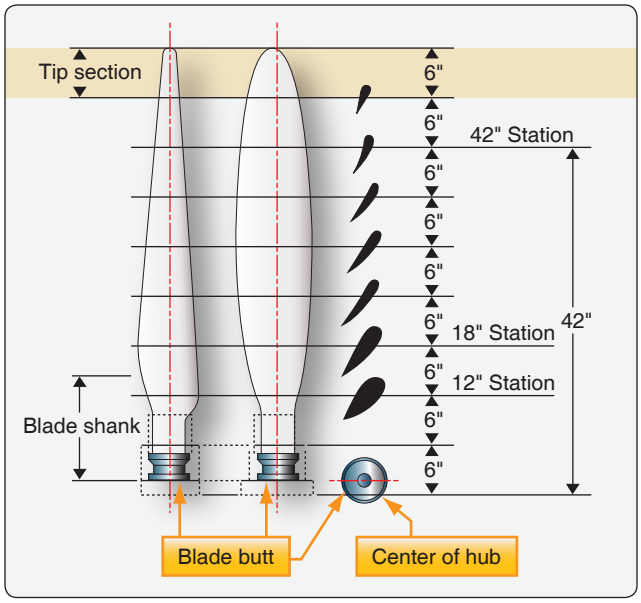

Figure 7-6. *Typical propeller blade elements.*

A cross-section of a typical propeller blade is shown in *Figure 7-7*. This section or blade element is an airfoil comparable to a cross-section of an aircraft wing. The blade back is the cambered or curved side of the blade, similar to the upper surface of an aircraft wing. The blade face is the flat side of the propeller blade. The chord line is an imaginary line drawn through the blade from the leading edge to the trailing edge. The leading edge is the thick edge of the blade that meets the air as the propeller rotates.

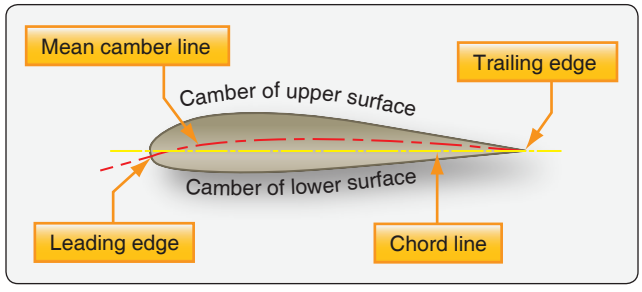

Figure 7-7. *Cross-section of a propeller blade.*

A rotating propeller is acted upon by centrifugal twisting, aerodynamic twisting, torque bending, and thrust bending forces. The principal forces acting on a rotating propeller are illustrated in *Figure 7-8*.

Centrifugal force is a physical force that tends to throw the rotating propeller blades away from the hub. *[Figure 7-8A]* This is the most dominant force on the propeller. Torque bending force, in the form of air resistance, tends to bend the propeller blades in the direction opposite that of rotation. *[Figure 7-8B]* Thrust bending force is the thrust load that tends to bend propeller blades forward as the aircraft is pulled through the air. *[Figure 7-8C]* Aerodynamic twisting force tends to turn the blades to a high blade angle. *[Figure 7-8D]* Centrifugal twisting force, being greater than the aerodynamic twisting force, tends to force the blades toward a low blade angle.

At least two of these forces acting on the propellers blades are used to move the blades on a controllable pitch propeller. Centrifugal twisting force is sometimes used to move the blades to the low pitch position, while aerodynamic twisting force is used to move the blades into high pitch. These forces can be the primary or secondary forces that move the blades to the new pitch position.

A propeller must be capable of withstanding severe stresses, which are greater near the hub, caused by centrifugal force and thrust. The stresses increase in proportion to the rpm. The blade face is also subjected to tension from the centrifugal force and additional tension from the bending. For these reasons, nicks or scratches on the blade may cause very serious consequences. These could lead to cracks and failure of the blade and are addressed in the repair section later in this chapter.

A propeller must also be rigid enough to prevent fluttering, a type of vibration in which the ends of the blade twist back and forth at high frequency around an axis perpendicular to the engine crankshaft. Fluttering is accompanied by a distinctive noise, often mistaken for exhaust noise. The

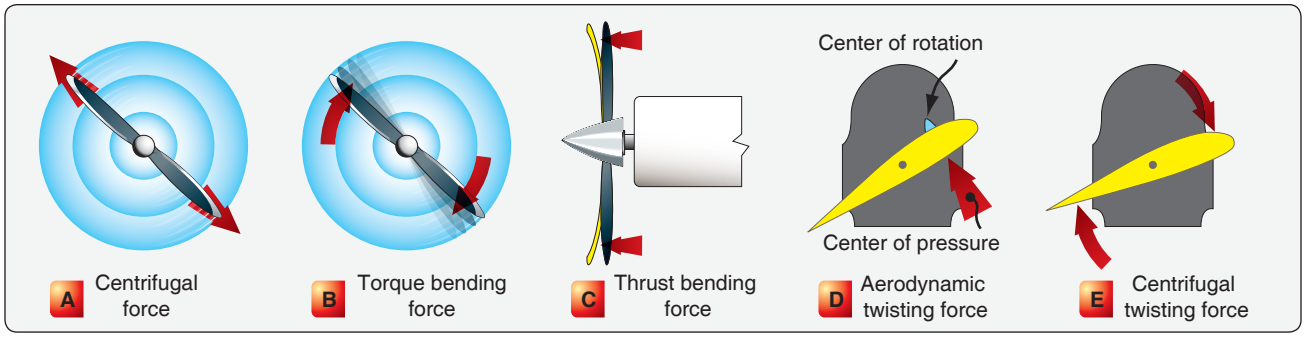

Figure 7-8. *Forces acting on a rotating propeller.*