cylinders. Cylinder head temperatures may differ by 100° F in a fuel-injected engine. Float carbureted engines can vary as much as 150° F between cylinders. This is due primarily to the fact that no cooling system is perfect. There are always misaligned baffles and variations in cowling. Also, the position of cylinders relative to the location of cowl flaps and placement of engine-driven accessories will affect the cooling of individual cylinders. The greater disparity of cylinder temperatures on engines equipped with float carburetors can be traced to the relatively inefficient fuel/air mixture distribution between cylinders.

The first law of thermodynamics essentially states that the rate of heat addition from fuel combustion equals engine power output plus the rate of heat rejection. Because their peak efficiency is only about 30 percent, aircraft engines must dissipate a lot of surplus heat.

Earlier, in tracing the route of a cooling air molecule, it was mentioned that during ground operations, the propeller pushed air back into the cowling, but in flight the prime mover was ram air pressure. A look at virtually any modern light aircraft will show that the portion of the propeller directly in front of the cooling air inlet has a very low angle of attack and generally is smaller or thicker than the rest of the propeller. It obviously is not all that effective at moving air. In addition, the actual air inlet has a fairly small opening. These two conditions significantly decrease the airplane's ability to cool the engine.

Operational Considerations

Problems resulting from improper cooling can take two forms: immediate and cumulative. Immediate problems include detonation and preignition. While significant, these problems tend to be immediately noticeable and draw attention like the proverbial "squeaky wheel."

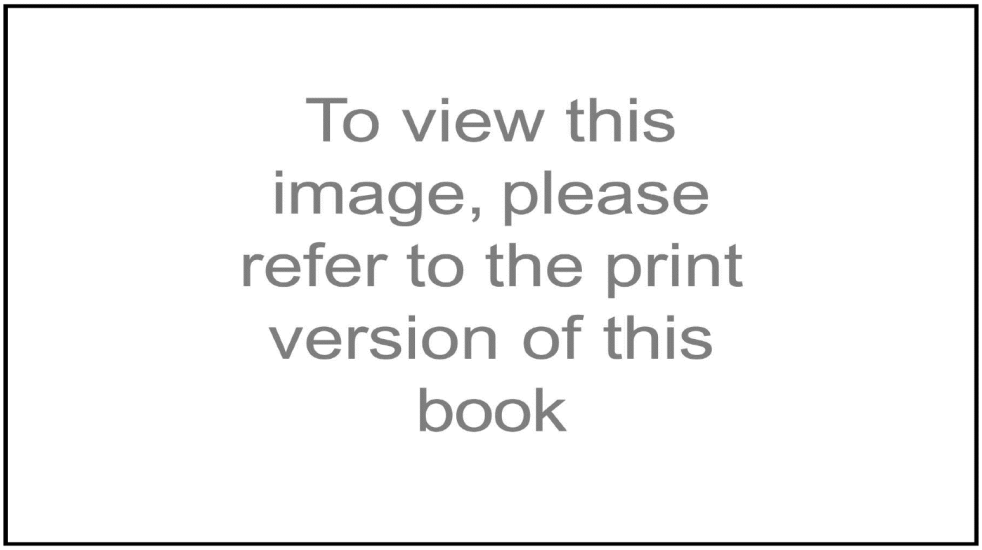

Fig. 4-6. *Engine-cooling airflow.*