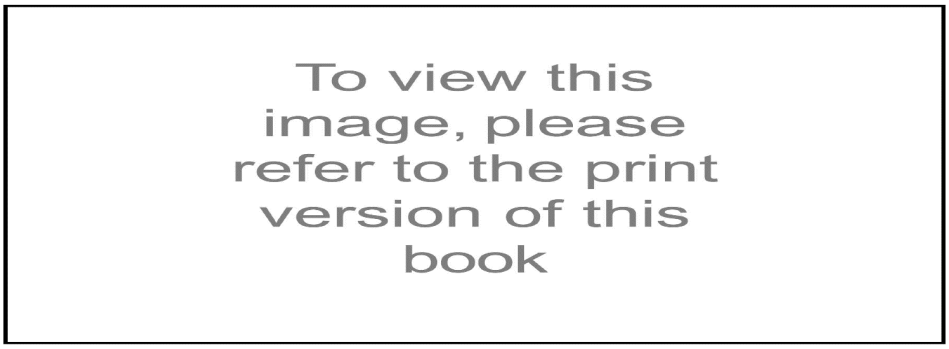

Fig. 4-12. *Cylinder head temp gauge bayonet probe.* (Courtesy of Alcor, Inc.)

In aircraft with fixed-pitch propellers, the RPM, or engine roughness, technique for leaning is used commonly. However, constant-speed propellers prevent detection of RPM variance. There is a more compelling reason for leaning with EGT, even with the fixed-pitch prop: the virtually indistinguishable difference between maximum power and maximum economy settings can be as little as .02 lb. fuel/lb. air.

A reciprocating engine can operate across a wide fuel/air mixture range—from .045 pounds of fuel per pound of air at lean misfire to .14 pounds of fuel per pound of air at rich misfire. It is at peak EGT that *stoichiometric combustion* takes place, meaning the maximum number of oxygen atoms and fuel molecules combine, producing the most efficient cruise condition. I used to love to work the word stoichiometric into conversations at parties when talking with women to impress them with how smart I was. It's probably why I've never been married. Anyway, engine operation at mixture settings leaner than that producing peak EGT can lead to cylinder and piston overheating, damage, and catastrophic failure. Operating on the rich side of peak, while less cause for concern, does produce lead-fouled plugs, costly engine deposits, and increased fuel consumption. The single-probe EGT system, common on many singles and light twins, actually measures the leanest-running cylinder as determined by the engine manufacturer.

In carburetor-equipped engines, fuel distribution differs among cylinders, and the actual cylinder experiencing the leanest mixture will vary with conditions and altitude. Because an excessively lean mixture is very harmful and the pilot has no way of knowing if the cylinder with the probe really is the leanest, a safety margin must be used to prevent inadvertent overleaning of one of the cylinders without an EGT probe. Therefore, manufacturers may recommend operating at best (maximum) power, which is achieved by enriching the mixture until the EGT is about 100 degrees F cooler than peak EGT. While safe, this technique is inefficient and costly. As the pilot leans the mixture from full rich, the airspeed will increase slightly until a temperature of 100 degrees on the rich side of peak (best power). If leaning is continued to peak EGT, the airspeed begins to decrease slightly, but range and fuel economy increase 15 percent, a significant advantage! Clearly, leaning to peak EGT is desirable but generally not feasible with the single-probe unit.