14. Ragged Edges
(The hazards of unallowable burring)

Competition is getting rougher. This compels us to use the most efficient machining processes, but in engine work we cannot replace an established practice with a new one simply because it removes material faster. There are other things to consider, too. Burrs left by machining is one of them.

The way I see the problem:

I know of an instance of actual damage that may shed some light on the problem: Combustion chambers are made of a material that is very difficult to machine. They have hundreds of cooling air holes that are very expensive to drill. So the engineers thought it might be a good idea to use a faster and cheaper drilling method. They did, but the combustion chambers they drilled performed very poorly in service. Closer examination showed that the new drilling technique had produced notable burrs at the exit end of the holes. This slowed down the flow of cooling air into the holes, so that the performance of the combustion chamber, which is very sensitive to such effects, suffered.

The serviceability of components may also be affected by the notch effect of a burr, even if it seems very small. If you take a look at this burr under sufficient magnification, you'll see that it has deep, sharp notches. From these, fatigue cracks may start and progress into the highly-stressed edges of holes or slots in a rotor disk, appreciably lowering the component's life expectancy.

Another problem may be caused when in a fuel or oil system, burr chips off. Particles from the burr, already past the protective filters, may then enter bearings and damage them.

So we see that components with burrs on them need careful attention, and not just because someone might injure their hand on them. Burrs must be detected and properly removed in recognition of the responsibility we have for the quality and safety of our components.

Things to remember:

Always be wary of burrs. Remember that burrs or similar edge deformations may result not only from mechanical machining, but also from such thermal processes as laser drilling and spark erosion, or from compaction as is caused by processes such as shot peening.

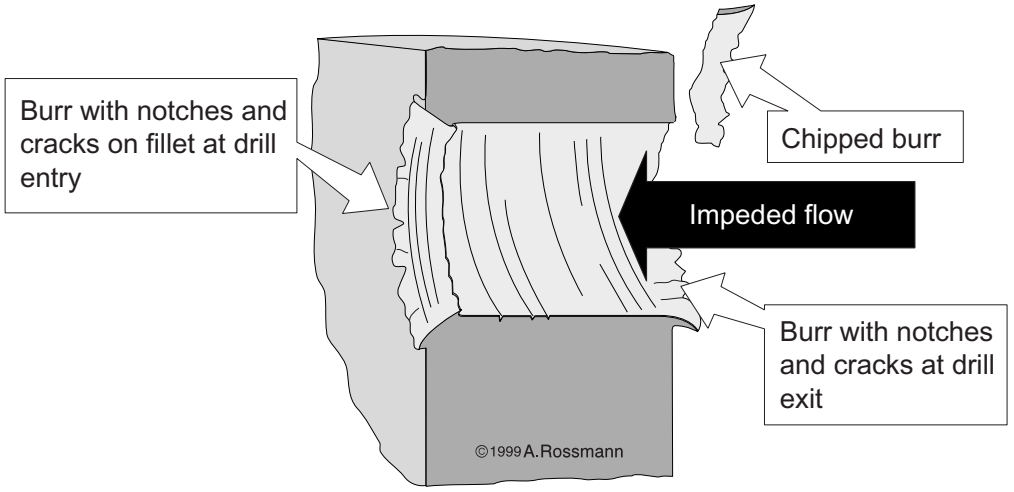
- Watch for abnormal burring throughout the manufacturing cycle; it may indicate unallowable variations in processes, auxiliary materials or component materials.
- When you change manufacturing practices or test new practices, watch for burring: it’s an alarm signal.
- Design engineers should clearly define allowable and unallowable edge conditions.

- Deburring is a responsible job and helps maintain the exceptional quality and life of our products.

- Deburring practices are full-fledged, clearly defined procedures to be performed in exact compliance with the associated specifications.

Burrs must be removed, if they can't be avoided in the first place.

Mechanically machined hole



Follow-on damage due to burrs:

- Notches and cracks can lead to fatigue crack growth and component failure.
- Broken-out burr pieces can block air, oil and fuel lines, and cause damage to roller bearing tracks, sealing surfaces and gear teeth.
- The assembly and connecting of components is made more difficult. Contact surfaces can be damaged.
- Reduction of flow due to higher coefficient of resistance.

Fig. 14

Burring may occur on all of a component's edges and with various manufacturing operations. It is a deficiency that impairs the strength and therefore the life of components. Deburring is a job that must be done properly and in accordance with instructions.