123 Maple Avenue
Ames, IA 50010

September 28, 2000

Dr. Gloria Starns
Mechanical Engineering
2062 H.M. Black Engineering Bldg.
Iowa State University
Ames, IA 50010

Dear Dr. Starns:

Enclosed you will find the results of my analysis for the lawn mower component we discussed on Wednesday, February 12, 2001. You will recall that the component was subjected to stresses of 45 ksi in the x direction, 25 ksi in the y direction and a shearing stress of 15 ksi in the x-y plane (a sketch of the critical stress element with directions follows this summary). Analysis includes determination of a factor of safety using three static failures theories: Maximum Normal Stress Theory, Maximum Shearing Stress Theory, and the Distortion Energy Theory.

Findings are as follows:

Maximum Normal Stress Theory

Factor of safety against yielding	=	1.18
Factor of safety against rupture	=	1.83

Maximum Shearing Stress Theory

Factor of safety against shearing	=	1.18

Distortion Energy Theory

Factor of safety against yielding	=	1.30

Since it is not clear from given properties whether or not the selected material is ductile or brittle, I have performed analysis that assumes both modes of behavior. The largest factor of safety, assuming brittle behavior, is 1.83, and the largest factor of safety against failure assuming ductile material behavior is 1.30. In my opinion, these safety factors **are not adequate for production**. My recommendation is to consider selection of another material with more strength. I do not recommend further processing of the material since it has already been normalized. Annealing while increasing ductility will only further reduce strength.

Supporting analysis follows. I am looking forward to your review.

Sincerely,

I. M. Emee
Senior, Mechanical Engineering