In "Explosive Deburring", metal parts are loaded into a thick walled vessel, an explosive mixture of methane and oxygen is pumped into the chamber at a pressure of 5 atmospheres and the mixture is detonated by a spark from a spark plug. Shown below is a 4 cm diameter steel sprocket (for driving a chain) before and after explosive deburring.

a) One engineer believes that the burrs are removed by the shock wave associated with the explosion. But you remember reading that that this process is also called "Thermal Deburring" and that the burr is actually removed by a combination of burning and vaporization. Provide two arguments to prove to your colleague that the shock wave can't be the mechanism for burr removal. One of the arguments should be based on physical principles with order of magnitude analysis and the other based on examination of the photos above. Express the argument based on physical principles symbolically and then estimate it numerically (see Note 2 below).

b) Your boss says that she would like to avoid explosions and asks you to change the methane/oxygen mixture so that it burns quickly, but does not explode. Develop a scaling argument to estimate how fast the flame front would have to move through the burning gas in order to deburr the part. Express the scaling argument symbolically and then estimate it numerically (see Note 2 below).

Notes:
1) Make and state any assumptions that you need.
2) If you happen to know approximate values of relevant physical properties, use them. If not, or if you are not sure, try to estimate them from your experience.