

In this very dramatic demonstration of air pressure a 55-gallon barrel is crushed by atmospheric pressure.[†] Water is boiled in the barrel to fill it with steam and water vapor. The barrel is then sealed and cooled with ice. When the steam condenses, its volume shrinks by a factor of about 1000, reducing the pressure within the barrel dramatically. The external air pressure then is sufficient to crush the barrel with a dramatic crack, as shown in *Figure 1*.



Figure 1

[†] Sutton, *Demonstration Experiments in Physics*, Demonstration M-326, Collapse of Tin Can.

We'll use atmospheric pressure to crush this sturdy steel barrel.

To accomplish this feat we must remove the air from the inside of the barrel so that it no longer balances the pressure from the external air.

To remove the air, we'll put a small amount of water in the bottom of the barrel.

Gas burners heat the water to boiling, and steam from the boiling water gradually drives the air out of the barrel.

When all the air is replaced by steam, the barrel is capped tightly.

Now we'll cool the barrel by loading ice onto the top.

As the steam cools it condenses to liquid water, which falls to the bottom of the barrel.

The steam pressure inside no longer balances the tremendous force due to external air pressure, and the barrel is crushed.

Equipment

1. 55-gallon barrel.
2. Four gallon cans to elevate barrel above burners.
3. Four Meker burners and sufficient tubing.
4. Supply of natural gas.
5. Source of flame.
6. Supply of water.
7. Gloves
8. Plugs for barrel openings.
9. Wrench.
10. Supply of crushed ice.