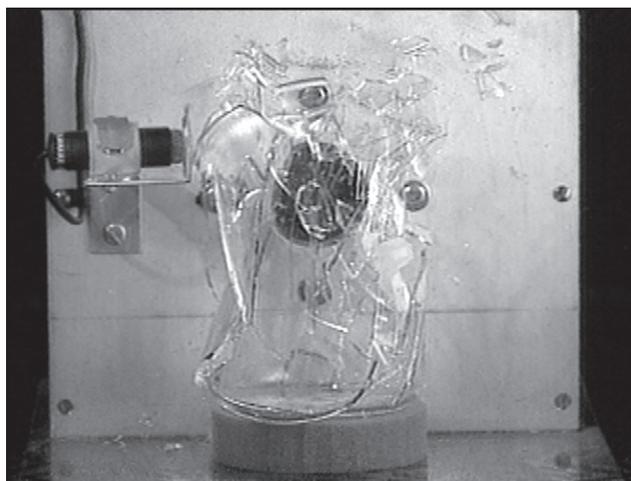


A glass beaker is caused to vibrate by exposing it to the sound wave produced by a high-power loudspeaker. If the frequency of the oscillator is set to exactly the resonant frequency of the beaker, the oscillations of the beaker can easily exceed the elastic limit of the glass, and the beaker will shatter,<sup>†</sup> as shown in *Figure 1*. This demonstration has been compared with the supposed shattering of a wineglass by a singer, which is totally without basis in fact.<sup>‡</sup>



*Figure 1*

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<sup>†</sup> Thomas D. Rossing, Wine Glasses, Bell Modes, and Lord Rayleigh, *The Physics Teacher* 28, 582-585 (1990). Haym Kruglak, Robert Hiltbrand and Don Kangas, Shattering Glass with Sound Simplified, *The Physics Teacher* 28, 418 (1990).  
<sup>‡</sup> Haym Kruglak and Rene Pittet, The Caruso Legend Lives on, *The Physics Teacher* 17, 49 (1979).

We will demonstrate resonance by breaking a glass beaker with a sound wave.

This beaker has a natural oscillation which can be produced by gently tapping its brim. We create a resonance by exposing the beaker to a sound wave of the same frequency.

For this demonstration we use a stable oscillator,

a power amplifier,

and a horn driver which can handle a large amount of power.

The beaker is positioned on a foam rubber pedestal in front of the hole from which the sound emerges. The sound wave emitted by the vibrating beaker is picked up by the microphone to the left of the beaker and displayed on the oscilloscope, the oscilloscope is triggered by the signal from the oscillator, but displays the signal emitted by the beaker, so that both the amplitude increase and the phase shift can be observed as the frequency is tuned through resonance.

The frequency of the oscillator has now been set to the natural frequency of the beaker.

Using a stroboscope, the oscillations of the brim of the beaker can be viewed from above.

Returning to a front view of the beaker, we now increase the amplitude of the sound wave until the oscillation of the beaker exceeds its elastic limit.

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***Equipment***

1. Highly stable audio oscillator.
2. Power amplifier.
3. Horn driver.
4. Support system for number 3 and a microphone.
5. Foam rubber pad.
6. Oscilloscope.
7. Strobe light.
8. Safety shield.