CHAPTER 6

# Experimental Techniques used to Evaluate Intermittent Motion

### Exact Measurements Are Difficult

Since it is difficult, and sometimes impossible, to calculate exact forces, accelerations, velocities, and displacements in many intermittent motion devices, it is useful to know how to evaluate the performance of a prototype design, experimentally. Unfortunately, it is often as difficult to make exact measurements as to make exact calculations when we are dealing with transient forces of very short duration, deformations, and the like. Nevertheless, the combination of rough calculation and approximate measurement is still very helpful for evaluating and improving designs. The mere act of observing and measuring the performance of a model, of course, often gives the engineer insight that leads instinctively, if not scientifically, to an improved solution to his design problem.

In studying high-speed intermittent motion devices we need measuring equipment that can detect rapid changes in highly localized portions of the machine bodies being studied. Ideally, the measuring device should be stable (produce no vibrations, etc., of its own) and it should load a machine so lightly that it does not effect the motion of the thing being measured. Many of the techniques which satisfy these conditions require fairly expensive equipment, and some skill and experience to operate it correctly. We will not give detailed instructions for the use of such equipment here, since such instructions would soon be out-of-date and current instructions are available from the manufacturers of the equipment you purchase. We will describe the measuring equipment in general terms, however, so you will know what to ask for.

### What Can Be Measured?

Displacement is probably the easiest parameter to measure at the present time. Many different techniques are available, experimental systems are relatively simple, and the results are generally easy to interpret.

Force is probably the next most easy thing to measure because such tools as strain gages and photoelastic coatings are available; but here, expertise is very definitely required. M.I.T. (and probably, other engineering schools) gives a two-week summer course in stress and strain measurement. This is an excellent way to get started if it can be arranged. Otherwise; work closely with your suppliers.

Velocity and acceleration are very difficult to measure directly, especially when dealing with transients, because there is very little instrumentation available. Furthermore, most of that which now is available really measures displacement or force, and then electronically integrates or differentiates these measurements to give a readout in terms of velocity or acceleration. Fortunately, we are usually more interested in displacement or in force, than we are