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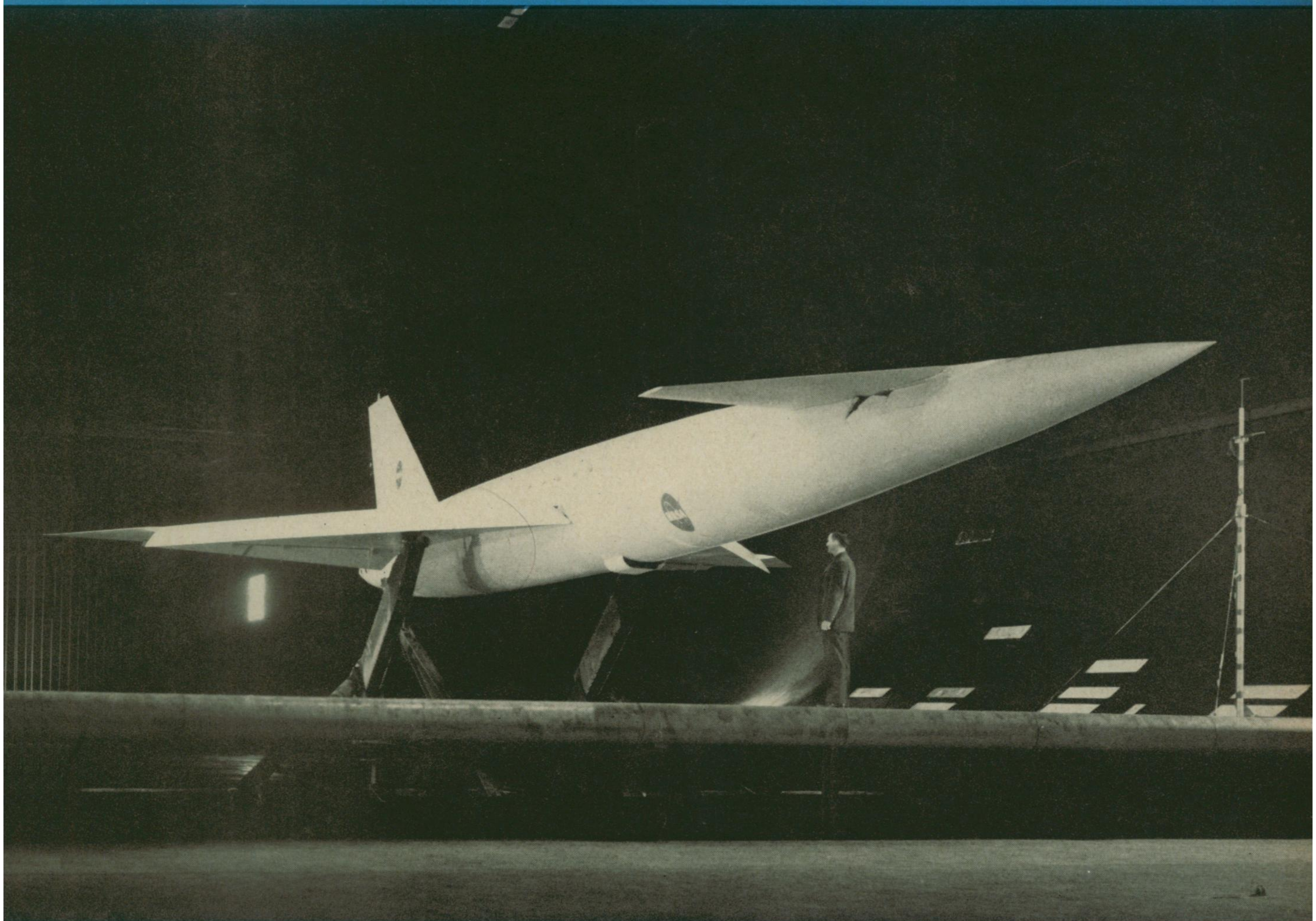
THE WEEKLY SUMMARY OF CURRENT SCIENCE



NASA

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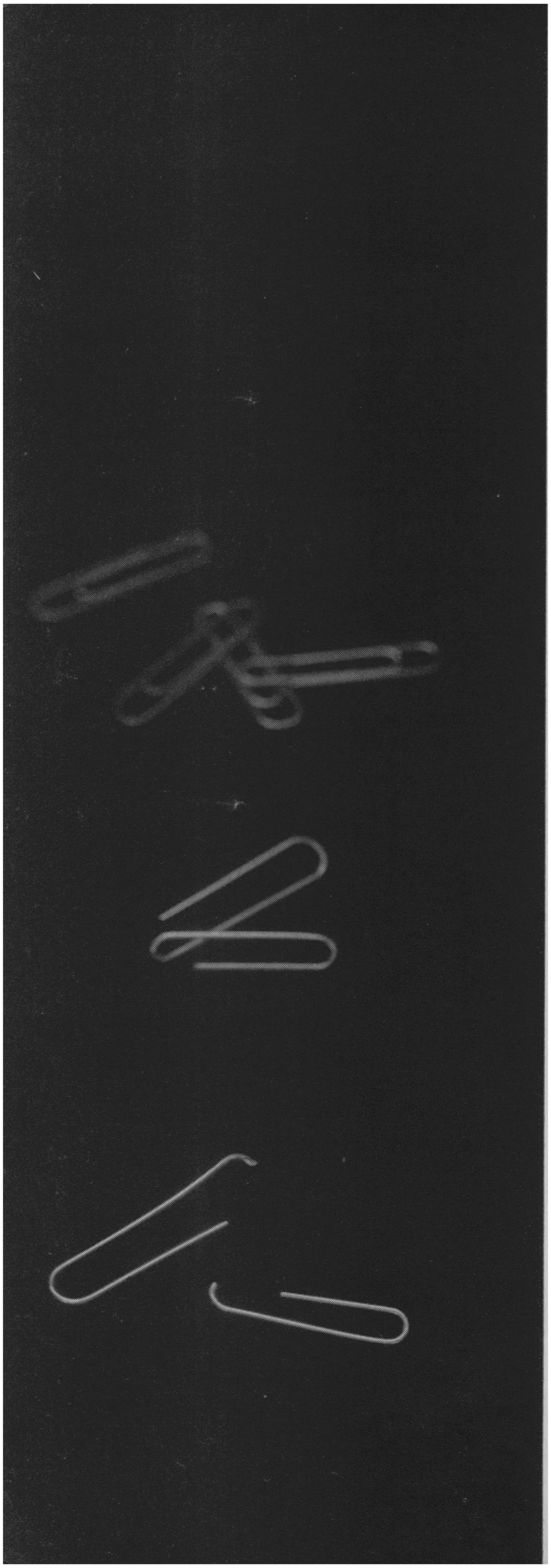


One of a series briefly describing GM's research in depth

The Curious Crystallography of Fatigue

Ever bend a paper clip back and forth till it breaks? That's metal fatigue, a problem important to those who work with materials and one just beginning to be understood at the atomic level. Unfortunately, there is still no generally accepted explanation as to why repeated loading on a part leads to the formation of fatigue cracks and eventual failure.

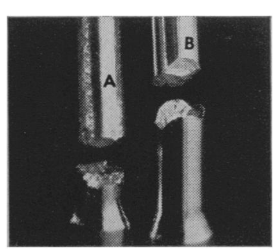
By stressing copper single crystals in cyclic torsion, physicists at the General Motors Research Laboratories are acquiring information that may help fill this gap. For instance, they have been able to relate fissure development to crystal orientation—and the type of surface deformation to the amplitude of cyclic strain.

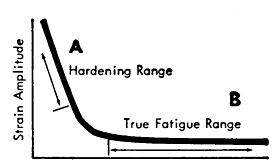
In developing a theory of fatigue, they have found that a fundamental distinction must be made between cycling at high and low strain amplitudes. In the hardening range of the fatigue curve (high amplitude), the crystal fractures in an irregular manner. In the true fatigue range (low amplitude), the fracture follows roughly the crystal's slip planes.

This basic research may eventually make it possible to predict the fatigue properties of an alloy from a knowledge of its microstructure. It's another example of the "research in depth" approach used by General Motors scientists and engineers to make things better.

General Motors Research Laboratories

Warren, Michigan





Note differences in two fractured single crystals of copper—identically oriented but fatigued at different amplitudes.