PHYSICS

Same Plastic May Be Made Hard or Soft, X-Ray Shows

It All Depends on the Orderly or Disorderly Array Of Its Molecules; Compromise Between Extremes Better

THE SAME plastic may be hard or soft according to the orderly or disorderly arrangement of its molecules. This was disclosed by X-ray investigations made in the Bell Telephone Laboratories by W. O. Baker, C. S. Fuller and N. R. Pape.

The molecules of a plastic are very large, thousands of times larger than those of water or gasoline. They are long and threadlike, being composed of many atoms strung in a row, and so are called chain molecules or polymers.

If the molten plastic is rapidly cooled and quenched, the X-rays revealed that the molecules are in a very disorderly state, as though the rapid solidification had not given them time enough to arrange themselves in a more regular fashion. The plastic is then soft and flexible.

If, however, the plastic is slowly cooled, the molecules do arrange themselves in a quite orderly fashion. They do not all face in the same direction, as in a single crystal, but in groups, the members of which all face in the same directions while the groups face in different directions. The plastic is then hard and strong, but may also be brittle.

Evidently a compromise between these extremes is to be desired. Hardness and strength must be combined with toughness rather than with brittleness. This goal can be attained, the studies showed, by regulating the quenching treatment so as to give the right proportion of ordered to disordered molecules. If a plastic comes out too soft, it can be hardened by moderate reheating and slow cooling.

This last operation brings out a striking difference between plastics and other solids, namely, that the molecules of a plastic even in the solid state can, to some extent, move about into a more orderly arrangement. In most other solids it is believed that the molecules are fixed and do not move from their positions until the melting point is reached.

This limited mobility of the molecules of a plastic even in the solid state, the investigators believe, is related to the curious property of "lazy" recovery when the plastic is deformed. It does not snap back like a steel spring, but returns slowly and at a decreasing rate—strikingly exemplified by vinyl plastics.

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AERONAUTICS

High Flying Airplanes Are Made Safe By Tests

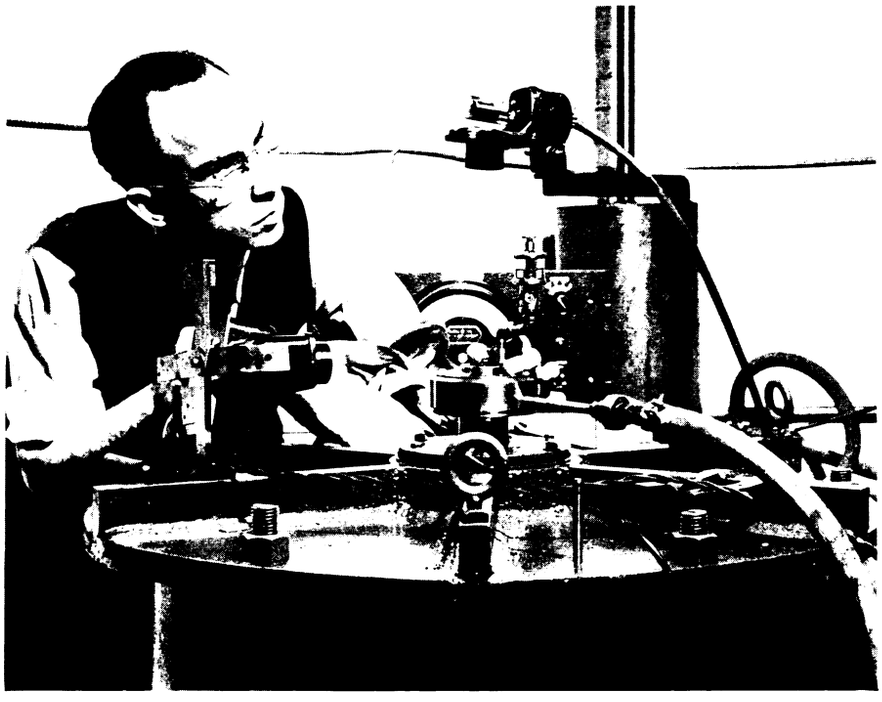
BY SPINNING the rotors of the supercharger and other metal wheels in a vacuum up to 1,000 revolutions per second, or until they fly apart, our bomber planes are being made safe for high altitude flying. The tests are being carried out by scientists at the General Electric Research Laboratories.

The wheels, weighing as much as ten to twenty pounds and a foot or more in diameter, are the largest and heaviest ever driven at this terrific speed, the scientists say. Every pound of metal on the rim exerts an outward pull due to centrifugal force of over 100 tons.

When the wheel bursts, the fragments fly in all directions with speeds around 1,400 miles per hour. They have as much energy as the projectile of a small naval gun. The wheel literally explodes.

As may be imagined, the chamber in which the wheel is spun, is built with massive steel walls. These are sometimes lined with lead bricks to reduce damage to the fragments so that the nature of the fractures may be examined.

This chamber is exhausted of air to a pressure one ten-thousandth that of the outside air. The vacuum is necessary because otherwise the air resistance would be so great that thousands of horsepower would be necessary to overcome it. With the wheel in an almost non-resistant vacuum, a one-horsepower turbine,



FOR TEST SPIN

This machine spins wheels at high speeds up to 1,000 revolutions per second. The wheel is suspended in the tank, from which the air has been exhausted, shown at the bottom of the picture. On top of the tank is a small compressed air turbine that spins the wheel. Frank D. Quinlan, of the General Electric Research Laboratory, is looking at an electric eye which receives flashes of light from the spinning wheel by means of which the speed of rotation is determined.