ENGINEERING

# Test Human Ability to Stand Motor Car Vibrations

## Human Ear, Not Modern Instruments, Is Final Judge Of Noise In Annoying Quality of Auto Noise

TRANSVERSE vibration, or sidesway, causes motor car riding annoyance quicker than any other type of vibration, it was disclosed at the meeting of the Society of Automotive Engineers in White Sulphur Springs, W. Va.

Prof. H. M. Jacklin, Purdue University authority, told of his studies of motor car vibrations with an instrument for measuring accelerations. The apparatus turns mere human guesses about riding comfort into facts and figures.

First using a shaking table in his laboratory and test subjects seated on hard-type rattan street car seats, Prof. Jacklin found the following comparison between the three possible types of vibration—transverse (sidesway), longitudinal and vertical.

| | |
|---|---|
| Vertical | 31.20 |
| Longitudinal | 4.02 |
| Transverse | 2.35 |

The figures represent an arbitrary scale devised by Prof. Jacklin which gives a measure of vibration tolerated with only "disturbing" results. The important thing is that the human body will tolerate nearly twice as much longitudinal vibration as transverse, and nearly 15 times as much vertical vibration as transverse or sidesway.

Going from the laboratory to driving in real cars, Prof. Jacklin used a specially chosen test group of observers whose records in the laboratory indicated that they were most nearly normal in their reactions to riding discomfort.

### "Disturbing"

Particular attention was given to "disturbing" vibrations which Prof. Jacklin defines as, "You note that certain organs or parts of your body have greater vibrations than you yourself, and you try to prevent this by tightening certain muscles."

Tests with the accelerometer showed that the maximum average acceleration tolerated before the "disturbing" conditions set in was one having a rating of nearly 10 feet per second. This is almost one-third of the acceleration of gravity in a free falling body, as if one jumped off a building. It is essentially the same acceleration used in the most modern of high-speed elevators.

Practical applications of his studies have already been made, said the Purdue professor. Special sponge rubber seats have been used to determine how they absorb the annoying vibrations. Using small vents in the sides of such seats, so that they act as bellows, it has been found that holes only one-quarter of an inch in diameter give best riding results.

Marked differences between old and new model cars were also found. Particularly good in its riding characteristics was a small German car having its motor in the rear. "It would seem that there may be real possibilities in this type of construction if the car were built of a size suitable for the American public," concluded Prof. Jacklin.

### Ear is "Supreme Court"

Despite all the modern sound analyzing instruments and learned talk of decibels, it is ultimately the ear of the motor car purchaser which decides whether the family's new automobile is noisy or not.

This, in essence, was the warning presented by John S. Parkinson of the Johns-Manville Research Laboratories.

Because it is the motor car owner who decides the apparent noises of an automobile (with the resultant reaction on sales) Mr. Parkinson described to his fellow automotive engineers the role of the ear as a noise-measuring instrument.

After discussing the role of sound pitch and intensity as factors of noise production, the speaker added:

"It is a curious fact that the annoyance caused by a sound is also very intimately related with the hearer's opinion as to whether the sound is necessary. There is evidence of this from everyday experience. A rattle or a squeak which does not appear to be necessary is considerably more disturbing than the ordinary engine noise which we always hear, even though this latter noise may be considerably louder. Unfortunately we have no instrumental means of measuring such uncertain psychological factors as this."

But while stating that the car owner's ears were the final court of judgment on car noises, Mr. Parkinson urged wider use of sound analyzing devices so that studies could be made of the various pitches of sounds produced by an automobile.

All manner of high and low pitched sounds are present, he explained, but it has been found that the noise only becomes annoying when the high pitches predominate. Low pitch sounds or a composite of sounds without any one frequency being predominant are the best compromise, he declared.

"Automobiles will never be quiet," Mr. Parkinson added, "but must always be quieter." Paradoxical as this may seem at first, it means that engineers must so balance and mix the known automobile noises so that the effect to the ear is less annoying and thus, in effect, quieter.

### Airplane Research

In contrast to Mr. Parkinson's report on blending sounds to reduce the apparent noise was the address of S. J. Zand, American engineer who has served as aviation acoustical consultant for both the French and Italian governments.

As acoustical expert for the Sperry Gyroscope Company on soundproofing airplane cabins, Mr. Zand frankly told the automotive engineers that they could reduce the noise level inside a modern motor car by 40 per cent if they wished to take advantage of what has been learned in the much more difficult field of aeronautical research.

Quieting cars would be a much easier problem than soundproofing airplane cabins located within a few feet of one of the most powerful sources of noise known to man—the airplane propeller.

The fact that cars are still noisy, Mr. Zand intimated, can be explained only by the fact that the automotive industry is not willing to appropriate sufficient funds to accomplish a thorough study of automotive acoustics. He went on to explain how such acoustical research might be carried out, emphasizing the fundamentals of acoustical phenomena.

### Next Year's Car

What will America's motor cars for 1937 look like?

No one at the meeting of the Society of Automotive Engineers gave a specific answer to the question, but behind-thescene facts about the stages by which automobile designers arrive at their final model were revealed by George J. Mercer, consulting body engineer of Detroit.

Here is an approximate recipe for producing next year's motor:

### Conservative Plus Radical

Take one part each of conservative body designer and artist with radical design tendencies. Let them produce drawings of what they would like the new car to look like on the assumption that the factory can produce anything. Then add two parts "practical" engineers who can season the extreme designs with knowledge about tool and die costs. Mix in a dash of public opinion as determined by questionnaires and test the mixture on a small group of executives.

Strange as this procedure may seem, it is one method of arriving at the new models. Inherent difficulty is that few people, either in the industry or out, have any concrete ideas of what they want. In the main they can only tell what they don't want, Mr. Mercer indicated.

Napoleon's comment that the only thing worse than an army with a poor general was an army with two good ones is equally applicable to body design, said Mr. Mercer. Final decision on the body style choice must be left to a small committee which may well have one woman member.

Final step in production is spreading the work out as widely as possible so that secrecy may be preserved. The idea is that while many people may know a few details it will be difficult for a competitor to get enough pieces of information together to make sense.

*Science News Letter, June 6, 1936*

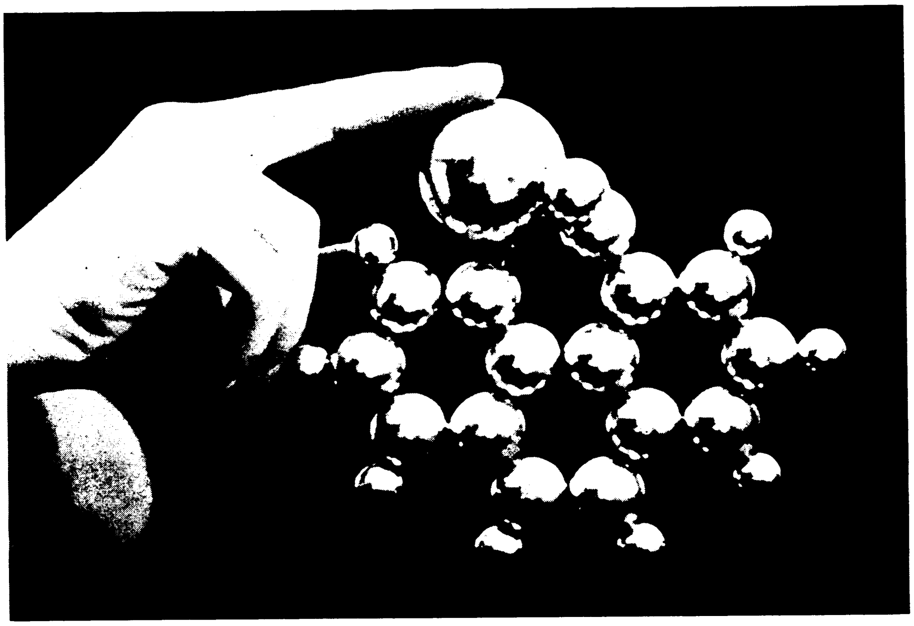
ORNITHOLOGY

## First Adventure of Young Robins Pictured

See Front Cover

JUST a couple of young robins, big enough to leave the nest but not quite ready yet to "go it alone" in the wide world provide the subject for the front cover illustration of this week's SCIENCE NEWS LETTER. They hang onto their twig with all the grip there is in their small toes—for there may be a cat on the ground. The photo is from the camera of Cornelia Clarke.

*Science News Letter, June 6, 1936*



*MODEL OF COMPLEX MOLECULES*

*With aluminum spheres whose relative sizes accurately picture the sizes of the different atoms chemists can now foretell whether they can build up complex organic molecules. Above, the chemist's hand is trying to add a large iodine atom to an already complicated molecule. Because the iodine atom is so big, it will not join on to the model at its proper place. Thus the chemist knows he cannot prepare the compound known as 5-iodo-4-nitro-phenanthrene, except perhaps in an indirect way. Dr. R. E. Steiger of Swarthmore College developed the molecular models.*

CHEMISTRY

# Large Models of Molecules Predict Chemical Facts

By DR. W. E. DANFORTH, Bartol Research Foundation of the Franklin Institute

A WATCH designer, in order to facilitate his work, may construct a model several times larger than the finished time-piece will be.

How convenient it would be for the organic chemist if he, likewise, could enlarge the molecules with which he deals to a size of several inches. Instead then of vainly attempting for months to prepare a certain compound, he could have seen at the outset that the method he was using could not possibly lead to the desired result.

The organic chemist is always anxious to know just how closely atoms or groups of atoms, appearing in the molecules of a compound, approach each other in space. With this knowledge he could foresee whether or not certain phenomena would take place.

To represent organic molecules correctly, models should be composed of spheres made to the scale of the atoms with a properly chosen magnification. Moreover, the spheres should not be separated by rods as are those in the old-type models.

This has been fully realized by Dr. Robert E. Steiger of Swarthmore College. His "Organospheres" are 172,410,000 times the actual size of the nonmetallic atoms one is most likely to find in organic substances. Made of solid aluminum, they can be connected to each other, at specific points ("valence points") on their surfaces, by means of pins which are no longer visible once the connection has been effected.

To speed up construction of the desired models, complete sets of Organospheres contain assemblages of two or more spheres corresponding to the groups of atoms most frequently occurring in organic compounds.

George A. Bourdelais of the Engineering Division of Swarthmore College deserves great credit for having successfully solved the serious technical diffi-