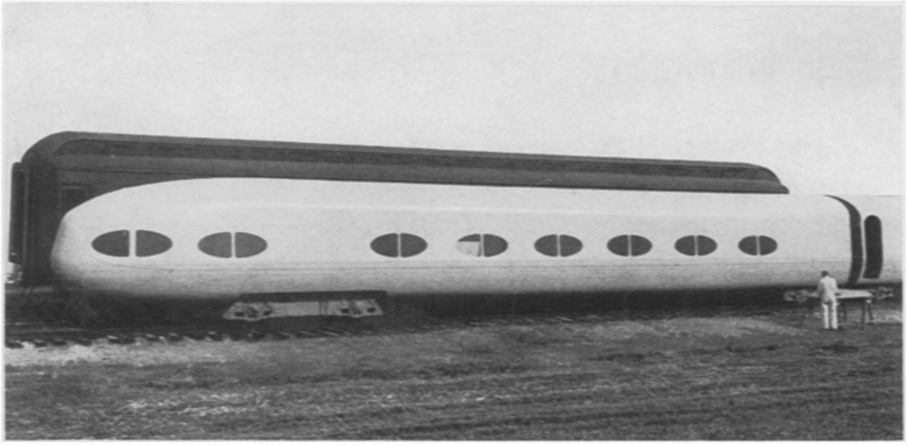

TOMORROW'S RAILROAD COACH

It may be coming to life in the form of this "pendulum" car now being developed by three California Institute of Technology scientists near Los Angeles. It hangs by soft springs from towers mounted on the trucks instead of resting on short, stiff springs over the trucks; it saves weight by applying aviation's "monocoque" construction which uses the skin to support the structure, thus eliminating girders and saving weight. Notice how low it appears compared to the conventional car behind it; but it is no less roomy.

ENGINEERING

New Type Railroad Coach May Revolutionize Travel

Borrowed From Disused Monorail Car, "Pendulum" Suspension From Above Brings Comfort to Travelers

By DR. R. M. LANGER

A RADICALLY new type of railway car that may revolutionize American train-riding habits and may recover much of the passenger traffic lost by the railroads in recent years to the bus and automobile is under test near Los Angeles.

Differing markedly from conventional cars not only in appearance but in fundamentals of construction as well, the new "pendulum" type car is hung like a hammock from above instead of riding on short springs over the trucks and under the floor of the car.

Swinging easily from the long soft springs by which it is suspended, the cars give passengers a ride which, for smoothness, cannot be compared with present-day passenger equipment.

Built for the Atchison, Topeka and Santa Fe Railway, the car is a practical and novel compromise with the frequently-tested, but never widely applied, principles of the monorail car.

When going around a curve, the floor swings out farther than the ceiling like a monorail and opposite to the ordinary cars of today. If a passenger happens to be drinking a glass of water on a curve the motion of the car is such as to help him balance instead of tending to spill the drink into his neighbor's lap.

While the riding advantages of the monorail overhead track suspension are obtained, the car runs on ordinary rails, eliminating one of the most important objections to the introduction of the monorail.

A four-wheeled truck is built up with two towers reaching about halfway between the floor and ceiling. Four flexible springs are carried on top of the towers, from which the car is suspended. Two such trucks carry each car. The springs are contained in closed compartments which take up only a small fraction of the useful space in the car. Lateral and longtitudinal motions are united and cushioned.

Since the springs are not crowded into the limited space, they need not be nearly so stiff as in present trucks so that riding qualities are superior and a trip is smoother as well as better balanced. It is easier to write or to walk and there is less jarring on the new cars than on standard coaches attached to the same locomotive and passing over the same track.

Railroad Family

The new development is due to three young men, Cortlandt T. Hill, William E. Van Dorn and F. C. Lindvall, who designed and built the trucks and passenger coaches tested by the Sante Fe. Hill is the son of the retired chairman of the board of directors of the Great Northern Railroad and grandson of James J. Hill, the "Empire Builder." Van Dorn, who originated the project while studying at the California Institute of Technology, comes from a railroad equipment family. Lindvall is professor of electrical engineering at the California Institute of Technology and a graduate of the Railway School of the University of Illinois.

The new coach appears much lower than the standard passenger car, yet it is as roomy as the older model. The floor level is low, giving great stability and convenience.

Differing not only in the way it is mounted, the car represents a combination of construction principles used in other transportation fields.

There are no supporting beams in the new coach. The strength is contributed entirely by the shell of the car itself. This is the socalled stressed-skin or monocoque type of construction which has been developed so successfully in the airplane industry.

Double Use

The weight of the strength members in present passenger coaches is the major load and the double use of the shell or skin for structural as well as for closure purposes is an important weight saving. The new construction is more rigid than than the old and as resistant to collapse in accident. The stressed skin construction naturally leads to rounded corners, smoother stream-lined bodies and graceful elliptical windows. Full air-conditioning will be provided.

In test runs up to 94 miles an hour riding records show a superiority of the "pendulum" car over standard, and standard lightweight, equipment in the same train.

During the tests engineers rushed from the standard cars to the new ones, carrying gadgets designed to measure the jerks due to curves and the inevitable irregularities of the track. Others sat by groups of blocks like children's building blocks and watched them topple as the cars lurched. Some sat at tables and tried to write, to compare the ease of writing in different cars. Some wandered through the corridors to see how hard it is to keep their balance. Others just looked at the landscape "to feel" the ride.

As important as the comfort of the passengers, is the cost of operation and maintenance of the new car. This is determined, in large measure, by the lightness which can be achieved without loss of safety. In this respect the "pendulum" car is noteworthy.

The "pendulum" car weighs 60,000 pounds as compared with about 160,000 pounds for the standard coach of today. The lightness makes possible faster stopping and starting. The good road-holding and smooth-riding qualities mean that there is no sacrifice of passenger comfort or long life of equipment. Diminished fuel and motive power requirements for light trains constitute an additional saving of weight. Braking becomes easier and the wear on wheels and tracks and roadbed is cut down.

The pendulum action and low center of gravity allow higher speed on curves. The linkage between the body and trucks is so flexible that the train could go around a curve of 180-foot radius. These considerations are especially important on short, tortuous runs through suburban areas where commuters watch every minute of schedule time.

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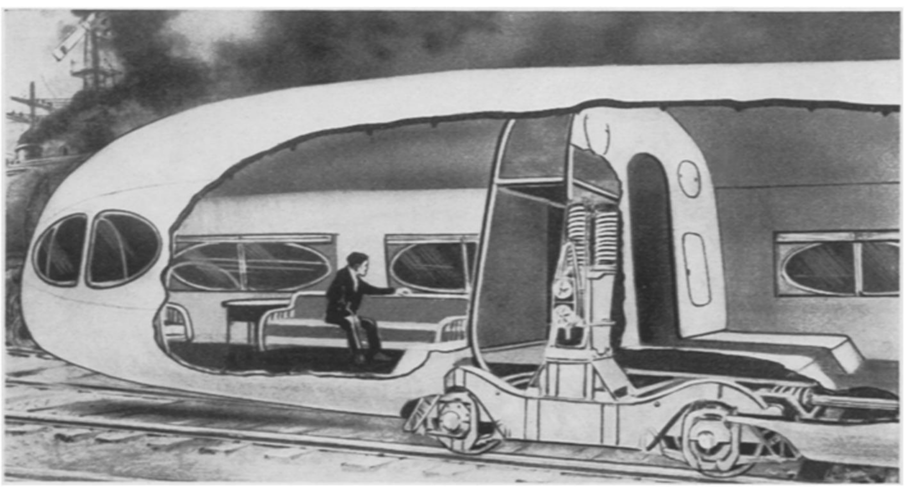

SUSPENSION

Soft springs on these towers carry the "pendulum" car which is suspended from them. Result of the novel construction, details of which are shown in this artist's drawing, is an easy-riding car that takes curves so well water will not spill out of the passenger's drinking cup. The principle of overhead suspension is adapted from monorail cars, which were never widely used because of already-existing two-rail track facilities; the new car rides on the regular tracks.

CHEMISTRY

Make Your Own Diamonds of Iron Filings and Sugar Carbon

Graduate Students Can Produce Genuine Stones, But Have Trouble in Finding Them After They Are Done

REAL diamonds made in the chemical laboratory, synthetically, were described at the meeting of the American Chemical Society in Dallas, Texas.

How many imminent bridegrooms for this year's crop of June brides thus missed an opportunity to go into the diamond-making business at the right time is unknown, but for their benefit the details should be recorded as outlined by Lewellyn D. Lloyd of the chemistry department of McPherson College, McPherson, Kansas.

Under the direction of Dr. J. Willard Hershey at McPherson synthetic diamonds have been prepared by successive groups of graduate students. Here is the simple formula for making diamonds:

Mix two parts of chemically pure iron filings with one part of pure sugar carbon, by volume. Place in a graphite crucible and heat to a temperature of at least 4,000 degrees Centigrade for a little over an hour. Then remove the crucible and plunge into a freezing solution of ice and salt brine. Treat the hardened mass with hot aqua regia for 300 hours to dissolve the iron and digest the residue as much as possible with various acids. Finally search the remaining carbon dust for the diamonds. Use a microscope in the search, for any diamonds will be very tiny. But they will be diamonds, which is what you started out to make.

But seriously, the simple statements above have required a great amount of research to bring them about. When Dr. Hershey began the year there was no way in which temperatures of 4,000 degrees could be controlled in a fashion required in the research. And there was the problem of building a fire brick furnace that could withstand the high temperatures.

The continued research has shown, Mr. Lloyd indicated, that the formation of the diamond seems to depend on how fast is the cooling of the heated mass of iron and carbon. This cooling and the tremendous pressures which are built up inside the iron-carbon mass during cooling, seem to turn black carbon into the transparent carbon which man calls a diamond.

As white hot molten iron cools to a red solid it expands, Mr. Lloyd said. As it cools from a red solid to room temperature it contracts. Thus the outside of the iron, which cools more rapidly than the inside of the mass, is contracting while the inside is still expanding. The carbon, dissolved in the iron, is thus subjected to a pressure estimated at 180,000 pounds to the square inch.

Dull Treasure Hunt

One of the most tedious stages, Mr. Lloyd said, is the searching for the microscopically-small diamonds after they are made. A student has recently proposed a method of mixing the final residue with potassium bisulphate which has a specific gravity between that of graphite and diamonds. Thus, the diamonds, if there are any, should sink to the bottom and the graphite float to the top. After the mass hardens it should