Maurice Olley

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by
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Today I want to talk about Maurice Olley

To understand Maurice Olley’s accomplishments in ride and handling one must know something of his background.

Olley was born in 1889 and spent all of his childhood in North Wales close to the Holyhead Road, one of the great historic roads on the island where the Royal Mail Coaches traveled before the railways came. In Olley's time it had been largely abandoned and served as a convenient playground and cycle track.

By the turn of the century when Olley was 11 years old it showed signs of life with strange “horseless carriages” which frequently broke down and had to be cranked back to “heaving life, after which they would explode themselves away out of sight.”

This was Olley's first exposure to the automobile and was the inspiration for his life's work.

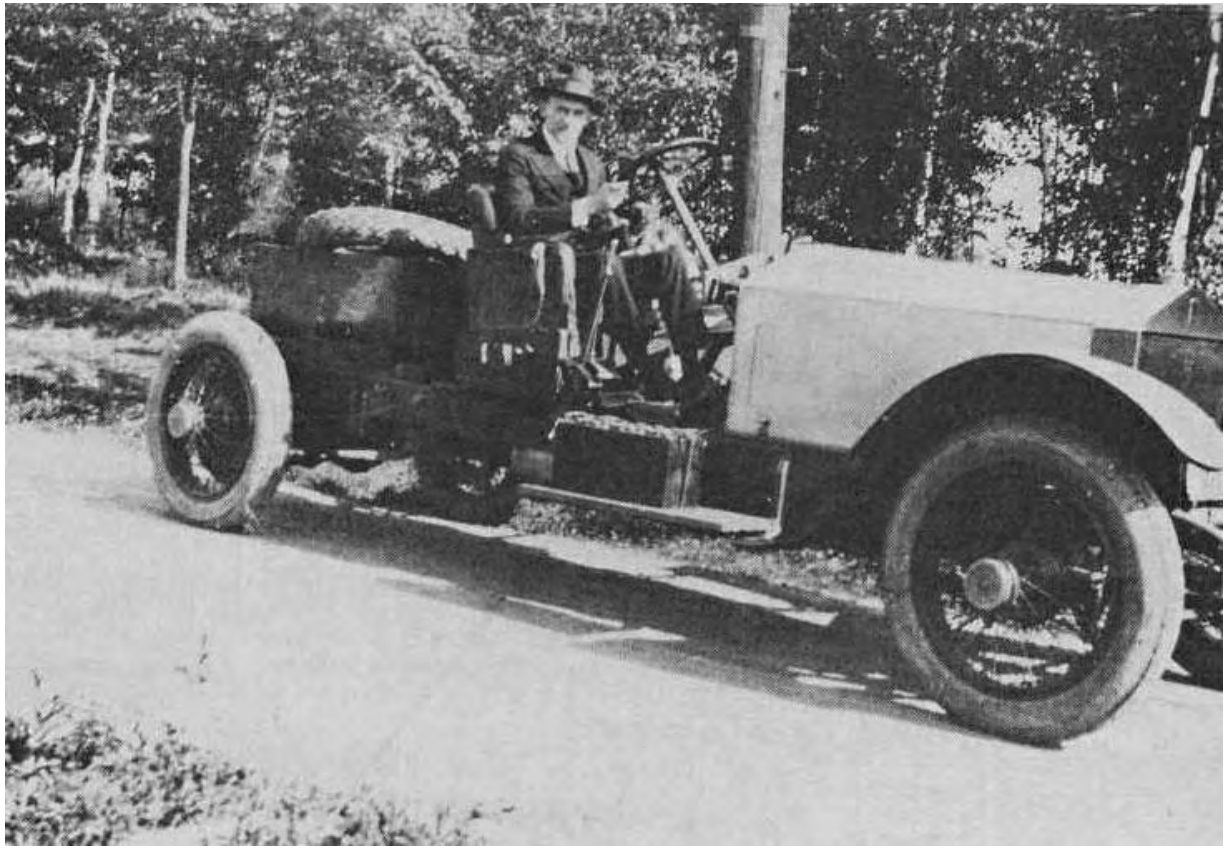
By 1906 Olley had completed one year in the Honor’s Engineering course at the University of Manchester, then became ill with tuberculosis and spent the next year on a farm recovering.

By 1912 he was working for Rolls Royce as a draftsman and the following year was sent to Le Canadel on the Riviera as a tool and jig designer for Sir Henry Royce who with his design team was located there.

By 1914 on the eve of WWI he was designing everything from starters and generators to cam shaft drives and planetary reduction gears, the latter for the Eagle aircraft engine.

In 1917 he was sent to the USA to study tooling and became involved in contracting with American car companies for producing components for the Eagle. While there he predicted the torsional crankshaft vibration which plagued the Liberty engine.

At the end of the war, 1918, Rolls-Royce decided to manufacture cars in the USA and Olley was to spend the next 10 years (to 1928) as chief engineer of R-R in Springfield, Mass. He was also involved in obtaining the financial backing for this enterprise from American investors.



Olley driving a Rolls Royce

With the Wall Street crash in 1929, R-R folded up and Olley, who by this time had married an American woman and had ties in the United States, was out of a job.

But in September 1930, he approached Ernest Seaholm, chief engineer of Cadillac and was taken on as chassis engineer. During his years in Springfield he had been exposed to all of the problems of ride and handling of solid axle cars and the numerous dynamic vibrations of the front unsprung masses such as shimmy, wobble and the violent oscillation, tramp.

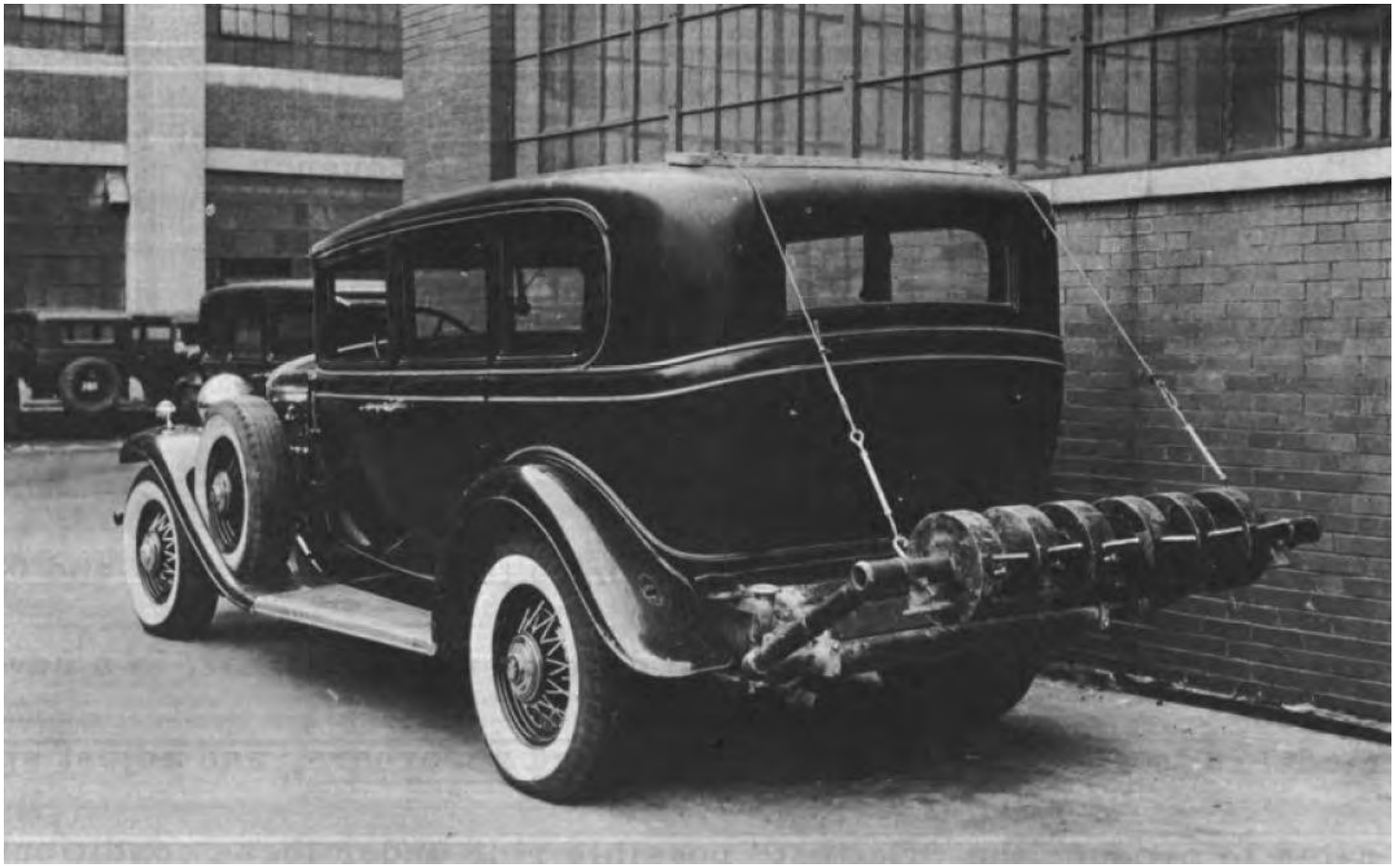
Recognizing his extensive car design background and his managerial experience, he was given a broad assignment to improve ride, with full access to the new General Motors Proving Ground. Thus began the most creative period of his life and the one of most interest to this conference.

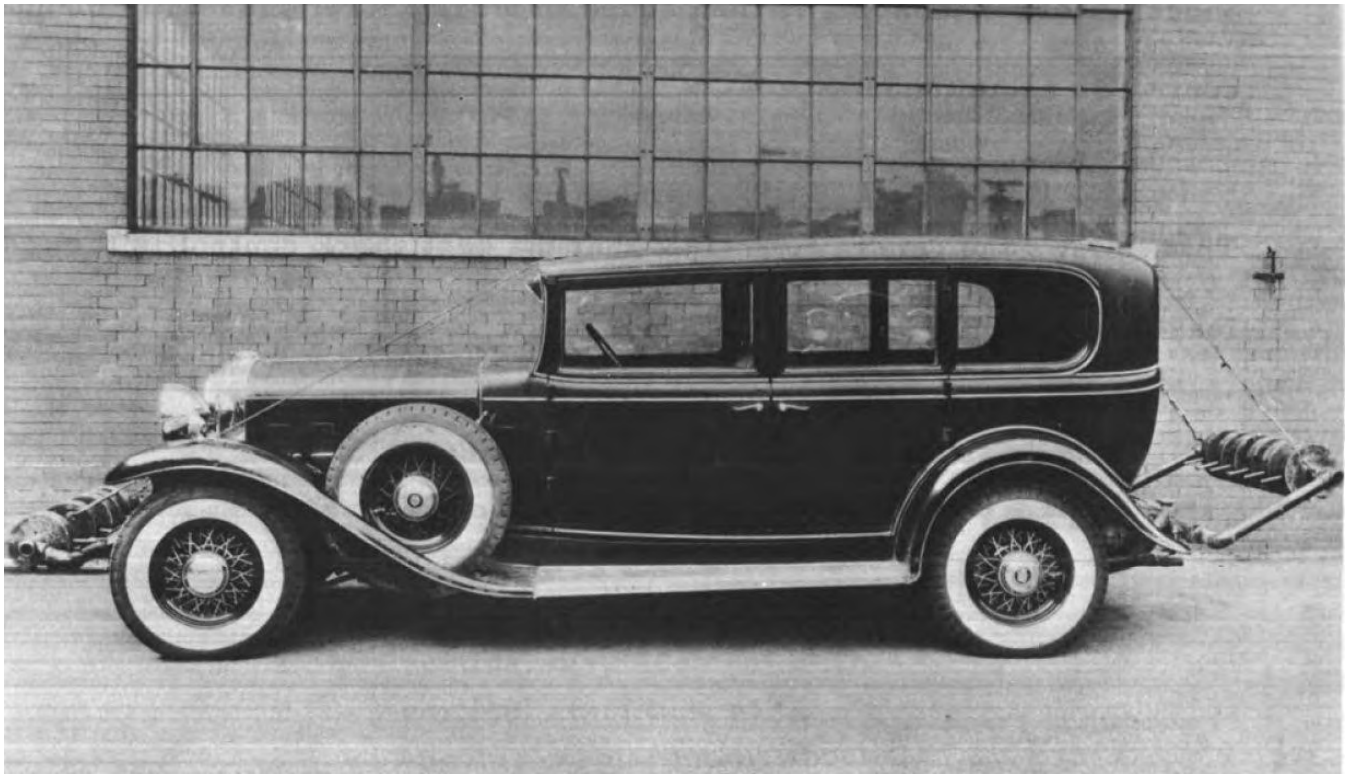
At Cadillac, Olley immediately introduced the “bump rig” developed by Rolls Royce on which the dynamics of a pair of wheels on an axle could be studied by phased bumps on the two drums on which the tires rested.

He also studied the principle theoretical analyses of ride by Rowell and Guest, which showed that there are two oscillation frequencies involved, one about a center within the wheelbase (the pitch center) and the other outside the wheelbase (the bounce center).

Although ride theory gave some clues, Olley recognized that desirable ride could only be determined by subjective evaluation.

He therefore built his famous k^2 rig, a large Cadillac sedan with external frames on the front and back which carried some large weights. By adding or removing weights he could adjust the longitudinal center of gravity and the pitch radius of gyration.





From tests he concluded that the static deflections should be some 30% higher at the front than at the rear for desirable ride; that is, the front suspension should be much softer, of lower frequency. This led to the concept of the “flat ride. ” When the car goes over a bump the initial pitch up is minimized and canceled by the counter-pitch from the stiffer rear suspension.

This in turn led to the independent front suspension, since violent tramp was experienced with low frequency solid axles.

By 1932 experimental cars with SLA (short/long arm) front suspensions were evaluated by General Motors' top management. The ride improvements were so great that the decision was made to put it on all GM cars, 1933. This was a tremendous gamble at the bottom of the depression when employees like Olley were working on half salary.

Chrysler heard about it and followed suit in 1934. The independent front suspension led to understeer (due to load on front and camber change). Olley coined this term, when in a circular skid pad test, (which he also initiated), the car "understeered" the intended Ackermann path.

Shortly after his employment at Cadillac, Olley had requested force/moment tire data from Goodyear. This data was measured on an 84" steel drum during 1932-33 by “Cap” Evans and was the first tire data available in the United States.

It proved invaluable in explaining understeer and, in general, the behavior of a car from the skid pad tests. For the next 5 years, until the start of World War II (1939), Olley and his associates developed most of the concepts that govern car handling design to this day.

The activities they covered are summarized here.

Concepts Developed

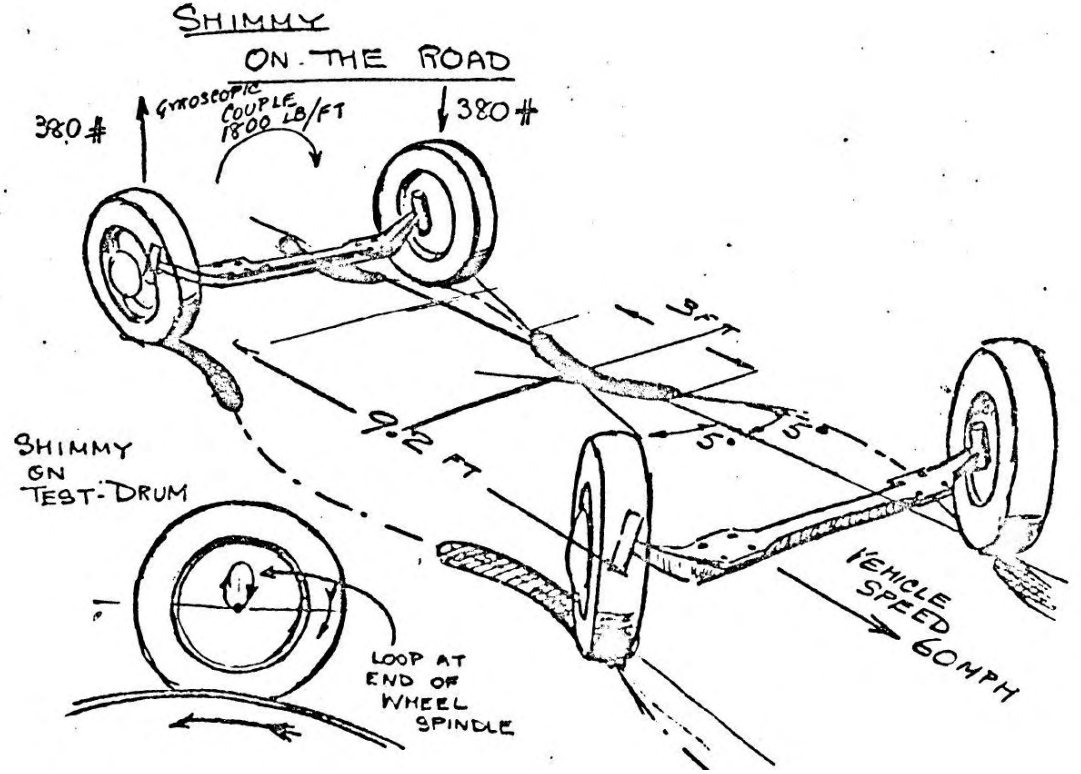
1. k2 Rig
2. Concept of “Flat Ride”
3. Introduction of IFS in USA
4. Definition of Critical Speed
5. Introduction of Circular Skid Pad Testing
6. Over/Understeer concept
7. Suspension and steering analysis
8. Roll center and axis concept
9. Analysis of lateral weight transfer distribution
10. Introduction of anti-roll bars
11. Earliest Tire Tests in USA
12. Anti-Dive and Squat
13. Analysis of drum brakes
14. Analysis of camber/swing axle

By this time, Olley and his GM associate Robert Schilling had produced a very good qualitative description of turn entry or “transition” as they called it, but lacked the mathematics to properly solve for this dynamic response.

I should also mention that during this period, Olley had advanced to a position on the GM Technical Staff but continued his handling research for Cadillac. Also he had spent some months at Vauxhall in England introducing the SLA front suspension.

When World War II started, R-R was anxious to have an American automobile firm manufacture parts for the Merlin. Remembering Olley’s services in the first war, Lord Hives persuaded GM to give Olley a leave of absence. Olley became part of the British mission and was instrumental in convincing Packard to produce complete Merlin engines.

By 1945 he was back consulting at Vauxhall for GM and in 1946 presented his famous paper, “Road Manners of the Modern Car” at the IME.



An Olley sketch from “Road Manners of the Modern Car”

Then in 1952, Ed Cole, president of GM, invited Olley to head up Chevrolet's Research and Development. Here he did the original Corvette chassis and the early air spring development.

I remember going out to the GM Proving Ground one day when Olley said, "I have a new 'mule' car we are developing and could you tell me what you think about it."

I was driving it around a handling loop and nearly lost it on a couple of occasions, when Olley reached over and tapped me on the shoulder and said, "I just wanted to mention that this is a prototype car and it is the only one of these that we have."

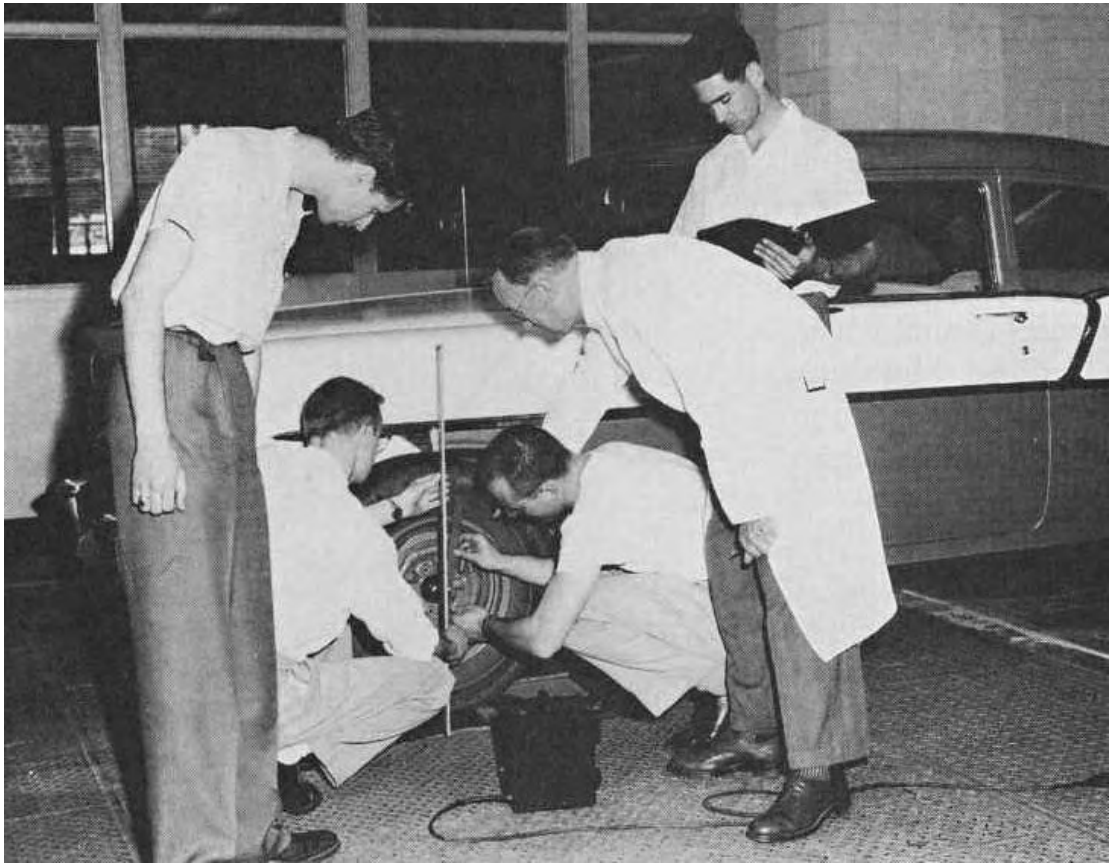
I didn't realize at the time that it was the first Corvette.

In 1957 he was retired at the age of 68.

Retirement was totally distasteful to Olley. He was to write,

“A day’s work is a wonderful thing, its absence is the curse of retirement.”

So for three years after retirement he engaged in consulting and some lecture activity at General Motors Institute.



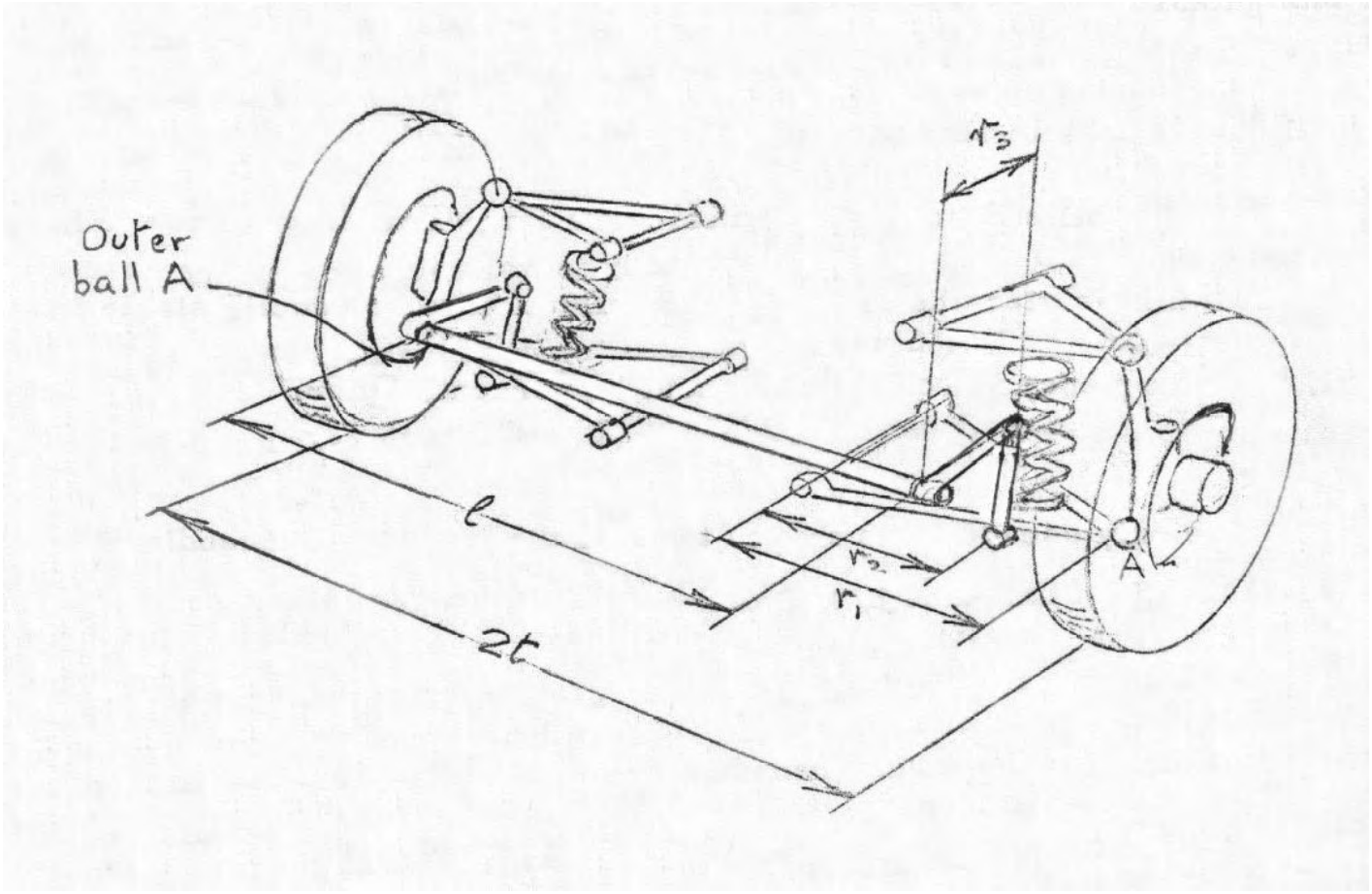
Maurice Olley with students at GMI

He also traveled around the country side hoping to find a location where he and his wife would settle down.

Nothing seemed suitable and in 1961 he reappeared at his old office at Chevrolet R & D, now headed by his friend, Frank Winchell.

Maurice said he would like to write up his technical accomplishments in ride and handling, on his own time, and could he have a desk where he could do it?

Winchell was delighted, gave him a desk in the corner, moved in Olley's old technical files and offered some secretarial help. For the next three years Olley came in on a regular basis and produced five monographs which he hoped to publish.



One of Olley's sketches from an original monograph

General Motors had other ideas, claimed they owned the work, and stamped all the monographs “GM Restricted.”

Four years later GM Research, under Joe Bidwell, gave Cornell Aero Lab a contract to produce a technical biography of Olley with his cooperation. That was also canceled by the legal staff claiming that it could have adverse affect on certain litigation proceedings.

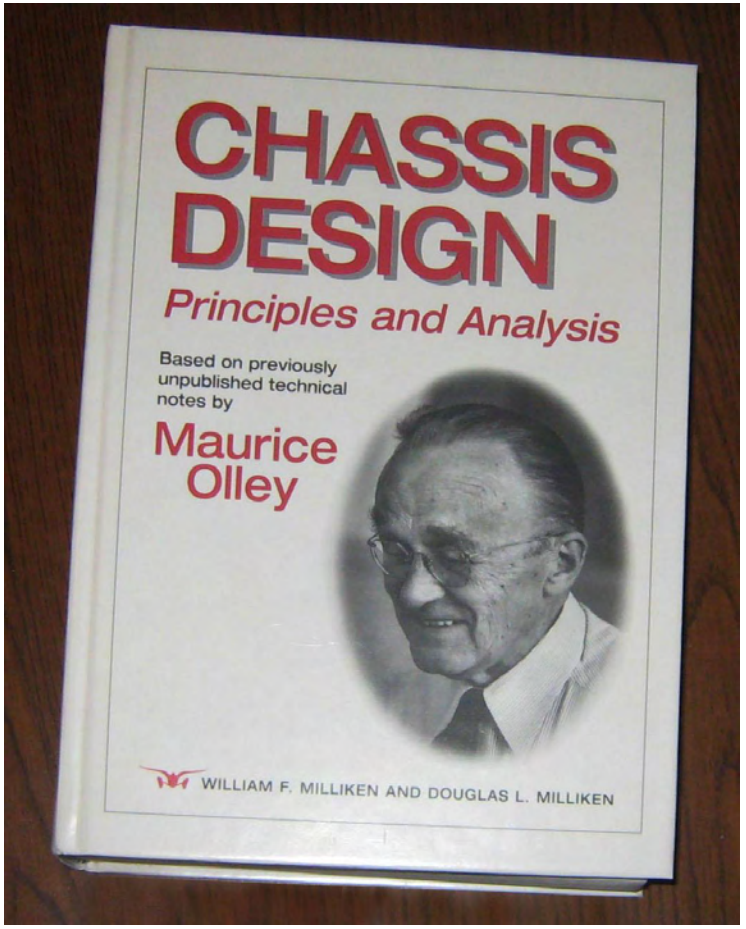
On a more positive note, Milliken Research later obtained the copyright to these technical monographs in 1996 along with a contract from SAE to organize them into a book.

In the course of doing the book we learned a lot about Olley.

Primarily he was a designer all his life, but far more analytical than his contemporaries.

In each aspect of design, he would invariably perform tests, then develop an analytical theory and after that validate. Having thus mastered some aspect of design he would carefully document it for future use.

Most of his material is as useful today as when he produced it. We believe this book will be a great graduate level text for students of car handling.



I first met Maurice in 1955 when he was still at Chevrolet. It was a dramatic meeting which came about as follows:

At that time I was Manager of Flight Research at Cornell Aeronautical Laboratory in Buffalo. We were engaged in pioneering flight dynamics research, attempting to measure the derivatives of the equations of motion in flight, performing the first-ever frequency response on an airplane, all for the Air Force.

Dave Whitcomb and I had become interested in early post-war sports car racing which, of course, was all about car handling and vehicle dynamics. We were well aware of the extensive literature on aircraft dynamics but failed to find anything comparable for the automobile.

This led us to Detroit and a meeting at the GM Proving Ground. In attendance were Olley, Bob Schilling, Ken Stonex, von Pohlemus and Tom Carmichael. As a group they had developed steady state car technology but stopped somewhat short of the full analytical treatment of time response, as noted earlier.

Since we had called the meeting, I told them about our aircraft research and how we went about it. In the course of that, Olley suddenly stood up and pronounced, “We should do it !” At that point I had no idea what he meant, but he meant that Chevrolet should give us a contract to apply the mathematical treatment of aircraft to the automobile.

We received a $25,000 contract immediately, were up to $100,000 in a year and finally obtained a half million dollar contract from the Bidwell group. Len Segel was the project engineer for the several year effort involved and will describe this classic research period in his talk.

I became a close friend of Olley. We met frequently and carried on an extensive correspondence for 17 years to the time of his death in 1972.

He had a great sense of history and a command of the English language. His memorable quotes have become known as “Olleyisms,” and one that is as applicable today as when he wrote it is:

“The entire history of mechanical engineering is of learning through failure. The prima donna type of mind is useless in engineering.”

Thank you.

Addendum

The foregoing is as it was presented with some added graphic content.

The presentation was made within a program with four additional papers. The other speakers were:

R. Thomas Bundorf – Vehicle Dynamics at General Motors 1952-1980
Leonard Segel - Calspan and the Equations of Motion
Hans Pacjeka - Europe
Marion Pottinger - Tires

The session was taped, but the quality is very poor.

The moderator was Tom Gillespie who, with Rajiv Gupta as Chairman, set up the session, held in Troy, Michigan, which was well attended.

The participants, Tom Gillespie, Tom Bundorf, Bill Milliken, Marion Pottinger, Hans Pacejka, and Len Segel, the photo taken at a dinner on the previous day.

Reference Materials and Sources

These books contain much historical information, not only on Maurice Olley, but on that which occurred in the succeeding time period when the equations of motion were first developed and applied.

Chassis Design - Principles and Analysis
William F. Milliken, Douglas L. Milliken
ISBN: 978-0-7680-0826-5

http://www.millikenresearch.com/olley.html
http://books.sae.org/book-r-206

Race Car Vehicle Dynamics
William F. Milliken, Douglas L. Milliken
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