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Letters

The General vs. the Beetle

I read with pleasure Peter Engelhard's fine article, "Making Room for Beetle: Volkswagen's Impact on the German Motor Industry" in *AHR* No. 54. Its careful analysis of social conditions and market forces in Germany during the postwar period helps to explain the dynamic growth of the industry. However, I believe there is an additional factor that set the stage for Volkswagen success—the policies and actions of General Motors Corporation—and that this story should be included to obtain a full understanding of events.

When General Motors purchased Adam Opel AG in 1929, it acquired the leading German producer with a modern plant based on American practice. On the eve of the Second World War its small Kadett was Germany's most popular car and the company had a large export trade driven by government financial subsidies. Nevertheless, under the impact of German financial controls and later by the removal of its manufacturing plant to Russia as war reparations, GM lost its entire investment. When the question came up of reassuming control, the GM directors declined to take up their prewar position. Only in 1948 and under the strong advice of Chairman Sloan was it agreed to begin again but with the condition that the corporation not advance or in any way guarantee the advance of any additional funds.

Opel's postwar program was entirely focused on the medium price car. The popular-price field was abandoned to Volkswagen and a few smaller builders. Not until 1962 did Opel re-enter the lists, giving VW a fifteen-year head start building for world markets. Surely GM had the resources; they were at that time creating an industry from scratch in Australia. Of course, it is not possible to guess how well Opel might have done faced with the new competitor. This seems to have been a failure of vision rare for this admired corporation, one that is perhaps still hampering them today.

Arthur Jones, Philadelphia, Pennsylvania.

Peter Engelhard responds:

I thank Arthur Jones for his remarks on my article about Volkswagen's impact on the German motor industry. He highlights the policies and actions of General Motors Corporation and how they relate to understanding the Volkswagen's postwar success. The fact that major parts of GM's Opel plant at Rüsselsheim were lost due to Russian reparation claims is mentioned in the article. Hence, a potential direct rival model to the Volkswagen was not available in postwar Germany. The absence of the Opel Kadett has been taken care of by my analysis of the "Abandoned Car Sales Potential."

Nevertheless Arthur Jones is right that further work needs to be done to fathom GM's strategy for Germany immediately after World War II; presumably the same exercise may be done for the case of Ford. There are pieces of evidence that Allied authorities saw no future for the German motor industry at all at that time. Reasons for this assumption were manifold: Domestic purchasing power was poor; levels of productivity and product quality were comparatively low at most German plants; manufacturers struggled with shortages of raw materials eventually well into the early 1950s. As a matter of fact, volumes of sales and production seemed to be at best limited to prewar levels during the first half of that decade. This and other concerns may have contributed to a certain reluctance among the big two US manufacturers to expand their capacities again in early postwar Germany.

Post-war strategies of GM and Ford for Western Germany need more careful analysis from automotive historians. This, however, I consider to be a different piece of work to be done, complementing the ideas I tried to bring forward in the aforementioned article on Volkswagen.

The Gordon Bennett Race

[Regarding the abstract of the paper on the 1903 Gordon Bennett Race (*AHR* No. 55, page 41)], Britain did not "refuse to host" the 1903 race and Ireland did not "agree to host it." Any student...will have read the definitive *The Gordon Bennett Races* by Lord Montagu of Beaulieu where it states that road racing was illegal in Great Britain and Ireland, but the passing of the Light Locomotives (Ireland) Bill, introduced by the then-Lord Montagu to the British Parliament, received Royal Assent on 27th March 1903, allowing the race to take place in Ireland. As most people are aware the 26 counties of what is now the Republic of Ireland did not obtain self-governing status until 1922. The Tourist Trophy road races were run in Ulster during the 1930s for the same reason.

The race did in fact do considerable good for the economy of that part of Ireland and also for the other venues for the supporting events.

Graham Skillen, Templecombe, Somerset, U.K.

The editor responds:

Thank you for pointing out this apparent and important misconception. In the telling and retelling of history, sometimes important facts get lost or are shaded, depending on who is doing the telling.

From the Editor

Readers will have noticed that this issue is horribly late. Although this phenomenon is far from unusual in volunteer organizations, the enormity of the tardiness in this instance is difficult to excuse.

In looking to the future, it is hard to see a dramatic improvement on my part. To paraphrase Carole King, it's too late, baby now, it's too late, though we really did try to make it...and I just can't fake it, oh, no, no. I have enjoyed editing both *SAH Journal*, some years ago, and two stints with *AHR*, but it's time for me to go. The Publications Committee and the Board will announce the appointment of a new, inspired editor, perhaps before you read this. Thank you all for your years of help with this vital piece of the SAH "puzzle."

Kit Foster

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 Correspondence in conjunction with *Automotive History Review* should be directed to:

Editor
1102 Long Cove Road, Gales Ferry, CT 06335-1812 USA
email: review@autohistory.org

Further information about the Society may be obtained by writing to The Society of Automotive Historians, Inc., c/o Cornerstone Registration, Ltd., P. O. Box 1715, Maple Grove, MN 55311 - 6715 USA or online at www.autohistory.org.

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CONTENTS

Front Cover: Separated at birth? Ferrari 250 GTO and Shelby Daytona Coupe from the Simeone Foundation Automotive Museum show remarkable similarities. Andrew M. Taylor photo.

Back cover: Tax Relief: This Freestone & Webb-bodied Rolls-Royce Silver Wraith, first registered on 9th June 1948, was taxed at £10, the same as a 918 cc Morris Minor. Wikimedia.

Function or Form?

A Design Comparison of the Ferrari GTO and the Shelby Daytona Coupe

By Alan Yankolonis and Dr. Frederick Simeone

Introduction

"Carroll Shelby's Cobras win the World Sports Car Championship, beating Ferrari." You've probably read or heard this statement many times and read much information as to how a group of "California hot-rodders" took on the famed Italian racing empire and beat them at their own game. A half century after the Daytona Cobra Coupe's historic win it is fitting that we share some more detailed information as to what made Shelby's Daytona Coupe faster than the vaunted Ferrari 250 GTO, enabling it to win the World Sports Car Championship in 1965.

This article was inspired by Ferrari GTO # 3387 and Shelby Daytona Coupe #2287, both of which are on display at the Simeone Foundation Automotive Museum in Philadelphia, where side-by-side comparisons could be documented. In 1961 Enzo Ferrari knew he needed more speed from his existing GT racers to compete on the fastest race tracks of Europe. He was dominating the World Sports Car Championship but challengers Jaguar and Aston Martin were quickly catching up. Enzo's existing 250 GT Berlinetta was doing the layman's work in securing the wins but something more was needed to increase the overall top speed at super-fast circuits like Spa in Belgium and, of course, Le Mans in France.

Since the Fédération Internationale de l'Automobile rules required at least 100 cars to be produced and sold, Ferrari decided to use his 250 GT Berlinetta chassis and engine as the basis for his "new" car since it was already battle-tested and had been in production since 1956. It had proven reliability and already met the FIA's production requirements. Ferrari believed he could convince the FIA that his completely-revised (new) aerodynamically superior body would satisfy the rules. It did not. Contrary to his belief, a "complete new body" was not allowed under the then-current rules, so Ferrari went to FIA's contest board and made a special application, requesting an exception for a new body and was promptly turned down.

The Ferrari 250 GT Berlinetta met FIA production requirements as built.
Pawel Litwinski photo, courtesy of Bonhams.

Peter Brock, the famous designer of the Daytona Coupe, related this story: "They [FIA] were agreeable to the chassis engineering changes that Ferrari had applied for because there were photographs of all those extra parts in the submitted homologation papers…but there was no photo for the 'complete' body as requested! (mainly because Ferrari was still experimenting with different shapes). Ferrari claimed his complete new body was a normal 'Evolution of Type' but of course his new body was so far beyond the spirit of the GT Rules that the FIA's contest board again rejected his papers. In my book you'll read how he then used his political power with the members of the contest board to reverse their decision…which became known as the Appendix J rule…and that rule change literally opened the door for Jaguar to build their beautiful "low drag" coupes and Aston Martin to build their three different 200 series racers...and of course my Daytona Coupe. Had Ferrari not pressured the FIA's contest board to allow his 'special' GTO (Gran Turismo Omologato) body under Appendix J, there never would have been a Daytona Coupe! In effect, he sealed his own fate by using his considerable political power with the FIA to change the rules. [Later on] in 1964 when he discovered Shelby's plans to race a Cobra Coupe he protested the decision to the FIA but they refused to reverse their ruling…pointing out that the Appendix J rule regarding special bodies on existing chassis was his own doing!"

Origins of the GTO

As mentioned above the GTO got off to a controversial start when Ferrari submitted his technical (homologation) papers to the FIA with specific changes that were accepted modifications to the original GT Berlinetta, such as dry sump lubrication, larger valves, five-speed gear box, six-carburetor intake system, suspension modifications and the new aerodynamic body attached to the existing Berlinetta chassis. With his success in persuading the FIA to create Appendix J for his car, the GTO was homologated in March 1961 and first shown to the public at Salon de l'Automobile, the Paris international auto show, in 1962. Over time, five more amendments to the Appendix J rule were made through 1964, which included another body variant for Ferrari, known as the Series II GTO Configuration. Keith Bluemel and Jess Pourret (1998) explain: "The first GTO body design is generally credited to [both Giotto Bizzarrini who started the design and] Sergio Scaglietti [refinement and construction] and consisted of a hand-made hammered aluminum body welded together and riveted to a steel tubular space frame (similar to [Touring's] Superleggera) [technique] fitted over a steel tubular chassis." In a *New York Times* obituary for Scaglietti, Douglas Martin (2011) wrote that "Scaglietti's method was to receive an idea and "interpret" it in aluminum, rarely using a drawing. He made a wire frame, and then hammered the metal into the shape he envisioned. He did this on bags of sand, because wood proved too hard. He did everything, he said, by the eye."

Chris Harvey, in his *Ferrari 250 GTO Super Profile* (1982), wrote that "Experiments with the Ferrari 400SA [actually a Pininfarina Berlinetta with a 400 SA tail] at Le Mans in 1961 and lessons learned were used to help refine the initial body shape of the prototype GTO [known as the 'Anteater']. The 400SA was prone to body lift and steering lightness at high speeds [a trait that Ferrari wanted to eliminate]. Additionally a dry sump lubrication system was installed to drop the engine even lower in the 250 GT chassis improving the overall center of gravity. [On the final design] a 'Kamm style' tail was used to reduce rear drag and a spoiler was added after initial testing to improve stability at high speeds plus under the rear fuel tank an "air tray" was added to reduce under car turbulence [i.e. ground effects]."

The Kamm influence

The mention above of a "Kamm style" tail has its roots in the theories of Prof. Wunibald Kamm, a German engineer in the 1930s who studied the aerodynamic effects on cars as they moved through air well beyond normal highway speeds. Kamm and his assistant, Reinhard von Koenig-Fachsenfeld, were some of the first to experiment with automotive aerodynamics, but studies were also underway in Turin at the University of Bologna prior to WWII. A general summation of the Kamm effect is described below.

The theoretical ideal shape for moving a given mass through air is a teardrop shape, with greater pressure at the front and tapering toward the rear with a 15-degree included angle, top and bottom. To improve the effectiveness of such a design it is helpful to reduce the high pressure at the front of the teardrop while still allowing the shape to taper off gradually at the rear. Placing the radiator at the nose, where there is the highest pressure, and exhausting heated air through the hood (as opposed to exiting under the car) helps to maintain the thinnest boundary layer of moving air (frictional layer) over the surface and near the base of the windshield by reducing turbulence. Forcing more air out over the hood of the car puts more volume at the base of the windshield where the air is starting to slow down. In turn, the air then proceeds up over the windshield and over the top of the vehicle, again at such an angle as to minimize the growth of boundary layer and subsequent turbulence. The idea was to help maintain a thin boundary layer overall, which helps to prevent separation and subsequent turbulence/drag. Bringing the air across the top of the vehicle and down rearward at a seven-degree angle and then chopping off the tail at approximately half the cross section of the tallest midsection of the car gives approximately the same aerodynamic effect (reduced drag) as shaping the rear of the car to a point like a teardrop. By chopping off the rear, weight is saved while creating a road-usable practical length. These principles were used on several Kamm-designed prototypes for Ley, Wanderer and BMW in the late 1930s to demonstrate the theory.

In 1952 American sportsman Briggs Cunningham had Dr. Kamm design a special coupe body for one of his Cunningham C4R roadsters. The resulting Cunningham C4RK "Le Mans Coupe" improved the high-speed capability of the chassis at Le Mans where the car broke the lap record. Some of this aerodynamic information was available, if one knew where to ask, but was not always faithfully applied in race car design to that time.

The Kamm influence on the GTO

It doesn't appear that Ferrari's design team religiously followed the full Kamm theory, but they used certain aspects to shape their new body. The front of the GTO was lowered and the leading edge was tapered to reduce air pressure; that was

With a new body and other refinements, the Ferrari 250 GT became the GTO.
Alan M. Taylor photo.

good. Also a full belly pan was attached underneath (with inspection holes) which helped to reduce under vehicle turbulence; which was also good. The windshield airflow was not optimized, as the roof over the driver started to immediately taper back and quickly achieved an angle greater than 7 degrees downward; that was not so good because it caused the boundary layer to increase in thickness and create drag. The GTO has a chopped tail (Kamm tail) and the proportions are about ½ the cross section of the tallest part of the car body; that was good.

In 1961, Carlo Chiti recommended that Ferrari acquire a wind tunnel. It has been rumored that, before the tunnel was built, a model of the GTO was tested in the wind tunnel at the University of Pisa and the shape was thus refined (Harvey 1982, Evans 2008). It has also been noted that Bizzarrini had access to the wind tunnel in Pisa and that several Berlinettas were used for aerodynamic tests to refine the design. Apparently Ferrari did not publicize these efforts (Pourret 1977). The special "air tray" under the fuel tank of the GTO is not a design that would naturally flow from a designer's pen, but rather from wind tunnel testing.

A rear spoiler was attached with rivets to stabilize the GTO after it exhibited lift during very hi-speed trials. Pourret (1977) recounts this story on the development of a rear spoiler: "Richie Ginther told the author [Pourret] an amusing story about the rear spoiler. In 1961 while he [Ginther] was test driver for the Factory [Ferrari] and testing the new rear-engine Dino sports car, some acute problems were developing with stability at high speed with the 'Kamm' blunt rear end on the Dino. A longitudinal fin had been experimented with, but not much change occurred. Ginther remembered his aviation days with the use of stability tabs and asked the people from the racing department to cut a piece of aluminum and rivet it to the rear of the bodywork. Thus, the first rear spoiler was born and the Dino then went full song without any more problems. Well, when the first cars started to appear at race tracks, competitors started to ask what 'that thing' [on the back end] was for, and in order not to lose the benefit of the find, it was answered that this gadget was meant to block exhaust fumes from reaching the cockpit when braking."

Findings and comments

The GTO body was an evolutionary design based on the 250 GT Berlinetta. The 250GT was known to have aerodynamic problems and needed reshaping to gain speed. The first order of business was to reduce the front end drag by lowering the engine a few inches, by use of a dry sump lubrication system, and improving the slope of the front end. 250GTs were known to run hot, so three C-shaped cut-outs were provided that could be covered over or opened, depending on ambient temperature and circuit speed. The windshield was not altered and the roofline above the windshield immediately tapered downward and therefore did not help to reduce turbulence off the windshield, which, in turn, caused the growth of a boundary layer. The roofline trails back and falls away but, with growth of the boundary layer, turbulent flow was present, which is not ideal, creating drag. The roof taper then increases beyond 20 degrees and eventually ends with a Kamm tail with a spoiler-air dam attached. We believe some wind tunnel testing was conducted to reduce drag and to clean up the airflow under the vehicle. An air foil under-tray below the fuel tank was attached to create a ground effects wing and reduce turbulence behind the car. Ferrari called it a "stone guard" to protect the fuel tank.

The GTO chassis was developed from the 250GT Short Wheelbase (SWB), a car designed in the late 1950s. The car featured independent front suspension with unequal length A arms, an anti-roll bar, coil springs and adjustable Koni shocks. The rear suspension used a live axle with leaf springs, trailing arms, Koni shocks, and limited slip differential. Modifications were made for the GTO design which encompassed smaller tubes in the tubular chassis, a Watts linkage to control rear axle geometry and coil springs around the Koni shock absorbers for the rear axle. Wider wheels and larger tires were included and disc brakes all around.

Front and rear views of the 1962 Ferrari GTO Series I . *Andrew M. Taylor photos.*

Make	Ferrari	Model	250 GTO
Year	1962	Serial Number	3387 GT
Engine #	3387 Block 2222/62E	VIN	
Engine Type	168/62 Competition V12, 60deg, sohc, 2953 cc (3 liters) Dry-sump oiling 300hp, @7750 rpm 295 ft-lbs @7000 rpm 6 Weber 38DCN with velocity stacks 2 Marelli distributers Top speed 175mph	Chassis Type	539/62 Comp Steel tubular chassis. Dunlop cast iron disc brakes F 12.4 in 314 mm Dia. R 11.7 in 298 mm Dia. Wheelbase: 2400mm (94.5 in) Track: F 1351mm (53.2 in) R 1346mm (53 in) Wheels: F 15 X 6 6.00 X 15 Tires R 15 X 6.5 7.00 x 15 Tires Independent front suspension w/unequal length A arms, anti-roll bar, coil springs and adjustable Koni shock absorbers. Live rear axle w/leaf springs, trailing arms, adjustable Watts linkage, coil springs around Koni shock absorbers, and limited slip differential.
Weight	2393 lbs (actual Chassis 3387) 2375 (average design) F 50% R 50%	Number Built	2nd of 36
Body Type	Berlinetta GTO Type 62	Body Builder	Scaglietti
First Owner	Luigi Chinetti North American Racing Team (NART)	Current Location	Simeone Museum

General Specifications and Details of 1962 Ferrari 250 GTO Chassis No. 3387 (Second GTO Built)

As a result of the these efforts a 1962 250 GTO (Type 62) emerged and hit the racing scene with a GT class win and second overall in the 1962 Sebring race (Chassis #3387). The GTO design was spectacular and went on to conquer all in 1962 and 1963 and win the World GT Sports Car Championship both years.

Although the GTO was down on power by some 66 HP compared to the power from the 289 Ford in the Daytona Coupe, the GTO was super reliable. It had been completely tested and ran two seasons of international racing and achieved two World Championships before the 1964 season. By the first race of the 1964 season 33 GTOs had been built and were racing around the world in private hands, giving tremendous technical feedback to the factory.

It should be noted that for 1964 and 1965 a Series II body configuration (Type 64) was developed for the factory team cars, which reduced weight and refined the aero-package of the original bodied GTOs. Although the car looked more streamlined, it was not much faster than the original and tended to experience worse front end adhesion than the original GTO (Pourret 1977). Additionally there were many more Type 62 GTOs than the Series II to contend with.

Origins of the Daytona Coupe

In the USA, Carroll Shelby started building his AC-based Cobra Roadsters in 1962, and by 1963 was winning many GT races on American short tracks. However, his cars were not doing so well on the high-speed tracks of Europe. (Two removable coupe-tops were tried unsuccessfully on regular Cobras at Le Mans in 1963.) Carroll realized that he needed more top speed to defeat the GTO Ferraris. Although he didn't realize it at the

Side view of the 1962 Ferrari GTO Series I. Andrew M. Taylor photo.

time what he needed was a new, aerodynamically-superior body.

The Cobra roadster was first homologated in November 1962 and raced throughout the US, and later in Europe in 1963. The car was fast and well suited for the relatively short road circuits in the US. On high-speed long straight-aways, like those in Europe, the roadster would peak out at about 160 mph. The body shape, specifically the nose and upright windshield, were like air brakes limiting top speed. Shelby wanted to take on Enzo in his own backyard, but he needed a faster car. The FIA required 100 cars to be built to compete in the GT category and Shelby was close to meeting this requirement with his roadsters, so he knew that somehow he'd have to utilize his roadster platform as the basis of a new car. Under the FIA's rules Shelby could modify the body and some other minor components as "normal evolutionary" improvements to the basic design and file them as amendments to the FIA homologation papers, as Ferrari had done for the GTO in 1962.

The design effort was started in the summer of 1963, when Shelby assigned Peter Brock to come up with a new body that would increase the top speed of the Cobra for the long distant races in the US and Europe. This was when Shelby became serious about winning the World Manufacturers Championship that had been dominated by Ferrari for the last several years. Brock would utilize the design cues from Prof. Kamm's studies, mentioned previously, and try to apply them as faithfully as possible. The initial coupe sketch was dated October 1963.

The Kamm influence on the Daytona Coupe

Peter Brock believed there were three areas of the design that were important:

• The rear-ward sloping angle of the roofline [ideally seven degrees], with the highest point just over the driver's head [tallest cross section of the car].
• The intersection of the top of the windscreen and the roof.
• His unique "ring airfoil" at the rear of the car to control lift at high speed.

(Brock, Friedman and Stauffer 1995) His objectives were to increase the car's top speed, reduce its fuel consumption and keep the rear of the car on the ground (prevent aerodynamic lift) by controlling lift with his "ring airfoil." Additionally, Peter believed that the more steeply-angled fastback rooflines of the Appendix J racing coupes from Ferrari, Aston Martin and Jaguar were creating undue turbulence that would diminish those cars' speeds. Air flowing over a car will not follow the body's line at the top of the windshield if the roofline falls away too quickly, which in turn causes turbulence and, ultimately, drag. The key to Brock's ideal shape was the angle of the roofline just behind the windshield. This was designed to maintain the thinnest air boundary layer possible. Additionally, the rear of the car was cut off at half the cross-section of the tallest part of the car and shaped to minimize drag, a so-called "Kamm tail." As it turned out, Brock also reduced the frontal area of the nose of the Cobra and ducted the expelled radiator air up over the hood of the car as Kamm's writings suggested. The Daytona Coupe also had a full belly pan to calm the air beneath the car. The Kamm influence was more religiously followed by Brock in its application to the Coupe and paid off with a 10 to 20 mph speed advantage over the GTO.

As the design was finalized and construction began, there were just 90 days available before the first race, the 1964 Daytona Continental in February. One of the casualties of the compressed timeframe was Brock's "ring airfoil" moveable wing. He desperately wanted it, but it was deleted for reasons of time and skepticism as to its validity. Peter commented to us on this by saying, "The Daytona Coupe, as you note, was designed with a movable airfoil wing at the back, and had that been built as designed the car would have been far superior in both top speed stability and cornering power. The reason it wasn't included in the build was two-fold; 1, Shelby's Chief Engineer, Phil Remington, thought much of the Daytona's design was wrong (as it didn't resemble the World Championship winning Ferraris [GTO]... which were then considered the epitome of good aerodynamics by the world). In fact Remington strongly advised Shelby not to build the car, as he considered it a 'waste of time'! It was only Ken Miles, our number 1 driver (who had equal power within Shelby American) who convinced Shelby that my ideas were worth pursuing. Remington relented but; 2. he refused to build the wing because it would have taken four or five days to build the wing, and we simply didn't have the time if the car was going to make the first race the 2000Ks of Daytona. (Remember, the Daytona Coupe was built in just 90 days!...it had to be 'perfect' when it first tested or the whole Daytona program would have been scrapped! Its speed at Riverside on that first test convinced Miles that he had a winner!) [23 mph faster than the Roadster on the straight-away] With no time for further testing the car was finished without the wing and ran that way at Daytona

Phantom view shows Kamm effect as applied to the Daytona coupe (upper) and the Ferrari 250 GTO. *Andrew M. Taylor photos.*

and Sebring…and the Le Mans test day [in April]…where it still set the GT lap record!"

During that first Daytona race, the car handled very well without the added downforce of the ring airfoil, due to the high-banked turns that created centrifugal force holding the car in place at speed. The Daytona Coupe proved to be the fastest GT car there. It probably would have won the first race had it not been for a fuel fire in the pits while the car was four laps in the lead. After the first race the car became the "Daytona Cobra Coupe," but most on the Shelby team just called it "our Daytona Coupe."

Shelby did not have access to a wind tunnel, so much of the aerodynamic fine tuning was done by using tufts of yarn (taping six-inch strands all over the body and then driving at high speeds to observe how the strings conformed to the air as it flowed over the body, indicating smooth and turbulent flow). This was done after the Daytona race and a couple of adjustments were made to correct air flow problems around the windshield to get more air into the air scoops for the rear brakes, leading to "fences" (air deflectors) on either side of the windshield.

At the 12 Hours of Sebring race a month later, the Daytona Coupe qualified first in GT III and was faster by seven seconds than the new Ferrari prototype 250LM. The race was a huge win in the GT III class for the Coupe and if it had not been held back to insure the class win (since there was only one Coupe available) it might well have won overall. The aerodynamic tweaking on the Coupe after the Daytona race paid off.

Because the Daytona's body shape was so efficient, besting the Ferrari 250LM and winning the GT III class at Sebring, Shelby considered modifying the last chassis assembled, CSX 2286, to race head to head with the Ferrari Prototypes. He ordered the chassis' wheelbase extended by three inches and also had the aluminum body extended to match. He then proceeded to have his crew install a special all-aluminum "big block" 390 cubic inch Ford-developed engine. It was planned to run this "Prototype" at Le Mans and Reims in 1964. Things were coming together well but the car was damaged in transport and missed the Le Mans race. Ford also decided to drop the 390 cid effort with continued focus on the GT 40 and therefore Shelby had to stop development because he had no spare engines. Chassis CSX 2286 was then converted back to the standard wheelbase, a 289 installed and it finally did race, but only once in 1965.

After Sebring in 1964, the first Daytona Coupe was shipped to Europe to campaign at the high-speed tracks. At the April 1964 Le Mans Test Day, Peter Brock comments that even without the ring airfoil the Coupe still set the GT lap record. After Le Mans test day the car moved on to the next race at Spa, Belgium.

Phil Hill was the Coupe's driver at Spa, one of the fastest tracks in Europe. During practice Phil verified Brock's long held prediction of aerodynamic lift and the need for rear down-force at sustained speeds over 180 mph. Overnight, Phil Remington fashioned a rear spoiler, similar to the GTO's and the Daytona Coupe was transformed. Hill and Remington's efforts at Spa made the Coupe the fastest car there, breaking the lap record three times and hitting 190 mph at 6,500 rpm on the back stretch. The Coupe would easily have won overall, also beating the Prototypes, but debris of "unknown source" in the fuel tank required repeated fuel stops to clean the filter and thus forced a finish too far back to gain any points (Brock, Friedman and Stuaffer 1995).

With the last major aerodynamic tweaks completed and another Coupe ready for Le Mans, Shelby was prepared, finally, to take on Ferrari at the famed 24-hour event, He knew the Coupes would shine with 190-plus mph on the Mulsanne straight. The second Coupe, piloted by Bob Bondurant and Dan Gurney, won the GTIII class at Le Mans and might well have won overall had it not been for a stone through the car's oil cooler, which forced a stop for repairs.

Findings and comments

The Daytona's body shape was considered quite radical for its time. The body design was drawn from scratch and reflected a more accurate interpretation of Professor Kamm's theories. The body was shaped to be aerodynamically smooth with low frontal area, the radiator angled with the

The Daytona Coupe's final body shape with the spoiler. Andrew M. Taylor photo.

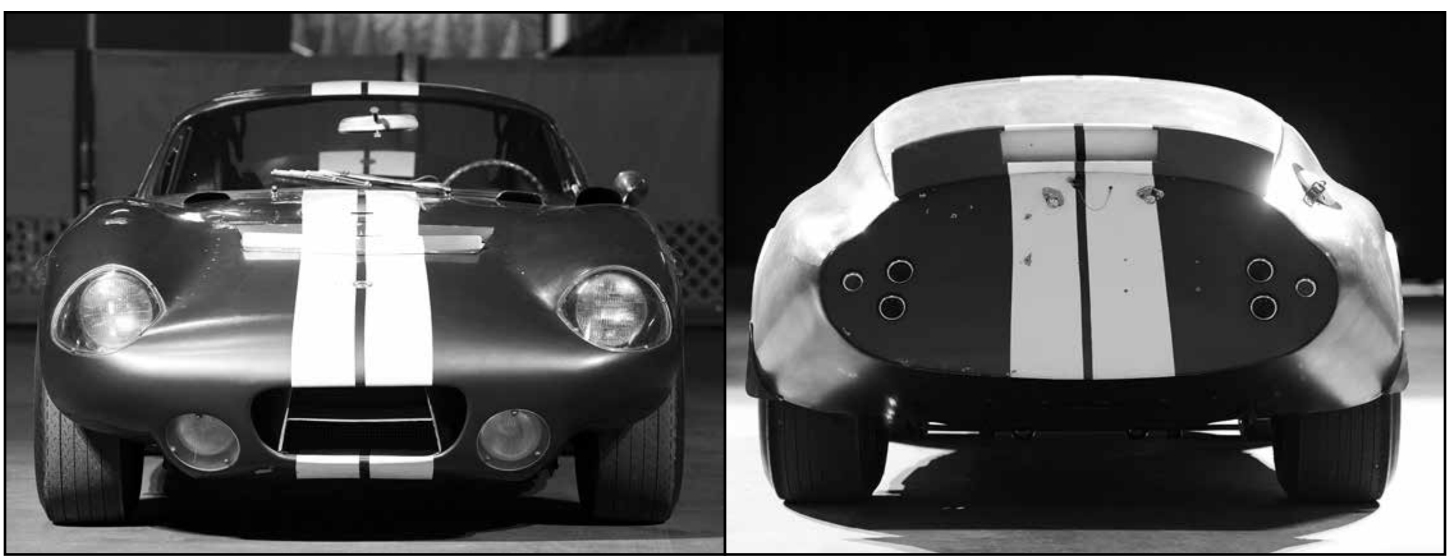
exiting air flowing over the hood not under the car. It had the smallest windshield allowed by the FIA and a gradual rise in the roofline above the windshield that would reduce air flow separation (boundary layer air growth, separating from the conformal shape causing turbulence and thus drag). The highest point of the roofline was above the driver's head and then the roofline fell away at about seven degrees and continued just beyond 15 degrees and eventually ended with a chopped off tail at half the tallest cross section of the car. During initial testing at Riverside Raceway the car showed an immediate 23 mph increase over the Cobra roadster. This convinced Shelby that the Daytona had potential. The car was further refined by doing tufts testing after the Daytona race. A spoiler was added at the rear when it went to Spa later in the year to prevent the rear from lifting at speeds above 180 mph.

The Daytona chassis was based on the existing Cobra roadster with a few modifications. The ladder-type steel tubular chassis was enhanced with vertical triangular sub-frames for the front and rear that torsionally stiffened the chassis tremendously. (The roadster was known for bending and torque flexing that occurred under acceleration and braking.) Because the chassis was from a roadster, and a coupe was being built, the extra framework for the top and roll bar added additional stiffening to the chassis, allowing the car to corner flatter and get the power down sooner. The suspension was fully-independent, with lower A arms, anti-roll bars, transverse leaf springs and adjustable Koni shock absorbers.

Make	Shelby American Inc.	Model	Daytona Coupe
Year	1964	Serial Number	2287
Engine #	Assy. code 5B24F Feb, 24 1965. (currently installed, believed to be the Bonneville engine. The engine was replaced many times throughout racing season.)	VIN	
Engine Type	V8 ohv, 289 cid (4.7 liters) 366hp @ 6,500 rpm 320 lbs-ft @ 4000 rpm 4 Weber 48 IDA Top speed: 196 mph @ 6,500 rpm at Spa and Le Mans 1964	Chassis Type	Ladder type steel tubular chassis with 2 triangulated sub-frames. F 11-5/8 in dia. Girling discs R 10-3/4 in dia. discs Wheelbase: 2286mm (90 in) Track: F 1321 mm (52 in) R 1359 mm (53.5 in) Wheels: Front 15 X 6-1/2 6.70 X 15 Tires Rear 15 X 8-1/2 8.20 X 15 Tires Goodyear Stock Car Special Independent suspension all around w/A arms, anti-roll bar and transverse leaf springs (front and rear) and adjustable Koni shock absorbers.
Weight	2249 lbs (actual Chassis 2287) 2300 lbs (average design) F 48% R 52% (actual #2287)	Number Built	1st of 6
Body Type	Coupe	Body Builder	Cal Metal Shaping (1st car) Carrozzeria Gransport, Italy (2nd thru 6th)
First Owner	Carroll Shelby	Current Location	Simeone Museum

General specifications and details of 1964 Daytona Cobra Coupe Chassis # 2287 (the first Coupe built)

Many folks think that the Daytona Coupe's superiority over the Ferrari GTO was its 66-hp advantage. Yes, the horsepower helped, but it must be remembered that the Cobra roadsters had the same engine and horsepower but



Front and rear views of the Daytona Coupe. Andrew M. Taylor photos.

peaked at 160 mph (poor aerodynamics). Gaining 30 mph on the long straights in Europe was a big advantage and so the aerodynamic package was a major factor in its superiority over the 250 GTO. We should keep in mind the aerodynamic efficiency of the coupe was so good that Shelby was thinking of entering a modified Daytona Coupe to run in Prototype GT class in ’65, because at Sebring and Spa the Coupe was faster than the Prototypes, so there was great merit to Peter Brock’s aero design. Ford’s strategy to concentrate their Prototype efforts on the GT40s killed that plan.

Driver comments on the two cars

Jack Sears: The Type 62 Ferrari 250 GTO was the principal competition for the Cobra in international racing. Although underpowered compared to the Cobra, the GTO’s reliability more than made up for its lack of horsepower. “In terms of handling, the GTO was vastly superior to the Daytona Coupe, E Type Jaguar, and the Aston Martin. The handling of the GTO was out of this world, it was the Williams GP car of its day. Nothing could touch it. In terms of straight-line speed, I don’t think there was much to choose from between them. The Cobra Coupe was probably faster in a straight line but as far as handling and braking, the GTO was considerably better than the rest. The GTO was very comfortable to drive and had a fantastic five speed gearbox which was much better than the Cobra’s and Jaguar’s four speeds. The gearbox on the Cobra wasn’t very positive whereas the GTO had an absolute perfect gate where the gear lever slipped into” (Bluemel and Pourret 1998).

Although GTO #3387 and Daytona #2287 never raced against each other, the same driver, Phil Hill, drove both cars. Phil drove the GTO to a class win in 1962 at Sebring and drove the Daytona Coupe at Spa and Goodwood in 1964.

Phil Hill: “I recall that at Sebring in 1962 there was a bit of controversy because Gendebien and I felt that we were being sidelined by being given the GTO. We wanted to drive a Sports Prototype, which we felt had the best chance of winning, and the fact of the matter was that it did. However, we weren’t totally unhappy with the GTO as we won the GT class and finished second overall. To tell the truth, I was surprised and delighted by the car although I wasn’t fond of its gearbox with the tall lever, as it felt slow and heavy after the sports prototypes. During the race the car ran like a clock, the road-holding was very predictable, and it was warm and dry inside. One thing I remember from the race was that whenever we accelerated away from the hairpin in company with one of the sports prototypes, the GTO would pull cleanly and strongly, while the sports prototype would be coughing and sputtering, enabling us to hold them off right down the straight. Perhaps we were given the car on its first race appearance because we were thought to be a particularly good pair for endurance races, and that we might give the car a good showing first time out. Little did we know that our result would go down in history as the first victory for a car that has gone on to be a legend?”

“The Daytona Coupe was a fantastic car at Spa and it was a great pleasure to drive there. That car was made for a place like that and I think we proved that when we broke every lap record in the book. If we wouldn’t have had that damn fuel starvation problem, we would have won the race and probably lapped the entire field in the process” (Brock, Friedman and Stauffer 1995). (N.B. Phil Hill also drove the winning GTO at Daytona in 1964, beating the Daytona Coupe after the Coupe caught fire in the pits.)

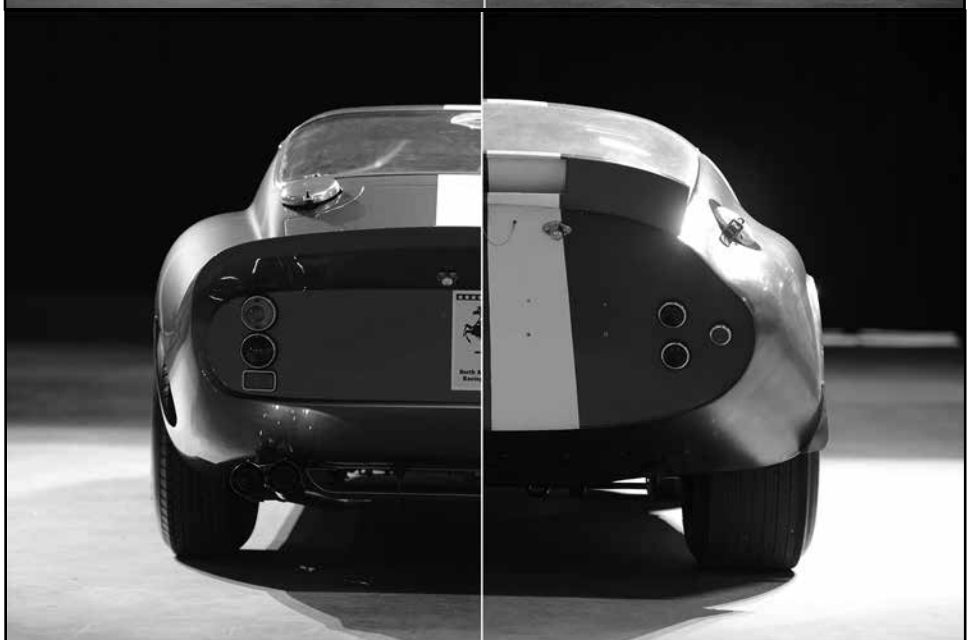
Dan Gurney: Dan Gurney had never set foot in a Cobra Coupe until he got to Le Mans in ’64. He must have liked it because he set the fastest lap ever for a GT car. “The Cobra Coupe was remarkably quick considering everything. It broke all the rules because it was a fairly old fashioned car, but it had a lot of power, good brakes, and the engine had a broad torque range. It was a friendly car to drive. You could take that car to the limits and then some without it getting you into trouble. You could drive the wheels off that car, and I did. It was a lot of fun to drive, it made great noise, had an American flavor to it, and had great people driving and working on it” (Brock, Friedman and Stauffer 1995).

Final thoughts

In 1964 the Daytona Coupe surprised all by winning many races throughout Europe. It was a big attraction at the major races all around Europe because it was faster than the previously dominant GTO Ferraris and was usually in the lead. Some understandable teething problems with a new car led to several DNFs. For the first few races only one coupe was available for the high-speed tracks. By June another coupe was finished and by September a third was available. Shelby would have won the GT III Championship that year assuming he would have won Monza with three cars available, but Enzo was able to win by having the GT III category canceled, thus denying Shelby the ability to win any points in that race. Ferrari won the championship in 1964 by six points.

In 1965 Ferrari saw the handwriting on the wall. The Daytona Coupes were now seasoned race cars and were about to steamroll the Ferraris with four to five cars at each race and the necessary speed to beat them. Ferrari had no more aces up his sleeve to challenge Shelby, so he “retired” from GT racing and left it up to the Ferrari privateers to do battle against the Coupes. The Ferraris were easily outclassed in 1965, so the Daytonas cruised to a defining World Championship winning the series by 19 points. Shelby finally won the 1965 World Championship of Makes for the GT class 2000cc and above, breaking the Ferrari stranglehold over the GT class.

At the end of 1964, Ford wanted Shelby to focus on their GT40 Prototypes because their own 1964 outing for the GT40s, with another team, did not go so well because of usual teething problems for the new design. Ford thus stopped funding the Daytona project at the end of ‘64 and the cars “loaned” to Alan Mann Racing in the UK for the 1965 season. (It was actually Alan Mann Racing who won the World’s GTIII Championship for Shelby) At the end of the ’65 season the coupes were now left almost abandoned at Alan Mann Racing in Great Britain (Ford’s racing team in Europe for the Shelby cars). The cars had originally been



brought into the UK under bond and were supposed to be returned to the US. The Daytonas sat there several months because Shelby had no budget to ship them back to the US and Ford didn't really want to spend the money on some "obsolete" racers. Finally, under threat of physically dumping the cars into the North Sea to prevent a fine by UK customs agents, the cars were eventually shipped back to the US. After Shelby won the 1965 season the FIA changed their 100-car requirement for the GT III class to 500 units. Neither Shelby nor Ferrari was capable of producing and selling that many cars in the required time, so both dropped out of the GT III class for 1966.

Conclusions

We believe that it was "function" over "form" in the body design for the Daytona Coupe, because aerodynamic requirements drove the design more than aesthetics. As for the GTO, we believe that the Italian's basic body design was the more aesthetically pleasing form. "By the eye" was the traditional way of Italian design and functional adjustments were made to tune the final product. The Daytona Coupe was more

Left, front and rear comparisons of the two cars (Daytona Coupe on the right). Below, overlay view of the cars highlights similarities and differences. Opposite, despite the similarities, one car was evolutionary, the other radical. Andrew M. Taylor photos.

faithful to Kamm's theories than the GTO. The GTO was still in the realm of beauty and shape and what looked good to the eye, whereas the Daytona had a single-minded purpose: reduction of drag and lift, with design following that purpose. Both cars met the task but we believe Peter Brock did a better job.

As a footnote the the International Historic Motoring Awards, which are the Academy Awards of the antique, classic and sporting automobile world, presented their 2014 "Car of the Year" honor to the 1964 Shelby Cobra Daytona Coupe. In addition to being the first American car to win the award, the Cobra Daytona Coupe is also the first American car nominated for this award. Also in 2014 the Daytona Coupe was the first automobile ever inducted into the National Historic Vehicle Register, a collaboration between the Historic Vehicle Association and the U.S Department of the Interior's Heritage Documentation Program.

Alan Yankolonis *is a retired mechanical engineer who worked at the U.S. Army Aberdeen Proving Ground, Maryland. He has been a sports car enthusiast since the early 1960s when he lived in Italy for three years. He then became a member of the Sports Car Club of America, supporting racing events at Watkins Glen, Pocono International and Summit Point. He volunteers at the renowned Simeone Foundation Automotive Museum in Philadelphia, where he does historical research and helps maintain the cars.*

Dr. Frederick A. Simeone *is a retired Philadelphia neurosurgeon who, over the span of five decades, assembled the world famous collection of sports racing cars that became the Simeone Foundation Automotive Museum. The museum celebrates the "Spirit of Competition" with a collection of some of the rarest and most significant sports racing cars ever built, including Alfa Romeo, Bugatti, Bentley, Jaguar, BMW, Mercer, Stutz, Ford and Porsche. Many of these cars are historical "celebrities" having raced at Le Mans, the Mille Miglia, the Targa Florio, Watkins Glen, Sebring and the Nürburgring.*

The authors would like to thank Peter Brock for answering many questions through his e-mails and providing additional insight beyond what he wrote in his book. That insight provided information that had not been recorded elsewhere and provides additional historical reference to what was happening during the evolution of the famous Shelby Daytona Coupe.

References

Bluemel, Keith and Jess Pourret. (1998). *Ferrari 250 GTO*. Bideford, Devon, UK: Bay View Books.

Brock, Peter, Dave Friedman and George Stauffer. (1995). *Daytona Cobra Coupes: Carroll Shelby's 1965 World Champions*. Fish Camp, California: Stauffer Publishing.

Evans, Chris. (2008). "Why the Ferrari 250 GTO is the best possible investment." *The Telegraph*, November 7, 2008.

Harvey, Chris. (1982). *Ferrari 250 GTO Super Profile.* Sparkford, Yeovil, UK: G.T. Foulis & Co.

Martin, Douglas. (2011). "Sergio Scaglietti, Sculptor of Sleekly Tailored Ferraris, Dies at 91." *The New York Times*, Nov. 26, 2011.

Pourret, Jess G. (1977). *The Ferrari Legend: 250 GT Competition*. Scarsdale, New York: J.W. Barnes, Jr.

Taxation and Tribulations
Origins and Consequences of the British Horsepower Tax

By Anders Ditlev Clausager MA MDes(RCA)

Introduction

In 2013, both of the remaining French auto manufacturers, Renaul and PSA Peugeot Citroën, were in trouble, with falling sales at home as well as in export markets. This was perhaps to be expected in the troubled European auto market, which contracted substantially during the post-2008 recession. Fiat in Italy was not doing very well either. On the other hand, the German manufacturers were thriving, while in Britain Jaguar Land Rover and BMW-owned Mini were success stories.

This prompts the thought that there may be other underlying reasons why the French and Italian companies should be in difficulties. This may be a subject best tackled by more competent economic analysts than I, but I can suggest that one contributory reason may be that Peugeot-Citroën, Renault and Fiat have all consistently failed to establish themselves successfully in the more profitable sector of the market: prestige and luxury sedans. Instead, this sector of the market in France and Italy appears to be dominated by the German Audi, BMW and Mercedes-Benz brands, as it is in most other European countries. The French or Italian auto buyer, looking for a prestigious luxury sedan with an engine much larger than three, or even two liters, will find few, if any, home-grown alternatives to the German imports. In the words of the British magazine *Autocar*, the mainstream French or Italian family cars "lack premium-brand allure" (Mar. 13, 2013, commenting on a new Vauxhall).

If we look at this historically, it is more or less the situation that has prevailed since World War II. It is, I believe, commonly accepted that a major factor behind the demise of the erstwhile French prestige car sector was the taxation system introduced in France after 1945, which put a progressive and very heavy annual tax on any car with an engine rated for fiscal purposes at more than 15CV (approximately three liters). This favored the largest Citroën, while hastening the demise of the few surviving *grandes routières*—Bugatti, Delage, Delahaye, Hotchkiss, and Talbot—all of which had engine sizes beyond this "fiscal cliff." In Italy, a similar cut-off point was set at around two liters. While post-war Germany also introduced a taxation system based on engine size, there the tariff was proportional rather than progressive and therefore did not discriminate so badly against large-engined cars.

By contrast, in a deliberate effort to encourage the manufacture of larger-engined cars considered suitable for overseas markets, in 1948 Britain abolished its long-established horsepower tax and substituted a flat-rate tax system, which continued for more than fifty years, until replaced in the twenty-first century by a system based on engine emissions. If one looks at the sales figures for European auto markets in the 1950s, it is interesting to find that, for instance, in the British home market for 1955, 7.5 percent of new cars had engines larger than 2,500 cc, as against 0.5 percent in Germany and 0.2 percent in France (Pomeroy 1957). In 1955-56, 15 British car makers (many of them the smaller specialists, but including some mass manufacturers) offered a total of 25 sedans and sports cars with engines of this size (*The Times*, 1955). The choice from Europe was limited to three each from Germany and Italy, two from France, and a single Spanish car (*Automobil Revue* 1956), nine in all, mostly expensive sports cars, only two of which were sedans (Germany's BMW and Mercedes-Benz).

This article deals with an example of how a taxation system influenced the motor industry: the horsepower tax system that was in use in Britain from 1909 to 1947, which I shall discuss in detail, beginning with a survey of the historical background to vehicle taxation, then a description of why and how the horsepower tax was introduced, followed by an analysis of the impact of the tax, with both negative and positive effects. There is an evaluation of some contemporary proposals for tax-beaters, and finally an outline of the debate preceding and the reasons for the replacement of the tax.

The beginnings of vehicle taxation

It did not take very long after the appearance of motor vehicles for them (predictably) to attract the attention of the tax man. In Britain, there had long been a tax on road vehicles, through the tolls levied by the turnpike trusts. The first road tolls had been introduced in 1663 and the system was refined from 1706 onwards, when the trusts began to be set up, and were given the power to levy tolls to pay for upkeep of the roads for which they were responsible. The eighteenth and early part of the nineteenth centuries comprised the golden age of the stage coach. The tolls became increasingly important, as improved methods of road construction were introduced in the early nineteenth century, notably by Thomas Telford and John McAdam, to cope with additional traffic. Naturally, they required substantial investment (Nicholson 1982, pp. 9-11, 23-25).

Then the steam railway locomotive was invented. Within a remarkably short time, a few decades in the middle of the eighteenth century, Britain built an extensive rail network linking villages, towns, and cities. This led to the demise of long-distance stage coach travel. In consequence, the income of the turnpike trusts fell by one-third from 1839 to 1857, and despite being less heavily used, some roads began to fall into disrepair. As steam-driven road vehicles gained in popularity, especially the traction engines often used for agricultural purposes, some turnpike trusts introduced tolls on these as well as on horse-drawn vehicles, but typically charged three times as much for a road locomotive, since it was argued that steam vehicles did greater damage to the roads. The position was regularized with the 1861 Locomotives Act which abolished all existing tolls and set new rates which more closely aligned tolls for road steamers with those for horse-drawn vehicles (Nicholson 1982, pp 187, 190, 218). It may incidentally be of interest that this 1861 act also contained certain early "construction and use" regulations for self-propelled road vehicles, and even concerned itself with the emission of smoke (!), a century before the safety and environmental regulations of the 1960s.

In 1864, the House of Commons recommended abolition of the turnpike trusts, and the final turnpike trust act expired in 1895 (Nicholson 1982, pp 328). Responsibility for the upkeep of roads then fell on local authorities, which raised funds primarily from the rates (i.e., real estate tax). From the 1880s onwards, Britain was gripped by the bicycle boom. Cyclists soon formed associations that campaigned for improved roads, notably the Roads Improvement Association, which had some success between 1886 and 1893 (Nicholson 1982 p. 292 and Plowden 1973, p. 7).

Meanwhile, County Councils were availing themselves of the powers granted under the Local Government Act of 1888 which allowed them to charge a license fee of up to £10 for a steam road locomotive, and by 1896 it was reported that 38 out of 46 country authorities charged license fees, 25 of them the maximum amount (Nicolson 1982, p. 331, note 1 to part 3). Furthermore, if the owner of a road locomotive took his vehicle into another county, that county would be entitled to charge its own £10 license fee (then about $50.00 U.S.), on top of what had already been paid in the owner's home county. In addition, a separate carriage license or duty had been payable at least since 1814; in 1874 there were 435,000 carriages paying duty, a figure not to be exceeded by motor vehicles of all types before 1920, and by cars on their own only in 1924 (Nicholson 1982, p. 345; Richardson 1977, p. 13, citing Duncan n.d., p. 636) . Before November 1896, a prudent motorist would pay both the locomotive license fee, and the carriage tax.

The motor car became a practical proposition in Britain with the Light Locomotives on Highways Order of 1896, which raised the speed limit from four to 12 miles per hour, and abolished the requirement for an attendant on foot preceding the motor vehicle (with or without a red flag). This law also set new excise duties for motor vehicles: £2 2s for vehicles of between one and two tons unladen, and £3 3s above two tons. This was aimed at the heavier steam-driven road vehicles and would leave most private motor cars untaxed, as they typically weighed less than one ton (Nicholson 1982, p. 424). Instead there is some (partly anecdotal) evidence that the heaviest financial contribution made by early private motorists came from the fines levied on them for breaking the speed limit or other similar misdemeanors. Then the Motor Car Act of 1903 increased the speed limit to 20 mph but at the same time introduced vehicle registration with number plates and a registration fee of £1 per motor vehicle, while motorists had to pay 5s annually for a driving license (Richardson 1977, p. 24; Plowden 1973, pp. 35-46).

The problem of paying for the maintenance of roads remained. The perceived antics of typically urban motorists when driving through country districts, and the wear and tear they were accused of causing to local roads, to whose upkeep they made no direct contribution, would eventually lead to the establishment of a national "road fund." Motor car owners would pay an annual "road tax," or license fee, into the fund, as suggested by the Royal Commission on Motor Cars in 1906 and in principle introduced by Lloyd George in his 1909 budget (Richardson 1977, p. 25, Plowden 1973, p. 78). It is worth quoting Herbert Asquith, the Prime Minister of the Liberal Government for which Lloyd George was Chancellor of the Exchequer, who in 1907 said that a motor car tax would be "almost an ideal tax, because it is a tax on a luxury which is apt to degenerate into a nuisance" (Plowden 1973, p. xi).

How to tax

The imaginative mind can devise several different ways of taxing a motor car. Most legislators seem to have considered it reasonable that a higher tax should be paid on larger and typically more expensive vehicles. Three favored methods have been to tax according to weight, according to engine size, or according to a formula for "horsepower." It was the last method that was chosen by Lloyd George. He likely was influenced by the fact that the Royal Automobile Club, the main organization of British motorists, had in 1906 devised a horsepower formula, and motorists could hardly object to a formula which had been proposed by their own organization.

As "the formula was not intended to be a scientific statement of horse-power," instead "manufacturers were asked to adopt the rating for the purposes of catalogue description" (SMMT 1924). The intent was to guide potential car buyers seeking to compare cars of different prices (Plowden 1973, p. 163; Church 1994, p. 14). In working out the formula, the RAC had made a number of assumptions, reflecting the then-current state of engine design, and therefore assigned fixed values to such factors as piston speed, mean effective pressure, and average mechanical efficiency. Canceling out the numerical values gave as the end result the following formula:

$$\frac{D^2N}{2.5}$$

where D was the diameter (bore) of the cylinder measured in inches, and N was the number of cylinders. If the bore was measured in millimeters, the dividing constant became 1612.9. As the formula included the square of the bore, it became effectively an expression of the piston area of an engine. The probable reason why the stroke of the cylinder was not included was that in the 1906-07 period, most car engines in Britain tended to have nearly square dimensions, with bore and stroke of approximately the same size. It was found that of 69 cars in 1907, the stroke/bore ratio was on average 1.16, and for British cars the average was 1.12 (SMMT 1924). [Readers may notice that this is the same formula adopted by the National Automobile Chamber of Commerce, successor to Association of Licensed Automobile Manufacturers, in the United States, although its use for taxation was far less prevalent—Editor.]

It seems probable that the RAC formula, even at the time it was devised, gave a somewhat conservative estimate of actual power output of many car engines, and technical developments soon left it hopelessly behind as even an approximation of brake horsepower, but in 1909 Lloyd George adopted a sliding scale of annual tax on cars, based on the RAC formula, and also introduced the first petrol tax of 3d per Imperial gallon (160 ounces, or 1.25 U.S. gallons). The scale of taxation was not proportional to the actual RAC horsepower rating of engines but had a number of wider steps as follows (Plowden 1973, pp. 78, 164; Brendon 1997, pp. 142-44).

Engines below 6½ horsepower	£2 2s
Engines over 6½, but not over 12 horsepower	£3 3s
Engines over 12, but not over 16 horsepower	£4 4s
Engines over 16, but not over 26 horsepower	£6 6s
Engines over 26, but not over 33 horsepower	£8 8s
Engines over 33, but not over 40 horsepower	£10 10s
Engines over 40, but not over 60 horsepower	£21 0s
Engines over 60 horsepower	£42 0s

Table 1 – Annual car tax under the 1909 schedule

It will be noted that the amounts payable were set in Guineas (an old-fashioned English currency unit of £1 1s., or 21 shillings). In practical terms, it meant that most of the cyclecars, which began to emerge from 1910 onwards and which had small single or twin-cylinder engines, fell within the lowest tax bracket. The new light cars with engines rated at between 8 and 12 hp would be taxed at 3 Guineas per year and the Ford Model T with a four-cylinder engine of 3.75-inch bore and 22.5 hp would cost six Guineas per year. At the top end of the scale there were very few cars with engines over 60 hp, but a Rolls-Royce Silver Ghost (officially known as the 40/50hp model) with a six cylinder engine of 4.5-inch in bore rated at 48.6 hp would cost 20 Guineas per year. This Rolls-Royce, incidentally, had a stroke also of 4.5 inches, while the Ford had a stroke of four inches, and both were therefore typical of the square engines of the period.

Ford began manufacturing Model Ts at Manchester, England, in 1911. By the early 1920s, Ford had become Britain's most popular car.
The Model T Ford Register of Great Britain.

Even in this early form, the horsepower tax began to influence the engine designs and product plans of British car manufacturers. From 1910 onwards, small cyclecars and light cars grew in popularity; they were of course also cheaper to buy. Among the leading established manufacturers, Wolseley had made mostly square engines until 1910: their four-cylinder so-called 16 hp model of 1906 had bore and stroke of four inches and was rated at 25.6 hp. They now brought out a range of new models with smaller bores and longer strokes. The 12/16 model had bore and stroke of 79 x 114 mm—a ratio of 1.44—was rated at 15.5 hp and fitted into the four-Guinea tax class. Another new model, the 20/28, kept the four-inch (102 mm) bore of the old 16, but had a longer stroke of 130 mm (Nixon 1949, appendix p. 160). Other British manufacturers followed similar policies, so that by 1911 it was calculated that the average stroke/bore ratio of British cars had increased from 1.12 (the 1907 figure) to 1.37; by 1924 it would reach 1.52 (SMMT 1924).

By that time the next step in developing the horsepower tax had occurred, as in 1920 the Government introduced the proportional horsepower tax, where the tax would be £1 on each RAC horsepower (or on that part of one hp which exceeded 0.1, i.e. an engine rated at 11.2 hp would be taxed on 12 hp), with a minimum tax of £6 (Plowden 1973, p. 165). This was the system which with only slight variations (such as the reduction to 15s per hp in 1935 and the increase to 25s per hp in 1940), would remain in place until 1947, and which became the subject of much heated debate over the years.

Impact of the horsepower tax

Opinions have differed greatly about the influence of the horsepower tax on British cars, on the British motor industry, and on the car market in Britain. Those commentators, at the time and later, who believed that the tax had some influence have tended to concentrate on what they considered to be negative effects, when a more dispassionate view might lead to the determination of positive effects. Some appeared to believe that the tax had no effect on the types of car made in Britain. Thus Church wrote that: "Any suggestion that the tax created the British small, high-performance light car which dominated sales and production between the wars is without foundation" (Church 1994, p. 15).

Plowden took the opposite view: "The tax provided an additional reason for concentrating on a specialty with which the Americans did not compete, and did not think it worth competing—the cheap, light car. By 1920 the tax was already basic to the whole manufacturing strategy of the British industry" (Plowden 1973, p. 165). While both authors point out that the conception of the British light car pre-dated the 1920 horsepower tax, neither examines the possibility that the 1909 tax might already have had some influence on car design, as discussed above. Maxcy and Silberston steered a middle course, finding that "The horse-power tax … almost certainly influenced design in the direction of [small-bore, long-stroke] engines. It also influenced design in the direction of small engines generally" (Maxcy and Silberston 1959, p. 49).

There is some truth in Church's assertion that "typical engine design in France and Germany (*where no vehicle tax was payable*) [italics added] was similar to that in Britain." However, he overlooks the fact that while the comparison is better made between small car engines of the 1920s from the three countries, during this decade Germany and France also levied a form of horsepower tax (although based on engine capacity rather than piston area), and these two countries only abolished these taxes in 1933 and 1934 respectively. In the case of France, the vehicle tax was then replaced by a steeply increased fuel tax, so that a gallon of petrol cost about 2s 6d (the new tax was stated to be 6½ d per gallon, and a further increase of 5½ d per gallon was under consideration. These figures pre-date the French devaluation in 1935. At the time, an Imperial gallon of petrol (160 oz. or 1.25 U.S. gallons) in Britain cost around 1s 6d, of which 8d was tax (*The Motor Trader* Jan. 3, 1934, p. 20 and Jan. 17, 1934. p. 62). While this was an incentive to producing economical cars, it may be noted that of the "Big Three" French manufacturers (Citroën, Peugeot and Renault),which together held some 75 percent of the market, only Peugeot, the smallest of the three, consistently made a car with an engine smaller than 1,500 cc throughout the 1930s.

In Germany, annual vehicle tax was abolished by Hitler soon after coming to power, as part of his *Motorisierung* program (Clausager 2010). This was, to a degree, offset by increased tax on fuel, especially from 1936 onwards. By October 1939, a liter of petrol cost 40 Pfennig in Germany (von Seherr-Thoss 1974, pp. 327, 335), or about 3s per gallon at the exchange rate of RM12 to the £. If the "par rate" of RM20 to the £ is used, the German cost of petrol was still 1s 9d. Germany was at this time behind Britain and France in motorization, and had a lower standard of living. Apart from the high fuel cost which influenced demand patterns, another incentive for the German industry to make small cars was the government's repeated exhortation to make a Volkswagen costing no more than RM1000 (Sachs 1992. p. 60), although this and the general *Motorisierung* policy have been held to be part of a wider program to stimulate the economy and increase employment (Overy 1975 and Clausager 2010).

It therefore seems that inasmuch as Germany, at least throughout the 1930s, continued to make mostly small cars, the reasons for doing so were slightly different from those that prevailed in Britain. Another difference lay in basic engine design. British designers, influenced by the horsepower formula, continued to build small-bore long-stroke engines in their efforts to maximize the engine size within each horsepower class. In Germany, as elsewhere in Europe and in the USA, in the latter part of the 1930s the trend was clearly back towards the original pre-1914 type of engine with more square bore and stroke dimensions, even in some cases towards the over-square engine with a bore larger than its stroke. Of popular German cars, the 1938 Opel Olympia had an engine of 80 x 74 mm (1488 cc), and the original Volkswagen of 70 x 64mm (985cc) (Oswald 1977, pp. 327, 383). Such engine dimensions would be unacceptable to the British public: the Opel was rated at 16 hp in Britain where most 1500 cc cars were of 12 hp. The Volkswagen would be taxed on 13 hp, but had an engine size comparable with the typical British 8 hp car.

In contrast to France and Germany in the 1930s, in Britain the horsepower tax came to dominate the outlook of the industry as well as the motorist. We may gauge the influence of the taxation system simply from the fact that most British cars of the 1920s and 1930s took their designation from their horsepower rating—Austin Seven, Morris Eight, Standard Nine, Ford Ten, etc.—if sometimes in a slightly misleading manner. The Austin Seven was rated at 8 hp, and other Austin models similarly had a higher horsepower rating than might be expected from their name. Motorists became used to comparing "Eights" or "Tens." A certain amount of snobbery attached to being able to afford a "Twelve" rather than a "Ten" or an "Eight." The most popular models within each horsepower class varied very little in price although curiously, from the 10 hp class upwards there was sufficient demand to warrant limited manufacture of rather more expensive semi-luxury specialized models in addition to the popular cars.

The annual tax, compared to the cost of a vehicle, was relatively high. For much of the 1930s, the cost of a new popular small car in the 8 hp class was between £115 and £130 (Maxcy and Silberston 1959, p. 101), but annual tax was not lower than £6 (in the 1935-39 period). The cheapest large car was the Ford V8, which in 1936 cost £220 but with a 22 hp engine [known as the 60 bhp engine in the United States – Ed.] cost £16 10s to tax. A conservative estimate would be of a typical annual tax of 5 percent of new car price, which in modern terms would equate to annual car tax of £500 on a car costing £10,000, when the present-day tax is £160 or less, even zero. There is therefore no question that the burden of the horsepower tax was comparatively high, and this became even more marked for large-engined second-hand cars which sometimes cost more to tax than their actual value.

Maxcy and Silberston point out that the difference in weekly running costs between an 8-hp and a 12-hp car, due simply to the horsepower tax, was in the order of 1s 2d, or £3 per year, which shows that the example was based on the lower rate of tax of the 1935-40 period (Maxcy and Silberston 1959, p. 49). This however was an increase of 50 percent, and the amount may not be as negligible as the authors seem to imply, if the car in question was a second-hand model costing perhaps £50 or less in the first place, and the difference had to come out of a weekly income of £4 or £5. Furthermore, the Road Traffic Act of 1930 introduced compulsory third-party insurance, and insurance premiums were

The Morris Cowley, rated at 12 hp, soon surpassed the Model T as Britain's favorite car, after the enactment of the horsepower tax in 1920. Wikipedia.

often geared to the horsepower rating (Plowden 1973, Chapter 12ff). If fuel consumption (typically higher for the larger car) was also taken into account, the financial incentive to run a smaller car was even greater.

It would certainly seem that the introduction of the horsepower tax in 1920 was the main reason why the 23-hp Ford Model T was replaced as Britain's most popular car by the 12-hp Morris Cowley, notwithstanding the fact that the Morris, despite repeated price cuts, was the more expensive car. It may also be considered significant that the Austin Seven, Britain's first practical four-cylinder, four-seater car rated at 8 hp, was introduced in 1922, after the horsepower tax had been established. Austin's first new model after the end of World War I had been the Twenty, which, like the Model T, had a horsepower rating of 23 hp and was designed somewhat along American lines. It was hoped to reduce the price of this model by mass production, but with the introduction of the horsepower tax and falling demand in the 1920-21 slump Austin was obliged to introduce the Twelve (13 hp) and then the Seven (8 hp).

This small car took quite a long time to become established, as throughout much of the 1920s most cars sold in Britain were in the range from 11 to 14 hp, which in 1927 still accounted for some 60 percent of the market. However, in 1929 the 8-hp class alone took nearly 25 percent of the market, a position this class would essentially maintain until 1939. From 1930 onwards the growth area became the 9-10 hp class which expanded from less than 10 percent in 1930 to almost 34 percent in 1933. The 11-14 hp bracket, by contrast, hit a low of 21.5 percent in 1935 although it then expanded slightly, possibly under the influence of the tax cut to 15s per horsepower that took effect from January 1935. In 1928 Morris had followed Austin's lead by introducing an 8 hp car, the first Morris Minor, and in 1932 Ford brought out the Model Y of similar size. These were the three most important small cars in the market, but Singer, Triumph, and a few others, also produced 8-hp models.

The greater choice of small cars may in itself have generated increased sales of such models, but it may also be pointed out that the swing to smaller cars in the 1929-32 period coincided with the depression. Car production in Britain during those years fell only by a maximum of 13 percent (from 182,347 in 1929 to 158,997 in 1931) (Plowden 1973, pp. 6, 8-10), as against 75 percent in the USA, 35 percent in France and 62 percent in Germany (SMMT 1947, pp. 28-9 and adjacent tables). Furthermore, in these other countries decreasing production continued into 1932, a year longer than in Britain. Therefore, while in overall terms the depression affected the motor industry and the car market in Britain less severely and for a shorter period than in other

Left: Herbert Austin's Twenty, named for its horsepower, was his attempt at a single model policy after World War I. This car, named "Arthur" for its first owner, had covered more than a million miles when retired by Mike Worthington-Williams *just a few years ago. Photo by the editor. Right: The editor learns to drive an Austin Seven, courtesy of owner* Malcolm Jeal. *Malcolm Jeal photo.*

The Model Y, introduced in 1932, was the first Ford purposely designed for an overseas market. The concept was scaled up for the 1933-34 Model 40 in the USA.
The Ford Model Y and C Model Register.

countries, there was demonstrably a swing towards smaller cars in Britain over this period.

Negative effects of the horsepower tax

The greatest effect of the horsepower tax was on engine design. It has been demonstrated that the stroke/bore ratio of typical car engines changed very quickly even after the introduction of the original broad-band taxation in 1909. From the original pre-1910 square engines, car manufacturers adopted the small-bore long-stroke engines, which remained typical in Britain until well after the horsepower tax was abandoned in 1948. It is, however, correct that at the beginning of the 1920s, many car engines, not only in Britain, were of the long-stroke type, usually with side valves and low compression ratios. Among the exceptions were the Ford Model T with an engine designed in 1908 of 95.25 x 101.6mm (3.75 x 4in), and the more recent Rover Eight small car with a two-cylinder engine of 85 x 88 mm.

Then a breakthrough occurred, which opened the way to more efficient engines. One way to improve the efficiency of the gasoline engine was to increase the compression ratio, which was then typically around 4:1 to 5:1. Attempts to raise compression ratios were frustrated by contemporary fuels which in engines with higher compression ratios would detonate too early or unevenly, causing engine "knock" (pre-detonation) which could harm the engine. In 1912, Harry Ricardo, the British engineer and master of combustion chamber design, experimentally determined that benzole, a fuel derived from coal, allowed the increase of compression from 4:1 to 5:1, which improved the power output of his test engine by about 20 percent. He subsequently determined that ethyl alcohol had a similar effect, and allowed the use of a compression ratio as high as 8:1. Petrol-alcohol mixtures, at first used for motor racing, also later became commercially available (Ricardo 1990, pp. 127, 208-212).

In the United States, Charles Kettering and Thomas Midgley, working for the General Motors Research Corporation in 1922, discovered that addition of a tetraethyl lead compound to petrol would significantly increase its knock resistance. In 1924 the Ethyl Gasoline Corporation was formed for the purpose of marketing this compound, and the first leaded gasoline became commercially available. In 1925, Dr. Graham Edgar of the Ethyl Corporation devised the octane rating as a measurement of knock resistance of petrol. GAsoline with an octane rating of 100 was practically knock-free. At this time, most commercially available petrol had an octane rating of 50 to 55, but this limited the compression ratio that could be employed and thus hampered the development of more powerful and efficient engines (Sloan 1965, pp 221-26).

Once higher-octane fuels became available, the compression ratio could be increased, but on the then-common type of engine with side valves the layout of the valves and the design of cylinder head meant that it was difficult to increase the compression ratio much beyond about 6:1 (Ricardo 1990, p. 239). It therefore became desirable to use overhead valves. Overhead valve engines could be designed more logically and simpler, if the stroke was shorter and the bore larger. A larger bore would permit the use of larger valves on the overhead valve engine, advantageous on this type of engine which has a better pattern of gas flow. Another point was that an engine with a shorter stroke would have a lower piston speed at a given engine speed, as the piston had to travel a shorter distance up and down in the cylinder. Accordingly, engine life and reliability would be improved.

The trend was therefore towards short-stroke, overhead valve engines. In the USA, Chevrolet for 1929 introduced a new overhead-valve six-cylinder engine of 84 x 96 mm. In Europe, the Italian Fiats developed in a similar manner. Their 509 model of 1925 had cylinder dimensions of 57 x 97 mm, but their 508 model of 1932 had dimensions of 65 x 75 mm. In 1934, this engine was converted from side valves to overhead valves, and the overhead-valve engine of the 1937 Fiat 1100 was of 68 x 75 mm (Sedgwick 1974, appendix pp. 328-30).

In Britain, such developments were frustrated by the horsepower tax. Among the "Big Six" manufacturers of popular cars, by 1939 only Morris (except for the 8-hp model) and Vauxhall had adopted overhead valves. A survey of 13 British small car engines of less than 1,300 cc displacement in 1938-39 shows that stroke/bore ratios varied from 1.4 to 1.67, with an average of 1.56. At the same time, 16 European small car engines of similar size (but including the 1,488 cc Opel engine) had stroke/bore ratios varying from 0.92 to

1.64, but with an average of 1.19. This group included four German engines which were over-square, with larger bores than strokes (Opel, two DKW engines, and the new KdF or Volkswagen; the DKWs were two-stroke engines, the Opel and Volkswagen had overhead valves).

While these German engines did not differ appreciably from contemporary British counterparts in terms of their compression ratios, engine speeds, or specific power outputs, it is significant that German engine designers chose short-stroke but low-revving and lightly stressed engines. The rationale was increased engine stamina and reliability under the conditions of sustained high-speed motoring, which could be experienced on the country's new network of motorways, the *Autobahnen*.

Not only did the British taxation system dictate stroke/bore ratios but it had some influence on the number of cylinders. Taking, for example, an engine of approximately 2,000 cc, which might have four, six or eight cylinders, and using the then-prevailing stroke/bore ratio of 1.5 (while bearing in mind that the public expected an engine of this size to be rated at no more than 16 hp for taxation purposes), we find that the engine may have the dimensions quoted in the first three examples in the table below. The horsepower rating increases by 2 hp for each additional two cylinders. If we want to design a square engine, as demonstrated in the second set of three examples, the horsepower ratings become quite unreasonable. Again, the horsepower ratings are higher for the higher number of cylinders.

No. of cylinders	Bore	Stroke	Stoke/bore ratio	Capacity	RAC hp
Four	75mm	112mm	1.49	1979 cc	14 hp
Six	65mm	100mm	1.54	1991 cc	16 hp
Eight	60mm	90mm	1.5	2036 cc	18 hp
Four	86mm	86mm	1.0	1998 cc	18.3 (19) hp
Six	75mm	75mm	1.0	1988 cc	20.9 (21) hp
Eight	68mm	68mm	1.0	1976 cc	22.9 (23) hp

Table 2 – Options for engine dimensions

Only in the luxury car class, where the horsepower tax mattered rather less to car buyers, did Britain have some examples of 1930s engines with larger bores and shorter strokes. The best British high-efficiency engine of the time was found in the Lagonda, a twelve-cylinder of 75 x 84.3 mm, with a stroke/bore ratio of 1.12, a capacity of 4,480 cc and a horsepower rating of 42 hp. While fashions in engine design have changed over the years, and in the meantime there have been remarkable examples of over-square engines, notably the 1959 British Ford Anglia of 80.96 x 48.41 mm, it is of interest that most current car engines from around the world employ square or near-square bore and stroke dimensions, having thus reverted to the practice already common by 1910 (see, for instance, the annual *Katalog der Automobil Revue*, Bern, Switzerland, with detailed specifications of all the world's production cars). It may be speculated that such engines have been found to offer the most efficient compromise.

The horsepower tax had a decisive influence on the production programs of British car manufacturers. Gradually throughout the 1920s and 1930s, British manufacturers extended their ranges to offer models in all the most popular taxation classes. Morris had started the 1920s with a choice of 12 hp and 14 hp models, achieved by the simple expedient of having two different bore sizes in otherwise identical engines. By 1936 Morris offered no fewer than eight different models, spanning the market from 8 hp (918 cc) to 25 hp (3,485 cc). Even Morris's up-market companion make, Wolseley, with a much smaller annual production, offered seven different engine sizes in the late 1930s, paralleling the Morris range from 10 hp (1,292 cc) upwards. In these examples, and in others, there was in fairness a degree of rationalization, and just four basic different engine designs were used in the Morris range, with six-cylinder engines of 14, 16 and 18 hp differing only in their bore dimensions. Similarly, chassis and bodies were usually shared between at least two models, sometimes more.

Because of the horsepower tax, the home-market public demanded—and got—this tremendous variety in engine sizes and models. A further complication was sometimes added by the perceived demands of export markets (chiefly, at this time, the Empire markets), which were widely understood to demand cars with larger engines than were normally required in Britain. Over the years, Morris made several attempts at introducing export models with larger engines. Where, in effect, the same car was available with two or more different engine sizes, the larger size was normally the model sold for export. Thus in 1935-37 Morris sold hardly any 10-hp cars for export, only the all-but-identical 12-hp model, while in the home market the smaller-engined car outsold the larger-engined model by about two to one, despite a difference in purchase price of only £5 – £172 10s, or £177 10s respectively (Morris production records in BMIHT archive).

Despite the degree of rationalization sometimes achieved, even with extremely wide model ranges, it is widely held that the plethora of models offered by British manufacturers increased their costs and thus made their products less competitive, having an adverse effect on export prospects in particular (Barnett 1996, pp. 58-59). This is correct if the comparison is made with the American industry of the time, where individual firms might produce a million cars per year, using one type of chassis, and one size of engine, and where cars were remarkably cheap. In the last pre-war season, the 1941 model year, the best-selling Chevrolet brand made over one million cars, all having the same engine and chassis, selling at prices from $712 (£146) to $995 (£204) depending on type of body and equipment (*Consumer Guide* 1989, p. 443). For the cost of a small British 10-hp car, the Chevrolet customer got a five-six seater car on a wheelbase of 116 inches fitted with a 3,548 cc engine developing 90 bhp and a top speed over 80 mph.

However, comparisons with other European motor industries were more favorable to Britain. Having passed France in 1932, Britain was the largest car manufacturer in Europe, with a pre-war high of almost 390,000 cars made in 1937. In 1935 Germany had also exceeded French production for the first time, and in 1938 attained more than

275,000 cars, while the highest French figure was 200,000 in the same year (*Motor Industry of Great Britain* 1947, pp. 6 ff— Statistics vary slightly depending on whether the calendar year or a year ending in September is used). Of individual companies, the largest single car maker in Europe at this time was the German Opel company (owned by General Motors) which in 1938 made 114,503 cars (Oswald 1977, p. 287), while the largest all-German car maker was Auto Union with 67,108 cars in the same year (Etzold et al 1992, p. 270). In Britain Morris was the largest individual company with production in the best calendar year, 1935, of nearly 99,000 cars and light commercial vehicles (Morris production records). Austin's highest figure was nearly 84,000 cars in 1937 (Church 1979, p. 84), while Ford at Dagenham in the same year produced 65,500 cars (Nevins and Hill 1963, p. 83). The largest of the French manufacturers, Citroën, Peugeot, and Renault, were capable of annual production of 50-60,000, the allegedly highest individual figure being 61,640 Citroëns in 1938-39 (Sedgwick 1970, p. 102). In Italy, Fiat's pre-war record was 54,931 cars in 1937 (Sedgwick 1974, p. 220).

Furthermore, Britain made cheaper small cars than the other European producers. In 1938-39, the cheapest British 8-hp models from Austin, Ford, Morris, and Standard cost from £120 to £130, and from 1935 to 1937 Ford had offered an 8-hp car at £100. The nearest equivalent to this in Germany had been the 1937 Opel P4 at RM 1,450, around £120, but by 1939 the cheapest models from Opel and DKW cost RM 1,800, or £150. A 1939 Ford 10-hp Prefect in Britain cost £145, but the German Ford Eifel with the same engine and a similar specification cost RM 2,590, or approximately £215. The much-touted Volkswagen at RM 990 (£83) had yet to materialize.

It is more difficult to accurately compare prices of French cars because of the devaluation of the French Franc from FFr 75 to FFr 125 to the £ in late 1936, but in November 1935 it was stated that the lowest-priced car on the French market cost £186. The Société des Ingénieurs de l'Automobiles (SIA) in France was launching a competition to design a vehicle costing not more than FFr 8,000 or £106, which attracted 102 entrants but none that, in the view of the judges, would meet the stipulated criteria (*The Motor Trader* Nov. 6, 1935, p. 209; Usher 1978, pp. 212-218—none other than Le Corbusier submitted a design). In April 1936, the Fiat 500, a two-seater car with a 569cc engine, went into production as the Simca Cinq in France priced at FFr 9,900 or £132, and it was stated that the cheapest Citroën (a 1,600 cc model) then cost £267 (*The Motor Trader* Apr. 8, 1936, p. 39). In Italy the Fiat 500 cost 8,900 Lire or £96. Its price in Britain was £120, in Germany RM 1,780 or £148 (Giacosa 1979, p. 39). The foregoing prices are generally from a variety of sources, including Oswald 1977 and Sedgwick 1970, as well as contemporary magazines, chiefly *The Autocar*.

Positive effects of the horsepower tax

If we accept that the horsepower tax had an influence on the type of car that became most popular in Britain, by encouraging a swing towards smaller cars and exerting a restricting influence on engine design, which must be considered a negative effect, we must consider whether there was a positive effect from the tax. The comparisons between production figures and prices of British and other European cars in the 1930s suggest that the British motor industry was more efficient at this time, in part because the British home market was more developed. Because of the horsepower tax, the British public demanded small cars. The British industry supplied more small cars, and at lower prices, than anyone else. Because of the horsepower tax, Britain had become the world's largest manufacturer of small cars. Furthermore, Britain was better than has often been alleged at exporting these small cars, to markets where a demand for this type of car existed.

As far as the British home market was concerned, the horsepower tax, together with the import duty of 33-1/3 percent on cars and parts for cars, offered the British motor industry a protected environment. The import duty, often known as the McKenna duty, after the Chancellor of the Exchequer who introduced it in 1915, was originally intended as a wartime measure to reduce luxury imports, and to conserve shipping space. One of its early victims was curiously William Morris who was planning large-scale production of a new car using an engine and other parts made in the USA, but the British Ford op-

The 1937-40 Lagonda V12 had Britain's most efficient engine of its day, yet rated a whopping 42 hp at tax time. *Photo by the editor.*

The 12 hp. Vauxhall Light Six of 1933 was the first small-engine model after the General Motors takeover in the 1920s. Wikipedia.

eration was also affected. The import duty was abolished by the Labour government in 1924, but was reinstated in the following year when the Conservatives were back in office (Plowden 1973, pp. 102-3, 171, 191), and would then remain until the 1960s. During the brief period of free import, in 1925 imports of cars almost doubled, from around 25,000 to almost 50,000, and then decreased as dramatically (Foreman-Peck et al 1995, p. 74). Most of these imports came from the USA. If the horsepower tax had not held back demand for cheap but large-engined American cars, the influx could have been even greater.

The British combination of import duty and horsepower tax offered some protection against imports, but could not stop American companies from establishing factories in Britain, making cars which were designed to meet British requirements. Although the popularity of the Manchester-built Ford Model T declined in the early 1920s, Henry Ford in 1925 refused to act on advice to build a smaller car in Britain (Collier and Horowitz 1989, pp. 118-9). However, in 1929 Ford began building a large new plant at Dagenham, with production commencing in March 1931 (Nevins and Hill 1957, pp. 543-547). The first car to be made there was the Model A, which for the British market was fitted with a small-bore engine of 14.9 hp and 2,033cc, compared with the normal engine of 23.8 hp and 3,285 cc. It was still not very popular in Britain, and in 1932 Ford finally introduced the 8-hp Model Y, which set the company on the path to success in Britain. Of the other American companies, General Motors bought Vauxhall in 1925, and in 1933 introduced the Light Six with 12- or 14-hp engines, followed in 1937 by a 10-hp model (Sloan 1965, p. 320-328). Other American manufacturers were also active in Britain, including Chrysler, Hudson-Essex, and Willys-Overland, but without any special products suited to the British home market none achieved the lasting success of Ford and Vauxhall.

Apart from setting up production in Europe, to circumvent tariff barriers and to make those smaller cars which Europe increasingly demanded, American companies could have built smaller cars in their home factories. It is however doubtful whether at this time there was any real demand for a small car in the American domestic market, where vehicle tax was minimal and fuel cheap. Only a few US manufacturers tried to sell what by local standards were small cars, with engines around 2,200 cc, including Continental and Willys, with prices in the $400 bracket (around £85) (Sedgwick 1970, p. 48-9). Neither was greatly successful, nor was the American Austin or Bantam (both derived from the Austin Seven), or the later Crosley.

While the established American manufacturers from time to time experimented with smaller-than-standard cars, they usually found that they could not produce them at significantly lower prices. In 1938 Ford built a prototype car which was 600 pounds lighter than their normal model but which was calculated to show a saving of only $36 compared to the regular Ford V8 which cost $540 (Nevins and Hill 1957, p.117). Yet America was aware that demand existed outside her borders for a cheaper, and therefore presumably smaller, car. In 1928, James Mooney of General Motors pointed out that the lowest-priced Chevrolet typically cost the buyer outside the USA 75 percent more than the American buyer, yet the foreign buyer had on average only 60 percent of the money needed to buy the car (Sloan 1965, p. 322).

Thus the light car remained a European preserve. Of the major European car-producing countries, in Britain it was preferred because of the horsepower tax and the petrol tax; in Germany because of lower purchase cost and better fuel economy; in Italy, again taxation and the cost of fuel gave small cars the advantage. Only in France was the situation in the 1930s anomalous; although the cost of fuel was high and economy therefore important, sales of small cars of the British 8-10 hp type (750-1,200 cc) were significantly lower than those of larger family cars (1,500-2,000 cc).

Since all European car manufacturing countries had protectionist import duties, Britain could not expect to sell large numbers of cars in France, Germany, or Italy. Britain's export market by choice was the Empire, which until well after World War II remained the most important market for British cars (Sieve 1950). After the Ottawa agreement of 1932 had established a system of Imperial preference, some Empire countries lowered their tariffs on goods from other Empire nations. Results did not universally favor Britain, as Eire and South Africa did not grant preferential rates on Empire-built cars, while Australia, New Zealand and Britain herself also reduced the duty on cars built in Canada by local branch plants of US companies (*The Motor Industry of Great Britain* 1939, pp. 114-119). In addition, some American cars were assembled in Australia and South Africa.

While American cars were often preferred to large British cars in Empire markets, small British cars were successful there in the late 1930s. From 1934 to 1939, Britain increased her share of the Australian market from 28 to 41.5

percent, in New Zealand from 45 to 59 percent, while consistently holding over 90 percent of the Irish market. On the other hand, in South Africa and India the British market share declined, in part owing to competition from German small cars. In Europe the picture was less encouraging, as Britain had to contend not only with American and German competition but also often with a strong presence from France or Italy. Denmark, which had concluded a bilateral trade treaty with Britain, was the best market for British cars in Europe, apart from Eire. The growth in new car sales in some key European markets in the late 1930s, in overall terms, mostly benefited the European producers of small cars and the American share of the market declined in such countries as Denmark, Finland, Portugal, Sweden and Switzerland *(The Motor Industry of Great Britain,* 1935-1939 issues).

On the whole, the British export performance during 1934-38 was good. While numerically, exports were much lower than those of the American industry (309,562 British cars were exported over the five-year period, against 887,543 from the USA), this represented an average export rate of 18.5 percent of British production, compared to just 5.9 percent of American production. Within Europe, Germany strongly increased production, exports and the percentage of exports, so that in 1938 Germany exported 21.7 percent of production, amounting to 60,099 cars, challenging Britain's figure of 68,257. Italy, which had a much weaker home market, exported up to 42 percent of production, but this amounted only to 25,772 cars in the best year (1937). France's best annual export performance was in the region of 20,000 cars, amounting to 11 percent of production (The Motor Industry of Great Britain 1935-1939 issues).

The British Empire regularly took around 80 percent of all British car exports, which was understandable in a period when Australia, New Zealand and South Africa were some of the best actual and potential car markets among the non-producing countries. Of the smaller European countries, only Belgium and Sweden as yet had new car sales on any comparable scale. In 1928, General Motors calculated that 38 percent of the world market outside the USA and Canada was in the British Empire (Sloan 1965, p. 322). The figure would probably have been at least twice as high if Europe was excluded from the calculation.

The Morris Minor of 1948, an Alec Issigonis design, was the first British postwar small car to be introduced.
Morris Minor Owners Club.

To sum up, the main advantage of the horsepower tax was that it forced Britain's motor industry to concentrate on the small car, a type of car that America chose not to compete with. The strength of the British home market, coupled with increasing demand for small cars in some key export markets, gave Britain the leading position among European car-producing nations in the 1930s.

Some observers did appreciate the fact that Britain in the 1930s was the world's largest and most successful maker of small cars, and expressed the view that Britain's motor industry should concentrate on such products, even in the post-war world. Thus Laurence Pomeroy Junior, the technical editor of *The Motor*, wrote, "There is reason to believe that of all cars…throughout the world at least three—possibly four—out of 10 are small cars of the type which we may consider indigenous to England and Europe. It would seem sound policy for British manufacturers to concentrate on securing the highest possible percentage of this market" (letter to *The Times*, Jan. 3, 1945). As will become clear from the discussion below, this plea by Pomeroy in 1945 by then represented a minority view.

The ultimate tax saver?

There was no attempt by any political body or motoring organization to further the development of mass-motorization in Britain between the two world wars. The Government largely pursued a hands-off policy with regard to the motor industry, except in areas such as taxation and duties, which were fiscal measures as much as, or more than, stimulants to the motor industry. However, as motoring became more widespread, the Government increasingly took the initiative to regulate it, introducing compulsory third-party insurance, driving tests, and the 30-mph speed limit in built-up areas. These initiatives were aimed at reducing the high rate of road accidents and fatalities. Compulsory insurance was brought in with the Road Traffic Act of 1930, which also abolished the general speed limit, still set at 20 mph as introduced in 1904, but in practice totally disregarded. The 30-mph limit in built-up areas and the driving tests followed in 1935 (Plowden 1973, Chapters 11-13).

The initiative therefore largely passed to the motor industry itself, and sometimes to the press. The Austin Seven, on its launch in 1922, was billed as "The Motor for the Million," offering "Motoring at Tram Fare," and the publicity for this car was to some extent aimed at cultivating new types of customers, such as women car buyers (Austin sales literature). Sir Herbert Austin aimed his new baby car at the working man, and wanted it to take the place of the then-popular motorcycle and sidecar combination (Wyatt 1976, pp. 19-22ff). Another British small car of the 1920s, the Trojan, was as eccentric in its engineering as it was in its advertising. The makers asked, "Can You Afford to Walk?" and then proceeded to calculate that the cost of shoe leather was more than the running costs of a Trojan (Bird 1967, p. 9; Montagu 1966, pp. 155-162).

William Morris stated in 1924 that "[u]ntil the worker goes to his factory by car, I shall not believe that we have touched more than the fringe of the home market" (Morris 1924, cited in Andrews and Brunner 1955, p. 121). In 1926, the Society of Motor Manufacturers and Traders calculated that an annual income of £450 was required to maintain a car (Richardson 1977, p. 103). Two years later, the *Morris Owner* magazine claimed that the Morris Minor, which then cost £125, could be maintained by "any steady-going working-man in regular employment." This may have been true, at least for Morris's own workers; William Morris, claiming that "no factory can turn out a cheap car on low wages" (Overy 1976, p. 112), paid a fairly generous level of wages including a bonus system which by 1925 had boosted the average weekly pay packet at Cowley to £4 6s. In 1934, the Austin workforce was described as "probably the best paid body of workers in Great Britain" with an average take-home pay of £180 each in the previous year (*Efficiency* magazine, Apr. 1934, cited in Richardson 1977, p. 117).

The SMMT calculation referred to above is likely to have been based on the purchase of a new car. In fact, there was a growing trade in second-hand cars. The average life of a car in the 1920s or 1930s was by modern standards extremely short, but a serviceable ten-year-old car could, by the mid-1930s, be bought for £10 or less. While the availability of second-hand cars is often cited as the greatest threat to sales of new, cheap cars, under the British horsepower tax system there was an incentive to buy a new, low-rated car, in preference to a second-hand, higher-rated car. Throughout the inter-war period, there were, accordingly, several attempts at making cars of an even smaller type than the 8 hp models to which the public had been accustomed. Many projects were touted as £100 cars, the magic figure first achieved by a stripped-out Morris Minor in 1931, and then by the Ford Model Y in 1935. Of equal relevance was the desire to reduce running costs; a car with an engine rated at 6 hp would qualify for the minimum rate of horsepower tax.

In 1930, the magazine *The Light Car and Cyclecar*—always the main proponent of the small car idea—ran a campaign on behalf of "real baby cars," the main contributor being "Focus" who was probably the magazine's editor, F.L.M. Harris (issues Aug. 1 to Sept. 5). He pleaded for consideration of a two-seater car with an engine rated at 6 hp, and forecast annual savings, as compared to the 8-hp models, "of £2 in taxation, £2 10s in petrol and probably £1 or so in insurance." In another article, "an experienced designer" suggested a rear-engined car with a conventional engine, and a reader contributed a scheme for a front-wheel drive car with a flat-twin engine, the principle later adopted by Grégoire and Citroën in France.

To be taken altogether more seriously was the 7-hp car proposed by Rover in 1931. The Scarab was displayed at the 1931 Motor Show, with a price of £89. The car had much technical merit, with all-independent suspension and an air-cooled overhead-valve V-twin engine mounted at the rear. Cylinder dimensions were 75 x 95 mm for 839 cc and 7 hp (Eves 1961; Frostick 1968, pp. 7-10; Oliver 1971, pp. 111-115). The body was a four-seater open tourer that, according to the Rover Company secretary F. Ward, was a great mistake, as it would limit potential demand for the car to 5,000 per year, instead of a possible 30,000 for a closed model. He felt that the low price in itself would not be attractive because of competition from larger second-hand cars (Foreman-Peck 1981, p 200; Robson 1977, pp. 162-164). Contributory to the swift demise of the Scarab project was the fact that while £15,000 had been spent on preliminary work, another £50,000 was required to put the car into production (Robson 1977, p. 164), while the company reported a loss of more than £77,500 for 1930-31, partly incurred by expenditure of £60,000 on an assembly plant in New Zealand (Oliver 1971, pp. 98, 101). Sources mostly agree that around six Scarabs were made. Apart from the condition of the Rover Company at the time and the uncertainties of the model's success in the market place, it is also unlikely that the British public would have accepted the unconventional design of the car.

With the 1934 budget, which lowered the rate of tax to 15s per horsepower, some of the interest in minimal motoring disappeared, and it fell to a foreign company to provide the first practical sub-8-hp car. This was the Italian Fiat 500, introduced in Britain in 1936 at a price of £120 (including import duty), possibly a handicap at a time when the cheapest Ford 8 hp four-seater sedan cost £100. The Fiat was of conventional but advanced design, with a front-mounted four-cylinder engine, of 52 x 67 mm, 569 cc and 6.7 hp, and was more modern than British small cars, with independent front suspension, hydraulic brakes, and streamlined bodywork. Sales in Britain were said to run at sixty cars per week (Sedgwick 1974, pp. 214-20); in fact, the highest recorded official figure for cars and chassis imported from Italy was

The Standard Vanguard, introduced in 1948, was made successful by the new flat tax that came into effect that year. Rated at 18 hp, it would have been taxed at £22 10s under the old system. The new rate was just £10. *Wikipedia*

2889 of all types during 1937 (*The Motor Industry of Great Britain* 1939, p. 57, table 15).

The main disadvantage of the Fiat was that it was originally only a two-seater, although in April 1939 a four-seat version was introduced at £133 10s. This body may have been built in Britain and was never offered in any other market. While sales of the Fiat were no threat to the British manufacturers of small cars, the increased number of cheap Italian and German imports at this time alarmed the SMMT, which accused the foreign manufacturers of "dumping" and appealed to the Import Duties Advisory Committee for help (Plowden 1973, p. 304). There was some hysteria in the British motoring press at the prospect of a flood of cheap German imports, which had reached 5,217 in 1937 and 3,419 in 1938 (*The Motor Industry of Great Britain* 1939 p. 57). By 1939, German Opels were being assembled in a factory at Southampton (Sedgwick 1977, p. 129).

It was the 1939 budget, with the increase of the horsepower tax from 15s to 25s, that occasioned the last pre-war wave of interest in the very small car. Before the budget, the technical editor of *The Motor*, Laurence Pomeroy, Junior, had already outlined in two articles the possible design of a "mini-motor" which, apart from the co-incidence in name, also featured a transverse engine of four cylinders and 600 cc with front-wheel drive (*The Motor* Jan. 31 and Feb. 7, 1939; Frostick 1968, pp. 93-96). After the budget, both the leading magazines returned to the subject of possible 6-hp cars, forecasting that such cars might be developed by British manufacturers and could be on the market already in 1940 (*The Motor* May 9, 1939; *The Autocar* May 12, 1939). A few months later, such discussion was effectively terminated with the outbreak of war.

Some work, however, was done by a variety of manufacturers during 1939-40, and again during the later stages of the war, on different small car projects. Of these, only the 6-hp Morris Mosquito would mature into production form as the Morris Minor. When that model was belatedly introduced in 1948, it was fitted with a conventional 8-hp engine, instead of any of the more advanced alternatives considered by its designer Alec Issigonis.

Abolition of the horsepower tax in Britain

During the later stages of World War II and the immediate post-war period, there was growing discussion about the British taxation system, in the press, in many Government departments, and sometimes in Parliament. Many proposals were put forward by manufacturers and interest groups. At the end of the day, the argument that Britain needed to make larger-engined cars suitable for post-war export markets, still mainly in the Empire or Commonwealth, came to be generally accepted. This had already been suggested in 1924 (if not earlier) when, in a debate about the Road Fund in the House of Commons, it was stated that the tax had "compelled manufacturers to build and design a type of engine which the foreigners will not buy, and which our colonial customers will not look at" (House of Commons Debate (HCD), Mar. 6, 1924, cited in Plowden 1973, p. 175).

In 1934, Chancellor of the Exchequer Neville Chamberlain stated in his budget speech that "I am informed that the trade has been to some extent hampered by the heavy horsepower tax which is levied in the United Kingdom, and that if any reduction could be made in the rate of that tax it would be likely to lead to an expansion in production of all kinds of private cars in this country, which in turn would react favorably upon the export trade. I have been impressed by the weight of that argument …" (HCD Apr. 17, 1934 and Public Record Office, Kew, both cited in Plowden 1973, p. 301) and accordingly he reduced the level of the tax from £1 to 15s per horsepower.

A later Chancellor, Sir John Simon, reversed this policy in 1939 when, faced with the cost of re-armament, he felt "bound to ask them [i.e., the motorists], in these stern times, to submit to a substantially increased scale" of tax from 15s to 25s per horsepower. Furthermore, this increase in motor taxation was seen as an alternative to an increase in income tax; the Chancellor referred to "The users of private cars, who very largely correspond to the Income Tax paying classes" (HCD Apr. 25, 1939, cited in Plowden 1973, p. 303). In the Committee Stage of the Debate on the Finance Bill, the Chancellor expressed the view that while the 1934 decrease in the tax had been made to assist the industry in increasing export sales, this had been a disappointment insofar as increased exports of high-powered cars did not materialize (HCD June 27, 1939, cols. 257-258).

When in January 1944 the wartime Chancellor Sir John Anderson first intimated that he was undertaking a review of the question (HCD Jan. 18, 1944, col. 55; *The Times*, Jan. 19, 1944), the floodgates opened. Between 1944 and 1947 many suggestions were put forward by various manufacturers, industry and trade bodies, and organizations representing the motorists. However, Sir John, poured cold water on some of the more hopeful or frankly crackpot suggestions, stating in his budget speech on April 25, 1944, that "at the present time, it is almost impossible for me to sacrifice revenue" (HCD Apr. 25, 1944, cols 656-657; *The Times*, Apr. 26, 1944) and later made it clear that "the yield in revenue from motor-vehicles shall not be less than that under the system in operation before the war" (*The Times*, Sept. 1, 1944).

So many conflicting proposals were being made that it was little wonder that succeeding Chancellors were to complain about the lack of unanimity on behalf of the representative bodies. Thus, Sir John Anderson, also in the 1944 budget speech, said: "While everybody agreed that a reduction of taxation would be a good thing, there was no such unanimity on the effect of motor taxation on design" (Budget Speech, HCD Apr. 25, 1944, col. 657; The Times, Apr. 26, 1944). He also spoke of "the embarrassing conflict …of opinion" in the industry (HCD Apr. 25, 1944, cited in Plowden 1973, p. 317). Similarly, postwar Chancellor Hugh Dalton was to complain that "he was a little embarrassed at the present time at the speed with which the spokesmen of the motor industry changed their minds" (HCD Feb. 18, 1947; *The Times* Feb. 19, 1947). Soon after, he stated that "the manufacturers…now seem to have changed their minds once more…even now they are not unanimous—they never are" (HCD Apr. 15, 1947, col. 79; The Times Apr. 16, 1947). Even when Dalton announced his solution on June 17,1947, he still described the manufacturers as "slightly elusive" (HCD June 17, 1947, col. 1822; *The Times,* June 18, 1947).

In fact, following the early submissions by various interest groups, in December 1944 the Chancellor had reached a decision, which he announced in the House of Commons in response to a question on December 19, 1944. He had found "no sufficient case … for making any shift of duty between the vehicle and its fuel, or for introducing any new form of taxation on the vehicle such as a tax on value." He did however conclude that there would be advantage in calculating the license duty on the basis of engine cubic capacity instead of by the bore and number of cylinders, as under the RAC formula. To obtain an equivalent amount of revenue, he proposed to charge the new duty at the rate of £1 per 100 cc; most 8-hp cars which were of 900-1,000 cc would thus continue to be taxed at £10 per year. The new system was expected to come into force on January 1, 1946 (HCD Dec. 19, 1944, cols. 1624-1626; *The Times* Dec. 20, 1944).

For the time being, Hugh Dalton continued his predecessor's policy. In his Budget Speech in October 1945, he repeated the intention of introducing the capacity tax, with 100 cc bands (HCD Oct. 23, 1945, col. 1890; *The Times* Oct. 24, 1945). Subsequently, Dalton announced in the House of Commons that the new capacity tax would come into force on 1 January 1947, would be charged at the rate of £1 per 100cc, with a minimum tax of £7 10s, but would only apply to new cars first registered on or after 1 January 1947; older cars would continue to pay a tax of 25s per RAC horsepower (*The Times* Feb. 13, 1946).

The conclusion came in the House of Commons on June 17, 1947, in the Committee Stage of the Debate on the Finance Bill when a Mr Shawcross sought to introduce a new clause in the act, stipulating a flat-rate tax of £5 per car (HCD June 17, 1947, cols. 1793-1840; the Chancellor's move on this day had been correctly predicted by *The Times* that morning). Shawcross was supported in this by several members with car factories in their constituencies. Dalton, in reply, agreed that "what we really want [in order] to divorce taxation from design is a flat and uniform annual licence fee...I am quite satisfied that the case is made for the flat licence duty for all cars to be made in the future...the proposal is that the annual licence fee, as from 1st January, 1948, on new cars shall be a flat rate of £10. Five pounds is too little..." (HCD June 17, 1947, cols. 1822-1823) to which he then added the sting in the tail that Purchase Tax (originally introduced in 1940) on cars with a basic price of £1000 or more would be doubled from 33 1/3 percent to 66-2/3 percent (HCD June 17, 1947, cols.1824-1825). On the other hand, there was to be no increase in the petrol duty. Effectively it meant that all new cars would be taxed at the rate which hitherto had applied only to the smallest practical popular models. It cleared the way for the British motor industry to manufacture new cars without any restrictions on cylinder bore or engine size.

Born and educated in Denmark, Anders Ditlev Clausager *earned a Master of Design degree from the Royal College of Art, London, in 1976 and a Master of Arts in History by research from the University of Warwick in 2000. A former designer for Volkswagenwerke and Austin-Morris, he was achivist for BL Heritage, later the British Motor Industry Heritage Trust. More recently, he has retired as chief archivist for the Jaguar Daimler Heritage Trust and serves as membership secretary of the Society of Automotive Historians in Britain. This article is based in part on his M.A. dissertation for the University of Warwick in 1999, "In Search of a British Peoples' Car.."*

Note: Before Britain's postwar devaluation in September 1949, the exchange rate was approximately U.S. $4 to the British £, but between 1934 and 1940 it had been closer to US $5 to the £. Prior to decimalization in 1971, British currency had 12 pence (d) to the shilling (s), 20 shillings to the pound (£).

References

Andrews, P.W.S. and Elizabeth Brunner. (1955). *The Life of Lord Nuffield: A Study in Enterprise & Benevolence*. Oxford: Pasil Blackwell.

Automobil Revue. (1956). Compiled from Katalog der Automobil Revue, annual catalogue issue. Bern, Switzerland, March 1956.

Barnett, Corelli. 1996. *The Audit of War: The Illusion and Reality of Britain as a Great Nation* (paperback edition). London: Papermac.

BMIHT archive. British Motor Industry Heritage Trust, Gaydon, Warwickshire, U.K.

Bird, Anthony. (1967). *The Trojan Utility Car*. Leatherhead, Surrey: Profile Publications, Ltd.

Brendon, Piers. (1997). *The Motoring Century: The Story of the Royal Automobile Club*. London: Bloomsbury Publishing.

Church, R.A. (1979). *Herbert Austin – The British Motor Car Industry to 1941*. London: Europa Publications Ltd.
——(1994). *The Rise and Decline of the British Motor Industry*. London: Palgrave Macmillan.

Clausager, Anders Ditlev. (2010). "Motorisierung: The German Motorization Program 1933-1939." *Automotive History Review* No. 52.

Collier, Peter and David Horowitz. (1989). *The Fords – An American Epic* (paperback edition), London: Futura Publications.

Consumer Guide, the auto editors of. (1989). *50 Years of American Automobiles, 1939-1989*. Chicago: Publications International, Ltd.
Duncan, H.O. (n.d.). *The World on Wheels*. Paris: H.O. Duncan.

Etzold, Hans-Rüdiger, Ewald Rother and Thomas Erdmann. (1992). *Im Zeichen der Vier Ringe 1873-1945* (Band 1). Ingolstadt, Germany: Edition Quattro GmbH

Eves, E. (1961). “Cars that might have been: Rover Scarab,” *The Autocar*, Dec. 8, 1961.

Foreman-Peck, James. (1981). “The Rover Company in the Inter-War Years”, *Business History* Vol.23 No.2, citing Rover Directors’ Minute Book, and study by Mr F. Ward dated 30 September 1931 in Rover Company Records, BMIHT archive.

Foreman-Peck, James, Sue Bowden and Alan McKinlay. (1995). *The British Motor Industry: British Industries in the Twentieth Century*. Manchester, U.K.: Manchester University Press.

Frostick, Michael. (1968). *The Cars That Got Away*. London: Cassell.

Giacosa, Dante. (1979). *Forty Years of Design with Fiat*. Milano: Automobilia.

Graf von Seherr-Thoss, H.C. (1974). *Die Deutsche Automobilindustrie*. Stuttgart: Deutsche Verlags-Anstalt.

Maxcy, G. and A. Silberston. (1959). *The Motor Industry*. London: Allen and Unwin.

Montagu, Edward Lord. (1966). *Lost Causes of Motoring*. London: Cassell.

Morris, William. (1924). “Policies that have built the Morris Motor Business” in *System*, Vol. XLV, No. 2. A full version of this was published in *Journal of Industrial Economics* Vol. 2, No. 3, August 1954, pp. 193–206.

Morris production records, BMIHT archive.

Motor Industry of Great Britain, The (various issues). Society of Motor Manufacturers and Traders annual handbook. London: SMMT.

Nevins, Allan and Frank Ernest Hill. (1957). *Ford: Expansion and Challenge, 1915-1933* (New York: Charles Scribner’s Sons.
——(1963). *Ford: Decline and Rebirth 1933-1962* (New York: Charles Scribner’s Sons.

Nicholson, T.R. (1982). *The Birth of the British Motor Car*. London: Macmillan Press, Ltd.

Nixon, St. John C. (1949). *Wolseley – A Saga of the Motor Industry*. London: G.T. Foulis & Co.

Oliver, G. (1971). *The Rover*. London: Cassell.
Oswald, W. (1977). *Deutsche Autos 1920-1945*. Stuttgart: Motorbuch-Verlag.

Overy, R.J. (1975). “Cars, Roads and Economic Recovery in Germany, 1932-8”, in *Economic History Review*, second series, 28, 1975.

——(1976). *William Morris – Viscount Nuffield*. London: Europa Publications.

Plowden, William. (1973). *The Motor Car and Politics in Britain, 1896-1970*. (Pelican edition), Harmondsworth, Middlesex: Penguin Books.

Pomeroy, L. (1957). “Microscope for Americans,” *The Motor*, 23 Jan. 1957 p.998; 30 Jan. 1957 p.1008 and p.1031, based on his paper “The Size, Structure and Export Performance of the Western European Automobile Industry,” delivered to the US Society of Automotive Engineers in January 1957.

Ricardo, Sir Harry. (1990). *Memories and Machines: The Pattern of My Life*. Slough: Constable.

Richardson, Kenneth (1977). *The British Motor Industry 1896-1939*. London: Macmillan Press, Ltd.

Robson, Graham. (1977). *The Rover Story*. Cambridge: Patrick Stephens, Ltd.

Sachs, W. (1992). *For Love of the Automobile: Looking Back into the History of Our Desires*. (Berkeley, California: University of California Press.

Sedgwick, Michael. (1970). *Cars of the 1930s*. London: B.T. Batsford Ltd.
——(1974). *FIAT*. London: Arco Publishing.

Sieve, E.J.B. (1950). “British Motor Vehicle Exports,” PhD Thesis, University of London. (contains a detailed survey of the five most important markets: Australia, South Africa, New Zealand, India and Eire.)

Sloan, Alfred P. (1965). *My Years with General Motors*. London: Sidgewick and Jackson Ltd.

SMMT (1924). Circular letters from The Society of Motor Manufacturers and Traders (SMMT) Sept-Oct. 1924, in BMIHT archive, Gaydon, accession 95/52/2/1 (Austin-Bramley collection).

The Times (1955). *The Times Survey of the British Motor Car Industry*. London, Oct 1955.

Usher, Frederick A. (1978). “The SIA Contest of 1935,” *Automobile Quarterly*, Vol. XVI No. 2. Kutztown, Pennsylvania: Automobile Quarterly, Inc.

Wyatt, R.J. (1976). *The Austin Seven: Motor for the Million*. Newton Abbot, U.K.: David and Charles.

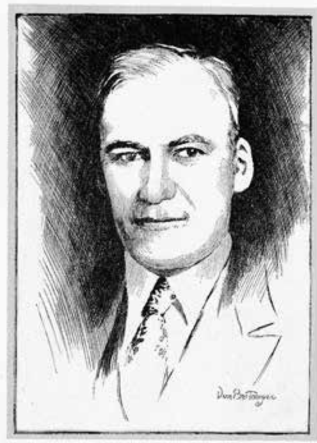
They Had Faith in America
Norman de Vaux, E.J. Hall and the De Vaux Automobile

By Ric Dias

Introduction

General Motors, Ford, and Chrysler, commonly referred to as “The Big Three” or “The Detroit Three,” dominated the North American auto industry through the second half of the twentieth century. Through its beginning decades, however, the industry had many more companies vying for customers; about 2,500 companies have tried their hand at automaking, although most never reached anything close to mass production. One such unsuccessful attempt to break into the highly competitive American auto market was by De Vaux-Hall Motors Company of the early 1930s, maker of the beautiful and capable, albeit short-lived, De Vaux automobile.


NORMAN DE VAUX


COLONEL ELBERT J. HALL

In hindsight, the founders of De Vaux-Hall picked a horrible time to launch their new automotive venture, during some of the toughest years of the Great Depression, but the firm’s two leading figures, Norman de Vaux and Elbert J. Hall, were not wide-eyed neophytes unfamiliar with the auto industry. Actually, it is a testament to the experience, not to mention the immense talent and tenacity of both men, that the De Vaux car even reached production. The De Vaux was an automobile of notable performance, good value, and fine lines. In the relentlessly cutthroat American auto market, however, those attributes were not enough to bring success, especially in the bleak years of the Great Depression.

The founders

The two founders and primary figures in the De Vaux story were such major parts in the creation and take-off of the car that their names and careers were promoted front and center, nearly as prominently as the car itself.

Norman de Vaux, who initiated the project, seems to have been born a salesman. Hard-working and smart, by the time he launched the De Vaux car he could look back to almost a quarter century in the automobile business, with a string of impressive accomplishments marking his career path. (Norman de Vaux did not capitalize the “d” in his family name, but the “D” is capitalized in “De Vaux” for the car and company named after him.) Maybe his winning ways could have been predicted from his remarkable drive, evident even in his youth when he bicycled across America in 1896 in the record-breaking time of just 37 days, 14 hours and 15 minutes (*San Francisco Chronicle*, July 9, 1896, p. 16; *San Francisco Bulletin*, Jan. 28, 1928, p. 29; *Time*, Dec. 29, 1930. Sources disagree about the exact duration of de Vaux’s bicycle trip.). His initiation to the auto industry came with selling Cadillacs in the opening years of the twentieth century (Jones 2003). More sales positions followed, with de Vaux ascending from the sales floor to the front office as a distributor. Along the way he completed stints at Buick, Auburn, Reo, Chevrolet, Star and Durant. He asserted that when under his command the car companies he worked for usually enjoyed first, second, or third place status in key states or the region he served (De Vaux-Hall 1930a). His work in distribution brought him into a close and long-term relationship with automobile empire builder William Crapo “Billy” Durant, the man most responsible for assembling General Motors. This friendship served both men well. In 1916, under Durant’s watch, de Vaux oversaw the building of Chevy’s Oakland, California, plant, with de Vaux stating that “with the completion of the plant I intend to make this city my home...(*Oakland Tribune*, Feb. 1, 1916, p. 7).” De Vaux then built a plant for Durant Motors in Oakland a few years later after the two men had left G.M. The American West had become de Vaux’s bailiwick, and by the World War I period he had risen to the top in his field (De Vaux-Hall 1930b). In 1925 Norman de Vaux assumed control of Durant Motors of California, which built Durant and Star cars destined for western states and overseas. According to *Time* (Dec. 29, 1930), de Vaux had “attained a great reputation,” logging 150,000 miles for work in 1930 alone, allowing him to “reap fat commissions” and live in the exclusive community of Piedmont, not far from Oakland, “on an estate previously belonging to R. C. Durant, son of William Crapo.” *Time* also said of de Vaux that “[w]hen not working, he is apt to be seen swishing around in fast speedboats, second

Norman de Vaux, standing far right, in front of a Durant car next to the Oakland Durant plant. Courtesy of the Oakland Public Library, Oakland History Room, found by John Perala.

in his heart only to automobiles." Norman de Vaux loved speed and machines.

Familiar with company operations and confident that he could move the product even if his boss could not, when Durant Motors began to fall apart in 1930 de Vaux did the unexpected—he bought the portion of the firm he oversaw, with plans to continue production. With the nation's economy still contracting—the Depression would not reach its nadir for another couple of years—de Vaux could have taken a more financially conservative and perhaps smarter move. Such was the confidence of this man in his own ability to sell that he did not.

Just as Norman de Vaux seemed to have been born to sell, Elbert John (E.J.) Hall was arguably born to engineer. Like many successful auto engineers of the early twentieth century, such as Clessie Cummins and Henry Ford, Hall did not possess a college diploma. In fact, Hall attended school only through the seventh grade, and even then his classes were consumed with drawing engines and other machines. His drawing of engines evolved to tinkering with them, which transitioned into repair work and then finally graduated to design and manufacture. His first automotive job came around 1905 at tiny Heine-Velox of San Francisco, maker of sophisticated, expensive, and potent cars (see *Automotive History Review* No. 15, Fall 1982). The devastating earthquake of April 1906 tossed Hall back onto the job market, and after the 'quake he worked at several shops in San Jose and San Francisco, tuning, designing, and building engines for autos and airplanes. Hall even did a bit of auto racing himself, setting at least one speed record as part of a team in a 1906 San Francisco to Los Angeles run. While clouded in some mystery today, it was during this period that Hall also built a car of his own, the record-setting little Comet. Hall bucked convention by building a car with a small, lightweight body, a 102-inch wheelbase and a tiny, high-revving engine (201 cubic inches, four cylinders, overhead valves). The Comet received fairly wide press even if the number of Comets sold can probably be counted on two hands (Bradford and Dias 2007).

Hall met fellow Californian Bert Scott in 1908, and that new friendship dramatically altered the trajectory of both their careers. Scott convinced Hall to join him in constructing a powered rail car (popular at the time and called a "motor car"), using a Hall-built powertrain. With the success of that first unit, the Hall-Scott Motor Car Company was born in 1910, formed to build rail motor cars plus engines for non-rail use. Using Hall's auto and air engines as a basis, soon augmented with new models, almost overnight Hall-Scott became one of America's leading providers of air power, using such industry-leading features as overhead camshafts, cross-flow and hemispherical cylinder heads, and extensive use of aluminum. The many racing successes racked up by Hall-Scott-powered airplanes led E.J. Hall to be invited in 1917 to partner with the respected Jesse Vincent of Packard Motors to design what became known as the Liberty motor, one of the great technological achievements emerging from World War I. By the close of the 1910s E.J. Hall had clearly "arrived" (Bradford and Dias 2007).

Following the end of the Great War in 1918, Hall-Scott diverged into a number of new markets for its engines, and E.J. Hall branched out as well. Hall-Scott assembled the

82 MOTOR BOATING FEBRUARY, 1922

HALL-SCOTT

4 cylinder, 125 H.P. Weight 1100 lbs.

THE unvarying success of Hall-Scott Marine Engines in both runabouts and cruisers has proved that the high speed motor boat is entirely practical from the standpoints of service and reliability, if equipped with a power plant properly designed and built for the purpose.

Superior design, more suitable materials and better workmanship has made Hall-Scott engines lighter in weight and more enduring in service than any other high speed engines. Their abilities are matters of fact, amply demonstrated by performance.

Hall-Scott Owners Are More Than Enthusiastic—

"MARATHON"—47 mile Sea Sled. Two 6 cyl. 200 H.P. Hall-Scotts.

Norman De Vaux, Oakland, Calif.—
"I am more than pleased with the pair of six-cylinder 200 H.P. motors installed in my 62 foot cruiser 'Myrno II.' She is really a different craft since making this installation. We are making three to four miles per hour more speed; saved three thousand pounds on engines and reduced the gasoline consumption at least one-third."
Mr. De Vaux has since purchased two additional Hall-Scotts.

The Sea Sled Company, West Mystic, Conn.—
Regarding the 30-ft. Sea Sled "Marathon."
"These engines have run at least three to four thousand miles since Mr. Plant had the boat, and Capt. Perry is very proud of the way they have behaved and stood up in this service."

John L. Hacker, Naval Architect and Boat Builder—
"After riding behind several of your 'fours' there is no need for a customer insisting on a 'six' to eliminate vibration. Your 'four' does the trick. We recommend your motors for runabouts and fast cruisers because holding down the weight means everything in the success of these types of boats; also your engines have proven they will stand up better and longer than any of the other fast turning motors."

A. Crawford Smith, Jr., Baltimore and Edgewood, Md.—
"I told you I wanted a motor that would go when I wanted to and keep it up until I quit. You said that yours would. So far it's more than made good. All told, I have burned over 800 gallons of gasoline this season and with the exception of a few dirty spark plugs, the motor hasn't had a wrench put on it. No carbon has had to be cleaned out, the valves or valve tappets haven't been touched. My boat is now being hauled out for the winter but the last time she ran, the motor turned up 1840 and maintained it like a chronometer until I throttled to make my landing."

"AJAX"—23-mile Ferry Boat. 40 ft. x 7 ft. 6 in. Six cyl. 200 H.P. Hall-Scott.

"ADIEU"—42 M.P.H. Fisher Allison Trophy winner at Miami, 1921. Six cyl. 200 H.P. Hall-Scott.

Advertising Index will be found on page 192

Norman de Vaux's admiration for Hall's engineering can be gleaned from this 1922 ad in which de Vaux endorsed Hall-Scott engines. From the author's collection.

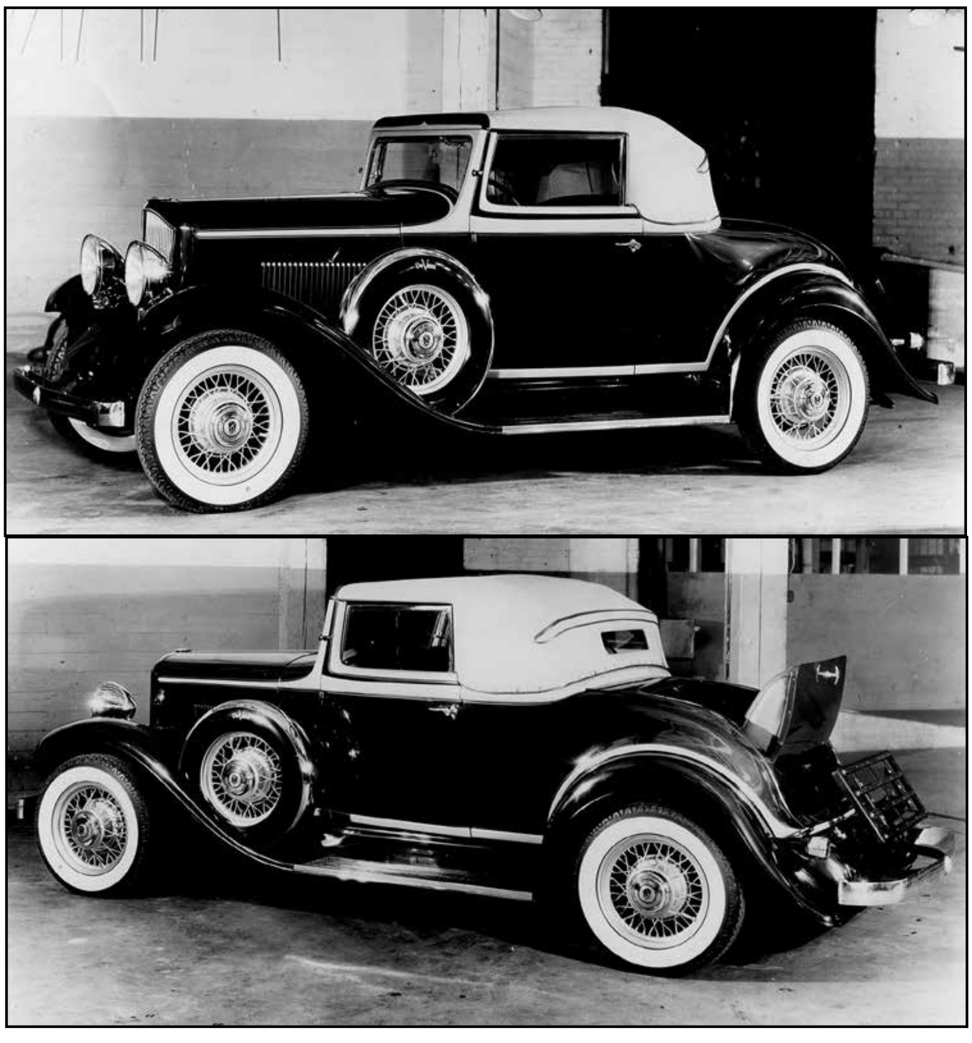
popular Ruckstell two-speed rear axle for the Model T Ford, and Hall found multiple companies willing to pay for his engineering skill. In the 1920s, Hall, now usually referred to as "Colonel" because of his World War I experience, designed components like engines, axles, and transmissions for trucks, buses, trains, boats, tractors, race cars, and airplanes. There seemed to be nothing automotive, broadly speaking, that the self-trained engineer could not do or improve.

Forming the company

As the chief of Durant's California operation, de Vaux knew all too well the difficulty of producing and selling cars in the sluggish economy of post-Crash America in 1930. Durant sales, even under de Vaux's watch, plummeted from 1929 to 1930. This free fall prompted Billy Durant to take bold action, which included selling an idle New Jersey factory, reorganizing the front office, selling the company's interest in three component makers, announcing the marketing of the tiny French Mathis car, and lowering the cost on the Durant four-door coach by $25 (*New York Times*, Jan. 18, 1930, p. 14; July 22, 1930, p. 34; Aug. 20, 1930, p. 16; Aug. 30, 1930, p. 26). These measures did not reanimate Durant Motors, but they bought the moribund company a little time. Then in mid-December 1930 Billy Durant and Norman de Vaux shocked the automotive world by announcing the sale of the Durant Motor Company of California, including its Oakland plant, to de Vaux (*New York Times*, Dec. 15, 1930, p. 38). Companies failed and factories closed with such regularity in 1930 that this might not have been newsworthy, but de Vaux's announcement of the Oakland plant purchase, plus lining-up a facility to produce cars in Grand Rapids, Michigan, with the entire project costing perhaps $20 million, captured coverage in major newspapers and trade publications nationwide (*New York Times*, Dec. 15, 1930, p. 38; "De Vaux Six – A New Car in the Lower Priced Field;" *Automotive Industries*, Dec. 20, 1930, pp. 899 and 903).

Norman de Vaux had no desire merely to sell a rebadged Durant, as that car wasn't finding enough buyers as it was. In fact, the part of Durant Motors that de Vaux didn't buy continued to stumble forward listlessly, selling a few cars into early 1932 (Hemmings 2006). Hoping for a different trajectory, de Vaux planned to launch a new car, based on the Durant but better suited to market realities. De Vaux recognized the difficulty that Americans were having finding the money needed to buy a new car, so he thought if he could offer consumers excellent value, giving them more car for their dollar, he could generate enough sales. He wanted shoppers in the "the low priced field" (he forecast his cars to range in cost between $525 and $750) to feel like they were buying a better and more expensive car; that would be his company's niche. To build such a vehicle, using the Durant car as a starting point, de Vaux brought aboard engineering, styling, and marketing talent and made subtle changes. After 30 years in the auto industry, de Vaux was finally poised to produce a car bearing his name. Not a man to move slowly, he forecast a February 1931 release of the new car, a shockingly early date. It would have been a stretch coming from most people, but perhaps not so surprising coming from him (*Grand Rapids Herald*, Dec. 14, 1930, p. 1).

Since Norman de Vaux called the East Bay of northern California home, he did not have to look far to find his engineer, the man who would bring together the mechanical elements of the De Vaux car: his old friend E.J. Hall. Hall was still at Hall-Scott in Berkeley, which is also near Oakland, in June 1930 when de Vaux asked him if he would like to jump ship and build cars with him (De Vaux-Hall 1930b). Evidence suggests that Hall was beginning to chafe under the leadership of Hall-Scott's distant parent company, rail car and bus maker American Car and Foundry (Bradford and Dias 2007). While Hall had just recently designed several impressive new engines at Hall-Scott, sales were



Two views of a 1931 De Vaux 6-75 convertible coupe. Courtesy of Jay Eitel.

nonetheless sinking to a worrisome level, so maybe it was a good time for him to leave. As a De Vaux-Hall brochure described Hall's acceptance, it was "[t]ypical of the manner in which Col. Hall acts, he accepted almost immediately Mr. de Vaux's proffer" (De Vaux-Hall 1930b).

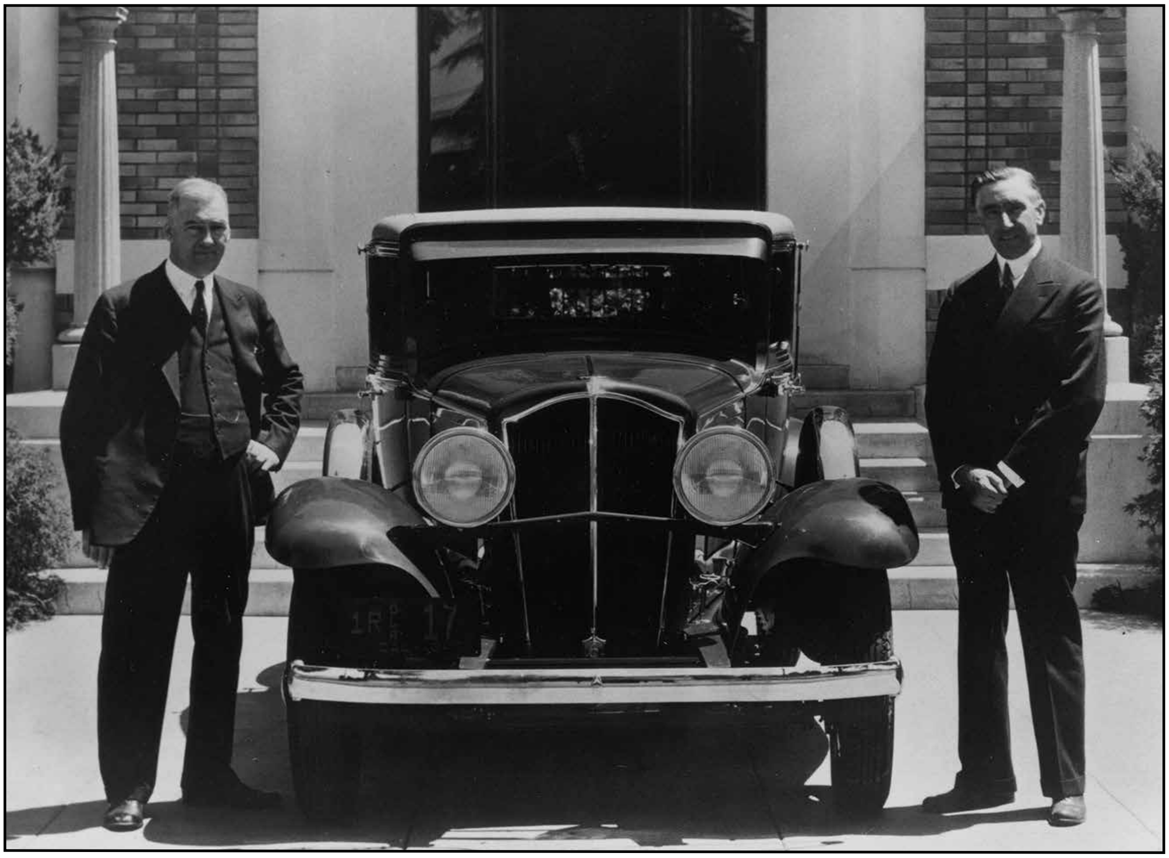
With rapid start-up time and low cost goals to meet, Hall used as many existing Durant components and as much cost-effective technology as possible. The De Vaux was basically a car assembled by parts made by outside suppliers, as was the Durant (Hemmings 2006). This strategy allowed for a quick roll-out of the new car, a clear knowledge of component costs, and ease of assembly.

E.J. Hall, vice president and member of the board, supervised "the manufacturing operation" and oversaw the testing of major components. For power, Hall chose as a starting point for the De Vaux engine a model from Continental Motors, the 22-A. Some encyclopedia, internet, and other overview sources have stated that Hall-Scott made the engines for De Vaux-Hall. However, both *Automobile Trade Journal* (March 1931, p. 33) and *Automotive Industries* (Dec. 20, 1930, p. 903) credit Continental as providing the base engine for the De Vaux, which Hall modified and Continental produced. Also, a focused look at Hall-Scott by book authors Bradford and Dias (2007) (Bradford was an engineer at Hall-Scott) did not find evidence of such a production association between Hall-Scott and De Vaux-Hall. Indeed, the only book-length history of Continental clearly states "production for engines for the new De Vaux-Hall cars was contracted with Continental Motors" (Wagner 1983, p. 58).

Continental, in business since 1902, was a popular engine supplier in the 1930s and had built power units for a number of truck companies, aircraft makers, and car firms, including Willys, Jordan, Peerless, Locomobile, and Star. Continental was also a major provider of engines for the U.S. military. "Conti's" in-line 6-cylinder Model 22-A was of conventional design and capacities, which was typical of their auto engines. It used a four-main-bearing crankshaft, had a bore and stroke of 3-3/8 x 4 inches and displaced 214.7 cubic inches. It was rated at 65 brake horsepower at 3,400 rpm. The De Vaux-Hall engine power rating increased over time. The engine was of L-head configuration, also known as "flathead" or "side-valve," which was very common in the period. That's worth noting as every engine Hall had designed for Hall-Scott since the mid-teens sported a more sophisticated and expensive overhead camshaft and valves, plus a hemispherical head. Hall was a confirmed believer in overhead valves; he even wrote an article in a 1929 Society of Automotive Engineers publication that argued, "At low engine-speed, the overhead-valve offers practically no advantage over the L-head type, which offers a more economical construction, but at the greater piston-speeds the fuel economy and higher torque of the overhead-valve engine are very definite advantages" (Hall 1929). The lower manufacturing cost of the L-head apparently trumped the greater fuel economy and higher-speed torque of overhead valves, so the 22-A's flathead stayed. However, Hall mandated changes to the 22-A engine block, manifolds, and carburetion that squeezed out a bit more performance. A unique feature of the De Vaux-Hall engine was that it had six discrete ports for the intake manifold, which contributed to what *Automotive Industries* called "one of the highest powered engines ever used in a car selling in the lowest priced field" (Dec. 20, 1930, p. 903). The engine had one last flourish—E.J. had "HALL" prominently cast into the side of the engine block and on the intake manifold. With the "tweaked" engine coupled to the improved Borg-Warner three-speed transmission, which boasted of having a quieter "constant mesh second-speed gear," a rarity in a car of its price, and with the light 2,725 pound curb weight of the sedan, the De Vaux offered sparkling performance and a pleasant all-around driving experience (*Automobile Trade Journal*, Mar. 1931, pp. 33 and 81). De Vaux owner and authority Howard Reinke reports that the 6-75 had such performance that the Grand Rapids Police Department used them as patrol cars (Reinke 2008).

Sakhnoffsky might best be remembered for creating a handful of highly stylized trailers and White trucks used to transport Labatt's beer in the 1930s. *Courtesy of the American Truck Historical Society.*

But just because a car was smooth running and a good value did not mean that buyers would flock to showrooms to buy it, in any year or economic climate, but especially in 1931. Any car would obviously benefit from standing out visually; after all, purchasing a car is oftentimes partly or greatly emotional. Therefore De Vaux-Hall enlisted a top-flight designer to add pleasing accents to its vehicle. Russian-born Count Alexis de Sakhnoffsky was an industrial designer who enjoyed international fame, and the company dropped his name shamelessly in brochures and advertisments; adding his name to the project gave the De Vaux a degree of panache (*Grand Rapids Herald*, Dec. 14, 1939, p. 1). As an added plus, the Count could list such premium automakers as Cord, Auburn and Packard among his clients, not to mention more ordinary firms like Nash, LaSalle and American Bantam; more recently he had worked at Hayes Body Corporation in Grand Rapids, Michigan. Count de Sakhnoffsky did not use an entirely



E.J. Hall (left) and Norman de Vaux flank a De Vaux 6-75. Courtesy of Harold Reinke.

new canvas for his work, but rather made subtle changes to the Durant body, as Hall had done to the car's mechanicals. He confined his touches to select parts of the car, notably the hood, fenders, and grille; his grille work seemed to attract particular attention.

Thus De Vaux-Hall had a lot going for it, having on the payroll perhaps America's best car salesman, one of America's leading auto engineers, and one of America's most recognized auto designers.

Among the more interesting aspects of the De Vaux story is its marketing strategy. Inasmuch as De Vaux-Hall was a new company, it employed some interesting means to earn the confidence of car buyers. First, Norman de Vaux wanted to saturate the media market with advertisements to build name recognition. To that end, the company committed to spend the amazing sum of $1 million on advertising in 1931, "To tell the De Vaux sales story throughout the world" (De Vaux-Hall 1930b, p. 21). Secondly, management hoped to build people's confidence in the car by familiarizing car buyers with the company's two principals, de Vaux and Hall, through biographies of varying detail. In De Vaux newspaper ads, bios of both men were often found. It's rare to find an automaker that makes its founders or leaders such a focal point in marketing, but de Vaux and Hall had impressive resumes, they were (somewhat) known and trusted, whereas their car was completely unknown. The most dedicated example of this strategy was a company brochure entitled "The Men Behind the De Vaux." This was really just an elaborate biography of both men, printed on heavy, textured paper, comprising nearly 20 pages but lacking even a single image of the car. The 6-75 was "the crowning achievement of their careers," claimed the brochure, "Indeed, their very records, teeming with achievement, are a guarantee of the surpassing excellence of the new De Vaux 6-75 (De Vaux-Hall 1930a). Perhaps these testimonials would loosen-up the purse strings of nervous and beleaguered Depression-era car consumers. Important (or not-so-important) events such as the opening of one plant, then another, building the first prototype, commencing regular production, etc., all became photo opportunities, venues to retell the story of the car and the biographies of the two founders, de Vaux and Hall.

Norman de Vaux, being what the *Grand Rapids Herald* called a "Sales Wizard" and a "Master of Selling Strategy," commanded a multi-pronged attack on the marketplace (Mar. 19, 1931, p. 1). In addition to buying print media ads, de Vaux used auto shows, phone calls, letters, personal visits, and arm-twisting travelling surrogates in an all-out assault on America's auto dealers and distributors; it was a group of men he knew and understood. The effort certainly bore fruit, and the company claimed to have signed 587 dealers before production began. Norman de Vaux dreamed big, so his company crowed about signing dealers in Asia, Europe, and the Middle East (De Vaux-Hall 1930a). The company used appearances of the De Vaux at auto shows held across the nation to put the car, and the two forward-thinking founders, firmly in the public imagination. Before production had commenced, the company claimed to have 8,500 orders for their car, which the *Grand Rapids Herald* described as "Believed Unprecedented in Motorcar History" (Mar. 19, 1931). Company executives hoped that as distributers and dealers were added, this large body of men would drive demand for cars in a very tight market.

It appears that de Vaux formulated the company's financing strategy as well. Significantly, De Vaux-Hall did not offer stock to the public to fund the operation. Management informed the Grand Rapids newspaper that "[n]o stock in the company will be offered to the public, as the backers have sufficient capital to float the project unassisted" (Dec. 14, 1930, p.1). A brochure appearing before the car hit the showrooms explained that "[o]wnership is controlled by a small group of men. The principal owners are Mr. de Vaux, Col. Hall and Mr. [George] Scott," who also worked at Chevy with de Vaux (De Vaux-Hall 1930b). The authors of this brochure must have believed that it brought peace of mind to readers if they learned that "[i]f at some future date money is needed because of tremendous expansion plans these men will have no difficulty in securing additional capital from among their personal friends." This claimed independence from America's troubled capital markets was pitched as a selling point, and was therefore shared with the public in press releases and brochures. Another De Vaux brochure said that de Vaux and Hall had been offered management positions in eastern factories to build the car "with heavy stock interests in them," but that "[t]hese offers were not accepted" (De Vaux-Hall 1930a). Even if the very pillars of American industry and finance were under siege and question, these two men could be trusted. Norman de Vaux believed he could make and market a new car very inexpensively, so his company did not need to generate many tens of millions of dollars in capitalization for start-up.

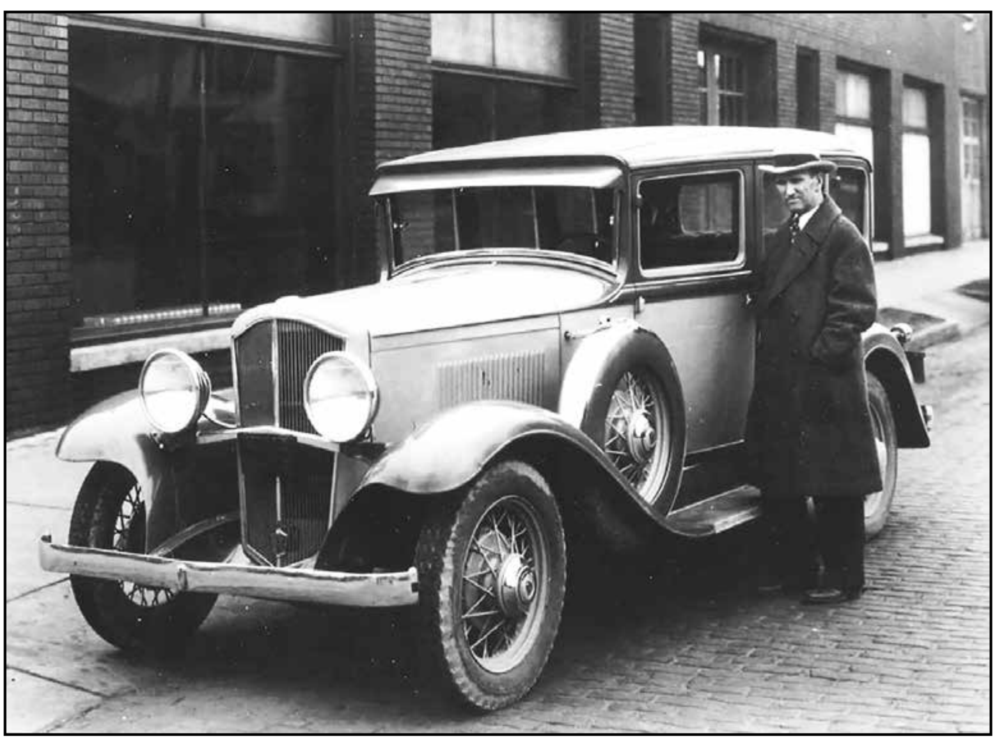
Norman de Vaux's words, at least those uttered publicly before production began, do not suggest that he considered himself foolhardy in timing the launch of his car. In fact, he maintained an amazing, perhaps even perplexing level of confidence, which caught the attention of many people. "Personally, I am of the opinion," de Vaux told the *Grand Rapids Herald* (Mar. 19, 1931, p. 1) "...that this time is most favorable to the launching of an enterprise such as ours." The paper could not help but report that this perspective "has caused wonderment not only among [his] friends, but also among industrial leaders the country over." Norman de Vaux the "sales wizard" maintained a solid front of optimism in the press, a bold face in an era almost defined by pessimism. Hall largely kept his opinions to himself, as he did his entire professional career, leaving the public pronouncements to his more outgoing partner. One ad used bold letters to proclaim of the two men and this new auto enterprise, "They had faith in America" (*Time*, May 11, 1931, p. 7).

Production and problems

The management strategy of buying all the components of the car and then having the workers assemble them into cars minimized engineering costs and insured a quicker start-up. Just as Hayes had built the bodies for Durant, so it did for De Vaux-Hall. The new automaker leased an area of a Grand Rapids building owned by Hayes, across the street from where bodies were made, erecting a small oval assembly line inside (De Vaux-Hall 1930a; *Grand Rapids Herald*, Mar. 19, 1931, p. 1). Continental Motors, located in nearby Muskegon, Michigan, about 35 miles from Grand Rapids, built the engines for De Vaux-Hall as it had for Durant. This geography was one reason why having the main assembly plant in Grand Rapids made sense. Other suppliers sent their contributions to the two De Vaux-Hall plants. As far as can be ascertained, De Vaux-Hall did not actually make any parts for the car. This is not an entirely unheard of method for car, or especially truck, manufacture. [In fact, these so-called "assembled" cars had been a significant part of the American auto industry in the 1920s —Editor]

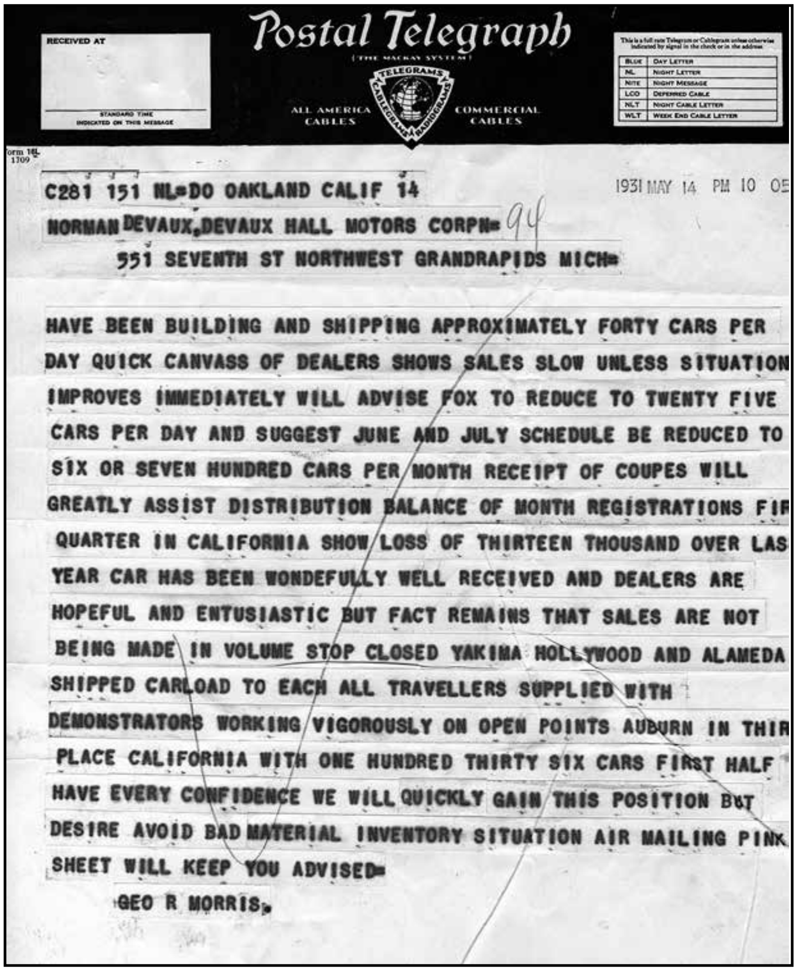
The first De Vaux car, a special hand-built unit, emerged from the Grand Rapids plant on Saturday afternoon, January 17, 1931 (*Grand Rapids Herald*, Jan. 18, 1931, p. 1). A two-tone grey custom sedan, it was destined solely for the car show circuit. Company and civic leaders posed for pictures, each casting admiring and loving looks at the new car, making positive predictions of the car's acceptance. Said some of these observers, "It's a knockout," "Looks like a high-priced job," and "It's got everything." True, they were hardly objective judges, but the words were enthusiastic and the pictures were compelling; newspapers documented that a De Vaux car, a pretty one at that, really did exist. This first car was just for show though, a fact de Vaux underscored to the company's engineer receiving the car in California. In a telegram de Vaux warned West Cost manager George Morris "do not start car but have towed to exhibit stop car most beautiful automobile ever built in price class radiator very distinctive" (de Vaux 1931a). While this prototype was just a peek, a tease for the market, "[w]e will make every effort to get into production on or before March 1," promised the company president; "Our dealer organization is rapidly being perfected and already orders are arriving in large numbers" (*Grand Rapids Herald*, Jan. 18, 1931).

Through these heady months of preproduction into the early months of production, in spite of the endless chal-



Hall's long-time friend, racing driver Earl Cooper, did much of the road testing of the 6-75, covering great distances across the United States.

Courtesy of Harold Reinke.


Postal Telegraph

C281 151 NL=DO OAKLAND CALIF 14 1931 MAY 14 PM 10 05

NORMAN DEVAUX, DEVAUX HALL MOTORS CORPN= 94

551 SEVENTH ST NORTHWEST GRANDRAPIDS MICH=

HAVE BEEN BUILDING AND SHIPPING APPROXIMATELY FORTY CARS PER DAY QUICK CANVASS OF DEALERS SHOWS SALES SLOW UNLESS SITUATION IMPROVES IMMEDIATELY WILL ADVISE FOX TO REDUCE TO TWENTY FIVE CARS PER DAY AND SUGGEST JUNE AND JULY SCHEDULE BE REDUCED TO SIX OR SEVEN HUNDRED CARS PER MONTH RECEIPT OF COUPES WILL GREATLY ASSIST DISTRIBUTION BALANCE OF MONTH REGISTRATIONS FIF QUARTER IN CALIFORNIA SHOW LOSS OF THIRTEEN THOUSAND OVER LAS YEAR CAR HAS BEEN WONDEFULLY WELL RECEIVED AND DEALERS ARE HOPEFUL AND ENTUSIASTIC BUT FACT REMAINS THAT SALES ARE NOT BEING MADE IN VOLUME STOP CLOSED YAKIMA HOLLYWOOD AND ALAMEDA SHIPPED CARLOAD TO EACH ALL TRAVELLERS SUPPLIED WITH DEMONSTRATORS WORKING VIGOROUSLY ON OPEN POINTS AUBURN IN THIR PLACE CALIFORNIA WITH ONE HUNDRED THIRTY SIX CARS FIRST HALF HAVE EVERY CONFIDENCE WE WILL QUICKLY GAIN THIS POSITION BUT DESIRE AVOID BAD MATERIAL INVENTORY SITUATION AIR MAILING PINK SHEET WILL KEEP YOU ADVISED=

GEO R MORRIS.

The telegram sent May 1931 from West Coast manager George Morris to Norman de Vaux, about a month into production, shows reality beginning to creep into the thinking of company managers.
Courtesy of Jay Eitel.

lenges and problems Norman de Vaux remained the very paragon of optimism. In late January 1931, he wrote George Morris and told him that "Everything is going wonderfully well" (de Vaux 1931b). Similarly, in a letter from de Vaux to Hall in mid-February 1931, the company president observed that "Our proposition looks better every day and with another half million dollars [of] capital in the business, which I know we can get, we will have a very fine proposition without mixing up with the any of the so-called dead automobile companies" (de Vaux 1931c). Norman de Vaux's boundless optimism notwithstanding, problems still held up regular production, so on March 21, 1931, the company president wrote from Grand Rapids to Morris in Oakland that "Everything is set here for production," waiting only for axles and transmissions to arrive, "but we are confident that we will get some cars (built) before the first of the month" (de Vaux 1931d).

Unfortunately, the favorable reviews and apparent appetite for De Vaux cars, as manifested in 8,500 early orders, did not translate into the anticipated flood of sales. Apparently placing an order for a car at an auto show is different than actually placing an order with a dealer once production has begun. The first day of production in Grand Rapids occurred on April 1, 1931 (ironically April Fools' Day), two months after the originally announced February launch (Godshall 1970). Oakland's production commenced shortly thereafter, but it never really enjoyed smooth sailing or volume operation. Wiring de Vaux from the Oakland plant in May 1931, George Morris warned the company president that they had "been building and shipping approximately forty cars per day [in California, but] a quick canvass of dealers shows sales slow [so] unless [the] situation improves immediately will advise [plant superintendent Miles] Fox to reduce to twenty five cars per day" (Morris 1931). Morris remained confident that De Vaux would become a market leader but he wanted to avoid an expensive accumulation of unsold cars in the short term. Management could not have been happy that such limited output in Oakland was still surpassing demand. President de Vaux approved the scaled-back production rate, but the Grand Rapids operation was also facing challenges. Component problems continued to bedevil managers in Grand Rapids, but in a June 8 letter de Vaux voiced his hope that once Oakland got its production to the appropriate level it would "get our inventory down where it should be. It will also help our cash position" (de Vaux 1931e). It appeared that initial estimates for De Vaux sales had been wildly overoptimistic.

By the summer of 1931, just months into production, the company was already in grave peril. Norman de Vaux and his management team were scrambling to save money and raise sales volume. In July, de Vaux scaled-back the advertising budget, with just $7,697.58 being allotted for that month, the president saying "I believe that is as low as we can possibly go" (de Vaux 1931f). This was a troubling sign, as de Vaux had placed great hope in the power of saturation advertising to overcome other shortcomings faced by the company. Top management also constrained "all large expenditures" in July, making them dependent on Executive Committee approval first (de Vaux 1931g). Days later, a worried President de Vaux suggested in a letter to Hall, whom he addressed as "My Dear Colonel," that in Oakland George Morris "transfer his office to the factory which will give him better supervision and by doing this he can eliminate one or two foremen from the payroll. . . In the Parts Department [in Grand Rapids] we have thirteen employees. Surely four or five can be cut off from this payroll" (de Vaux 1931h). The ominous situation facing the company had become evident even to de Vaux.

An August 1931 letter from Syracuse Gear Company illustrates a fatal situation at De Vaux-Hall – the inability of the struggling automaker to pay component suppliers (Henninger 1931). In March 1931, before regular production had begun, De Vaux-Hall and Syracuse Gear had agreed to a price based on the automaker purchasing 300 units per day. By late August 1931, however, De Vaux-Hall had only purchased 5,000 units, which was closer to 50 units per day, meaning that Syracuse Gear had given the auto firm a low cost-per-unit price that ultimately robbed itself of significant revenue. A.A. Henninger, Syracuse Gear's president and former associate of de Vaux, was not threatening or accusatory in his letter, but he was firm, stating that, "we have been unable to manufacture these units at the prices agreed

This ad from July 1931 has the oft-used Hall and de Vaux biographies and highlights the car's low price.
From the author's collection.

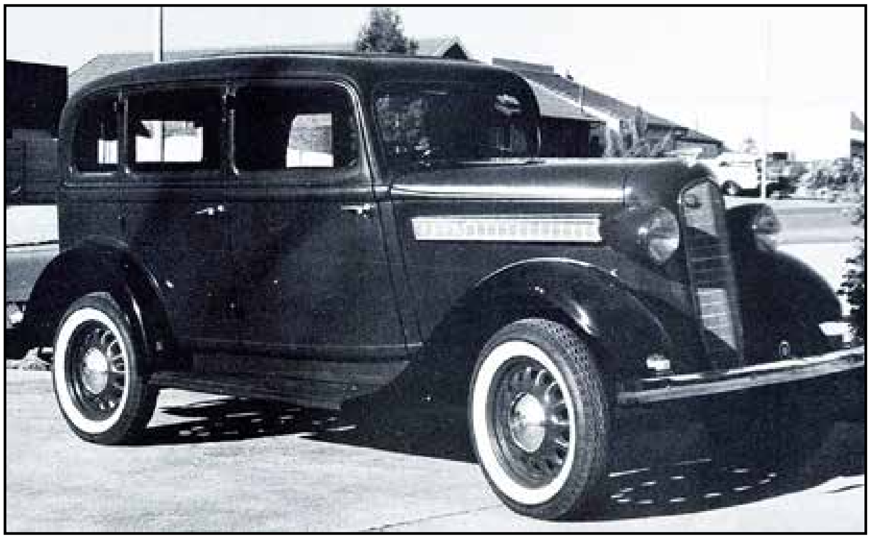
upon, [so] we are asking your assistance . . . to work out a program . . . with the whole thought in mind of protecting you, the vendors, and ourselves." He was certainly not letting De Vaux-Hall out of its commitment to honor contractual obligations, so, "attached is a schedule of new prices that we feel should go into effect immediately; also, a cash consideration for materials to be purchased, to be used as a protection for the vendors." Syracuse Gear was not alone in

Continental's cars, like the Beacon shown here, had slightly more conservative styling and advertising, lacking the flair brought by Norman de Vaux. Brochure from the author's collection.

worrying about getting paid by De Vaux-Hall; there was a long list of those owed money with their hands out. Norman de Vaux told a friend (and another component supplier) in a letter dated September 17, 1931 that the company had plans to shutter the Oakland plant very soon, which would "relieve us of a heavy burden in the way of inventory in Oakland and will put us in a position to pay our bills promptly" (de Vaux 1931i). He thanked the supplier executive for undisclosed "co-operation that you have given," and hoped the two could enjoy a game of golf together soon. Even more significantly perhaps, by the end of 1931 Continental Motors, the automaker's engine supplier, was claiming that De Vaux-Hall was falling behind on payments totaling hundreds of thousands of dollars, a ruinous amount for the start-up firm.

When the company rolled-out its 1932 models in the fall of 1931 it boasted of making changes both inside and outside the car (Larrowe 1972, pp. 30-31). Bodies were widened and the much-ballyhooed grille was heightened slightly. Designers gave the dashboard new gauges. The engine received a modest bump in output and got new rubber motor mounts. New Process became the new transmission supplier and freewheeling, a popular transmission option that promised fuel and maintenance savings, was added as an option. De Vaux-Hall management placed great stock in the availability of freewheeling to lure economy-minded car buyers.

But by the close of calendar 1931 De Vaux-Hall was caught in the pincers of low sales volume and incessant demands for payment from component suppliers and others. It was increasingly difficult to be positive about the future of the firm. In January 1932, de Vaux's friend James Houlihan unveiled his "Advertising Recommendations" to management. They would "build new confidence with present De Vaux distributors and dealers, members of the automotive industry at large, and the general public" that would "stem the tide of gossip" that De Vaux-Hall was going down. (Houlihan 1932). Houlihan's goal was more than a little ambitious: a "sales objective of selling 20,000 De Vauxs in 1932." His aggressive plan called for a targeted campaign in select markets and venues, including more focus on smaller markets, spending at least $45 per car (which would be less than the $57 spent in 1931). But the ship that could have saved De Vaux-Hall had long since left the dock. Not having appreciable cash on hand, access to sufficient capital, or robust sales (De Vaux-Hall only built about 6,100 cars in 1931 and 1932) put the company in a cash flow crisis (Marvin 1987, p. 52). Faced with this intractable position, not having a pile of cash from stock sales, and not having some of their touted private sources of capital come though, on February 9, 1932 De Vaux-Hall officials submitted paperwork for bankruptcy protection in U.S. District Court in Grand Rapids (*New York Times*, Feb. 10, 1932, p. 34). The carmaker claimed $1.8 million in liabilities and $2 million in assets, shining a light on just how poorly capitalized it was. This failure, and it was a total failure, was a rarity for the two historically



The stillborn De-Vo was essentially a Continental Beacon with a new nose treatment. The prototype turned up in South Africa in the 1960s.
Bert E. Smith photo, courtesy of the late Keith Marvin.

Wagner 1983, p. 58). Not surprisingly, Continental men replaced the old guard in the boardroom, the first crew being thoroughly discredited. Norman de Vaux and E.J. Hall left the car-making operation immediately, but at least de Vaux's name remained on letterhead and the cars (for the time being). The *San Francisco Call-Bulletin* (Dec. 7, 1932 p. 13) reported that Norman de Vaux was "newly appointed president of the Willys-Overland Pacific Company," so he quickly got back on his feet in the automobile business following the failure of De Vaux-Hall. Similarly, E. J. Hall landed at Citroën in France around 1932 (Dias 2008). The front office in Muskegon planned to introduce some ground-up new models, but until they were ready for production, as a stopgap measure Continental dusted off the De Vaux 6-75, made some minor changes, and sold it as the De Vaux 80. In terms of differences, the new owners abandoned the Hall-engineered motor in favor of a similar stock Continental engine, claiming slightly more output, 80 horsepower, and a marginally higher top speed, 75 mph being easily attainable while 82 mph was "possible" (*New York Times*, Apr. 17, 1932, p. XX5). The new owners had a very similar production set-up as De Vaux, using many of the same suppliers and even the same Grand Rapids plant, which greatly simplified start-up. Continental entered the market a little slower than had been announced but still built about 1,300 units for the 1932 model year. Reliable, primary source data on production numbers are hard to find, but Larrowe (1972, p. 32) and Marvin (1987, p. 55) provide estimates. Continental continued selling De Vaux cars in Canada under the Frontenac name too, as the previous firm

successful founders. The end to De Vaux-Hall came quickly, just months into its history, as did the unfolding of its next chapter.

Postscript – Continental Motors Company

Just days after De Vaux-Hall entered receivership, Continental Motors, to which De Vaux-Hall owed $487,118.26, announced that it would purchase the Michigan assets of the failed automaker (*New York Times*, Feb. 13, 1932, p. 26; Wagner 1983, pp. 58-59). Continental also purchased another vehicle maker, Divco, a maker of delivery vans with a history of marginal profitability (Wagner 1983, p. 63). Convinced that De Vaux-Hall could never make good on its debt, Continental leaders William R. Angell, Jr. and Henry Vandeven decided to assume control of part of De Vaux-Hall and continue making cars, and soon. Angell seemed to believe, just like de Vaux before him, that the product itself was not the problem, but rather it was more a matter of salesmanship, saying, "[i]t is our intention to popularize and aggressively merchandise the De Vaux automobile" (Wagner 1983, p. 58). With its actions, Continental turned its back on a three-decades-long (and arguably wise) policy of avoiding vehicle manufacture.

When Continental took the reins at De Vaux-Hall in March, it reworked the business name to reflect the boardroom changes, the new moniker being the Continental-De Vaux Company, Inc., a subsidiary of Continental Motors (*New York Times*, Mar. 20, 1932, p.XX6;

The 1933 Ace was the top of Continental's line. Although based on the De Vaux 6-75 it had more stylish lines. *From the editor's collection.*

had (Wagner 1983, pp. 58-59). It was a start, albeit a modest one, and Continental Motors had made the transition from auto supplier to automaker. The company also changed its name to the Continental Automobile Company, dropping the De Vaux name (*New York Times*, May 21, 1933, p. XX7) .

Continental was a new car company in 1933, and to management's credit, Continental brought a number of fresh ideas to the enterprise. Among the more original notions coming out of the Muskegon front office was their marketing strategy. Rather than relying so heavily on advertising in print media, radio, and other traditional outlets, Angell decided to market the Continental car directly to the company's 30,000 shareholders, allowing them to make an auto purchase that would also benefit their investment portfolio. Angell confidently suggested that this approach "will be equal to a million dollars in advertising," the dollar amount targeted by Norman de Vaux (Wagner 1983, p. 60).

An important difference between Continental and De Vaux-Hall was that Continental offered more than one model of car. Continental had three distinct cars in its 1933 line-up: the Ace, with a 114-inch wheelbase and an 80-85 h.p. six-cylinder engine), the Flyer (a 107-inch wheelbase sedan with a smaller 65 h.p. six), and the Beacon (101.5-inch wheelbase, 40 h.p. four-cylinder engine). There was no De Vaux name on the cars either, even if the Ace sold for about the same price and had the same wheelbase measurement, and was possibly based on the De Vaux 6-75 (Wagner 1983, p. 60-61). Hayes still built the bodies and the cars were still assembled in the same Grand Rapids plant, so there was certainly some carryover between the two firms. But in 1933 Continental tried to distance itself from the earlier failed firm; the all-new Beacon was perhaps just what Continental needed to achieve success. The ultra-low-priced Beacon grabbed the most attention of the three models; its cost, just $355, insured that, making it one of the cheapest cars sold in America (*New York Times*, Jan. 8, 1933, p. XX7; Wagner 1983, p. 61). Seeking to better exploit the low cost aspect, to access customers who were highly price sensitive, Angell toyed with the idea of bypassing dealers entirely by delivering Beacons directly to buyers through 50,000 gas stations across the U.S., but the plan never really got off the ground (Wagner, 1983, p. 60). Angell and his colleagues must have felt at least some satisfaction with their decision to introduce the new Beacon, as it quickly constituted the lion's share of total Continental production, about two-thirds of 1933 sales.

Unfortunately for the company though, too few people purchased Continentals in 1933, in spite of the expanded line-up, novel marketing ideas, low price and other changes. The Great Depression arguably reached its depth in 1933, giving beleaguered consumers plenty of reason to forestall purchasing a new car at the same time Continental announced its new models. In addition a strike at Hayes hampered Continental's output (Wagner 1983, p. 62). The new carmaker could not seem to catch a break.

In January 1934 Continental announced prices for its 1934 cars, but with such disappointing sales in 1933, only about 3,000 cars, hope for 1934's sales must have been in short supply in Muskegon (*New York Times*, Jan. 7, 1934, p. N2). This production figure is from Marvin (1987, p. 52); Wagner (1983, p. 62) gives about 6,500 in 1933, 1,200 for 1934. Continental sales did not reach acceptable levels, so in the summer, after building about 1,000 1934 models, the Grand Rapids assembly line ground to a halt again, before any 1935 Continental models could be announced, much less produced (Wagner 1983, p. 62; Marvin 1987, p. 52). The car line that had begun as Durant, had become De Vaux-Hall, then renamed Continental-De Vaux and finally reworked as Continental, appeared to be dead. Continental Motors was an established and well-financed company, but it posted losses of one to two million dollars a year during the early 1930s, in spite of good sales in some of its divisions, notably in aircraft engines. The money-losing car operation was too heavy a burden to shoulder. Reflecting on Continental's stab at automobile making, company treasurer Henry Vandeven observed that "[t]he project died, almost taking the parent company with it" (Wagner 1983, p. 62). Looking to wring out of the failed venture whatever money possible, in the fall of 1934 Continental held a garage sale of sorts, selling everything from engines ($146.60) and upholstered bodies ($147.50) to a set of hubcaps ($5), all at rock bottom prices (Larrowe 1972, p. 32; Wagner 1983, p. 62). Norman de Vaux attracted some media attention when he announced his plans to reanimate the Continental Beacon under a different name, but the venture never reached production (Wagner 1983, pp. 62-63; Marvin 1987, p. 52). Marvin's article documents the discovery of the 1937 prototype of the proposed car, the De-Vo, to be built by de Vaux, which amazingly resurfaced in South Africa, several decades after it was built. Jeffrey Godshall (1987, p. 54) also wrote on Reo and Graham-Paige's desire to revive the Beacon, but even the force of Norman de Vaux's unbounded optimism could not revive the car enterprise by 1934.

Conclusion

By all accounts the De Vaux was a good car; in fact, it was quite good given its low price. The reasons for its demise lay elsewhere, and a great amount of blame must be laid at the feet of Norman de Vaux. No charlatan or scam artist, evidence suggests that he actually believed his own words and optimism. His irrepressible "can-do" outlook was not new to the carmaking venture either, but instead part of his personality. Said Hall to his wife about his friend de Vaux, "people with whom he does business say he works with a sharpened pencil and is slick," so his enthusiasm did cause even some who were close to him to doubt his sincerity (Hall, n.d.). This inflated faith in his own ability to carry the operation in spite of everything else is an over-arching reason for the company's failure. The mentioned profound undercapitalization of De Vaux-Hall is related to this. Norman de Vaux was confident; indeed he bragged that he did not need to use conventional means of financing his auto company. He tried to make his operation run with as little capitalization as possible, and he succeeded in making the company efficient, hoping a large sales volume of cheap cars would bring profits. But relying on private funding and then realizing only disappointing sales could not generate enough cash, even for an operation with a very low break-even point. Norman de Vaux also misread the market. The auto market of the early 1930s was unusual in that Americans were cash-starved, but they had plentiful access to good, cheap used cars. Oftentimes they had more widely-recognized names that carried with them superior dealer and parts support, known reliability and performance, and higher trade-in value. With car companies failing regularly in the early 1930s, few people wanted to buy a car, even a good one, if the company might not be around in a few years to support it. In other words, it was a bad time to launch a car, especially perhaps, one "in the low price field." Supporters have called de Vaux and Hall brave and forward-thinking, but perhaps the more negative evaluation offered by their detractors is more on the mark.

Ric Dias *received a Ph.D.. in History from the University of California at Riverside in 1995. He then joined the faculty of Northern State University in Aberdeen, South Dakota, where he is currently a Professor of History in the College of Arts and Sciences. This is his second article for* Automotive History Review.

The author thanks Jay Eitel, John Perala *and Jeff Worsinger for finding and providing many of the references and illustrations for this article. Eitel was E.J. Hall's nephew and possessed several large file cabinets containing Hall's personal and professional effects, from engine sketches, to company telegrams, to the Colonel's shaving kit.*

References

Bradford, Francis and Ric Dias. 2007. *Hall-Scott: The Untold Story of a Great American Engine Maker.* Warrendale, Pennsylvania: SAE International.

de Vaux 1931a. Telegram, Norman de Vaux to George Morris, Jan. 19, 1931. Courtesy of Jay Eitel.
——1931b. Letter from Norman de Vaux to George Morris, Jan. 23, 1931. Courtesy of Jay Eitel.
——1931c. Letter from Norman de Vaux to E.J. Hall, Feb. 12, 1931. Courtesy of Jay Eitel.
——1931d. Letter from Norman de Vaux to George Morris, Mar. 21, 1931. Courtesy of Jay Eitel.
——1931e. Letter from Norman de Vaux to George Morris, June 8, 1931. Courtesy of Jay Eitel.
——1931f. Letter from Norman de Vaux to A.L. Warmington, July 3, 1931. Courtesy of Jay Eitel.
——1931g. Letter from Norman de Vaux to James Houlihan, July 3, 1931. Courtesy of Jay Eitel.
——1931h. Letter from Norman de Vaux to E.J. Hall, July 9, 1931. Courtesy of Jay Eitel.
——1931i. Letter from Norman de Vaux to Harry Tillotson, Sept. 17, 1931. Courtesy of Jay Eitel.

De Vaux-Hall. 1930a. "The Men Behind the De Vaux," De Vaux-Hall Motor Corp. brochure, circa 1930.
——1930b. "The De Vaux-Hall Organization and Its Principals," De Vaux-Hall Motor Corp. brochure, circa 1930.

Dias, Ric. 2008. "E. J. Hall's Life of Power," *Automobile Quarterly, Vol. 48 No. 1. First Quarter 2008.*

Godshall, J.L. 1970. "De Vaux Continental," Autoenthusiasts International, January-February 1970.

Hall, E.J. 1929. "Reducing Transportation Cost by Means of Engine Design," Society of Automotive Engineers, Northern California Section Paper, #290010, 1929.
——No date. Letter from Mr. E.J. Hall to Mrs. E.J. Hall, no date. Courtesy of Jay Eitel.

Hemmings. 2006. "Durant Deluxe," *Hemmings Motor News*. Apr. 1, 2006, www.hemmings.com.

Henninger 1931. Letter from A.A. Henninger to De Vaux-Hall Motors Corporation, Aug. 25, 1931. Courtesy of Jay Eitel.

Houlihan, James. 1932. "Advertising Recommendations for De Vaux-Hall Motors Corporation," report, Jan. 1932. Courtesy of Jay Eitel.

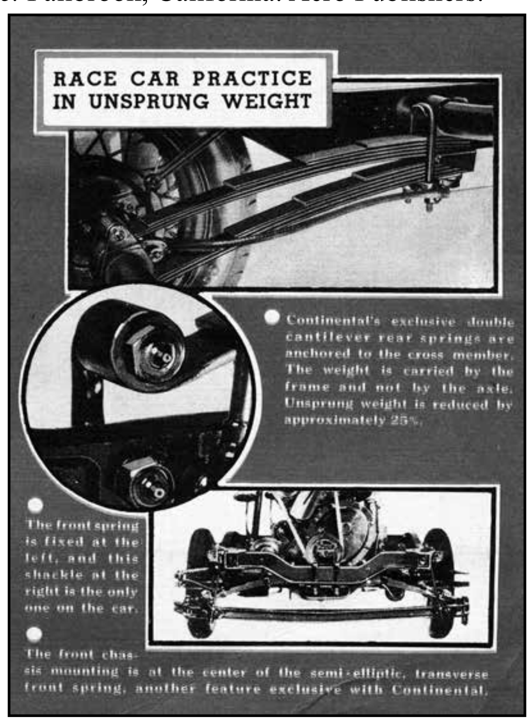
Jones, Keith. 2003. "If Only in Another Time: The Story of the De Vaux-Hall Motors Corporation," *Automotive History Review* No. 40, Summer 2003.

Larrowe, Richard. 1972. "The De Vaux Automobile," *Antique Automobile*, March-April 1972.

Marvin, Keith. 1987. "The De-Vo, One That Got Away," *Special Interest Autos* No. 102, December 1987.

Morris 1931. Telegram George Morris to Norman de Vaux, May 14, 1931. Courtesy of Jay Eitel.

Wagner, William. 1983. *Continental!; Its Motors and its People.* Fallbrook, California: Aero Publishers.



Unlike the Continental Ace, which was derived from the De Vaux 6-75, the Flyer and Beacon had unconventional suspension, with a transverse leaf in front with a single shackle, and dual quarter-elliptic rear leaf springs. From the editor's collection.

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