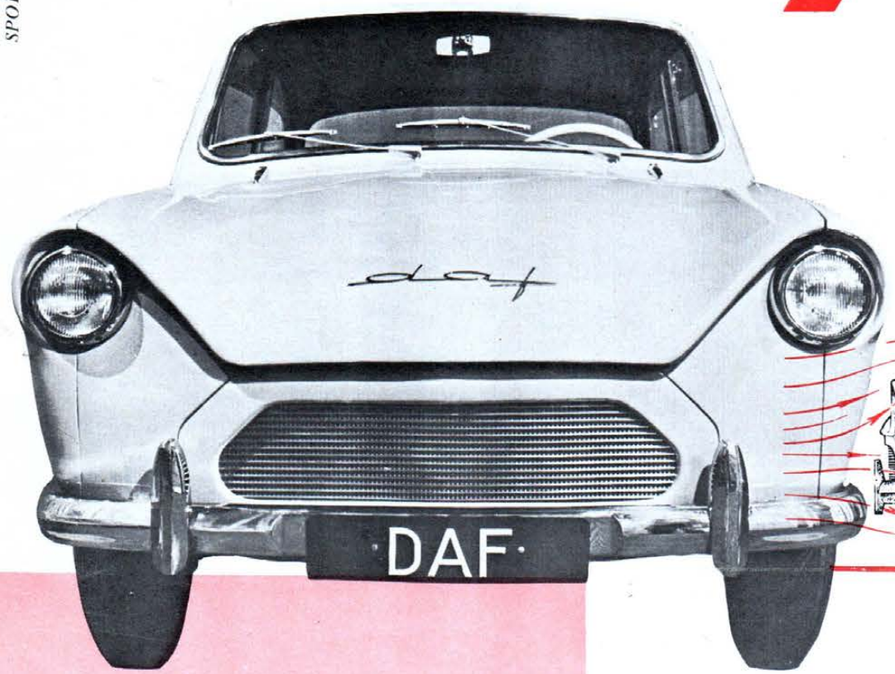
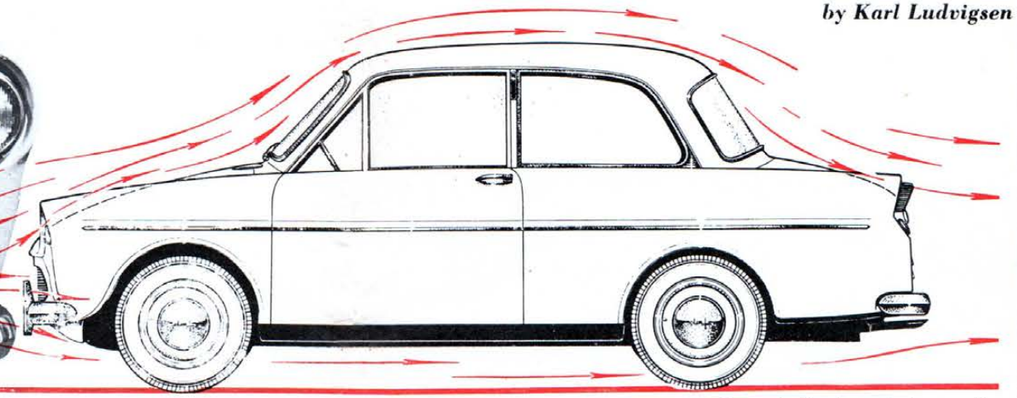
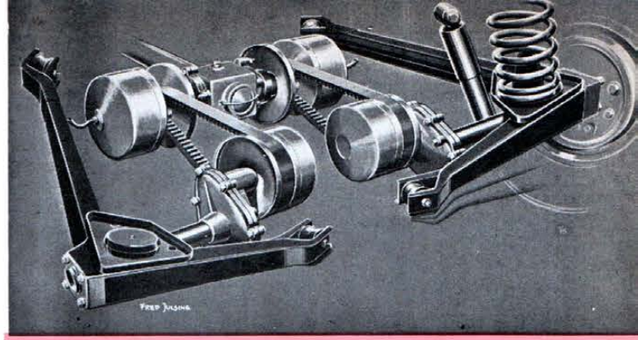
DAF

by Karl Ludvigsen

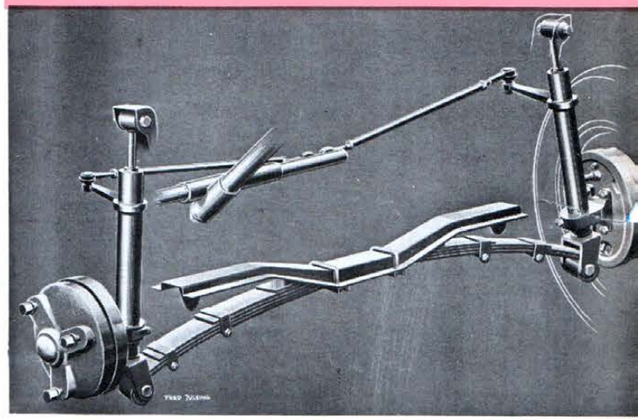


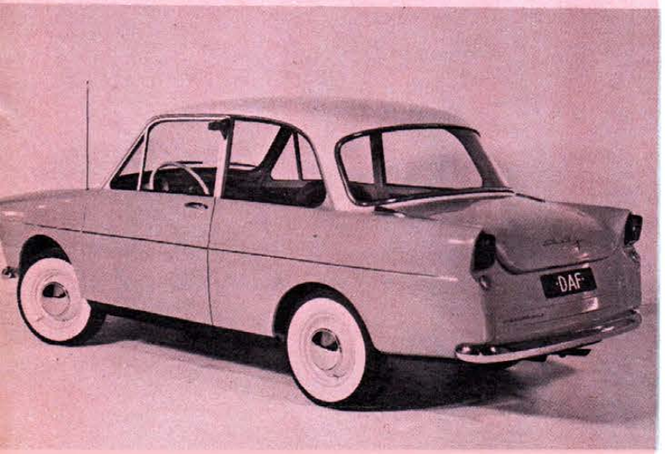


Body design was improved aerodynamically through the use of extensive wind-tunnel tests using the "mirror image" method to duplicate road conditions.



Rear suspension by two wide-based rubber-bushed swing arms with Studebaker type progressive coil springs. Front suspension utilizes Koni shocks as steering knuckles, king pins, and wheel guides. Transverse spring in lieu of lower suspension arms eliminates all grease points.





AT a back road crossing in Belgium the investigating officer felt that something in this superficially simple incident wasn't quite right. A little German Lloyd van was involved, and though its driver apparently bore no blame he semed oddly nervous and eager to take his leave. Everything settled, the little group broke up. Had our officer delayed his departure a few seconds he would have *heard* the reason for his puzzlement. The Lloyd moved away with a steadily rising buzz from its twin cylinders, totally unmarred by pauses for changing cogs.

Based in Holland, this unprepossessing machine had been wandering over the roads of Europe for three years with just one objective: the thorough testing of a remarkable new transmission system devised by van Doorne's Automobielfabriek of Eindhoven, Nederland. Known as DAF by the purchasers and users of their wide range of heavy trucks, this progressive concern had been considering production of a small car since 1951, and, visualizing an automatic drive as a highly desirable feature for such a car, had begun design and test work on this problem before any other. The same systematic approach, over ample time, was applied to every aspect of the DAF's design.

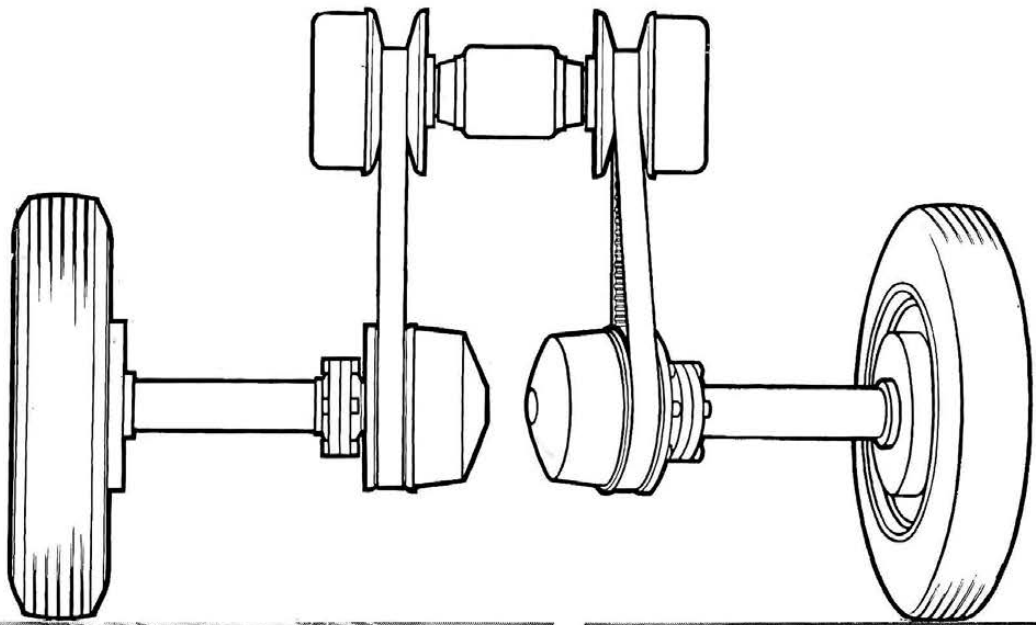
Founded in 1928 by the van Doornes, in a small shed still maintained in replica on the premises, DAF has since waxed rapidly into Holland's biggest truck-building business. A growing home and export market played its part, but the van Doornes also displayed more than a dollop of shrewdness. Vehicles exported to Belgium, for example, draw less duty if they're assembled there rather than delivered whole. Every DAF truck, accordingly, crosses the border with its cab strapped on above the rear axle. Equally economical is the construction, in the DAF factory, of major steel framing to cover the press shops for the small car's body parts. DAF also produces a line of 4x4 and 6x6 military vehicles whose chassis engineering, with torsion bars and multiple trailing arms, would do credit to a Grand Prix car. I can personally vouch that it provides a far better ride than our comparable vehicles offer.

Looking around and seeing a large native market presently hurtling about the Dutch roads on two-wheelers of all types, with no home-grown cars available, the van Doornes decided on a new venture. All plant development since 1951 has been with this in mind. DAF engineering was first concerned with the conditions of use their cars would encounter, one such being that many of their customers will never have driven, let alone owned, a car before. This, plus contemplation of the female American market, led inexorably to the automatic box idea. Service was likely to be at infrequent intervals and the duty often of a severe, cross-country type. Result: ingeniously rugged construction, seven inches of ground clearance, and the utter banishment of grease nipples.

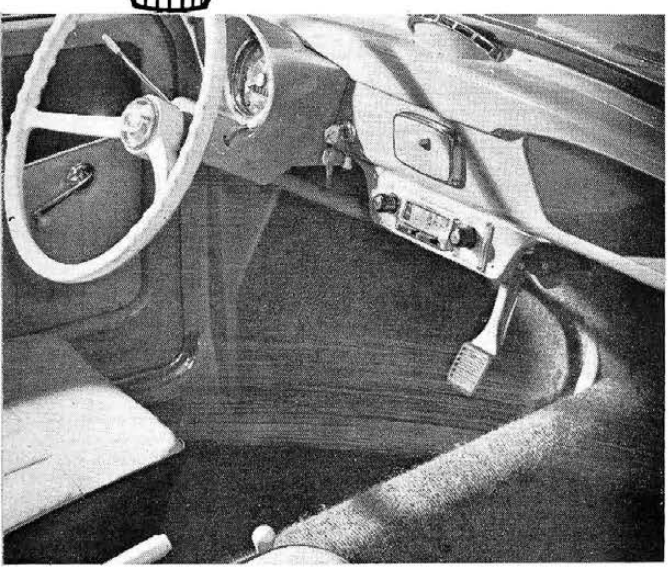
If any precedents influenced the DAF they were the Lancia Aurelia and the Fiat 600, two of our cleverest postwar designs. Most in evidence is the Lancia's drive line layout, with its wide separation of the main engine and gearbox masses to obtain both a high polar moment of inertia and a weight distribution of 50/50 unladen. Front engine and back- box is practically S.O.P. in Grand Prix racing for these reasons, and is equally logical for our native production cars.

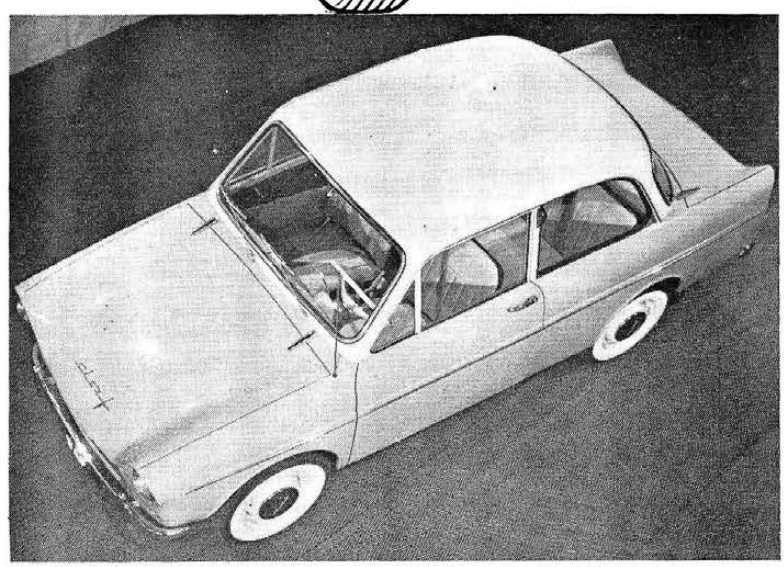
Perfectly suited to mounting ahead of the front wheel centers is the 590 cc opposed-twin engine whose deep aluminum cylinder fins (cast around an iron liner) enjoy forced refreshing breezes at speed, only a small Panhard-style idling fan being fitted. Air cooling was chosen for its warmup and thus reduces cylinder wear, and because the higher prevailing cylinder head temperatures promote better thermal efficiency. Noise will be the main problem, especially with unit construction, and though an effective three-point mounting has been devised, the muffling system is still in a state of flux at this writing.

The forged and balanced crankshaft rides in plain bearings in the vertically-split aluminum crankcase, while the compact rods have lead-bronze big-end shells. Three-ringed aluminum pistons are conventional. Under the crank and driven through a fiber gearwheel is the two-lobe camshaft, poking the self-rotating valves open through mushroom tappets, aluminum pushrods and steel rockers. All the familiar Panhard and VW tuning techniques should be applicable to the aluminum cylinder heads with their bronze valve guides and shrink-fitted iron alloy seats. Present rating, with a single downdraft Solex and 7/1 compression ratio, is 22 bhp at 4000 revs. Dimensions are oversquare, at 3 x 2½ inches, and I might note that the former dimension is usefully close to the 3.12 inches of Panhard and Norton cylinders. Oil changes will be cheap; the finned, itegral sump holds two quarts.



The left rear wheel deflected upward, as viewed from underneath. The tight upper side of the belt is in the swing-axle pivot plane and subjected to minimum lateral motion, while the lower side is loose enough to accommodate the deflection.





Interior is well appointed and roomy, due to squarish but attractive body design.

Plans to improve the performance of any car will be contingent on the capacity of the drive system, which in the DAF's case is wholly new to the automotive world. In brief and in sequence it uses a centrifugal clutch, drive shaft, cog-box for 90 degree direction change and forward/reverse shifting, and a belt drive to each rear wheel.

The DAF's Variomatic drive is distinguished from most previous belt efforts by its use of a clutch rather than the belts themselves to take up the drive from a standstill. Built into the flywheel, the drum-brake-like clutch locks up early and stays locked until near-halting speed is reached, providing plenty of engine braking. A single bevel pinion in the cog-box can be dog-clutched to either a left or right-hand bevel gear, for forward or reverse, or can be isolated in neutral by a handy but unobtrusive lever between the seats.

The more you scrutinize this disarmingly simple belt drive, the more devilishly clever it appears. First is its torque-converting function. The effective diameters of the two pulleys for each belt can be changed by opening or closing the spacing between the tapered pulley sides. Controlling is handled by the front pulleys, the rear (driven) ones being spring loaded to "follow" along. Students of the McCulloch blower's variable-speed drive will be familiar with this industry-proven principle.

At or near a standstill the front pulleys are fully spread and thus, at their smallest effective diameter, provide a maximum reduction of about 20 to 1. As more power is applied and speed increases, centrifugal weights squeeze the pulleys together and raise the ratio, but they can be overridden to a degree by a diaphragm (not a piston) under the influence of engine vacuum. To hold a lower ratio longer you just tromp down more and signal the unit with a lower manifold vacuum. Very promising methods are also being studied to apply high coasting vacuum to the double-action diaphragm so as to induce a "down shift" for hilly or traffic driving, perhaps to be selected by an additional control. van Doorne engineers are frankly excited about the literally limitless possibilities at hand.

These broad cogged belts also render universal joints superfluous in the DAF's fully-independent rear end. They're so oriented that the tight upper side of the belt is right in the swing axle pivot plane and is subjected to a minimum of lateral motion. The looser lower side can and does accommodate it. There's also no differential as such,

the two separate belt systems taking care of all that and ensuring traction on *any* surface.

Okay, so these belts replace the transmission, constant-velocity U-joints and the differential. How do they stand up? When the cars are in service DAF will recommend that the belts be changed at intervals of 35,000 miles. The operation can be carried out during an oil change and will run you about six bucks per belt. Test belt systems have been run for as long as 50,000 miles without loss of efficiency, reflecting a fundamental conservatism at Eindhoven. The rated capacity of each belt is 2/3 of the engine output, the idea being that if you happen to throw a belt you can still hie it home at 2/3 the normal maximum of 57 miles per hour. This clearly indicates the margin remaining for power boosting. Thanks to 4.4/1 reductions included between each driven pulley and its wheel, the belts run at high speeds and low tensions, and the belt units can be placed high under the rear seat for maximum ground clearance.

Two wide-based slightly angled swing arms comprise independent rear suspension very much after the manner of the Fiat 600. The four husky pivots are rubber-bushed while Studebaker-style progressive coil springs are fitted to minimize negative camber when heavily laden.

In principle the front suspension is the Ford (British) MacPherson system with, if possible, some simplification. Developed with the cooperation of Koni of Amsterdam, whose precision-made shocks are being found nowadays on racing Ferraris and Maseratis, the DAF's front dampers serve also as steering knuckles, king-pins and wheel guides. Koni consultants, used to hard jobs, admitted that this was one of their hardest, but its successful solution, joined with the use of a transverse leaf spring instead of lower suspenion arms, meant that all grease points could be eliminated. Steering is by rack and pinion gear acting through a split track rod and locking over a tight turning circle of 28 feet.

Characteristic of this front end layout is a roll center well clear of the ground, and it has also been discovered that the shocks tend to stiffen up a shade through mechanical friction when the DAF is tossed into a corner. These attributes allied with A-1 weight distribution have produced a vehicle whose steering at medium speeds is neutral, developing into mild

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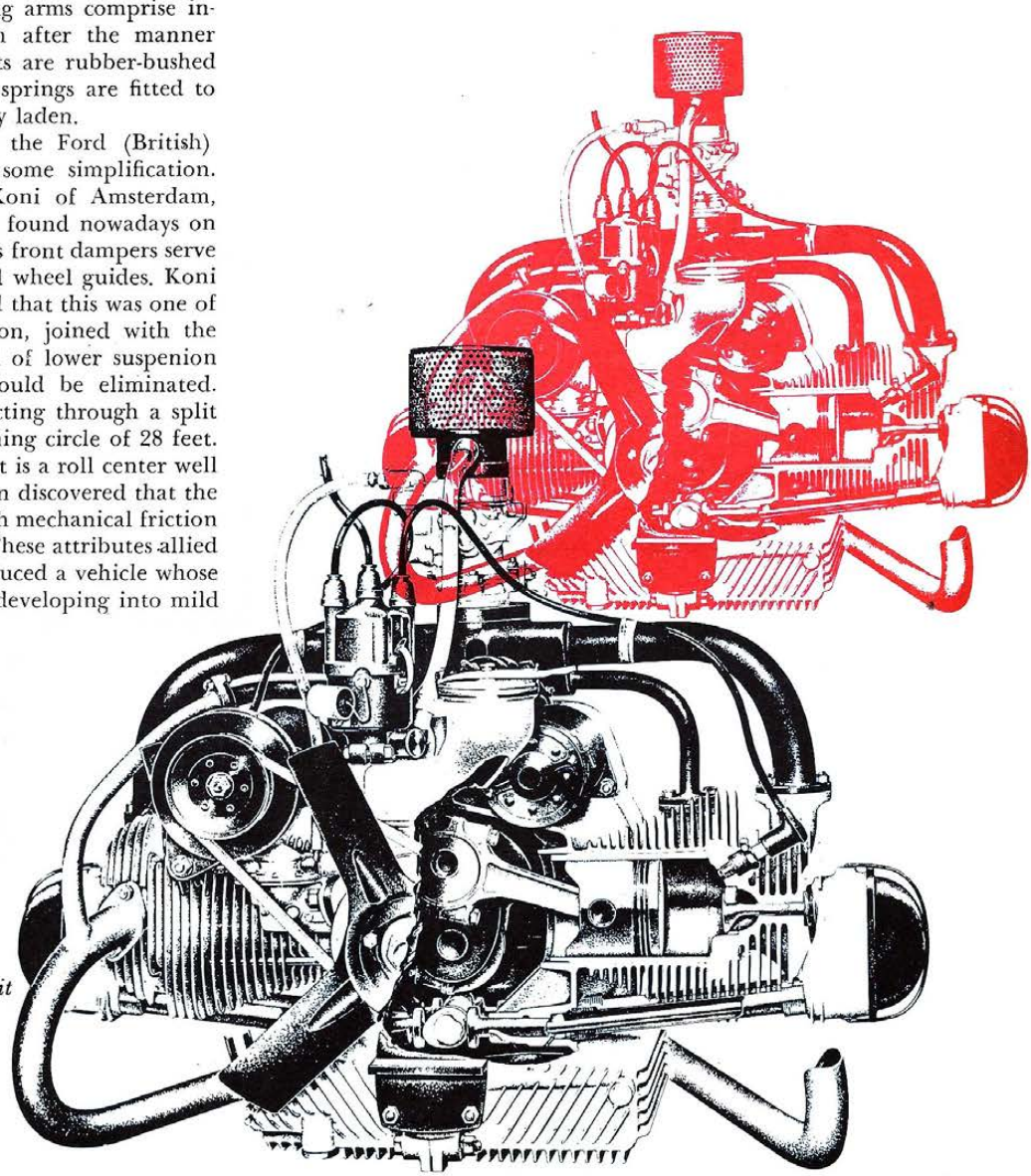

Opposed-twin engine has aluminum cooling fins cast around iron liners. With a single Solex downdraft carburetor and 7:1 compression ratio, it develops 22 bhp from 590 cc.

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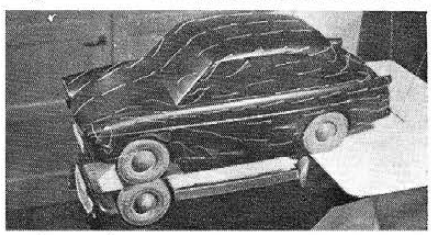
understeer at higher lateral g's. DAF technicians liken the handling to that of the Lancia Aurelia, and comment with sincerity that "after all, designing a car is not merely a matter of drawing and calculation, but principally of 'feeling'. We believe that the DAF is a full-blooded car which will enthuse many admirers of larger, more expensive and even sporting models".

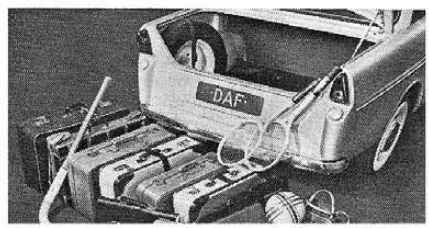
All these esoteria are hung from a spot-welded unit body based on a fork-like subframe which connects the action points of the front leaf and the two rear coils. Main stresses are absorbed by this member, which also houses the drive shaft.

Holland is a flat, seashore country with more than its share of strong gusty winds, so the DAF's breeze behavior was of particular interest. Serious wind tunnel testing was undertaken at the National Aero-



nautical Laboratory in Amsterdam, both to determine the exterior shape and to examine cooling air flow under the hood. One model tested had a more steeply raked windshield and a roof line tapering back to the rear bumper. Though its head-on resistance was measurably lower it was much more sensitive to side winds than the present notch-back contour. Checks with fairings applied to the squarish front end revealed no measurable difference, confirming that the back end of the modern car has the most aerodynamic influence.

The DAF's interior is thoroughly practical without having "austerity" written all over. There's head room and leg room in abundance, with a wide seat adjustment range, and seats which give really top-



notch back and thigh support. Foot space tends to be narrow, but with just two pedals there's sufficient room. With the engine in front good heating and defrosting is easily supplied. A wide lid gives access to an astonishingly long and deep trunk, in which the spare is carried upright. The seven gallon gas tank (reputedly enough for 300 miles) is slung underneath.

In the fall of 1958 ten hand-built prototypes were being flailed over the Belgian cobbles and up and down Switzerland's precipitous passes in an effort to wring out all last-minute bugs and gremlins. In the meantime the new press shop is being completed while the engine machining is being set up alongside DAF's lines for six-cylinder Diesel and gasoline truck engines. Shakedown production should be under way by November, full stride being scheduled for April of 1959. In that first year 25,000 DAF's will be born, and twice that number in '60.

A full-scale invasion of the U.S. will probably be staged in the latter year, once the home market, with its knotty dealer problem, is straightened out. Negotiations are currently being made with both major importers and manufacturers here, but it seems likely that DAF will follow the wise trail blazed by SAAB in setting up a *bona fide* factory branch Stateside. When they do decide to come there'll definitely be a couple more models in the line, including a station wagon and a cabriolet. With the existing fine balance and chassis engineering the two-seater DAF could be a most sporting machine, as outlined in our exclusive factory drawings. Under-hood matters like higher compression and dual carburetion are well past the planning stage.

Even in standard 4½ passenger form this van Doorne creation will be very beguiling to urban Americans. Excellent mileage, negligible maintenance and ample room, coupled with a genuine shiftless drive present an unequaled package. And I can assure you the price, even in De Luxe trim, will be *highly* competitive.

Karl Ludvigsen

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