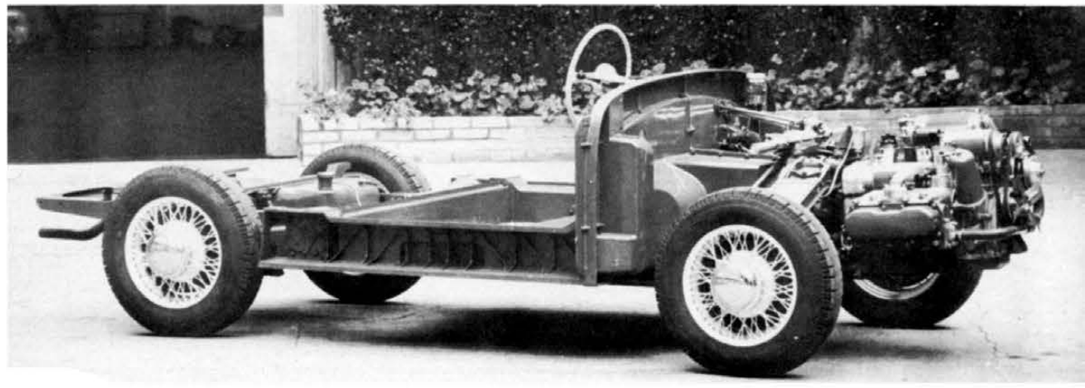
The story of the Kaiser might have had a different ending had its builder taken up his $60,000 option to use the designs of...

Monsieur Gregoire, engineering genius of the Gregoire Sport, going over the schematic of his latest sports model.



Chassis and engine wait for body outside Gregoire shop. Wire wheels add to lightness of completed machine. Note simplicity of frame — no X braces are needed.

Monsieur Gregoire and the wheels that pull

By ALEX JORDAN

The Gregoire, unassuming in appearance, can probably outmaneuver many sports machines.

EVEN when their ideas run pretty close together, a German and a Frenchman are sure to approach a problem from opposite angles. Thus while the late Ferdinand Porsche and Jean Albert Gregoire were both convinced that the engine should be at the same end of the car as the wheels it drives, they differed in their choice of position. A car having only two ends, the choice was perhaps not very wide. Porsche put his engine in the back and Gregoire out in front — both engines flat fours, for reasons of space saving and lightness.

The Gregoire name is no stranger to U. S. automotive circles. Early in 1946 the use of aluminum in the peppery Frenchman's designs attracted the attention of Henry J. Kaiser, then in the process of trying to crash the automobile market. As a large aluminum producer, Kaiser was on the lookout for new outlets for the metal as well as being eager to start building cars to fill the postwar shortage. He had a Gregoire car shipped to California and invited its designer to come along to discuss the possibility of a new American car built around the Gregoire designs. The upshot was that Kaiser paid $60,000 for an option on the Gregoire design. He failed to pick it up and the car that was finally built is now past history. How it would have ended had Kaiser used the then radically new design is a matter for speculation, but only over the third beer — or the fourth.

The latest Gregoire model, the "Gregoire Sport," exhibited recently at the Ford Museum in Detroit and at the ALCOA headquarters in Pittsburgh, is the culmination of thirty years of automobile design and shows what the Kaiser might have been. It incorporates the three principal Gregoire inventions, the Tracta homokinetic joint for the front wheel drive, the variable rate suspension and the die-cast light metal chassis frame.

Each of these devices has behind it a long history of development. In 1926 Gregoire, then a young man, decided to enter the 24 hours race at Le Mans with a car of his own design. It was the so-called Tracta because its front wheels pulled the car behind them, instead of pushing it from behind.

Most of the previous front-wheel drive cars used ordinary universal joints. The variation in power transmission through such joints is insignificant when the angle is small, but increases alarmingly when the two shafts are at a sharper angle. Since the front wheels must have a wide angle of movement for steering purposes, the use of standard universals for this purpose is unsatisfactory.

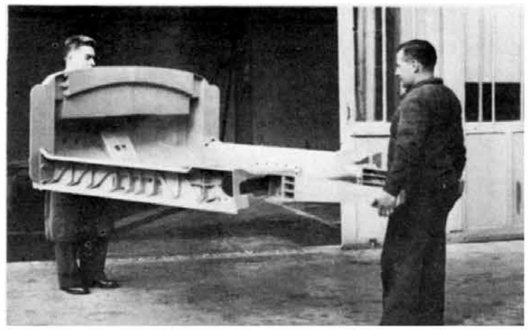
The Tracta joint, designed by Gregoire and Fenaille, is described as "homokinetic" which is the Greek way of saying that motion is transmitted uniformly and smoothly, regardless of the angle between the driving and the driven shaft.

In the 24 hours of Le Mans, in 1927, there were 29 starters and only seven cars at the finish. One of them was the front wheel drive Tracta, driven by Gregoire himself. He competed for three successive years, chalking up a remarkable reliability record. Out of nine Tractas entered in four Le Mans races, eight were seen at the finish. No other make has ever equalled that percentage. The Tractas could not hope to win, because they were light, somewhat underpowered cars with a top speed of about 95 mph — which was quite good for those days, but not enough to beat the huge Bentleys and the Alfas.

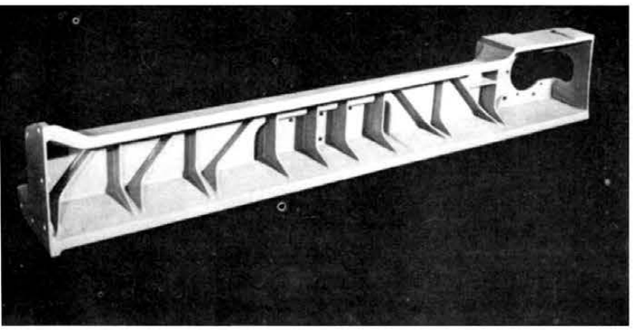
The reliability record, however, was important, for it established beyond dispute the value of the front wheel drive with Tracta joints. Opponents of front wheel drive claimed that it could never be reliable. But when his own engineers argued this point with Andre Citroen, the French motor tycoon replied: "Anything that can last the 24 hours at Le Mans is good enough for my cars."

Although the front wheel drive Citroens, starting with 1934, did not use the Tracta joint, the decision to adopt the f.w.d. principle was certainly influenced by the Gregoire reliability record at Le Mans.

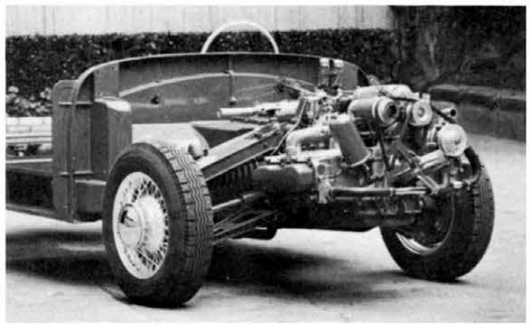
In the meantime the German D.K.W. had used the Tracta joint since 1929, and the Adler since 1931. The British Bendix Corporation built Tracta-type joints during World War II for about 600,000 military vehicles — four



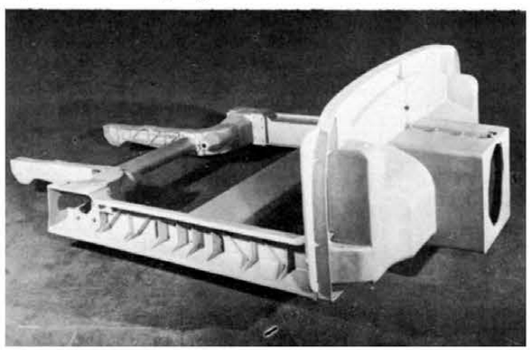
Two men carry die-cast light metal frame with no strain. Light components give car its excellent mileage even at high speed.



Section of frame shows vertical and diagonal rigid supports which strengthen light alloy beam. Note depth of frame rail.

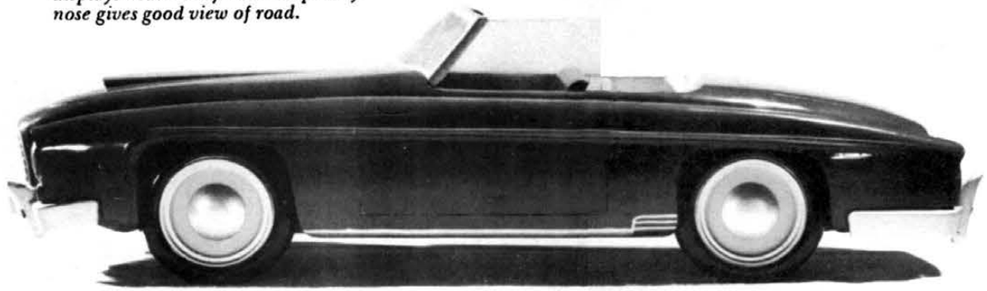


The flat-four water cooled engine sits forward of the driving front wheels. Weight helps give car excellent balance. Radiator has been removed for better view of engine.



Almost abstract in design, frame looks like weird futuristic girder. For its light weight, frame is rugged and sturdy, withstands stresses of hard driving.

Scale model of Gregoire Sport machine displays neatness of line. Drop-away nose gives good view of road.



wheel drive trucks and armored cars. In the U. S. A. they were made, on license, by the New Process Gear Corp. of Syracuse, N. Y. for jeeps and other military vehicles.

Among current models the Dyna Panhard and the Hotchkiss-Gregoire both use the Tracta joint for their front wheel drive units. Thus the adoption of the front wheel drive – used by 25 percent of all French cars – owes a great deal to the pioneering work of Gregoire in the twenties.

The story of the variable suspension is more recent. In 1941 Gregoire designed a light car for the French Aluminum Company – naturally front wheel drive – with a light metal cast chassis and an air-cooled engine. The car weighed only 1000 lbs., but was designed to carry four persons. Thus the total weight of car and passengers might in some circumstances be double the dry weight of the car. This posed a tough suspension problem: springs stiff enough for the full load would be very hard when only one person was riding; spring soft enough for the empty car would not support the full load. A variable suspension was the answer. Its principle is very simple: a helical spring in tension, so positioned in the suspension system that under light load the pull on it is negligible, increasing with the deflection under load. This system can be used on its own, or as an auxiliary to a more conventional suspension – as for example on the Hotchkiss-Gregoire. The positioning of the spring and its points of attachment are determined by a mathematical formula calculated to give progressive tension, variable according to the load.

It is thus possible to have very soft springing in a lightly loaded car, without the penalty of mushiness under load. This feature is particularly valuable in a sports car in which the general tendency is toward excessively hard springing.

The third Gregoire principle – the chassis frame built of light metal castings – was originated in 1935. A competition for a light car design was held in France. Gregoire submitted a small car with a chassis-body shell of cast aluminum, front wheel drive and a two-cylinder air-cooled engine. The car was made in small numbers by the French Aluminum Co.

In 1937 the light-metal chassis principle was used in the Gregoire designed Amilcar Compound, a model which was the sensation of that year's Motor Show in Paris.

In the 1956 Gregoire Sport the chassis frame is made of die-cast aluminum parts bolted together. Lighter than a steel frame, it is also stiffer, owing to the much greater depth of the girders. For small and medium production runs – which are the rule in Europe – this type of frame

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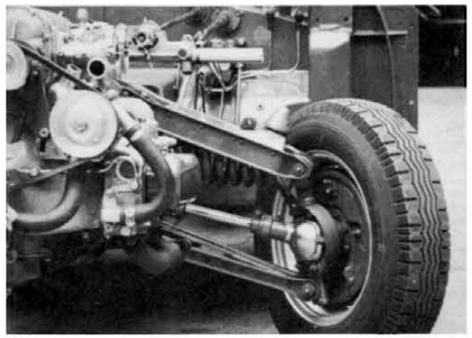
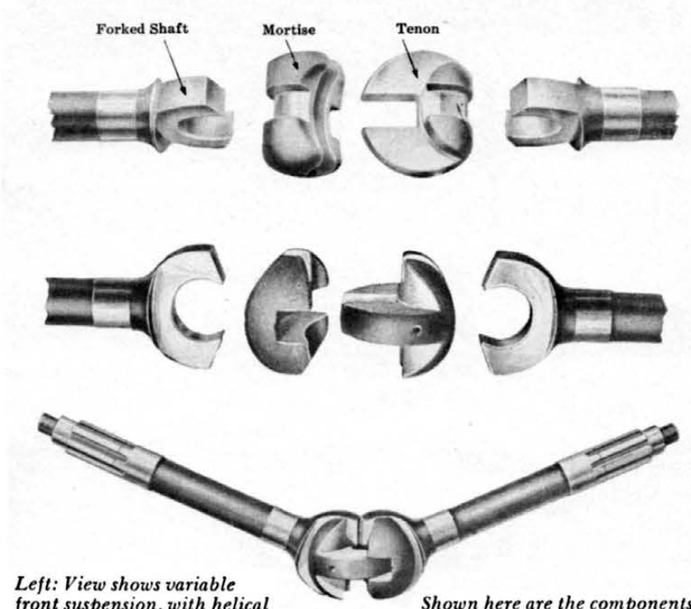
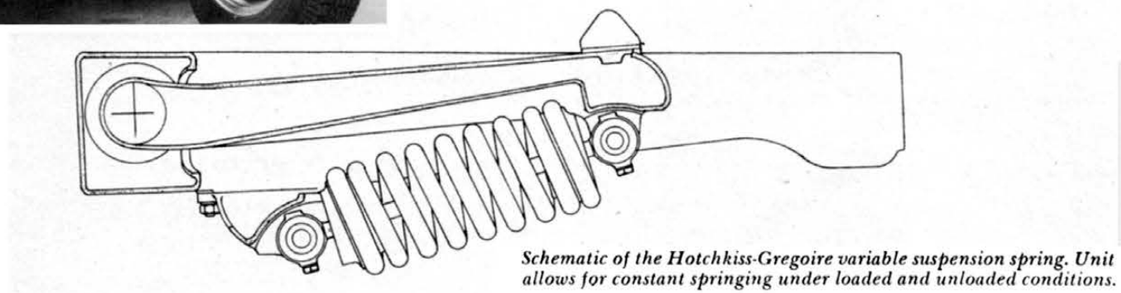




Left: View shows variable front suspension, with helical spring in tension, and front wheel drive unit. Upward arm movement causes spring to stretch, thus compensating for different loads.

Shown here are the components of the Tracta homokinetic joint for the front wheel drive. Bearing surface tolerances are critically machined for minimized friction in power transmission.



Schematic of the Hotchkiss-Gregoire variable suspension spring. Unit allows for constant springing under loaded and unloaded conditions.

SPECIFICATIONS
GREGOIRE SPORT

CHASSIS

Wheelbase	94.5″
Front Track	56.8″
Rear Track	52″
Overall Length	177″
Overall Width	69″
Height (without windshield)	35.4″
Tires	Michelin 185 x 400 mm
Turning Circle Radius	13 feet

ENGINE

Cylinders	4 opposed
Bore and Stroke	3.54 in. by 3.38 in.
Displacement	133.51 cu. inches
Compression ratio	6.9
Solex twin barrel carbureter	
Horsepower	130 bhp @ 4500 rpm
Cooling	liquid

Constantin supercharger delivers 5.5 psi boost at 4000.

TRANSMISSION

Four forward speeds (top overdrive) and one reverse.

With a Gleason Spiral bevel drive of 11/30 and standard tires, the road speeds per 1000 rpm are the following:

1st – 7 mph. 3rd – 19.4 mph.
2nd – 15 mph. 4th – 25.6 mph.
reverse 7.83 mph.

LIQUIDS

Cooling System	13.73 quarts
Oil	6.34 quarts
Gearbox and Differential	3.6 quarts
Fuel Tank	15.85 gallons

FUEL CONSUMPTION

16.8 mph at an average speed of 65 mph.

SPEED	118 mph.
STEERING	rack and pinion
SUSPENSION	variable, independent on all wheels by four helical springs working in traction. Four Houdaille hydraulic shock absorbers. Two stabiliser bars.

Gregoire

(Continued from page 41)

may be cheaper than a steel pressing, requiring less tooling. It is also claimed to be particularly suitable for the installation of a plastic body, thanks to the greater rigidity of the frame, avoiding distortion and resulting cracks in the plastic. In a sports car, of course, frame rigidity is absolutely essential and that is why the Gregoire Sport uses that type of construction.

The Gregoire ultra-light car of the early forties later became the Dyna Panhard. Slightly modified by Deutsch-Bonnet (the D. B. Panhard), it has performed extremely well at Le Mans in recent years. In the index of performance rating, allowing for the differences of power between different cars, the D. P. Panhards have been consistent winners. They have (naturally) front wheel drive with Tracta joints, a flat-twin air-cooled engine and a light metal frame. Considering that the engine has a displacement of only 750 cc's, the car's performance is remarkable.

In 1947 Gregoire presented a new car at the Paris Motor Show, this time a full size model, following his by then traditional pattern of design: front wheel drive, variable suspension, light metal frame. It was notable for its extremely low gasoline consumption — only 32 miles per gallon for a generously sized five seater sedan with a top speed of 90 miles per hour. Economy was not the designer's primary objective in this case, but it was rather the by-product of very light weight in relation to size and good streamlining. This design was later adopted by the French Hotchkiss Company and is still made under the name of Hotchkiss-Gregoire.

It is interesting to note that although the 1956 Gregoire Sport appears quite revolutionary to the average American motorist, all the unusual components of the car have been tested over a period of many years. This shows how far ahead of his time Gregoire was in 1926 for the front wheel drive, in 1953 for the aluminum frame and in 1941 for the variable suspension.

In 1949 he was awarded the annual Gold Medal of the French Society for the Promotion of Industry, founded by Napoleon in 1801. Only two other men connected with automobile design ever received that distinction: in 1862 de Rochas, inventor of the four stroke engine; and in 1921 the marquis De Dion, the great motoring pioneer.

Gregoire is today a man in an enviable position, one that many of us might dream about. He is a free-lance designer with his own factory in which to manufacture prototypes. He has no sales manager, no vice-president in charge of production, no board of directors wield their whips over his back. He simply designs his cars as he thinks fit and then offers the completed model to the highest bidder among large scale manufacturers. They can take it or leave it. The income from his numerous patents makes Gregoire independent of his customers. Besides, he is not interested in growing into a French Ford or Enzo Ferrari, with the difference that he no longer goes into racing competition.

Gregoire is primarily an artist. He has written several books on motoring subjects and branched out recently into fiction. His first novel "The 24 Hours at Le Mans" uses a background with which Gregoire is thoroughly familiar.

In 1927 he drove practically the entire 24 hours single-handed when his co-driver was injured on the eve of the race. The subject of the novel — aside from the romantic interest — is a fictional attempt by a new turbine car to beat the Jaguars and Ferraris.

Turbine cars are not entirely unknown to novelist Gregoire. In 1952 he designed a turbine automobile for the French Socema Company. It was never manufactured owing to economic reasons, but it performed very well indeed in tests.

Gregoire has also designed electric cars — this during the wartime gasoline shortage.

His publications include a treatise on California wines — an item not recommended for reading by West Coast patriots. Gregoire is a profound student of wines, keeping a small cellar under his factory at Asnieres near Paris. "It keeps better there than in the city. No vibration from subways nearby," he says.

Gregoire's latest effort is not primarily intended as a competition car, although it perhaps could become one with some modifications. It made its Stateside debut at the Ford Museum in Detroit as one of a series of "personal cars."

Seating three abreast, the car is far roomier than most sports models. The location of the engine with the entire transmission in front leaves a completely flat floor and plenty of room for luggage in the back.

The engine is a flat-four, water-cooled. In accordance with current practice it is oversquare with a 3.54 inch bore and 3.38 inch stroke and a volume of 133.51 cubic inches. The Constantin supercharger delivers 4½ psi boost at 4000 rpm. Power at 4,500 rpm is a claimed 130 bhp. The use of a supercharger gives good torque at low speeds and a favorable power-to-displacement ratio without excessively high engine speeds.

Fuel consumption for an average speed of 65 mph is only 17 miles per U. S. gallon, despite the use of a supercharger. This is probably due to the low weight (2200 lbs.) and small frontal area. These factors are probably also responsible for the top speed of 118 mph. Accurate acceleration data is not yet available.

The four speed gearbox gives the following speeds per 1000 revs:

First	7 mph
Second	15 mph
Third	19.4 mph
Fourth	25.6 mph

It will be seen that the advertised top speed of 118 mph is obtained at less than 5000 revs. — which clearly leaves plenty of room for improvement. The standard compression ratio is only 6.9 to 1 — which again shows that far from being overstressed the car has plenty of stretch left for future modification — if one is brave enough to try it in the presence of the blower.

The steering is, of course, rack and pinion — usual with front wheel drive layouts.

Where the Gregoire Sport scores is in the roadholding department rather than in straight performance, although it should be quite creditable if we go by power to weight ratio. Front wheel drive often confers on any car quite exceptional cornering ability — a Citroen is well known to be able to take a hardcorner considerably faster than a corresponding rear drive model. Coupled with this is the weight distribution with two thirds of the weight on the front driving wheels. Good wheel adhesion is quite a point if the horses are to pull the car instead of burning

rubber. The variable suspension, together with two anti-roll bars in front and back, gives the Gregoire Sport excellent lateral stability without sacrifice of comfort.

It would certainly be interesting to match a Gregoire Sport against a Thunderbird or a Corvette on a winding mountain road. The chances are that its superior cornering would more than offset the disadvantage in acceleration, if there was any. For a match against semi-competition models some modifications to the Gregoire power plant would be necessary before a fair comparison could be made.

If the Gregoire Sport was described as a French answer to the Porsche, the Dyna Panhard – also a Gregoire design – is clearly the opposite number of the Volkswagen. Manufactured in smaller quantities, it is more costly, but designwise it is strictly the equivalent of the other creation of Dr. Ferdinand Porsche. The Dyna Panhard is a direct descendant of the Gregoire light car design of 1946 – the car that was flown to Oakland, California, at the request of Henry J. Kaiser.

It is a full five seater sedan, yet it weighs only 1562 lbs. Low weight is the key to the remarkable efficiency of the Dyna, which attains a top speed of nearly 80 mph with an engine of only 850 cubic centimeters (51.8 cubic inches!) displacement.

The miniature Dyna engine delivers a respectable 42 bhp at 5000 rpm. This is somewhat more than the Volkswagen engine which has a larger displacement. In fact the power per cubic inch ratio of the little two cylinder air-cooled Dyna is about the same as that of the 1956 Cadillac, despite a moderate 7.25 compression ratio.

To the French, Dyna's principal attraction is the extraordinary thriftiness of that five-seater, roomy by European standards. The Dyna has been officially tested at Monthlery with the following results: fuel consumption at 50 mph – 39 mpg. The same car, with the same carburetor setting, clocked 80 mph.

Some argue that the Dyna is superior to the Volkswagen in efficiency and performance. Unfortunately the French factory makes only a small number of the Dynas, while the German one has already turned out over a million VWs. The result is that the Dyna sells in France for the equivalent of $1900 – while the VW is much cheaper. This certainly proves that the Germans knew better how to organize their production, but from the standpoint of overall excellence of design the Gregoire product is in no way second to the Porsche masterpiece.

In both cases the advoidance of the superfluous was the guiding principle. The pay-off is reduced weight, with the resulting low gas consumption and comparatively good performance. These ideas might appear obvious, yet innumerable cars drag around thousands of pounds of unnecessary weight, using for that purpose hundreds of superfluous horses eating up gallons of wasted fuel. Neither the VW nor the Dyna Panhard are weighed down with such burdens which is why they are both among the most efficient vehicles ever built.

If such a car had been put on the market in 1948 by Kaiser, it might have caught on. After all, Volkswagens are selling in the U.S. at a rate of 60,000 a year and hoping to reach 100,000 or more – and the Kaiser-Gregoire would have been a much larger and more powerful car at about the same price.

The Gregoire Sport, of course, is not likely ever to be mass produced; the immediate plans of Gregoire call for the making of about a dozen of them in his small plant. They will not be cheap. If taken over by a manufacturer with larger facilities, the Gregoire Sport could probably be made to sell for the price of a Jaguar or a Mercedes 190 SL.

And there is always the chance that Gregoire may spring some new ideas on us, as he has done before. Comparable to Porsche in creative engineering ability, he has one important advantage over the German automotive genius – he is alive and a youthful 55. #

Alfa—Giulietta

(Continued from page 47)

in its current form the Giulietta's clutch is soft enough to be quite comparable with clutches that survive in American practice. You can let it out slowly while bringing the engine revs up gently, or you can let it out fast and use higher revs. Smooth first-gear starts can be made with engine speeds as low as about 1800 rpm.

The choice of transmission ratios is excellent, first being useful up to about 35 mph, second to 50 and third to 75. Torque is so ample that fourth is a perfectly acceptable gear for traffic but if you want to be aggressive, third will really get the job done. The gears emit a faint, pleasant whine.

But all is not perfection in the cog box. It is described as having "four forward synchromesh speeds" but there is no synchro on bottom gear. This is the first discovery and it's quickly followed by others. My test car was well broken in but the column-shift linkage remained stiff, much too stiff. Getting into second from first was often noisy. The long zig-zag shift from second to third sometimes failed – third was simply a closed door, so back to neutral and then back for another try to get in. On these repeat shifts the synchro would be inoperative, a fact announced by the noise of grinding gears. This also occurred during downshifts but could be avoided by double-clutching and speeding up the engine.

As far as our test car was concerned, some of these malfunctions must have occurred because the column-shift linkage was out of adjustment. Which, all by itself, is a sufficiently lethal indictment against the column shift. No manufacturer has ever built finer floor-shift transmissions than Alfa Romeo – Theirs are legendary. It's good to hear that the very latest Giulietta Sprint models *are* arriving in the U. S. equipped with floor shift.

STEERING

Giuliettas are fitted with ZF worm-and-roller steering. There are more expensive ways of building a steering mechanism but I've handled nothing, including worm-and-wheel, that is more perfectly precise. There is no lost motion in it and it's as quick and direct as a bicycle's steering. How this is accomplished with three turns of the wheel from lock to lock I'm not prepared to explain.

This steering has all the feel you could ask for or need, yet it's light. Little effort is required in parking and at 10, 40, or 80 mph you can hold the rim of the wheel between the tips of thumb and one finger and steer the car through a maze.

SUSPENSION

The Giulietta was first exhibited at the Turin Show of '54 and at that time its rear suspension was based on traditional quarter-elliptic springs. There may or may not be a connection between that fact and some early reports

(Continued on page 61)