An Introduction To The Mini

1984

25

BRITISH MOTOR CORPORATION

CONSOLIDATED TECHNICAL DATA

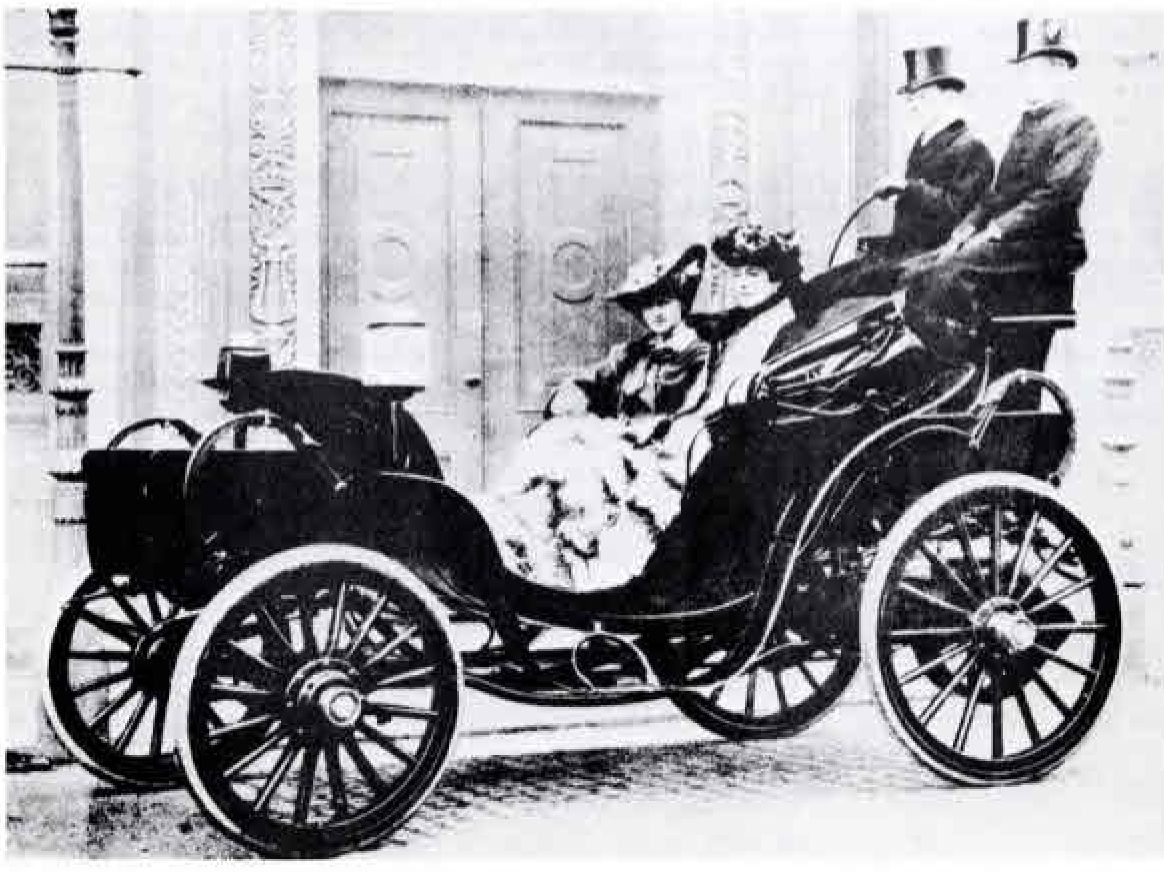
for the

Austin Seven 850

and the

Morris Mini-Minor 850

"Some solutions have been ridiculous, others merely absurd."



THE DESIGN PHILOSOPHY OF THE NEW AUSTIN SEVEN

Which embodies Transverse Triplane engine gearbox aggregate
66 inch lounge room: 120 inch overall length
850 c.c. : curb weight 1275 lbs.
2.4 b.h.p./sq ft/frontal area: maximum 73 m.p.h.
46 b.h.p./laden ton: top gear gradient 1 in 13
Front wheel drive: all independent suspension with rubber springs of variable rate.

"It was new; it was singular; it was simple"

Admiral Lord Nelson on the tactical
plan prepared before Trafalgar.

Before the Battle of Trafalgar Nelson had to solve a technical problem. How to employ superior material and personal forces as to ensure, to use again his own words, "Not Victory but Annihilation" by breaking through the line of battleships opposed to him.

History records how completely he achieved his aim on October 21st 1805; posterity will in turn regard August 26 1959 as a landmark in the development of the popular car. For it will be generally agreed that the end product of a small design and development team led by Alec Issigonis during the past two years marks a real break through in automobile engineering technique which brings with it major benefits to the motor car user.

What is this breakthrough?

What are these benefits?

It is the production of a 10 ft long car capable of exceeding 70 m.p.h., and bettering 50 m.p.g., which weighs only 1260 lbs., will climb a 1 in 13 hill in top gear, will reach 50 m.p.h. from rest in 18 seconds, has variable rate all independent rubber suspension and is yet one of the lowest priced cars in the world.

They are the enjoyment of this unique alliance of performance and economy by four persons who travel in comfort and security, who can take with them ample personal effects, who can view the outer world through large windows calmly and with the comforting knowledge that they are making less demand on highway space and on raw materials than has hitherto been, or even thought, possible.

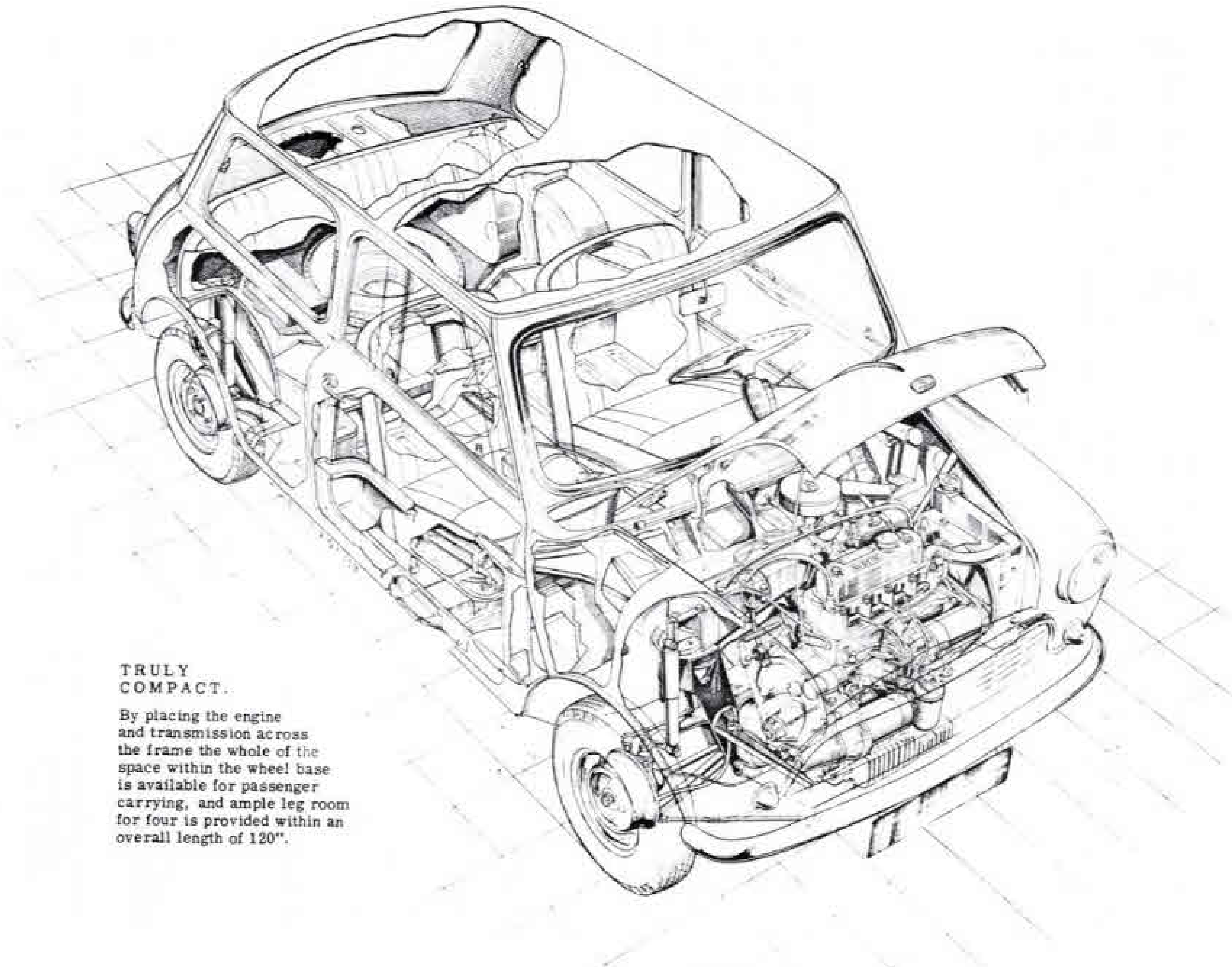
From the earliest day of motoring one of the prime problems has been how to carry a passenger load of at least 4 persons with the smallest encroachment upon space on the highway, which must be paid for by the public, and the minimum weight of metal in the vehicle itself, and fuel and rubber which it consumes during its working life which have to be paid for by the buyer and subsequent owners.

During the past 60 years some solutions have been ridiculous, others merely absurd but in the post war period the best brains in the Automobile industry in Europe have addressed themselves to this matter and there are now a number of small cars, some with front drive and others with rear engines, which offers comfortable travel to two, and passable comfort for four, with road speeds superior to 60 m.p.h. and fuel consumption better than 40 m.p.g.

But conventional concepts of comfort and performance are transcended by the accomplishments of the New Austin Seven, a claim that may perhaps best be illustrated by comparing it in various aspects with the average figures derived from the best selling model in France, Germany and Italy.

Such a comparison can thus be displayed:

	Measurements Average of 3 best European Sellers.	Austin Seven	Notes
1. Wheelbase	87.5 in	80 in	9% shorter
2. Total length	147 in	120 in	23% shorter
3. Width	58 in	55 in	5% narrower
4. Height	56 in	51.5 in	9% lower
5. Frontal area	18 Ft^2	15.4 Ft^2	14% less
6. Road area	57 in	46 in	24% less
7. Curb weight	1420 lb	1260 lb	10% lighter



TRULY
COMPACT.

By placing the engine and transmission across the frame the whole of the space within the wheel base is available for passenger carrying, and ample leg room for four is provided within an overall length of 120".

8. Front seat width	48 in	49 in	No significant change
9. Rear seat	49 in	49 in	
10 Pedals to rear squab	62 in	66 in	The equal of space provided on the 1959 American car.
11 Rear Leg room	8 in	11 in	

It will be seen that the new car is sensibly smaller, and noticeably lighter, than corresponding current models; in fact ten Austins can be parked in the space occupied by eight of the most popular Europeans.

It would be logical to conclude that so favourable a conjunction of internal spaciousness with external diminutiveness has been achieved by a ruthless sacrifice of engine size and road performance. On the contrary, the figures in this respect are just as remarkable as those which have been examined above.

PERFORMANCE STATISTICS

	Average 3 best European Sellers	Austin Seven	Notes
a. Engine capacity CM^3	890	850	$5\frac{1}{2}$ smaller
b. Engine Power B.H.P.	24.5	34	40% more
c. H.P. Laden Ton	30	45	50% better
d. HP/Sq. Ft. Frontal area	1.55	2.4	55% better
e. Max. speed on level	64 m.p.h.	73 m.p.h.	12% faster
f. Max. top gear gradient	1 in 19	1 in 13	45% steeper hill climb
g. Rest to 50 m.p.h.	25 secs	18.0 secs	28% less time
h. Fuel Consumption @ 50 m.p.h.	45 m.p.g.	46.5 m.p.g.	3% better at steady speed
i. Per cent piston speed corrected (vide Dr F.W. Lanchester) to equivalent stress on engines of 1:1 S.B. Ratio	100	109	9% higher
j. H.P./Litre at 50 m.p.h.	13.5	12.3	9% less
k. B.M.E.P. at 50 m.p.h.	54 p.s.i.	47.5 p.s.i.	12% lower

Let us now consider some of the major design problems which had to be solved before it was possible to present Europe's Most Modern Motor Car.

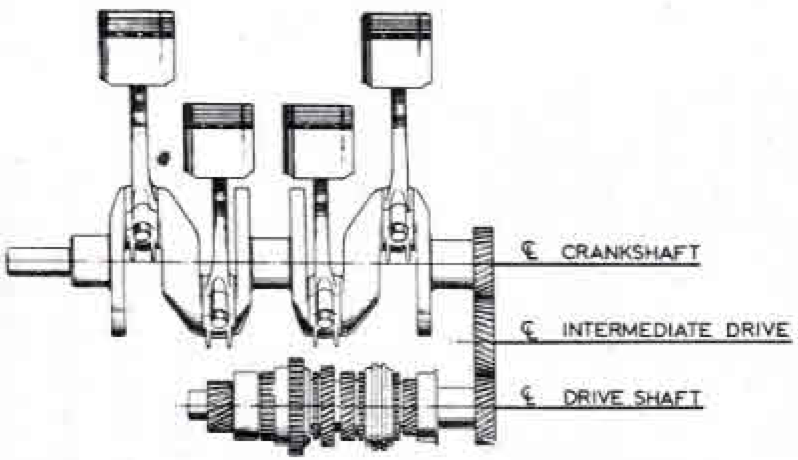
SPACE PROBLEMS

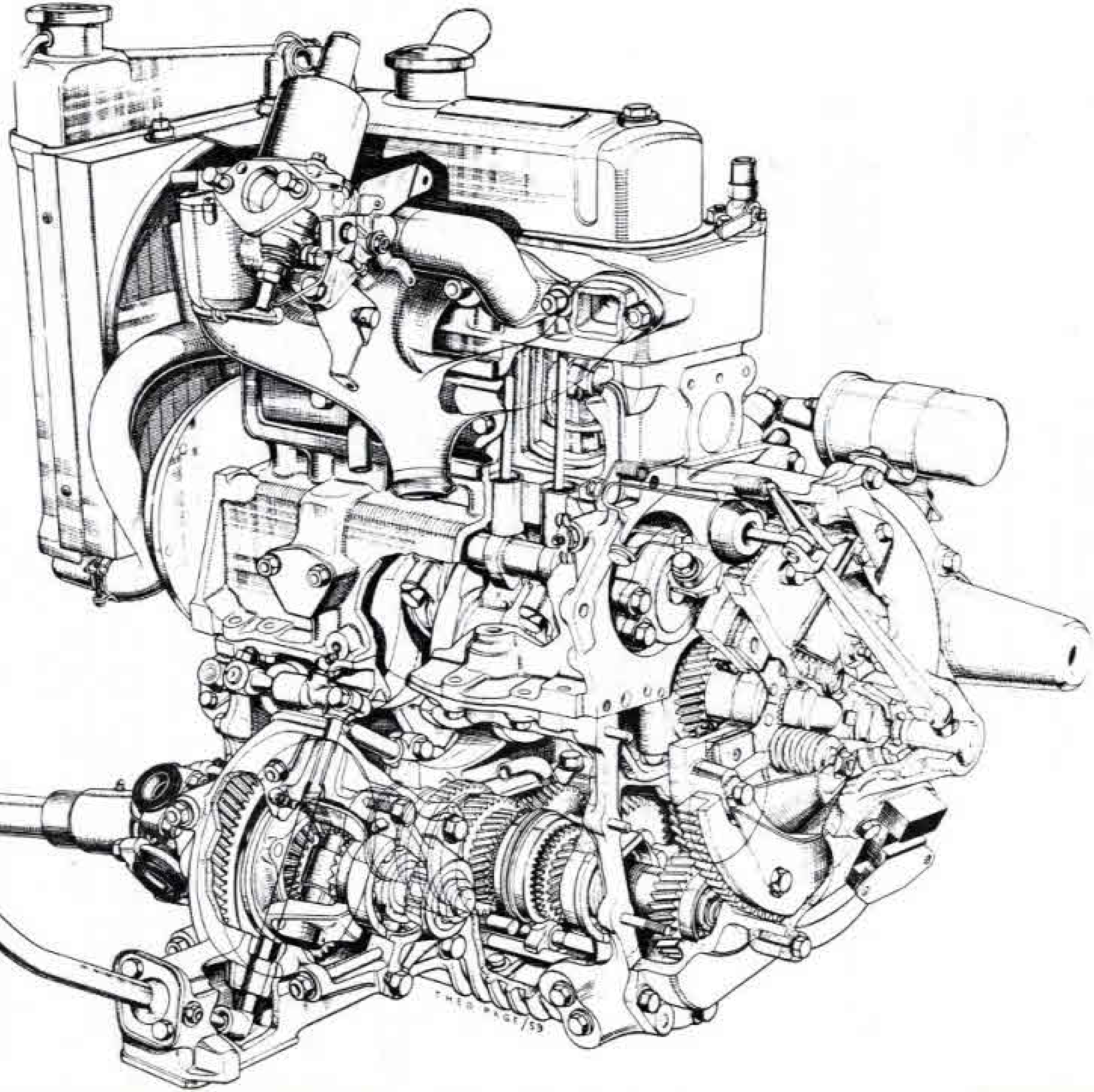
The size of a car fixes, for practical purposes, the weight of the structure and this, in turn, exercises an over riding influence on the cost. Weight also determines fuel and tyre consumption in normal driving.

So the most important need of the small, light car is that it should be as small and light as possible. But if four persons are to be carried in comfort there is an absolute minimum size for a motor car even if no allowance is made for space occupied by the engine, or space provided for the luggage carrying.

These minimum dimensions can be set out thus:

Length:	1. Pedal travel	4 in
	2. Front Leg Room	18 in
	3. Front Seat	18 in
	4. Front Seat Squad	4 in
	5. Rear Leg Room	6 in
	6. Rear Seat	17 in
	Minimum platform length	67 in





TRANSVERSE TRIPLANE

By placing the crankshaft above the gear shafts (and ahead of the final drive) length is exchanged for height, which saves space and immensely increases the structural stiffness of the power pack.

Plus:	7. ½ Front wheel Arch	15 in
	8. 2/3 Rear wheel Arch	20 in
	Minimum overall length	102 inches.
Width:	Minimum acceptable seat width, 45 inches.	
Height:	Ground to floor	6 in
	Floor to roof	45 in
	Total height	51 inches.

But of practical necessity, there must be a projection beyond the wheel arch at each end, and as for reasons of stability the wheel track should not be less than 48 inches, the width of the car must be at least 50 inches.

So the smallest possible four seater vehicle will be: 110 inches long
50 inches wide
51 inches high

In practice the length must be somewhat greater as luggage carrying capacity is essential. It might also be thought that extra length must be provided to accommodate the power unit and generally speaking this is true. On the New Austin Seven, however, a revolutionary concept of engine and front drive transmission is employed whereby no additional length is called for; and at the same time there is no encroachment of the power unit (or transmission) into the potential passenger carrying area.

The Issigonis Transverse Triplane Installation

The New York skyscraper economises in city area for a given cubic content by extending into the third dimension of height. So does the audacious concept of Issigonis which puts the transmission gears directly beneath the crankshaft so that they are accommodated in the sump. This brilliantly simple idea makes it possible to mount the engine and transmission transversely at the front of the car without limits on numbers of cylinders (or engine capacity) on the one hand, or a severe restriction of steering lock on the other.

As can be seen from an illustration the passenger carrying area is not invaded and a slight protrusion in the floor accommodates the exhaust pipe so that the floor level is equal to the ground clearance. There are no elements beneath the floor which can foul on rough cross country going.

This low floor level coupled with the absence of a rear axle (the drive being at the front) makes possible a really low roof line giving small frontal area with fully adequate head room.

A further important advantage of this system of engine mounting may not be fully appreciated. With the normal combination, of engine, clutch housing, gearbox, and drive shaft extension the engine and transmission is mounted upon points which are widely apart and there is flexibility between these points. This can give rise to drumming which is wholly absent on the much more compact unit which derives naturally from the triplane design.

In fact this arrangement of the engine and gearbox area exemplifies in a particularly vivid way the remarks in the July 8, 1899 issue of "Le Sport Universel Illustre" describing the Latil et Riancey car. It said, "M. Riancey has started from the principle that it is more sensible to pull than to push his voiturette: the mechanism is in one group so it can be easily protected, and there is no vibration. Apart from the excellent balance thus achieved the whole arrangement gives lightness to the carriage, a quality as yet rare among thermal combustion vehicles."

As the engine demands no longitudinal space on its own account a car only 120 inches long can accommodate four persons and a substantial luggage locker and, as shown in a side elevation, four fifths of the overall length is available for these purposes. The transverse triplane engine/transmission layout not only plays a paramount part in achieving this but also, by offering front wheel drive, confers a remarkable combination of comfort, stability and traction.

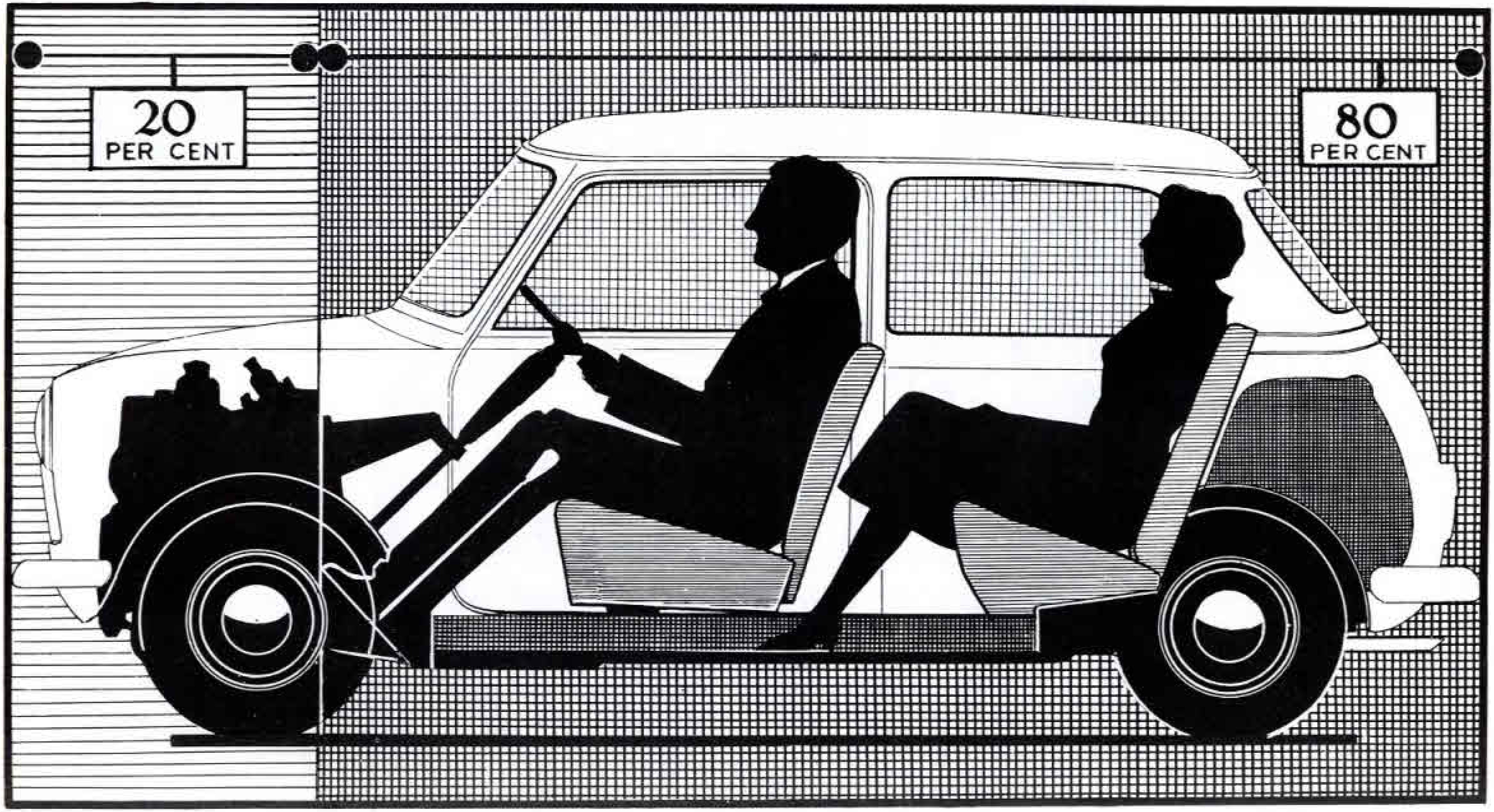
The Dynamics and Aero Dynamics of the Front Wheel Drive Car

The driver is conscious of the behaviour of his car when:

1. Driving in a straight line on a level road.
2. Cornering.
3. Climbing a hill.
4. 2 and 3 in combination.

For cases 1 and 2 some degree of understeer is desirable to confer stability.

To ensure understeer it is desirable to load the front tyres more than the back tyres in



The cut away "Seven" on the Austin Stand shows that 80% of the car's length can be used to carry people or baggage.

"Ascends hills by rising superior to adverse forces to which rear driven cars all too easily succumb."

order to diminish their cornering power, and this is commonly done by placing the mass of the engine and gearbox well forward in the frame. The transverse engine mounting fulfills this requirement and the act of putting torque through the carcase of the front tyres also diminishes their cornering power and thus enhances the understeer effects obtained by carrying 60% of the weight on the front wheels.

Hence the Austin Seven is inherently dynamically stable.

The transverse engine mounting, coupled with the general configuration of the vehicle, also plays an important part in securing aero-dynamic stability. With increase in road speed the centre of wind pressure moves steadily forward, and if it advances sufficiently ahead of the centre of gravity a side wind acts through a long lever to prise the car off the straight course.

On the Austin Seven cars the centre of gravity is naturally far forward and the relatively long, parallel, sides of the body behind the C of G act in themselves as a strong stabilising influence. Hence so far as stability on the straight is concerned a front engine driving the front wheels is superior to any other combination.

In strong contrast with a rear engine, driving the rear wheels, the rear tyres at once support the greatest weight and transmit torque, and therefore have the least cornering power, and the C of G is far back and the lever effect of the forward centre of air pressure thereby enhanced.

The rear engined car is thus inherently unstable both dynamically and aero-dynamically. The former condition can be ameliorated by low front tyre pressures and a strong anti-roll bar; the latter by fins if they are made large enough but very few stable rear engined vehicles have yet been produced, some critics might say none.

On corners the front drive car understeers with power applied. Contrariwise, shutting the throttle at once slows the car and reduces the cornering radius and the natural instinct of the average driver when going too fast is thus turned into a valuable safety measure.

In the hill climbing condition weight is transferred from the front to the back of the car and hence load is taken off the front, and added to the rear wheels. If, however, the front wheels are initially loaded 50 percent more heavily than the back they continue to carry adequate weight for traction on dry roads up to a gradient of 1 in 3, and thus have an ample margin for all normal motoring in any part of the world.

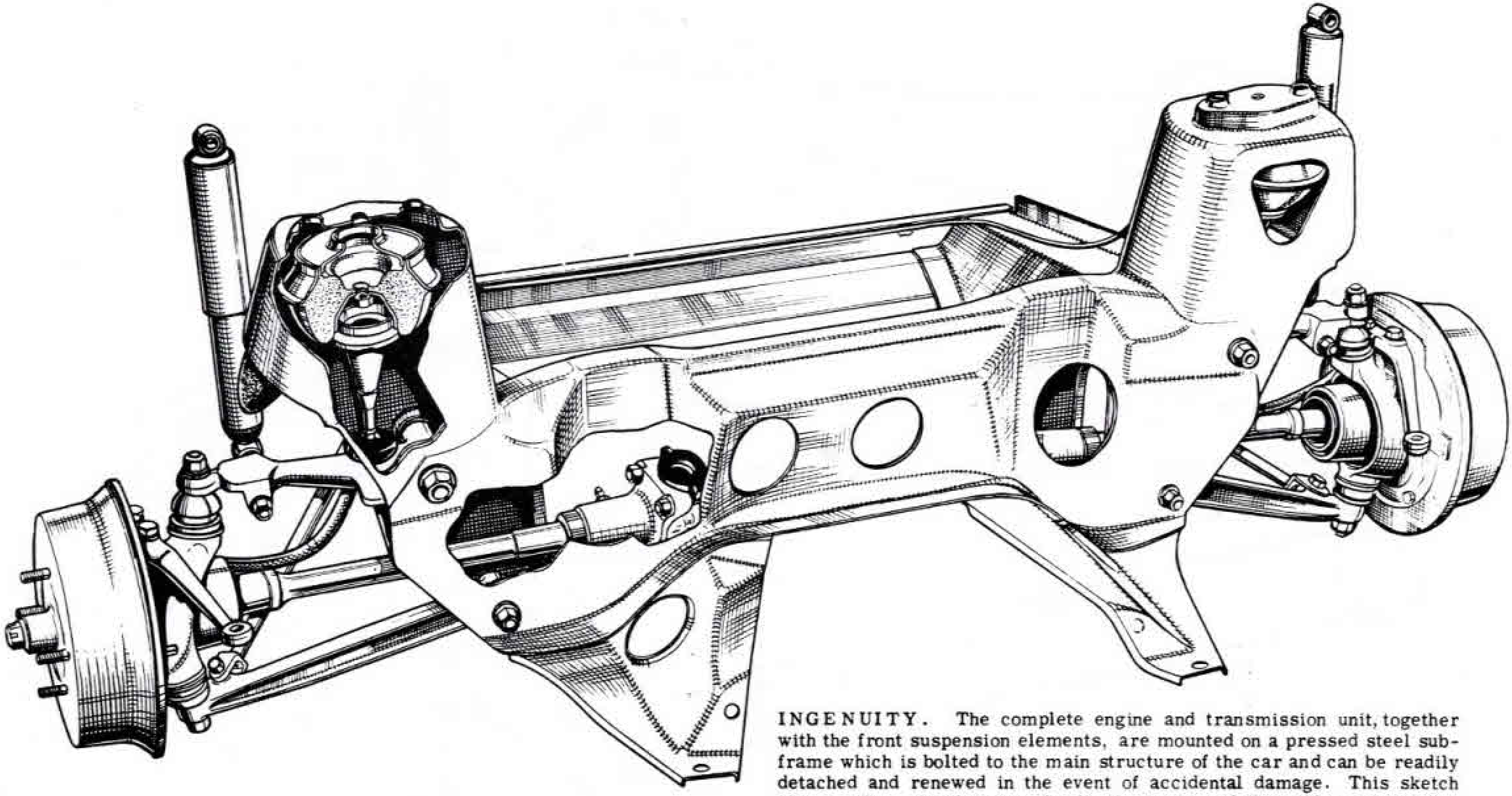
On slippery surfaces some of these assessments of merit must be revised. When cornering or when on a straight road in the presence of external excitations such as side winds or road camber, the exceptional traction ability of the rear engine car is offset by difficulty in control if slippery surfaces cause the rear wheels to spin and the car to side slip.

In this event the spin must be suppressed by reducing power and, at the same moment, steering control restored by a counter movement. If overdone this results in a slide in a sense opposite to the original and, unless the driver be skilled, to a further series of tail slides which may increase until the vehicle becomes completely out of control. But whereas wheel spin on a rear drive car promotes an already inherent disposition to oversteer (which can only be corrected by shutting the throttle) on the front drive car wheel spin exaggerates an existing understeer condition which can easily be countered by laying on more steering lock whilst at the same time maintaining traction by keeping the throttle in some degree open. So on slippery roads driving a front driven car is relatively easy and it may, with no great skill on the part of the driver, ascend hills of sub-critical gradient by rising superior to adverse external forces to which rear driven cars, and particularly rear driven cars carrying more weight on the front wheels than on the back, all too easily succumb.

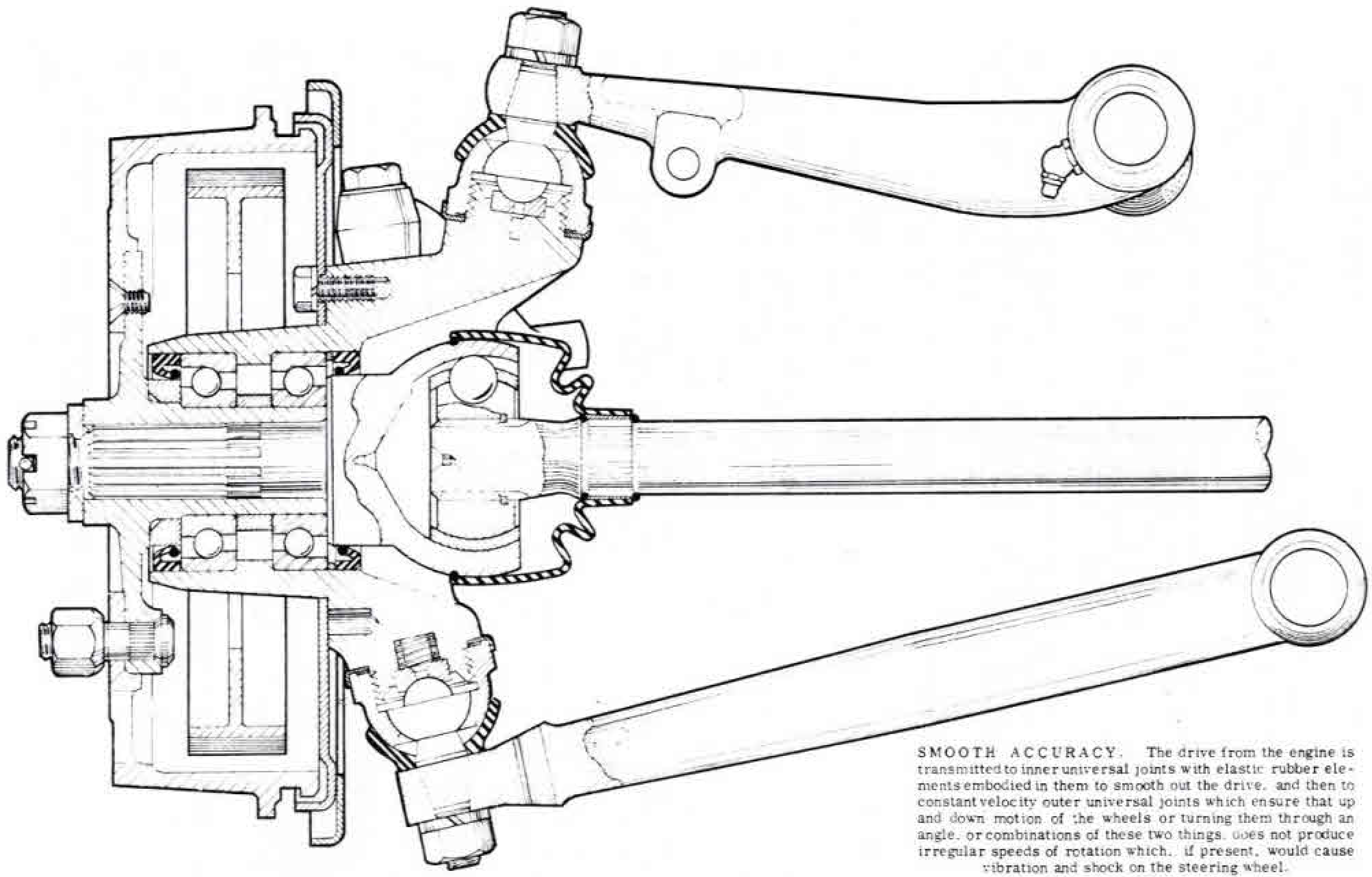
We see then that the rear engined rear drive car has outstanding traction ability if the driver is sufficiently skilled to avoid wheel spin or to take the right action if this occurs. The conventional layout favours cornering at limiting speeds by a driver able to use the throttle to help the steering. In all other circumstances the well designed front drive front engine car shows to advantage to a degree which lessens manifestly the burden of the average individual and thereby adds to the sum of road safety.

Suspension Problems peculiar to the Small Light Car

Metal springs, be they leaf, coil, or torsion bar, respond in exact proportion to load; that is to say if 100 lb. will compress the spring 1", 200 lb. will compress 2" and so on. But as the laden weight of a small car may vary in ratio of 1.0 : 1.5 various arrangements have been proposed to give the suspension system a variable rate, for example, 100 lb. deflecting through 1" but say 70 lb. more being required for the next ½" and say 100 lb. for the next ½". In this case a load of say 370 lb. in place of 200 lb. would be carried with a total deflection of 2". These arrangements are for the most part complex and unsuited to large scale production, and for this reason the solo driver of small cars has had to endure a rough ride dictated by the mathematics of the fully laden situation.



INGENUITY. The complete engine and transmission unit, together with the front suspension elements, are mounted on a pressed steel sub-frame which is bolted to the main structure of the car and can be readily detached and renewed in the event of accidental damage. This sketch shows, also, the drive to the front wheels and the rubber suspension elements, together with their special shape which stiffens the suspension as increasing load is applied.



SMOOTH ACCURACY. The drive from the engine is transmitted to inner universal joints with elastic rubber elements embodied in them to smooth out the drive, and then to constant velocity outer universal joints which ensure that up and down motion of the wheels or turning them through an angle, or combinations of these two things, does not produce irregular speeds of rotation which, if present, would cause vibration and shock on the steering wheel.

As with the engine and transmission layout so with the suspension, Austin Seven marks a technical break-through in offering for the first time on a really large production vehicle independent suspension by rubber to all four wheels applied in such a fashion as to secure a marked variation in suspension rate with no complication in construction and a most economic use of material.

Rubber is an expensive material and cannot be used on a small cheap car unless full advantage is taken of the exceptional energy absorbing characteristics i.e. it must be highly stressed and some of the mechanical elements including the linkages must also be stressed to a very high level.

On the Austin Seven the four Moulton rubber buffers have a weight of only 6 lb, yet they support the fully laden weight of the car, amounting to 1800 lbs. To achieve this very favourable ratio the suspension linkage is arranged to multiply the wheel load by five and the interconnecting ball joints are thus very heavily loaded. In sum the commercial application of these rubber springs, with all their advantages of light weight, natural self-damping, and variable rate has depended upon the technical solution of the ball joint problem.

The method by which variable rate is achieved is set out in the section dealing with the Mechanical Construction of the car but it may be mentioned here that this is not only a powerful contribution to traversing rough roads without shock should the car be lightly laden with driver and perhaps one passenger, and without fouling should four people and luggage be on board, but serves also as an inherent anti-roll device.

Thus this combination of the Moulton spring with mechanical development in the ball joint serves to secure comfort with exceptional road worthiness.

As will be seen from perspective drawings, the movement of the front wheels is conventional as they are suspended on links of unequal radius giving a modest swing axle effect and putting the front roll centre $2\frac{1}{2}$" above the ground.

In view of the very light weight of the car 10" diameter wheel rims mounting 5.20" section tyres have proved quite satisfactory and contribute to a second problem besetting the ultra light car, which is how to maintain the weight of the unsprung masses in an acceptable relationship with the sprung mass of the vehicle.

At the rear end of the car unsprung weight is reduced to a minimum by a complete elimination of an axle beam - the wheels are located on trailing arms in such a manner as to have a vertical rise and fall with the implication that the roll centre at the rear of the car is at ground level, and as the roll couple at the front is therefore greater than that at the rear basic understeers results.

Parallel motion of the rear wheels exerts a beneficent influence in two other respects. Rear end steering caused by changes in the camber angle as the wheels rise and fall is eliminated and so is sideways shake of the back of the car caused by the changing angle of the rear wheels which is common to both the conventional live axle and to swing axle cars.

For these reasons the driver enjoys a noticeable uniformity of ride and handling and the rear seat passengers can, if they wish, slumber undisturbed by mental apprehension or by disagreeable physical buffetting. A further aspect of car weight, or more properly weight distribution deserves attention.

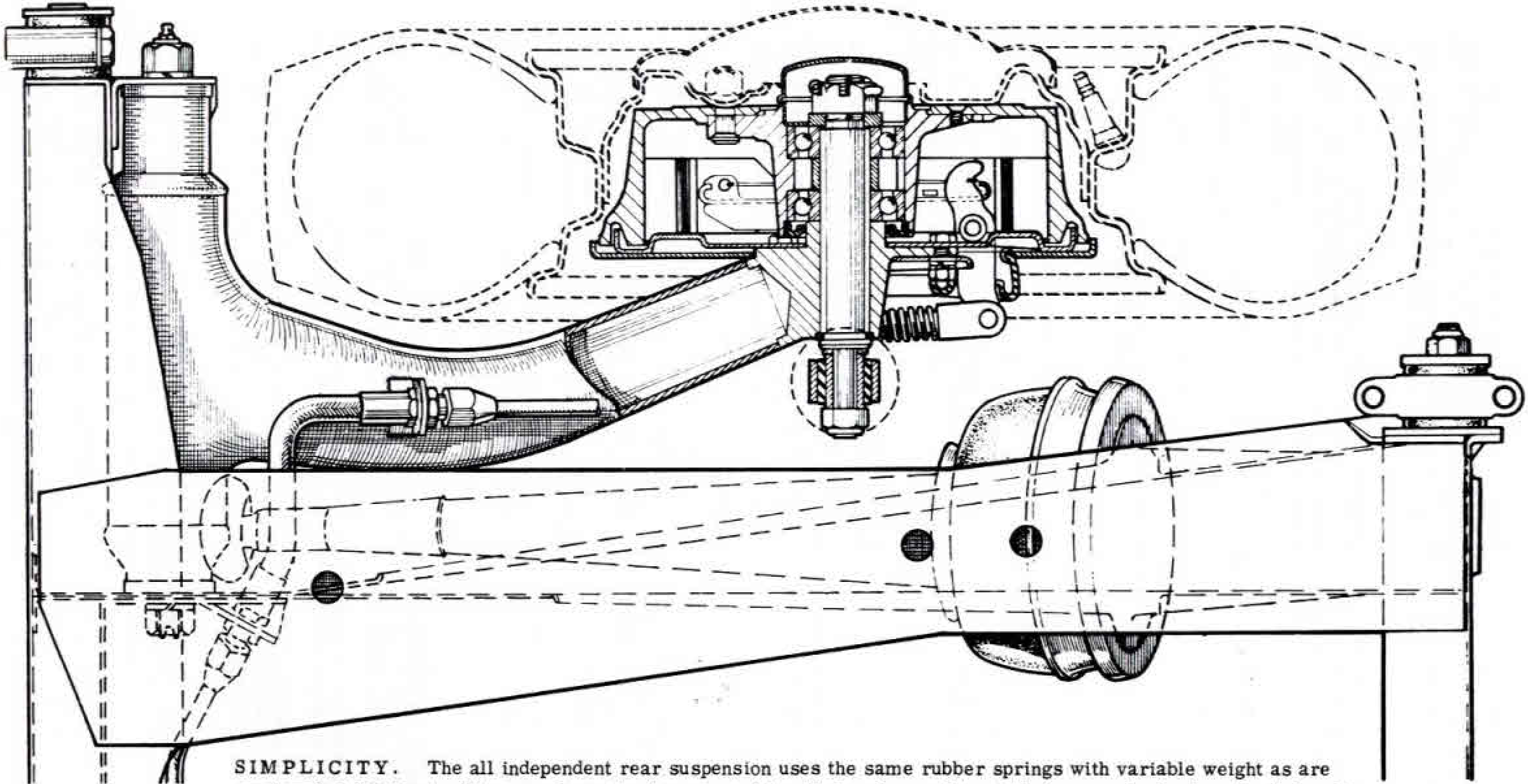
When over 60% of the weight of the car is carried by the front wheels, and taking into account the forward transfer of weight which takes place during high rates of retardation, it would seem desirable, in the driver only position, to divide the distribution of braking effort in the ratio of about 80% on front wheels and 20% on the back. But such a division would lead in normal motoring, where brake applications greater than 0.4 G are rarely needed, to an undue and unnecessary, loading at the front wheel brake system leading to an unnecessary high rate of wear on the front friction linings.

To avoid this the Lockheed brakes are biased by an ingenious limiting valve. With pedal pressures below 40lb. (the equivalent to a rate of retardation of 0.4 G or a stopping distance at 30 m.p.h. of 75ft.) the main line hydraulic oil pressure is distributed equally to front and rear systems but above this pressure, a plunger is forced on to a seating by a spring and further increases in the main line hydraulic fluid pressure are transferred solely to the front wheels.

By this means all four wheels make a contribution to normal motoring but in an emergency on dry roads it is impossible prematurely to lock the back wheels and to lose stopping power from this cause.

Driving and Steering the Front Wheels

Conventional cars have a front engine which drives the rear wheels through a long propeller shaft and a back axle which is mounted on leaf springs. This arrangement, commonly called the Hotchkiss drive, has considerable elasticity which cushions irregular impulses from the engine or a roughness in take-up through the clutch.



SIMPLICITY. The all independent rear suspension uses the same rubber springs with variable weight as are employed at the front. These springs also have a useful self-damping quality which lessens the load on the hydraulic units and increases their life. As at the front, so at the back, the suspension elements are mounted on a detachable pressed steel sub-frame.

When the engine and transmission is in one unit, be it at front or back, and drives the adjacent wheels this elasticity is lost and roughness in the drive is often observed although it can be diminished by the use of very flexible engine mountings. But these are in themselves objectionable as the movement of the engine upon them may be felt as a disagreeable phenomenon by the driver and for this reason on some cars of this kind a resilient coupling is included in the exposed half-shafts.

On the Austin Seven the required cushioning effect has been obtained in a most elegant manner by the use of flexible elements in the inner universal joint and this (patented) scheme has proved so successful that comparatively rigid engine mounting points can be used. The driver and passengers thus receive the full benefits of the very extremely stiff body structure with its reinforcing sub-frames at each end.

The outer universal joint on any front wheel drive car presents a complex and critical problem for it has to:

a) Have large angular displacement;

b) Give constant velocity as between the input and the output shaft irrespective of angular displacement;

c) Be compact

d) Sustain high loading without rapid wear;

e) Be inexpensive.

The Birfield joint has been developed from the Rzeppa design to meet these requirements. As the centre line of the steering is projected through the neutral point of the joint neither full power nor over-run, nor turning the wheels on the lock result in any reaction being fed into the steering mechanism.

The joint fits neatly between the upper and lower wish-bones and as these are of unequal length there is a very slight swing axle effect which gives small gyroscopic reactions which are fed into the steering gear. This is of simple, positive, rack and pinion type, but the design in general, and the angle at which the teeth are cut in particular, results in a big difference between the "forward" and "reverse" efficiencies. Steering wheel shake is thus exorcised without diminishing the sensitivity and feeling of direct control which makes a definitive contribution to safety as well as being features that are greatly enjoyed by experienced drivers.

The Body and Sub-Frame

A stressed hull is the primary structure, the very small dimensions of the car contributing to the very low weight of 310 lb. and the excellent stiffness figure of 6,500 lb. ft/deg. The floor is stiffened, as a beam and in torsion, by the front and rear sub-frames which also serve as mounting points for the suspension links and at the front for the engine/transmission/cooling elements. All these parts are built onto the sub-frames before they are placed on the assembly line so that accurate alignment of each pair of wheels can be predetermined and neither assembly nor inspection is hampered by the proximity of metal panels.

On the assembly line the hull is dropped on to the sub-frames which are quickly and accurately bolted to it and can, in case of accident, readily be removed and replaced by new components.

The Liquid Cooled Inline Engine

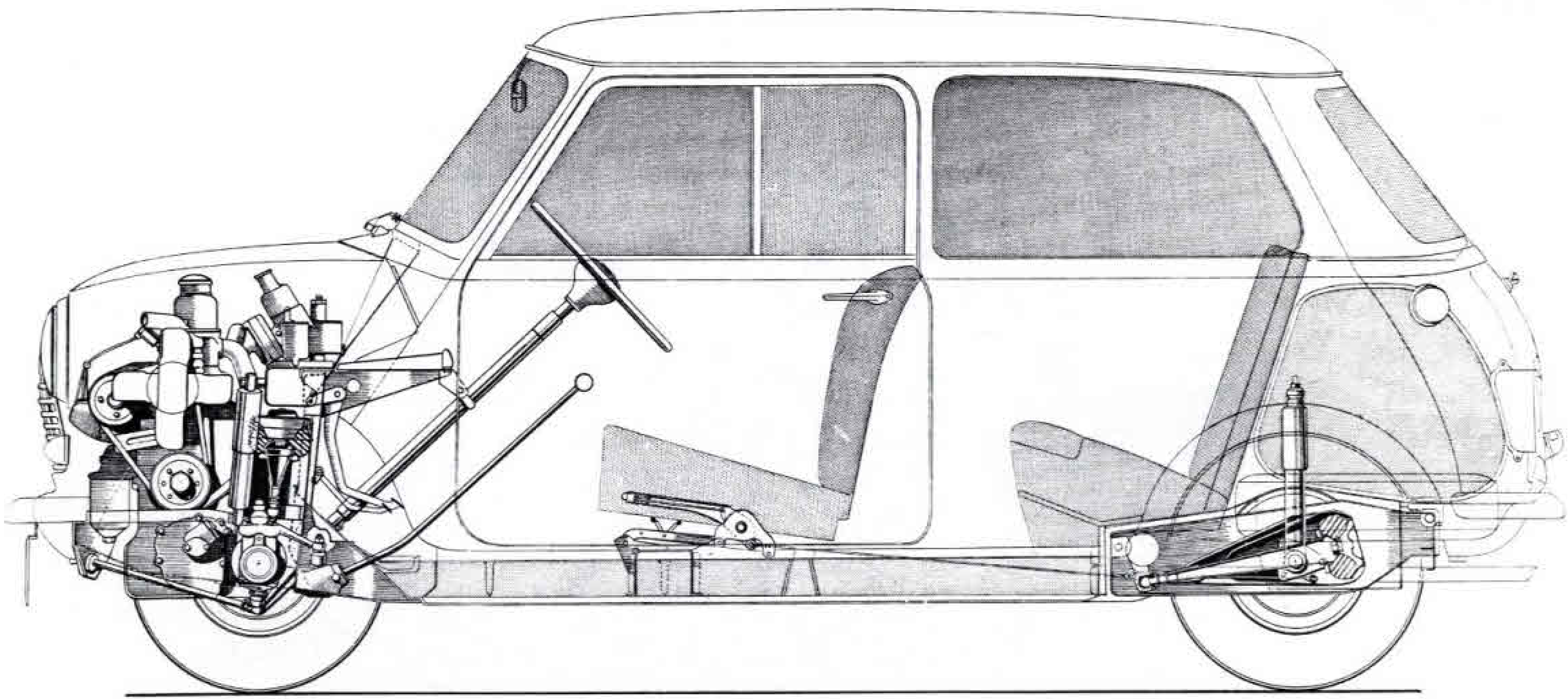
As mentioned earlier the transverse triplane location on the crankshaft and transmission shafts make it possible to use a conventional liquid-cooled four cylinder inline engine without encroaching on space that could possibly be used for the carriage of people or their effects.

This has in turn presented the possibility of continuing an extremely well-established basic engine line of which 1¼ million have already been made and are in use all over the world.

The merits of this choice from viewpoints of design, development and consumer service throughout the world are clearly apparent but these were not the only arguments which were decisive in rejecting the alternatives of air cooling or a different arrangement of the cylinder bores.

Placing the cylinders in other than in line position would not save any useful space, would offer little benefit to offset against many serious problems in flexibility of structure and the arrangement of carburetters, inlet pipes, and exhaust systems but would facilitate air cooling.

Air neither freezes nor boils, but it is equally true that air-cooled engines suffer from disabilities in conditions of extreme heat, or in sub-zero temperatures. In the former case, the high ambient temperature results in very high operating temperatures, which can lead to distortion and valve troubles, and which limit acceptable compression ratios to less than 7:1, despite the lowered volumetric efficiency following from the high temperature of the ingoing charge.



SIDE ELEVATION to scale 1:10 approx.

"Rear seat passengers can slumber undisturbed by mental apprehension or by disagreeable physical buffetting."

In very cold climates, the provision of effective heat to the inlet manifold is wholly dependent upon an exhaust hot spot, and unless inlet areas so small as to limit desirable engine power are used there will be poor distribution of fuel for a substantial time after the engine is started - indeed perhaps permanently in very cold conditions with a modest use of the throttle such as would be natural on ice or snow bound roads.

A further serious practical disadvantage of air cooling in cold climates is the absence of any reservoir in the heating system, and the difficulty of maintaining acceptable interior temperatures in part throttle conditions or when descending mountains.

It may further be stated that although it may not be impossible to design a cooling fan capable of delivering an adequate air flow over a speed range of, say, 4:1 without noise following from excessive tip speed in the upper speed ranges, and a substantial consumption of power in relation to the total needed to drive the car at, say, 50 m.p.h., such a component has not yet been applied to a production motor car.

The liquid cooling system chosen ensures:

(1) A stable operating temperature irrespective of ambient conditions.

(2) A compression ratio of 8.3:1.

(3) A specific output of 41 b.h.p./litre.

(4) Mechanical quietness.

(5) Rapid warm-up from cold in all circumstances.

(6) An effective supply of heat to an internal heating system.

A pusher fan passes air through the transversely mounted radiator core into the wheel arch, which is an area of low pressure.

This arrangement results in:

(a) An exceptionally low power loss in the fan;

(b) A reduction in radiator core area of 20% as compared with that needed by the same engine when the radiator is in the conventional position.

As over 90% of the vehicles in use throughout the world are liquid cooled, it is scarcely necessary to add that the technique of servicing them in all climates is well known and presents the user with no difficulties.

Passenger Amenities

Amenities beyond the mere carriage of four passengers form so important a part in the modern motor car that they may well be referred to in this Technical Review.

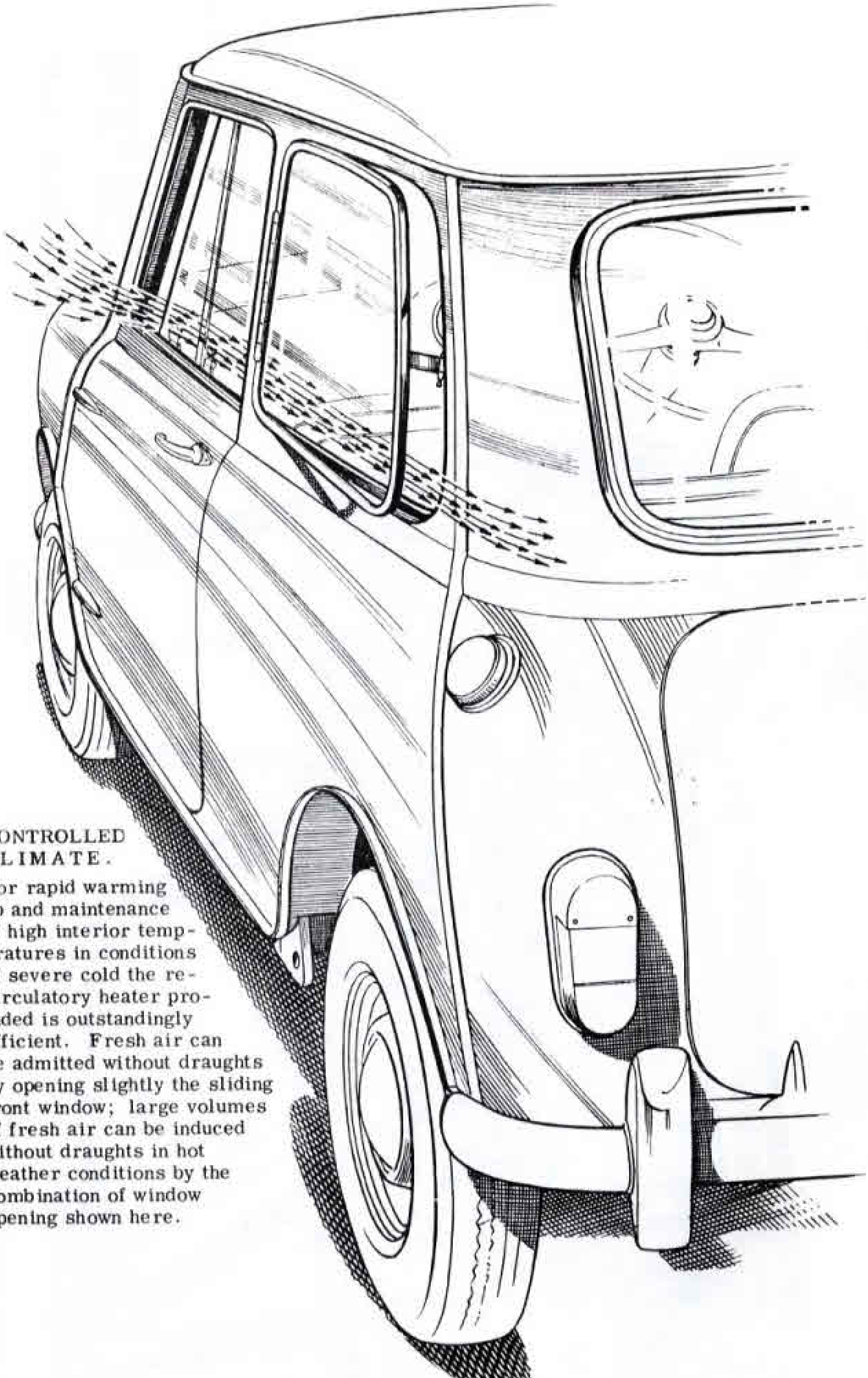
With an overall length as small as 10ft. and a turning radius of under 15ft. it is possible to park the car in a gap of only 11ft. 6ins., and this maneouvre is facilitated by the ease with which the driver can put both head and shoulder through the sliding panels in the front windows. This construction also greatly reduces wind noise, gives a considerable gain in interior space, and by an arrangement of opening shown in a drawing gives superb draught free ventilation which will be most welcome in hot weather motoring.

Illustrations show how full advantage is also taken to place recesses along the base of the doors and at the side of each rear seat. These are all sufficiently wide and deep to hold an immense array of magazines, guide books, thermos flasks, glasses, fruit, umbrellas, slide rules, sandwiches and other objects which the motorist who uses his car as a second home has constant need.

The very wide open shelf below the windscreen conveniently carries handbags and other large objects.

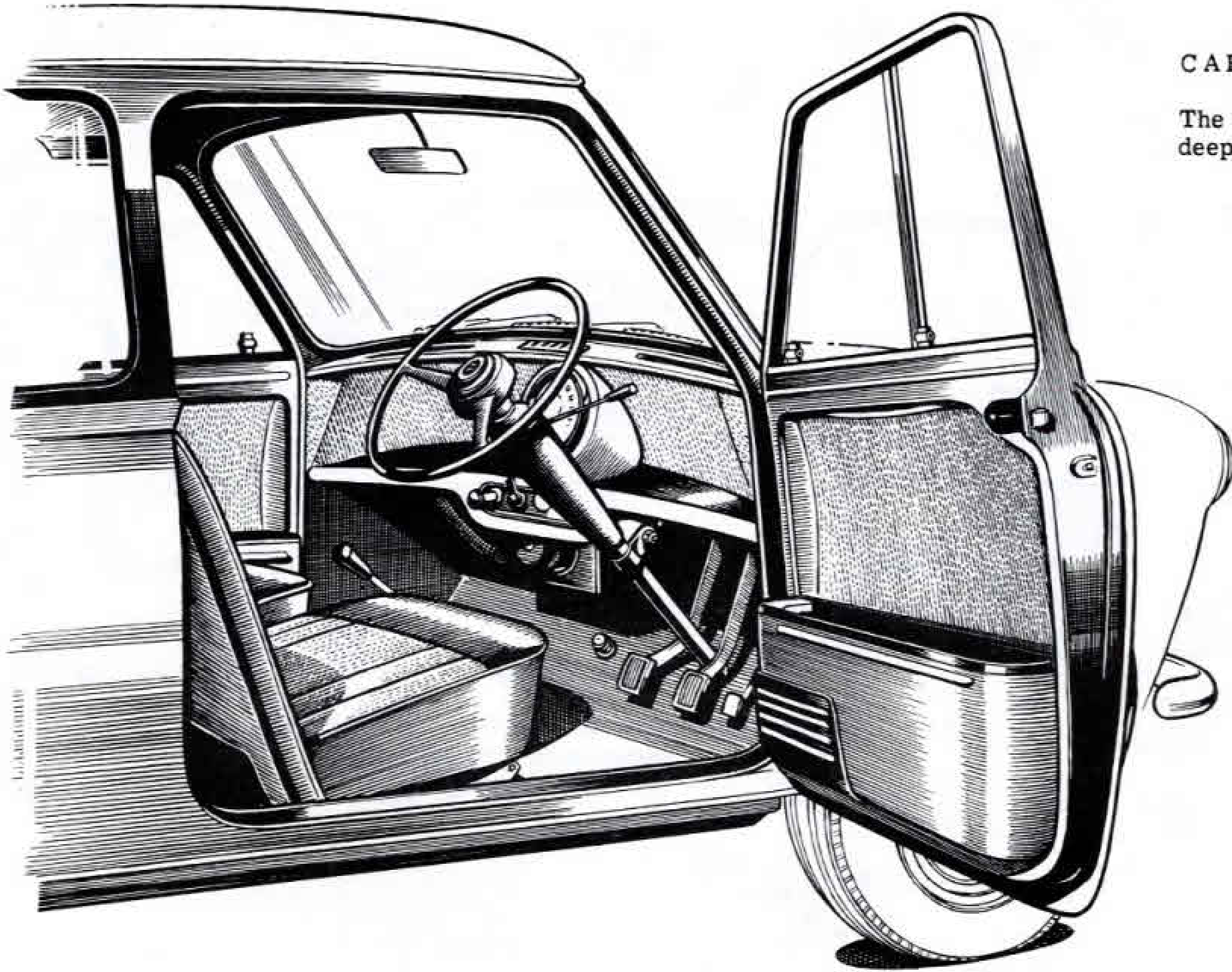
The absence of a rear axle beam (eliminated for technical reasons) is highly advantageous in ensuring adequate luggage carrying capacity despite the negligible overhang behind the rear wheel arch. It is possible to stow quite large objects on the floor beneath the rear seat cushion, and there is an enclosed lockable volume in the tail of six cubic feet. The locker lid, and supports thereto, are stressed so that they can be let down and really large pieces of impedimenta can be carried in this fashion.

To summarise, the every day requirements of the motorist are probably better provided for than in any other car irrespective of size and price.



CONTROLLED
CLIMATE.

For rapid warming up and maintenance of high interior temperatures in conditions of severe cold the recirculatory heater provided is outstandingly efficient. Fresh air can be admitted without draughts by opening slightly the sliding front window; large volumes of fresh air can be induced without draughts in hot weather conditions by the combination of window opening shown here.



CARRYING CAPACITY.

The wide front parcel tray and deep side pockets are displayed in this drawing.

"The every day requirements of the motorist are probably better provided for than in any other car irrespective of size and price."

Even when four persons occupy the seats the use of the locker lid will give more than adequate luggage carrying for a long weekend, and the rod, gun, or golfer will find no difficulty in accommodating his equipment however lavish it may be. The ability to absorb the table and chairs in the tail of the car; to place large wicker hampers beneath the rear seat; and to carry abundant supplies of cold or hot liquids in the side lockers must make an over-whelming appeal to the serious picnicker.

Maintenance

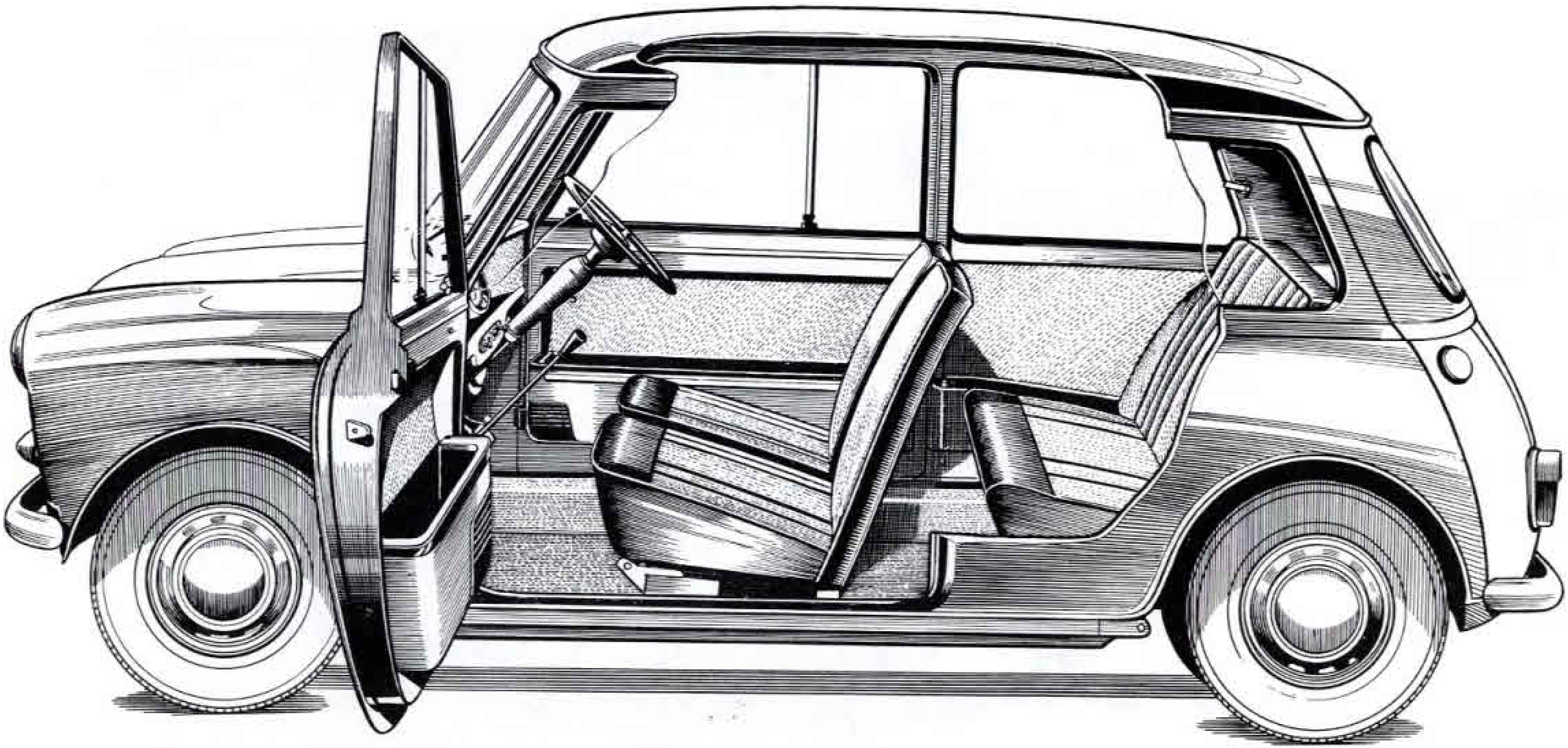
Improved standards of production efficiency make it possible to pay higher factory wages without inflating the cost of the product, but equally high wages for labour in conditions where productivity cannot easily be improved, such as in ordinary garages dealing with motor car service and repair, place a formidable burden on the car owner and this high cost of "bought out" maintenance gives ever increasing strength to the "do it yourself" movement.

Motorists who wish to do their own maintenance have therefore been catered for in many ways. The engine, gearbox, and final drive, all use a common lubricant restored when necessary through a single intake orifice. The forward facing distributor and sparking plugs could not be more accessible, there is no difficulty in adjusting the tappets or carburetter should this be required, or in lifting the cylinder head when this becomes necessary.

The rubber springs are naturally quiet and fatigue free, and as they have a measure of self damping the hydraulic shock absorbers are exceptionally lightly loaded and are capable of running very long distances without attention or renewal.

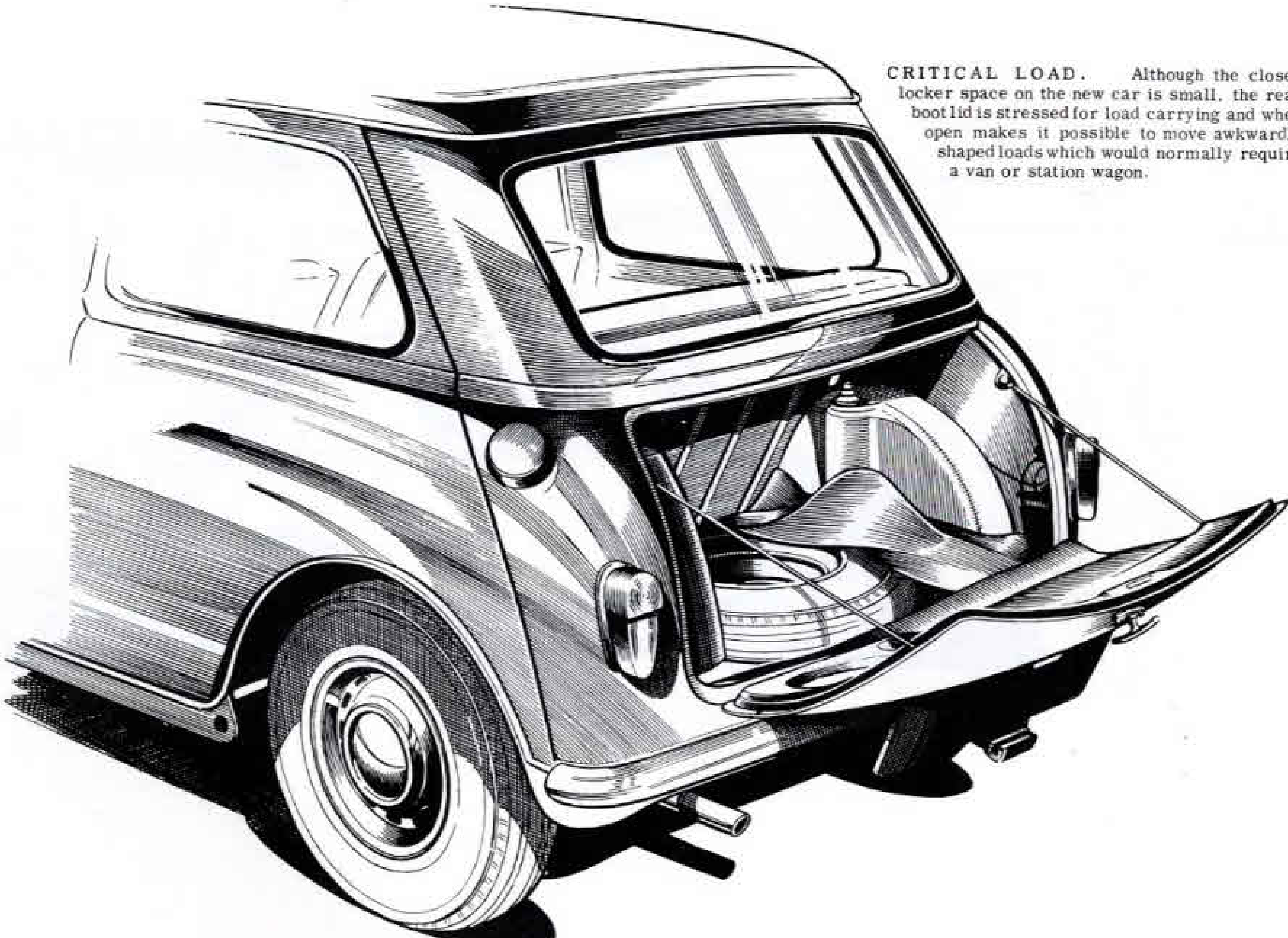
Relatively little routine chassis lubrication is required and there are no oiling points which are difficult of access without a pit or hoist.

This apart the saving in service station costs flowing from the simplicity of the design will, together with the long life of the components stemming from a basic low stress concept, very favourably influence running costs and, by so doing, and in the long run, much reduce depreciation charges which are the biggest single item the owner has to meet.

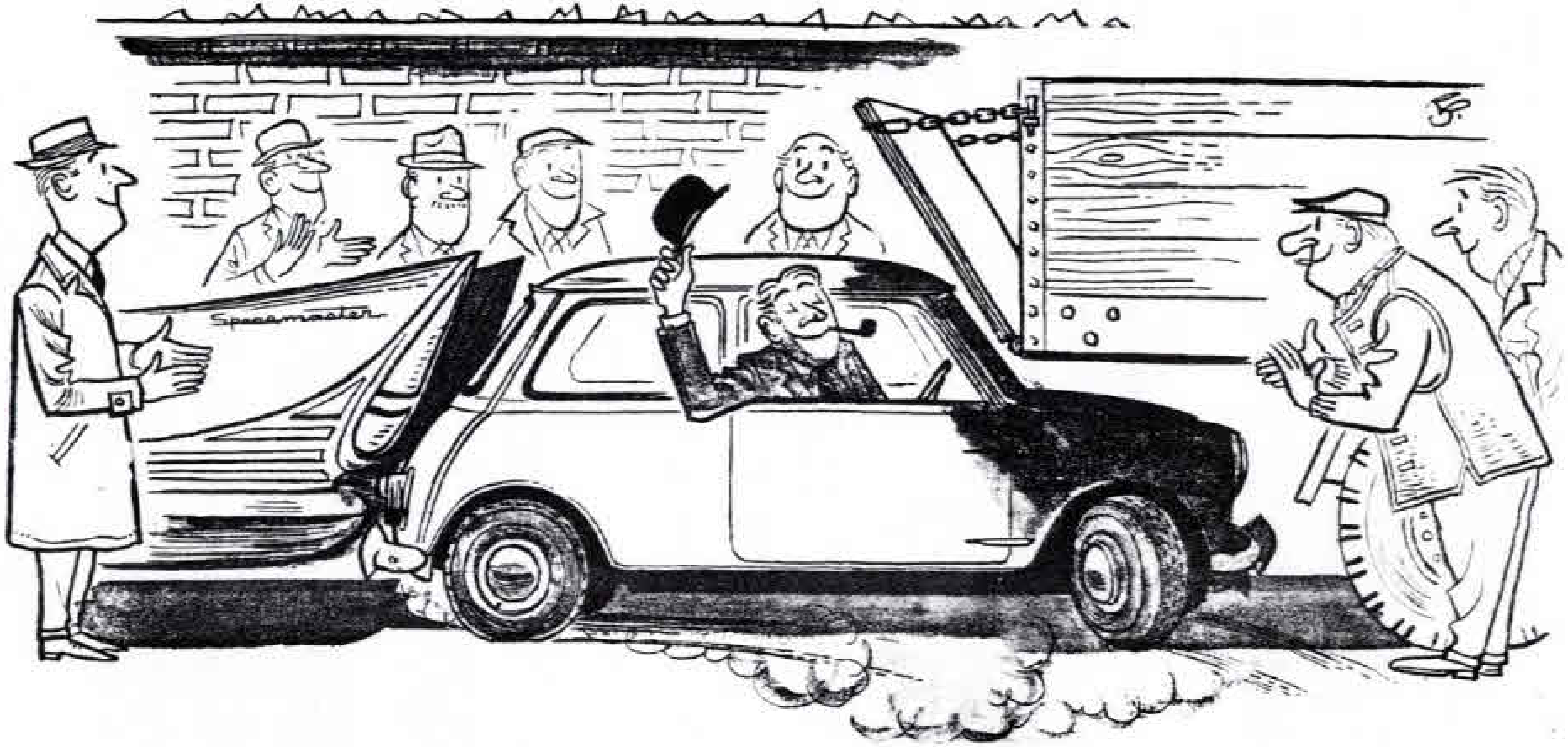


SPACE WITHOUT WASTE. The extremely small overhang wheel lodges of the new car is shown in this drawing, also the exceptional leg room for the rear passengers made possible by placing the whole of the engine and transmission aggregate ahead of the front wheel centre. The wide front door gives exceptional ease of ingress and egress to the rear seat passengers.

"The rod, gun or golfer finds no difficulty in accommodating his equipment no matter how lavish it may be."



CRITICAL LOAD. Although the closed locker space on the new car is small, the rear boot lid is stressed for load carrying and when open makes it possible to move awkwardly shaped loads which would normally require a van or station wagon.



"Will easily fit into a parking space of 12 ft."

The Austin Seven on the Road

Argumentum non sufficit, sed experientia
Roger Bacon, Circa 1260

Reference has already been made to the road performance of the Austin Seven in relation to the average given by the three best selling cars in France, Germany and Italy.

This comparison may usefully be extended by reference to some graphs which bear upon the important points of fuel consumption, top gear hill climbing ability, and acceleration when making best use of the transmission.

All things being equal superiority in any one of these functions is obtained at the sacrifice of another, e.g. low gearing gives good hill climbing ability but poor fuel consumption or vice versa. Alternatively a small engine is good for economy at modest speeds but with mounting internal friction and diminishing volumetric efficiency such engines are poor performers when driven hard.

It is a measure of the technical break through achieved on the Austin Seven that it is better than the best achieved by any one of the three biggest selling cars in France, Germany and Italy in all the three aspects of performance above mentioned.

That is to say it reaches 60 m.p.h. in less time when using the gearbox; it climbs any gradient from 8% (1 in 12) to 3% (1 in 33) considerably faster; and it uses less fuel over a wide band of the speed range!

It is also faster on the flat.

The fact is that this unique design offers performance factors which give favourable comparisons with smaller cars in respect of economy, with larger types in top gear ability and with far more expensive vehicles in terms of sheer acceleration and maximum speed.

Taking 22 small cars which vary in engine size; b.h.p.; weight and price in ratio of 1 : 2 we find they have:

Engine capacity	-	580 cc. up to 1200 cc.
Engine power	-	20 b.h.p. up to 40 b.h.p.
Overall length	-	9' 6" (114") up to 13' 4" (160")
Unladen weight	-	9. 7 cwt. (1090 lb.) up to 17. 5 cwt (1960 lb.)

Tests by the European technical press of these 22 cars show maximum speed between 59 m.p.h. and 76 m.p.h. with an average of 67.5 m.p.h.

The Austin Seven with a maximum 73 m.p.h. thus offers an 8% gain over the average of all British and Continental cars of the same class, and it is 24% faster than the slowest.

In top gear hill climbing the average of all competitive cars is a limiting gradient of 1 in 15 the variation being between 1 in 12 and 1 in 23.

The Austin Seven, with a limiting gradient of 1 in 13, is therefore 17% better than the average, 77% better than the worst.

Making full use of the gears, the average of all rivals requires 20.8 seconds to reach 50 m.p.h. from rest, the variations being between 17 and 32 seconds.

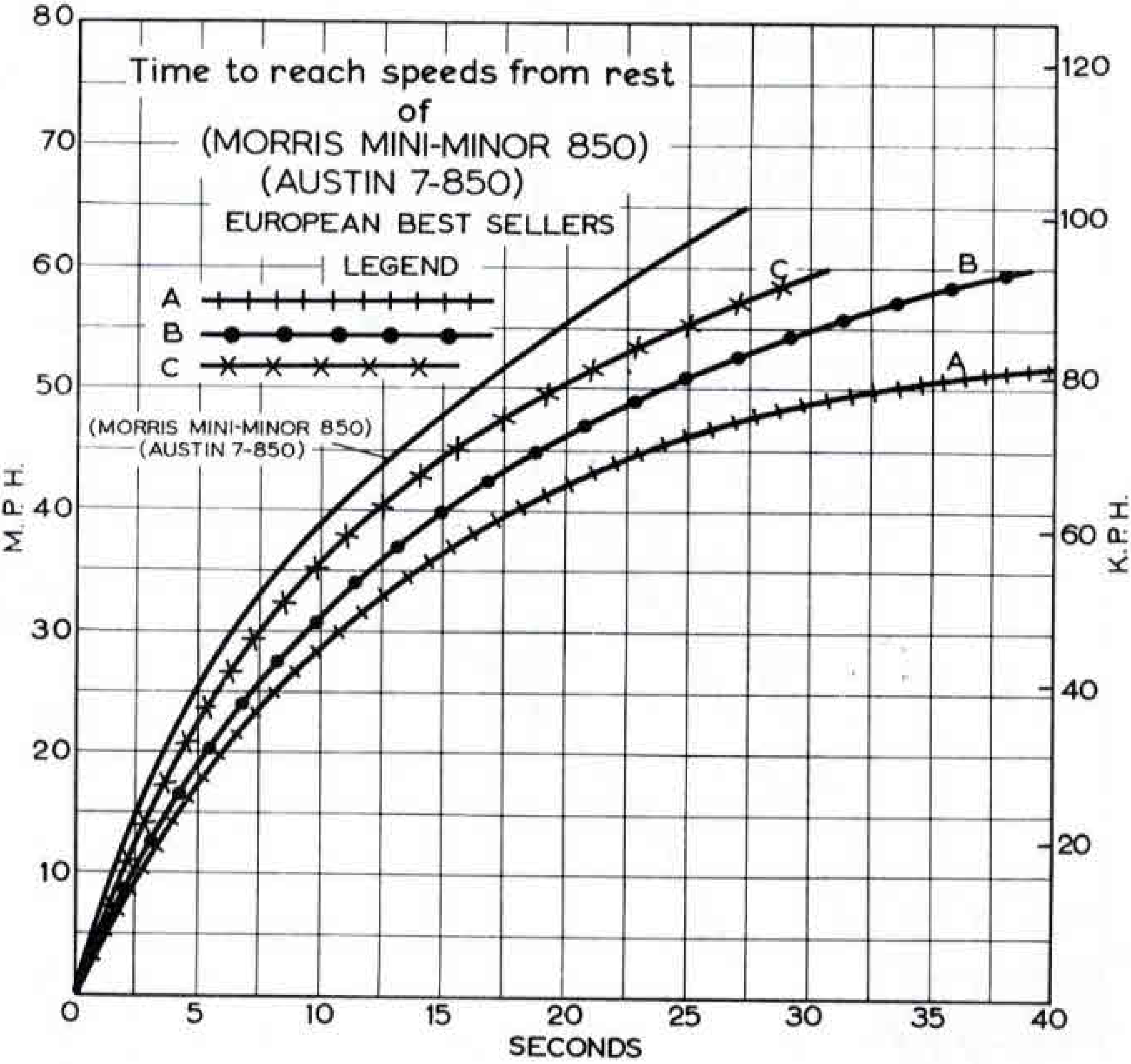
The time of 18 seconds for Austin Seven is 15% better than average and 78% better than the worst. To conclude with fuel consumption we find that the average at 40 m.p.h. is 50 m.p.g. with variations between 40 and 60 m.p.g. With approximately 57 m.p.g. the Austin Seven shows a gain of 15% over the average and of 46% over the worst.

But the fastest car of the 22 is the most expensive and comes 17th in top gear climbing ability; the most economical takes 15th position in respect of 0-50 acceleration time (making full use of the gears) and the best top gear hill climber has the worst fuel consumption of all.

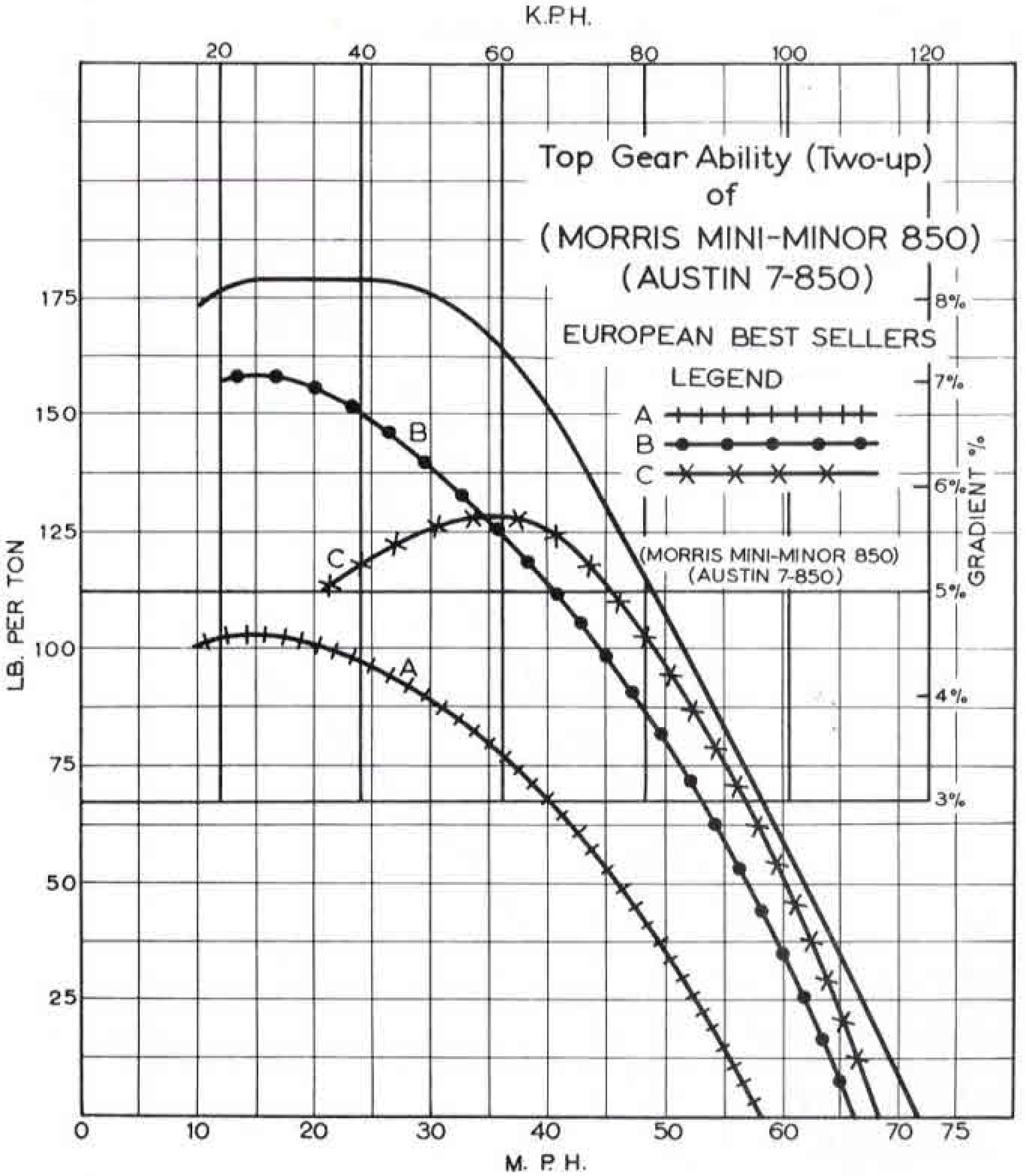
By contrast in the Austin Seven no one characteristic has been over-developed at the sacrifice of another so that it is in the first six in every category above considered.

To the statistical elements which have been set out above must of course be added the excellent quality of the ride, derived from the independent suspension to all wheels with variable rate rubber springs; the first class handling qualities and the exceptional passenger space.

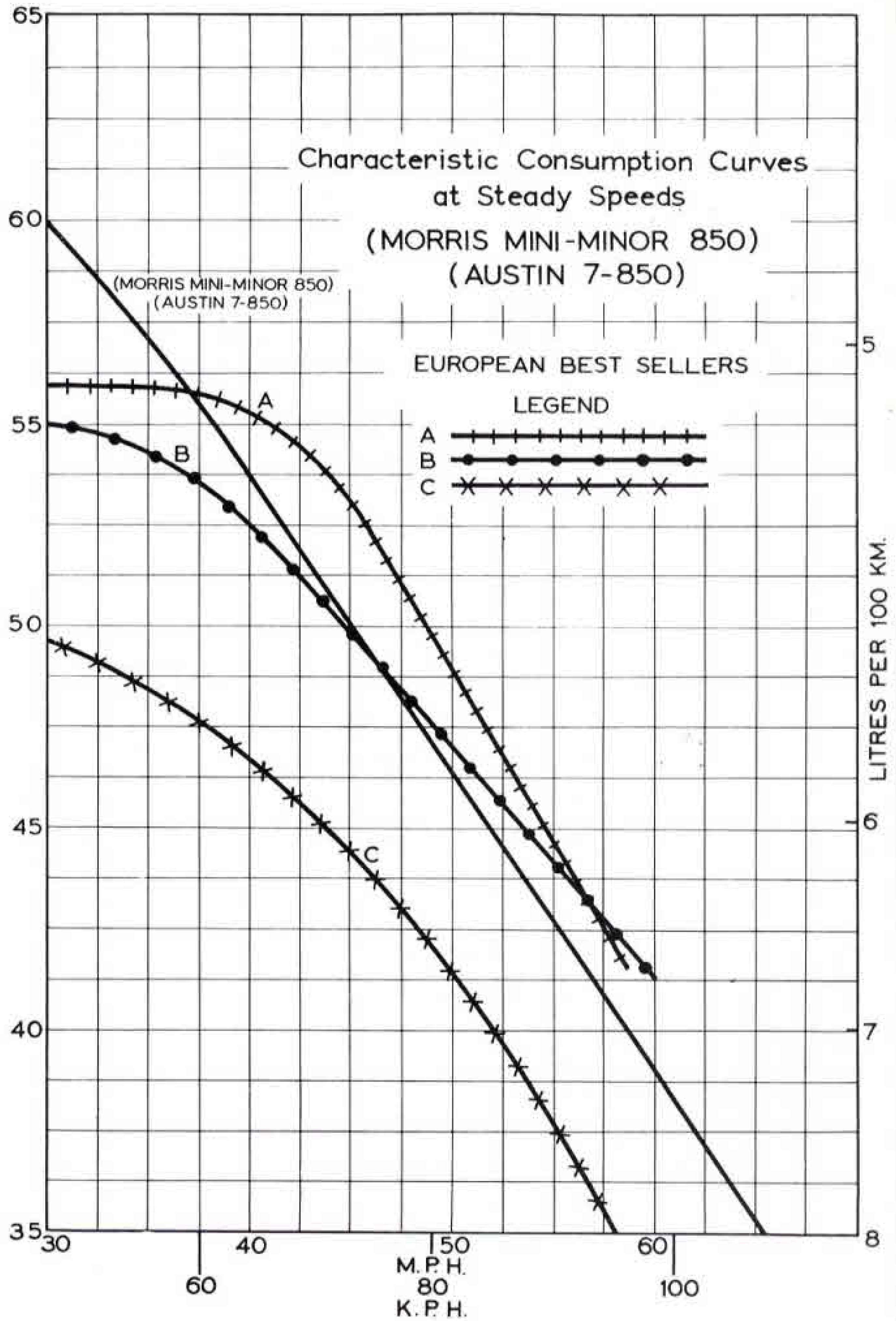
Just over a hundred years ago the American Ralph Waldo Emerson wrote "The logic of Englishmen is a logic that brings salt to soup, oar to boat. Their mind is not dazzled by its own means but locked and bolted to results." The layout of these new models, and their performance on the road, not to mention the immense productive and service facilities which lie behind them, demonstrate that what was observed in 1850 continues true in 1959.



Time to reach speeds from rest
of
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
EUROPEAN BEST SELLERS
LEGEND
A
B
C
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
M.P.H.
K.P.H.
SECONDS
0
5
10
15
20
25
30
35
40
10
20
30
40
50
60
70
80
20
40
60
80
100
120



K.P.H.
20
40
60
80
100
120
Top Gear Ability (Two-up)
of
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
EUROPEAN BEST SELLERS
LEGEND
A
B
C
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
LB. PER TON
175
150
125
100
75
50
25
GRADIENT %
8%
7%
6%
5%
4%
3%
0
10
20
30
40
50
60
70
75
M. P. H.



Characteristic Consumption Curves
at Steady Speeds
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
(MORRIS MINI-MINOR 850)
(AUSTIN 7-850)
EUROPEAN BEST SELLERS
LEGEND
A
B
C
65
60
55
50
45
40
35
30
40
50
60
M.P.H.
60
80
100
K.P.H.
5
6
7
8
LITRES PER 100 KM.

PERFORMANCE DATA

Acceleration Times

Time in Seconds

		Top	3rd	2nd
Speed Range	10 - 30 m.p.h.	12.8	8.1	5.75
	20 - 40 m.p.h.	12.9	8.7	-
	30 - 50 m.p.h.	13.8	10	-
	40 - 60 m.p.h.	17.9	-	-

Through Gears	0.	30 m.p.h.	9.6 Secs
		40 m.p.h.	12.7 Secs
		50 m.p.h.	18.1 Secs
		60 m.p.h.	29 Secs
	Standard ¼ mile		24.5 Secs

Fuel Consumption

At steady	30 m.p.h.	65.8 m.p.g.
	40 m.p.h.	59.9 m.p.g.
	50 m.p.h.	51.8 m.p.g.
	60 m.p.h.	43.7 m.p.g.

Limiting Gradients

1 in 13 (7.7%) on Top Gear

1 in 8 (12.5%) on 3rd Gear

1 in 5.7 (17. 4%) on 2nd Gear

1 in 3.0 (33.3%) on 1st Gear

The Mechanical Construction of the Car

"I had rather see the portrait of a dog I know than all the allegories you can show me"

Dr Samuel Johnson.

The vital statistics of the Austin Seven are set out in tabular form but these Notes may be of value to those interested in the mechanical construction of the vehicle.

The Engine

As before stated the working parts of the engine are in most cases identical to the B.M.C. 'A' series which has been the power unit for the 'A' type Austin since October 1951 and for the Morris Minor since 1954. Designed originally with a bore and stroke of 58 x 76 mm. the engine has since 1956 been built with the dimensions of 62.9 x 76.2 mm. and as fitted to the new models 62.9 x 68.26 mm. giving a capacity of 849 cc.

This short stroke version developes as much power as the larger unit and a slight reduction in torque is offset by the extraordinary light weight of the vehicle.

The 8.3 : 1 compression ratio is one of the highest offered on a small large-scale production unit and makes a useful contribution to the h.p. figures and to the excellent specific fuel consumption on part throttle, which shows up favourably in the road/load figures which are graphically displayed.

Power is transmitted from the end of the crankshaft to a very simple single plate clutch of B.M.C. design which is coupled on the output side to a helical gear of 24 teeth which slides over, and rotates around the input shaft to the clutch.

From this first stage gear the drive is taken to an idle gear (31 teeth) which in turn meshes with a gear of 24 teeth driving the primary gear shaft at engine speed.

As can be seen from the drawing the primary shaft lies directly beneath the crankshaft and is supported by ball bearings in a deep light alloy casing.

As shown in a further drawing (which gives a plan view of the sump-transmission casing) the secondary gears are placed forward of the primary shaft but in the same plane; the entire 4-speed unit being once more similar with that normally used on the 'A' series engine.

The drive from the gear box to the exposed half-shafts is through a pair of spur wheels which are behind, and in the same plane as, the primary gear shaft, a normal differential unit being embodied.

A gallon of oil contained in the sump cum transmission housing serves as a common lubricant for the engine and the transmission but the dry plate clutch is of course isolated, the operation thereof being through a hydraulic unit.

Drive Shaft and Universal Joints

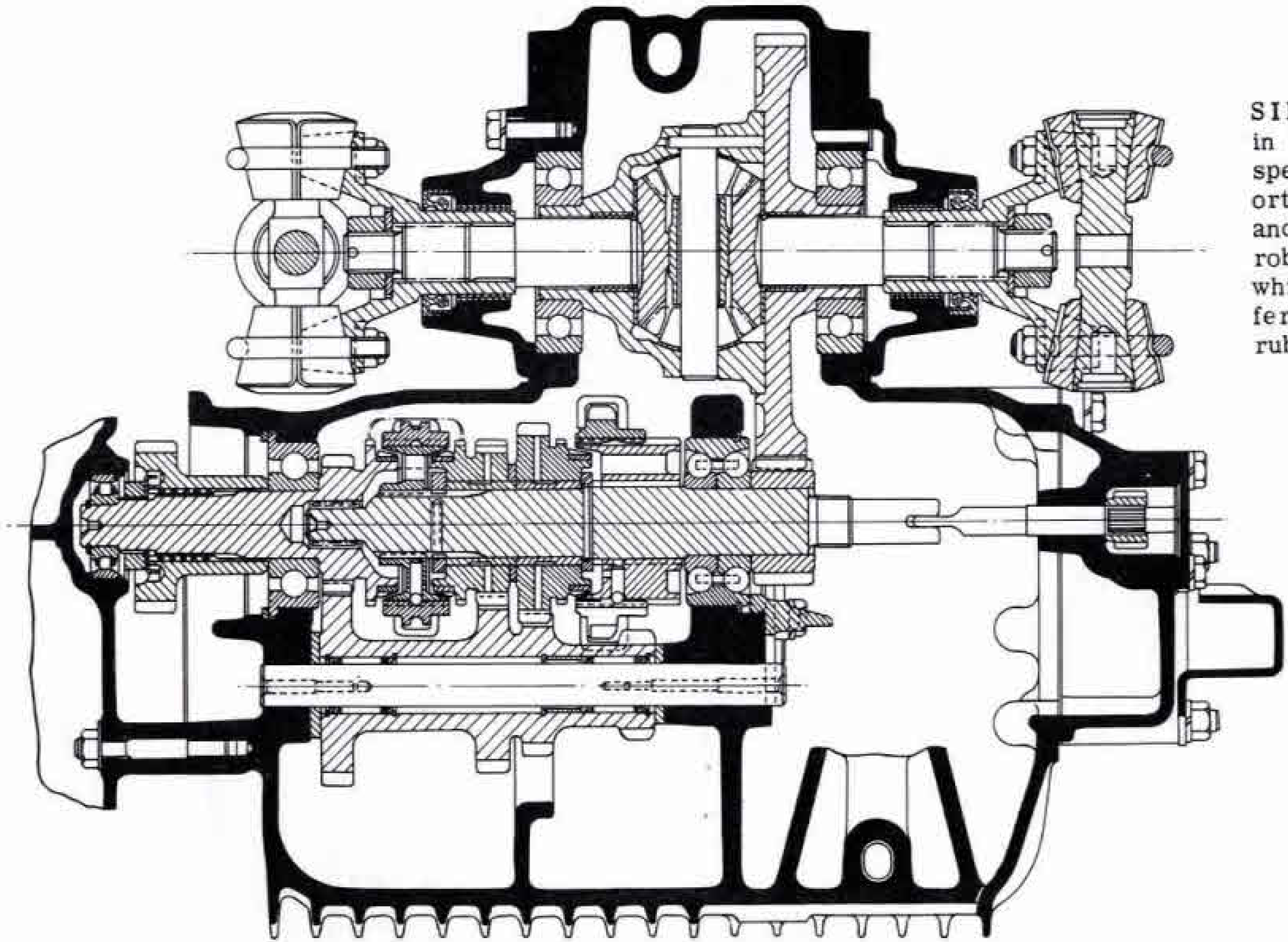
From the final reduction gears the drive is transmitted to Hooke type joints on each side; these however having the important refinement that the pins are located in conically shaped rubber members which are bonded to the driving and driven forks. This simple system provides a degree of elasticity in drive which gives big benefits in smoothness and the fact that the Hooke type joint does not give constant velocity is of small account in view of the fact that the largest angle of working is 14 degs.

Short exposed half shafts carry the drive to the outer constant velocity joints which are of Birfield construction based upon the original Rzeppa design. Used also on the World Land Speed record holder, the Rzeppa joint is a device of the utmost simplicity in which the drive is transmitted through balls running in grooves formed in inner and outer members of semi-spherical forms. The generation of these grooves geometrically and in the machine shop is a highly refined art but the result is a quiet compact drive with immense length of life, which gives uniform angular velocity between the input and output shafts, and provides angular motion up to 40 degs.

The small size of joint enables it to be correctly located in relation to the steering pivots and in no way disturbs the layout of the front suspension linkages.

Front Suspension System

A drawing shows how the front suspension elements are built into the pressing which serves also to locate the engine transmission aggregate and which is bolted to the hull of the vehicle. The drawing makes plain the basic similarity of the front suspension links to the design initiated ten years ago on the Austin Seven and since widely copied throughout the world, including the U.S.A.



SIMPLICITY. Although placed in an unorthodox position, the four speed transmission unit is wholly orthodox in design and construction, and the final drive is by an immensely robust pair of helical gear wheels which, through a conventional differential unit, feed the drive to the rubber insulated universal joints.

In brief there are single forged top and bottom arms of unequal length which give a slight "swing axle" effect by bringing the front roll centre $2\frac{1}{2}$" above ground level. These arms end in ball and sockets joints which pivot a steel forging on each side which embraces the Birfield constant velocity joint and supports the front wheel hub and brake back plate. Nylon is used as a bearing material in these ball joints and gives a very long life without the demand for lubrication.

The arms pivot in pin-type bearings which take cornering loads, braking, driving torque and end location, coming under the control of a diagonal radius arm located forward of the steering links in a rubber bush. In effect there is a composite wide based lower wish bone and a single upper arm.

This upper arm is connected to direct acting orifice-type dampers at the outer end and at the inner end to the patented rubber springs which are separately considered.

Variable Rate Rubber Springs

As a suspension medium rubber has the merit of high load capacity in relation to size and weight, and has a hysterisis characteristic which gives inherent damping of an order which sensibly diminishes the demand on any external hydraulic damping system.

The patented Moulton springs made by Dunlop for the Austin Seven have an additional advantage of offering variable rate suspension without additional moving mechanical elements.

Each of the four wheels is sprung on a rubber element approximately 5.25" dia. and 3.25" deep which forms the centre element of a sandwich between:

1. A conical pressing which is attached to the relevant suspension link.

2. A larger external conical pressing which locates the spring on the vehicle.

In principle, therefore, movement of the suspension link drives a wedge into the rubber and by varying the shape of this wedge the relation between movement and displacement of the rubber can be varied so as to change the rate by more than 2:1 as between the mid point with light impacts and the approach to the full bump position as met on rough roads with a fully laden vehicle.

Each spring weighs about 2.0 lb. of which the metal casing parts weigh .72 lb. and the rubber 1.28 lb.

The characteristic of variable rate together with natural damping qualities of rubber not only relieves the hydraulic dampers but also make possible the successful employment of orifice control.

The conventional damper displays a rapid initial increase in resistance with increasing speed of movement; the resistance curve then markedly flattening out. In other words it tends to be too hard with low speed impacts and too soft in severe conditions. The orifice type damper has the opposite characteristic in the resistance rises on a concave curve with increased speed so that a soft setting can be used for normal ride with a rapid build-up in control in severe circumstances.

Steering Gear

The wheels are turned in their pivots by short swinging arms with a ball joint at each end, connecting directly to a rack moved transversely by a pinion on the end of the steering column. This rack and pinion gear has been simplified in design to the greatest possible extent and with helically-cut teeth has a low reverse mechanical efficiency which absorbs road shocks and prevents them being transmitted to the steering wheel; at the same time the forward efficiency is high giving positive and delicate control.

Front Sub-Frame

All the front mechanical elements are assembled onto a sub-frame consisting of a box section which is bolted on to the forepart of the hull.

Rear Suspension System

Each rear wheel is independently located on a steel fabricated arm which swings around a pivot at 11.75" from the hub centre. Placed beneath the arm is a spherical joint to which is connected a push, pull rod of the same length which works upon the rubber suspension unit in a ratio of 5.0:1; e.g. a vertical movement of 1" on the wheel gives a horizontal movement of 0.2" on the rubber suspension element.

The trailing arms are also connected to Armstrong direct acting telescopic dampers and as at the front so at the back these are very lightly loaded, and of orifice control pattern, the reasons being set out when describing the front suspension system.

Each wheel rises and falls vertically with no change in angle relative to the longitudinal axis of the vehicle and in consequence wheel movement on rough roads imparts no rear steering effects to the vehicle, nor is there any sideways shake transmitted to the structure in general, and the rear seat passengers in particular.

This purely vertical movement puts the rear roll centre at ground level and the roll angle of the wheels when cornering is equal to that of the car and in the same sense. However roll is small owing to the low centre of gravity and to the increasing rate of the suspension system mentioned above.

Correct alignment of the rear wheels, a matter of vital importance, is dependent not only upon the stiffness of the linkages but also upon carefully designed mounting points which will be free from wear over big mileages as even a small amount of play seriously effects the steering of the car.

As can be seen from the drawing the arm swings on a base of $8\frac{1}{4}$" between two plain bushes which are served by a large reservoir of lubricant that gives an insurance against neglect in maintenance. As at the front, so at the back, the suspension elements are initially assembled onto a rectangular box section sub-frame to which the main part of the vehicle is subsequently bolted.

The Hull

Constructed as a one-piece stress bearing unit the hull is noted for the employment of relatively few, and correspondingly unusually large, main pressings; the general construction being facilitated by the simplification following from the use of front wheel drive and the absence of a transmission tunnel.

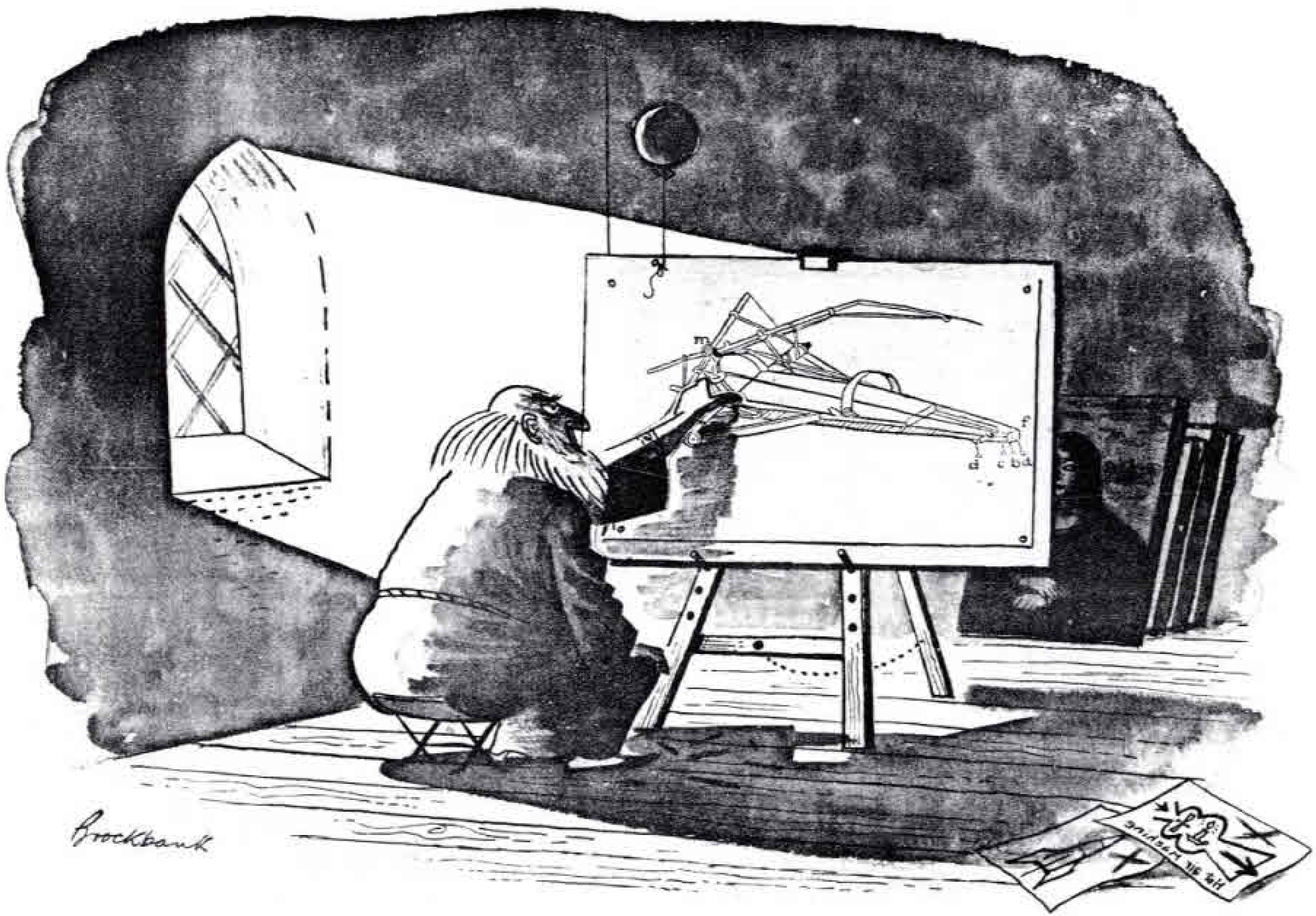
Wheels 10" Diameter

The small wheels have been selected so as to maintain harmonious proportions between the wheels, the wheel arches and the car, to minimise unsprung weight and to improve steering lock. The Dunlop Company have produced special tyres for mounting on these rims which have given wholly satisfactory wear figures.

Braking

The Lockheed braking system includes a "stop down" valve which cuts off the rear brake shoes from the main hydraulic line when the driver applies more than 40 lb. to the pedal. At higher pressures all the additional load is applied to the front brakes. Despite the small diameter of the wheels there is 106 sq.in. of friction area/unladen ton and there is 97 sq.in. in the two-up laden condition.

"Braking effort effectively distributed between the front and rear wheels."



"Exemplifies the simplicity of construction so ardently advocated by Leonardo da Vinci."

CODA

It is hoped that this exposé of the principles which have animated the design of Austin Seven models will justify the application of Lord Nelson's dictum "it was new; it was singular; it was simple", and also show that they meet the requirements laid down by Leonardo da Vinci "when you wish to produce a result by means of an instrument do not allow yourself to complicate it by introducing many subsidiary parts but follow the briefest way possible."

SECTION A: SUMMARY OF PRINCIPAL CHARACTERISTICS

VEHICLE

A two door, 4 seater, saloon with 848 c.c. transverse front engine, front drive, with all independent variable rate rubber springs and separate underbody suspension frame.

	GENERAL DIMENSIONS	ENGLISH	METRIC
1	Overall Length	10 ft. (120 in.)	3.03 m.
2	Overall Width	4 ft. 7 in. (55 in.)	1.39 m.
3	Height (unladen)	4 ft. 5 in. (53 in.)	1.35 m.
4	Frontal Area	15.4 sq. ft.	1.43 sq. m.
5	Wheelbase	6 ft. 8 in. (80 in.)	2.03 m.
6	Front Track	3 ft. $11\frac{3}{4}$ in. ($47\frac{3}{4}$ in.)	1.21 m.
7	Rear Track	3 ft. $9\frac{7}{8}$ in. ($45\frac{7}{8}$ in.)	1.14 m.
8	Turning Circle	29 ft. 6 in.	8.85 m.
9	Weight (kerb) unladen plus 2 galls. petrol	11 cwt. 1 qr. (1260 lb.) (Basic)	575 kg.
10	Kerb weight on front wheels %	60	
11	Front Seat Width	1 ft. 8 in. x 2 (20 in.)	0.51 x 2
12	Rear Seat Width	4 ft. 1 in. (49 in.)	1.24 m.
13	Luggage Locker Volume	$5\frac{1}{2}$ cu. ft.	0.155 cu. m.
	ENGINE		
14	No. of cylinders and dimensions	4 x 2.478 in. x 2.687 in.	4 x 62.9 x 68.26 mm.
15	Cylinder capacity	51. 74 cu. in.	848 c. c.
16	Compression ratio	8. 3:1	
17	Output	B.H.P. 37 gross B.H.P. 34 nett	
18	Specific Output	0.715 H.P./cu. in.	43.5 H.P./litre
19	At (a) Crankshaft Speed	5,500 R.P.M.	
	(b) Piston Speed	2,460 ft./min.	13.35 m./sec.
20	Max. BMEP	128 lb./sq. in.	9.0 kg./sq. cm.
	Max. Torque	44 lb. ft.	6.1 kg. ms.
21	At Crankshaft Speed.	2,900 R. P. M.	

SECTION A: SUMMARY OF PRINCIPAL CHARACTERISTICS

TRANSMISSION		
22 Clutch	Single dry plate $7^1/_8$ in. Hydraulic operation	18.1 cm.
23 Automatic engagement or alternative	No	
24 No. of forward speeds	4 (3 synchronised)	
25 Position of gear lever	Central on floor	
26 Final Drive	To front wheels through helical spur gears, universal joints and open shafts. Drive casing in unit with engine and gearbox includes final drive.	
27 Suspension: Front	IFS with Levers of unequal length. Swivel Axle Mounted on ball Joints. Rubber springs & Telescopic Shock Absorbers mounted above Top Lever. Top Levers roller Bearing & Lower Rubber mounted at Inner ends. Fore & Aft Location by Rubber Mounted Tie Rod.	
Rear	IRS with Trailing Tubular Levers with Rubber Springs and Telescopic Shock Absorbers. Levers carry stub shaft for Hubs which have Twin Dual Purpose Bearings.	
BRAKES		
28 Type	4 Wheel Hydraulic, Pendant Pedal. Leading & Trailing Shoes all round. Rear brakes have a Pressure limiting valve.	
29 Friction lining area	67.5 sq. in.	435.4 sq. cm.
STEERING		
30 Type of steering box	Rack and Pinion	
31 Layout of Linkage	Equal length Tie Rod direct from end of Rack to Steering Levers	
TYRES		
32 Make, Type and Size	Dunlop, Tubeless, 5.20 x 10	
FUEL		
33 Tank Capacity	$5\frac{1}{2}$ gallons	25 litres
34 Type of Pump	S.U. Electric. Type P.D.	

SECTION B: COMPONENT DETAILS AND DIMENSIONS

ENGINE DIMENSIONS	ENGLISH	METRIC
35 No. and Disposition of Cylinders	4 in line	
36 Bore	2.478 in.	62.9 mm.
37 Stroke	2.687 in.	68.26 mm.
38 S : B Ratio		
39 Capacity	51.74 cu. in.	848 c.c.
40 Piston Area	19.3 sq. in.	124.6 sq.cm.
41 Compression Ratio	8.3 : 1	
42 Weight, Ready for installation with fan, radiator, gearbox & final drive, clutch and electrics (dry)	308 lb. (approx.)	140 kg.

ENGINE PERFORMANCE		
43 Max. Power	37 B.H.P.	
44 At Crankshaft Speed	5,500 R.P.M.	36.4 C.V.
45 Piston Speed	2,460 ft./min.	13.35 m./sec.
46 Max. BMEP	128 lb./sq. in.	13.35 m./sec.
47 Max. Torque	44 lb./ft.	9.0 kg./sq. cm.
48 At Crankshaft Speed	2,900 R.P.M.	6.1 kg./m.
49 Output per sq. in. (sq. cm.) of piston area (see also Item 18)	1.92 H.P./sq. in. Gross	0.305 C.V./sq. cm.
50 Power Weight Ratio (Engine, Gearbox & Final Drive)	8.38 lb./H.P.	3.74 kg./C.V.

ENGINE CONSTRUCTION		
51 Material of Main Block	Cast Iron: No cylinder liners	
52 Material of Crankshaft	Forged Steel: No damper	
53 No. and type of Main Bearings	3 Shell Type	
54 Size of Main Bearings	Front 1.7505 Dia. x 1.367 in. Centre 1.7505 Dia. x 1.379 in. Rear 1.7505 Dia. x 1.393 in.	44.46 x 34.72 mm. 44.46 x 35.02 mm. 44.46 x 35.38 mm.
55 Type of big end	Shell	
56 Size of big end	1.6254 Dia. x 1.00 in.	47.65 x 25. 4 mm.
57 Type of Piston and Ring No.	Split Skirt; 3 compression and oil ring	
58 Camshaft Drive	Chain with tensioner	
59 Camshaft Bearings	3	

SECTION B: COMPONENT DETAILS AND DIMENSIONS

ENGINE CONSTRUCTION - CONTD	ENGLISH	METRIC
60 Valve Mechanism	By Tappets, Pushrods and Rockers, O.H. Valves Vertical in Cylinder Head	
61 Head Dia. of Inlet Valve	1.093 in.	27.76 mm.
62 Head Dia. of Exhaust Valve	1.00 in.	25.4 mm.
63 Valve diagram	See Maintenance, SECTION D	
64 No. of Valve Ports	2 Inlet; 3 Exhaust	
65 Cylinder Head Material	Cast Iron	
66 Sump Material	Magnesium Electron	
67 Oil Pump, Type and Make	Eccentric Vane	
68 Normal Oil Pressure	40 to 60 lb./sq. in.	2.81 to 4.22 kg./sq. cm.
69 Water Pump	Centrifugal on face of cylinder block	
70 Pusher Fan, Drive and Speed	Home 4 blade, Export 6 blade. Driven by belt at 1.2 x engine speed	
ENGINE ACCESSORIES		
71 Air Filter Make and Type	Coopers Paper Element - Home and Export	
72 Carburetter Make and Type	S.U. Type HS2	
73 Distributor Make and Type	Lucas Type D.M.2	
74 Coil Make and Type	Lucas Type L.A.12	
75 Sparking Plugs Make and Type	Champion Type N5	
76 Oil Filter Make and Type	Purolator Full Flow	
77 Thermostat Make and Type	Smiths Bellows Type	
TRANSMISSION SYSTEM		
78 Alternatives to Standard	None	
79 Clutch Make and Type	B.M.C. Single Dry Plate Hydraulically Operated	
80 Clutch Dia.	See Item 22	
81 Clutch Housing Material	Aluminium Alloy	
82 Gearbox Sump Material	Magnesium Electron	
83 Gear Shaft extension cover	None	
84 Gear Shaft Bearings	Ball and rollers	

SECTION B: COMPONENT DETAILS AND DIMENSIONS

TRANSMISSION SYSTEM - CONTD	ENGLISH	METRIC
85 Location of gear lever	Central, through floor	
86 Synchromesh	On 3 upper forward ratios	
87 No. of forward speeds	4	
88 Internal gear ratios	1.0; 1.412; 2.172; 3.628; and Reverse 3.628	
89 Overall Ratios	3.765; 5.316; 8.177; 13.658; Reverse 13.658	
90 Weight of clutch housing, gear-box with extension and rear mounting (dry)	Integral with engine	
91 Drive Shaft Make and Type	Birfield with Rzeppa C.V. Outer Joint	
92 Universal Joints (Inner)	B.M.C. Patented Resilient Coupling	
93 Final Drive	To Front Wheels via Helical Spur Gears, Universal Joints and open Shafts. Drive Casing in Unit with Engine and Gearbox	
94 Pinion Offset	Not Applicable	
95 Final Reduction	17/64 or 3.76 : 1	
96 Rear Suspension	Independent, non driving	
97 Rear Suspension Unit, including Drums and Shoes (less wheels)	$21\frac{1}{2}$ lb. per side	

FRONT SUSPENSION		
98 Material of Upper Wishbone	Steel Forging	
99 Distance between Pivots (Radius)	7 in.	
100 Outboard Pivot	Ball end	
101 Material of Lower Wishbone	Steel Forging	
102 Distance between Pivots (Radius)	$10^1/_8$ in.	28.7 cm.
103 Outboard Pivot	Ball pin	
104 Inboard Bearings upper	Needle Rollers	
105 Inboard Bearings Lower	Rubber bushes	
106 Dampers	Telescopic(orifice control) double acting front & rear	
107 Springs	Patented Rubber Cone Units	
108 Spring Rate at Wheel	Variable	
109 Height of Front Roll Centre from ground	$2\frac{1}{2}$ in. approx.	6.4 cm.

SECTION B: COMPONENT DETAILS AND DIMENSIONS

REAR SUSPENSION	ENGLISH	METRIC
110 Type of Spring	Rubber Patented Design (See Item 27)	
111 No. of Leaves	None	
112 Width of Leaves	Not applicable	
113 Length of Main Leaf	Not applicable	
114 Type of Front Pivot	Not applicable	
115 Type of Rear Shackle	Not applicable	
116 Make and Type of Damper	Telescopic (orifice type)	
117 Rate at Wheel	Variable	
ANTI-ROLL BARS, ETC.		
118 Front	None	
119 Rear	None	
120 Rear hub end & side location	By trailing arms	
121 Rear Roll Centre	On ground	
STEERING GEAR		
122 Make and Type of Box	Rack and Pinion	
123 Internal Ratio	Not applicable	
124 Turns lock to lock	$2^1/_3$	
125 Steering Response at 5 M.P.H. (8 K.P.H.)	Not available	
126 Track Rod System	See Item 31	
127 Number of Link Joints	2 at Rack - 2 at Steering Levers	
128 Dia. of Steering Wheel	$15\frac{3}{4}$ in.	
129 Rim Thickness	$^{27}/_{32}$ in.	2.14 cm.
130 Number of Spokes	2	
BRAKES		
131 Make and Type	Lockheed Hydraulic single leading shoes, with cables to rear shoes from pull up hand-brake	
132 Servo Assistance	Nil.	
133 Shoe System, front	1 leading 1 trailing	
134 Shoe System, rear	1 leading 1 trailing	

BRAKES - CONTD	ENGLISH	METRIC
135 Brake Drum Material	Cast Iron (No insert)	
136 Brake Drum Dia. and Shoe Width, front	7 in. x $1\frac{1}{4}$ in.	17.8 x 3.18 cm.
137 Brake Drum Dia. and Shoe Width, rear	7 in. x $1\frac{1}{4}$ in.	17.8 x 3.18 cm.
138 Friction Lining Area	See Item 29	
WHEELS AND TYRES		
139 Type of Wheel	Pressed Steel 10 in. x 3.5 in. 4 stud fixing (rimbellishers on de luxe)	
140 Make of Tyre	Dunlop Tubeless	
141 Tyre Section	5.20 x 10 in.	
142 Revolutions	1073 per mile	666 per km.
143 Spare Wheel Location	On boot floor	
FUEL SYSTEM		
144 Position of Tank	At side of Boot on left hand side	
145 Location of Filler Cap	On left hand side of Tail	
146 Tank Capacity	$5\frac{1}{2}$ imp. galls.	25 litres
147 Make and Type of Fuel Pump	S.U. Type P.D.	
148 Location of Fuel Pump	Below Petrol Tank	
ELECTRICS		
149 Make, Type and Location of Battery	Lucas GLTW7A. Beneath Boot Floor with Cover. Positive Earth	
150 Battery Capacity	SLTW7A (34 Amp. Hr. at 20 Hr. Rating)	
151 Make and Type of Dynamo	Lucas Type C40	
152 Make and Type of Starter	Lucas Type M.35.G/1	
153 Make and Type of Voltage Control	Lucas Type RB.106/2	
154 Number of Fuses	2 + 2 spare (35 amp.)	
155 External Lighting:		
(a) Headlamps	2 Lucas Type F.700	
(b) Parking Lights	2 Lucas Type (combined with headlamps with separate bulbs)	

ELECTRICS - CONTD	ENGLISH	METRIC
(c) Tail Lights))- (d) Stop Lights)	In unit with Rear Flasher and Reflector	
(e) Reverse Light	None	
(f) Rear Flashers	2 in unit with Stop/Tail	
(g) Front Flashers	2 in front wings	
(h) Rear Number Plate	1 (on swinging plate)	
(i) Fog, Pass, etc.	None	
156 Switches for above:		
(a) Head, Park and Tail	3 position Tumbler Type on Switch Panel	
(b) Starter and Ignition	Directly Operated Push Switch in Floor (Starter) in Switch Panel (Ignition)	
(c) Fog, Pass, etc.	None	
(d) Direction Indicators	Arm on Steering Column, Self cancelling	
157 Interior Lights and Switches, also Windscreen Wipers and Heater Unit	See Body (Equipment), SECTION C.	

SECTION C: BODY CONSTRUCTION AND DETAILS

	ENGLISH	METRIC
158 Chassis Frame	Detachable Sub Frames at Front and Rear	
159 Body Type	2 Door Saloon	
160 Alternatives	None	
161 System of Body Construction	Spot Welded Unit Construction	
162 Torsional Stiffness (over wheelbase)	6500 lb. ft./degree	900 kg. metre/degree
163 Weight of Bare Hull	310 lb.	141 kg.
164 Interior Dimensions	See Body Drawings	
165 Windscreen Wipers	Twin Blade Lucas Electric with Switch on Instrument Panel	
166 Windscreen Washers	On de luxe, optional extra on standard	
167 Sun Visors	Twin on de luxe, single on basic	
168 Instruments	Speedo with Mileage Recorder, incorporates Petrol Gauge, Oil Pressure Warning Light, Ignition Light and High Beam Indicator Light	
169 Panel Light	In combined Instrument	
170 Warning Lights	Oil Pressure, Ignition, Headlamp Beam, Flasher	
171 Locks: with ignition key	Doors	
with other keys	Boot	
172 Glove Lockers	None	
173 Map and parcel Pockets	Along lower edges of Front Doors and at ends of Rear Seat	
174 Parcel Shelves	1 under Facia, 1 behind Rear Squab. Stowage space below Rear Seat	
175 Ashtrays	1 front (Standard) 1 each side of Rear Seat (de luxe)	
176 Cigar Lighters	None	
177 Interior Lights	1 standard 3 de luxe	
(a) Position	In Instrument Cover (standard) + 1 each side of Rear Seat (de luxe)	
(b) Courtesy Switches	None	
178 Interior Heater	Optional Extra	
(a) Standard Make	Smiths (Recirculatory)	

SECTION C: BODY CONSTRUCTION AND DETAILS

	ENGLISH	METRIC
(b) Equivalent Output	Not applicable	
(c) Air Intake	Recirculatory	
179 Car Radio	Optional Extra	
(a) Make and Type	Smiths Radiomobile	
(b) Speaker Position	In rear Parcel Shelf	
180 Upholstery Material	Cloth standard. Leather Cloth de luxe.	
181 Floor Covering	Rubber and U/Felt standard. Carpet and U/Felt de luxe.	
182 Exterior Colours Standardised	3 Monotones.	
183 Starting Handle	None	
184 Jack	See Tool Kit	
185 Jacking Points	Centre of each Sill	
186 Standard Tool Kit	Side Lifting Jack, Ignition Gauge and Screwdriver, Tyre Valve Tool, Tyre Pump, Box Spanner for Sparking Plug, Sparking Plug and Tappet Clearance Gauge Complete, Tommy Bar, Grease Gun Complete, Brake Shoe Adjustment Spanner, Wheel Nut Brace and Jack Handle, Toolbag, Handbook.	

SECTION D: MAINTENANCE

		ENGLISH	METRIC
187	Sump	8 pints + 1 pint if filter is changed Tropical and temperate down to 32°F (10°C) S.A.E. 30 Extreme cold down to 10°F (—12°C) S.A.E. 20.W Arctic consistently below 10°F (—12°C) S.A.E. 10.W	4.54 litres + 0.52 litres if filter is changed
188	Gearbox	Combined in Sump—S.A.E. 30	
189	Final Drive	Combined in Sump	
190	Steering Gear Lubricant	Hypoid 90	
191	Cooling System Capacity (without heater)	$5\frac{1}{4}$ pints 2 Drain Taps (add 1 pint for heater)	3 litres
192	Chassis Lubrication	By Grease Gun every 1,000 miles to 10 points	10 points at 1,600 Km.
193	Ignition Timing	T.D.C.	
194	Contact-breaker Gap	0.014 in. -0.016 in.	0.356 mm. -0.406 mm.
195	Sparking Plug Type	Champion Type N.5	
196	Sparking Plug Gap	0.024 in-0.026 in.	0.610 mm. -0.660 mm.
197	Valve Timing	Inlet Opens 5°B.T.D.C. Inlet Closes 45° A.B.D.C. Exhaust Opens 40°B.B.D.C. Exhaust Closes 10° A.T.D.C.	
198	Tappet Clearances (Hot or cold)	0.012 in.	0.381 mm.
199	Front Wheel Toe, out	1/8 in. Nominal	3.175 mm.
200	Camber Angle	1° Nominal (At normal laden height)	
201	Castor Angle	$1\frac{1}{2}$° (At normal laden height)	
202	Steering Swivel Pin Inclination	$9\frac{1}{2}$°(At normal laden height)	
203	Tyre Pressures	Front 24 lb./sq.in. Rear 22 lb./sq.in.	1.62 kgs./sq.cm. 1.76 kgs./sq.cm.
204	Brake Fluid	Lockheed S.A.E. Spec. 70-R-1	

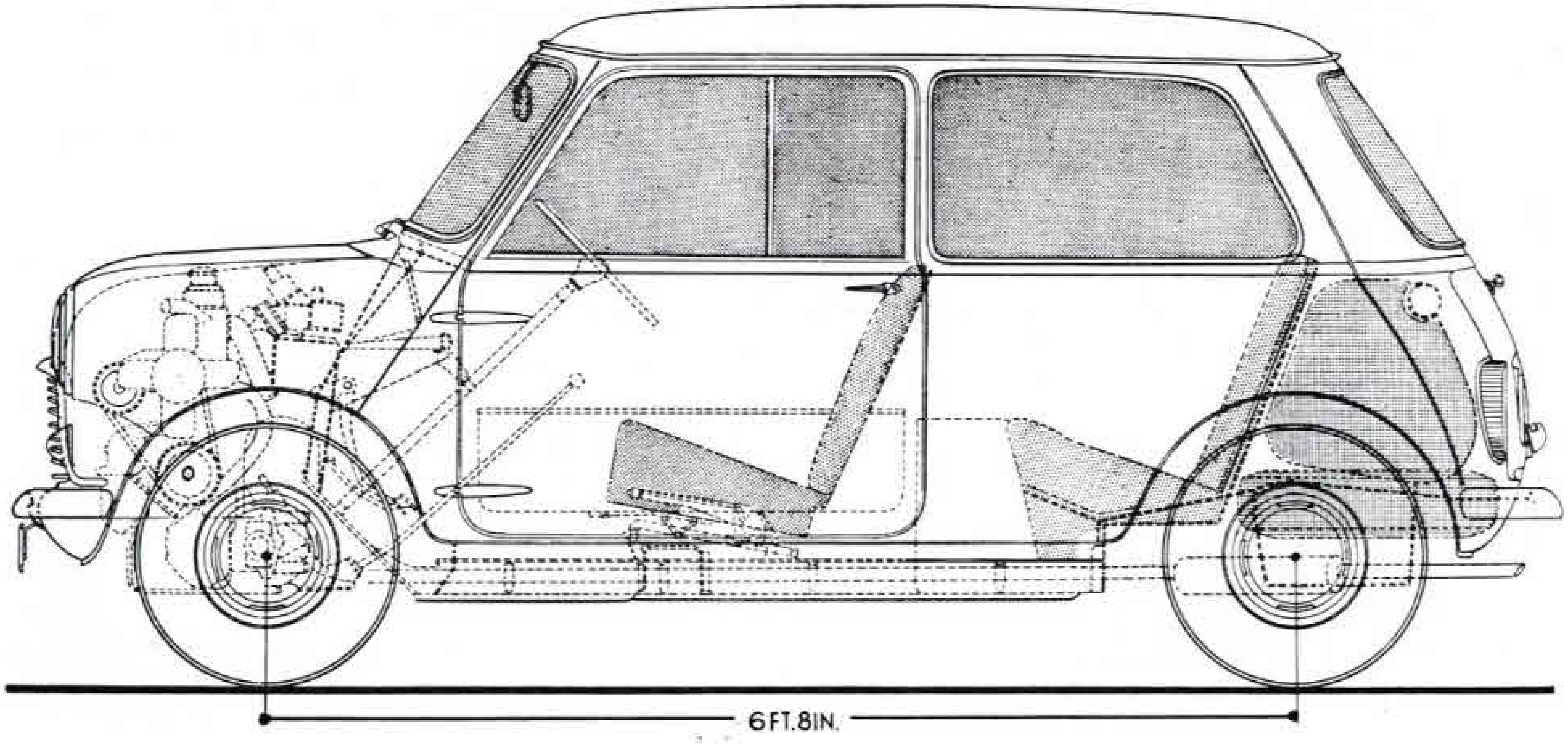
SECTION E: PERFORMANCE FACTORS*

	ENGLISH	METRIC
205 Power per unladen weight:-		
(a) Long Ton	65.7 B.H.P. (Gross)	25.8 C.V./Kg.
(b) Short Ton	58.7 B.H.P. (Gross)	
206 Top Gear Engine Displacement		
(a) Litres/Long Ton/Mile	3,050	
(b) Litres 1000 Kg./Km.		1880
(c) Cu.in. per Short Ton/Mile	168,000	
207 Capacity: Weight		
(a) Litres/Long Ton	1.52	
(b) Litres/1000 Kg.		1.48
(c) Cu.in./Short Ton	101	
208 B.H.P.: Frontal Area (15.4 sq.ft.)	2.4 per sq.ft. (Gross)	25.2 C.V./sq. m. H.C. (Gross)
209 Total Drag at 60 M.P.H.	Not Available	
Total Drag at 97 K.P.H.		Not Available
210 Engine Revolutions in Top Gear	4,040 per mile	2520 per km.
211 Road Speeds at 1,000 R.P.M.		
Top	14.85 M.P.H.	23.8 K.P.H.
3rd	10.52 M.P.H.	17 K.P.H.
2nd	6.9 M.P.H.	10.2 K.P.H.
1st	4.1 M.P.H.	6.6 K.P.H.
212 Road Speeds at Max Torque (2.900 R.P.M.)		
Top	43.1 M.P.H.	69.2 K.P.H.
3rd	30.5 M.P.H.	49.2 K.P.H.
2nd	20 M.P.H.	32.2 K.P.H.
1st	10.9 M.P.H.	17.6 K.P.H.

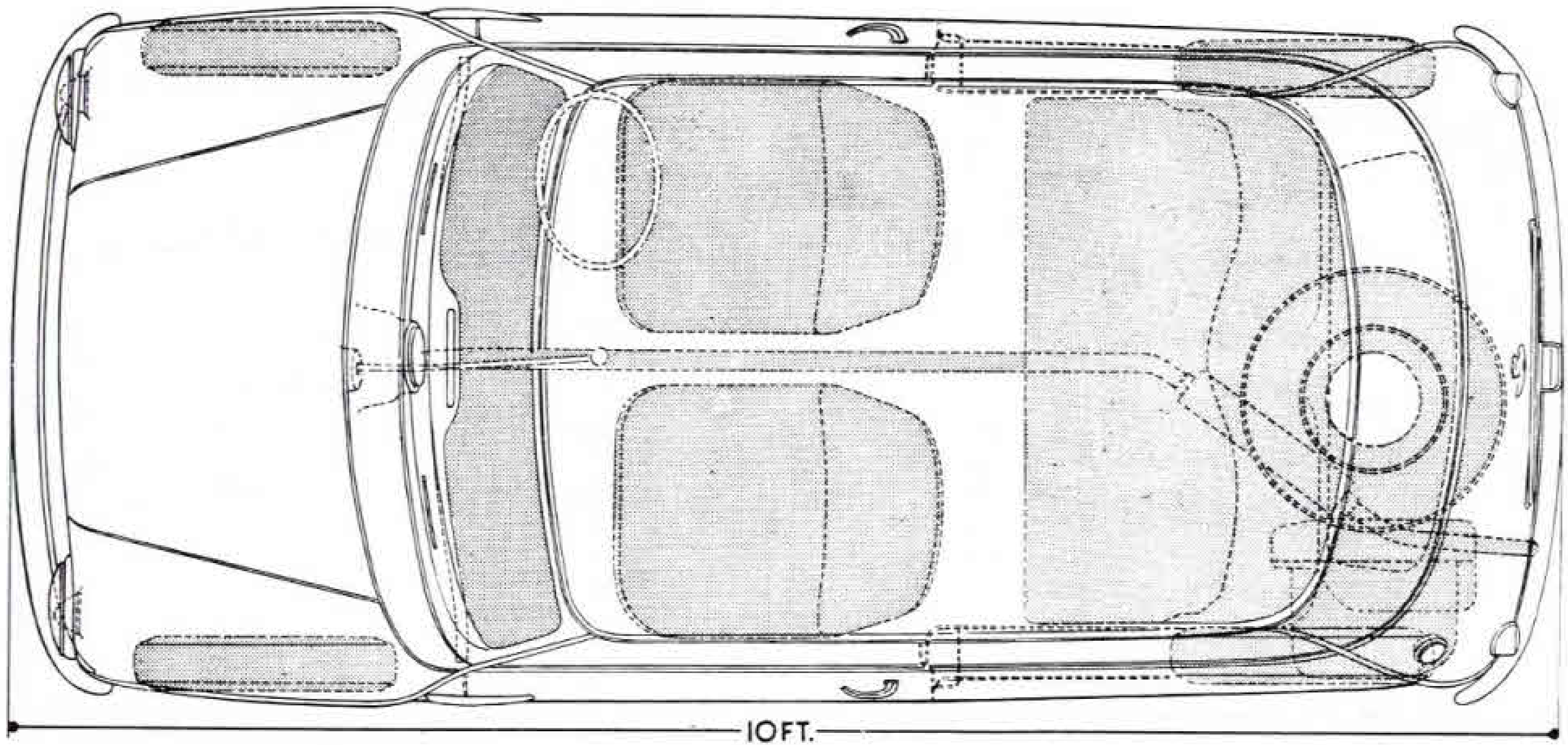
SECTION E: PERFORMANCE FACTORS*

	ENGLISH	METRIC
213 Road Speeds at Max. Power (5,500 R.P.M.)		
Top	81.7 M.P.H.	131.8 K.P.H.
3rd	58 M.P.H.	93.4 K.P.H.
2nd	38 M.P.H.	61.2 K.P.H.
1st	22.5 M.P.H.	36.2 K.P.H.
214 Road Speed at 1,000 ft./min. Piston Speed	33.1 M.P.H.	53.3 K.P.H.
215 Road Speed at 5 m./sec. Piston Speed		52.2 K.P.H.
216 Piston Area: Weight	34.4 sq.in. per Long Ton 30.6 sq.in. per Short Ton	219 sq.cm. per 1000 kg.
217 Friction Area: Weight		
(a) sq.in. Long Ton	120	
(b) sq.in. Short Ton	107	760 sq. cm. per 1000 kg.

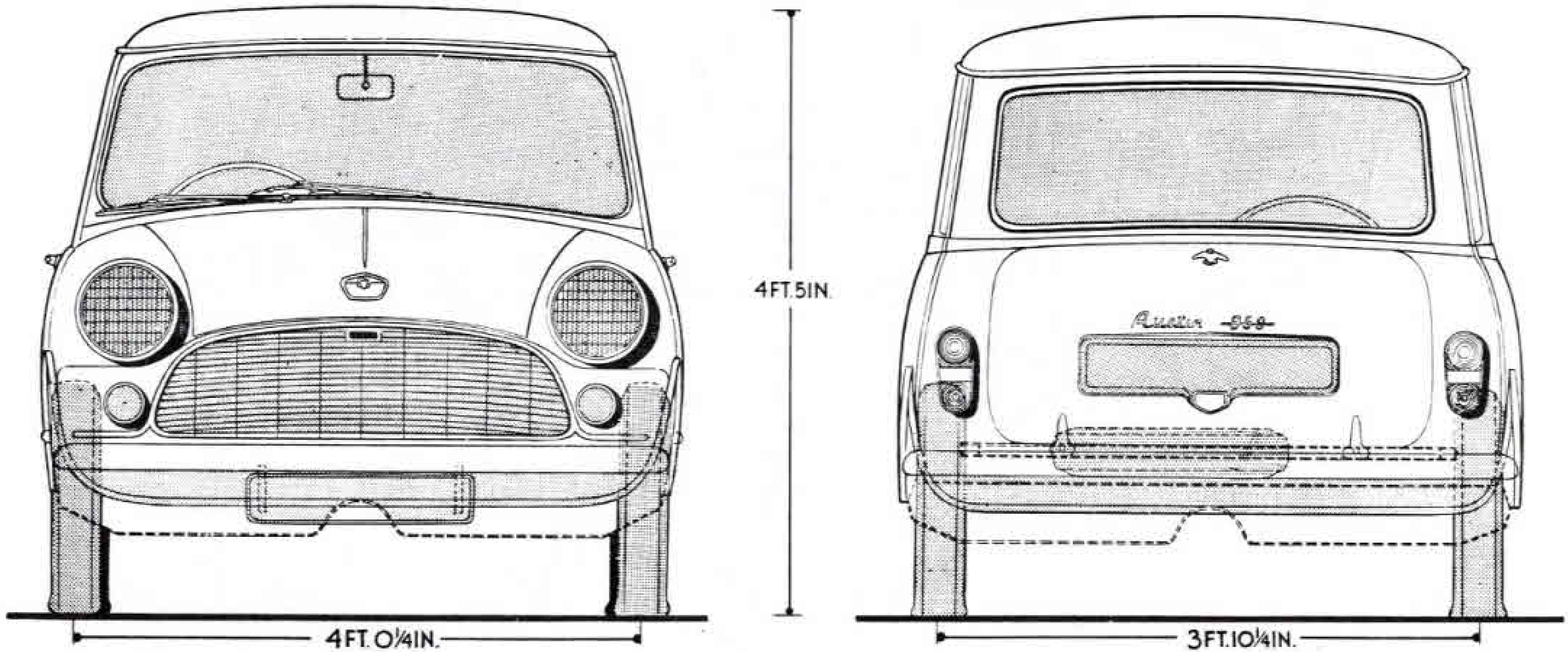
*At Kerb Weight: Diminish where appropriate, 2 up by 19%, 4 up by 32%



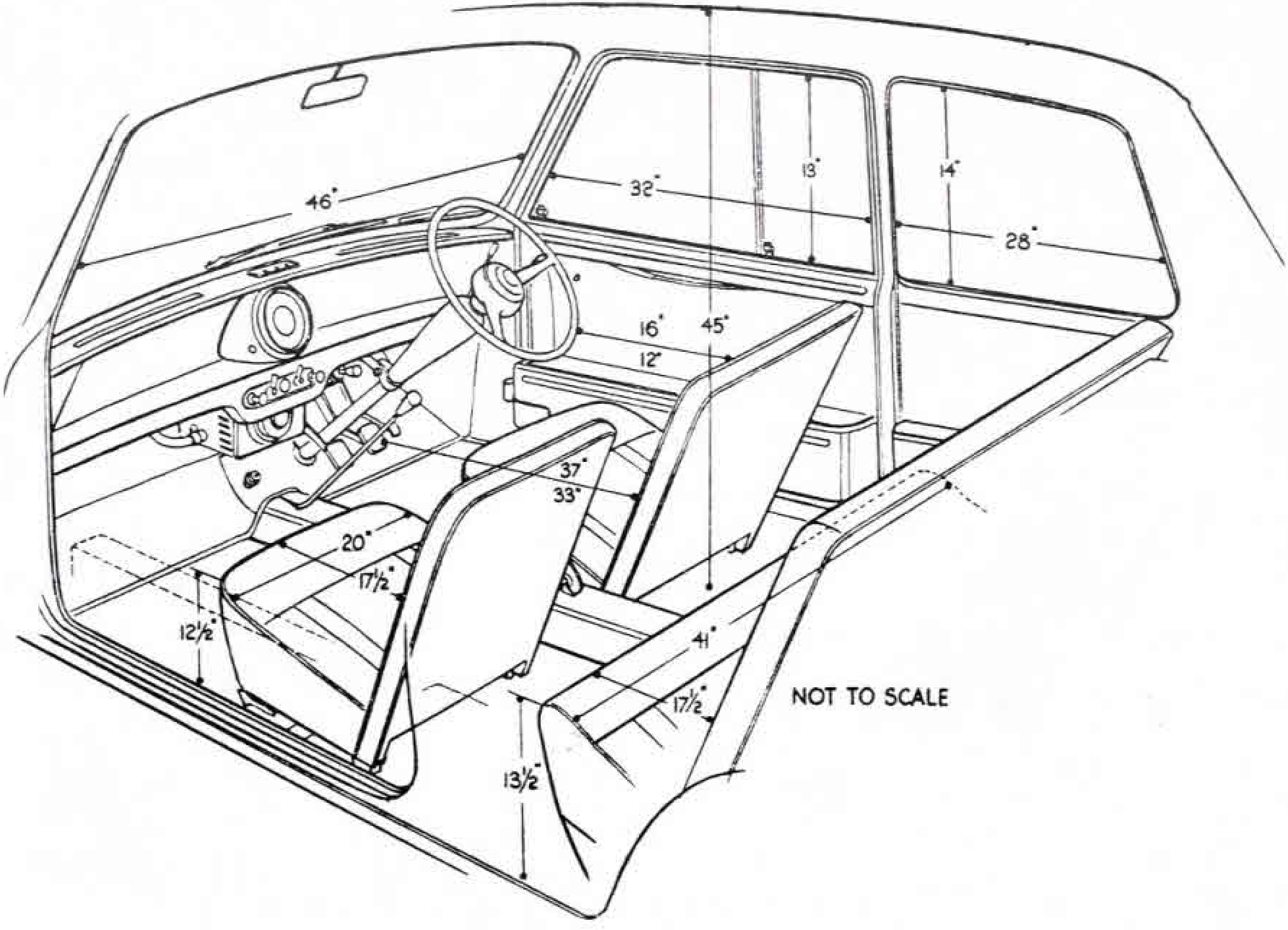
SIDE ELEVATION Scale 1:12



PLAN VIEW Scale approx 1:12



THE AUSTIN SEVEN 850 Scale approx 1:12



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