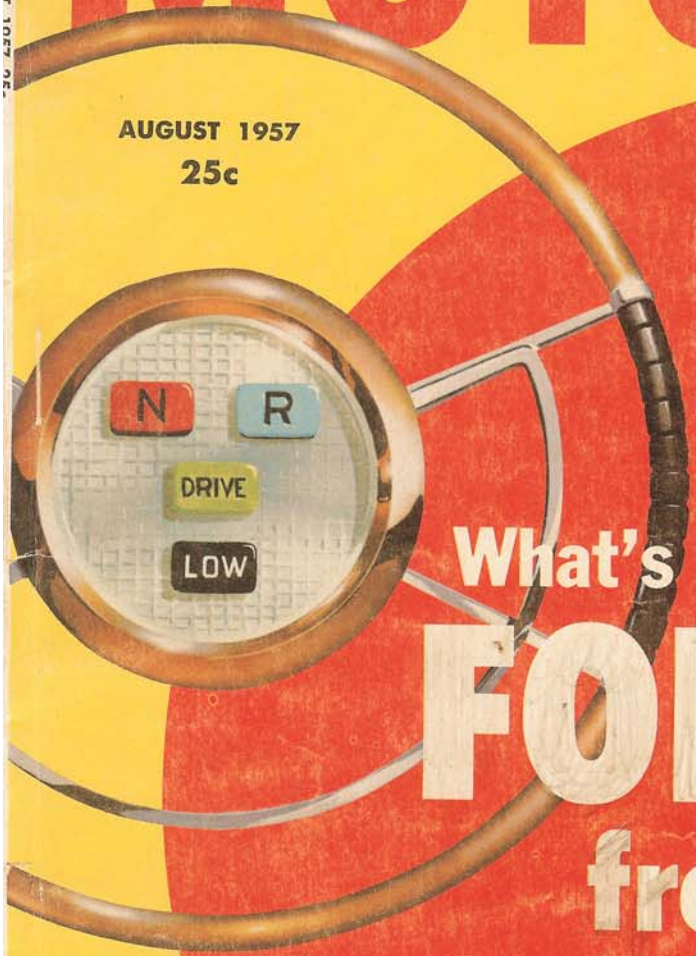
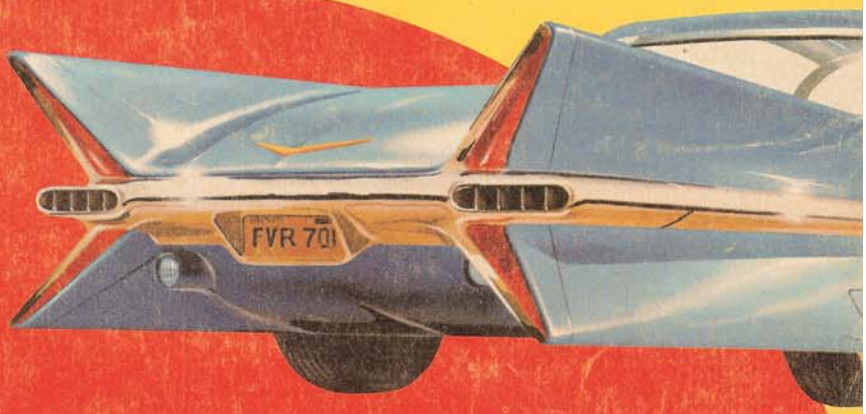
# MOTOR LIFE

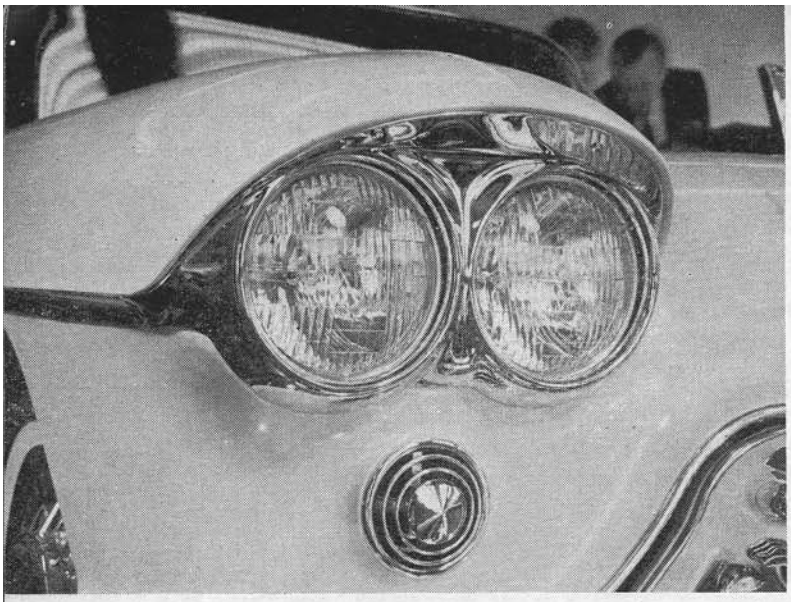
AUGUST 1957
25c

## What's Coming in New Cars!

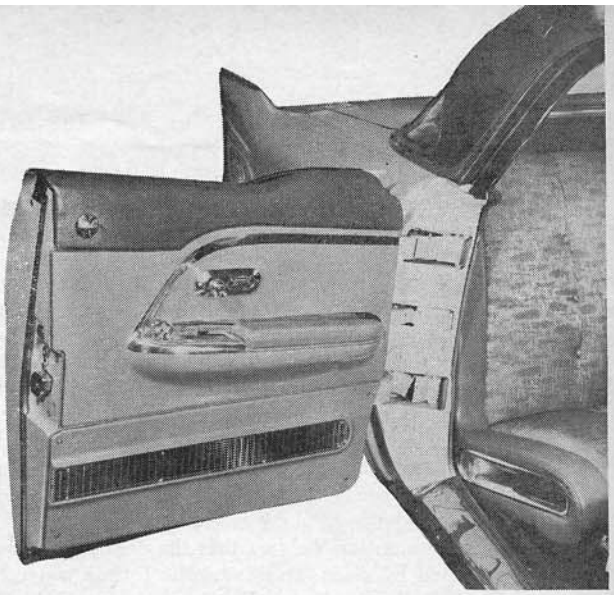
# FORECAST from DETROIT



**DUAL HEADLIGHTS** were pioneered on the original Eldorado show car and will be in widespread use throughout the industry soon. Most features claimed for the Eldorado "Dream car" will be found on the production version and may follow soon on other models.



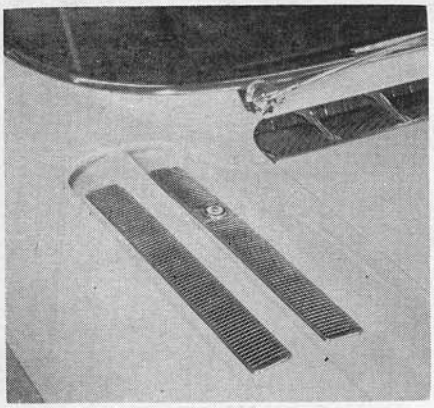
**REAR DOOR** has its own cigarette lighter and ash tray mounted in the arm rest. Pull-type door handle and window lift buttons are grouped above arm rest. Round object, in upper left hand corner of door, is electric door lock control switch.

# The New Pattern For GM

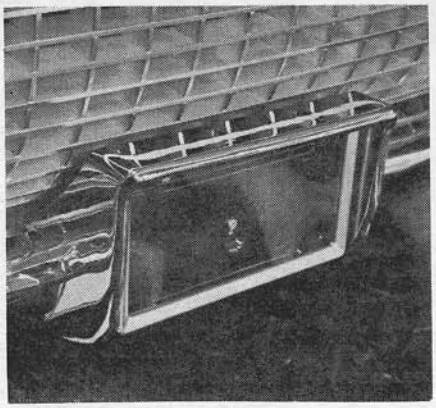

MUCH HAS been made of the fact that the Cadillac Eldorado Brougham is a super-luxury vehicle, the costliest made in the U.S. This is an interesting item, but what is of greater significance to the car buyer and driver is that the Brougham is a rolling forecast of what is likely to appear in General Motors' other and less expensive cars, in the future.

This is a pattern from the past and it is not likely to be altered in any important way. In other words, a close look at the Brougham will provide some excellent clues on forthcoming features. These innovations extend up to and beyond such revolutionary developments as air suspension. They include some of the most minute details, right on down to door latches, ash trays and seating arrangements. With all this in mind, on these pages is a closeup look at the pride of Cadillac. •

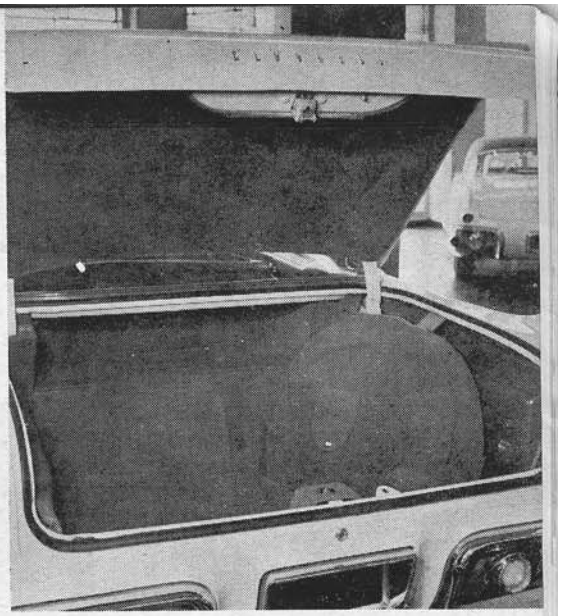
**INSTRUMENT PANEL** in the Brougham is similar, but not identical, to the standard 1957 models in the Cadillac line. Inside the glove box are the controls for the electrically operated deck lid, along with vanity mirror, tissue dispenser, etc.



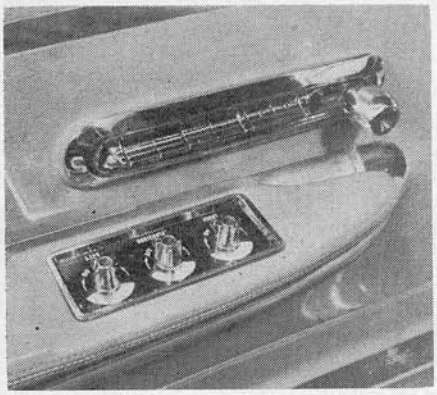
**RADIO ANTENNA** is buried in air intake grille, in upper right front fender, when not in use. Turning on transistor radio automatically raises antenna to proper height.



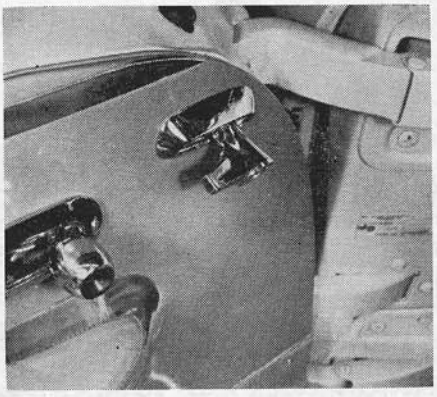
**FRONT LICENSE BRACKET** is cast rather than stamped, as on most cars. This is typical of detail refinements on the Brougham which sets it apart from ordinary vehicles.



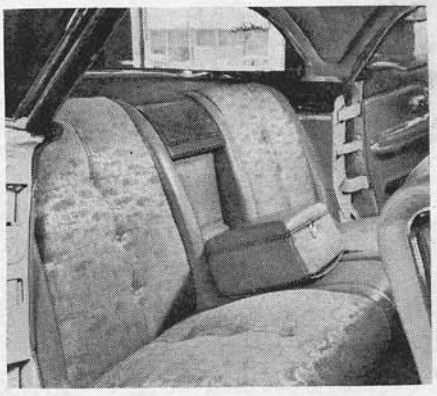
**CARPETING** is used inside entire trunk area, including the spare tire cover, to keep luggage clean. The 12-volt battery is mounted under cover, at right, behind the spare tire.



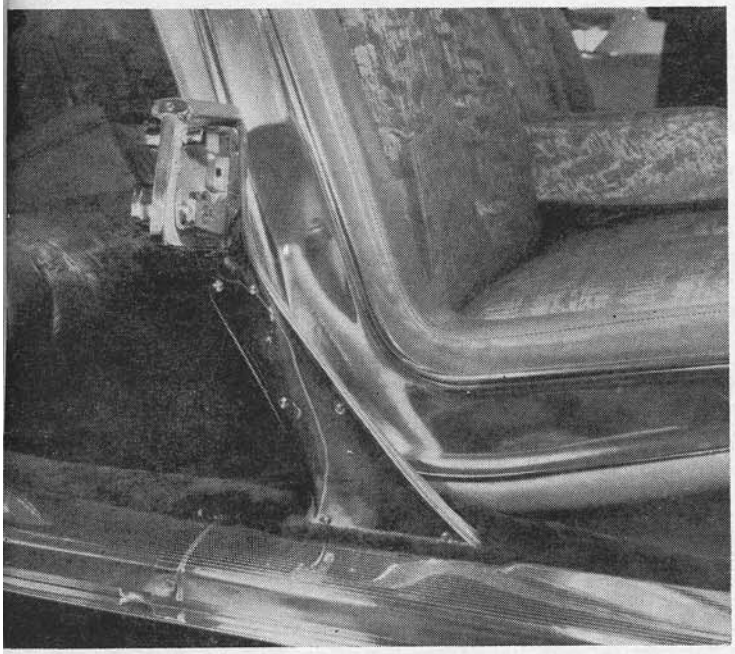
**DRIVER'S CONTROLS** include, on the left front door, buttons for four windows and vent wings, automatic "Favorite Position Seat" setting dial. Round knob is door handle.



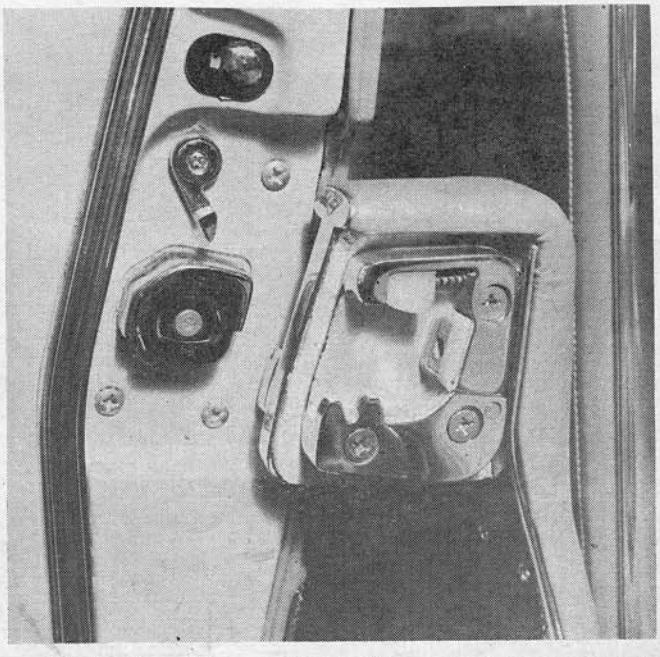
**OUTSIDE MIRROR** adjustment is made from inside by handle shown here on front door (driver's side only). Adjustment is made in same way a spotlight is controlled.

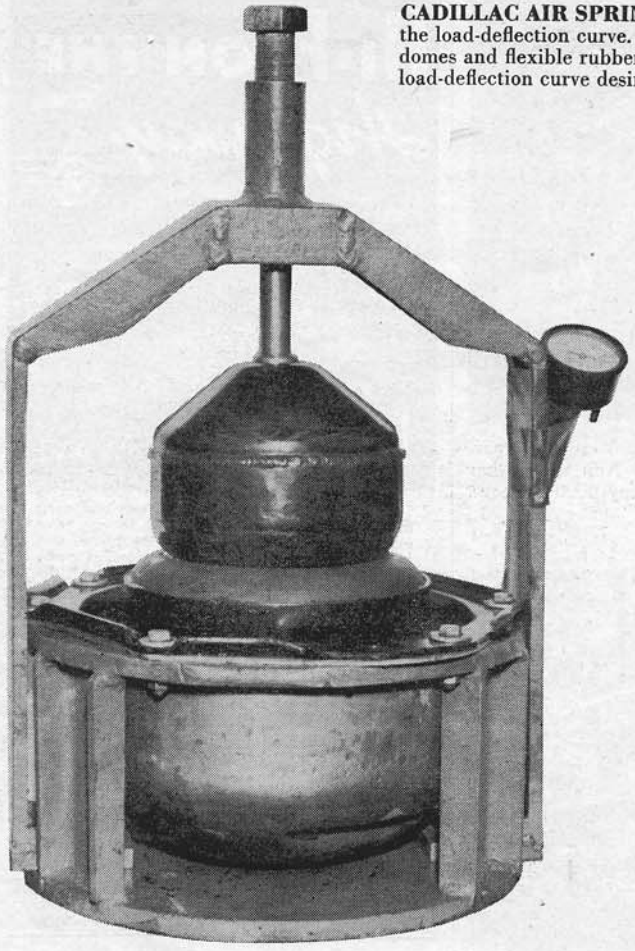


**FORTY FOUR** interior combinations of rich fabrics and genuine leather is available, with carpeting in nylon Karakul or Mouton. Rich interior befits a car of this price class.



**LATCH MECHANISM** for both doors, on a side, is located at the top of this pedestal. Cadillac engineers were faced with a problem of rigidity here, as well as strength, due to the X-type frame used by Cadillac this year. Hydra-Matic control lever cannot be placed in "DR" if either rear door is open and rear doors will open only if the Hydra-Matic lever is in the "N" or "Park" position.





**CADILLAC AIR SPRING UNIT** under test to determine the load-deflection curve. By proper shaping of the metal retaining domes and flexible rubber diaphragm, virtually any load-deflection curve desired can be designed on the drawing board.

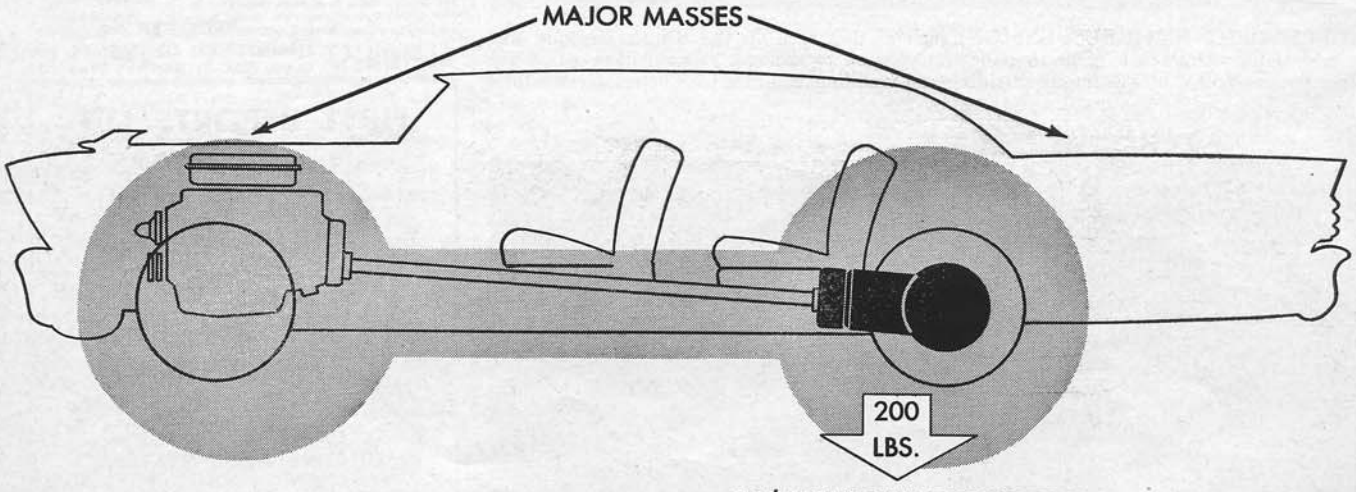
# Suspensions

by Roger Huntington

MANY auto industry observers are saying that steel suspension springs are on the way out—that *air* is the spring medium of the future. But back in the secret drawing rooms of certain Detroit engineering departments some of the boys are whispering that maybe *springs* are on the way out—*period!* They talk of *power suspension*, where the energy generated by the wheels moving up and down over bumps can be fed in and out of some sort of reversible-cycle power supply, to give precise automatic external control of wheel movement, suspension frequency, static height, and all the other variables over the full ride range! This sort of thing is undoubtedly more than five years away . . . but it just goes to show that there's no such thing as the "ultimate" around Detroit today.

Right now the engineers have more pressing concerns. Torsion bars are battling with air bags as the best all-around spring medium. Independent rear suspensions and rear-mounted transmissions are around the corner. Each has its own engineering headaches. The next three or four years promise to be a veritable "suspension era" in the evolution of the American automobile. Great changes are in the wind.

Probably the most crying need of the conventional American passenger car suspension system today is *less unsprung weight*. (The "unsprung" masses are those parts not supported by the springs—like wheels, tires, brakes, axles, and part of the spring weight itself. These move up and down directly with the road wheels.) The relationship between sprung and unsprung weight determines the amount of road shock transmitted to the




**53/47 WEIGHT DISTRIBUTION**

**LOW PITCH RATE**

**REAR MOUNTED TRANSMISSION** would have several advantages over the current arrangement, but would add to cost of production. Advantages are: more foot room in front passenger compartment, lower drive shaft tunnel, better weight distribution which would add to handling and riding qualities, better ride through the necessity of independent rear suspension, and better acceleration.

passenger compartment, since it is the inertia of the sprung mass which resists the upward inertia of the unsprung parts bouncing over bumps. High unsprung weight (in relation to sprung weight) not only jolts the passengers, but requires stiffer springs and shocks to control wheel movement. Tomorrow's super-highway cruiser that can loaf at 100 mph all day with silky smoothness and a sure-footed grip on the road will have to have a lot less unsprung weight than today's family cars.

Best place to start the reducing exercises is on the rear axle. This 250-pound hunk of iron has to go. Tomorrow's car will have the heavy differential assembly mounted on the frame—as sprung weight—with the wheels driven through U-jointed half-shafts. Not only does this drastically cut the total unsprung weight, but softer springs and shocks can be used without having the wheels bouncing all over creation. A bonus benefit is that drive shaft torque reaction is absorbed by the frame, so there is no lifting of the right rear wheel on hard acceleration. Independent rear suspension will make an entirely new vehicle out of the Detroit passenger car.

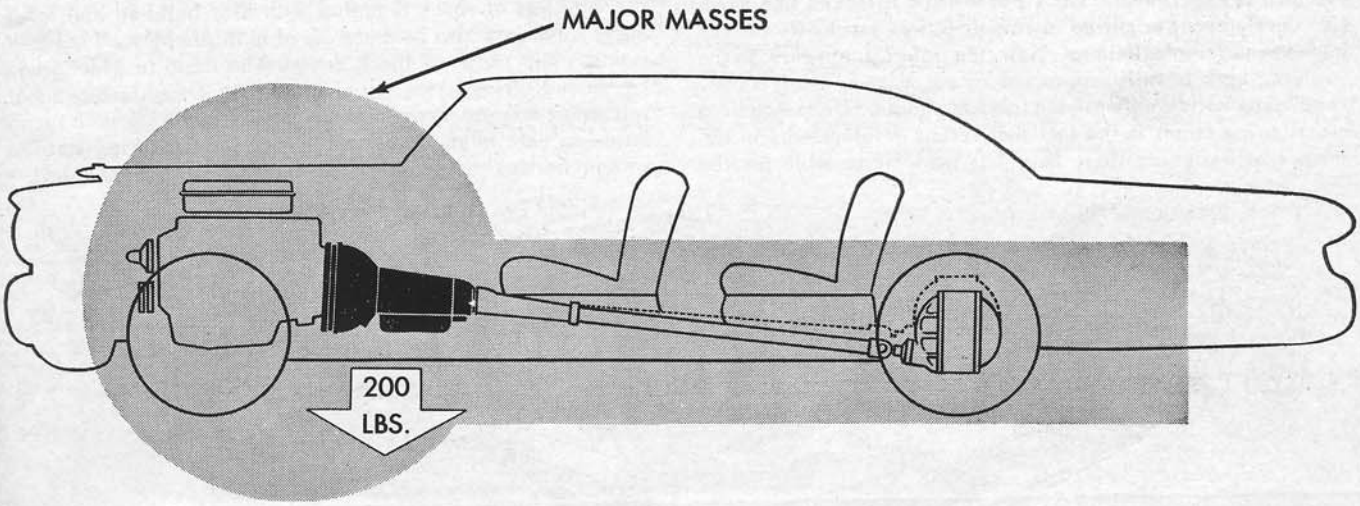
The method of wheel control can take three general forms: (1) The wheels can be carried on pivoting links, similar to various independent front suspensions; (2) the wheels can swing up and down *on an arc* about some central pivot point, with links to control fore-and-aft movement only; and (3) the 60-year-old DeDion principle can be used, where the wheels are tied rigidly together by a tube member (equal to a dead axle), but with the frame-mounted differential, U-joint drive, and a linkage system to control movement in all directions.

Each layout has its advantages and disadvantages. The "link" layout offers the greatest possibilities for rear-steering geometry and minimum unsprung weight; but it's relatively expensive. The swing axle costs less because only two U-joints are needed, but the car tends to oversteer because of the inherent wheel motion geometry. The DeDion is probably somewhere between the two in cost; but here the cross tube is unsprung weight, so the advantage of mounting the differential on the frame is less pronounced. Just what form the typical 1960 independent rear suspension will take is anybody's guess.

Another very important advantage of independent rear suspension—possibly more important than the roadability angle in the long run—is that the transmission can be conveniently mounted at the rear, in unit with the differential. The advantages are obvious: The drive shaft no longer swings up and down, so the tunnel through the passenger compartment can be lowered—possibly even permitting a lower roof line. If "transfer" gearing is used at both ends of the shaft, it can be dropped as low as ground clearance requirements permit. Even more important, perhaps, a rear-mounted transmission helps to even up fore-and-aft weight distribution, so the car is not so noseheavy; cornering and straight-line stability are both improved. Futhermore, the added mass toward the rear increases the "flywheel effect" of the whole car about its center of gravity, so the amount of body pitch when passing over bumps is reduced. The rear-mounted transmission will do a lot for the American family car.

On the matter of spring medium choices—coil springs, leaf springs, torsion bars, or air bags—there is no such well-defined trend. At the same time Chrysler Corp. switches to torsion bars across the board, GM concentrates on air springs, and brings out a practical "production" setup for the Cadillac Brougham. For 1958, at least, that will be the pattern. It is entirely possible that *all* GM makes will offer some form of air suspension, at least as optional equipment, on their next models. Perhaps this is not entirely an engineering matter. GM has been taking a beating from Chrysler and Ford sales-wise this year. In this situation the GM top brass figure it would be a dangerous mistake to appear to *follow* the lead of Chrysler or Ford in any

# Coming Up...




**56/44 WEIGHT DISTRIBUTION**
**HIGH PITCH RATE**

**PRESENT LOCATION** of transmission adds weight to the front end of the car, making it nose-heavy, which not only cuts down the accelerative ability but hampers handling qualities, adds to front brake and tire wear, and cuts down the usable room in the front seat area due to huge floor boards to cover the transmission. Linkage to the rear transmission would not be too awkward.

way—either in mechanical features or body styling. Thus, torsion bars would be out of the question for GM, whether they gave a superior suspension system or not.

Actually, the science of automotive suspension design has not progressed to the stage yet where there is any apparent "superior" spring medium. The ad men rave about the bars and the bags, but most of it is overrated. The much-improved roadability of the '57 Chrysler chassis has nothing to do with the torsion bar springs in themselves. The secrets are substantial widening of the lateral spring base (by increasing tread width and out-rigging rear leaf springs), a substantial lowering of the center of gravity (by lowering body and using 14-inch tires), and some stiffening of the spring rates. All this tends to improve lateral stability and roll stiffness without hurting the ride too much. They could've gotten the same effect with coil springs. The major advantage of a torsion bar as a spring medium is that it permits a lighter and more compact suspension installation in some cases. The bars were convenient in Chrysler's case because engines were dropped well down on the new chassis, and there was little room for conventional coil springs and wishbones. If torsion bars are widely used in the near future—say, by Ford Motor on their next crop of chassis—it will undoubtedly be primarily because of space problems.

As this is written it looks definitely like GM will be concentrating on developing air suspension in the next two or three years. What does this offer over and above steel springs? "Not much," say many engineers today. They will all admit that air suspension can be made to do certain things that steel springs can't—like permitting easy adjustment of suspension natural frequency—but they won't all agree that these features are important, or even worth the extra cost on tomorrow's car. Only time will tell.

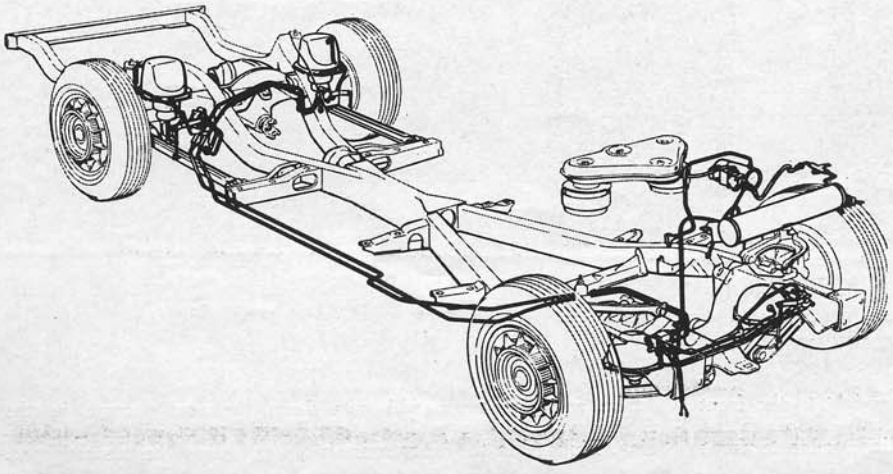
Several facts about air springs are now pretty well established, however:

For one thing, when used to replace steel *leaf* springs a better ride is sure to result, because of the considerable friction between the leaves of the latter—which deadens the response of the spring to small. high-frequency road vibrations, and is equivalent to an increase in spring stiffness. Now if the air spring takes the form of an air-oil "strut" (where a hydraulic cylinder and piston arrangement follows the wheel motion, and is balanced against an air chamber across a flexible diaphragm), the advantage will be much less pronounced, because of the friction of the piston sliding up and down in the cylinder. (This is the system used with the Delco struts on the GM Firebird II experimental car.) For a while it looked like much GM development might go in this direction, especially for the less-expensive installations. Now the interest appears to be swinging back to full compressed-air suspension, using rubber "bag"-type spring units of one form or another. Undoubtedly a contributing factor is the fact that recent developments in the science of designing these bags has made it possible for the chassis engineer to pre-select any load-deflection curve he wants for his suspension. (This is made possible by using metal sleeves and bulbs to limit the bulge of the bag over its up-and-down travel, thereby varying the effective stiffness.) This is a very handy gimmick—and it can't be done handily with steel springs.

How important is the feature of variable suspension frequency (also not possible with steel springs)? Chief advantage here, of course, is that a more or less constant ride quality can be maintained with changing loads in the car. Since the natural frequency of pitch and bounce oscillations of the body depends on the relative *deflection* of the springs, in order to keep these frequencies constant there must be a way to keep the deflection constant with varying loads. With air suspension it's a simple matter of pumping air in or out of the bags (oil in the case of air-oil setups). Cars with steel springs ride best with a full load; this effect can be achieved with *any* load with air suspension. Just how important this feature will be to the buyer of tomorrow—whether he'll be willing to pay extra for it—is debatable.

Leveling the static height of the body may be much more important. Understand that this has nothing to do with varying the ride frequency. Height is adjusted automatically when air pressure is changed in the bags; but this can also be done conveniently with torsion bars by merely rotating the bar anchor settings (by an electric motor or some such). This feature is taking on added importance because of the trend to super-low bodies. Spring deflection and static height with conventional steel springs must be a compromise now, so the springs won't "bottom" easily with a six-passenger load. Result is that the body stands about two inches higher than it needs to with only the driver in the car! Those two inches look awfully good to the body designers. And, since they can get the effect fairly easily with torsion bars, this is another reason why air suspension does not appear to have any really clinching advantages just now. John Q. Buyer will decide.

Meanwhile, there are still possibilities for improving conventional suspension systems. Studebaker's variable-rate coil spring is clever; this not only helps to hold a fairly constant ride frequency with varying loads, but tends to reduce the roll angle on corners. There is much room for improvement in shock absorbers. Biggest difficulty, perhaps, is that Detroit is trying to build a part with *dimes* that should be built with *dollars*. The trend now, though, is toward a larger *volume* of oil in action, with larger piston diameters (which gives smoother action and prevents loss of shock damping with heat build-up and foaming); there may also be more use of multiple blow-off valves to give a wider range of shock action. The trend to wider wheel treads and spring bases will also continue. Other factors equal, roll stiffness is proportional to the *square* of the effective spring base—so here is another fruitful field for improving stability without hurting the ride. Look at what Chrysler accomplished. •



**PLUMBING LAYOUT** for the air suspension system on Cadillac Eldorado Brougham. This type of installation costs a lot of money and is questionable just how soon it would be adaptable for mass production.