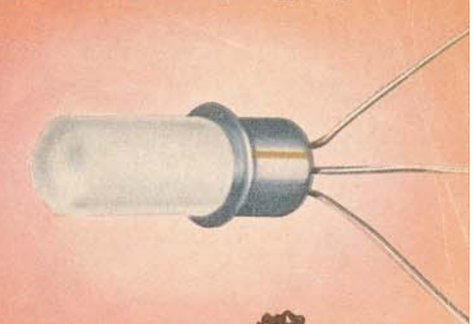
FORECAST FROM DETROIT

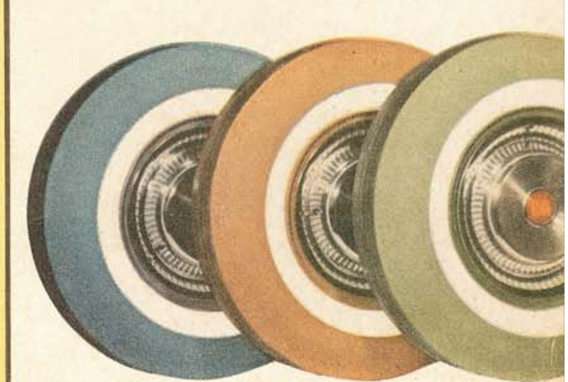
# MOTOR *Life*

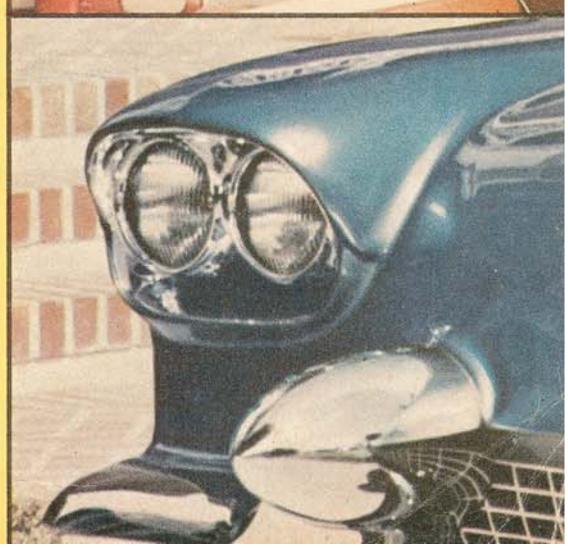
THE MAGAZINE OF AMERICAN MOTORING

SEPTEMBER, 1955 25¢



## special report on what's coming up in cars





*THE ELDORADO BROUGHAM—*

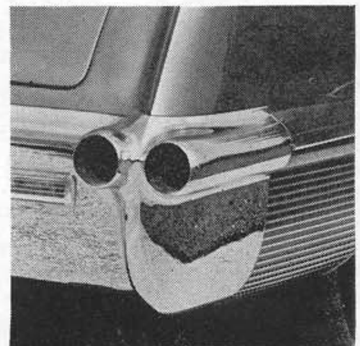
# A NEW CADILLAC FOR 1956

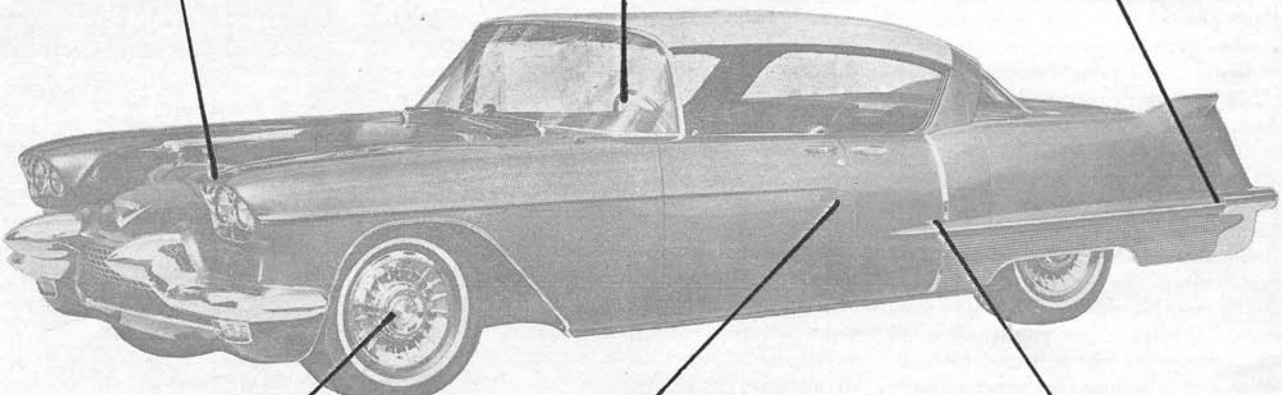
***The class of super-luxury cars, neglected since the 1930's, is on the way back, and this one is sure to be a style-setter in advanced features***

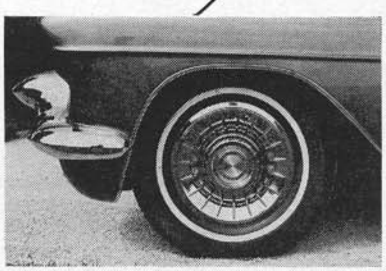
**TWIN HEADLIGHTS** at the front end of each fender have five-inch lenses. Outer lamps are flat-beam city lights; inner lamps are for highway use. An Autronic Eye will switch from one to the other as conditions on the road require.

**INTERIOR** includes padded instrument panel with recessed controls. Driver's seat pivots outward for easy entry and exit, while center of both front and rear seats contains storage compartment. Note absence of small ventilator windows, considered unnecessary in car having air conditioner and heater as integral unit.

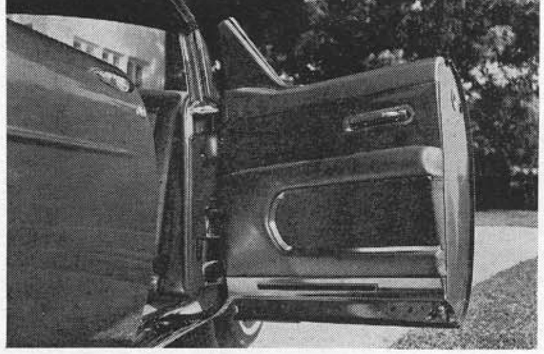
**QUAD EXHAUST** is what Cadillac is calling the system that has dual pipes issuing from rear fenders on each side of the car. This could be said to balance dual-dual headlights in front, but benefits in engine efficiency are unknown.

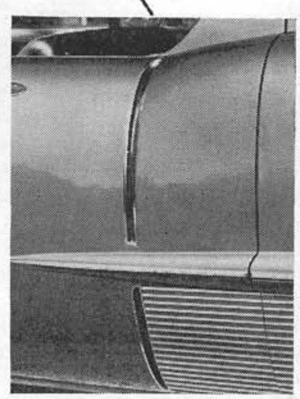




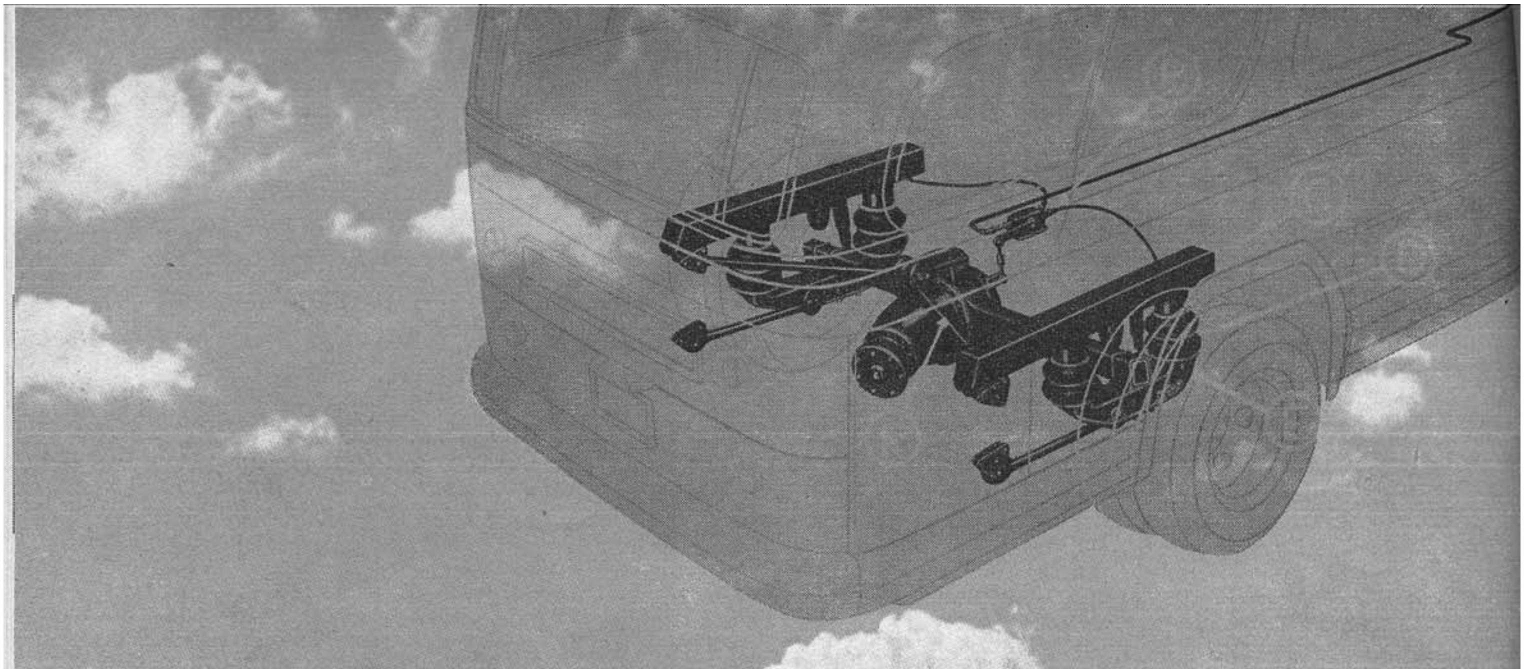


**MAGNESIUM WHEELS** simulate wire wheels, but obviously will be easier to clean and polish. Front bumper has been a Cadillac trademark for several years. Top of Brougham, incidentally, is tinted aluminum, forecasting more widespread use of non-rusting metal in cars to come.





**REAR DOORS** open into the wind (above), a characteristic of four-door hardtops. But Cadillac engineers say they have developed an adequate safety device to forestall mishaps. Note triangular section that forms upper rear of door. Only chromed strip on side of body (right) is vertical trim, another Cadillac trademark in recent years, which may point the way to more restraint in exterior treatments for the future. Significant item: the Brougham's wheelbase is 124 inches, five less than the current Cadillac 62 series. Are scaled-down cars coming from other U.S. auto manufacturers?



# RIDING ON AIR

by Roger Huntington

*Salesmen have been saying their cars are like that for 40 years. It won't be long before they're right*

**THE FARTHER WE GO in this fascinating science of automobile design the more it looks like the next ideal spring medium between chassis and road wheels simply will be compressed air. It's cheap, quiet, smooth in compression and expansion, sensitive to the tiniest vibrations, and it never wears out.**

**Packard rocked the auto world in 1955 by introducing an advanced new suspension system based on torsion bar springs. Many observers thought this would set a pattern for the industry. I don't think so. The Big Three will take a broader jump than Packard, by-pass torsion bars—which are really only a variation of the coil spring—and advance directly from current layouts to full air suspension. Packard pushed 'em into it, but they're not going to be content to follow the leader in this case.**

**It's plain as day to any industry observer that something big is brewing, suspension-wise, around Detroit these days. The few who have been pounding the stump for air suspension for 20 years have suddenly clammed up; research departments are not releasing a thing; the grapevine has it that Air-Lift engineers were called in for consultation by Chrysler Engineering months ago! The obvious conclusion . . . well, I think the biggest question is whether we'll first see it in 1956 models or the 1957's.**

## WHY AIR SUSPENSION?

To answer this question we're going to have to brush a few fundamentals of ride engineering. I discussed this subject quite thoroughly in the July '54 issue of MOTOR *Life*. So let's bring ourselves up to date.

You'll recall that a vital factor in the ride comfort of any car is the "natural frequency" of the suspension—or that rate at which the sprung mass (body and chassis) oscillates up and down when acted upon by road forces (bumps) through the wheels. This natural frequency depends *only* on the stiffness of the spring medium and the sprung weight. The heavier the body and the softer the springs, the lower the frequency. Twenty-five years of ride engineering have shown us that this frequency should be somewhere between 60 and 80 cycles per minute for optimum passenger comfort.

Now this is all well and good; it's easy enough to design any desired natural frequency into any type of suspension. But here's the big rub: As the car load changes—as you add or subtract passengers and luggage—the sprung weight changes, and the frequency varies accordingly. On a truck or a bus, where normal loads vary over a wide range, this effect can change the ride characteristics radically. (If you've ever ridden in a big truck with no load you'll know what I mean!) Even in the passenger car field the designer must compromise his springing for an "average" load for overall benefits under varying conditions.

Now, obviously, if we could somehow *change the stiffness* of our springs as the sprung load varies, we could maintain a *constant frequency* at all times—and get the best possible ride. This is, in effect, what Packard does with their "Torsion-Level" deal; an electric motor puts a pre-load on the torsion bars through a screw jack to maintain a constant body height. (This is actually equivalent to changing spring stiffness.) With air suspension you can do the same thing by merely pumping air in or out of the flexible spring member.

Another fundamental factor in ride problems is the *friction* in the suspension members themselves. You get friction between the leaves of a leaf spring, at joints where suspension links pivot, in torsion bar bushings. Obviously this is going to reduce the effectiveness of your springing. In fact, under very small road vibrations, the bump force isn't sufficient to overcome this friction . . . and it's as if you *didn't have any springs at all!* The vibration is then transferred directly to the body. By far the worst offender here, of course, is the leaf spring; even with modern inter-leaf anti-friction linings and lubricants the friction hurts the ride considerably. Coil springs and torsion bars are much better, with mostly only pivot and bushing friction to contend with. An air spring is best of all, though, because compressed air is far more sen-

# THE PROBLEMS OF AIR SUSPENSION

I THINK you'll eventually agree that air makes just about the ideal suspension system for a passenger car. We might summarize now the major advantages as follows: (1) Constant natural frequency and body level under all load conditions, achieved with a relatively simple mechanism; (2) reduction of very small, high-frequency road vibrations due to suspension friction and lack of response; (3) better control of roll stability; (4) better sound insulation against road rumble; (5) springs that will last the life of the vehicle.

Right now, of course—and as usual—the big objection to air suspension is the cost. The suspension linkage and rubber bellows themselves would not need to cost any more than conventional springs and linkages; but there would still be the air compressor, reservoir tank, control valves, and plumbing. A couple of years of mass production on this stuff would certainly bring the costs far below anything we can see now (it always does) . . . but whether air suspension *with ride control* could ever really be "competitive" costwise with plain steel springs is debatable. Maybe it isn't important. Detroit has never hesitated to add an extra-cost feature if convinced it would make a better car wtih more sales appeal (which air suspension would certainly do).

You won't need to worry about reliability and durability with air suspension. The bellows are practically indestructible. The complete layout has run up nearly 50,000 miles on the axle-busting Belgian Block road on the GM Proving Grounds . . . which is equivalent to many times that number of miles on the highway. The pressure control system is quite simple, and looks virtually foolproof, as well as easy to maintain. The absence of electrical mechanism is very attractive. When you have electric control, as on Packard's levelizer, you have problems of corroded contact points, shorted wiring, etc.

There are a flock of little 40-watt headaches the engineers are thinking about. One comes to mind: The natural leakage of compressed air from the system would gradually bleed out all the pressure when the car is parked, and the chassis would slowly settle. There's no exact idea how fast it would leak—the designers say the system can be made as air-tight as a tire—but it's conceivable that, after leaving the car for several weeks, the suspension could be bottomed, and you'd need to run the engine a few minutes to get up pressure before driving the car. This might take a little explaining by the salesman!

But are these little things any reason to put off a really improved ride? What do you think?

*—Roger Huntington*

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sitive to tiny vibrations—even those caused by the tread of the tires (!)—than steel.

Of course, this is all assuming that the flexible container for the air is a practically frictionless member, like a rubber bag. If you used a piston moving up and down in a cylinder the friction of the piston would kill most of the advantages of using air as the spring medium. Get the idea? As it is, the combination of air and rubber serves also to insulate the body from a lot of road rumble that would be transferred through normal suspension linkages.

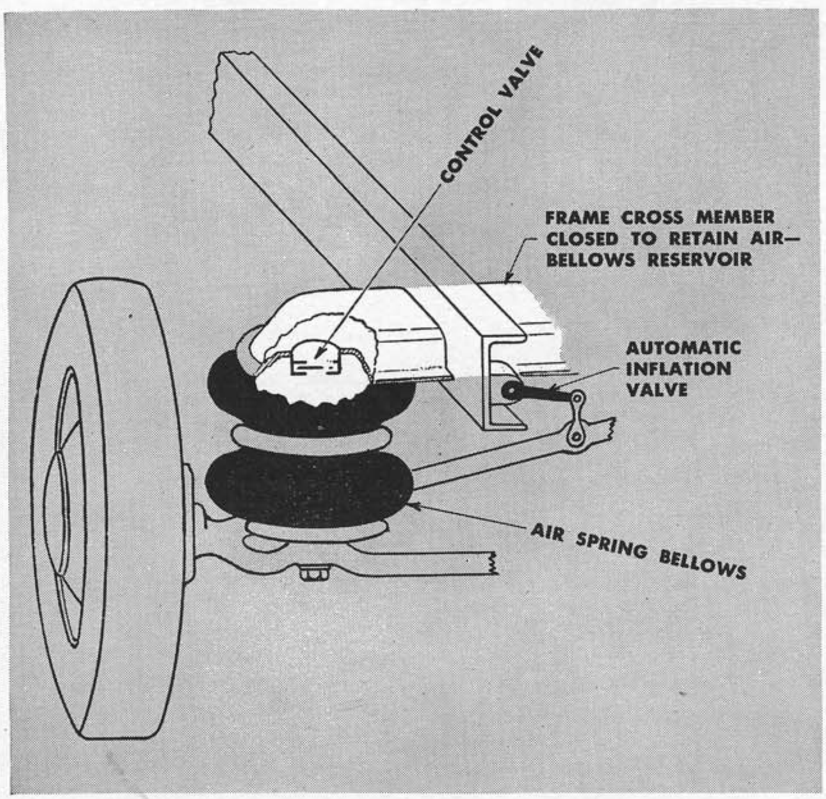
And one other more obscure feature of air suspension is the matter of lateral or *roll stability* on curves. Theoretically your spring stiffness should *increase* on the low side when the body rolls to give an inherent stabilizing effect. You can arrange this with conventional suspensions by juggling the linkage geometry and/or using a lateral anti-roll bar. But these layouts are subject to a number of limitations. With air suspension, you can precisely adjust your desired lateral stability over a wide range by simply changing the effective *volume* of the air-containing spring member. (This is a complicated concept, so we needn't go into it any further here.)

Anyway, the above is what air suspension has to offer. Now let's look at an actual installation on a typical passenger car and see how it works:

#### AIR SUSPENSION IN PRACTICE

The best-known—and probably most highly developed—air suspension system actually in production today, in the field of road vehicles, is the one installed on some models of General Motors buses since 1953. This deal has most of the features that I think will show up on early passenger car installations. Some accompanying drawings show the layout. The actual spring members here are rubber "bellows," two on each wheel, built up something like a tire with a nylon cord carcass; the outer coating is neoprene to resist weather, oil and salt thrown up from the road, etc. Firestone

(*Continued on page 54*)




**Principal components of a typical air spring suspension system are shown above. Arrangements differ in various axle and wheel positioning setups.**