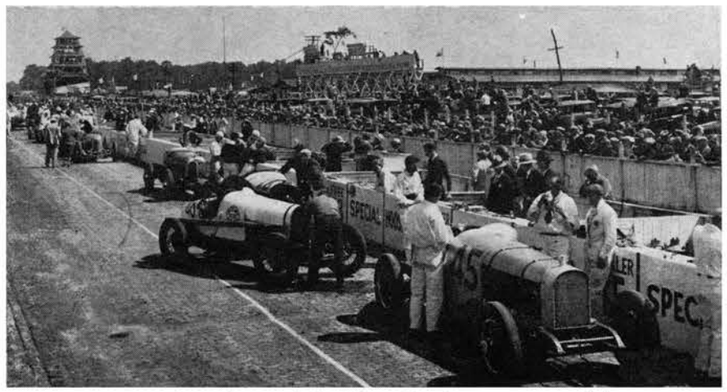
INDIAN

What was it like when stockers invaded the Brickyard? Will they return...?

by J. L. Beardsley

BILL CUMMINGS' VICTORY at Indianapolis in 1934, behind the wheel of a four-cylinder Boyle Special, marked the beginning of a lasting monopoly on Victory Lane by the dominating Offenhauser racing engine — a monopoly that has remained unbroken in all but three of the 22 races following the 1934 Classic. Wilbur Shaw did it with a Maserati in 1939-40, while little George Robson turned the trick in 1946 when he tooled the six-cylinder Thorne-Sparks Special home in the first postwar 500.



Car 45, a Lycoming, and No. 28, a Chrysler, were part of the 10 stock-engined cars which participated in the 1930 Indy race.

Others have tried to beat the Offy monopoly but failed, and it appears that the powerful engine (now known as the Meyer-Drake) will continue to dominate Indianapolis for a time at least, since its success and popularity has left only scattered opposition from other powerplants.

But there was a time, in the years before 1934, when a good share of the starters at Indy were made up of converted stockers — many of them fully sponsored by factory racing teams. Today, with stock cars hitting such fantastic speeds as 151 mph and better at Daytona Beach, it would appear that the time is ripe for the stock-block engines to reappear in force at Indianapolis.

At least two stock engines — highly modified to compete against the Offy — are being readied for the 1961 Classic, and the recent success of Chevy-powered sprint cars during the 1960 season seems to indicate they have at least an outside chance. The day may be in the very near future when stockers will be well represented in the 500 starting fields again, as they were during the colorful '20s and early '30s. It could be a tremendous boost to racing in general.

There was extra interest in those days when Studebaker, Buick, Hudson, Ford, Stutz, Packard, Hupmobile, Oakland, Graham, Chevrolet, Reo, Chrysler, Cummins and other familiar names ran against the sleek Millers, Duesenbergs and Frontenacs from this country, and the Peugeots, Delanges, Sunbeams, Fiats and Bugattis from Europe.

This was something the average fan had a stake in. The race then, as now, was the world's most dramatic and spectacular sports event, but then — unlike present times — it had a special aspect when a spectator could root for a favorite driver as well as a car with the same name as the one he would be driving home from the track. This simple fact was instrumental in making stock car racing so popular today. At Indy, however, fans haven't had this extra thrill since the advent of the Offy.

Indianapolis began as a "stock chassis" track in 1909 when it was built as a proving ground for the entire auto industry. Dozens of new ideas and innovations were first tested and developed on the Speedway, and when the industry began booming after World War I, optimism and expansion all along the line created an ideal atmosphere for company-sponsored competition. We have something of the same situation today.

Better automobiles were built after the war and, to oil the wheels of progress, the Speedway management lowered engine displacement from 300 to 183 cubic inches for the 1920 race, as a stimulus for the development of more efficient American powerplants.

DE PALMA IN PACKARD

Five stock entries had gone into the 1919 Classic, which was the last for 300-cubic-inch engines. They included Ralph DePalma's Packard; Ira Vail and Ora Haibe in Hudson Super Sixes; and two Duesenberg-powered sports cars of the Roamer team driven by Kurt Hitke and Louis Le Cocq.

From lack of competition — after DePalma's Packard encountered valve and wheel bearing trouble — Howdy Wilcox drove his Peugeot to victory at an average speed of 87.95 mph. His mount, although made in Europe, had been rebuilt using mostly American-made parts. DePalma, who pushed his big Packard into the lead for 150 miles and averaged over 92 mph for the short distance, wound up in sixth position after making numerous pit stops. Once he replaced an exhaust valve and another time he replaced a wheel bearing. Vail's Hudson placed eighth but most of the other stock entries were a total loss. Le Cocq's Roamer turned over and burst into flame on the 96th lap, killing the driver and riding mechanic, while the second Roamer was sidelined with bearing trouble after completing 57 laps.

In 1920 and again in 1921, for the first time since 1912, victory went to an American automobile. Gaston Chevrolet captured the 1920 Classic, driving a Monroe designed and built by his brother

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APOLIS

What would it be like if Indy designers started a "copy Cooper caper"...?

by Roger Huntington

EVER SINCE WILBUR SHAW won the 1939 and 1940 Indianapolis races with an Italian Maserati Grand Prix car, Europe has been casting green eyes on the Memorial Day pot of gold. But the overseas racing people haven't had a bit of luck since. The last time a European car even *qualified* was in 1952, when Ascari squeezed in with a V-12 Ferrari — only to have a hub collapse on the 40th lap. There have been a number of attempts to crack the brickyard since then. As recently as 1959 two V-8 Maseratis were entered, reputed to develop 450 hp. Neither could hit 140 mph, even with nitro fuel.

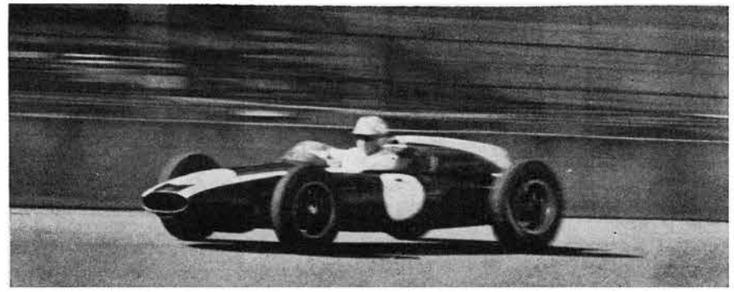
Then one gray afternoon last October the whole picture changed. World champion Jack Brabham, experimenting on the Indy track with his Formula I Cooper race car (which had just won the world road racing championship), racked up a lap speed average of an astonishing 144.8 mph. This was only five mph less than the lap *record*, and faster than most cars that qualified in last year's race. He did this with less than 50 laps of practice, on straight gasoline instead of the usual alcohol fuel used at Indy — and with some 100 fewer cubic inches than our regular Indianapolis cars are allowed.

So now American car enthusiasts and professional racing men are *really* wondering. What is the true potential of these modern lightweight Formula I cars? Would they have a chance at Indy? Is American race car design obsolete? Let's have a look.

WHAT DID COOPER DO?

Perhaps the most impressive thing about the recent Cooper-Brabham Indy runs was the unexpected ease with which the car and driver could lap the track in the 142-144 mph bracket. This is racing speed — and yet Brabham appeared to be on a Sunday cruise. He turned 15 to 20 laps in this speed range with no effort at all. When former "500" winner Rodger Ward took the Cooper around for a few laps he was amazed at the smoothness and ease of handling. The Cooper is an entirely different bucket of bolts from conventional Indy "roadsters."

For one thing it's much smaller and lighter. Wheelbase is 91 inches compared with 96 for a typical Indy car. Dry weight is only around 1050 pounds, 500 pounds lighter than the latest Indy designs (and 600-700 pounds less than the average). Lighter 15-inch wheels and tires are used instead of the 16 and 18-inchers on Indy cars. The beautifully-designed space chassis-frame is welded up from tiny 1½-inch steel tubes



Champion Jack Brabham shook up Indy regulars last fall when he drove Formula I Cooper to 144-mph average at Speedway.

with only .050- and .062-inch wall thickness. It probably doesn't weigh over 50 pounds. The engine and gearbox are made from aluminum and magnesium castings — contrasted with the big cast iron "Offy" engine in our Indy cars. The actual weight of the four-cylinder Coventry-Climax engine in the Cooper is 290 pounds, or roughly 200 pounds lighter than the Offy.

Any time you can reduce the size and weight of a car you've got a running start on easing the handling.

And then there's suspension. The Cooper has independent suspension on all four wheels, using coil springs and very light A-frames fabricated from tubing to control the wheel up-and-down motion. Our Indy cars use solid axles and torsion bar springs—a straight tubular axle on the front and a Halibrand quick-change setup in the rear. Axle motion is controlled by leading and trailing links. The advantage of the four-wheel-independent setup on the Cooper is that it greatly reduces the unsprung weight (the weight that bounces up and down with the wheels) in relation to the *sprung* weight, or that weight supported *on* the springs. This allows the use of softer springs and still keeps the tires on the ground for maximum bite. The ride over the bricks on the front straightaway at Indianapolis is improved immeasurably. Also the independent rear suspension cancels the crosswise torque reaction that tries to lift the right rear wheel when you jam the throttle — so it gives better bite coming off the turns.

Other factors on the Cooper that help handling: Light, positive rack-and-pinion steering, with a quickness that's just right for handling at speed. With the engine in the rear the front/rear weight distribution (with driver in place) is 44/56, which is a good compromise between traction and handling. Further, the fuel tanks are placed alongside the driver near the center of the car, so weight distribution changes very little as the fuel is used up. This is a big problem on Indy cars which carry 40 or 50 gallons of fuel in the tail. Indy cars start out with nearly 60 per cent of their total weight on the rear wheels and end up with more like a 50/50 weight distribution. The change in rear weight can make a difference in handling in the turns that's hard to com-

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Cooper at Indy

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pensate for. (Some cars have manual screw adjustments in the cockpit so the driver can vary rear spring rates as the fuel is burned!)

The Cooper has Girling disc brakes all around, which offer almost unlimited braking capacity if the driver needs it. Jim Hurtubise used his brakes hard to set the new lap record last year, and it's likely that braking will become more popular – *necessary,* in fact – as speeds go up at the brickyard. Finally, of course, we have that beautiful Cooper-designed five-speed gearbox in the back. Brabham found it didn't help much to downshift in the turns on a fast track like Indy; but gears might help getting in and out of the pits quickly – and the very close ratio spread between fourth and fifth speeds (1.17:1) might be utilized to give a "cruising" and "sprint" gear for use in the race.

Add it all up and you've got a very interesting combination to meet the Indianapolis challenge – on paper anyway.

CLOCKING THE COOPER

To get an idea of the true lap speed *potential* of the Cooper Formula I car we have to look beyond the overall average speed and check the car speed at different *points* on the track. Fortunately some of the top men in American professional auto racing were on hand at Indy to watch Brabham run. Their figures give a very complete picture of the little car's performance.

In the first place, Brabham was getting through the turns at a speed that amazed everybody. If you stand at a certain spot in the infield near the southwest turn (at the end of the front straightaway) you can sight the cars through this 90-degree arc with a stopwatch. This is a distance of very nearly one-quarter mile when you stand at the apex of the arc. Firestone engineers use these turn speeds to help judge the performance of new tire designs; mechanics frequently do their own timing to check on chassis adjustments. None of these speeds could be considered "official," because an error of just ⅒th second by hand-timing over this short distance would make a difference of two mph in the calculated speed. Anyway the boys caught Brabham's highest speed through this trap at just a shade under *140 mph!* The highest turn speed recorded on Firestone's books is 138.2 mph, turned by Tony Bettenhausen last year in tire tests. (This is the most reliable record we have.) Some mechanics have timed various cars between 138 and 140 mph. There is no doubt that Brabham was getting his Cooper through the Indy turns as fast as the very fastest U.S. cars – and a good deal faster than 95 per cent of them.

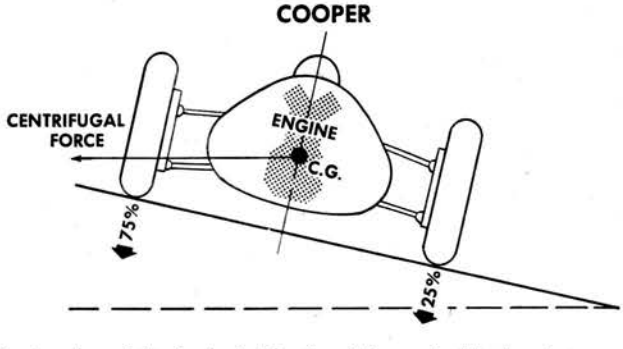
It was another story on the straightaways. With only 151 cubic inches and burning gasoline, acceleration of the Cooper was pretty doggy compared with our big Offys. Some mechanics check acceleration by standing up in the timing tower, sighting on a big tree near the fourth turn, and clocking the time from the turn to the finish line – a distance of about 2400 feet. Brabham was timing between 11.4 and 11.5 seconds through this trap, getting up to speeds between 150 and 155 mph before shutting off for the southwest turn. Our hotter Offys will turn between 10.7 and 11.2 for this distance, and wind up to 165 or 170 mph. If the two types of cars started side-by-side coming off the fourth turn this means the Offy would be 140 or 150 feet ahead when both crossed the finish line.

Obviously the Cooper is long on cornering and short on acceleration. But any sharp Indy mechanic will tell you that speed through the turns is more important to lap speed than peak speed down the straights. We recall the late Clay Smith, master mechanic in Indy in the late '40s and early '50s, who once calculated that one mph higher speed through the turns would increase the lap average by as much as *four* mph more peak speed reached on the straight. In other words the Cooper, with its very high turn speed potential, must have a very high *lap* speed potential, if we can just hop up that engine to give us a little *acceleration.*

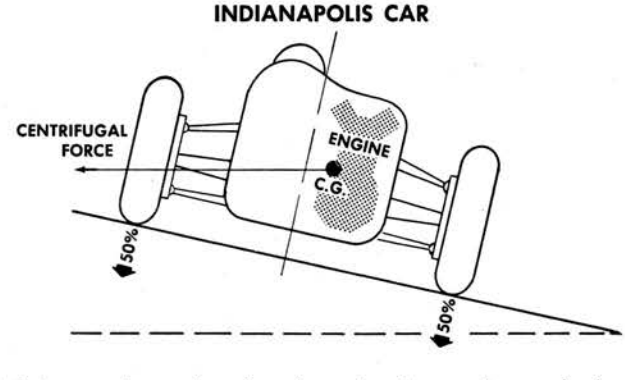
This might not be as tough as it sounds. In the first place the International Formula I rules last year called for a maximum piston displacement on unblown engines of 2½ liters, or 152 cubic inches – and gasoline must be used. At Indianapolis unblown engines may have up to 4.2 liters (255 cubic inches) and may use *any* kind of fuel. You can even use a supercharger on engines up to 171 cubic inches. This leaves all kinds of hop-up possibilities for the little Coventry-Climax engine in the Cooper.

In its present form this four-cylinder engine has a bore of 3.70 inches and a stroke of 3.50, for a total displacement of 151 cubic inches. It was originally designed to drive high-pressure portable fire pumps, but was later beefed up, bored and stroked, and given a new cylinder head with double overhead camshafts to adapt it for racing in British road racing machines. The engine features all aluminum construction, "wet" cylinder sleeves, five beefy main bearings with conventional bolt-on caps, and two large valves operate in hemispherical combustion chambers – with high-dome pistons to give a 12:1 compression ratio. The latest versions are said to give a maximum of 243 hp at 6800 rpm on 100/130 octane aviation gas, using two big twin-throat Weber carburetors. This is equivalent to 1.6 hp per cubic inch – which isn't bad for an unblown engine on gas in anybody's language.

Theoretically, all we would have to do



Centered weight is desirable for left- and right-hand turns of road racing circuits, but increases outside tire wear on Indy oval.



Left turns only, such as found on American racing ovals, favor offset chassis and engine. Weight on wheels is equal in corners.

with the Cooper to match the best lap speeds of American cars would be to hop up this engine to give an equal weight/hp ratio, so the acceleration off the turns would be equal to our American cars. If we asume 400 hp and a total weight of 2000 pounds for a typical American Offy (five pounds per hp), this means a total weight of, say, 1350 pounds in the Cooper would require 270 hp to give equal acceleration. This is not out of reason at all for a good 2½-liter racing engine. The current V-6 Ferrari is said to put out 290 hp at 8300 rpm! The Climax engine probably doesn't have that potential, but John Cooper, owner of the car, said he would bore the block to 165 cubic inches and go to straight methanol (wood alcohol) if he decided to come back to Indianapolis. He estimated these changes would yield about 280 hp. (The effect of alcohol here is to *cool* the fuel/air mixture, contract it – so the cylinders draw in a greater *weight* of fuel on each suction stroke.) With 280 hp available and the right gearing the Cooper should have no trouble accelerating to 165 mph on the main straightaways – and if it can still get through the turns at 138-140 mph – the overall lap average could be anything up to 148 or 149 mph. It might even crack the long-coveted 150-mph barrier.

And that's not all. Remember that the *supercharger* limit is 171 cubic inches. The Cooper people could bore out the engine to 165 cubic inches, use alky fuel – and *still* add a supercharger on top of that. Even a mild pressure boost of 12 or 15 pounds per inch should give at least *450 hp* with a reasonably efficient blower installation. Even if the blower increased car weight 50 or 75 pounds we'd still end up with a lap speed potential well above 150 mph.

In other words, on paper the little Cooper Formula I car stacks up as the fastest combination ever to run on the Indianapolis track. *continued on page 81*

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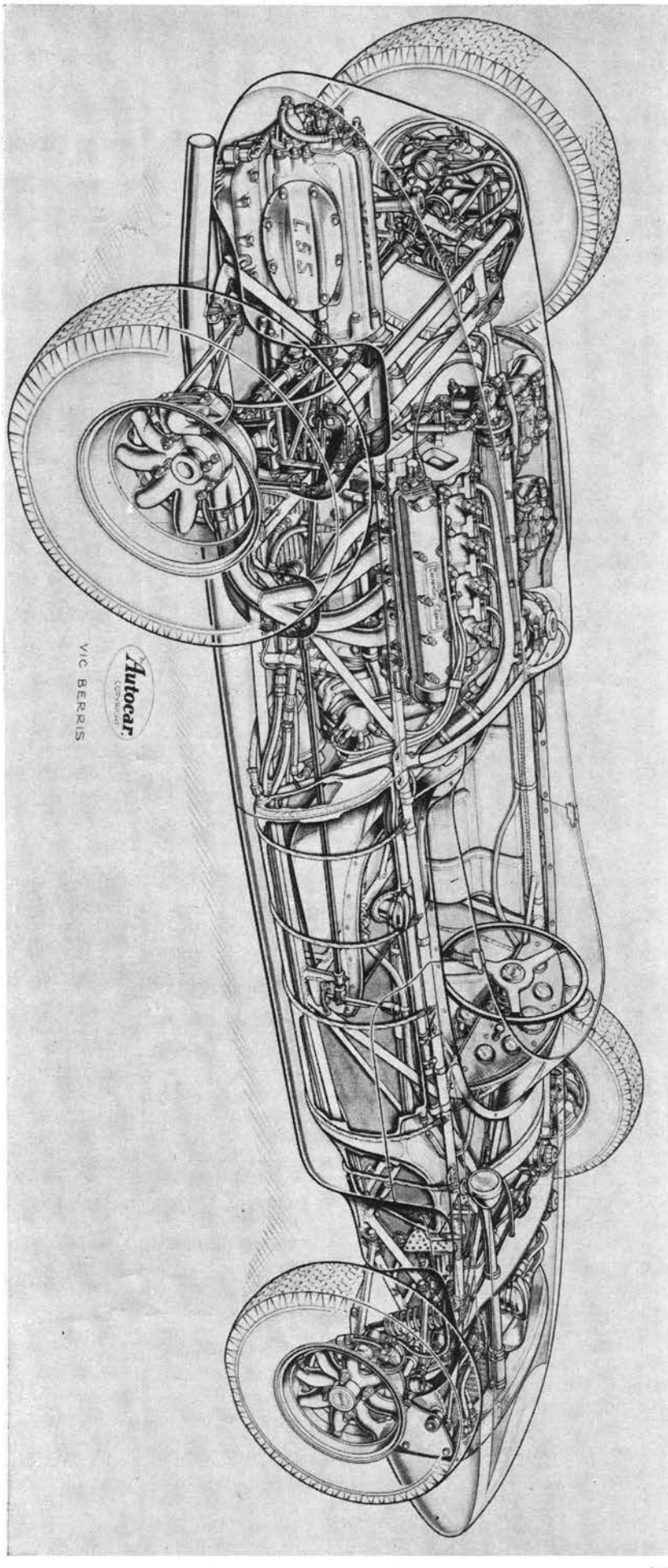

THE COOPER

Extremely light, dohc four-cylinder engine, placed well forward, puts its share of weight on front wheels, has 18-degree tilt to right to keep center of gravity low. Contoured fuel tanks outside main frame tubes extend well forward, maintain a nearly constant front-to-rear weight distribution – whether full or empty. Cockpit location ahead of the linear center, radiator and header tank forward of front suspension, give the Cooper needed front wheel weight. This compensates for rear engine plus the five-speed box extending behind differential and fully independent, splined, U-jointed axles.

Cooper at Indy

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PROBLEMS, PROBLEMS

But could it win a 200-lap, 500-mile race? That's another question. There's much more to it than just getting around the track fast on a four-lap qualifying dash.

The big problem would be tire wear. On his test runs Brabham was using regular Dunlop road racing tires, which are constructed of a relatively soft rubber compound to give maximum bite. He wore out the right front tire in only *eight or 10 laps* at speeds of 143-144 mph. The terrific additional load on the outside wheels in the turns, caused by centrifugal force, chews up tires at a terrific rate – and an increase in turn speed of only four or five mph may *double* tire wear in the turns.

This kind of tire wear would never do in the race. Most Indy mechanics plan race strategy for three tire stops – which means each set has to last about 50 laps. (Actually the first set lasts about 45 laps – then when the track gets well oiled up later in the race the last sets will go 55 or 60 laps.) The Cooper might be able to keep up a good average speed stopping *four* times for tires; but that would be the absolute maximum – and even that would require 40 laps out of each set.

The obvious answer is a harder rubber compound for the Cooper's tires. This would improve wear but it would also reduce the bite, so maybe the car couldn't get through the turns at 140 mph. There's no clear indication that, even with the optimum rubber compound for wear, the car could get 40 or 50 laps out of a set at lap speeds of 142-144 mph. Here's the gimmick: Modern Indianapolis cars are built with the weight offset to the left of the chassis, so they will have anywhere from 55 to 65 per cent of their total weight on the left wheels when standing still or running straight down the track. Then when centrifugal force tilts the body in the turns the load is more or less *evened* on all four wheels; the tire wear is spread more evenly, and the car can go a lot farther on a set. Actually, A. J. Watson's chassis, with the engine upright and drive line set far to the left, is the best layout from this standpoint, putting nearly 65 per cent of the weight on the left side. Some of the "laydown" engine jobs don't get as much weight to the left.

The Cooper doesn't have *any* appreciable left-side weight bias, and it would require major alterations to the chassis to give it some. It's a question of whether the alterations would be practical – and if it *weren't* done, it's a question whether the car could ever be competitive with our Indy machines on this tire wear angle.

Another factor that hurts tire wear is the independent front suspension, one of the things that makes the car so easy to handle. With i. f. s. the outside front wheel tilts outward when the body tilts under centrifugal force, and this tends to increase tire wear. Our Indy cars have straight tubular front axles; the front wheels stay straight up and down regardless of what the body does. When some of our mechanics experimented with i. f. s. a couple of years ago they ran into this very problem.

And there's another big bug. Can the light, flimsy Cooper chassis take the pounding of 200 laps on the bricks? Can the little Climax engine take 500 miles of revving over 6000 rpm? Most foreign racing men have little idea just how rugged this Indy race can be. It literally pounds cars to pieces. It's not unusual at all to have cars finish the race with shock absorber brackets broken off, shocks hanging limp, screws and bolts missing. Undoubtedly the Cooper chassis could be beefed up to stand the gaff – but that would increase weight and reduce acceleration. Also the Cooper people would need to add a roll bar, bumpers and fiberglass fuel tank shield to meet our safety rules – which would add more weight. The minimum wheelbase requirement of 96 inches for Indy cars would undoubtedly be waived in case of a Cooper entry.

So that's the picture right now. Will we see a Cooper entry this year? John Cooper says they're very interested. He realizes the seriousness of these problems of tire wear and chassis strength. He learned a lot in his two days at the brickyard. But there is much speculation that he will bring a couple of cars over this year with no intention of running the race – *but only to break the 150-mph lap speed barrier!* Jim Hurtubise came within a whisker of it last year at 149.60 mph. The Indy boys will be going all out this year. But if Cooper could get to Indy early in May with a hopped-up engine of a solid 280 hp, get some good driver practice in, and then get in the qualifying line-up on the first day . . . who knows?

There are said to be at least two American rear-engine Indy cars under construction for this year's race. And the benefits of light weight are there to see. They say some U.S. racing men have already asked about price and delivery on 2½-liter Climax engines. They not only save 200 pounds in the engine, but the whole chassis can be made lighter to accommodate it. If this catches on we could see Reventlow producing his 2½-liter design for the American market. Then the Offy people would be forced to switch to aluminum . . . and the revolution would be here! •