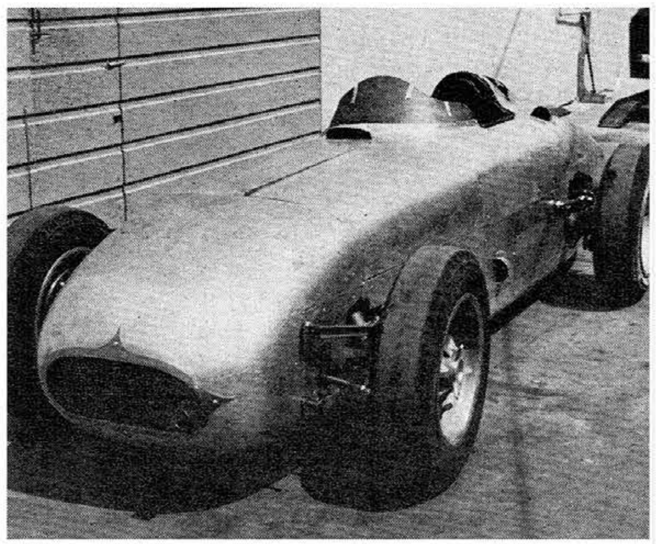
INDIANAPOLIS CHASSIS: 1954

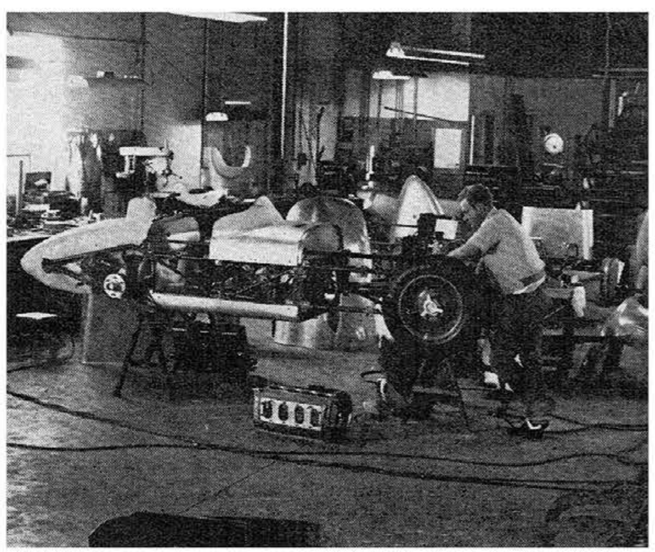
10 top contenders in the Speedway Classic will drive new Kurtis 500-C's. The man who knows them best, the builder of our fastest racing iron, describes the highest refinement of this car to date

BY FRANK KURTIS AS TOLD TO GRIFF BORGESON



Front view of Kurtis car shows change in grille over last year; perforated metal screen replaces "bucktooth bars"

Pre-Indianapolis scene in the Kurtis shops. Car is being prepared for Jack McGrath. The Offie crankcase on floor is merely a dummy which is used for trial installations



THIS YEAR for the first time in Speedway history qualifying speeds of better than 140 mph are almost certain to be achieved by several entries in the 500-mile classic. Only bad weather or the sudden collapse of morale brought about by a bad accident—which we pray won't happen—can keep the 140 mark from being cracked. We have the behind-the-scenes talent, the drivers and the equipment to do the job.

The word equipment covers a multitude of things, each one critically important when the green flag goes down, each one contributing in a big or little way to the steady progress of American professional racing. It covers cotter pins and engines, rubber and fuel. It also covers chassis and bodies, and this is the area of the sport that I know best and in which I try to make some useful contributions each year.

Our shop is building ten cars for the 1954 race, all basically alike. They differ considerably from their direct ancestors, last year's 500-A and 500-B "roadsters," but retain the best qualities of those cars. If you read "Indianapolis Analysis" (HOP UP, September 1953) you probably remember the most important characteristics of these forerunners of our new machines—the low, wide bodies, semi-enclosed cockpits, offset engines and torsion bar suspension with front arms trailing and rear arms leading (parallel-to-frame rear bars in 500-A).

This year's cars have all these basic features, but many important details have been modified. My biggest challenge is to build equipment that is better, safer and faster than what has gone before. I try to be my own most ruthless critic, and each May the Speedway teaches me new lessons. The ones I've learned since last year's "500" are responsible for the 1954 Kurtis 500-C.

Its frame, for example, is very new. Both the 500-A and 500-B frames used a box-section construction built up by spot welding a steel sheet to each hat-section side member, the sheets becoming part of the skin or body. The welds were trouble-free in all the cars at Indy except the one owned by Sandy Belond and driven by Johnny Parsons. One of the spot welds in this car let go during the race and when the show was over we found that vibration had shaken a section about six inches square out of the outer sheet which made up the box. This was a lesson that couldn't be ignored and I went to work designing a better frame.

I decided that while I was at it I would retire the box-section entirely instead of simply using more weld, and work out a design that would be lighter and more accessible as well as more reliable. The result in the 500-C is a truss-type, entirely tubular arrangement based on principles that were well proved in our 3000 Series cars. The structure is as rigid as that of the 500-A and -B but weighs about ten percent less. The main rails both top and bottom are 1.5 inch tubes, and a few of the cross tubes have the same diameter. The rest have .875 inch diameter. All have wall thicknesses of .083 4130 steel.

This was one case where an actual defect triggered the modification, but we're just as sensitive to comment and opinion. There was some talk last year to the effect that the "roadsters" were too wide, and this was enough to make us reexamine the problem of providing space for the driver. Driving on the dirt requires a certain amount of gymnastics at the steering wheel, but at the Speedway it doesn't get turned very far. We found that we could build the frame and body one inch narrower on the driver's side and still leave room for movement of his right elbow; the 500-C is therefore an inch narrower on each side. This helps the appearance of the car and makes for a small reduction in frontal area.

The cockpit is, of course, even snugger than before, but that's the way we have to build it if we're going to keep the driver out of the air stream. One of the big assets of the roadster-type racing car is that the low sitting position makes the driver much less subject to fatigue from the buffeting of the wind. But if you remember last year's race you also remember the heat. In 1953 the Speedway was an oven, and drivers went through hell in all kinds of cockpits. It's hard to say whether the roadsters were better or worse than the machines that exposed half the driver's body to the suffocating, drenching heat. Neither kind helped the drivers much last year. But with the semi-enclosed cockpit it's possible to control ventilation to a much greater extent, and we've given the problem a lot of thought for this year's cars.

We've discovered that however you look at it, it's tricky. If you duct air through the engine compartment you wind up with a heater. We knew this, of course, when we first started the 500 series, and we mounted an air scoop on the cowl which discharged air at ambient temperature around the driver's legs. On all 500 models we duct cooling air past the oil tank on the left-hand side of the cockpit and back to the final drive which in itself generates a lot of heat. In the older versions this caused warm air to become pressurized in the tailpiece and feed back into the cockpit. In the 500-C we've corrected this condition by providing an air-tight bulkhead behind the driver; even the opening for the vertically moving torque tube is sealed by a flexible boot. The 500-C's underpanning is punched with many more louvers than before, and this year they are all inverted to present a flat surface to the air stream and create an "extractor" effect. The firewall is insulated with a heavy Fiberglas blanket which will minimize the effects of engine heat as far as the driver is concerned. The driver's compartment is completely isolated from other parts of the car and ventilated by a constant flow of air at "atmospheric" temperature. The rows of louvers in the driver compartment underpanning are staggered with relation to those in the engine compartment to reduce the possibility that hot engine air will enter the cockpit through them.

There are a few other changes in the 500-C's aluminum skin. Last year some of the drivers at Indy had the impression that the roadsters' front ends had a tendency to lift slightly on the straightaway. We decided that this might have been caused by a small negative pressure area at the rear edge of the nosepiece. Therefore the forward portion of the 500-C has been mildly recontoured to insure positive pressure along the entire upper surface. The grilles have been changed too. In previous cars they were made up of rather widely-spaced vertical bars which proved to be not entirely invulnerable to pieces of tread and burst engines flung through the air by other cars. We've corrected this by adopting a strong but light perforated metal grille. Another detail modification has been our elimination of leather hood-straps, which have been known to elongate and cause vibration during that tough 500 miles. This year the hood is retained by three Dzus fasteners on each side. It takes an instant longer to remove or install

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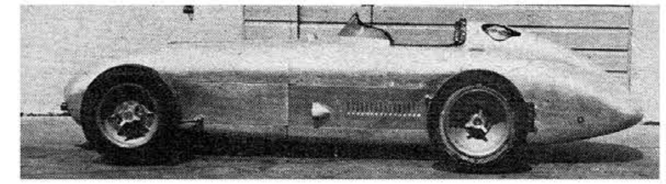
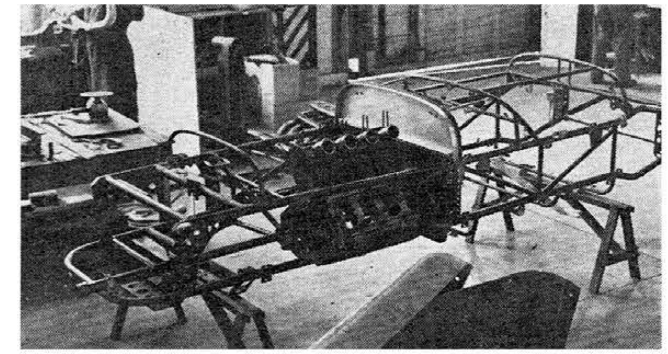
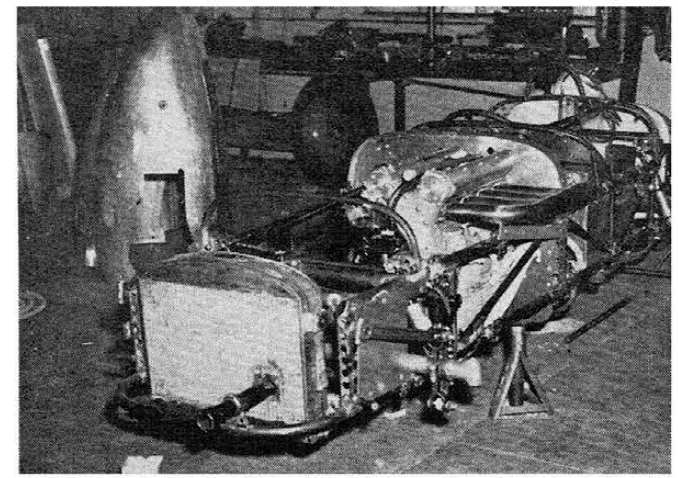


Profile of race car is clean, shows windshield change and relocation of ga: tank filler spout in headrest fairing

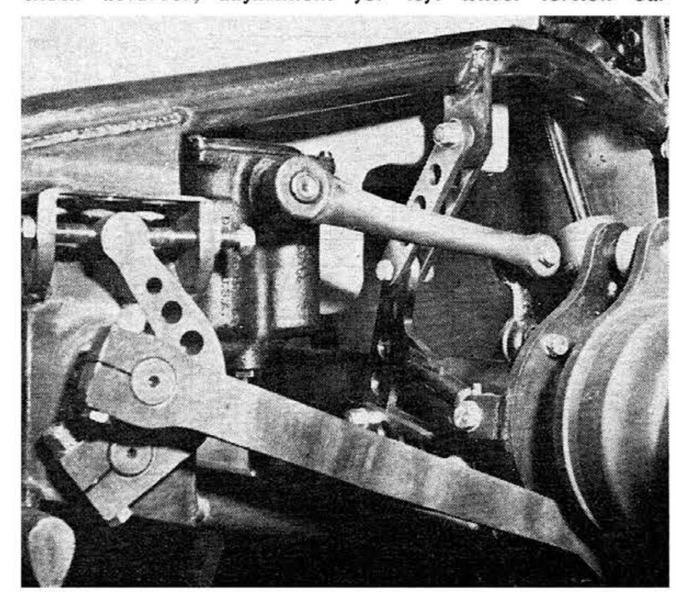


Rugged featherweight; this year's Kurtis 500-C Speedway frame employs truss rather than box section construction. It is about 10 per cent lighter but with same rigidity



500-C chassis with vertically mounted, six-inch offset engine. Four of these are being built. Eight-inch offset is accomplished by inclining engine and is preferred by many owners, six being prepared for Speedway this year

Detail of rear suspension shows "Jacob's ladder" stabilizer linkage, flame-cut rear torsion bar arm, piston-type shock absorber, adjustment for left wheel torsion bar



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the hood but there is no chance that it will come even slightly adrift. The body side panels are now made in wider sections and all of them are removable, making it possible to strip the frame completely in a very few minutes.

While the contours of the tailpiece are generally similar to last year's design, they have been changed in detail, a modification dictated largely by the reduction in the size of our fuel tanks. In '53 there were still a few car owners who insisted on having tanks of 75-gallon capacity, even though the necessity for tire changes rather than for refueling had become the factor governing the frequency of pit stops. Tanks holding no more than 50 gallons should be adequate to racing conditions this year but to play it safe we are providing capacity for 60 gallons. The filler-opening has been moved from its former left-hand position and is now blended into the headrest fairing. We made this change because in the old location fuel was discharged against a step placed in the bottom of the tank to clear the rear-axle center section, and there was some tendency for fuel to blow back during high pressure filling. This can't happen with the new design; now the fuel falls straight to the bottom of the tank.

Structurally the tanks are the same this year as before. They are made of rust-proof lead-zinc plated steel and have a minimum of welded seams. Last year our cars had no tank-seam failures at all, and this, we feel, is due to our methods of mounting and vibration damping. The tank's main support is the rear frame cross member, which runs right through the after portion of the tank and is insulated from it by rubber bushings. A ball-and-socket joint provides the forward support at the centerline. Thus such slight twisting as may occur in the frame can't distort the tank. In 1953 we applied coatings of Fiberglas cloth and synthetic resin to all the roadster tanks as a means of absorbing vibration. There were some cases of separation of the bond between metal and plastic in small areas, and this year we're using a bond which tests have proved to be the last word in presenting a permanent seal.

The 500-C's smaller tank provides more room on the right-hand side of the car than on the left for mounting of our rear suspension stabilizing linkage. A photo shows this linkage in its new location. Its very important function is to permit only up-and-down movement of the rear axle and rule out any sideways motion. It works like a Jacob's-ladder—the lattice-like device on which you may have seen an old-fashioned telephone mounted. One of its pivots is anchored to the axle housing, the other two to the frame. If you wonder why we don't use the more simple solution of a Panhard rod (a trans-

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verse tube with one end attached to the frame and the other attached to the axle), the reason is that this device controls vertical axle movement through an arc, and this would be no answer for us because axle deviations from a strictly vertical path would put a strain on the torque tube. We do use a Panhard rod at the front axle, where the arc travel is not as critical in the rear.

The layout of the torsion bars is the same as last year's. The front bars are mounted transversely but are slightly diagonal to the frame and cross one another. The transverse rear bars are perfectly parallel. The torsion bar arms, which link the bars to the axles, are trailing in front and leading in the rear, meaning that those in the front point aft and those in the rear point forward. The main object of this arrangement is to locate the suspension's pivot points at the frame's four extremities, in the interest of flat riding qualities. The 500-C uses I-section forged torsion arms in front, and rectangular-section, flame-cut arms in the rear end of the car.

This year the roadster's shock absorber specification has been changed to provide a Delco-Lovejoy piston type shock absorber at each wheel in place of the vane type we used previously. This change was dictated by lessons learned with a machine we developed for testing all types of dampers. We found that the vane-type shock lost about 35 percent of its efficiency in the first 15 minutes of heavy-duty operation with our normal pressure settings. The Delco shock, on the other hand, showed no decrease in efficiency at all. The vane type shock has the advantages of easy external adjustment and lighter weight, but these are offset by the superior reliability of the Delco unit. Shock expert Al Swanson has developed his own spring-loaded metering device for converting the Delco-Lovejoys to 50-50 action. He also prepares our Gabriel tubular shocks, one for each wheel. We find that Monroe tubulars are equally effective and the car buyer has his choice of either variety for installation.

Ted Halibrand builds our spot disc brakes, and the 500-C's are identical to last year's. For 1954, however, Halibrand has specified a two-stage master cylinder which is mounted on the right-hand side of the firewall in the engine compartment. It acts as a power-brake unit; the first stage displaces the large volume of fluid required by the big oil cylinders at each wheel, and the second stage has the separate function of pressurizing the fluid. The result is great braking force with short pedal travel.

The greatest single modification in the roadster chassis for 1954 is in the steering system as a whole. This came about because to begin with we were not satisfied with the amount of tooth contact provided by standard worm and wheel steering. I asked Ernie Casale for a solution and he designed a new and larger steering box with dished teeth on the wheel which bear upon a larger radius of the worm. The steering box in previous versions was mounted forward on the frame, but now we moved it and the pitman arm into the driver's compartment. More radical changes followed.

With the new arrangement a long drag link runs forward from the pitman arm just under the hood, to connect with a horizontal bell crank. The pitman arm and bell crank arm each have three mounting holes for the drag link so that an unusually broad range of steering ratios is easily available. Incidentally, driver preferences in steering ratios range from very fast to very slow, at Indianapolis.

The horizontal bell crank arm is mounted on a vertical shaft which terminates in a T-arm located slightly above and forward of the front axle. The branches of the T are mounting points for two tie rods, each about one-half the length of the older single tie rod, which joined the trailing steering arms behind the front axle. The 500-C's steering arms are leading, meaning that the tie rods move through a much smaller vertical arc than before. They are much shorter than the old single rod and vibrate much less. The T-arm is designed so that during the steering's movement from lock to lock the inner ends of the two tie rods overlap and the effective overall distance between steering arm pivots varies to give each front wheel its own distinct and correct angle when cornering. We've eliminated the two universal joints that were necessary in the older system. The new system is stronger and safer and demands less driver effort.

There has been a lot of discussion in the recent past on the subject of canopies and fully-enclosed cockpits. This year, like last year, the Belond-Parsons 500-B may experiment with a canopy during practice and qualifying. But although we expect a fairly wide use of canopies by European cars in some of the Grand Prix races this year the short chutes at the Speedway give us small incentive to experiment in that direction. The Alfieri Maserati firm in Modena, Italy, has been very generous with its solution to the problem of keeping canopy windscreens free of dirt and oil, and we may see their construction adapted to the Belond car.

Our equipment for America's greatest race in '54 is not revolutionary. It is, rather, a carefully calculated refinement of several years' design and racing experience. It is substantially different from all that has gone before. How much better it is you and I will learn on the afternoon of Memorial Day.