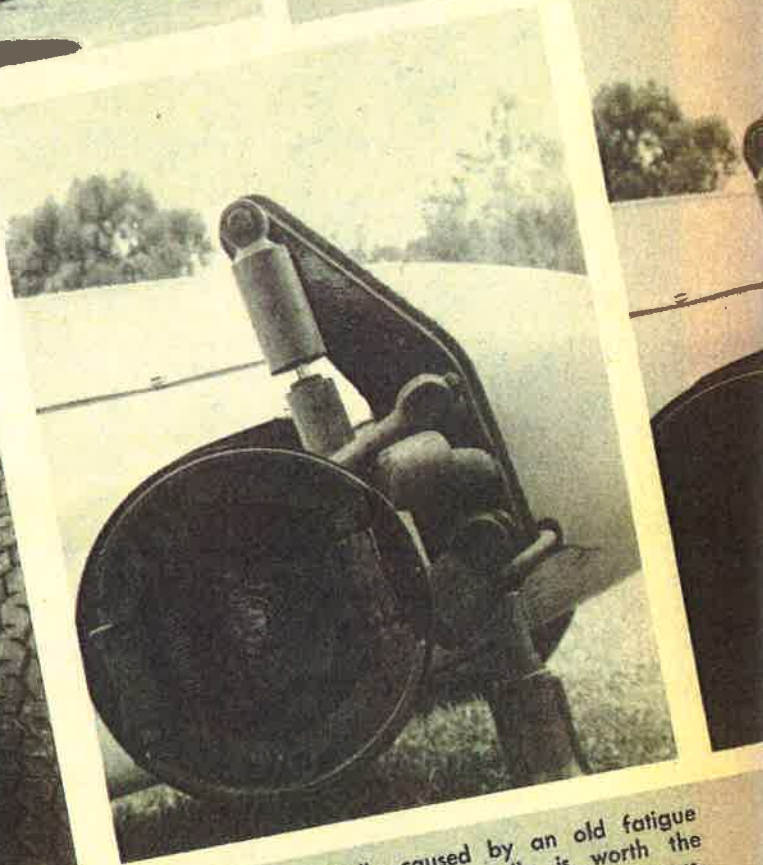


Several minor modifications made this completely SCCA-legal Formcar handle well enough to take the 1965 South East National Championship. Cornering flat-out at Bainbridge, Georgia in the race that clinched the title, note vertical front wheels and oversize rear tires.

SECRETS OF A FAST



To adjust front Koni shocks, remove top bolt, compress shock by hand to the bottom and turn it. Note rubber suspension stop under upper trailing arm (arrow) and stock VW anti-sway bar (double arrow). These are the minor, completely legal front suspension gimmicks that keep those wheels vertical under stress.



A broken front spindle caused by an old fatigue crack (magnafluxing spindles really is worth the trouble and expense) made it easy to show front suspension caster. The whole unit is installed on the Vee frame leaning back a bit so the lower torsion bar tube is half an inch ahead of the upper one.

FORMULA VEE

By WHIT THARIN

BEATING A SLOWER CAR DOESN'T COUNT FOR AS MUCH AS BEATING AND EQUAL OR BETTER ONE—AT LEAST WITH THIS CHAMPION—HERE'S HOW HE SETS UP HIS WINNING FORMCAR'S HANDLING FOR LOWEST LAP TIMES

▶ "You can't tell me that guy is running a stock Volkswagen engine. He just turned a lap at 1:31 on a two-mile course. I remember three years ago that even a Formula Jr. with twice the horsepower couldn't turn it that fast. Just who do these Vee drivers think they're kidding? Not me!"

The speaker was a knowledgeable fan of sports car racing, but he couldn't have been more wrong. I know because that guy was me in my 1965 SE National Championship car. And since then Bill Campbell has set a Vee lap record of 1:29.6 at this course, which is one second faster than the Formula Jr. record. The engine of my car was lifted from a wrecked '65 VW Sedan and straightway bolted into the old Formcar. There had been no balancing, no polishing, and no flywheel chopping. All of these could have been done legally. The carburetor and distributor had been swapped for older models and the engine then tuned on a dynameter. It couldn't have been more stock. So how did it go so fast with 40 horse-

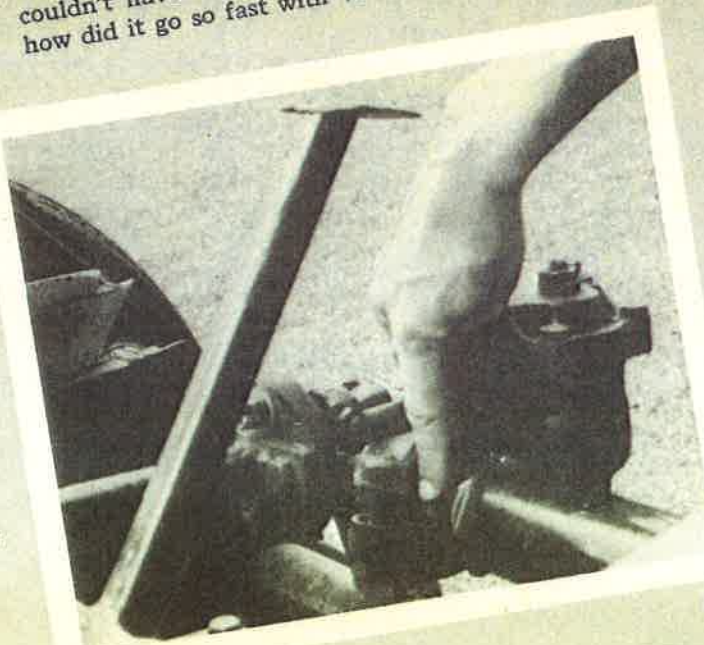
power? Well, let's take a look at the entire car.

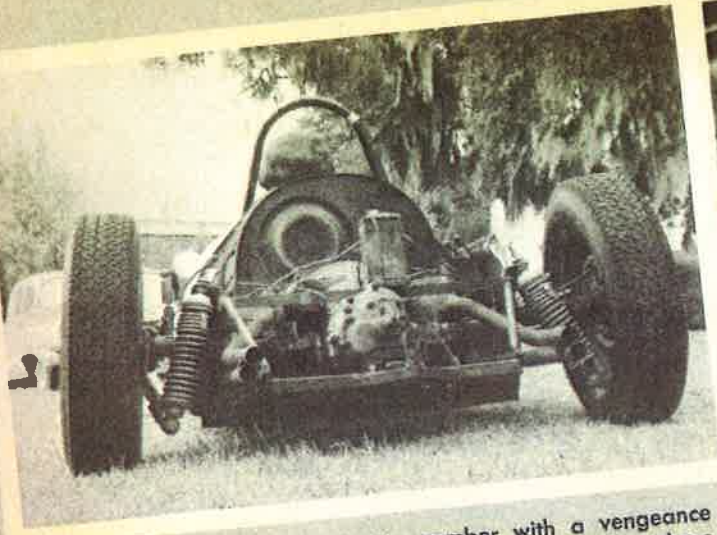
There are undoubtedly many tricks, methods, and theories which are as good as or better than mine, but those I shall describe have served to make my early Formcar a front runner for four seasons. I have not used all of these items for all of that time since many were developed or borrowed as the various problems they solve came up. Indeed, if any Vee had been so set up in the beginning, it would have easily won any event entered in 1963 or '64 and most of '65. Lap times (including a few records) set in 1964 were lowered 4 to 6 seconds by this same car in early '65 and it was 2 to 3 seconds faster than that by the end of the season. The point? Formula Vee is not a stagnant class, as some have maintained. Constant improvement of both car and driver is necessary if you mean to be a front runner. No one knows yet what will be the ultimate set-up, because better combinations are continually being developed.



ABOVE: Level shows caster angle. Brakes are stock VW with stock linings. Jack comes under stock front anti-sway bar mounting. Note how fiber glass is cut away to make room for sway bar.

RIGHT: Steering box is mounted on front frame member and located by keeper bar (finger) and clamped in place. You can't see the pitman arm which comes out the under side of the steering box in front of the front frame.





ABOVE: Rear wheels have negative camber with a vengeance which is accurately and easily adjusted by the radiator hose clamps compressing the top five coils of the rear springs. The tires are Goodyear R-2s. This much negative camber cuts tire life, but who cares if it handles really well.

RIGHT: In addition to hose clamp on spring coils, note camber limiting steel cable indicated by spread fingers. This cable keeps the rear wheels from tucking under in a hard turn and is an important safety feature that should be on all Formula Vee racers, and it wouldn't hurt stock VW sedans either.



SECRETS OF A FAST

The suspension is probably the most important single aspect of preparing a good Formula Vee. If you can't get it around a corner, no amount of engine work (legal type) will win a race. No matter how well you drive, neither you nor Stirling Moss can take it around a corner any faster than the limit of adhesion, and that limit is inherent in the suspension set-up. So let's look at it.

All standard Formula Vee kits now being sold are vastly improved over the early models of the first three kit makers, but all can be further improved by the individual driver to suit his own style. He must experiment and seek a set-up that works for him, and responds to his particular instincts and reactions. The car can be set up for oversteer, understeer, neutral, or a modicum of all three under varying conditions.

In arriving at my suspension set-up, the primary goal was maximum speed in moderate to high speed corners. This is easiest to achieve by avoiding oversteer, or rear wheel breakaway. Hanging the rear end out is a lot of fun, but it is a very momentum robbing method of getting a car around a corner. I don't object to all four wheels sliding a

bit, but a hung out rear end will be slower anytime you are past the apex of a corner. On the other hand, the car should not be so addicted to "rails" that it can't be easily controlled in a slide, or even "pitched" into a corner occasionally. It is rare that the ideal line can be followed in every corner, every lap of a race. So the ability of the suspension to keep you in command on less than ideal lines, and when dicing or dodging, is tremendously important.

My secondary goal in my suspension set-up was to compensate for my own driving inadequacies. Therefore, some of my net effect may be wasted on consistent, alert drivers who seldom make mistakes that must be corrected in the vicinity of the apex after late-braking somebody at nine-and-a-half tenths of maximum possible speed. In short, I believe my suspension to be spin-proof in the hands of any driver with average reactions and anything other than lead in his seat. Much of what is in my old Formcar applies to most Vees.

The front end is from a 1962 sedan. I removed the top torsion bar and replaced it with the standard Formcar swaybar, and I left the

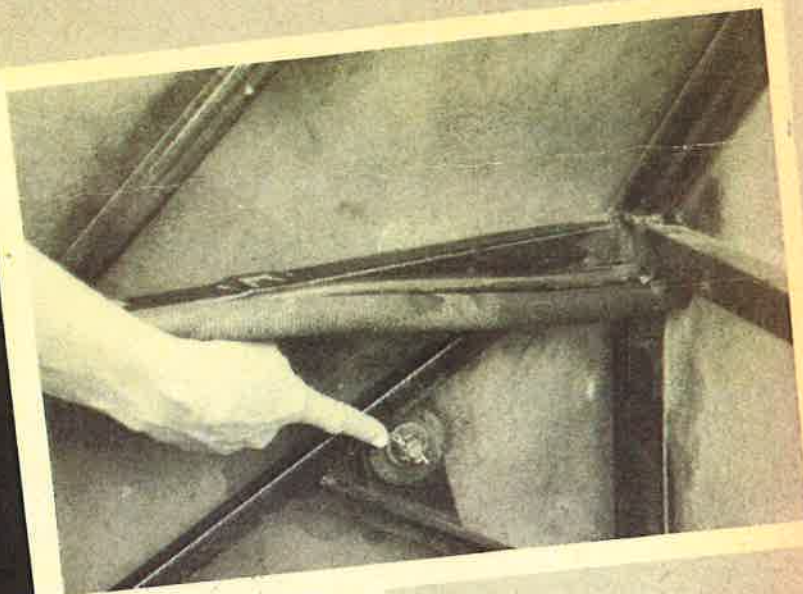
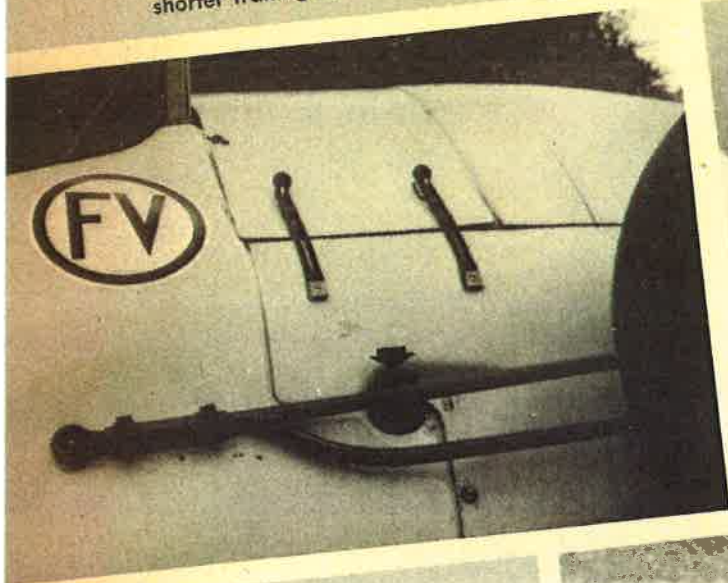
standard VW sway-bar on it, too. The shocks are adjustable Koni's from a wrecked '63 Porsche, set about one turn from full soft, but I regard them as important only for their adjustability. I set them softer for courses with rough corners and harder for smooth corners.

The whole front end is mounted so that the lower tube is about half an inch ahead of the upper tube. This is to get the caster, which does two things—it reduces wander on the straights and makes the tires lean in at the top when they are turned in a corner. Set properly, the lean-in will just compensate for front end give or yield, and result in a vertical wheel. This places the tire in good, flat contact with the road surface under hard cornering.

Since VW has both roller and ball bearings for the front wheels, you may choose either. I use ball bearings for reduced friction and use a light bearing grease such as a Bosche, Coppercoat, or some moly-grease. I adjust and pack them for each race. Front wheel brakes are completely standard VW, 1962.

One important item often overlooked is the location of the pitman arm. The steering box should be rotated on the torsion bar tube so

BELOW: Extra long trailing arms help keep rear suspension in line. Note hole (arrow) for original, shorter trailing arm.



ABOVE: New trailing arm mounting point was welded into the basic frame structure of the car. (finger). Hose above hand carries all wires from dash to engine compartment, smaller tube is reinforced neoprene fuel line.

FORMULA VEE

that the tie rods are level with the ground. When you have done this, set the toe-in at about one quarter of an inch. The movement of the front end when loaded will be mostly down and will only decrease the toe-in. This won't hurt you as long as it doesn't go to toe-out. The object of this is to insure toe-in under all cornering conditions. A brief spate of toe-out can be very worrisome, indeed. When the steering box is properly located, a keeper bar should be welded to the tube.

The rear suspension has two main features—a lot of easily adjusted negative camber and extra-long trailing arms. There are other minor items, but let's look at the two main ones first.

I run what appears to most people to be an excessive amount of negative camber. True, it saps power at the universals, but it works in the corners. For old Formcars and any others using large coil springs, the adjustment feature can be added in five minutes. Four worm gear hose clamps, two on opposite sides of each spring, are attached so that the top 5 coils are drawn together. This yields an easy and infinite adjustment of camber. You can tune the suspension for every course with



LEFT: Tiny motorcycle battery helps shed some of the about 50-pounds excess weight of early Formcars. It will start a hot engine but needs a booster when cold. Rear mounting helps balance.

just a screwdriver. You can even set either wheel for more or less camber in courses where the tough turns are predominately left or right. Most new kits have built-in camber adjustment, but few give you enough, even at maximum settings.

My trailing arms are 32 inches long now, but the originals were less than 20 inches. I believe that any trailing arm less than 26 inches can be improved by lengthening it. How you do it depends on what kit you have. I made new arms from Schedule 80, 3/8-inch, seamless black pipe and used 1953 Ford tie rod ends with a counter-threaded, female adjusting sleeve. The tie rod ends bolt through a hole cut in the fiberglass to new mounting points on the frame, right in the cockpit.

I am still using the original equipment type of coil-shock unit (Monroe LL 56), but sure do wish the shocks were adjustable. I would like to be able to progressively compensate for wear since the shocks are excellent for only two or three races, after which they get weaker and worse. I try to get 8 to 10 races out of them because I simply can't afford \$42 every other race for new ones. In fairness to Monroe, it must be stated that I tow on an unsprung trailer, letting the Vee ride on its own suspension. That shortens the life of the shocks.

Among the miscellaneous items are camber limiting straps. Other drivers have devised ingenious systems of cables and pulleys that re-

(Continued on Page 61)

spread out all over your work bench (mine is an older door laid on saw horses and a \$3 dining room side-board picked up at a second-hand furniture store). If the part is vital to the car's operation, you'll get it back together quickly, but if it is not, you may tend to get sidetracked. Left over and used parts have a way of collecting on, under, and around a work bench if you don't store each one in its own proper place or throw out the really worthless ones when you finish working with them. Pretty soon, you'll find that you can't work for extraneous stuff in the way.

And the solution is the same as the one to the problem of doing good work on your car—neatness. A Saturday afternoon spent in sweeping out your garage, discarding really useless junk, and sorting your used parts collection will pay off almost immediately—perhaps in cold cash. My solution to the parts storage problem is simply to hang most of them on the wall. Nails driven only part way home make fine, inexpensive hooks. And a heater, an intake manifold, clutch disk, or other mechanical part can hang where you can see them and find them. Then, if you need a part, you can find it without having to root through piles of junk. Also, it won't get broken or ruined, rusted shut, or more likely just plain lost. What's more, you'll know what you have so you can trade it or perhaps even sell it.

About twice a year, no matter how careful I think I'm being, my garage gets to the point where the car will hardly fit in it. Then it's time to move my son's wagon and make a place for everything, put the screens or storm windows up where they belong, and generally give the place a scorched earth treatment. The results almost always amaze me because I find so much room I'd forgotten existed, and I turn up all sorts of parts which I'd feared were gone forever.

One thing that any dyed-in-the-wool car tinkerer really needs is a collection of used spare parts. If yours is an older model car, the way to get them is to beg, buy, or otherwise acquire a dead car of the same vintage. This can then be stripped and will supply major units like a transmission at a great saving over buying a new one or even getting

one from a junk yard. But even more important, the dead car will keep you in minor items which add up fast. Things like electrical connectors, a dimmer switch, speedometer head, bumper guard, you name it. Not only will you save money, you'll have the part right on hand. You'll also find spare wheels, tires, and various engine parts.

If you don't have room for a dead car, perhaps you can arrange to strip one for parts which you can then store more easily. Having the parts makes it possible to work the great exchange game. Say you suspect that your car will soon need a valve job. If you can scare up a cylinder head (or heads), you can take your time doing part of the work yourself and hiring the rest of it done at your leisure. Then when the time comes, you can simply swap the cylinder heads which can be done on most cars on a single Saturday. If you have to remove the head, grind or replace the valves, and replace it, this usually comes to more than a one-day job.

These are some machine shops which have parts collections and will work an exchange deal with you. You simply pay a core charge and promise to return your rebuildable parts to them after you make the exchange. Doing it this way, you can often save considerable money over hiring the whole job done, and yet not have to have a complete garage yourself.

But whether the work you plan for your back road bomber is a simple grease job or a major engine overhaul, neatness counts in both your shop and the work you do on the car itself. ●

FAST VEE SECRETS

(Continued from Page 29)

sult in an interaction of forces between the rear wheels. With my setup, I don't need that, but for safety's sake I do have individual cables. These cables limit downward travel to 0° camber and are purely to keep the wheels from folding under in case of a spin-out.

Tires are another very important factor in any car's handling. You simply cannot be competitive on street tires, even very good ones. Racing rubber is required. I have used Goodyears R-2's since they

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61

were first available, and will go to whatever new ones they produce. Tire pressures are critical on R-2's. I have seen a small change make a big difference. The final pressure selected will depend on many things, as everybody knows, but mine vary from 20 to 27 on the front and from 24 to 32 on the rear. I usually begin practice with 27 front and 32 rear and reduce in two pound increments until it gets worse. Then I add air back to the last good pressure and reduce again in one pound shots. If it rains, I add 12 to 15 psi, depending on how high the pressures were on the dry course. Suspension adjustments are made in about the same manner.

The place to do all of this suspension and tire adjusting for the first time is at a Driver's School or with private time on a course. Don't go sauntering off to a National Race with a screwdriver in one hand and a tire gauge in the other. Once it is set, the variations from course to course are relatively small if you keep good records. Then when the big races come around, there is ample practice time to work them down to a fine point. And that is what *must* be done if you want to be a winner.

Tire sizes are dictated by the length of the straights. In general, I run as small a tire as possible on the front and as large as I can pull

on the back. This usually means, for me, 4.50-15's on the front and either 5.00-15's or 5.50-15's on the rear. I run a stock 1962 sedan trans-axle and have never changed a gear in it. Tire size is my only gear change. My car has never been able to satisfactorily pull a 5.90 or 6.00-15, but if it could, I would probably go up to 5.00-15's on the front. I know a lot of experts disagree with this theory but none of them can out-corner my Vee on standard VW wheels.

As you can easily see, there are a myriad of minor items that go to make up a top-notch Vee. Not the least of these is engine preparation, and I don't mean to imply that any old mill will do the job. It must be finely tuned and in fresh condition with no flaws in its innards. But given such an engine, the suspension is by far the most important factor. And running a close second is the driver. He must be swift, smooth and smart, but most of all determined to win. He must force himself and his car to the absolute limit in every corner, every lap, and do it without making any serious mistakes.

From this combination—suspension, driver, and engine—come the champions in Formula Vee. If you think you would like to know more about it and how to get started, write to Formula Vee International, Box 291-F, Ephrata, Washington, 98823. Ask for the free booklet that tells all about Vees.

BITS & PIECES

(Continued from Page 6)

and the car rolled. The driver was thrown in a soft ditch and not even knocked unconscious. My nephew remained in the car and was, of course, killed.

Sure he was right in having his belt fastened but I think he was wrong in riding in such a stupid car. I think topless cars should be outlawed immediately, including the one on the cover of your January issue.

Also I think that magazines like yours should stop printing pictures of convertibles, in advertisements or otherwise, and avoid mentioning them except in editorials against them.

I wrote to Dr. Paul Gikas about

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