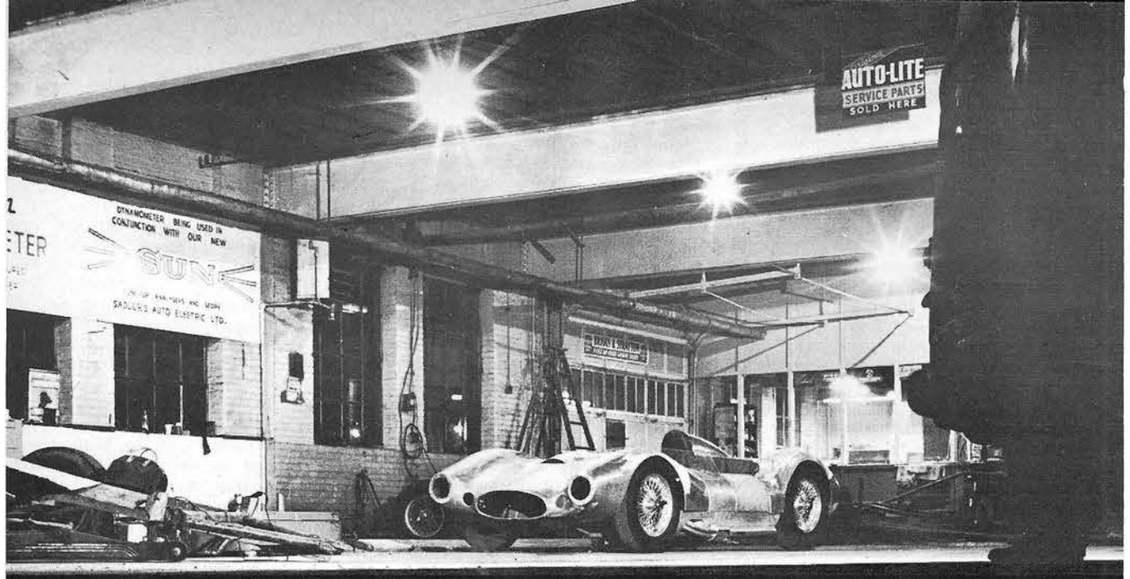


SCI **TECHNICAL REPORT**

Built to order as the Nisonger KLG Special,

the Sadler mk 3

will out-dig, out-stop and out-corner anything from Hollywood to Modena. Soon we'll know if it can out-race them, too.

by Stephen F. Wilder

MANY A special builder dreams of someday becoming a bona-fide producer of sports cars for sale, but precious few ever get close. A brilliant exception, Bill Sadler of St. Catherines, Ontario bids fair to become Canada's answer to England's Colin Chapman.

Bill's attitude toward his interest is best described by the rather solemn phrase, "total involvement." In 1953 when he and Anne were married, his hobbies were photography and "ham" radio and there were cameras, antennae, developing tanks, enlargers, transmitters and receivers all over the place. On their honeymoon to England, they bought a green MG TD. And as sure as acorns become giant oaks, after they got back home, Bill ran it in a race near Ottawa. When he discovered he'd worn out a full set of tires in one event, he realized that even his job as a guided missile technician didn't pay well enough to support this activity.

The MG was followed by a Singer and then by a Q-ship-like Hillman Minx. Bill had shoe-horned a Ford V8-60 into it! But they were none of them fast enough or cheap enough for Bill to be happy with so in 1954 he started on what would later be known as the Jowett version of the Sadler Mk I.

Total involvement means that in the fall of 1956 he and Anne and their two daughters upped stakes and moved to England where he worked for John Tojeiro as a designer. Like coals to Newcastle, he took his Mark 2 with him and in the following year, living in and out-of a converted English van, they took in as many English race meetings as they could manage. Home again a year later, he convinced his mother and father to stake him while he endeavored to establish himself as a constructor of sports cars. His parents own and operate Sadler Auto Electric, a highly prosperous firm, and perhaps it's not accurate to say that he started from scratch. They gave him free access to the firm's well-equipped shop plus the exclusive use of the basement in which he started construction of a production prototype early in 1958. When you realize that a truck-size Clayton Dynamomotor is one of the items of equipment, you'll appreciate that this is sort of a back country version of GM's Tech Center, and just about an ideal place to build a special.

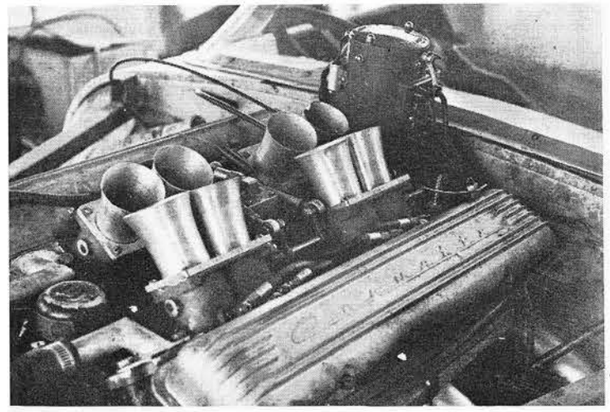
A year and a month ago in SCI, we chronicled Bill's series of specials. They were a varied lot, three engines having dwelt in the first chassis, the last of which graduated to his second one to become the subject of Clarence La Tourett's detailed cutaway before being clothed in a new aluminum body. This Mark 2 car was campaigned on an extremely limited budget with considerable success. But the car was also built on a budget, using lots of second-hand parts, and it kept coming apart just as it would really get going. Probably its biggest moment was at the '58 Montgomery SCCA Nationals, where Bill pushed it in front of *both* Scarabs and *both* Lister-Jaguars. But it was only a moment, because one of the universal joints in the rear axle gave up.

This meteoric performance, together with a solid win at the Watkins Glen Classic, was enough to catch both the eye and the enthusiasm of Earl Nisonger, president of one of the oldest firms in the imported automotive business. His first step was to have Sadler replace all the running gear on the Mark 2 with new parts, brand new. His next was to put Bob Said in the driver's seat and have him race it in the then-embryonic USAC road-racing program. Undaunted by a relentless run of ill-fortune, Nisonger then commissioned the crew-cut, 27-year old Canadian to build a completely new car. With two seasons' worth of lessons run past its wheels, one in England where Bill worked for John Tojeiro, original designer of the Ace-Bristol, followed by one in Canada and the Northeastern States, this meant a lot of changes.

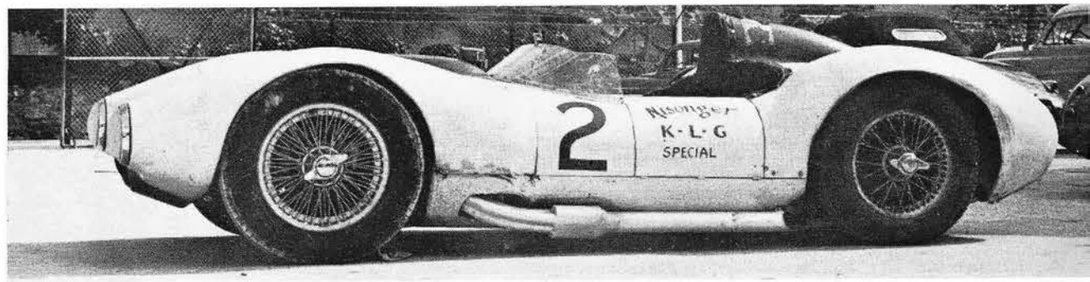
In fact, the Mark 3 is a completely new car, but its heritage is evident from the needle-nosed fenders to the Sadler-designed swing axles at the rear. Differences abound, too. The simplicity of the ladder-like, large-tube frame of the Mk 2 has been abandoned for the lightness and convenience of a space frame built solely of square section, seamless tubing, .049 inches thick. This chrome-moly tubing varies in section from ¾ to 1⅛, but no matter what the size, the ever-present flat sides thoroughly simplify the shaping of joints and the provision of brackets. All welds were made with mild steel rod. It's nearly a pure space frame, i.e., a welded replica of a pin-jointed truss with no bending loads at the connections, but more important, as Bill says, "It does its job."

Its job is to hold the working parts of the car together with the least fuss and bother. Given a sufficiency of rigidity, all one can ask of a frame is that it lose weight — and not break. One of the best ways to keep a frame light in spite of its heavy loads is to keep the upper and lower frame rails well separated. Sadler has done this to such an extent that at the front, upper ones are on the same level as the valve covers while the lower ones, 15-inches below, are flush with the bottom of the special twelve-quart sump. Depth is drastically reduced to ten inches at the cockpit sides to combine the legal-size doors and a satisfactorily low cockpit edge with the lowest seating position this side of a toboggan chute. Behind the seats, the upper rails flare upward over the axle shafts with inches to spare so that the coil springs can be attached directly to the frame. An adjacent upright and a truss-like diagonal from the lower rail ensure that spring and shock absorber loads are well distributed into the frame, while a subsidiary framework to the rear serves several minor functions. Outboard it holds the pivots for the body's tail section, inboard it carries the minimal Lucas battery as far aft as possible. Across the entire width

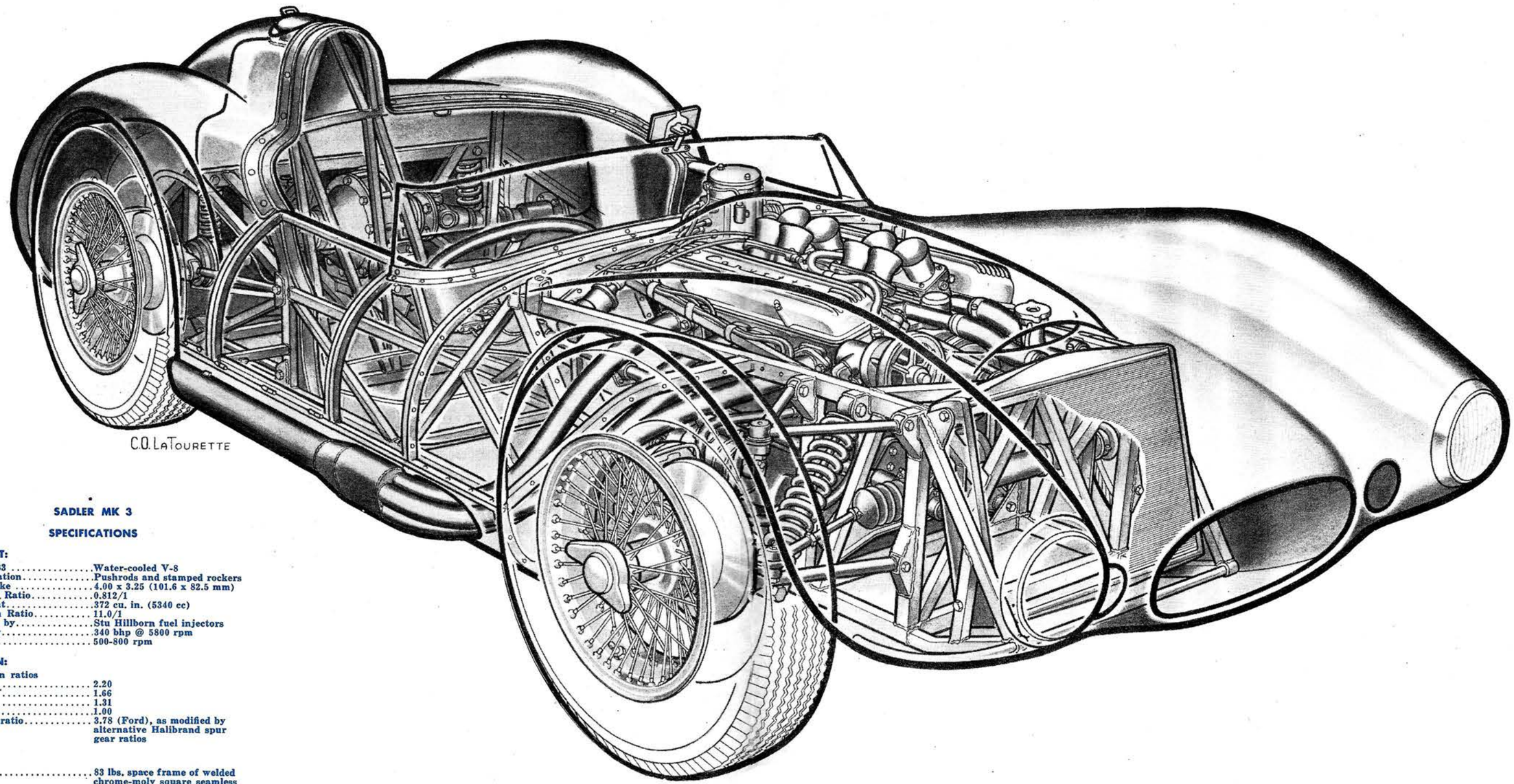
Ram-tubes highlight the slanted entry to Stu Hilborn's newest injection set-up for Chev V8s. The towering Spalding distributor required a hole in the hood, so it will soon be moved to the front of the engine, where it will be driven off the crankshaft nose.



Bill Sadler, a 27-year old Canadian, has designed an answer to Ferraris and Scarabs. Reproductions soon to be available to enthusiast market.



Windshield on Mk 3 is even with Mk 2's hood. Driver's eyes are about level with fender crowns.



SADLER MK 3

SPECIFICATIONS

POWER UNIT:

Chevrolet 283	Water-cooled V-8
Valve Operation	Pushrods and stamped rockers
Bore & Stroke	4.00 x 3.25 (101.6 x 82.5 mm)
Stroke/Bore Ratio	0.812/1
Displacement	372 cu. in. (5340 cc)
Compression Ratio	11.0/1
Carburetion by	Stu Hillborn fuel injectors
Max. Power	340 bhp @ 5800 rpm
Idle Speed	500-800 rpm

DRIVE TRAIN:

Transmission ratios	
I	2.20
II	1.66
III	1.31
IV	1.00
Final drive ratio	3.78 (Ford), as modified by alternative Halibrand spur gear ratios

CHASSIS:

Frame	83 lbs. space frame of welded chrome-moly square seamless tubing
Wheelbase	86 in.
Tread, front and rear	53½, 51 in.
Front Suspension	Coil and nearly equal wishbones
Rear Suspension	Low pivot point swing axle, fully articulated drive shafts
Shock absorbers	Koni adjustable telescopic inside the coil springs
Steering type	Morris Minor rack and pinion
Steering wheel turns L to L	2½ (being changed to 1¾)
Brakes	Girling discs, A (11 in.) front, B (10½ in.) rear
Tire size	5.50 x 16 front, 7.00 x 16 rear
Rim size	4.5 x 16 front, 5.5 x 16 rear

GENERAL:

Weight, curb, as computed by weighing all parts	1650 lbs.
Weight distribution, F/R as tested	
Fuel capacity	47½ U.S. gallons

RATING FACTORS:

Specific Power Output	1.04 bhp/cu. in.
Power to Curb Weight Ratio	4.9 lbs./hp.

runs a bumper-like cross piece which should protect the Halibrand quick-change center section from brakeless competitors. Total frame weight, including brackets, is only 83-lbs.

From the front cross-member to the next to last one, the bottom of the frame is only a belly pan's thickness away from being the bottom of the car . . . which is just 4½ inches from the ground. The latter proved to be insufficient when Bob Said burst a tire against a runway marker light at Nassau and the Mark 3 sat down on its frame and slid. Static flat tire ground clearance is about half-an-inch, but dynamically, it went negative for long enough to grind some essentials away.

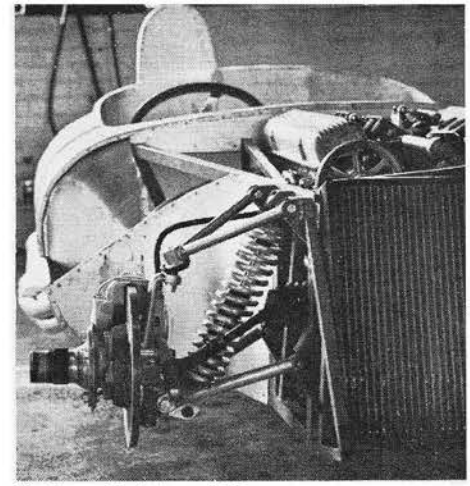
Back in the days when Bill was just another special-builder, one of his guiding principles was, sensibly, "What can I get for cheap?" Availability of components affected layouts, a noteworthy example being the second-hand ENV pre-selector gearbox. Obtained on an even swap against a well-used TR engine, it was a natural for the rearward location adjacent to a frame-mounted final drive center section.

But now, with Nisonger's backing, Bill is aiming at more than "just" a race-winning car, he wants to build saleable cars. Not only are junkie parts out of the picture, but so are unusual, hard-to-get items like that gearbox. Nothing could be more natural than to use the fully synchronized Chevrolet four-speed gearbox and, since the shoe fits, why not bolt it onto the bell housing?

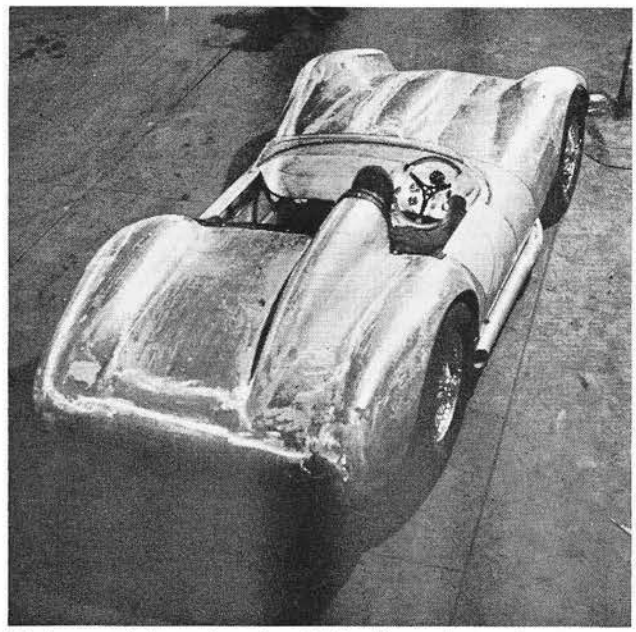
The engine is but of course a Chevrolet. If any engine will steal the title ubiquitous from the Coventry Climax fire pumper, it's surely this Detroit barge pusher. Though Bill has experimented considerably with power plants himself (his raucous fuel-injected TR will be long remembered), he felt that ample power for road racing with equal portions of reliability was available in the bolt-on equipment field.

Stu Hilborn's latest angled-port fuel injection unit provides the mix. The olive in this Chevy cocktail is an air-cooled Spalding distributor. It gives a hot spark alright, but

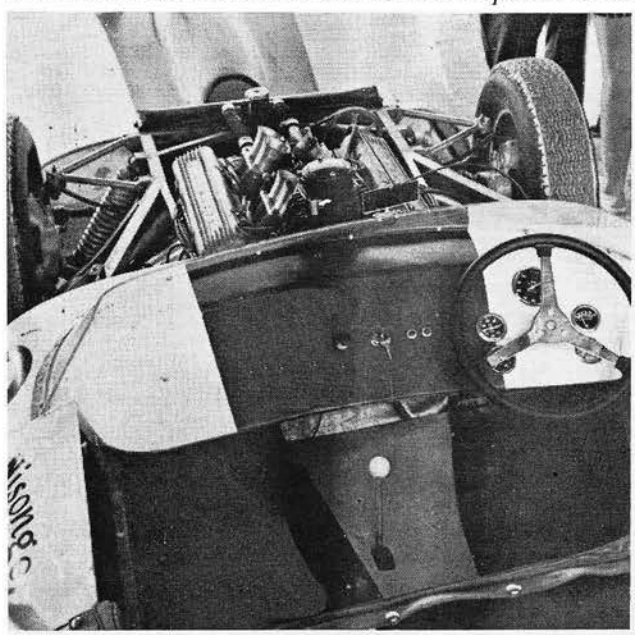
Fred Davies, Bill's right-hand man in the construction of the new Mark 3, helped him build it in only eight weeks.



Outboard of the wishbones, front end is stock Triumph. Special tubular wishbones locate, Morris rack, pinion steer.



Trying cockpit on for size, Bill indicates better leverage achieved by nearly horizontal steering wheel. Transmission and central part of space frame are neatly covered by sheet aluminum shroud which was installed with explosive rivets.

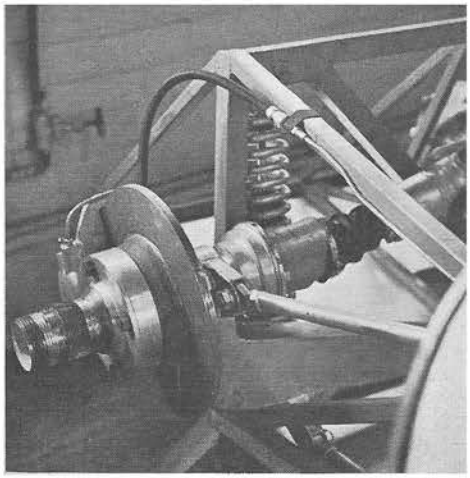


the reason for air cooling is that its coaxial rotors are stacked vertically, making the whole unit a good bit taller than the hood line. They're much like magneto collector rings. Since it's right in front of the windshield, and aerodynamics aren't considered too important on America's sprint-like courses, well, it just sticks up there in front of Bob Said and everybody. Bill discovered last year that as far as class wins are concerned, it's better to enlarge the 283 cu. in. (4640 cc) enough to get over the five-litre mark. This time he went way out. The bore and stroke are now 4.00 and 3.25, 1/8 and 1/4 over stock dimensions respectively, making the displacement equal to an impressive 327 cubic inches (5340 cc). At 5800 revs, output is estimated at some 340 horsepower.

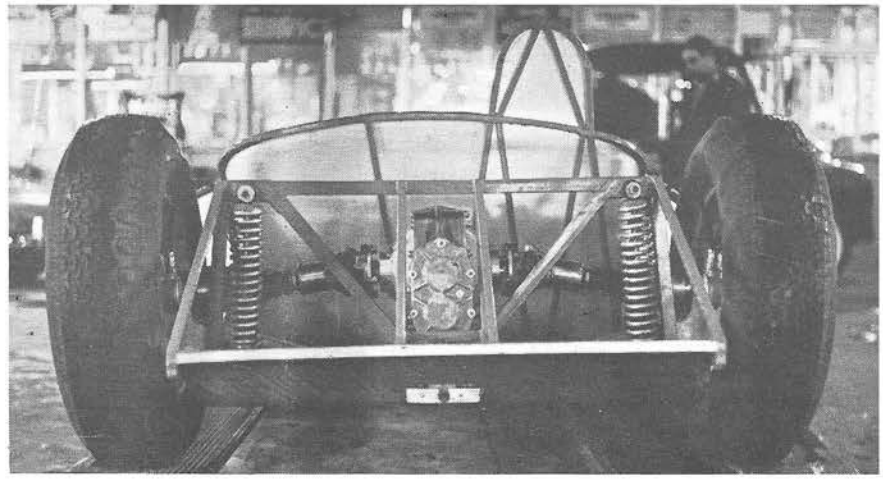
At the heart of this engine is a Racer Brown "Super-Torque #2" camshaft, identical to the one chosen by Warren Olson for the Scarab's assault on Nassau. Short, bell-mouth ram tubes admit fresh air, while burnt gasses are expelled through carefully shaped exhaust pipes of 1 5/8-inch diameter. The four separate pipes sweep close together as they pass behind the wheel well. Just after they emerge through the body itself, they enter a six-inch long pseudo-muffler that is only 3-inches by 5 in cross-section. These individual pipes vary in length from 30 to 34-inches, measured from the cylinder head to the beginning of the muffler can, the front ones naturally being slightly longer than the rear ones. The lengths were chosen to provide exhaust-tuning but the effect of this small variation is to somewhat spread the usually abrupt boost of power, though perhaps at the cost of unequal loads on the crankshaft. Beyond the muffler extends two-and-a-half feet of three-inch exhaust pipe; its bellowing roar at full throttle makes a diesel tractor sound like a power lawn mower.

But all this is fairly straight-forward and not too unusual. Not so the Sadler touches. Though none of them stick up and scream for attention, there are several items well worth noting.

To ensure an ample supply of oil even during 250-mile events, Bill welded up a 12-quart, T-section pan to close off the crankcase. This provides the same oil level as the standard five quart sump but the



More Girling discs and Sadler-designed hubs are located by paired radius rods, tapered swing arm welded of mild steel.



GMC truck-style Spicer universal joints sprout from speical bearing carriers on sides of Halibrand quick-change differential. Outer joints are Chrysler pot-type. Swing arm pivot bolt is seen through belly pan.

larger volume gives the oil more time to cool before being pumped through the system again.

As on his previous Chevrolet-engined car, Sadler has made a carefully baffled breather pipe so that the extra large supply of oil isn't promptly pumped overboard. The reasoning behind the baffle is this: The fumes from the crankcase, (heavily laden with oil vapor), are pushed to the breather pipe by the pressure of the blow-by past the piston rings. But the breather pipe is necessarily much cooler than the crankcase so droplets of oil condense on its inner surface.

On racing engines, with especially loose fits between pistons and cylinders to reduce friction, blow-by is more extensive by far than it is on touring engines. Instead of draining back into the crankcase, the condensed oil is normally swept overboard by the rush of air. Sadler's ingenious system provides a trap for the droplets by forcing the blow-by fumes to follow a somewhat circuitous path.

Also stemming from his Mark 2 car, tapered shock absorber rubbers are used to mount both engine and gearbox to the frame. They isolate the high frequency vibrations (which only have small amplitudes) without allowing excesses of engine movement as do normal rubber engine mounts.

Bolted firmly together at the bell housing, the engine-gearbox combination has a three point installation. A welded-up, mild steel carrier extends across the front of the engine below the crankshaft center line. It reaches down to the lower frame rails, where cylindrical fittings from shock absorber ends accept the pairs of tapered rubber bushings. Bolts, lying fore and aft, connect this installation to small flanges on the second lower crossmember.

Under the rear of the gearbox extension, two side-by-side vertical studs pick up a pair of spigot or compression-type shock absorber mountings. The attachment is to a central portion of the frame which runs inboard from the front suspension and downward from the cowl section, still tapering inward, and ending in a mounting cradle for the Halibrand center-section.

Between the engine and gearbox, both the flywheel and clutch are aluminum, as is the bronze-faced pressure disc. A single

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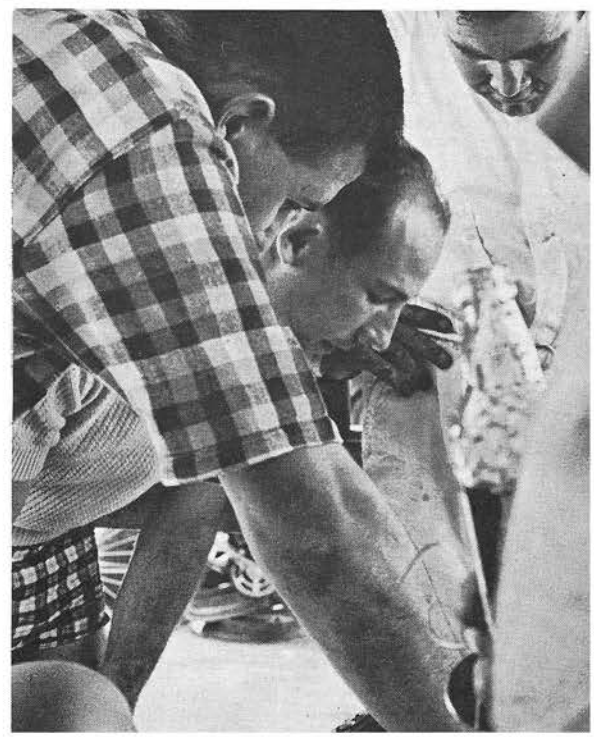
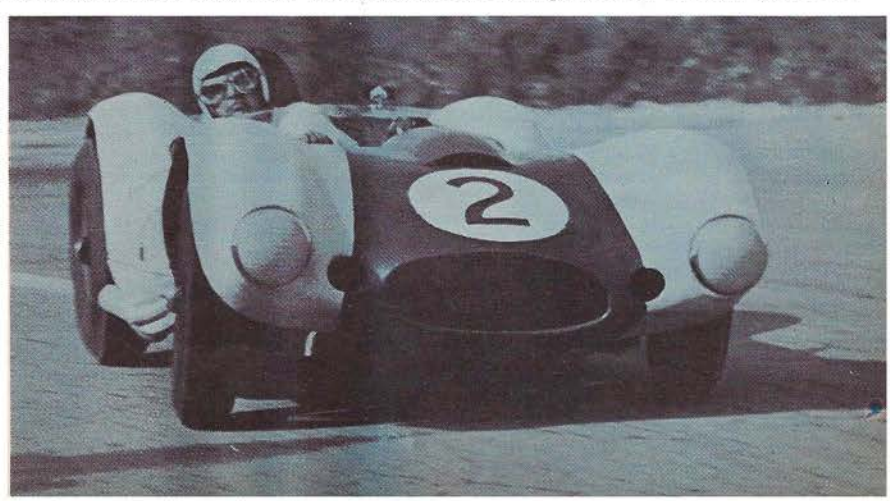


Mark 3's Nassau introduction proved meteoric, brilliant but short-lived. Brief as it was, it impressed many, including Stirling Moss.

Without anti-roll bar, Mk 3 tilts a lot as Bob Said presses on through fast bend.



SADLER Mk3

(Continued from page 37)

exception is the steel stamping which holds the Schaeffer-built clutch together.

An all-copper radiator, 24-inches wide, 15 deep and 2½-inches thick provides all the cooling needed. Because the engine itself is so low, there is no need for a header tank. The two one-inch water pipes actually run slightly downwards to the radiator, but the filler neck is well over the water level in the cylinder heads.

Not to be ignored is that the engine and gearbox are mounted about 1½-inches to the left of the car's center line. With the driver sitting on the right, this move increases his foot room and to a mild extent, balances his weight.

Bill feels very strongly about driver comfort, pointing out that, "in extra fast cars such as this, the driver is so wrapped up in actually driving, trying to stay right on top of the continually changing situation, that he cannot afford even a 2% wastage of his concentration on such non-essentials as leg cramps, wind-buffeting, blisters from stiff steering or too-hot cockpit surfaces."

He continues, "Comfort is not all physical. It's partly psychological, too. In other words, a car should handle. Obviously, both qualities are desirable."

"People in England have been building cars for road racing for years now and while I was there, I learned lots of interesting things that they take for granted that we've never heard of over here. For instance," Bill went on, "by raising the outboard ball joint in the steering linkage, you can increase the amount of toe-in you get with body roll. Even on a car as low as mine, load transfer makes the outboard wheel the one to watch.

This toe-in with body roll gives an effect which the driver interprets as oversteer, as the front wheels turn further into the corner without his moving the steering wheel. Now, this is just jim-dandy for sharp hairpins but it's no good at all on a long fast turn.

"I laid the entire front suspension out on paper first." He went on to point out that the geometry was based mostly on a desire to use an unmodified Morris Minor rack and pinion steering set-up. Actually, he did have to weld a bolt on to the end of the ball socket in order get more threads in contact with the steering arms, because the tread is about three inches wider.

Continuing, he remarked, "In order to make the front suspension adjustable, or perhaps I should say, so that I could tune the chassis too, the bolts that install the steering gear fit through slotted holes in the frame." The theory is that moving this unit down is the same as raising the ball joint further outboard, and it saves bending and rebending the drag links. "These changes are much more significant than anything you can do with tire pressures."

Bill made his own wishbones. The upper ones are ¾-inch diameter, the lower are ⅞. Their inboard pivots form a ten-inch square on the frame but the width of the top one is only 7⅜-inches compared to the bottom one's nine. The ball joint on the upper wishbone is sawed off a Triumph TR upper joint, all the rest below it is stock TR (though cadmium plated). Eleven-inch disc brakes are also from the Triumph parts bin but instead of DS-1, he uses Ferodo's DS-3 Severe Service pads.

In the design of the rear suspension Bill Sadler has again sought adjustability. But first he shortened the wheelbase four-inches, having found the Mk 2 had more than enough directional stability on long fast bends and was, if anything, a bit hog-like to get around slow, tight turns.

"In cars as light and as powerful as this," Bill says, "I think that the geometry of the rear suspension is much more critical than the front. On the Mark 2, you'll remember, I added a single radius rod running forward from the wheel hub housing. Its angle relative to the ground is like the height of the steering linkage. If you drop the front pivot point, you get more toe-in with body roll, if you raise it, you can get toe-out. And as before, the driver sees these as over- and understeer characteristics, although, strictly they're not.

"This time I've put 10½-inch discs, brakes, outboard so I need two radius rods instead of one in order to handle the braking torque." Bill hasn't made any provision for raising or lowering their forward ends, but with Heim spherical rod ends threaded on each end, they are adjustable for length and therefore for toe-in.

Dynamic changes in toe-in may be altered another way. The specially fabricated swing arms are in unit with the wheel-hub carrier. A variety of ears carry the two radius rods and the combined coil spring and Koni shock absorber assemblies. The square section swing-arm tapers down to another Heim spherical bushing at the car's center line. A single large bolt serves as a hinge pin for both swing arms, the left one being just in front of the right one. Adjustment is achieved through the provision of many spacers between the pair of ball joints and the two brackets provided on the frame to carry the hinge bolt. By putting more shims to the rear, the bushings are moved forward, increasing the toe-out.

Bill suggests, "Someday, perhaps instead of using shims, we can move the flanges themselves and have them connected to a ratchet and handle of some sort in the cockpit. That way the driver could alter the handling characteristics to suit the particular corner he's about to enter."

When asked if he might use hydraulic or electrical means, with perhaps a speed sensitive automatic control, Bill made it quite clear that he is no disciple of the GM Tech Center. Instead, he follows the advice of Bill Stout, designer of the Ford Trimotor. To wit, "Simplicate, and add lightness."

With an attitude like this, a willingness to explore new areas of design and with enough energy for two, Bill should go a long way towards putting the American continent on the road-racing map.

Perhaps someday his production project may be revived, but currently Bill speaks of producing duplicates of this Mark 3. His total involvement is today directed at high speed handling, a field which he feels is just opening up. But if USAC should promote races for Chevy-engined single-seaters, he'll surely be one of the first to build one.

Stephen F. Wilder