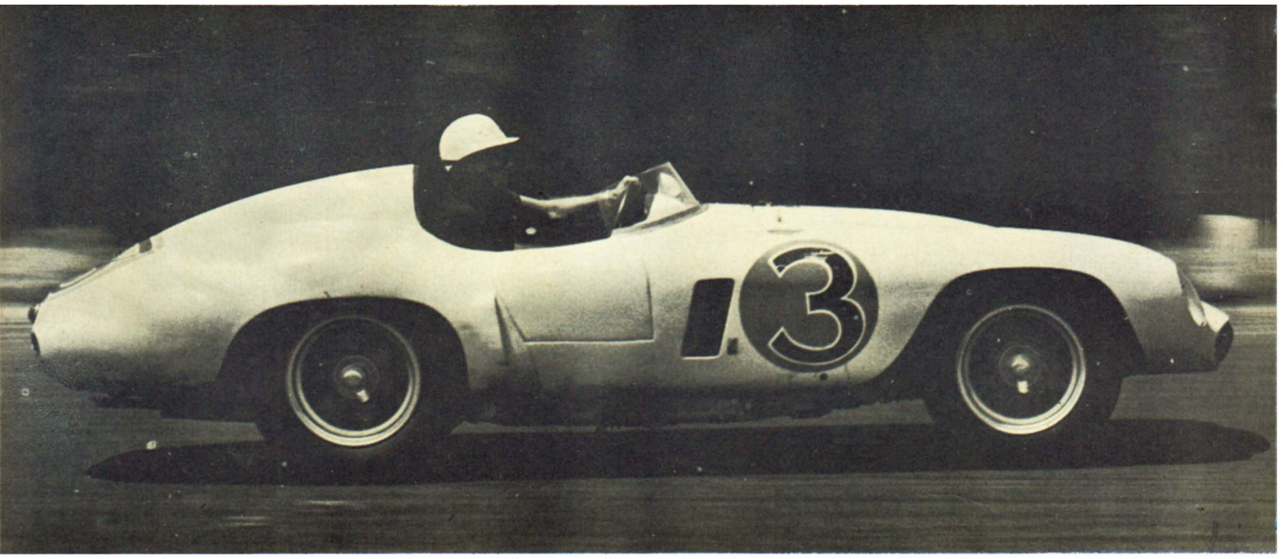


Phil Hill barrels a new 3 liter Ferrari Monza as he succeeds in capturing two overall firsts and two modified class D wins in the 52 mile Tea Party (sic) Trophy, and the 104 mile Beverly Trophy at Beverly, Mass. He averaged better than 80 mph.

the seven hour Stormer

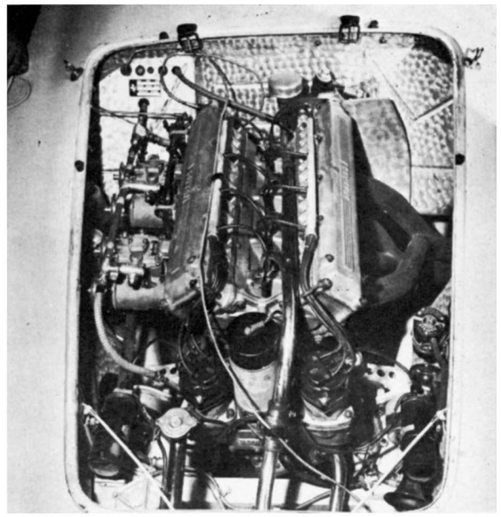
The 750 Monza, a busy four with an average life expectancy of just seven hours, is still king of the short course.

By KARL LUDVIGSEN

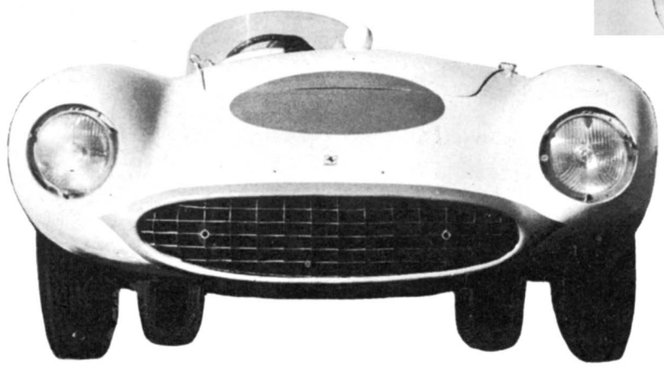
CLASSIC tradition in sports car design has always insisted that the pure racing car must come first. From that the sports car can be developed, and, eventually, the touring car. Before the war Bugatti and Alfa Romeo stood as very good examples of this technique, and Tony Lago followed generally similar lines with his French Talbots in more recent years. Italy has always remained the homeland of the purest in automotive design, however, and only there could such establishments as O.S.C.A. and Ferrari flourish.

Enzo Ferrari in particular has carried on the pure design tradition, and even his early postwar racing machines were Grand Prix or sports at the twist of a fender or headlight. The recent strong emphasis on sports cars has drawn the likeness even closer, and Ferrari sports and G. P. developments seem to proceed at a parallel and

Unfinished cockpit of a Monza in assembly reveals polished light alloy interior. Early body designs were executed by Autodromo, Vignale and Farina, but later models owed their form and shape to Dino Ferrari, son of famous Enzo.



Designated the Type 105 by Ferrari, the four cylinder power plant employs such racing engine features as twin overhead camshafts, twin ignition, hemispherical combustion chambers, and sodium filled valve stems.



Monza front shows a wide symmetrical grin as if anticipating victories to come.

equal pace. No better illustration could be chosen than the famed Monza model, which through 1955 became the backbone of the Ferrari team and the all-purpose workhouse of many private owners. For do-it-yourself racing on an international level, the Monza has become THE car. Performance-wise it is overshadowed by its more spectacular big brothers, the 4.4 and 4.9, but its handiness and versatility have made it the King of the Short Courses and a tough contender in bigger arenas.

It really all started during the 1950 Formula II season, when John Heath ran a very impressive team of HWM cars on the European continent. Particularly in the hands of Stirling Moss, these deceptive-looking green cars pressed the official team of two-liter Ferrari V-12's, and did it with Alta engines of only four cylinders. Ferrari could see that this type of engine had torque and weight characteristics well suited to certain types of tracks, and he put his "new boy" Aurelio Lampredi to work on a new Formula II engine. In 100 days the first four-barrel from Ferrari had been designed and built, and it saw action in the Fall of 1951.

That same Fall found a 2.6 litre version of the four in a G.P. car at Monza, and engines of that size were campaigned in Formule Libre races as preparation for the 1954 formula change. From these it was but a short step to a three liter version, and such an experimental sports car made a promising but troublesome appearance at Senigallia in 1953. Ascari wrecked another one at Monza in that year, and in January of 1954 Bonomi and Menditeguy took the Senigallia car to Buenos Aires and there held off one of the regular "twelves" until the torque of the four shattered the final

The 750 Monza —
"a car for do-it-yourself racing
on an International level."

ENGINE

Cylinders	4, in line
Bore and stroke	4.05 in x 3.55 in (103 mm x 90 mm)
Capacity	182 cu in (2999 cc)
Piston area	51.2 sq ins.
Compression ratio	9.2 to 1
Output	250 bhp @ 6000 rpm

Valves	Intake	Exhaust
Open	50° BTC	78° BBC
Close	80° ABC	48° AT C
Clearance	.008	.010

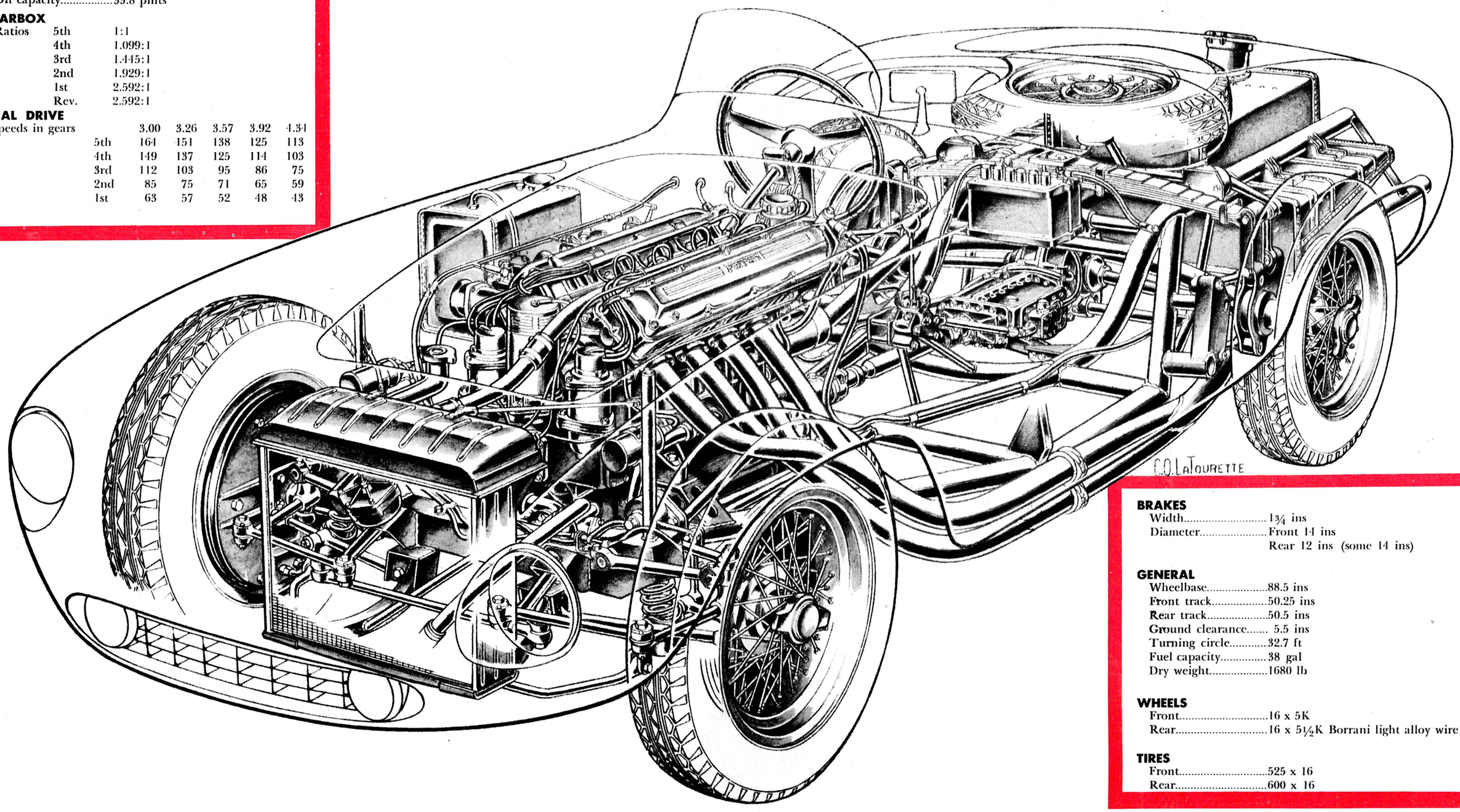
Clutch	10″ dia. dry double plate
Carburetors	2 Weber 58/DCOA/3
Oil capacity	33.8 pints

GEARBOX

Ratios	
5th	1:1
4th	1.099:1
3rd	1.445:1
2nd	1.929:1
1st	2.592:1
Rev.	2.592:1

FINAL DRIVE

Speeds in gears	3.00	3.26	3.57	3.92	4.34
5th	164	151	138	125	113
4th	149	137	125	114	103
3rd	112	103	95	86	75
2nd	85	75	71	65	59
1st	63	57	52	48	43



BRAKES

Width	1¾ ins
Diameter	Front 14 ins
	Rear 12 ins (some 14 ins)

GENERAL

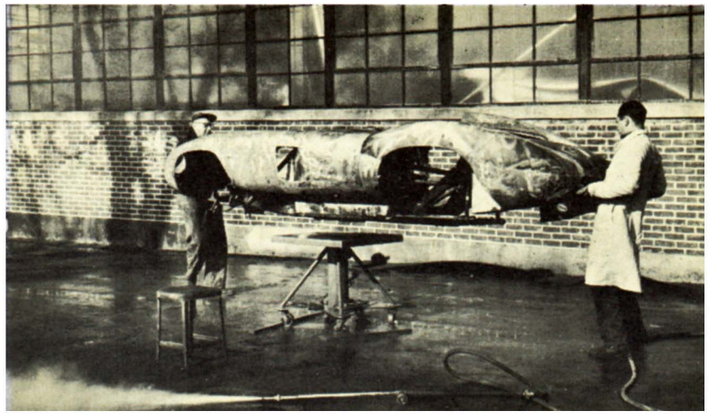
Wheelbase	88.5 ins
Front track	50.25 ins
Rear track	50.5 ins
Ground clearance	5.5 ins
Turning circle	32.7 ft
Fuel capacity	38 gal
Dry weight	1680 lb

WHEELS

Front	16 x 5K
Rear	16 x 5½K Borrani light alloy wire

TIRES

Front	525 x 16
Rear	600 x 16



Two men lift light chassis and body onto steel welding table for further refinements before mounting running gear.

drive after a pit stop. Milan drove a new car to a conservative fifth place.

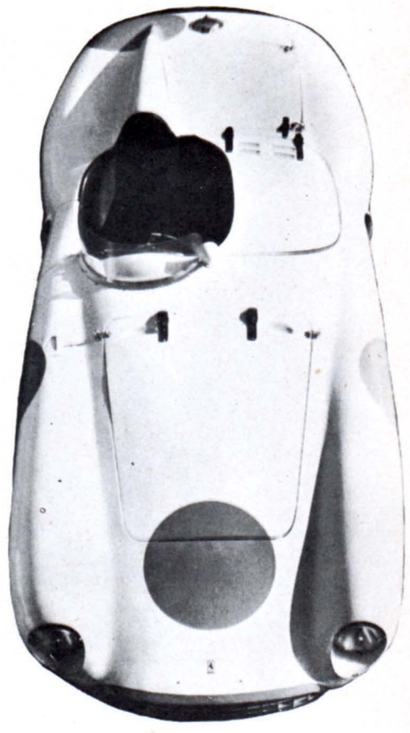
These early cars were all highly experimental and closely related to the Formula II cars and the then-developing Mondial, and as such received the type number 735. A greatly altered engine appeared in the Ferrari "Squalo" Grand Prix car at the end of the '53 season and this new pattern plus experience with the 735 cars allowed the designers to lay out a new Type 750 sports car. It will of course be anticlimactic to add that its first appearance was at Monza on June 27, 1954, when Hawthorn-Maglioli took first and Gonzales-Trintignant second in the 1000 Kilometer Supercorte-maggiore sports car G.P.

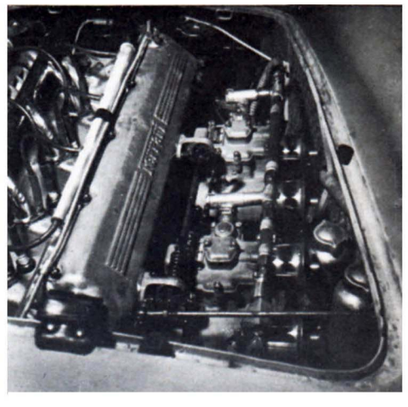
The newly christened Monza model went from strength to strength in subsequent months, and in the light of further experience was modified for a limited degree of production in the winter of 1954-55. Virtually all the Monzas now in action embody these changes, one notable exception being the Sterling Edwards car in this country. It is basically a 1954 machine, and the variations will be dealt with as they come up here.

The main line of development toward the Monza series has been via the engine, which is currently designated the Type 105 by Ferrari. Its construction is highly unusual and very clever, and yet embodies many traditional racing engine features. Among the latter are the use of twin overhead camshafts and an integral head and cylinders. This basic Siluminium upper-end casting includes the ports, combustion chambers and water jackets, but not the cylinders themselves, which are separately cast of iron and screwed up into the chambers. Complete and thorough inspection for casting flaws and core sand is thus allowed, and liner thickness and cooling rate can be precisely controlled.

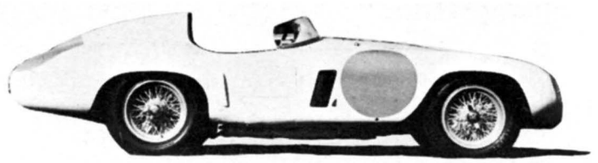
Intake valves are inclined at 45° to the vertical and are at 85° to the ex-

Top view of aerodynamic Monza with metallic tonneau cover in place.

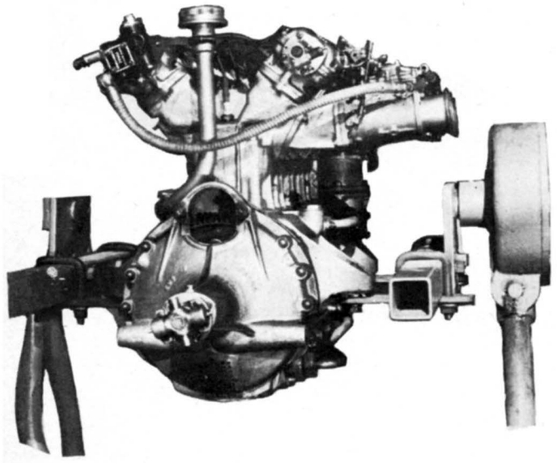




Two 58/DCOA/3 type twin-choke Webers feed the powerful 3 liter engine. These carburetors carry voluminous 44 mm venturii and straight through design which allows ultimate high speeds. Engine is somewhat over carbureted for low speed. But then who goes slow in a Ferrari?

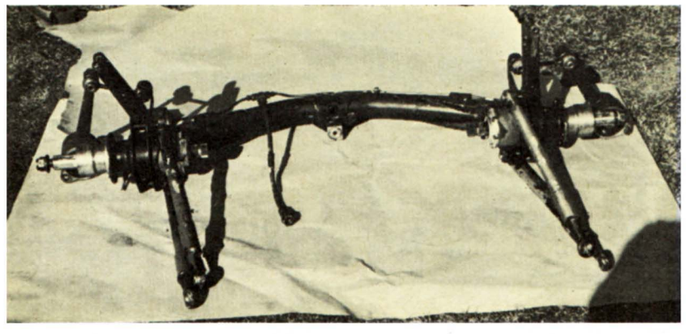


Profile of Ferrari Monza. In terms of power to weight the engine develops approximately one hp for every 6.8 pounds the car carries. Wheels are Borrani light alloy.



Engine sits on test bed prior to installation. Note universal joint which connects to driveshaft just after flywheel and clutch housing. Reason for this is full de Dion rear which carries transmission astern of driver. Opening at top of flywheel cover is for starter.

Frame of de Dion rear-end reveals lateral bars, spring shackles, Houdaille shock absorbers, hydraulic brake line, splined axles and the 2½ inch diameter de Dion tube which connects the hubs.



haust valves, which have sodium-filled stems. Both valves seat in shrunk-in inserts. The combustion chamber is a modified hemisphere, with special contouring around the spark plug holes. Placed at the fore and aft ends of the camber, the twin plugs are properly close to the exhaust valve, and with a bore of over four inches are vital to proper ignition of a spread-out mixture.

Precedent is scorned in the design of the valve gear, which is about as wild as possible without resorting to desmodromics. Twin hairpin valve springs are placed in a fore-and-aft plane and close the valves through a collar retained by split keepers. Above this the tappets and camshaft are carried in separate cast light-alloy boxes, as in the latest Singer and HRG engines. T-shaped in cross section, the alloy tappets are guided by their stems and carry thin rollers which protrude only slightly from the wide tops. The lower parts of the rollers themselves ride in vertical slots and thus prevent the tappet from rotating.

To ensure that this assembly is held in contact with the cam, a pair of very light concentric coil springs acts against each tappet only, leaving the hairpins to deal solely with the valves.

Shim clearance adjustment is provided, and current advice is to replace the tappet assemblies and their guides when the lateral lash exceeds .006 of an inch.

The separate tappet box allows through lubrication of cam and followers without forcing leakage down the valve stems, and accounts for the unusually high and wide Monza cam boxes (No, that's *not* a V-8 in there, dear). Though the spring system may seem unduly complex, recall that it must take a beating from cams that provide 310° of intake duration and 98° of overlap. Lobes little more than ⅜ of an inch wide do the job, and are carried on large-diameter tubular shafts, which in turn rest in five plain white-metal bearings each.

Exhaust porting is impressive, the outer opening being flared considerably from the size at the valve. Properly tuned manifolding is used, with the cylinders paired 1-4 and 2-3, and these two later joined at a single expansion chamber. Induction plumbing

(Continued on page 62)

T-Bird

(Continued from page 29)

reading 143, the most optimistic error I've come across in a long time and one that the pink-slip jousters would do well to remember. Another good point to remember is that on a car as heavy as the Bird ordinary passenger-car tires are likely to start shedding their threads after 8 or 10 miles of 110 to 115 mph driving. Ford had the cars at the proving ground equipped with Firestone Super Sport tires — tubeless, of course. Under the Bird's hard acceleration the tires slip on the driving wheels and would easily shear the valve stems from conventional tubes. Anyone contemplating serious dragging, using standard tubes would do well to put screws in the wheel rims.

The Bird's brakes are better than they were before. The car I tested last year and this year's test car both had power brakes. In the case of the '55 you could depress the brake pedal a couple of inches and nothing would happen. One sixteenth of an inch more and the wheels would suddenly lock, with assorted embarrassing consequences.

The '56 model's brakes take hold smoothly and evenly. At below 50-mph speeds they lack authority and at 100 mph they seem to serve a sort of token function. These are not the brakes you look for on a sports car or on what the Europeans call a *gran turismo* machine. You learn quickly to downshift to Low Range to add to the car's braking power.

On the whole, the Bird feels quite good at high speed — as good as any loose-steering car can feel. But this and the tendency to dance on its springs makes driving the Bird a more nerve-tightening experience than the average sports car driver is happy to accept.

Another objection that the man who wants a pure sports car is likely to make is that the car has far more iron than it needs. The Bird may be small by Detroit standards but it's unnecessarily bulky and ponderous for a high-performance car. Here again the car's dual personality is the reason. The Bird is based on a shortened version of the Ford convertible frame which, with its rugged cruciform construction, is itself a heavy device. On the Bird this frame is beefed up even more with an immense amount of strap iron that is hand-welded to the bottom of the frame. This iron, two inches wide and half an inch thick, is applied to the side members of the frame and to the four segments of the central X-member. The resulting structure ought to be very rigid and reliable. As a sports car frame it is laughably heavy. As a touring car frame it is ruggedly substantial.

On many other touring-car counts the T-Bird scores very well indeed. It has plenty of room for luggage and passengers. It doesn't have the shoulder-cradling bucket seats that the sports car *aficionado* might prefer, but its yielding upholstery does an above-average job of body bracing. Furthermore, the bench seat is wide enough to accommodate three adults in total comfort or two adults and two kids. The detail work is excellent by any standard, but most important to the American mass market, it meets good U. S. standards of quality, style and comfort. I detected only one jarring note in the luxurious overall effect; cranking the windows up or down is so difficult that you would welcome power assist.

Physically, the '56 Bird, like the '55, is a handsome beast. The biggest styling change this year is, of course, the switch to the continental spare, which makes the car look more like a logical successor to the old Lincoln Continental than the new Continental itself. Naturally the new, external mounting for the spare makes a big difference in the T-Bird's luggage capacity — something all short wheelbase cars can use. In a car that is not essentially a competition machine, the style and utility benefits of this change more than compensate for the small sacrifice in additional wind drag. #

Monza

(Continued from page 37)

by Weber is no surprise, and the Monza uses two of the 58/DCOA/3 type twin-choke carburetors. These are really prodigious, and carry 44 mm venturis. Webers are noted for their careful interior streamlining and "straight-through" design, which is fine at high revs but impairs proper correction for low-speed running. Paul Frere quotes a volumetric efficiency of *over* 100 percent at 5000 rpm for the similarly equipped Ferrari Grand Prix engine, which should be approached by the thorough intake and exhaust tuning on the Monza. Very short angled alloy pipes connect the gasworks to the ports, and stubby velocity stacks are fitted. A heavy throttle linkage cross shaft is carried in two ball bearings.

A notorious torque producer, the Monza top end imposes a high level of stress on the rest of the engine and drive train. In actual fact the less glamorous bearing end of the engine is a trifle overstressed, and as a result the standard Monza's full-bore racing life is limited on the average to a period of seven hours. Beyond this point tune falls off and clearances become excessive, calling for a complete rebuild and renewal of bearings, pistons, etc. Endurance races have thus seldom been the Monza's meat.

The short head and cylinder unit bolts directly to the very deep Siluminium crankcase, and rubber rings form water seals at the bottoms of the individual cylinders. Very simple solid webbing supports each of the five main bearings, which are 2.36 inches in diameter and available in four undersizes. The webbing continues down an inch and a half or so beyond the crank centerline, to give the deep, I-sectioned bearing caps some lateral support. There are two retaining studs per cap.

That it may carry the oil supply to the crank and big ends, the center main is $\frac{5}{8}$ of an inch wider than its $1\frac{1}{8}$ inch breatheren. Quite devoid of elaborate balance weighting, the forged steel crankshaft receives the impact through 1.97 inch diameter big-end journals. Aluminum-bronze Vandervell thin wall bearings are fitted here, as at the mains, and four undersizes are again available.

Connecting rods are short and simple, the sides of the I-section center being perfect tangents to the outer diameter of the wrist-pin end. Two bolts retain the big-end cap, while the

fully-floating wrist pin receives its lubrication from splash alone. The pistons are completely skirted and carry two compression and two oil rings, one of the latter being below the wrist pin.

An alloy cover at the engine front conceals the accessory and camshaft drive train of 3/8 of an inch width spur gears. The upper gears deal with the cams, while the water and oil pumps are placed low down at the front. Dry sump lubrication is used, and two screened pickups scavenge the front and rear of the intricately finned cast alloy pan. The scavenge oil pump has two idlers, to ensure that it keeps up with the demand, and it supplies a riveted tank on the right hand side.

A single-idler pressure pump draws from the reserve and replenishes the mains through a sump-mounted full-flow filter. Lampredi relied heavily on external and internal piping to carry the oil around, and apparently did not want to mar his crankcases with too many cast or drilled-in oil passages.

Almost excessive simplicity marks the cooling system, which is kept in motion by a twin-outlet pump adjacent to the scavenged oil supply. Drawing from the bottom of the gilled tube radiator, the pump sends the coolest water to both sides of the crankcase, where it can absorb some heat from the main bearings. From there it rises past the cylinders to outlets directly above each combustion chamber. Thus the water is at its warmest when it reaches the exhaust valves, which do not receive any high-velocity cooling stream. The use of sodium-filled valve stems is clearly vindicated. Though it must be lower than the cylinder head, the header tank is integral with the radiator.

An extension from the cam gear-train bevel-drives a cross shaft within a magnesium-alloy box at the engine front. Further bevels rotate the central 12-volt generator and the Marelli distributors at each side. Earlier cars used magnetos, and some of the Grand Prix cars actually used this bottom end with a cover plate in place of the generator. Coil ignition was deemed better for all-around "production car" use.

A Fimac mechanical pump driven from the rear of the exhaust camshaft supplies fuel to the back end of the carburetor system, while the front end is supplied by a rear-mounted Autolex electric pump. Four rubber mountings suspend the riveted alloy fuel tank.

The starter motor protrudes back from the top of the shallow clutch housing, which encloses a ten-inch dry double-plate clutch with flexible centers. A short extension supports the Hooke-type universal at the forward end of the driveshaft. Four heavy crankcase brackets mount the engine package on rubber inserts.

Monza torque is transmitted to the rear-mounted gearbox by a tubular shaft and another universal, there being a splined joint at the shaft forward end. Placed just ahead of the final drive gears, the transmission is split vertically in line with the mainshaft and carries the countershaft on the right and the selector mechanism on the left. Dog clutches engage constant-mesh gears in the top four of the five speeds, while a sharply angled jointed shaft transmits the driver's desires from the centrally-placed cast shift tower. A compact, conventional gate is used, with a simple reverse latch-out.

A few of the early-type Monzas had four-speed boxes, but the five-speed version was prepared in time for early 1955 use on both the Monza and the Type 625 Grand Prix car. The smaller Mondial had a similar setup a few months earlier.

A large spiral bevel gear at the back of the mainshaft drives a similar gear on a short cross-shaft at a ratio of unity, and the ZF torque-bias differential is directly driven from the short shaft by helical gears. This final drive alloy casing is also split vertically down the middle, allowing rapid disassembly and selection of any one of a myriad of possible ratios. The use of the cross-shaft and the flat layout of the gearbox keep the whole assembly very low, and prevents any interference with the seats. Deep longitudinal fins cool the sump of the alloy transmission case, while a gear-type pump circulates the lubricant.

Needle-type universal joints are carried almost within the final drive case, as a follow-through from the old swing-axle days, and allow angular variations in the machined half-shafts. Simple splined clamp joints facilitate disassembly, and connect to the hub-mounted pot-type universals.

CHASSIS

Early angled tube chassis experiments have been refined into a smoothly contoured structural base for the Monza. Two oval-section tubes constitute the main members, and are cross-linked and integrated into the body by many smaller round steel tubes. It is thus not a true space-type frame, and as such lags slightly behind current thinking, not to mention advanced design as exemplified by last month's D Jaguar structure. The Monza chassis carries the type number 501, as developed from the Type 500 Mondial.

Rear suspension is by the modern classic, deDion. The 2½ inch diameter steel axle tube curves behind the differential and connects the fabricated

(Continued on page 64)

(Continued from page 37)

hubs. At the tube center a ball carries a square bronze block vertically between steel plates in the back of the rear end casing, and thus locates the tube laterally. This point also determines the rear roll center. Lampredi can be credited with the use of two parallel trailing arms on each side to guide the tube and absorb braking torque. Since each set of arms forms a parallelogram, vertical movement of one end of the tube will produce no twisting moment between hubs, and floating mountings are avoided. Rubber bushings are used at the chassis connections, while the axle ends of the arms have ball joints.

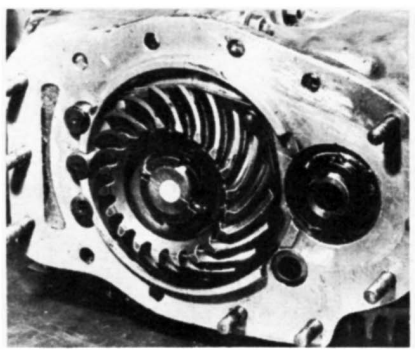
A transverse leaf spring is frame-mounted above the axle casing, and is connected to the hubs by long drop shackles. Houdaille vane-type shocks damp the vertical oscillations, which are limited by rubber buffers acting against the deDion tube. Most of the Monza leaf springs now in use are quite flat while in a static position, and a more highly arched pattern is now coming into use. It should give a much more progressive suspension action.

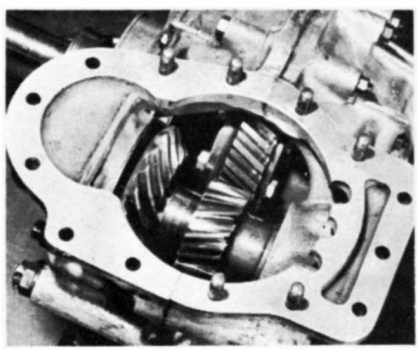
Experimental Monza front suspensions also used transverse leaf springs, as was then current on the G.P. cars. Barcelona in 1954 proved the superiority of a coil layout on the Squalo Ferrari, and a complete switch was made on all Modena models. Basic geometry remained the same, with two low and close-placed parallel wishbones to each wheel, the bottom area being roughly half again as long as the top. The arm components are forged, polished and bolted together. A single wide bronze bushing pivots the top arm to the boxed front crossmember, while two bushings are used for the wider bottom arm. The latter carries brackets for the shock linkage and the end of the torsion anti-roll bar, as well as for the bottom end of the small, slightly "sea-legged" coil spring.

The front suspension geometry is such as to give a roll center very near ground level, but it is raised somewhat by the anti-roll bar. As a result more of the overturning couple is resisted by the front wheels, producing a degree of understeer and leaving the rear wheels free to put power on the road. This, plus the semi-solid differential action, frame-mounted drive gears and low rear unsprung weight give the Monza excellent traction on tricky real-road courses. No strictly airport car, this.

Tapered steering arms extend forward from the forged stub axles, and are connected by a three-piece track rod. The length of the outer members is so calculated as to be geometrically consistent with the suspension movement. A forward pitman arm transfers movement from the worm and wheel steering box, and is balanced by a slave arm on the left hand side. The long-revered Ackermann steering principle is de-emphasized here, as in many other modern high-performance cars. Three universal joints carry the steering column sharply around the protruding carburetors.

Brakes are mounted at the wheels all 'round, to simplify installation and cooling. Their mechanical layout looks at first glance like two-leading-shoe, but actually employs a central guide for each shoe to balance out the servo effect and wear, and thus avoid the excessive self-wrapping effect of the usual 2LS brake gear. Two double-acting cylinders per wheel apply force equally to all four shoe ends, and receive it from a single-bore master cylinder with separate circuits and reservoirs for front and rear systems.





Spiral cut bevel gear of transmission drives helical final drive gear.

Ferraris have long been noted for the deep, tapered finning bonded to the steel liners of their brake drums, and have been equally conspicuous for the absence of spectacular scoops on the backing plates. These are just beginning to appear on some Monzas, but most cars have four simple screened apertures per wheel. Air circulation is inducted by so ducting the face of the brake drum that it acts as a centrifugal fan and rapidly exhausts warm air from the interior of the unit.

While these assemblies are known to be very potent, it's worth noting that in 1955 Jean Lucas brought a Messier disc-braked Monza to the Supercortemaggiore race and had no difficulty in outbraking the standard cars, particularly toward the end of the event.

The Borrani wire wheels are set well out from the brakes, leaving the finning of the latter exposed to best advantage. Wheel rims are light alloy and the hubs the familiar Rudge type, with two-eared locking nuts.

Racing experience is revealed in the disposition of the electrical equipment where it is readily accessible in the event of a petty breakdown. The battery rests above the gearbox and between the seats, while all junction boxes, relays, etc. are on a single panel under the cowl on the passenger side. Instrumentation is compact and complete, with tachometer, ammeter, oil pressure and oil and water temperatures. The hand brake lever is suspended on the right hand side of the cockpit, and applies the rear brakes through a cable system.

Various early Monzas had bodies by Autodromo, Vignale and Farina, but the currently standard shape was laid out by Dino Ferrari, son of the celebrated Enzo, and is being executed by the small Scaglietti firm of Modena. Of course there are many options here as in the rest of the car, some of the choices concerning the windshield, headrest, tonneau cover, headlights or brake venting. Most of the cars, however, have large side vents to exhaust warm air from the engine compartment. Belly pans are often fitted from the firewall back.

Since the Ferrari policy is one of continuous, even headlong, improvement, it is virtually impossible to settle on one cut-and-dried specification for the Monza, but the foregoing provides a broad picture of the design scheme. Factory alterations tend to be subtle, such as the shifting of the engines three inches forward after the 1955 Tourist Trophy. The suspension and chassis also underwent detail changes for last year's Targa Florio.

More than fifty Monzas have been turned out, and it thus attains International Production Sports Car status. As a factory racing car it has been displaced by the new 3.5 litre four, which bears a close family relationship but differs in many details. Monza Ferraris are still available from the works, but only on special order. They have never been the most powerful or the fastest sports cars in the world, but they have been rugged and nimble, and like the series 35 Bugattis, they have won many contests by sheer weight of numbers and will undoubtedly continue to do so in the future. #