Part 2
1948 – 1951: 4 Racing Years
Examples 26 to 29

26. 1948 Alfa Romeo 158; 1,480 cc; 310 HP @ 7,500 RPM (see Figs. 26A, 26B)
28. 1950 Alfa Romeo 159; 1,480 cc; 370 HP @ 8,900 RPM (see Fig. 28A)
29. 1951 Alfa Romeo 159M; 1,480 cc; 400 HP @ 9,000 RPM (see Fig. 29A)

Rule change considerations in 1938 -1939

Before WW2, when it was clear that lap speeds had not been reduced significantly by the 1938 Formula, there had been discussions about reducing Grand Prix Pressure-Charged (PC) engines once again, as in 1926 – 1927, to the 1.5 L swept volume used for Voiturette racing since 1921 and then continued for this class post-1927. It was thought that this change would come into effect in 1941.

Enzo Ferrari, patron of Scuderia Ferrari, in a first example of his uncanny ability to lead rule-makers, had already proposed to Alfa Romeo in early 1937 that jointly they should build a more powerful 1.5 L Voiturette than those available from ERA and Maserati (25) (see Note 46). This was agreed and the resulting IL8 type 158 had just won its first race in August 1938 when the Italian organising club announced in September that all their races in 1939 would be limited to 1.5 L PC. They thought that this would stop the constant succession of German wins. Their countries were allied in international politics but this did nothing to reconcile them to German technical arrogance! This they were able to combat in motorcycle racing with the 4-cylinder supercharged Gilera beating the German 2-cylinder supercharged BMW.

Undoubtedly because of the probability that 1.5 L would become the PC rule in 2 years time, justifying the extra work and expense, Daimler-Benz built secretly two 90V8 1.5 L PC cars in the next 8 months. This was remarkably less than the usual 18 months lead time for a formula change – the Alfa 158 had taken 14 months.

These Mercedes-Benz type W165s were then entered for the first major Italian race of 1939 at Tripoli and finished 1st and 2nd (468). It was one of the most outstanding feats in motor-racing history. Details of the later 2-stage-supercharged M165 are included in Appendix 1 at SO13.

Auto Union in 1939 also ran 1-cylinder rig tests aimed at a 60V12 1.5 L PC engine (30), with a valve rig running up to 12,000 RPM (311), which suggests that if racing had continued and it had been completed their new car would have given Mercedes-Benz quite a shock. A recent internet posting claimed that the 1-cylinder test produced power equivalent to 327 HP for 1½ litres (1073). Furthermore, although the 1938 – 1939 mid-engined cars had much improved handling compared with their "P-Wagen" predecessors, Auto Union were actually considering changing their chassis design to front-engined at this time (30).

World War 2 now intervened. The consequence of this at the supreme level of human affairs was, at the minor level of motor-racing, (to adapt a remark of Harold Willis of Velocette in 1938 about English motorcycle racing), "*For 'German supremacy', read 'Had it'* ".

Post WW2 Rules

Post WW2, to no-one's surprise, the new Federation International de l' Automobile (FIA), which had replaced the AIACR, issued in 1946 a Grand Prix (Formula A) rule for 1948 – 1953 (660) of 1.5 L PC but retaining the alternative 4.5 L NA. Since the NA/PC x1.5 factor had proved quite insufficient for equality pre-War, this x3 factor was adopted in hopes of more even racing. As before since 1930 there were no restrictions on fuel quantity or type.

Italian supremacy now applied. Alfa Romeo had carried out a further year's development of the 158 after their 1939 Tripoli debacle because Italy did not join the war until June 1940.They were able to win the purely-national May 1940 Tripoli race at a new record speed. The cars were preserved during the war and, since Italy had changed sides in 1943, they were not barred from being entered and dominating the races soon organised after 1945.

The post-War CoY series

The author has chosen 1948 to restart the CoY series because this was the first year in which new Maserati and Talbot cars plus cars from the new firm created by Enzo Ferrari were available to give competition to the Alfa Romeo 158. The latter, apart from a DNF hiccup at St Cloud in Paris when first resurrected in 1946, had already won all the races for which they were entered in 1946 – 1947.Efforts then begun to produce a "British Racing Motor" resulted only in continual disappointment for many years.

Italian cars would reign for 8 years post-War – until Mercedes-Benz re-entered the arena, as will be told in its place.

Alfa Romeo 3 years as CoY

Alfa Romeo were CoY in 1948, abstained in 1949 while all engineering resources were needed to develop the type 1900 production car, returned in 1950 for the newly-instituted World Drivers' Championship series and had a final campaign in 1951. They were also CoY for these last two years.

Type 158/159 details

Details for the post-WW2 engines are given in Appendix 1 but are approximate.

The original type 158 design (*1.5 Litri, 8 cylindri*) had been led by Gioachino Colombo, who had worked at Alfa Romeo under Vittorio Jano since 1924 and who had been lent to Scuderia Ferrari at Modena for the project in May 1937 (25). In some ways it was an IL8 extrapolated and reduced from a 6-cylinder bank of the last 4.5 L 60V12 designed by Jano for 1937 GPs. That had B/S = 72/92 = 0.78, which was altered in the new Voiturette to 58/70 = 0.83. The VIA was 100^0 instead of 104^0, with a classical Jano-type 2 valves-per-cylinder layout but a somewhat more straight-through flow than the M-shaped passages of the P2 and Tipo B "P3". Valve gear was DOHC with adjustable tappets running in the bore of enlarged-outside-diameter guides. These guides were removable to fit the valves up the open-ended *wet* steel liners screwed into the Al-alloy head-cum-block – a novelty (see Fig. 26A). It seems unlikely that these liners, once fitted, were ever removed except in the case of bore damage. The camshaft gear drives were now conventionally from an end of the crankshaft instead of from the centre as on the 1932 – 1935 IL8s but at the front instead of from the rear where the Jano V12s had them. The main valve springs, as was now usual, had a few turns of thick wire to raise the natural frequency and were near chock at full lift so as to minimise the room for coil surging. Inner springs of different frequency assisted this aim. The exhaust valve heads were partially hollow, as well as the stems, to improve the sodium cooling*. Originally main, big-end and camshaft bearings were all plain – a far cry from the 1926 – 1927 1.5 L Delage and showing the advance in such bearings over 10 years.

The development career of the 158 engine first built as a Voiturette in early 1938 to the final Grand Prix specification in late 1951 (redesignated as 159 in 1950 and finally 159M – for "*Maggiorata*" – "Increased") can be summed up as follows:-

IL8 x 58mm x 70 = 1,480 cc

No major changes to castings or crank

Sources: 25, 31, 579, 711

	1st Bench test	Final Bench Tast	
Compression Ratio (R)	6.5	7.5	
Inlet Valve Pressure (IVP) ATA	2.2	3.9	x 1.77
Manifold Density Ratio (MDR)	≈1.94	2.86	≈ x 1.47
	1-stage Roots	2-stage Roots	
Peak Power (PP) HP @ RPM	180 @ 6,500	425 @ 9,300	x 2.36
			X 1.43 on RPM
Adjusted BMEP/MDR Bar	10.3	11.0	x 1.07
Combined Efficiency (ECOM)	43.0%	45.9%	

Racing Powers

	1st race August 1938 (won)	Last race October 1951 (won)	
PP @ RPM	195 @ 7,000	400 @ 9,000	x 2.05

*See P.3

*Fangio in ref.(1083/1991)stated that his 3 Alfa DNF in 1950 from classic GPs were all due to “broken valves”, although other causes were published at the time. It is *presumed* that these were exhaust valves. The cars were not being pressed on the first and second occasions but certainly were on the 3rd by the Ferrari type 375s. If there *was* a common cause it was cured for 1951. Perhaps a few faulty parts had slipped through inspection.

Over 1938 – 1940 (before Italy entered WW2) improvements had to be made to lubrication and cooling and the plain big-ends were replaced by needle-rollers in split races (31) – the only known example in GP racing. These changes allowed an increase in RPM to 7,500.

A major change came in 1946 when 2-stage-supercharging was adopted. As Ferrari, from 1948 building his own Grand Prix cars, intensified his competition the pressure was then pushed up year-by-year and RPM raised to 8,500 regularly and 9,000 “*in extremis*”. Fuel finally had to be nearly 99% Methanol and the mixture super-rich to obtain the highest possible MDR. Consumption rose to 180 L/100 km. With all the on-board tanks that could be fitted – 300 L in total – this still meant 2 refuels in the standard regulation 500 km race. The opportunity was therefore created for a modern 4.5 L NA-engined car of lower consumption to beat the PC 1.5 L. At the end of its career the Alfa was reaching in races MPSP = 21 m/s and MVSP = 3 m/s – the original B/S ratio of 0.83 had optimised the 1951 technical limits.

Fig. 26A
1948 Alfa Romeo 158
IL8 58/70 = 0.829 1,480 cc
Note: the semi-hollow head of the internally-cooled exhaust valve;
the cylinder liner screwed into the 1-piece head + block;
and the needle-roller big-end bearing.
DASO 711

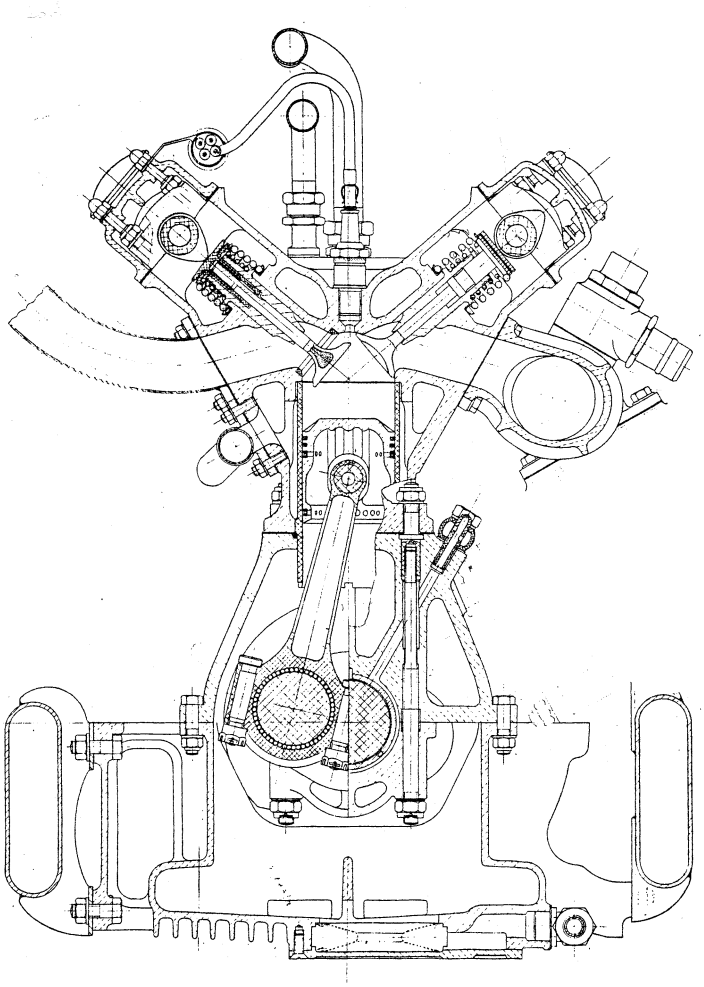


Fig. 26B
1940 Alfa Romeo 158
IL8 58/70 = 0.829 1,480 cc
Shows the original 1-stage Roots supercharger
and the low side intake of the 3-choke Weber carburetter.
DASO 25 p.114

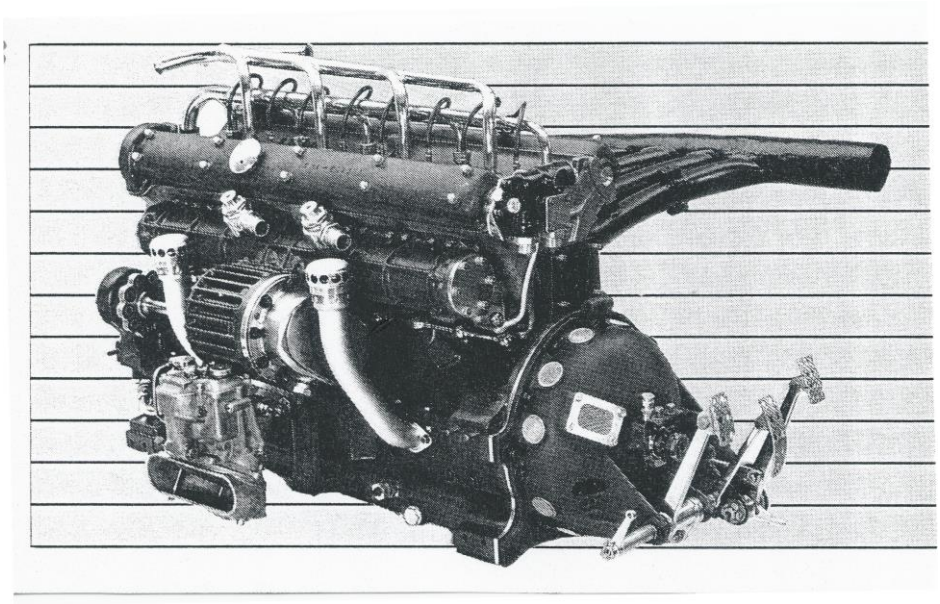


Fig. 28A
1950 Alfa Romeo 159
IL8 58/70 = 0.829 1,480 cc
Shows the 2-stage Roots supercharger
now with a downdraught 3-choke Weber carburetter
DASO 25 p.157

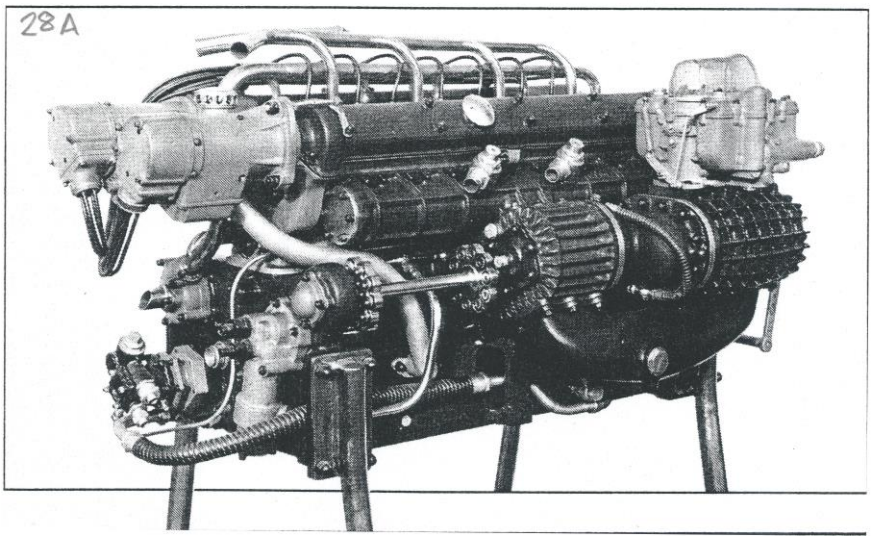
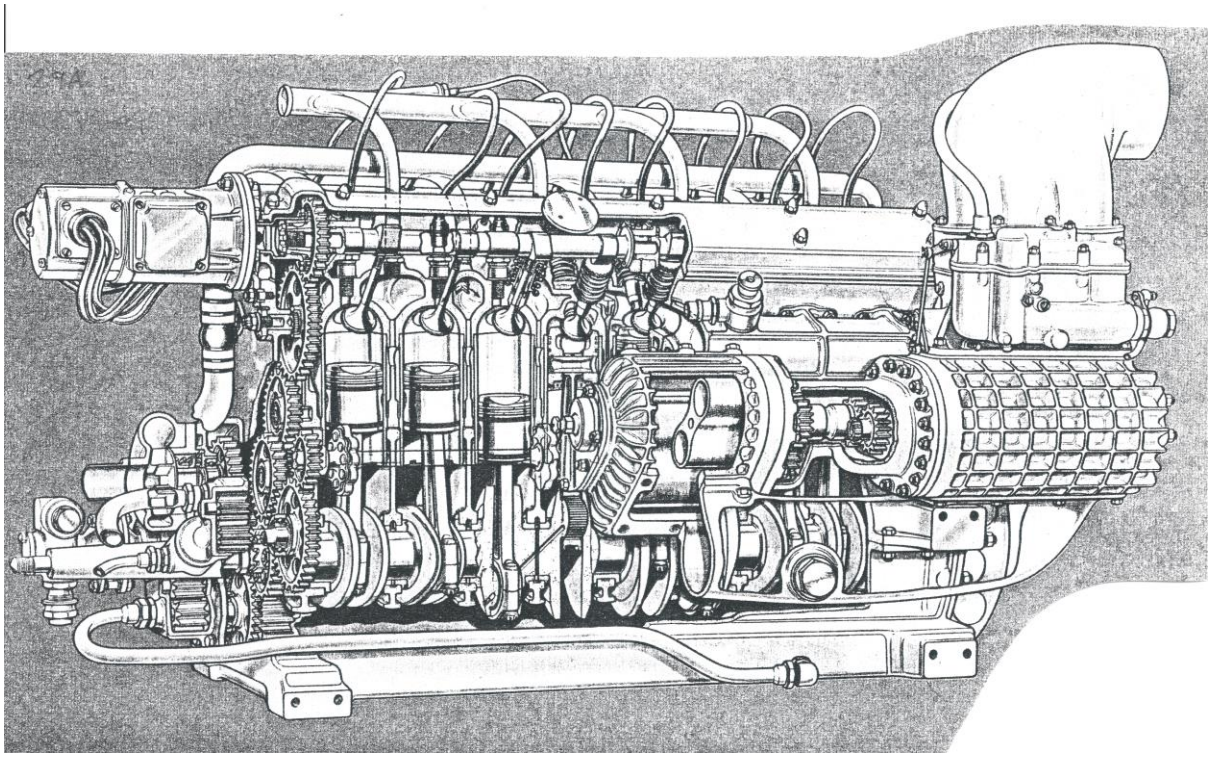


Fig. 29A
Late-1951 Alfa Romeo 159M
IL8 58/70 = 0.829 1,480 cc
Shows the 1st supercharger now drawing cold air from an intake in front of the windscreen.
Previously the duct feeding the supercharger bent *forward* in an 'elephant's trunk' shape
and will have picked up warm under-bonnet air.

DASO 959 p.1219



1st Pressure-Charged Era (1PC) Part II continued on P.6

27. 1949 Ferrari 125GPC/49; 1,497 cc; 286 HP @ 7,500 RPM (see Figs. 27A, 27B)

Before describing the Ferrari type 375 which did finally defeat the Alfa 159 (not CoY but "Significant Other SO14) the 1949 CoY member of that new marque will be reviewed. During that year, when Alfa Romeo were absent, Ferrari raced two types of car.

Type 125

The first, the type 125GPC, was essentially the same as the car which had its Grand Prix debut towards the end of 1948 with an engine based on the original NA Ferrari engine designed by Gioachino Columbo in August 1945. This latter engine, a break with his previous Alfa work, was type 125* 60V12 of B/S = 55mm/52.5 = 1.05.. The intention to overcome 'Bottom-end' piston speed limitations in this 'Over-Square' way placed a bigger burden on the 'Top-end', but the valve gear had only a (novel) triple-chain-driven Single Overhead Camshaft (SOHC) per bank ,with 2 valves per cylinder (2v/c) at Valve Included Angle (VIA) of 60^0 operated by long rockers. Some concession was made to potential valve speed limits by employing hairpin valve return springs (HVRS). Such springs, in which the steel wire is bent instead of twisted as in a coil spring, had their piston-engine origin in the 1925 Sunbeam racing motorcycle and had been adopted by all British NA singles which dominated the motorcycle competition scene until supercharged German and Italian machines were developed fully just pre-WW2. HVRS had the triple advantages of:-

- Avoiding coil spring "surge";
- Placing the spring material further away from the hot valve;
- allowing cooling air – or oil, if enclosed – easier access to the upper part of the valve stem.

Triple *disadvantages* were:-

- bulk;
- high cost, having to be hand-made;
- difficulty of avoiding stress-raising surface scratches in manufacture.

The 125 engine main static structure was all Al-alloy with a detachable cylinder head, i.e. VIA = 60^0 was an *unforced* choice , not associated with valve insertion from below, and therefore represented a conscious move to improve combustion- chamber shape at high compression ratio, away from the "classic" Italian 100^0 or so used since the 1922 FIAT and last used by Colombo in his 1937 Alfa 158.

Colombo had designed originally for roller bottom-end bearings but after comparative tests with British Vandervell "Thinwall" plain bearings had shown 10% higher power (633) had adopted the latter. The weight and lifetime costs were also much lower, of course, (more on bearings development is given in Note 18).

The RPM achieved by this 1st NA engine by Colombo, even in multi-carburetter sports tune, must have been disappointing – only 7,000 – so that MPS = 12.3 m/s and MVS = probably only 2.1. Both figures were well below the mechanical limits possible at the time. The problem seems to have been the siamesed inlet ports restricting the breathing. This arrangement had been forced on the design to find room for sparking plugs which could not be mounted centrally because of the SOHC. In itself, the near-inlet plug position was bad, as mentioned before in describing Bugatti SOHC engines (see Eg. 12), and furthermore the plug points had to be deeply-recessed from the combustion chamber.

However, the low stresses did provide good reliability. This was shown by the type 166 2 L NA Sports derivative (B/S = 60/58.8 = 1.02 and still 7,000 RPM so MPS = 13.7 m/s only) winning the 24 hour race at Le Mans in 1949 as the smallest capacity NA engine ever to do so.

After various sports-car races, the 125GPC Grand Prix version appeared in September 1948. It was the 1st oversquare Grand Prix engine for 41 years. It had a single Roots supercharger. The Inlet Valve Pressure (IVP) usually reported, at 2.6 ATA, seems unlikely but the quoted 225 HP @ 7,500 RPM was probably correct. In a short and light chassis (86% of its rivals' wheelbases) and with a swing rear axle it was difficult to drive but it was able to compete with the 1948 Maserati and the 1947-type Alfa 158. The Alfa 1948 car was too fast for it.

During 1949, in the absence of the Alfa team, the 125GPC with some chassis improvements won 4 major races. It was beaten on 2 occasions by non-stop runs of the 4.5 L IL6 Lago-Talbots, which had a fuel consumption of 31 L/100 km. This triggered action by Enzo Ferrari which would bear fruit in 1950, as will be described later.

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*Until the mid-50s Ferrari engine designation was based on the volume of 1 cylinder.

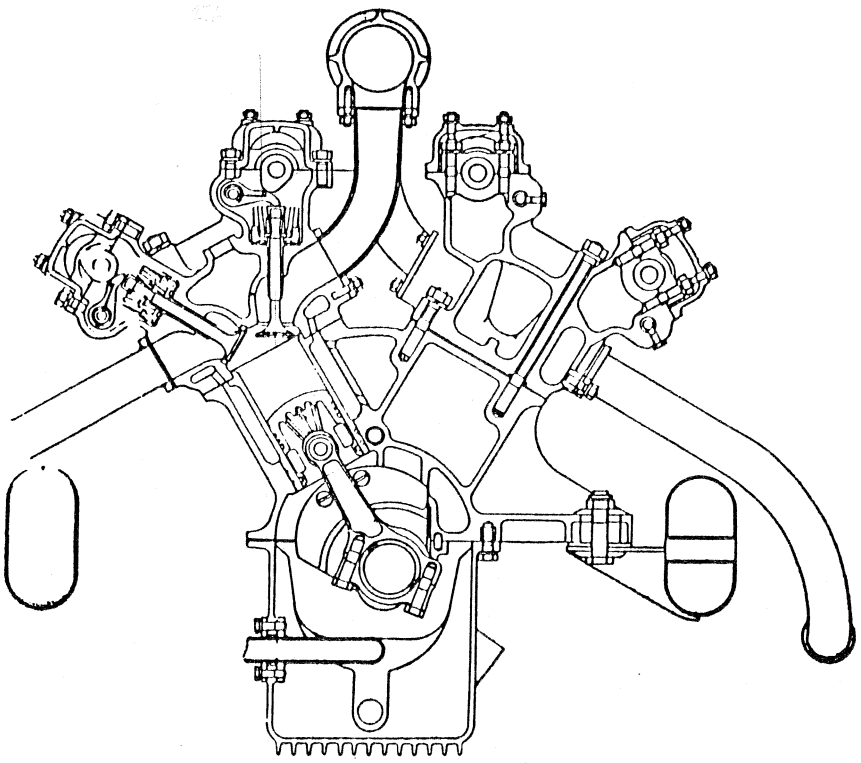
125GPC/49

In September 1949 the Ferrari works team appeared with new engines in 10% longer chassis to win the Italian Grand Prix for the 1st time. This 125GPC/49 type has been chosen as CoY. Full engine details appear in Appendix 1. Basically, it was the same 'Bottom-end' fitted with a new cylinder head and with 2-stage supercharging. The 'Top-end' was now gear-driven DOHC per bank with finger cam followers, central plugs, still 2v/c and VIA of 60^0 and still HVRS.

The quoted IVP = 2.6 ATA for this engine was believable, for 286 HP.

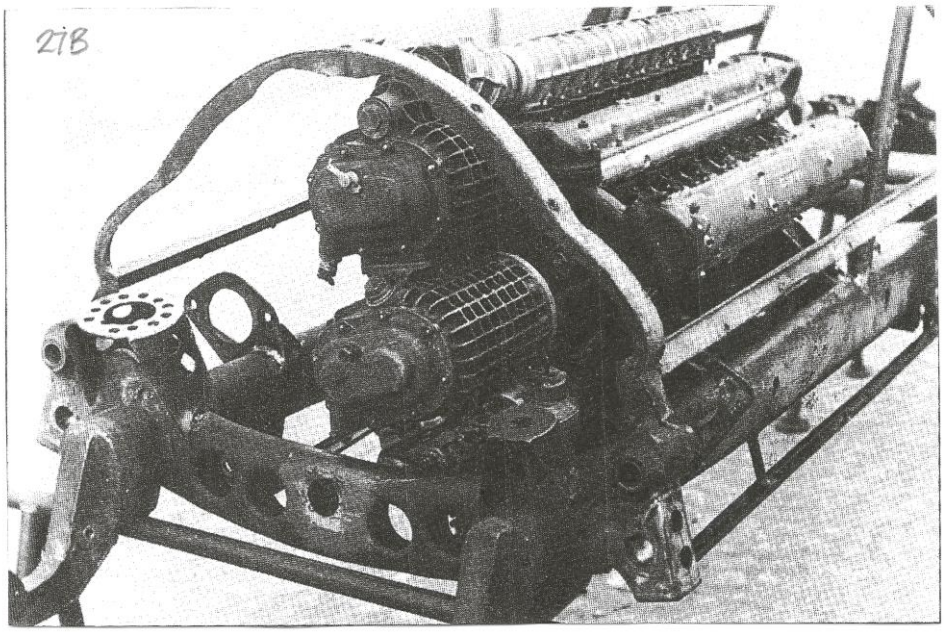
The engine was still unable to rev beyond 7,500 RPM for MPSP = 13.1 m/s and MVSP = 2.3 m/s. Really, DOHC and HVRS turned out not to have earned their keep, for reasons not immediately apparent.

Fig. 27A
1949 Ferrari 125GPC/49
60V12 55/52.5 = 1.048 1,497 cc
The 1st 'over-square' CoY engine since 1907.
Note the hairpin valve springs (HVRS)
and the angled-split-big-ends to enable the con-rod to be withdrawn upwards.
The method of locating the wet cylinder liners is not clear
but it is *possible* that they were screwed at the bottom.
DASO 4



Eg.27 continued on P.8.

Fig. 27B
1949 Ferrari 125GPC/49
60V12 55/52.5 1.048 1,497 cc
Showing the 2-stage Roots superchargers and the original inlet manifold.
In 1950 the outflow from the second blower was split into two pipes
feeding the manifold at ¼ and ¾ of its length on opposite sides.
The DOHC per bank were gear-driven instead of chain as on the previous SOHC engine.
DASO 702 p.119



Type 375

The author is here going to deviate from reviewing the engine of the "Car-of-the-Year" in order to describe a "Significant Other" engine, SO14 in Appendix 1, the Ferrari type 375. This car was very nearly CoY in 1951; it put an end to the post-WW2 Alfa Romeo dominance; and it ended forever the era of the mechanically-supercharged Grand Prix engine.

The type 375 was 60V12 4.5 L NA.

It seems very likely that, after the 4.5 L NA Lago-Talbots, which were IL6 with PROHV and rather low-powered, defeated his 1.5 L PC cars by non-stop runs in 1949 in the Belgian and French Grands Prix*, Enzo Ferrari decided that a more multi-cylindered NA machine could achieve a sufficient balance of speed and fuel economy to win consistently. Colombo having returned to Alfa Romeo such a design was produced by Aurelio Lampredi.

Presumably it was thought at first that a 60V12 3.3 L could do the trick since that is what Ferrari built for early 1950, B/S being 72/68 = 1.059 (essentially the same as the type 125 1.5 L). Apart from size and a change to wet iron liners screwed into the head like the Alfa 158 (instead of the liners being trapped between a detachable head and the block as before (138)), this type 275 was very like the original Colombo V12 with SOHC and HVRS. A detail change was rockers with rollers running on the cams.

The 3.3 L was *not* fast enough. It was followed quickly by the type 340 with bore enlarged to 80mm (B/S = 80/68 = 1.176) to give 4.1 L.

Still not fast enough, Alfa having increased the power of their 1950 engine.

Finally, the full 4.5 L rule was adopted with a new crank, type 375 with B/S = 80/74.5 = 1.074. This put great pressure on the Alfas in the last classic race of 1950, the Italian Grand Prix and in the early races of 1951. Then, at last, the famous first victory of Ferrari over his old team - still using the 158

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basis designed originally in the Scuderia Ferrari works – was achieved by Froilan Gonzalez at the1951 British Grand Prix.

This victory was the more remarkable for being accomplished with the late 1950 type, whereas in 1951 new engines had been built with an extra row of sparking plugs on the exhaust side of each bank (but also deeply recessed) (see Fig.SO14B). A power increase of 15% was claimed for this modification- 380 CV versus 330 (633). Probably the medium RPM torque of the 12 plug engine was superior and better suited to Silverstone. The 12 plug car won again at the German GP on the twisty Nurburgring, which tends to support the torque suggestion – Ascari, the winner, *chose* to drive it. Ascari driving the 24 plug version then won at Monza, a power circuit.

The 375/51 now reached MPSP = 18.6 m/s and MVSP = 2 m/s at 7,500 RPM, whereas the 12 plug engine at its 6,500 RPM had only 16.1 and 1.7 respectively. Clearly the extra plugs had overcome one deficit of the cylinder-head design. It seems that the 6-choke carburetter layout cramped in the vee were holding down BMPP to 10 Bar at R = 13, burning fuel with 40% Methyl Alcohol, 30% Benzole and 30% Petrol (142). For comparison, the 1950 4.5 L NA Lago-Talbot –also with 2 plugs per cylinder and 2 cylinders per carburetter choke - produced 11 Bar at R = 11 (485).

The Ferrari ECOM was 40.8% v. the Talbot at 46.9%.

The 375's MGVP at 71 m/s was probably too high for the "Tortuous" inlet system (see Note 34) Note 47 describes the handicap imposed by the inlet porting on the early SOHC Ferraris.

The product (R x VIA) @ (13 x 60^0) = 780^0 meant that the combustion chamber at TDC with a high piston hump had reached the in-efficient "orange-peel" shape i.e. too high a (Surface Area/Volume) ratio and therefore more heat loss than a hemisphere and also an obstruction to flame front development.

The last race of the 1PC Era

The 3 Ferrari wins up to September 1951 had been secured by a superior combination of power and torque and with the better fuel consumption permitting lower fuel weight on board but with equal numbers of pit-stops per race. In the final race of 1951 in October at Barcelona, which would settle whether Fangio (Alfa Romeo) or Ascari (Ferrari) would be Champion, Ferrari finally tried to run non-stop. The extra fuel weight, with tyre treads thick enough to last the race, proved too much for their choice of smaller diameter rear wheels than Alfa (7.50-16'' v. 7.00-18''). Most of their 24 plug cars had several treads strip off. The best (Gonzalez) had only 1 brief tyre stop but was still unable to better 2nd place to Fangio – who stopped twice for fuel but *no* tyres, a particularly galling circumstance for Ferrari! Juan Fangio therefore won, what would turn out to be, the first of his ultimate five Drivers' Championships.

Had there been a Constructors' Championship in 1951, with the then-current points scale (best 4 to count), the Ferrari 4.5 L NA would have won it with 86 (61) points to Alfa's 1.5 L PC at 75 (54).

The end of the 1st Pressure-Charged (PC) Era and the end of Mechanical-Supercharging (MSC)

Alfa Romeo saw that the 159M had reached the end of its development and the Ferrari 375 had not, so they withdrew from racing after 1951. With a technical victory over the season of the 4.5 L NA engine over the 1.5 L PC at last, this brought an end to a 158/159 Grand Prix career post-WW2 of 29 major races securing 26 wins.

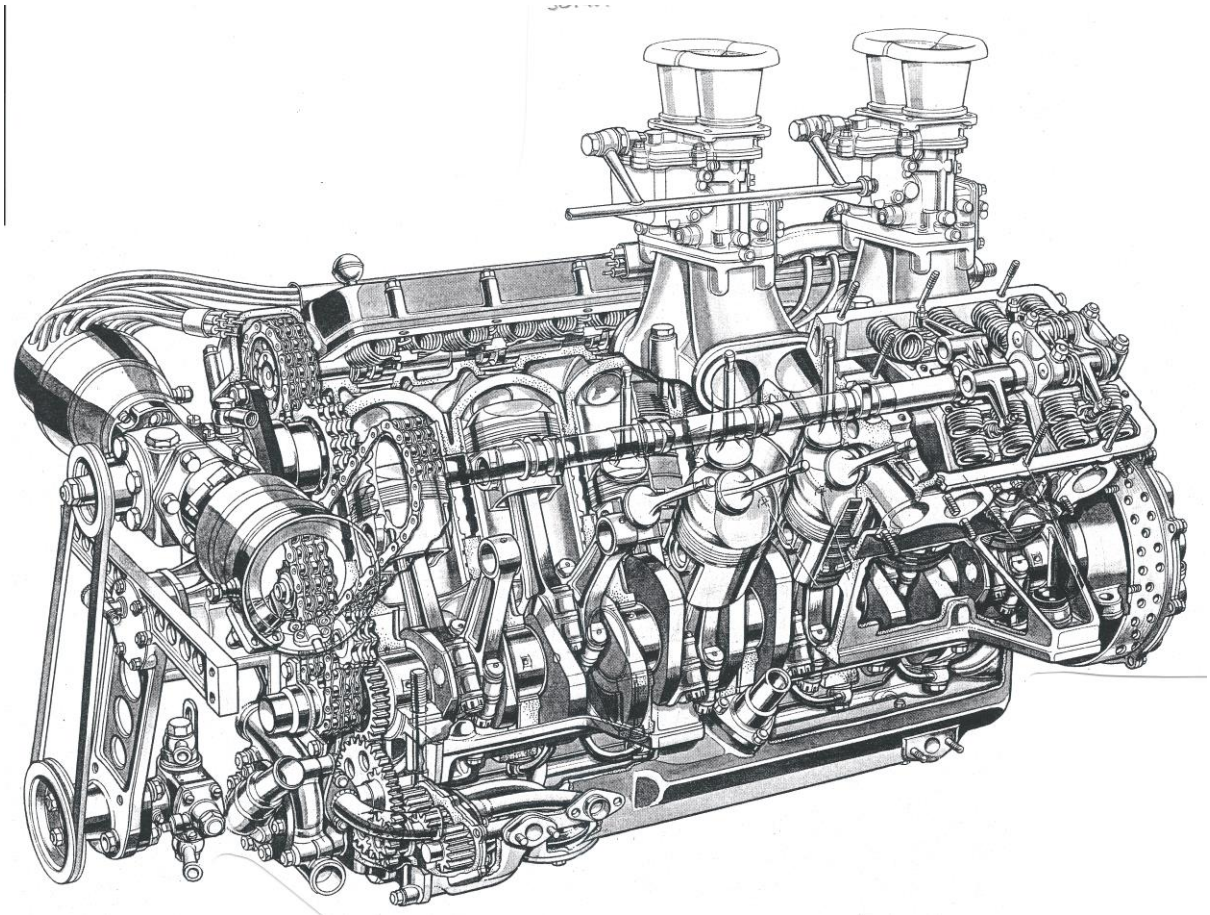
It also closed the 1st PC Era after 20 racing years. Furthermore, it closed the use for Grand Prix racing of Mechanical-Supercharging (MSC) which had always been by Roots-type units.

Technical competition in 1 PC

The 1937 and the 1951 seasons had been the most exciting of the Era, since they were close contests between technically very-different machines with 'ace' drivers on each side. Curiously these years were also internecine conflicts, between two German teams in the first case and two Italian teams in the second. Perhaps these duels were sharpened by the different regions of each country – Swabia (Stuttgart) v. Saxony (Chemnitz); and Lombardy (Milan) v. Emilia (Maranello).

Illustrations of the Ferrari 375 are given on P.10 and P.11.

Fig. SO14A
This illustration was drawn in 1973 from the preserved Vandervell Thinwall Special
1951 Ferrari Type 375
60V12 80/74.5 = 1.081 4.494 cc
375 HP @ 7,500 RPM on 40% Methanol fuel.
Representing
1950 Ferrari Type 375
Of same dimensions but only 1 sparking plug per cylinder,
325 HP @ 6,500 RPM.
Designed by Aurelio Lampredi.
Note the chain SOHC drive, which continued a feature of the original Gioachino Colombo-designed type125 NA of 1947, when it was then a novelty for high-speed automobile engines.
The cylinder liners were screwed into the detachable head. HVRS.
Inlet ports as shown were *not* siamesed but were grouped in pairs
with inside plugs presumably spaced 1-2-2-1.
This may have been a post-1951 modification, see below about the 1952 specification.
DASO 142



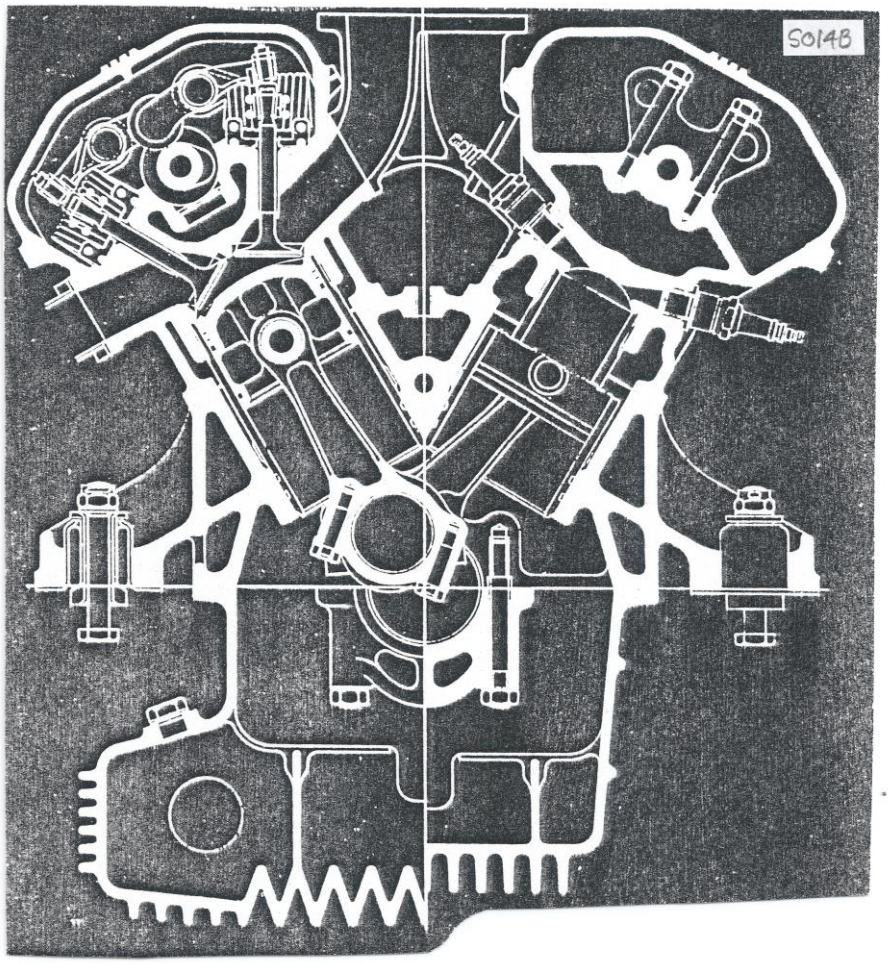
The 1950-type 375 Ferrari 4½ litre broke the Alfa Romeo 158/159 run of Grand Prix wins in every race entered since June 1947 at the Silverstone British GP in July 1951, driven by Froilan Gonzalez. He had obtained pole for that race at 100.6 MPH, the first 'Century' lap at the circuit.

1952 type 375 'Indy' specification

In 1952 Ferrari improved the 24 plug type 375, intending to race at Indianapolis, to give 450 CV (424 BHP) @ 7,500 RPM (8) (BMPP = 11.3 Bar, + 13% above the 1951 specification, @ the same MPSP of 18.6 m/s).

The changes included 3 x 4-choke carburettors instead of 3 x 2-choke. It is *possible* that the cylinder head porting was altered at that time to permit the carburetter change and that this then was supplied for the Thinwall, as drawn. Tony Vandervell was always able to secure the latest Ferrari parts and continued to modify his Special up to the end of 1953. He did try 4-choke carburettors but reverted to the 2-choke, as shown on Fig. SO14A.

Fig. SO14B
1956 Ferrari Type 290MM/130S
60V12 73/69.5 = 1.050 3,491 cc
Representing also some features of the 1950/1951 type 375,
such as:- HVRS valve gear; screwed-in cylinder liners with their own locating stub, separate from the outer head wall; deeply-recessed sparking-plug position on the inside of the vee.
The additional plug on the outside of the cylinder, also recessed, was the 1951 type 375 addition.
To provide for these plugs the exhaust ports in each bank had to be spaced 1 – 2 – 2 – 1, which provides an external identifying feature. This can be seen on Fig. SO14A.
The angled split big ends were a type 130S feature.
As a Sports car running on Petrol the 130S compression ratio was 9
so that the piston hump was not significant.
This type won the 1956 Mille Miglia, driven by Eugenio Castelotti.
DASO 8B



It could be argued that the inlet port shape would produce “Tumble Swirl”
(contrast it with Fig. 27A).
Certainly the 290MM/130S *claim* (8) of 350 CV (345 HP) @ 7,200 RPM on Petrol with R = 9
equal to BMPP = 12.3 Bar @ 16.7 m/s was a large improvement on the 375/51.
However, this is equivalent to ECOM = 55.3% and this seems unlikely for 1956.
It is not known if there was a difference in the port shapes of the two engines, 5 years apart.