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Cisitalia: Porsche Type 360

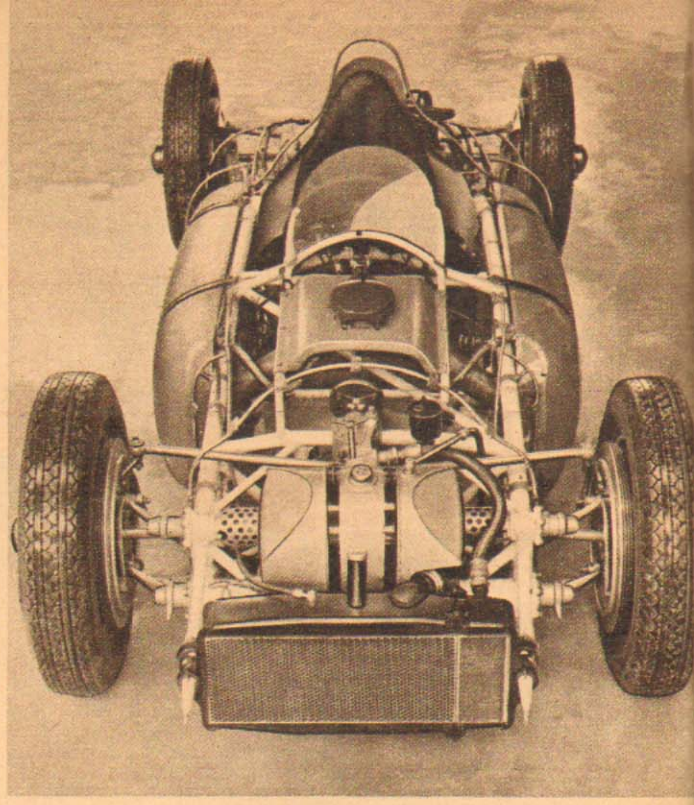
ONE OF THE MOST INTERESTING RACING CARS EVER PRODUCED RETURNS TO THE PORSCHE MUSEUM

THROUGHOUT the history of motor racing there have been countless projects which started off with a great deal of promise, but which were either never developed fully, or made a solitary appearance on the starting line; such names as S.E.F.A.C. and CTA-Arsenal come readily to mind. Many of these failed through lack of sound finance, and quite often through poor design.

Among the post-war cars which have been built and proceeded with no farther through lack of money was the Cisitalia, one of Dr. Ferdinand Porsche's innumerable designs. This was probably the most technically interesting project prepared for the 1947-53 formula 1, which limited the cylinder capacity to 1½-litres supercharged or 4½-litres normally aspirated. Included in its unusual features the Cisitalia had four-wheel drive, and, rare for that time, the now almost universal tubular space frame. After construction in Italy the only example completed was sent to the Argentine, but no development took place and it was never entered for a race. After a great deal of negotiation, this ingenious car has now returned to the Porsche factory in Stuttgart, where it will take its place among the other exhibits in the company's museum that provide evidence of Dr. Porsche's very fertile mind.

The Cisitalia company was founded in Turin by Pietro Dusio, a wealthy Italian sportsman. Initially sports and sports-racing cars were developed, using standard Fiat parts. In 1947 Dusio decided to produce a formula 1 car from scratch. To undertake the work he engaged Dr. Ferdinand Porsche, who in those troubled post-war years had set up a small organization at Gmund in Austria; hence the derivation of the Porsche type 360. Working with Dr. Porsche at that time were his son Ferry and Julius Rabe, who today are president and vice-president respectively of the Porsche Company in Zuffenhausen. Among other technical assistants employed were Carl Abarth, who has since founded his own successful company, and Dr. Eberan von Eberhorst, who was earlier associated with Dr. Porsche on the design of the Auto Union racing cars.

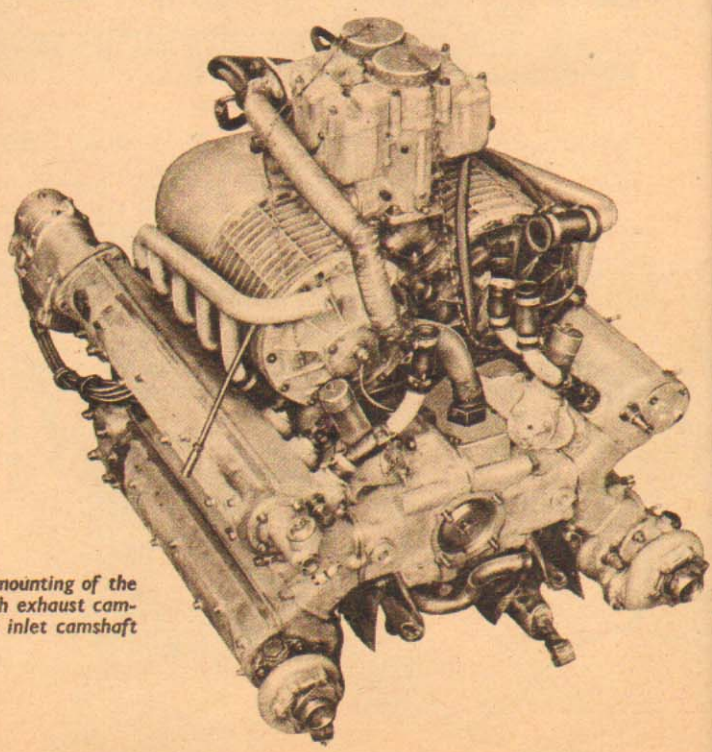
Although the Cisitalia is outstanding for its use of four-wheel drive and a space-type frame, it also has several traditional Porsche features—among them the rear engine layout and trailing arm front suspension. In fact, throughout Dr. Porsche's long career, certain unmistakable lines of thought can be traced, and are indeed still evident in the company's products today.



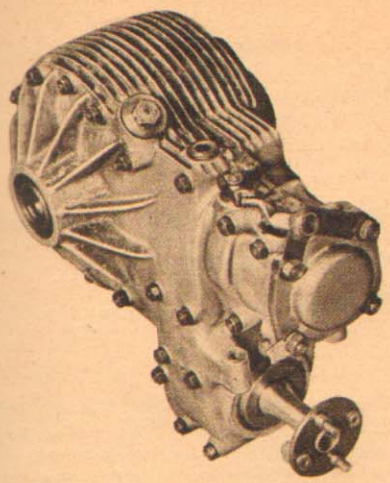
Two side-mounted fuel tanks with a central scuttle filler have a total capacity of 44 gallons. The oil tank is mounted behind the radiator and above the front wheels' differential

A horizontally opposed layout was chosen for the 12-cylinder engine, which has a bore and stroke of 56 × 51 mm. The light alloy crankcase is formed in halves with a vertical split, and incorporates wet cylinder liners. In each aluminium cylinder head there are two valves having an included angle of 90 deg., and these valves seat direct in the hemispherical combustion chamber, with no separate inserts. Twin overhead camshafts on a horizontally opposed engine always present a problem, as the means for driving them can be complex and heavy. Dr. Porsche overcame this by a system of horizontal and vertical shafts with bevel gears at each end. This type of drive is continued for the overhead-camshaft air-cooled Porsche engine today.

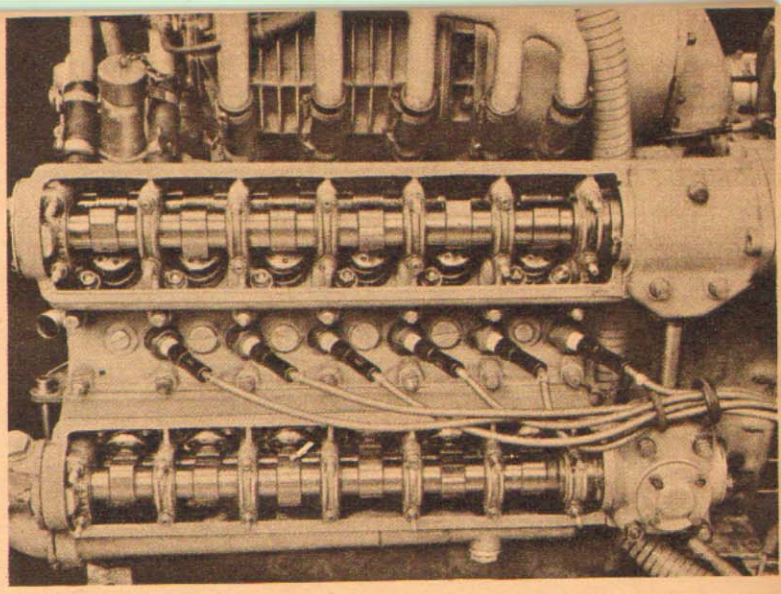
The crankshaft runs in seven roller bearings and is located endwise by one ball bearing. By using the patented Hirth type of construction, with each throw made separately and joined to the next section by zero bevel face serrations and secured by through-bolts, it was possible to utilize a roller bearing big end



An opposed cylinder layout makes for comparatively easy and compact mounting of the twin superchargers. A water pump is driven from the forward end of each exhaust camshaft; there is a six-cylinder magneto driven from the rear end of each inlet camshaft



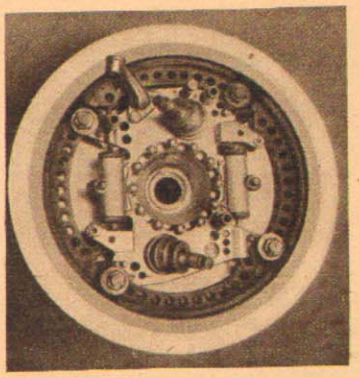
Differential for the front wheels, showing the input drive shaft from the rear-mounted transmission. On top is the control for clutching in and out this drive



Camshafts for inlet (top of picture), and exhaust exposed; the valves are operated by fingers interposed between cams and valves. The vertical drive-shaft and bevel-gear housing for these camshafts can be seen on the right

and one-piece connecting rod; needle rollers are used in the small end. Fuel mixture is supplied by two single-stage eccentric vane superchargers from two single-choke downdraught carburettors with twin float chambers. Maximum boost at the time development was suspended was 28 p.s.i. (approximately 3 Ata), resulting in a maximum power output of 296 b.h.p. at 8,500 r.p.m.; maximum b.m.e.p. was 322 p.s.i. at 6,000 r.p.m.

As with the 16-cylinder B.R.M., a great deal of nonsense was talked about the Cisitalia engine being capable of running continuously at speeds of between 10,000 and 12,000 r.p.m., and developing over 500 b.h.p. as a result of these high crankshaft speeds. In terms of mean piston speed (4,000ft per minute at 12,000 r.p.m.)—which is almost meaningless as a design criterion—the Cisitalia could run at these speeds. However, it is known that piston acceleration is the limiting factor if destructive inertia effects are to be avoided. The acknowledged ceiling of piston acceleration is around 100,000ft per sec per sec when using modern narrow piston rings. This figure occurred at 8,500 r.p.m. on the Cisitalia, so that although greater powers may have been achieved with increased boost pressure as development proceeded, higher engine revolutions were not feasible.



Front brake assembly, showing the four leading shoes. The wheels pivot on the two ball joints attached to the back plate

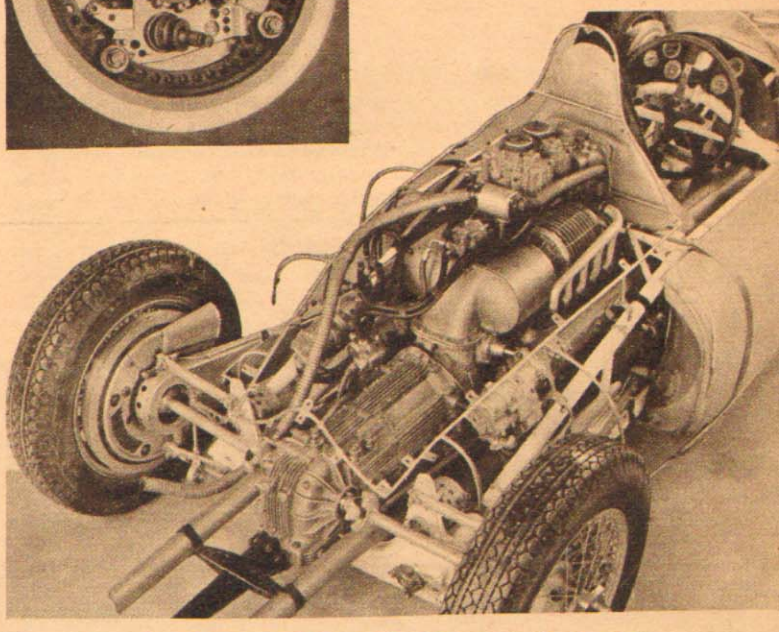
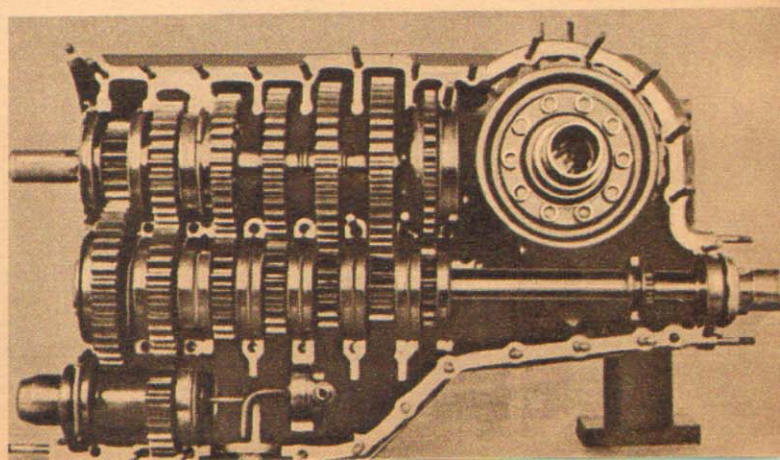
Unusual Gearbox Position

Rather surprisingly for a rear-engined car, the five-speed gearbox is placed between the engine and the differential, which results in low polar moments of inertia for the car. Input is to the top shaft, from which the drive goes through a pair of constant mesh gears to the lower one. On this lower shaft are five free-running gears, each mounted separately on a ball bearing. Each gear is selected in turn by means of an externally splined sliding sleeve engaging with internal splines in each of the gears. Thus each ratio is selected successively with a positive-stop type of gear change, as used on last season's Lotus formula 1 and 2 cars.

A third constant-mesh gear in the transmission train takes the drive forward to a train of three gears and bevel box differential at the front of the car. This drive to the front wheels can be engaged or disengaged by operating a lever placed below the steering column. The drive shafts have double Hooke joints to give constant velocity outboard, and a single Hooke joint inboard. It is apparent that Dr. Porsche had not fully solved the problems of continuous four-wheel drive, but this arrangement was designed to make full use of the power from the starting line and it was hoped it would be useful in accelerating away from slow corners.

A basic wishbone type of layout is used for the rear suspension. The wheel assemblies are connected to the frame by equal length transverse arms at each side and located longitudinally by a long fabricated deep section trailing radius arm. Four leading shoes are fitted to each of the outboard brakes, which have an effective diameter of 13·5in. and a width of 2·25in. Each shoe in each front brake provides self-servo effect, but it is believed that the shoes of the rear brakes have trailing action. Wheelbase of the Cisitalia is 8ft 6·5in., which is approximately 1ft longer than the current Cooper and Lotus, and the tracks are equal at 4ft 3·2in. The published weight with oil and water was 600 kg (1,320 lb), or 330 lb more than the minimum allowed for the 1961 formula.

Fourteen years ago, when the design of the Cisitalia commenced, it was a farsighted project. It is fitting that the one model built should now be preserved as a tribute to its creator.



Above: Rear end with tail cowling removed. Torsion bars (longitudinal rear, transverse front) are used for the suspension. Below: Running gear of the transmission exposed. Input from the clutch is to the top shaft and the lowest one takes the drive forward to the front wheels. The gear selector is to the right of the intermediate shaft, which has a dog for use with an electric starter at the rear