

THE ALFA ROMEO PERSPECTIVE ON MAGNESIUM

by M. Raveglia

...the opportunity to speak briefly with you today on the subject of magnesium, and more specifically on magnesium from our perspective at Alfa Romeo.

Our company is oriented to the production of high performance cars, and we got a very early start in using light alloys for the purpose of weight reduction. Here are just a few important dates in our light alloys calendar:

- 1952 - first engine with an aluminum crankcase
- 1960 - first magnesium wheels
- 1964 - first light alloy mechanical pieces for series (engine, clutch, and gearbox)

Today our fastest car, the GTV - 6/2.5 liter coupe, (Figure 1) uses about 45 kilograms (99 pounds) of magnesium. This is a record for the use of this metal in relatively large volume (10,000 units per year) production cars. Accompanying this report are photographs of the various mechanical parts of this car fabricated from magnesium alloy.

Figures 2-6 show the sump, sump bottom, clutch cover, and engine back cover. The specifications of these parts are summarized in table 1. All parts in this group have a chromate finish which assures, according to our tests, sufficient protection against corrosion for these specific uses.

As you might expect, wheels account for the major use of magnesium by our company. In fact, about 75% of the magnesium we consume is in the form of wheels. Alfa Romeo supplies magnesium wheels as standard equipment on all top line models, and we offer mag wheels as options on other models. Figures 7-12 show various Alfa Romeo wheels currently in production. The specifications for these wheels are summarized in table 2.

From both the standpoint of safety and appearance preventing corrosion is a critical problem with magnesium wheels. Increasing use of salt and stones on roads in northern countries has made the environment more aggressive, and we see the need to improve surface treatments for all metals, including magnesium, used in automobiles. For this reason Alfa Romeo has developed a 5 step protection treatment for the wheels we install on our vehicles. This protection process begins with an electrochemical followed by cationic EDP. The wheels are then primed with epoxy and finished with two coats of enamel. With this treatment the wheels show good saline corrosion and stone chipping resistance under accelerated in-use tests.

In closing I want to say just a few words about a project we have underway aimed at substituting magnesium for a number of aluminum parts. We are experiencing good results up to now, with various parts for our four cylinder engine. The specifications for these experimental parts are summarized

in table 3, and the parts themselves are shown in figures 13-19. If all these parts prove to be practical in magnesium the total weight reduction will amount to about 7.5%.

ation makes this economically feasible.

Very important experimental contributions in the design and development of magnesium castings have come to us from our racing car programs (Figure 20). Racing offers the opportunity of testing experimental parts under severe stress and fatigue conditions.

Our research and developments are done in cooperation with our suppliers who include Societe Italiano per il Magnesio, a primary magnesium producer, and Tecnomagnesio and Cromodora, both casting suppliers. The technical support of these suppliers, who are all members of the International Magnesium Association, is very much appreciated.

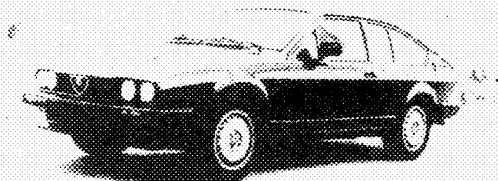


Figure 1

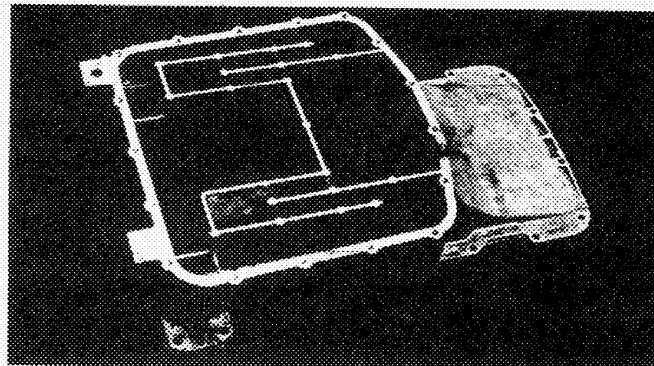


Figure 2

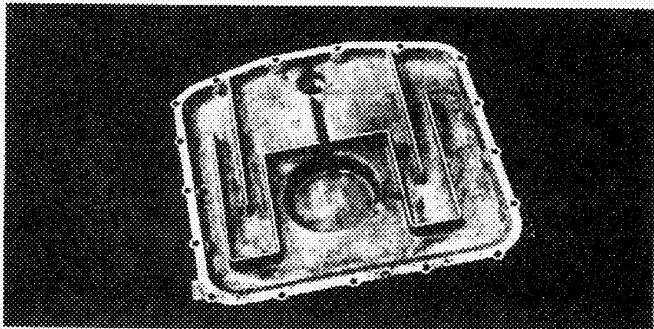


Figure 3

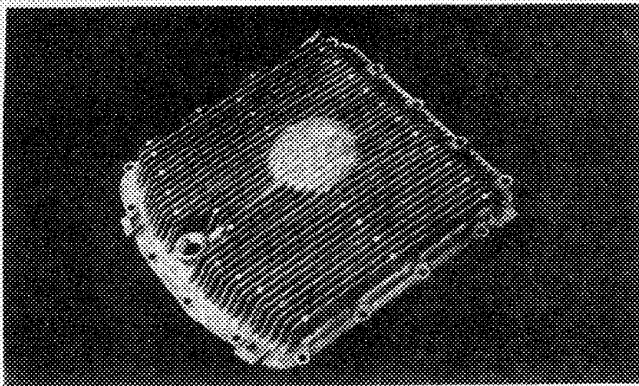


Figure 4

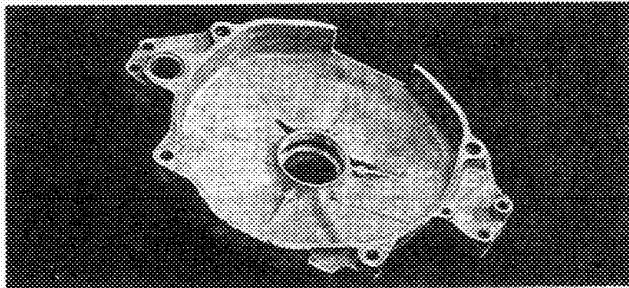


Figure 5

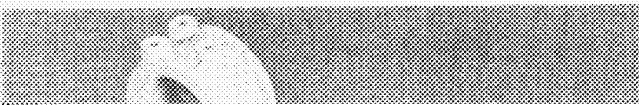


Figure 6

Alfa Romeo Magnesium Pressure Die Castings in Production (Six Cylinder Engine)

PIECE	ALLOY	WEIGHT		FINISHING	FIGURE
		Kg	Lb		
Sump		3.450	7.600		2
Sump bottom	ISO Mg-Al 9 Zn, No. 2 ASTM AZ 91	1.870	4.120	Chromating	3 & 4
Clutch cover		1.240	2.730		5
Engine back cover		2.750	6.060		6

Table 1

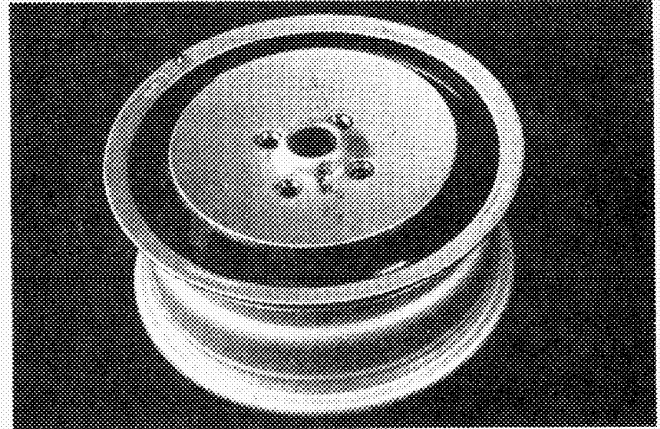


Figure 7



Figure 8

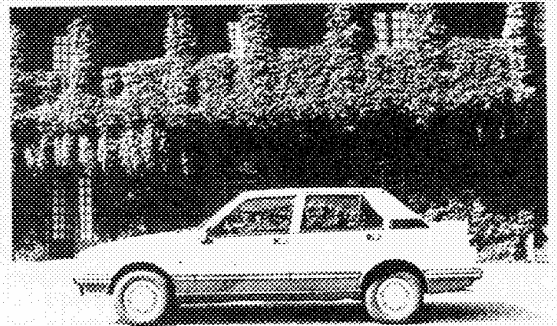


Figure 9

Alfa Romeo Experimental Magnesium Pressure Die Castings (Four Cylinder Engine)

PIECE	Al-ALLOY	Mg-ALLOY	WEIGHT IN ALLUMINUM		WEIGHT IN MAGNESIUM		WEIGHT SAVING		FIGURE
			Kg	Lb	Kg	Lb	Kg	Lb	
Transmission case			4.830	10.650	3.188	7.020	1.642	3.620	11
Pedal support			1.190	2.624	0.785	1.731	0.405	0.893	12
Head cover	UNI GD-A1512CJ2Fe	ISO Mg-Al 9 Zn No. 2	2.210	4.893	1.527	3.363	0.785	1.730	15 & 14
Sump	ASTM SC 102A	ASTM AZ91	5.850	12.900	3.801	8.414	1.989	4.386	17
Engine back cover			4.290	9.450	2.811	6.202	1.459	3.248	18
Clutch cover			1.960	4.330	1.243	2.741	0.667	1.470	19

Table 3

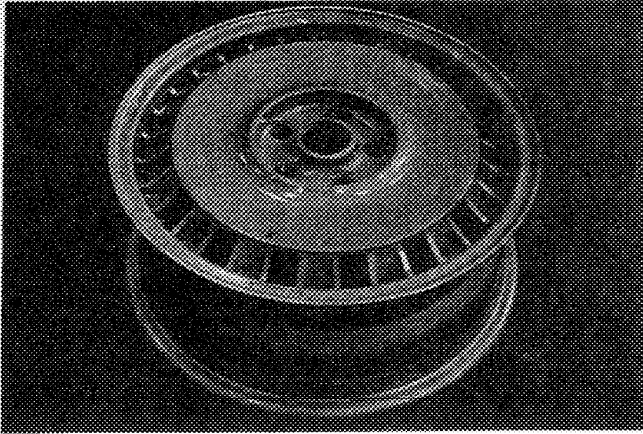


Figure 10

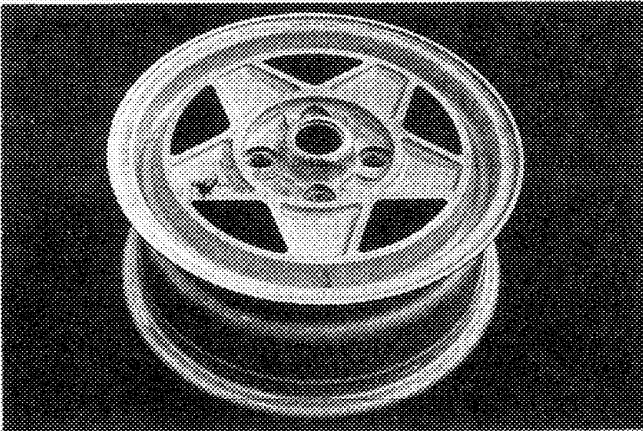


Figure 11

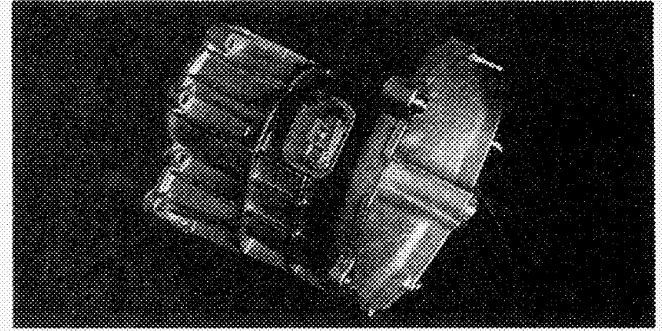
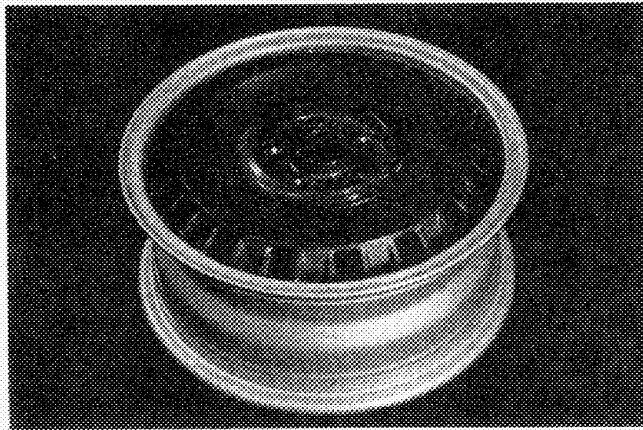


Figure 13

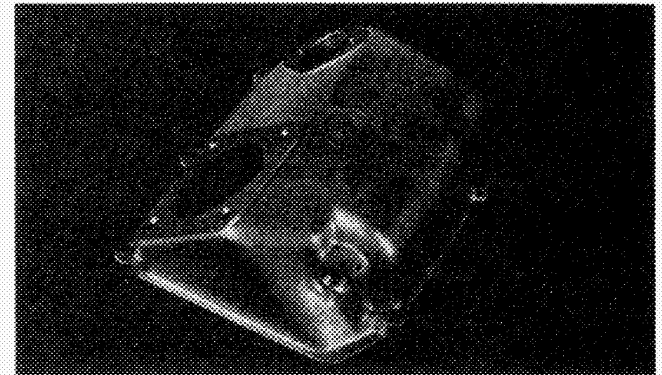


Figure 14

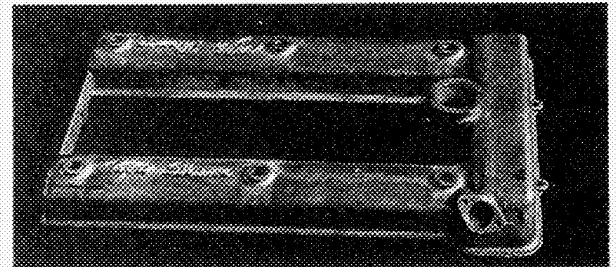


Figure 15

Alfa Romeo Magnesium Wheels

CAR MODEL	ALLOY	WEIGHT		FINISHING	FIGURE
		Kg	Lb		
Alfetta 2.0 "Quadrifoglio"		5.0	11.0	1. Electrochemical treatment	7
Alfetta 2.0		6.4	14.1	2. Dow 17	8 & 9
	ISO Mg-Al 9 Zn. No. 2			3. Cationic EDP	
GTV 2.0	ASTM AZ91C-T4	6.1	13.5	4. Epoxy primer	10
				5. Base coat	
Spyder veloce		5.5	12.1	6. Clear coat	11
GTV 6/2.5 Coupe		6.1	13.5		12

Table 2



Figure 16

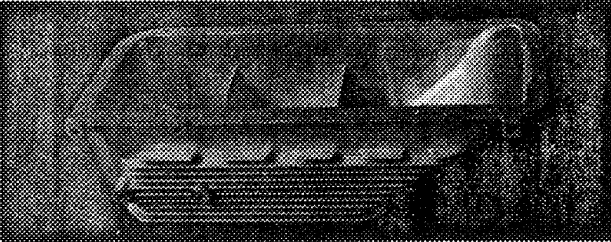


Figure 17

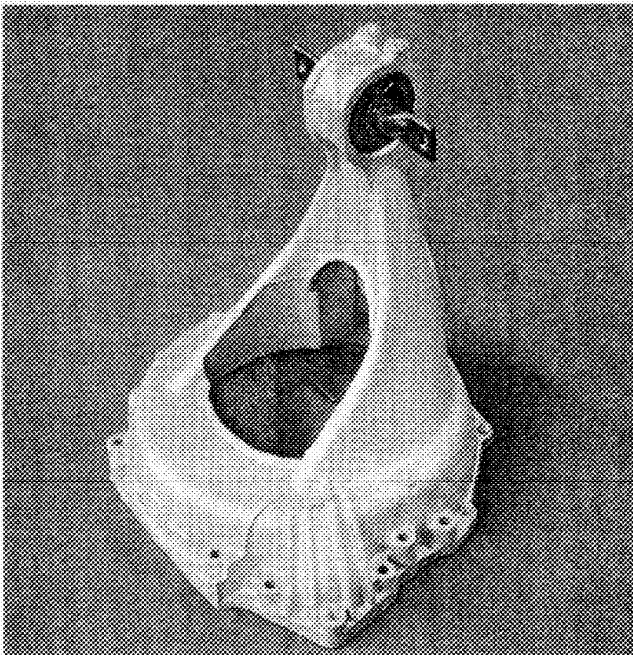


Figure 18

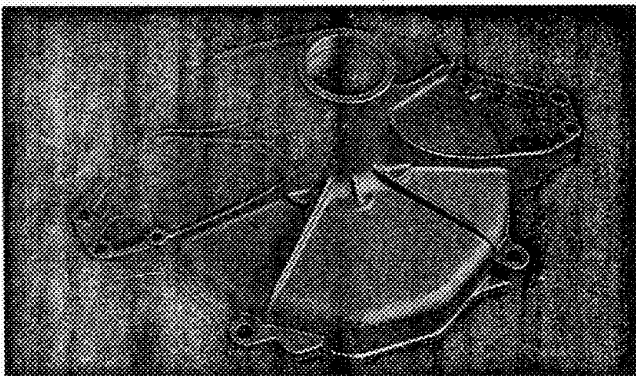


Figure 19

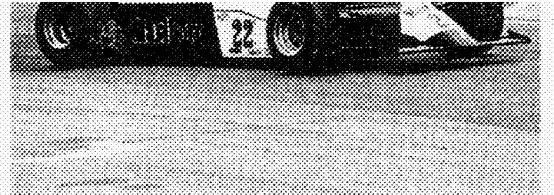


Figure 20