atmosphere clean. In the late 40's I ran some large turbo-compound engines of this kind at Cornell as well as at Pratt & Whitney Aircraft and found surprisingly low levels of carbon monoxide in the exhaust during operation below 80 percent of full load at all speeds. In the early 50's, I witnessed the "Texaco Combustion Process" engine, which seemed unusually indifferent to octane rating. The engine ran on almost anything. My recollection is that I wasn't particularly impressed with the combustion chamber design and privately predicted nothing would come of it. Nevertheless, I recall that the design permitted a form of air-fuel mixing that promoted detonation resistance and might be worth another look from the standpoint of lowering atmospheric contamination from fuel additives, but I doubt whether the CO level would be reduced. This kind of engine design might be an example of the performance compromise that Fay and Keck so correctly anticipate. I agree with them that virtually every method for reducing pollution would introduce serious performance penalties.

I do not think that the automotive steam engine (even if somehow run condensing) would be especially attractive either in terms of economy or the instant response required of characteristic stop-and-go driving as well as of sudden accelerations as in high speed passing. Therefore I doubt whether there is a truly practical solution to the pollution problem without inordinate costs to the car operator.

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Cultura Italiana

Some of Nicola Di Ferrante's comments (Letters, 20 Sept.) on the Italian academic situation bear some truth, but I cannot help feeling that he suffers from "Italophobia." It is not uncommon among Italians, especially those who emigrate to other lands to criticize excessively that very country and those institutions which prepared them, during the "green years," to attain success in life. Most remarkable, are not the shortcomings of the Italians, but the abilities of Italians to denounce their own shortcomings, without ultimately doing anything to resolve them. It is not unusual that they would even denounce themselves for sins which are either nonexistent or common to the entire human race, as Barzini (*1*) has involuntarily demonstrated by writing his book.

Everybody agrees that the university system in Italy needs complete overhauling, but for Di Ferrante to say that the new generation learns precious little and is well versed in the art of intrigue and academic politics goes beyond a fair and constructive criticism and creates the general impression that Italian students are ignorant lads whose primary pursuit is deception. Di Ferrante reassures us that he did not intend it as an accusation against Italian students and graduates, but in the meantime, for all practical purposes, the accusation has been made.

Regardless of how impractical the programs and system of teaching in Italian universities may be, most Italian students who reach the university have perhaps the highest general culture training among their counterparts in any country. The American public, even in the academic world, is not aware that the university in Italy, as in other countries in Europe, is in essence a graduate school. Before entering the university, the Italian student goes through 3 grueling years of *Liceo*, during which he practically "recapitulates" 3000 years of knowledge of the western world. He has to digest an impressive number of Latin and Greek authors in the original language, including translation, interpretation, and comment. The same is true for an endless list of Italian poets and writers, Dante's entire *Divine Comedy*, the philosophical work of German, English, or French authors, and works of art: painting, sculpture, and architecture, from Phidias to Frank Lloyd Wright.

To this, one has to add the chronological histories of each subject: history of Greek literature, history of Latin literature, history of Italian literature, history of philosophy, and so forth.

The humanities represent the major load, but the natural sciences are also part of the course of study. Division of subjects is conventional, with no fragmentation into a variety of courses with different exotic titles. A single word "Latin" defines a subject which may comprise everything that was written in Roman times.

The value of such training has been seldom pointed out or sufficiently emphasized. Rather, it has been minimized by the Italians themselves, at a time when many in America are crying for more humanistic training for scientists

and engineers in order to produce more "complete, universal men." University reform and elimination of obsolete methods and practices is imperative in Italy, but international vilification of the *Mater universitatis* and her students and graduates is not.

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Reference

1. L. Barzini, *The Italians* (Atheneum, New York, 1964).

Zond 5: Sketches and Guesses

While I generally agree with the uses of the Zond 5 class of (Soviet) spacecraft proposed by Davies and Murray (11 Oct., p. 243), their description of Zond 5 as being comparable in design to the Soviet Mars and Venus probes is, I think, wide of the mark.

The sketch in Dmitriyev's article (*Pravda*, 25 Sept.) does show three sections for the spacecraft in its parking orbit. However, it is easily seen that the section described by Davies and Murray as containing a midcourse rocket motor (that is, a rocket engine) is not that at all. It is, in fact, the upper stage of the booster rocket and its purpose is to inject the Zond 5 into its translunar trajectory. That upper stage adds some 10,400 feet per second (3120 meters per second) to the Zond 5 which at that point already has an Earth satellite velocity of perhaps 25,400 feet per second. Midcourse engines add only corrections of the order of hundreds of feet per second and often less ΔV. The stage was ignited 67 minutes after the initial launching and discarded after burn-out, leaving only *two* compartments. All this is described by Dmitriyev and is shown in his sketches. He describes a sphere—the "descent vehicle"—and an instrument compartment as leaving the parking orbit.

Despite Dmitriyev's relatively detailed article, both Davies and Murray and myself will have to await photographs of the Zond 5 spacecraft comparable to those of the Venus 4 released by the Soviet Union. The latter were sufficiently detailed so as to permit counting of threads in the "plumbing," whereas the crude sketches of Zond 5 give rise to an extended guessing game, no less.

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