

and calculations made involving the area covered by Boston. The result—a startling revelation of waste and inefficiency.

Thoroughness. Doctor Little recently wanted to make himself-letter perfect in a certain part of chemistry. He cut up a book on the subject and carried a portion of it with him. Odd moments were spent in study. When one section was mastered the next followed. Problems were solved. Cards were prepared with questions on one side and answers on the other to be used in self-imposed examinations. Could an overconscientious student do more in preparation for a doctor's examination? And all this at the age of sixty-four.

The *Industrial Bulletin* published by Arthur D. Little, Inc., under his close guidance is an example of how a thing can be done better than it has been done before. The appearance of the bulletin is inviting; one is impressed with the quality of the paper and the artistic make-up—the product of serious study. It tells of recent advances in chemistry and engineering in language that can be understood by the non-professional reader, and as a consequence is quoted frequently by newspapers and by the *Literary Digest*. One cannot read the bulletin without seeing clearly the relationship between research and advance in industry. Doctor Little has always taught that industry grows,

and only grows, when it is nourished on the products of the research laboratory; and he has emphasized the importance of the work of the chemist and the dignity of his profession.

Doctor Little has accomplished much and has received a long list of honors. (See *Who's Who in America* and *American Men of Science*.) He did not finish the undergraduate course at the Massachusetts Institute of Technology but he is a doctor *honoris causa*. He is largely a self-made man; but he was made by an artist, not an artisan. He is not an alumnus of the Massachusetts Institute of Technology but he has been president of the Alumni Association and is a life member of the corporation of the Institute. He has served actively the professional societies of which he is a member. His leadership was recognized when he was selected to fill the office of president of the AMERICAN CHEMICAL SOCIETY, of the Society of Chemical Industry, and of the American Institute of Chemical Engineers.

Doctor Little is now in the prime of his intellectual and scientific life. He looks ahead, not back. His greatest admirers are those who know him best—a fact that explains why the writer sees so clearly the high lights in the photograph.

JAMES F. NORRIS

NOTES AND CORRESPONDENCE

Sulfur Tolerance in Gasoline An Addition

Since the publication of our paper, "Sulfur Tolerance in Gasoline" [*IND. ENG. CHEM.*, 20, 899 (1928)], a considerable amount of additional information has come to us which shows even more clearly that, at least during mild climatic conditions, the sulfur specification for gasoline may well be revoked.

An official of one of the largest refining organizations in the United States writes us—

All the evidence of which I know personally is against the setting of any limit at all, either for hot or cold climates. Diesel oils are marketed in Europe with sulfur content up to 2.5 per cent without trouble. We made some attempt to get experimental evidence on the influence of sulfur on engine corrosion and failed to find any sign of corrosion on fuels up to 0.4 per cent sulfur. Conditions were favorable to corrosion in that, the fuel being kerosene, there was a high dilution of the lube oil, (20 per cent), and in one of the tests water was added to the oil. [The temperature was 12° C.] As far as our results went, they were decidedly in support of Doctor Egloff's conclusions and recommendations.

In other instances that have been brought to our attention, automobiles have been operated for long periods on fuel containing 0.35, 0.4, even 0.6 per cent sulfur with negligible or no corrosion occurring.

In England there is no sulfur specification for motor fuels. Last year approximately 20 million gallons of benzene blend fuels containing from 0.4 to 0.6 per cent sulfur were marketed in that country, while in some blends now on the market there the sulfur runs as high as 0.7 per cent. Five per cent of all the gasoline sold in England at the present time is a benzene blend offered at a premium of 5 cents a gallon though containing 0.2 to 0.5 per cent sulfur. One large benzene-producing company in England has for a number of years operated its motor vehicles on straight benzene motor fuel containing 0.4 to 0.5 per cent sulfur without encountering any corrosion. An officer of the firm has used this fuel exclusively for eight years, and in that time has driven his car 130,000 miles, with no signs of corrosion of the motor. Before the war the sulfur in English gasoline ran as

high as 1.3 per cent. In war time motor cars were operated without harm on the "first runnings" from benzene stills, rich in carbon disulfide and analyzing 40 per cent sulfur. Despite this widespread and long-continued use of high-sulfur motor fuels, corrosion of motors is immaterial in England.

Germany also makes no limitation of the sulfur content of gasoline. Approximately half of the motor fuel sold to German automobile owners consists of benzene blends containing 0.2 to 1.4 per cent sulfur, some grades having even a 2 per cent sulfur content. At the World Power Fuel Conference recently concluded in London, a speaker from the German Aircraft Research Foundation (Deutsche Versuchsanstalt für Luftfahrt) stated that, while the sulfur maximum in motor fuel for aircraft use should normally be 0.3 per cent, benzene-lignite spirit blends containing 0.5 per cent sulfur were used without hesitation. Certainly this is a case where the greatest conservatism would be used in setting a sulfur limit. It was pointed out that airplane motors are operated at high temperatures and with abundant crankcase ventilation, conditions which prevent condensation of water and thus eliminate corrosion regardless of the fuel used.

The gathered evidence not only reinforces our previous conclusion that sulfur limitation in warm weather is useless and wasteful, but it casts grave doubt on the value of a sulfur specification at any time of year.

UNIVERSAL OIL PRODUCTS COMPANY
CHICAGO, ILL.
October 30, 1928

GUSTAV EGLOFF
C. D. LOWRY, JR.

Correction

In the article "Quantitative Relations of the Countercurrent Washing Process," by Ludwik Silberstein [*IND. ENG. CHEM.*, 20, 899 (1928)], the equation for application of the four-tank system, nine lines from the end of the article, has been printed incorrectly. It should read:

$$\frac{\alpha^4 p}{(1 - 3s + s^2)} = 1.60 \text{ per cent}$$