CHEMISTRY

Tomorrow's Gasoline

Petroleum chemists say triptane, a fuel which is not gasoline but another hydrocarbon, may give Allied planes great superiority over the Axis.

By JOHN A. MIRT

➤ A FEW YEARS ago, triptane, the world's most powerful "gasoline," was a laboratory curiosity. It was considered a fuel of great potentialities. But it cost $3,600 a gallon to produce.

The coming of war spurred research and much was accomplished. The price was hammered down to $40 per gallon, which was low relatively but not nearly low enough, even for our well-heeled army. And there the matter rested until an old man in a Chicago laboratory began testing and worrying and pacing the floor and staying awake nights. Toward dawn one day he got hold of a thread and the whole thing unraveled. The cost of making triptane came down to less than $1 a gallon. Under mass-production methods, the cost will be less.

The discoverer was six-foot Prof. Vladimir N. Ipatieff, a man of 76 years, who knows as much about gasoline and oil chemistry as any man living. He was assisted by 28-year-old Dr. Vladimir Haensel. In addition to developing triptane, Professor Ipatieff was largely responsible for 100-octane gas, without which our war planes could not fight effectively. He did the major research in butadiene, basic ingredient of most synthetic rubber production. He has also taken oil field gases which once floated off as waste and compressed them into gasoline—thus helping immensely to conserve our petroleum resources.

Triptane is his greatest achievement. Fill the gas tank of an airplane with triptane and it could get up in the air from a much shorter runway. And once off the ground, it would go faster, climb higher, maneuver more easily and go farther than with any other fuel yet developed. Technically, triptane is not "a gasoline" but another hydrocarbon. Petroleum chemists say it will give our planes a 40 to 50 octane superiority over those of the enemy and Dr. Gustav Egloff, former president of the American Institute of Chemists, has said that with triptane in our tanks we would be able to shoot down German and Jap fliers "as if they were roosting pigeons."

When the war ends, these virtues of more miles to the gallon, from a smaller and more potent engine, will be handed along to the car owner, to make driving more pleasant and more economical.

Despite this and other achievements, triptane's genius, Professor Ipatieff, is virtually unknown to the people of this, his adopted country. Yet his story is written in the records of the great scientific institutions of the world, in the fields of both practical and abstract research. Robust as Professor Ipatieff is, his broad chest is scarcely wide enough to make room for all the decorations which have been awarded to him.

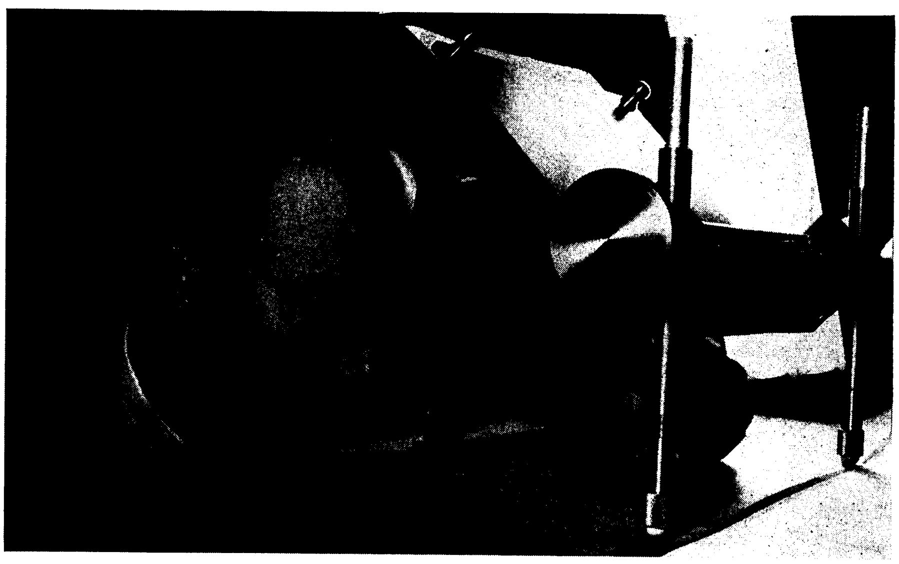
Vladimir Nikolaevich Ipatieff was born in Moscow 76 years ago, the son of an architect, descendant of a famous Russian family. It was on the Ipatieff estate that the first Romanoff, Michael, assumed the crown of Russia. And it was from the home of Professor Ipatieff's brother that the last of the Romanoffs were kidnaped and sent to their death.

The young Vladimir, destined for a military career, went to Russia's West Point, was graduated a captain, but instead of going into the service remained to teach chemistry to the young cadets. Fortunately the job left him plenty of time for research.

His career began with a failure. He was trying to make butadiene but he got something else, an aldehyde (which is intermediary between an acid and an alcohol). He couldn't understand it and was so concerned that he went back over the experiment until he had traced the outcome to the fact that he had used an iron tube instead of one of glass. The iron had acted as a catalytic agent, that is, it had influenced the result without being affected itself. Now catalysis was not new; for more than a hundred years, chemists had known about it. But Ipatieff put it to work and, following his example, so have thousands of other scientists with far-reaching results in our everyday life. It is today one of the most important tools at the command of modern chemistry.

This achievement won him wide recognition and honors which for any ordinary man would have been enough. But Ipatieff, having discovered the magic wrought by catalysis, wanted to find out more about it. He wanted, for example, to discover how catalysis functioned under pressure.

The only pressure tank available to the chemist in that year—1903—was one which had been invented in 1690. It pro-



MERITORIOUS SERVICE—James L. Buckmaster, a photogrammetric engineer of the Geological Survey, U. S. Department of the Interior, was awarded a salary promotion for the invention of this "sketchmaster."

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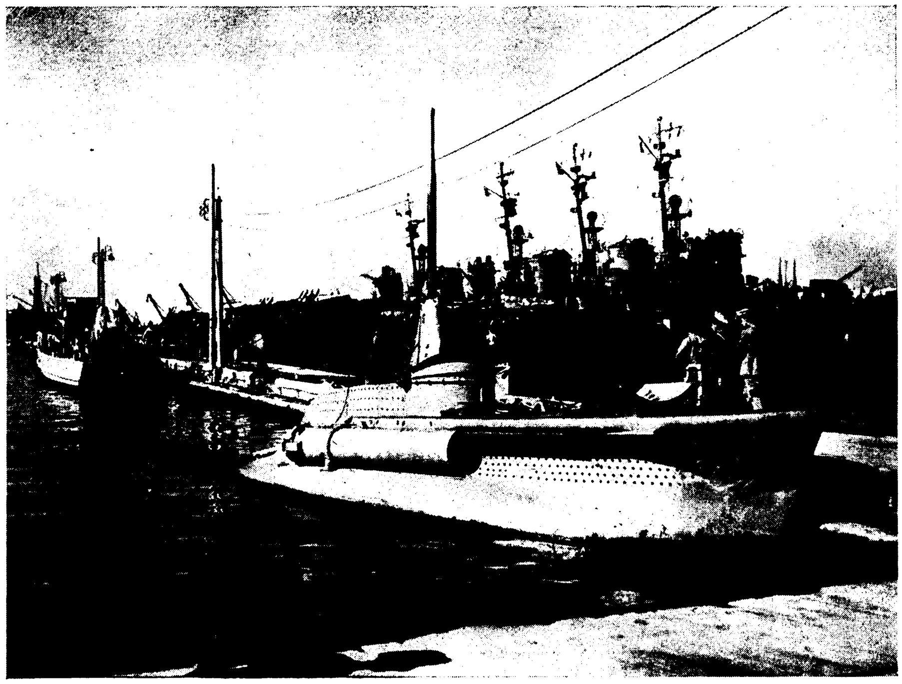

ITALIAN MIDGET—One of the tiny submarines of Italy's fleet is shown in this official U. S. Navy Photograph. Below the torpedo tubes fixed to the sides, the hull bulges out, making it look like a turnip from a bow-on view.

vided a pressure of 50 atmospheres, and was considered a very dangerous instrument.

Ipatieff, undaunted, built a tank with a pressure of 500 atmospheres and then used it to develop a revolutionary industrial process for hydrogenation. This is the method by which organic substances are changed by the injection of hydrogen.

One of his major discoveries—one vital to our war effort and tied in with the development of triptane—occurred when he took paraffins which had been regarded as "dead" or inert to chemical reaction and made them go to work. The product of this job was, in time, high-octane gas.

At a testimonial dinner to Professor Ipatieff on his 75th birthday, tendered by the American Institute of Chemists, Dr. Frank C. Whitmore, dean of Penn State's School of Chemistry, said: "The great triumph of modern internal combustion engines has been the work of thousands of different scientists and engineers. However, if one had to pick out one lone man who was more responsible than any other for our high-octane gasoline, one of our most important weapons in defense and offense, that one man is Ipatieff."

Earlier in his career Professor Ipatieff had published a paper in which he established the constitution of isoprene, the so-called mother hydrocarbon of natural rubber. In 1928, as consultant for the Bavarian Nitrogen Works, he developed a process for turning phosphorus into phosphoric acid—an achievement of incalculable value to farmers using artificial fertilizer.

When the first World War broke out he was raised to the rank of a general and named director of Russia's chemical industries. He continued in the post after the revolution, building from scratch. Lenin and Trotsky often consulted with this man who had been a frequent guest at the palace of the Czar Nicholas. He was impelled to go on by love for his work and gratitude for the appreciation shown him by the Soviet authorities.

In 1930, Dr. Egloff, then director of research for Universal Oil Products Company, invited the eminent Russian to come to Chicago to organize a laboratory for the study of catalytic problems in the petroleum industry. A passport and a first-class passage were placed in Professor Ipatieff's hands before he had definitely made up his mind, and in 1930 he and his wife set out for the U. S.

Professor Ipatieff liked the United States. When Joseph Stalin asked him to return to Russia, in the belief that the chemist had developed new formulas for explosives and poison gas, Ipatieff refused. Stalin insisted, once sending Alexander Troyanovsky, Russian Ambassador to the United States and a former pupil of Ipatieff's, to Chicago to persuade him to return.

At that time Ipatieff said: "I am not going back because I prefer American working conditions. I am getting on in years and when the weather is bad and I am feeling ill, I appreciate the privilege of staying away from my laboratory without resorting to a lot of unpleasant red tape to get official permission."

Stalin's displeasure was definitely revealed in 1937 when at a dinner honoring Ipatieff's 70th birthday, given by the American Chemical Society and attended by scientific notables from every country in the world—one nation was not represented, Soviet Russia. A month later word came that he had been expelled from the Russian Academy of Sciences, that his citizenship had been taken away and his honors revoked.

Shortly afterward, his son and namesake, a professor of chemistry in Leningrad, publicly denounced his father for his refusal to come back to Russia, calling him "an enemy of the proletariat."

Professor Ipatieff, not without a certain regret, became a citizen of the United States. He had wanted to revisit Russia, to see his children again. But he was adamant in his love for freedom. When he took his examination for citizenship he was asked if he attended church. "Certainly," he replied. "What church?" continued the judge. "Any church—this is a free country." The examination came to an end right there.

Every country in the world has honored him. France gave him the Lavoisier medal for his work on high pressure. The University of Munich gave him an honorary doctorate, Russia the Lenin prize. In 1939 he was elected to the National Academy of Sciences in this country and a year later was named "Modern Pioneer" by the National Association of Manufacturers. That same year, the Willard Gibbs medal, most coveted of American prizes, was bestowed upon him by a committee of scientists.

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For his adopted country he has performed many acts of generosity. A teacher at Northwestern, he gave the university $26,000 for a high-pressure research laboratory. Besides many individual gifts to talented young chemists, he established a $35,000 trust fund, the interest of which is being used for prizes to be awarded by the American Chemical Society. In explanation of these gifts, he said, "I should like to feel that I had a part in developing young American chemists."

At the university he is extremely popular as the prof who exults in the triumph of his students, who is perhaps more forlorn than they are when they fail, and who when excited becomes incomprehensible because he forgets his English and talks only Russian.

Each day this erect gray-haired man sets out for a one-hour walk, no more, no less. He is a gentleman of the old school, clicking his heels, and bowing at the waist. His voice is soft and it is rarely raised. To a gathering of eminent scientists honoring him on his 75th birthday, which was also his golden wedding anniversary and the 50th anniversary of the presentation of his first scientific paper, he said simply: "I have lived through several wars and revolutions and I am happy that I have been able to keep my love for my chosen science and that I still retain my physical strength."

Professor Ipatieff's wife is quite as spry as her husband. The old man refers to her as his personal catalytic agent—by that, he explains, he means his inspiration. He added: "On a wife's love and tact depend not only that well-being of her children but the well-being and peace of mind of her husband, without which he cannot work or create. These are the highest aims of a wife and these my wife has fulfilled."

This simplicity is typical of the man who has worked out processes which may well add up to the greatest individual contribution to an Allied victory.

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PHOTOGRAPHY

Rating Film Speeds

Sensitivity characteristics of camera film will be classified by a single system by an American Standards Association book, eliminating present confusion.

➤ CONFUSION created by numerous methods of rating the speed of photographic film will be eliminated when manufacturers publish the American Standards Association speeds for films.

In the past each manufacturer of films and exposure meters rated the many kinds of films now used by photographers with a system of his own. These many different ratings often left the user of film in doubt about the exposure needed for the film he wished to use; or the rating given him would not be the one best suited for the use of his light meter.

The single well-defined system of expressing the sensitivity characteristics of film now adopted will remove this confusion, and manufacturers need publish only one set of ratings.

All standard films will be rated by two methods. One method, called the ASA speed, gives an absolute value, indicating the minimum camera exposure which the film must receive in order to produce a negative from which an excellent print may be made. The other, called American standard speed number, is the number giving recommended exposures for normal photographic practice to yield the highest number of excellent pictures.

The American standard speed number falls approximately halfway between the Weston and General Electric numbers. This makes possible its use with existing photoelectric exposure meters with no change in the dials. The latitude of most film will take care of the difference in the ratings.

Branches of the armed forces are now having meters made with the new numbers on the calculators. After the war probably all meters will use the new numbers.

Film furnished the armed forces has been rated by the new method for some time, but the number is called exposure index and is designed to be used with the *American Emergency Standard Photographic Exposure Computer,* a small book which allows computation of exposure by observation.

The American Standards Association has the cooperation of all leading film and equipment manufacturers, who will publish the film speed numbers.

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Do You Know?

Gasoline consumption in Denmark is only 1% of the pre-war rate.

Cigarette paper that sheds water, now reported available, will permit soldiers and others to smoke in the rain.

Approximately one-fourth the *copper* mined and smelted in the world in 1938 was produced in the United States.

Common *paperboard* is being made in Palestine from banana and orange peel pulp, cotton waste and banana leaves.

As late as 900 A.D. the Dalmatians and Dacians along the Danube used poisoned *arrows* for hunting and fighting.

New *oil wells* are now in production near Ft. Norman in northwest Canada, only about 100 miles from the Arctic Circle.

An *oyster* pumps through its gills every day about 40 gallons of water, straining out micro-organisms for food and absorbing lime for its shell.

Britain's *"sticky bomb"* is a glass flask filled with a high explosive and covered with a sticky fabric; hurled against the side of a tank, it sticks, then explodes.

The science of electric *arc welding* of metals was known during World War I but relatively little used; now it is used in practically all types of metal construction.

The Federal Bureau of Reclamation has 52 *operating projects* that are providing irrigation, power, or municipal water to western areas with a population of nearly 5,000,000 people.

The 1942 average yield of *potatoes* in the United States was 136 bushels an acre, a 10% increase over the 1930-39 ten-year average, due largely to new varieties which resist disease and give greater yields.

Riveters and rivet-buckers at an aircraft plant use throat microphones to talk with each other; although only a foot or so apart they are separated by a wall of metal through which they can communicate only by telephone.