CHEMISTRY

# Synthetic Rubber Made From Waste Oil Refinery Gases

## Butyl Rubber Can Be Produced In This Country In Unlimited Quantities When Facilities Are Ready

BY MAKING it as a chain of molecules to which only a very limited number of additional links can be added, American chemists have been able to produce from oil refinery gases formerly wasted a synthetic rubber-like substance with many advantages over imported natural rubber.

Speaking before the 100th meeting of the American Chemical Society at Detroit, Dr. Per K. Frolich, director of the chemical division of the Esso Laboratories, Elizabeth, N. J., gave the first technical report of the new "butyl rubber," developed after ten years of research by Standard Oil chemists. It is colorless, odorless, tasteless, and more stretchable than rubber from trees.

In his address, prepared in collaboration with R. M. Thomas, I. E. Lightbown, W. J. Sparks and E. V. Murphree, Dr. Frolich stated that butyl rubber can be produced in this country in unlimited quantities as soon as necessary plant facilities are available, thus making us independent should our supply routes of natural rubber from the East Indies and Africa be cut. At present butyl rubber is being produced in a semi-commercial pilot plant in quantities sufficient for tests of its usefulness for defense and other purposes, made at the request of the Army and Navy Munitions Board.

Secret of the superiority, in certain respects, of the new product over that made by nature is in the chain-like molecules of which each is made. These, in natural rubber, give elasticity but not great strength. Vulcanization, however, causes these molecules to react with sulfur so that, without themselves being greatly altered, they are linked together into a firm structure.

### Extremely Polygamous

The rubber molecules are extremely polygamous, for even after being married in the vulcanizing process, they still want to join others. They will combine with oxygen from the air, for example, and this causes deterioration of rubber with aging even though it is not in use. The chemist calls this willingness of the molecules to marry others "unsaturation." The butyl rubber molecules have just enough unsaturation to permit them to combine with sulfur for strength. Then they are satisfied, and do not tend to react further.

Dr. Frolich explained it this way:

"Nature's rubber molecule and all its synthetic semblances are either wholly or predominantly polymers, or multiples, of much smaller molecules which belong to a class of highly unsaturated compounds called diolefins. It is to this diolefinic origin that the natural and synthetic rubbers owe their extreme degree of unsaturation and resultant chemical reactivity.

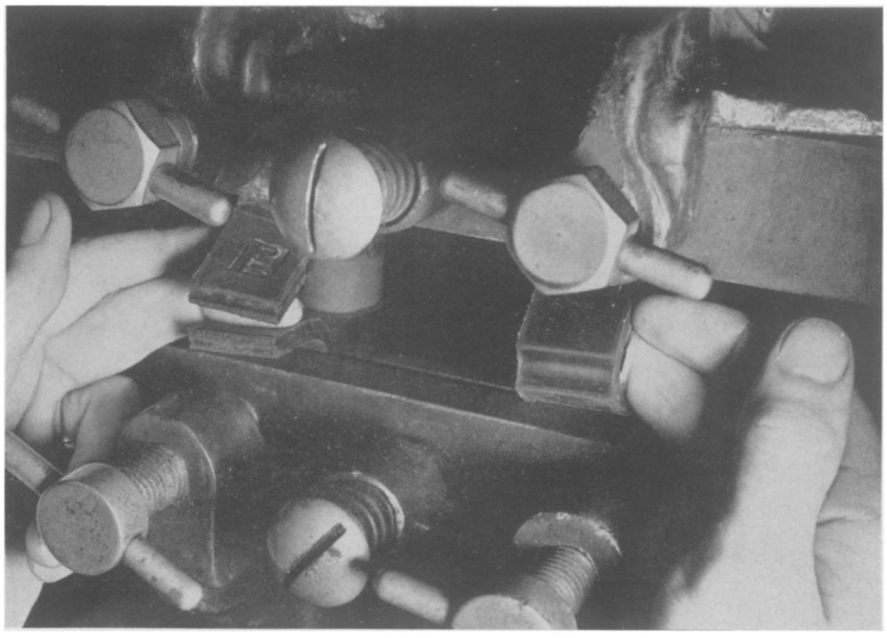
"Chemists working on rubber have been inclined to associate the elasticity and other important physical properties of rubber with its chemical unsaturation. Chemists in the Esso Laboratories, however, in their studies of chain-like polymers with no residual unsaturation, recognized a majority of these important rubber-like properties. Polymers with no residual unsaturation may be made by uniting the simple olefins, or compounds, which are readily available as constituents of petroleum refinery gases. But these olefins because of their saturated character resist all efforts to vulcanize them with sulfur.

"Through long years of research by a large group of men, the Esso Laboratories have now developed a method of co-polymerizing olefins with small amounts of diolefins to give just the proper degree of unsaturation for vulcanization—but no more.

"Out of these efforts has come butyl rubber which after vulcanization is a product with substantially no residual chemical unsaturation. As a result, butyl rubber is characterized by a remarkable stability and durability which for many purposes make it superior to natural rubber and to other synthetics.

"By variations in the composition of the raw materials employed, it is possible to obtain products that differ considerably in their detailed properties, but the basic characteristic remains the same insofar as the limited unsaturation is concerned."

His researches, Dr. Frolich said, have made it possible to pick out definite qualities in which the butyl rubber should excel. These can be achieved, thus adapting it to specific purposes, such as tires,



*DURABLE*

*After 3,000,000 sharp bends or flexures, a rubber sample (left) has been broken, while the butyl rubber (right) is as good as new.*

electrical insulation, hose, etc., which may make different demands. Future manufacturing plans, he explained, are dependent on the progress of tests now being made and will also be governed by the defense needs of the U. S. Government.

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GENERAL SCIENCE

# Science, Philosophy, Religion Find Ground for Common Front

## Emphasize Need for Upholding Human Dignity of Individual As Means for Combating the Dictator Ideologies

By WATSON DAVIS

EMPHATICALLY repudiating the primitive identification of the state and the Deity that the totalitarian states have reestablished, scientists, philosophers and religionists who met in a Conference on Science, Philosophy and Religion joined in a manifesto calling upon America to marshall her intellectual and spiritual forces to a united front in the face of the pseudo-religious philosophies of Hitler, Stalin and the Japanese Emperor. The conference was held at the Jewish Theological Seminary of America, New York, Sept. 9-11, under the chairmanship of President Louis Finkelstein of the host institution.

The ancient doctrines of human dignity, formulated in terms of modern science and philosophy, the statement declares, may become a motivating power, energizing our people to defend their freedom with a passion equal to that brought by the totalitarians to its destruction.

Some 40 intellectual leaders signed the manifesto.

"The pseudo-religious philosophies of the totalitarian nations have proven formidable weapons in their hands," the manifesto explains. "Decreasing respect for ethical and religious values among the democratic peoples has introduced intellectual confusion in their educational systems, in their literatures, and in organs of public opinion generally. Taking advantage of this confusion, the totalitarians have won considerable numbers of adherents even among the free peoples of the world. In consequence, the morale of the democracies has deteriorated and their power of resistance to totalitarian arms and diplomacy has diminished.

*CONFEREES*

*Dr. William E. Ritter, biologist and honorary president of Science Service, (left) is here shown chatting between sessions of the Conference on Science, Philosophy and Religion with Prof. Louis Finkelstein, president of the host institution, the Jewish Theological Seminary of America.*

## Union Needed for Defense

"We dare not remain disunited or in conflict with one another, in a world where our opponents are closely united. Nor dare we rear our children as cynical recipients of the benefits of civilized society, rather than as responsible participants in its burdens. A cynical, divided, hyper-individualistic America will necessarily become a doomed America.

"No resort to totalitarianism is needed to overcome the intellectual confusion of our time. America was the first nation to apply the principle of federation to a land of continental dimensions. American genius should be able to apply the same principle to cooperation between groups of different religious, political, and educational views. Without for a moment considering the submergence of any discipline, scientific or philosophical, to any other, and without believing it possible or desirable that Western religions be reduced to a common denominator, our common background gives us a broad basis for a united, dynamic philosophy of American democratic life. This philosophy must take as its major premise the religious principle of the Fatherhood of God, and the worth and dignity of Man. It must uncompromisingly oppose any effort at deification of the state, or the suppression of individual liberty and sense of moral responsibility."

During the coming year the Conference on Science, Philosophy and Religion, called by 80 founding members, and attended by about 500 persons, will endeavor to obtain cooperation from all the leaders of science, philosophy and religion who agree with its fundamental principles for promoting the democratic way of life.

## Scientists Favor Naturalism

The conference made it evident that there is a dividing line drawn on the question of supernaturalism. (*Turn to page 188*)