Rivalry in Discovery of Synthetic Rubber

IS the world on the eve of another commercial revolution due to an accidental chemical discovery? Is synthetic rubber going to take its place upon equal terms of competition with the juice of the trees and plants which so long have supplied the rubber commerce?

Just at the present time English and German chemists are disputing over their claims to precedence in finding a way to create from certain raw materials a chemical counterpart of natural rubber. The world at large is not directly concerned in the determination of this question of priority, but it has a very deep interest in the commercial practicability of these discoveries.

Two years ago Dr. F. E. Matthews of England, then associated with other distinguished chemists, among them Prof. W. H. Perkin, Sir William Ramsay and Prof. Fernbach, was seeking to perfect a cheap process for the manufacture of synthetic rubber and by chance left some isoprene and metallic sodium in contact for a period of about two months, going off in the meanwhile for his summer outing. Upon his return Dr. Matthews was amazed to find that the isoprene had in the interval been converted into solid rubber. The long sought key to the riddle was thus uncovered by an accident.

Isoprene is an oily, volatile hydrocarbon. It was obtained by distillation from caoutchouc fifty years ago by Williams, and the analysis of isoprene showed that it was chemically identical with the oil of turpentine. The problem since that day has been twofold; first, to derive isoprene from abundant raw materials, and then to effect its conversion into rubber through the medium of plentiful and cheap reagents. In order to compete with nature's product it was necessary that artificial rubber should be made in large quantities and at a cost which would put it on a par at least with the expense of gathering

nature's rubber and delivering it at the factories.

Fermentation is an action set up by various kinds of germs, and Prof. Fernbach found the germ that would convert certain plentiful starchy materials into fusel oil, and from this fusel oil he obtained cheap isoprene. It was this isoprene which Dr. Matthews learned by accident how to turn into rubber by means of sodium. Sir William Ramsay and his associates believe that rubber can be made in this way at a cost of about 24 cents a pound. From 25 to 28 cents a pound is what it costs now to collect rubber in the far east and amid the forests of the Amazon. The heaviest after expense is involved in transporting the raw material to manufacturing centers, and also in purifying this rubber so that it shall be fit to go into the finished products.

The rubber hunter mixes the juice or latex of many trees, and the raw stuff is seldom uniform and is frequently filled with foreign substances, and even pebbles, the latter hidden away in the gum to increase the weight. The cost of getting rid of these things is heavy, and this fact must be borne in mind in giving proper value to any process for the synthetic making of rubber. It is natural to suppose that a chemical production would be subject to perfect control and that the synthetic rubber factory would be located where it could reach easily its raw materials and its market for the finished output. Climatic and geographical conditions have prescribed the zones in which the rubber plant can be successfully grown, even though its cultivation be subject to scientific methods and are free from the haphazard ways of the rubber hunter.

In England the present discoveries are hailed by Sir William Ramsay and his fellows not so much as a promise of commercial advantage but as a professional achievement which puts the British chemist ahead of his rivals across the Channel. That the Germans have good reason to be satisfied with their own accomplishments in this very field is undoubtedly true. The Germans claim that they have now a method for making rubber synthetically which will soon be ready to compete with the output of the tropical forests.

Back in the '80's Tilden, an Englishman, gave long study to the problem of making synthetic rubber, but abandoned his work finally because he did not believe the attainment practicable. The individual was powerless to cope with so gigantic a problem and his resources were unequal to the task. Capital was necessary as well as the united efforts of many men. In fact in one factory alone in Germany there were 300 college bred chemists concentrating upon the technical researches involved in that single establishment. Many factories in the fatherland had joined in this international effort to find an artificial process by which rubber could be built up synthetically from raw materials readily available, but to the Elberfelder Farbenfabriken belongs the distinction of priority in the solution of the problem. Dr. Fritz Hofman, director in charge at Elberfeld, gives his own story of the pursuit of the elusive key.

"By mere chance my attention was called to this question of synthetic rubber through a lecture delivered in London about six years ago by Prof. Dunatan. As a pharmaceutic chemist in a dye factory my work did not take me in the direction of rubber, but the problem fascinated me.

"I found on reading up the subject that caoutchouc was based on isoprene, and I tried to prove it. To do that I had to have isoprene, and, what was more, I had to have synthetic isoprene and not the kind obtained by a dry distillation of rubber such as had hitherto generally been used. I had a task before me.

"To the organic chemist coal is an ideal mother substance, and I chose it as my basic material. In this we were justified, and in March of 1909 Carl Coutelle and I succeeded in obtaining the first large quantity of pure synthetic isoprene—several litres of it. This showed us that we had the right formulae, the scientific execution of which was no longer questionable. But with the making of isoprene our troubles were not ended; on the contrary, they were but beginning.

"We were confronted with the problem of converting this liquid into that tough, elastic, plastic colloid which was to be a successful substitute for rubber, in truth its very counterpart. Theoretically the task was easy, because, as Beilstein says, isoprene is converted into caoutchouc by treating it with muriatic acid. Of course, we tried that at once, but for our pains we got nothing but oily chlorides—not a trace of rubber. We were apparently defied.

"We tried all sorts of likely and imaginable physical and chemical mediums in connection with isoprene, but the wilful stuff refused to thicken. Finally I discovered the power to perform this miracle hidden away in heat. There was nothing new in heating isoprene, but the result we obtained thereby was new. Other authorities had tried heat, but all they got was either an oily or at best a resinous substance.

"Polymerism in chemistry is that property peculiar to some compounds by which they differ in their molecular weights and also in their chemical properties even when formed from the same elements and combined in the same proportions. In other words, the structural atoms are differently arranged, and the body or substance thus differs from another of the same chemical get up but with its tiny units otherwise distributed.

"We soon recognized that the polymerizing power of heat could be furthered by numerous chemical admixtures, but we soon found that there are many more substances that work in opposition to this end. In August of 1909 I obtained the first rubber polymerized by heat in the laboratory of the Elberfeld works. In September of that year I submitted a sample of this material to Dr. Gerlach. He was the first to confirm that our product actually contained caoutchouc. A month later Harries tested our synthetic material with his ozone method, and by this means was able to establish that our heat polymerized isoprene was veritable india rubber."

Dr. Hofmann frankly admits that should the extensive rubber plantations cultivated under English direction in the Malay Archipelago meet expectations synthetic rubber will not be so necessary in supplying at a more reasonable rate the present market. However, he says that the synthesist has so adjusted conditions that he can compete with his ware in price and quality with the natural product.

Thousands upon thousands of experiments have thus been brought to a crystallized knowledge which makes it possible and practicable to embark upon the manufacture of rubber synthetically from available cheap materials. The plantations in the far east have been developing over a period of fully thirty-five years, and in a sense they have the start of the artificial product in a quantitative estimate, but this advantage will not continue if the chemist manufacturer can make rubber synthetically as cheaply as Dr. Hofmann predicts.

In 1910 and 1911 the world production of india rubber reached a total of about 80,000 tons and the world consumption of caoutchouc was in the neighborhood of 75,000 tons. Figuring the cost of this rubber at an average of $1 a pound the total value of the production reaches $160,000,000.

Synthetic rubber, it is believed, would make it possible to widen the field of application of rubber. Makeshifts and substitutes of one sort or another are now used in many directions, because natural rubber is too expensive. Therefore, the public is interested in the artificial product first because it will add stability to the price of the rubber from trees, and next it will make it possible to apply it in many ways now prohibited by price and the relatively limited output of plantations and the wild growth.

Whether the basic isoprene be made from a starchy substance after the English process or from a product of coal, as Dr. Hoffmann has chosen, there will be immense quantities of by-products which will be a part of the systems employed in making isoprene and in converting it into counterpart caoutchouc in either case. It would be financially prohibitive to neglect these by-products in concentrating upon the manufacture of artificial rubber.

Dr. Hoffmann says that if 25 per cent of artificial rubber could be produced from every pound of basic material, then a factory turning out half a million pounds a day would require 2,000,000 pounds of the mother substance, three-quarters of which would accumulate every twenty-four hours in the form of by-products. This gives an idea of what the chemist-manufacturer has before him, even though the secret of synthetic rubber has been solved. With characteristic thoroughness, the Germans are working away at this end of the question.

So far as is known the German synthetic rubber has met all the exacting tests and analyses of other German chemists. On the other hand, it is said that the English artificial rubber is not chemically identical in its atomic makeup with natural caoutchouc, and the critics declare that this artificial substitute will not meet all of the requirements. It seems that the artificial rubber contains one atom of carbon less than nature's caoutchouc, and whether or not this difference will prove vital either at once or later in the employment of the synthetic substance has yet to be established.

Summer School.

Particularly significant is the growth of summer schools in the Carolinas, where the movement started comparatively late. At the University of North Carolina there was an attendance of 450 this year, just double last year's enrollment. At the normal school at Greensboro, North Carolina, a session of eight weeks was held, the first in the history of the institution, and 200 enthusiastic teachers were in attendance. At the summer session of the Winthrop Normal College, Rock Hill, South Carolina, particular attention was paid to problems of industrial education and rural schools, and men of national prominence participated in the work.

Growth Attached to It.

"You've been sleeping in the telephone booth, I believe," said the manager of the summer hotel.

"Yes."

"I can give you a billiard table now, if you like."

"No; I'll stick to the booth. I rather like the room. It isn't large, but it's cosy."

INTERNATIONAL SUNDAY SCHOOL LESSON

(By E. O. SELLERS, Director of Evening Department, The Moody Bible Institute, Chicago.)

LESSON FOR SEPT. 22.

FEEDING THE FIVE THOUSAND.

LESSON TEXT—Mark 6:30-44.
GOLDEN TEXT—"Jesus said unto them, I am the bread of life."—John 6:35.

This parable marks the high level of the year of popularity in the life of our Lord. It is such an important miracle as to be the only one recorded by all four gospel writers.

The returning disciples (v. 30) are urged by the Master to come with him into a desert place that they might rest, and also that he might comfort their hearts over the death of John the Baptist. "They had no leisure." Jesus knew the need and also the proper use of leisure. But the multitude would not grant this and flocked to his retreat in the desert. They saw and followed that they might listen to his gracious words or behold some new wonder, but Jesus also saw and ministered, v. 24. Carlisle said he saw in England "forty millions, mostly fools." Not so with Jesus. He saw and was moved, not with sarcasm, but with compassion, which compassion took a tangable form of service. It is interesting to note in verse 34 that the compassion of Jesus led him first of all to teach. It is better to teach a man how to help himself than to help the man. We also infer from this verse that the soul of a man is of more value than his body. It is not enough, however, to say, "God bless you, be fed and warm," when a man is hungry. So it is that Jesus listened to his diciples when they saw the physical need of the multitude.

A Great Task.

St. John tells us in this connection of the conversation with Philip. Philip lived in Bethsaida near by, yet to feed this multitude was for him too great a task, even with his knowledge of the resources at hand, John 6:5-7. Yet we need not be surprised at Philip's slowness of faith. Moses in like manner was once nonplussed how to feed six thousand in the wilderness, see Num. 11:21-23. It is not so much as to how great the need nor how little we possess, but rather is the little given to God.

Another disciple, Andrew, who had discovered the Saviour unto Peter, discovers as though in desperation a boy whose mother had thoughtfully provided him with a lunch consisting of five barley biscuits and two small dried herring (John 6:9), at least that much remained. It is a great commentary upon the tide of interest at this time that this boy should not have eaten his lunch, for a boy's hunger is proverbial. It seems as though Jesus emphasizes the helplessness of the diciples in order that he may show his power. His command, "give ye them," (v. 37) teaches us that we are to give such as we have, not look to others, nor do our charity by proxy. Prov. 11:24, 25.

Again the Saviour asks his disciples to see (v. 38) as though he would teach them the boundless resources of his kingdom. Give what you have and he will bless and increase it to the supplying of the needs of the multitude. The secret of success was when he took the loaves and "looking up" for God also saw on that day, and blessed it.

We need to observe the systematic procedure. The people seated or reclining upon the ground in ranks or by companies. The Master blessing and breaking the boy's cakes and giving first to the disciples, for God only works such miracles through human agencies, and then giving to the people. The result of this systematic procedure was that "all did eat," and further, they were satisfied, v. 42. Not alone, however, was there Divine order and lavishness, but there was economy and thrift as well, for Jesus gave careful directions as to the fragments. The lavishness is shown by the fact that the baskets into which the fragments were gathered were each large enough in which to sleep.

Living Bread.

The conversation process was a stinging rebuke to the improvident orientals, and to the present day prodigals of that wonderful bounty with which God has blessed our land.

God gives to us that we may use. Joy dies unless it is shared. Jesus, the living bread (John 6:48) will satisfy hunger, and life, as bread, generates in the human body heat, energy, vitality, power, etc., so he would feed the hungry souls of mankind. We have at hand the Word; it is for lack of it that men die in the deepest sense of that word.

The poverty and perplexity of the disciples in his presence and the presence of this great need is being repeated over and over today and yet it is absurd. We have not enough to feed the multitude. Our few loaves of amusements, mental activities, etc., will not feed them, but when we break unto them the Living Bread they have enough and to spare. The words of the late Maltbie Babcock are appropriate in this connection:

Back of the loaf is the snowy flour,
And back of the flour the mill,
And back of the mill is the wheat and the shower
And the sun, and the Father's will.

FOREIGN BELIEFS ARE QUEER

Spanish Wedding Is Ruined If One Person Appears Entirely In Black —Some Other Signs.

In Spain the wedding is spoiled if one of the guests appears entirely in black, or if the bride looks into a mirror after orange blossoms and veil are fast in her headdress.

When a person's hair ends split, it's taken by the superstitious for a sign that she is either a witch or has been bewitched. As blond hair splits more readily than dark hair, all witches, spirits and sorceresses have blond or red hair, according to popular belief. Likewise, according to the standard of art.

On the marriage there is often much good-natured rivalry between the groom and the bride in the Slav countries as to who shall blow out the candle, for the person who does will be "first to die." It is impossible to trace the origin of this superstition, yet it prevails in aristocratic society as well as in the peasant's hut, even as like this, that "to insure the life and health of the children" the woman must occupy the right side of the bed. In addition, she must not smoke before her forty-fifth year.

There is a superstition in this country and many others against burning a broom. The bud of birch broom is used in southern Germany as a preventive against erysipelas. These buds, a piece of yellow wax and some other articles are enclosed in a pink silk bag, secured with red silk and worn on the back of the neck. The person must change his shirt every Friday.

The Status.

"I see this prospect of a strapless street car is still hanging on."

"So are the passengers."

A man must draw the line somewhere, but the chances are he will get on the other side of it later.