RUBBER ON THE AMAZON

By WALTER J. KAHLER

Since they lost the world's rubber-producing center in Malaya, the Allies have had to depend on synthetic rubber and the rubber produced in Latin America. The author, a world traveler known to our readers from previous contributions, gives an idea of the difficulties involved in stepping up production in the rubber areas in Brazil.

THERE are many plants in the world that contain rubber. Practically all of them grow in the tropics, in regions with plenty of rain, reaching to 13 degrees of latitude north and south of the equator. Some of these plants are huge trees, others are lianas or bushes. Quite a number of these plants are not tapped for rubber because of the insufficient quantity or quality of their sap. The best latex is supplied by *Syphonia elastica*, better known as *Hevea Brasiliensis*, a tree which in its wild state grows to a height of thirty meters and of which no less than twenty different species are known.

The home of *hevea* is the vast, impenetrable region of the Amazon and its main tributaries, the Rios Tocantins, Xingú, Tapajós, Madeira-Mamoré, Purús, Jurúa, Javarí, Ucayali, Japurá, and Rio Negro, a region covered by jungle and in part entirely unexplored. This huge area, which includes the Brazilian provinces of Amazonas, Pará, and Matto Grosso, is the world's largest river system. It covers 4½ million square kilometers, far more than half of the entire country. It is significant that the population of these three provinces amounts to only 2¼ millions, while almost 38 million people live in the remaining nineteen provinces of Brazil, which cover 3.8 million square kilometers.

Our knowledge of the Amazon region reaches back to the year 1500, when the Spanish navigator Vicente Yáñez Pinzón discovered the mouth of that river. Thirty-five years later, Gonzales Pizarro, brother of the great conquistador Francisco Pizarro, attempted to travel from Peru down the Marañón, as the upper course is called. But only one of his companions, a certain Orellana, succeeded in reaching the Atlantic by this route. Around 1600, Pinzón was followed by French seamen, who established the first plantations of rice, coffee, and cotton on the island of Marajó in the mouth of the Amazon. The actual economic development of this region, however, did not begin until 1866, when the first large steamers opened up the Amazon to international navigation. Today, steamers of 3,000 tons can ply without difficulty as far as Iquitos, more than 3,500 kilometers from the mouth of the river, while all in all more than 50,000 kilometers of this gigantic river system are navigable by steamer.

JOURNEY'S START

After an exciting trip over ancient Inca roads, across high mountains, on flimsy rafts through the rapids of minor tributaries, and by oxcart across the hot pampas of the Beni region in northern Bolivia, we reached Santa Rosa, a small village on the Jacuma. Santa Rosa was to be our headquarters for three weeks, for that was the time it took the natives to hollow out a dugout for us. They do this by lighting a fire in the center of the tree trunk and letting it smolder until the entire length has been burned out. The outside of the dugout is smoothed down with an ax.

Six oxen dragged this heavy canoe several kilometers across the pampas to the river. The prairie was enlivened by storks, clumsy marabous (which resembled old professors), spoonbills, gray *tapacarés*, ibis, and other wading birds. A swarm of hideous black vultures was tearing away at the last remains of a dead cow.

We pushed our way through the high pampas grass, which reached almost up to our chests, until a black *sikuri* as thick as a man's arm winding through the grass at our feet gave us our first fright and made us dash for safety to the oxcart. The tropics of South America abound in snakes. In Brazil alone there are 150 different species, and according to statistics some 25,000 people are bitten by snakes every year. The inhabitants of the regions along the Beni River use a number of plants known by the general term of *contrayerba* which are supposed to neutralize the effects of the venom; they boil them and make compresses of them or take them internally. Scientists have examined several of these plants, most of which belong to the *Aristolochia* species, for their effectiveness against snake venom, and deny that they are of any use.

In an arm of the Jacuma where we intended to let our boat into the water, several gnarled old logs floating there came to life at the sight of us and, snorting and splashing, disappeared into the water. This part of the river is full

of alligators. A few of the armored amphibians swam upriver; we chased away the others by firing at them with a rifle. The afternoon was spent fitting out our canoe. On each side of the narrow vessel we fastened balsa logs to increase the stability; then we built a roof of twigs and canvas over the whole.

JUNGLE RIVER

The Jacuma River flows slowly along. Its banks are covered with dense bushes and with trees whose overhanging branches almost touch the water. Lianas and other creepers entwine the trunks; mosses, orchids, and parasitic plants grow rank on the branches. The musty smell rising from the water and the jungle seemed to hold a promise of adventure which, combined with the strange silence enveloping the place, gave us a feeling of uncertainty. This uneasy feeling, the sensing of an unknown danger, increased with the falling of darkness and caused us to keep a fire going all night and to take turns every two hours at keeping watch. As a precaution against snakes, we strewed our camping-ground with ashes and garlic.

For a while we all crouched around the fire. We had been told that after six days we would reach Santa Ana, just above the spot where the Jacuma flows into the Mamoré, and that we would not have to worry about food as there was plenty of game, birds, and fish. But what had not been mentioned were the annoyances and dangers entailed by a jungle trip and which are a daily phenomenon in the life of a rubber collector.

In some districts malaria is so common that people do not even talk about it. It is carried by the female anopheles mosquito. To keep away the mosquitoes we had been advised to use citronella oil or a 20-per-cent alcoholic solution of pyrethrum. It is the same plant whose blossoms are used in Europe for the manufacture of insect powder, in Japan for that of mosquito coils. Our experience seemed to prove, however, that all these preventive measures only served to attract the insects. But while I suffered from repeated attacks of malaria during my Africa expedition in the Sudan and the Congo in spite of the employment of quinine and plasmoquin, on this trip not one of the four participants had a single attack as a result of the proper use of "Atebrin," although we were almost bitten to death by mosquitoes every day.

Further downriver, *Stygoma faciata* makes a nuisance of itself, a mosquito which spreads the deadly yellow fever. In other districts, the people suffer from beriberi. Typhoid and dysentery also occur frequently.

ANTS INSTEAD OF DUCKS

The night passed quietly. Only the snorting of the alligators, the scream of a night bird, or the melancholy call of an owl which had its nest in a hollow tree somewhere in the forest, and the fine humming of the mosquitoes penetrated the silence. The first two days also went by without any particular sensation. The primeval river scenery and our attempts at shooting game for food took up all our attention. Palms and other giants of the jungle raised their heads above the thick underbrush, covered from the roots to the outermost branches with lianas, creepers, and other vegetation. Long-tailed monkeys climbed around in the tops and green lizards a yard long looked down upon us from overhanging branches. *Bufeos*—fresh-water dolphins—appeared behind the canoe, grunting like walruses, and followed us for some time.

We got some shots at wild geese, at ducks, wild turkey, toucans, and monkeys. But in the current the canoe always drifted off many yards before we were able to tie up at a branch and go off in search of our booty. It was extremely difficult to cut one's way with a machete through the dense underbrush. Elastic creepers and tendrils caught the invader by his head or his feet and tried to hold him like the tendrils of an octopus. Poisonous scorpions and centipedes were hiding under the leaves and behind stones. Black and red ants—of which there are quite a number of species in the Amazon region—fell like rain drops from the trees, biting necks and arms and penetrating under one's net. Later we found them in our luggage, in the jam, in the sugar, everywhere. There was the *aracara*, the dreaded fire ant, whose bite stings for hours; the bite of the *chicataya*, of the black *tachee*, and of the

Rubber-producing areas are shaded. Santa Ana is near the confluence of the Jacuma and Mamoré Rivers

tucushee causes fever; the head of the *tucandeira* is filled with poison. Other species are less dangerous, and the *tanjura* is fried in lard by the natives and eaten as a delicacy.

We had to fight against all these pests, against wasps whose nests—the size of a football—hung in the branches, and against ticks. But our search was usually in vain: our booty remained undiscoverable, hanging somewhere in the bushes or hidden by the leaves. Covered with bites and scratched by thorns, we returned disheartened to our canoe.

CAMP'S COLLAPSE

Late in the afternoon we picked a place on the bank, burned down the grass at the spot where we intended to camp in order to drive off snakes and insects, and carried all our luggage on shore. In spite of the heat, we had to wear leather jackets and face protectors, as the mosquitoes stung right through our shirts and pants. The heavy, damp air was so tiring that, although we had only eaten a handful of oats all day, we hardly felt any desire to cook a meal. We only felt terribly thirsty all the time, in addition to the torment of thousands of mosquitoes swarming around us like a humming cloud; not even the smoke of our fire seemed to bother them.

The weird screams of the howling monkeys which preceded dusk every evening and resounded through the forest every morning, intermingled with the ceaseless screeching of the cicadas and the loud croaking of the bullfrogs in the marshes, were the proper music to conjure up the atmosphere of Dante's *Inferno*. Gradually the howling was silenced and the jungle noises of the night awoke, noises for whose origin we often could find no explanation. From the river came the snorting of the dolphins and the growling yawn of the alligators. Then there was a curious sound, as if someone were hitting a hollow trunk with an iron bar, followed by a rustling in the leaves near by or a squeaking in the underbrush. Sometimes there was a muffled blow or cracking, as if a heavy branch or tree trunk had fallen down. Then again a loud scream of terror and the death rattle of an animal resounded through the forest. The ensuing silence only served to increase the effect all these sounds created in our imagination.

Toward midnight a thunderstorm broke loose. A few short gusts of wind were followed by a cloudburst such as can only be experienced in the tropics. The stars had disappeared behind banks of clouds, and the night had turned pitch black. The poles holding up our tent collapsed over our heads under the weight of the torrents of rain. Our fire hissed and went out. A few minutes later we stood in water up to our ankles. Shivering with cold and wet to the skin, we waited for daybreak.

FED UP

That morning the howling monkeys seemed to mock us. Great blue crabs were crawling about among our cases and luggage, seeming to grin maliciously. Sleeping bags, mosquito nets, and clothing were soaked; our supply of flour was a sticky paste; the contents of the bags of sugar and salt had melted away; the guns were freshly coated with rust; the cartridges had swollen so that they no longer fitted into the barrels. The canoe was filled to the rim with water.

Cool showers alternated with sultry hours in the tropical sunshine. Our clothes and all our luggage in the boat, soaked time and again by the rain, began to get moldy and smell musty. Seven days had passed like this, and we still had not reached Santa Ana. To reach our goal more quickly, we decided to paddle through the night too. The pale reflection of the moon on the smooth surface of the water showed up the course of the river against its dark, menacing banks. We were beginning to hate the green jungle and the river with its endless windings.

Our frequent failure to shoot game, the plague of insects, exhaustion and hunger and, above all, the fact that we had completely lost our bearings, made each of us irritable.[1] For days we had had to be content with a handful of *chivé* (yucca flour). This otherwise so nutritious substance, the main staple of the inhabitants of the Beni region, had been turned by the dampness into a gritty paste, which looked and tasted like sawdust. Now and again we chewed at our last piece of *charqui* (dried meat), which was as tough as leather.

At last, on the morning of the eleventh day, we heard the distant hoot of a steamer, a sound which had the same reviving effect on us as an approaching lifeboat on a group of shipwrecked people. By this time we looked like beachcombers of the worst kind. Our bearded faces were scratched and covered with insect bites; our hands and knees were grazed; our clothing consisted of nothing but a few rags covered with mud; the soles of our boots were swollen like pieces of cardboard and barely held together by pieces of wire.

BLOWPIPES . . .

The region of the Amazon provides ample opportunity for ending one's life in an original manner. One can die of fever, of snake bite, or be eaten to the bone by fish. One can drink oneself to death on *cachassa* or be hit by a poisoned dart shot from ambush. But then there *are* people who have survived all these ways of dying for several years.

The endless jungles and lonely prairies are inhabited by a number of Indian tribes, some of which have had little or no contact with civilization. These *barbaros* are extremely hostile to strangers, either because they feel

that their territories are threatened by the advancing white man or because they have had unpleasant experiences with the rubber collectors and white traders.

Their most dangerous weapon is the blowpipe, with which they achieve an astounding accuracy of aim over distances up to forty meters. To shoot with it, the blowpipe is first held vertically, with the mouthpiece pressed firmly against the lips; then the weapon is slowly lowered toward the target and the dart discharged by a short, sharp expulsion of the breath. The blowpipe is two to three meters long with an outer diameter of 2½ centimeters and a bore of eleven to thirteen millimeters. It looks as if it were made of one piece, but it actually consists of two pipes fitted into each other. The inner one is made of *arundinaria*, a reed resembling bamboo and growing to a height of nine to twelve meters; the outer one is made from the wood of the *iriartea* palm. It is hardened in fire and coated with wax to prevent warping. At the end of the pipe there is a mouthpiece of red wood some six to eight centimeters long. The sighting equipment consists of a blob of wax or two incisor teeth of a small rodent which are stuck on with wax.

Amazon Indian with headdress of bright yellow and dark feathers

. . . AND POISONED DARTS

In their tribal feuds and for hunting purposes, the Indians use poisoned darts. Even a slight scratch from one of these darts is fatal to animals and humans alike, bringing death within a few minutes. The darts, which are about twenty centimeters long, are made from a certain type of bamboo (*chusquea*). The point is sometimes made of the poisoned, barbed spine of the sting ray. The poison is rubbed into grooves, to make it adhere better to the dart. Just below the point there is a notch which causes the dart to break off upon hitting the target, leaving the poisoned barb in the wound. Plant fiber or cotton is wound around the end of the dart to make it fit exactly into the pipe.

The composition of the poison is a secret often known only to the tribal chief or the medicine man. There are only a few tribes which manufacture the poison themselves, the other tribes buying it. All these poisons, known by various names such as *curare*, *urari*, *wurali*, and *bejuco*, are obtained from the extract of plants of the *strychnos* species. The poison is contained in the bark of these vines. Its effective ingredient is curarin which, upon entering the blood stream, causes paralysis of the limbs and of the breathing system within a very short time. Taken by way of the stomach, the poison is less effective, so that animals killed with it can be consumed with impunity. Before the meat is cooked, the dart and the flesh surrounding the wound are, of course, cut out. Other plant poisons which are added by some Indian tribes to the mixture are of lesser toxicological importance. The effect of *Strychnos* alone is quite sufficient to kill a large animal or a human being.

Although Brazil abounds in poisonous snakes, little has been heard about the employment of snake venom in the preparation of South American dart poison. Some witch doctors add the heads of poisonous snakes to their concoctions; but the venom, being an albumen, completely loses its poisonous effect in the process of heating. On the other hand, there is a small green frog (*Phyleobates*) to be found in the provinces of Buenaventura and Choco in Colombia which lives in the hot forests of the Cordillera valleys. When it is held close to a fire, the skin of its back sweats out a milky, pale-yellow secretion, which is extremely poisonous and into which the arrows or darts are dipped. One frog is enough to poison some fifty arrows. The Indians of these parts successfully employed this poison against the Spanish conquistadors. Upon entering the blood stream it kills a jaguar within a few minutes by paralyzing the breathing system. It also brings on violent cramps.

There is no known antitoxin against these deadly dart poisons. The only chance to save the life of the victim is immediately to cut out the point of the dart together with the flesh surrounding the wound.

WORLD'S COSTLIEST RAILWAY

Every two weeks or so a steamer sails from Santa Ana up the Mamoré River to Trinidad, the capital of the Bolivian province of Beni, or downriver to Guajamirim, a trip taking three days. The Mamoré is 300 meters wide here, but during the rainy season its dirty brown waters widen to 475 meters.

The stern-wheelers plying up and down these rivers increase their loading capacity by attaching two or three barges to their sides. Apart from a few Indians who come alongside in their canoes to trade bananas for salt or other things they need, the trip is uneventful. The

scenery never changes. For us, however, it meant a pleasant respite, in spite of the fact that we could hardly find space to move among the piles of firewood, cases, sacks, chicken, parrots, and the confusion of hammocks, the deck being crowded with half-breeds and families, headed for the rubber plantations on the lower Beni.

The river shipping connecting the Rio Beni, Guaporé, and Mamoré with the Madeira is interrupted east of Guajamirim by no less than twenty-six cataracts, the largest of which has a fall of eleven meters and a width of 1,400 meters. In former times, rubber, Brazil nuts, and hides from Bolivia were brought downriver in large canoes, which sped like arrows through the small rapids and were carefully let down the big ones with ropes. Such a journey, especially the snail-like return trip, took several months, quite apart from the losses in lives and goods. So a project arose to circumvent these rapids by a railway from Guajamirim to Porto Velho.

In 1870 an American engineer was given the concession for building this railway, but it was not until eight years later that work was actually begun. After another year the work was stopped again, for the losses in human life through malaria and other diseases were exorbitant. However, when the growing demand caused a rubber fever to grip the entire Amazon region, the project was revived in 1907. Again malaria, yellow fever, typhoid, and beriberi took their ghastly toll. It is said that, of 600 Germans who participated in the construction work, no less than 400 perished within six months.

In 1909 the first 87 kilometers of the railway were opened to traffic; but, in spite of 1,800 laborers being constantly employed at the job, hardly more than half of the total line was completed after four years. When quinine was introduced as a prophylactic—no less than two tons being used every year—and after all living quarters had been provided with mosquito screens, the work progressed at a better speed. By 1913 the last section of the line was completed. The whole line of 366 kilometers had cost no less than 40 million dollars to build. But hardly had the railway been opened to traffic when the big slump in the Brazilian rubber market set in. Since then there has only been one train a week in each direction.

EARLY RUBBER

Long before Columbus discovered the New World, the Indians of America knew about rubber. They used it to manufacture balls, footwear, jars for fetching water, and quivers for their poisoned arrows. The Spaniards reported from Mexico, for instance, that the natives played a game similar to our tennis, which they called *tlachtli*, using balls made from the sap of a tropical tree.

The first samples of rubber came from Peru about 1736. The Portuguese sent home rubber boots from Brazil, and in 1823 the first 500 pairs of "Indian rubber shoes" were imported in Boston. However, in its original condition the rubber showed several grave defects: in warm weather it became sticky, and in cold weather it got hard and brittle. When in 1832 Hayward, an American, noticed that rubber lost its stickiness when it was strewn with flower of sulphur, the first step toward vulcanizing had been taken. Fourteen years later, Hancock succeeded in producing rubber goods in forms. In 1852, Goodyear took out a patent on hard rubber (ebonite).

After these three inventions, the demand for rubber rose tremendously, as a consequence of which a rubber fever gripped the Amazon region similar to the gold fever in the Klondike. *Ouro preto*, as the Brazilians called it, the black, or rather brown, gold, brought untold riches to the country, especially to its principal export centers, Belém do Pará, Manáos, and other towns which shot up like mushrooms. And then one day the dream was over, as suddenly as it had begun: the plantation rubber of Ceylon and the Malay States appeared on the world market and was preferred to the Brazilian rubber because of its more careful preparation and lower price.

The chief centers of production of Pará rubber are in the provinces of Pará, Amazonas, Matto Grosso, Acre, and Fortaleza (Ceará). The best rubber is produced in the valleys of the Purus and the Madeira. The center of the entire upper Amazon region is Manáos, at the confluence of the Rio Negro with the Amazon. Forty-five years ago this city was nothing but a large village. The rubber boom turned it within a few years into a magnificent metropolis, with wide boulevards, splendid buildings, with trams and an opera house which would have been the pride of any city in Europe. The population figure rose to 75,000, but since the collapse which came ten years later it has sunk again to 45,000, as cocoa, tobacco, cotton, coffee, and other produce have never been able to replace the export of rubber.

THE RUBBER COLLECTOR SETS OUT

Every year at the end of May, when the low-water season starts, some 20,000 seasonal workers with their families, coming chiefly from Fortaleza on the coast, travel to the upper reaches of the Amazon to go into the jungle for six months and collect rubber. There are two types of collectors: *Seringueiros*, who only prepare the latex of the *hevea* species, and *Caucheros*, who exploit the sap of other rubber plants such as *castilloa*, *landolphia*, and *hancornia*.

According to the size of their "claims," the *patrones*, or owners, employ from two to five

hundred of these people, whom they supply with an advance in the form of foodstuffs worth about two thirds of their expected harvests. These supplies are usually charged at three times their actual value. By this means the *patron* tries to protect himself against losses, for it often happens that a collector dies in the jungle, or that he simply disappears with his supplies, or takes on a job with another *patron*. The supplies usually consist of cornmeal or *maniok* flour, dried beans, tinned goods, dried meat, maté, tobacco, *cachassa* (a strong alcoholic liquor distilled from sugar cane), weapons, ammunition, medical supplies, and some textiles for their women.

The rubber collectors are taken upriver by motorboat as close as possible to their places of work. The family goes ashore and builds a hut of palm trunks and a shed for smoking the latex. Its total possessions consist of a few cooking utensils, a hammock, a Winchester rifle, machetes and knives, and bowls for collecting the latex. Their clothing requirements are equally modest; all they have is a broad-brimmed hat, a shirt, and a pair of long trousers. On their return, however, they often behave extravagantly with their hard-won earnings. Then they don't mind paying high prices for luxury perfumes, for imported French hats, or jewelry, with which they present their women. Sometimes they also gamble away everything they have earned.

The rubber collectors possess expert knowledge of the forest and the animals and plants to be found in it. They cover their food requirements by shooting tapir, deer, peccary, wild boar, and all kinds of birds, as well as by fishing and by catching turtles, of which there are many to be found during the dry season along the shallow river banks and which are very easily caught. As for the provisions they have brought along, they must use them sparingly, for exorbitant prices are demanded for all goods the further one penetrates into the interior.

RUBBER COLLECTOR AT WORK

The work starts by the collector going off with his son and cutting a trail through the undergrowth with his machete in order to investigate his terrain for trees that can be tapped. As a rule, two or three *heveas* are to be found in the jungle about every 80 meters. These trails are laid in a zigzag or in a curve from the house in such a way that they end at the house again after having passed some 120 to 150 trees.

In the early years, the rubber trees were exploited pretty ruthlessly. But now they are tapped more economically, and the trees are spared as much as possible. The latex is contained as an emulsion in a system of capillaries in the bark of the tree, which latter is about one centimeter thick. In addition to 1 to 2 per cent of albumens and resins, the latex contains up to 40 per cent of rubber. In tapping, only the surface of the bark must be cut.

After some eight or ten years, the *hevea* species reach a height of about ten meters. It is at this age that they begin to give a plentiful yield. Their most fruitful period is between 15 and 18 years, but trees up to the age of 40 can still be exploited. The first day they are tapped there is only a slight flow of sap; later the trees provide some 40 to 60 grams of latex every day.

The work begins at six in the morning, for it has been found that the trees yield more latex up to 10 a.m. than all the rest of the day. The collector begins by clearing the ground around the trunk and removing moss and parasitic plants. Then he applies four to six cuts to the bark 12 to 15 centimeters apart. These cuts are made in spirals or in slanting straight cuts running toward a central groove. The collecting cup is fastened just below the cut. After the extraction, the cuts are covered with earth again to prevent harmful insects from entering them.

Since the trees can be tapped every second day only, the collector usually provides himself with two trails, and he works these on alternate days. Every morning he covers a distance of four to six kilometers. His average daily harvest amounts to some eight or ten liters of latex, which produce about four kilograms of dry rubber. The season yields him 400 kilograms of rubber, but hard-working collectors have been known to obtain twice this quantity.

The collecting of the latex is ended by noon. Now the collector returns to his house and spends the next two or three hours in the drying shed smoking the latex. The latex is first heated to 40° centigrade in order to remove vegetable impurities. Then a fire of wood shavings and the fruits of the *urucuri* palm is lit under a conical funnel or a mud stove. Into the thick smoke given off by this fire, a paddlelike stick is held and constantly turned, while simultaneously liquid latex is poured onto it which, under the influence of the creosote contents of the smoke, begins to coagulate around the stick after a few minutes. As soon as one layer has solidified, another bowl of latex is poured on. This work is continued until an oval, brownish-black ball has formed on the stick. The weight of this ball may vary between eight and fifty kilograms. When the desired size has been reached, the ball is squeezed out on a board to rid it of any liquid that might still be contained in it. The Pará rubber obtained by these methods is sorted into four qualities. The third quality consists of rubber that has been insufficiently smoked or that has begun to ferment, and the fourth quality of rubber made of air-dried latex or containing a high percentage of impurities. Its price is 30 to 40 per cent below

that of the second or most common quality.

THE END OF THE BOOM

The death knell of Brazilian rubber was sounded in 1876, when Henry Wickham, an Englishman, succeeded in bringing 70,000 seeds of *Hevea Brasiliensis* from the forests of the upper Tapajós to Kew Gardens in London. This was the first step in the creation of a competition which was within a few years to bring Brazil's rubber industry to a standstill.

Two months after these seeds, which are as large as pigeon's eggs, reached London, 2,000 shoots were shipped to Colombo to be raised in an experimental plantation. In 1877 the first saplings were planted on the Malay Peninsula, and thus the foundation laid for a rubber industry which was to supply 40 per cent of the entire world production.

It is evident that, in systematically laid-out plantations, production is far more rational than is possible when the latex is collected from wild trees in the Brazilian jungle. In a plantation a collector can tap 350 to 400 trees in a single morning.

A few figures will serve to illustrate the rapid growth of the rubber industry. In 1830 the world consumption of rubber amounted to 156 tons. By 1899 production, which came until then exclusively from Brazil, had mounted to 25,000 tons. In 1900 the first 4 tons of rubber produced in Asia appeared on the world market. Eight years later the world already consumed 70,000 tons, 65 per cent of this quantity coming from Brazil, 32 per cent from Africa, and no more than 3 per cent from Asia. At that time 1,250,000 acres in Ceylon and Malaya had been planted with rubber trees, which were just beginning to yield their first crop. From then onwards the production of plantation rubber rose steadily, while the sinking rubber prices practically killed off the Brazilian production.

Before the war, the world demand for rubber by far exceeded 1,135,000 tons, of which Brazil supplied less than 2 per cent. America consumed 60 per cent of the total, followed by England and Canada with together 15.7 per cent, Germany with 8 per cent, France with 6 per cent, Japan with 5 per cent, and the Soviet Union with 2.2 per cent.

BRAZILIAN REVIVAL

There are thousands of articles of daily use, in the home, in industry, and in agriculture, which are made of rubber or which contain parts of rubber, from rubber mattresses to artificial bosoms for flat-chested movie stars. Counting all the various sizes, the Goodrich works alone produce more than 32,640 rubber articles. For the manufacture of some of these articles, liquid latex has been shipped directly in tankers from the plantations to the USA. The most important field for rubber is, of course, the automobile industry. Apart from the tires, for which 70 per cent of America's rubber imports was used, there are more than 330 parts in a motorcar which are made of rubber. A good rubber tree must be tapped for three years to yield sufficient rubber for a normal motorcar tire.

Even before the Greater East Asia War cut off America from the rubber plantations of southeastern Asia, some of the large rubber consumers had made attempts to obtain plantation rubber in South America. In 1935 the Goodyear Tire and Rubber Company laid out an experimental plantation on Lake Gatun in Panama with shoots taken from their large plantations in the Philippines. The experiment was so successful that by 1939 1,500 acres had been planted with *heveas*. Other plantations were laid out in Costa Rica.

A shipment of specially bred shoots from Sumatra, Java, and Malaya was sent from Singapore to Brazil in 1934. The young plants were packed in sawdust and carefully protected throughout the voyage against disease, with the temperature and humidity of the packing being constantly regulated. The shipment was destined for the Ford plantation "Fordlandia" on the Tapajós, 220 kilometers above its confluence with the Amazon. There the shoots were planted in the very same region where, sixty years before, Sir Henry Wickham had collected the first seeds.

The war has given a powerful impetus to the rubber industry in Brazil. The production, which in 1934 amounted to hardly 12,000 tons, is said to be 20,000 tons now, and the hope has been expressed that this figure will soon be doubled. Even in the Peruvian and Bolivian parts of the Amazon region, which had hitherto produced practically no rubber at all, rubber collecting is now being promoted. But all this represents at present only a drop in the ocean. For many years to come, Brazil will be unable to supply the great demands of the United States, for it takes seven or eight years before new plantations produce their first latex.

The main difficulties facing rubber production along the Amazon continue to consist of the bad health conditions and the problem of transportation. All the disagreeable vexations I described still have to be coped with. The greatest problem, however, is provided by the scanty population of those parts, which makes it very difficult to find sufficient labor. For the time being, at any rate, the United States is compelled to cover the major part of her requirements with synthetic rubber.

Important Invention

In Washington, a patent was awarded to Charles T. Jacobs for a device that keeps the ice in a cocktail shaker from diluting the "dividend."