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Daniela Martinez

Rubber: The Cost of Modernity



Image by Daniela Martinez, 2023

Today we can find rubber in almost every piece of clothing, activity, and space we inhabit. It is so immersed in our modern way of living that we often take it for granted. However, it was not until 1844, when the American Charles Goodyear discovered vulcanization, that rubber became part of our daily lives, an essential industrial product in the economy of the United States, and indispensable for modern architecture. To the extent to say that modern architecture, as we know it, would not be possible without rubber. However, the modernity and progress that rubber brought to the world came with a high cost, measurable in human lives, violence, geopolitical interests, and biopiracy.

Previously, only indigenous people inhabiting tropical areas where the Havea, or rubber tree, grows wild used rubber to make balls and apport waterproof properties to some pieces of clothing.¹ Its collection was limited to Central America, west and Central Africa, and the Amazon rainforest.² The first records on Rubber date back to the 15th century after Spanish colonizers returned to Europe from "the Indies." Amazed by the rubber balls' bouncing capacity, Hernan Cortez presented two Mesoamerican ball players in Barcelona, where the German painter Christoph Weiditz made the drawing shown below, in which he clearly emphasizes the rubber pieces.³

¹ Heloisa Maria Bertol Domingues and Emilie Carreón, "Rubber," in *New World Objects of Knowledge* (London: University of London Press, Institute of Latin American Studies, 2021).

² Office of War Mobilization and Reconversion, *Rubber: First and Second Reports of the Inter-Agency Committee on Rubber* (Washington, DC: Government Printing Office, 1946).

³ Bertol Domingues and Carreón, "Rubber."



Source: Heloisa Maria Bertol Domingues and Emilie Carreón, "Rubber," in *New World Objects of Knowledge* (London: University of London Press, Institute of Latin American Studies, 2021).

Nonetheless, in its raw state, Rubber was very susceptible to temperature and pressure changes, thus extremely unstainable to be used industrially. By the eighteenth century, many people had tried to work the substance, to benefit from its waterproof and elastic properties, with little to no result, when in 1844, the American Charles Goodyear made his breakthrough discovery. Vulcanization, as the inventor called it, was a process that provided stability to the material by chemically altering it without losing its desired properties.⁴ The process consisted of heating for a couple of hours at 212 to 350 degrees Fahrenheit a blend of twenty-five parts of raw rubber with five parts of sulfur. The mix could be altered by adding colors or materials like wool, silk, or cotton to modify the final product's elasticity and hardness, which made vulcanized rubber the highly

⁴ Philip Scholberg, "Rubber: A Review," *The Architectural Review* 86 (November 1939): 215–20.

versatile modern material we use today.⁵ The inventor participated in the Great Exhibition of 1852 in London with a giant exhibit known as "The Vulcanite Court," where he displayed all kinds of objects made of rubber, including furniture, rugs, and clothes.⁶ The exhibit earned Goodyear the public's fascination and a gold medal; the press wrote on the matter: "This later discovery is moreover upon the eve of a further development, as applied, not alone to clothing, but to every class of drapery used for upholstery, as curtain hangings, sofa, and chair coverings, carpeting, substitutes for leather and prunello, &c., which will clearly define a completely new and most important era in invention."⁷

As predicted at The Christal Palace, after Goodyear's discovery, rubber was adopted in almost every industry and human activity; only a century later, by the 1930s, the material had over 40.000 uses.⁸ In architecture, rubber is often used as a durable and flexible mold for prefabricating repetitive pieces, a pillar of modernity. The image below shows a mold made of Rubber, patented in 1894 by Michael Smith in New Jersey. The inventor highlights its use to make castings of plaster or any fragile material that can be easily removed without breaking off prominent parts of the design.⁹ Another critical use of Rubber in modern architecture was to provide insulation for hightension wires, patented in 1892 as part of Edison's "Electric conductor." Edison insulated wires allowed electricity to enter safely into the building; the exterior covering was composed of dissolved crude rubber mixed with an infusible material like chalk to add fireproof properties to

⁵ Charles Goodyear, Improvement in the Manufacture of Caoutchouc, United States Patent Office 3633 (New Heaven, Connecticut, issued June 15, 1844).

⁶ Skrabec, Rubber: An American Industrial History.

⁷ "The Vulcanite Court, Crystal Palace," *The Crystal Palace Magazine*, 1857, Classic Google Books.

⁸ Scholberg, "Rubber: A Review."

⁹ Michael Smith, Rubber Mold or Pattern and Process of Manufacturing Same, United States Patent Office 516,028 (Passaic, New Jersey, issued March 6, 1894).

the raw gum's insulative, flexible, and waterproof nature.¹⁰ As it happens, it ultimately means that rubber made possible electric building illumination, a significant factor in modern architecture.



Source: Smith, Michael. Rubber Mold or Pattern and Process of Manufacturing Same. United States Patent Office 516,028. Passaic, New Jersey, issued March 6, 1894. Annotated by Daniela Martinez.

¹⁰ Thomas A. Edison, Electric Conductor, United States Patent Office 470,924 (Llewellyn Park, New Jersey, issued March 15, 1892).



Source: Thomas A. Edison, Electric Conductor, United States Patent Office 470,924 (Llewellyn Park, New Jersey, issued March 15, 1892). Annotated by Daniela Martinez.

Additionally, Small rubber pieces are often used in swing doors and around windows for sound and weather insulation. Rubber pieces can even help prevent damage to old buildings from traffic vibrations.¹¹ Another exciting and widespread use of rubber in modern architecture is as a flexible flooring material, which I will focus on more in-depth because it is intrinsically architectonic and uses the most extensive amounts of material. In 1896, as shown in the image below, the innovative Philadelphia- born architect Frank Furness patented an interlocking tile made of rubber that could be arranged to create unique patterns of shapes and colors and to cover as much or as little as desired by the designer.¹²

¹¹ Scholberg, "Rubber: A Review."

¹² Frank Furness, Interlocking Tile, United States Patent Office 565,734 (Philadelphia, Pennsylvania, issued August 11, 1896).



Source: Furness, Frank. Interlocking Tile. United States Patent Office 565,734. Philadelphia, Pennsylvania, issued August 11, 1896.

This new flooring type was advertised as durable, hygienic, noiseless, and comfortable to walk in. Additionally, it could mimic other materials like marble, stone, and wood. It could be equally used to cover walls and ceilings and was rapidly manufactured by many companies, including the American rubber giant The Goodyear Tire and Rubber Company.¹³ The company patented its interlocking tile version in 1902 in Akron, Ohio, where it had its main headquarters and production plants.¹⁴ Even if The Goodyear Tire and Rubber Company discontinued its rubber flooring line during the First World War, it was soon relaunched in 1923, including sheet rubber flooring. On top of that, in 1929, the company began publishing a monthly magazine entitled Rubber Flooring News, promoting, and showing pictures of the installed product in different locations. The publication's last issue was in April 1931. Still, Goodyear rubber flooring became so popular that by the 1950s, it could be seen in residences, offices, hospitals, schools, and iconic modern buildings such as the US Capitol in Washington, DC, the Chrysler Building in New York City, and Los Angeles City Hall.¹⁵ Goodyear rubber tiles came in standard sizes of four per four, six per six, twelve per six, twelve per twelve, and nine per eighteen inches, with a maximum thickness of a quarter of an inch. The sheet flooring came in rolls of twenty-five per thirty-five yards long per one yard wide. Both rubber flooring versions were to be installed over a dry, smooth concrete underfloor and required skilled labor to guarantee their best performance.¹⁶

¹³ Goodyear Tire and Rubber Company, Inc., "Goodyear Wingfoot Rubber Flooring and Wall Rubber" (Goodyear Tire and Rubber Co, 1938), buildingtechnologyheritagelibrary; additional_collections; catalogs.

¹⁴ Will C. State, Tile, United States Patent Office 704,766 (Akron, Ohio, issued July 1902).

¹⁵ S. Victor Fleischer, *The Goodyear Tire & Rubber Company: A Photographic History, 1898-1951* (Akron, Ohio: The University of Akron Press, 2020).

¹⁶ Goodyear Tire and Rubber Company, Inc., "Goodyear Wingfoot Rubber Flooring and Wall Rubber."



Image by Daniela Martinez, 2023



Source: Goodyear Tire and Rubber Company. Fine Floors. Akron, Ohio.: Goodyear Tire & Rubber Company, 1932.

Rubber flooring gained popularity worldwide and was particularly favored in England. It was shown at the first International Rubber and Allied Trades Exhibition held in London in 1908, where the organizers as regards wrote: "When the public realizes the comfort, and often economy, of using rubber flooring in front of and inside public and other buildings, on board ship, as well as for means of communication, mechanical, domestic, and a thousand and one other purposes, it cannot fail to stimulate the demand for, and consequently, the consumption of, the raw material."¹⁷

From the beginning of the 20th century, the United States has consumed approximately half of all the Rubber produced worldwide.¹⁸ Nonetheless, the raw material grew far from where it was mainly vulcanized and consumed. At the turn of the 20th century, roughly 90% of the collected rubber worldwide came wild from the region of the Amazon Valley.¹⁹ It was a vast, grossly unexplored area nearly the size of the whole of Europe, excluding Russia, today occupied by Brazil, Peru, Colombia, Ecuador, Bolivia, and Venezuela, only accessible through the navigation of the Amazon River and its affluents.²⁰

Collecting wild rubber was an extenuating and dangerous job that can be paralleled to mining, as the worker must first find a rubber tree, tap it and, if lucky, collect the white sap, or latex, in buckets for later processing. In the wild, rubber trees did not grow in clusters but sometimes miles away from each other which made its collection very labor intensive.²¹ In many areas where wild rubber grew, it led to the slavery, mutilation, and mass murder of indigenous people forced to tap, treat,

¹⁷ International Rubber Exhibition, "International Rubber Exhibitions" (London, 1908), Internet Archive.

¹⁸ Office of War Mobilization and Reconversion, *Rubber: First and Second Reports of the Inter-Agency Committee on Rubber*.

¹⁹ Skrabec, *Rubber: An American Industrial History*.

²⁰ Norman Thomson, *The Putumayo Red Book* (London, 1915).

²¹ Scholberg, "Rubber: A Review."

and carry the raw material to collection points under inhuman conditions. These communities were chosen because they had natural defenses against tropical diseases, had traditional knowledge of navigating the impenetrable tropical forests, were considered less than animals as a legacy from colonial times, and had the critical knowledge on how to treat the raw substance successfully before it reached its destination to be vulcanized. ²² The process consisted of coagulating the sap by heating and smoking it to build a ball or biscuit, after which the rubber would turn into an opaque blackish color. The biscuits were brought by fluvial navigation to seaports and shipped overseas for final processing.²³

One of the most horrifying cases happened in Putumayo from the rubber exploitation activities of J.C Arana & Hermanos, directed by the Peruvian Julio Cesar Arana. The firm became the Peruvian Amazon Company after partnering with British shareholders in 1907, but its business model remained unaltered.²⁴ At the end of the 18th century, small Colombian and Peruvian companies exploited rubber from the region, or how it was informally called "black gold."²⁵ In 1889, after realizing how modernity craved rubber, the Peruvian businessman Julio Cesar Arana, who previously commercialized all kinds of products from the upper Amazon Valley, refocused his business on the white sap.²⁶ In 1903, alongside Pablo Zumaeta, Abel Alarco and his brother Lizardo, Arana formed the society J.C Arana & Hermanos and began to buy, or better, violently forced to sell at meager prices, all the properties in a 12.000 sq. miles territory of a dense forest whose sovereignty was strongly disputed with Colombia at the time.²⁷

²² Thomson, *The Putumayo Red Book*.

²³ Skrabec, Rubber: An American Industrial History.

²⁴ W. E. Hardenburg, *The Putumayo: The Devil's Paradise* (London: T. Fisher Unwin, 1912).

²⁵ Hardenburg, *The Putumayo: The Devil's Paradise*.

²⁶ Julio César Arana, Las Cuestiones Del Putumayo; Declaraciones Prestadas Ante El Comité de Investigación de La Cámara de Los Comunes y Debidamente Anotadas (Barcelona: Viuda de L. Tasso, 1913).

²⁷ Thomson, *The Putumayo Red Book*.



Image by Daniela Martinez, 2023

The firm rapidly monopolized all of Putumayo's rubber production, and Julio Cesar Arana became known as the Rubber King. To carry out its business, J.C. Arana & Hermanos enslaved the Uitotos, the native people inhabiting the region, to collect and transport the rubber from the area.²⁸ Arana falsely stated that to justify his actions, the indigenous tribe practiced cannibalism and "from time to time, murdered white colonizers," and his firm was somehow "civilizing" them.²⁹ Nonetheless, he never fully admitted his crimes. The Uitotos population was reduced from 50.000 to less than

²⁸ Hardenburg, *The Putumayo: The Devil's Paradise*

²⁹ Arana, Las Cuestiones Del Putumayo; Declaraciones Prestadas Ante El Comité de Investigación de La Cámara de Los Comunes y Debidamente Anotadas.

10.000 individuals as part of the mass murder, abuse, and massacre the company was responsible for. 30



Source: W. E. Hardenburg, The Putumayo: The Devil's Paradise (London: T. Fisher Unwin, 1912).

Arana's business had two principal stations in Putumayo, La Chorrera and El Encanto, under the management of a superintendent. Each station overlooked forty branches, each controlled by a section chief. This person had the duty to assign the required kilograms the enslaved workers must gather every ten days. Each individual was scarred with the "Arana mark" on their backs, just like cattle, and forced to carry an average of fifty, even up to a hundred kilograms of raw rubber, to a

³⁰ Hardenburg, *The Putumayo: The Devil's Paradise*.

branch, partly by foot, partly by river on rudimental canoes. In charge of overseeing and forcing the Uitotos to work were five to eighty *racionales* who were armed with Winchester rifles. If the worker failed to deliver the required amount, was tortured, mutilated, or condemned to starvation. Due to the despair to reach the required kilograms, the worker would often overcut the tree to gather as much sap as possible, causing many to dry out and die annually. All the Peruvian Amazon Company's "civilized employees" were not paid a monthly fixed salary but commissions on the amount of rubber gathered. This system encouraged the section chiefs to ask for ridiculous amounts of rubber.³¹ In 1904, the company hired a hundred men from Barbados to work on rubber. However, once in the deep forest, they were forced by the section chief, under death threat, to work "not as rubber hunters but as Indian hunters." As Robert Isaac, a Barbadian man who managed to escape from Putumayo, stated in a 1912 New York Times article, these men were forced to go deep into the forest to capture indigenous people to work enslaved for Arana's company and to kill them if they denied to.³²

Roughly every three months, the gathered rubber would reach a principal station, from where it was shipped via the Amazon River to the cities of Iquitos in Peru or Manaus in Brazil. Once there, the company would sell the rubber to a wholesale market to be shipped mainly to New York and London. ³³ The rubber from the whole region was often generalized as a Brazilian product.³⁴ A significant part of the natural Rubber shipped to New York traveled via railroad for final

³¹ Hardenburg, *The Putumayo: The Devil's Paradise*.

³² The New York Times, "Saw Wholesale Murder in the Amazon Rubber Fields," *The New York Times*, 1912, ProQuest Historical Newspapers.

³³ Hardenburg, *The Putumayo: The Devil's Paradise*

³⁴ Joseph Torrey and A. Staines Manders, *The Rubber Industry* (London, 1911).

processing to Ohio. By 1907, the city of Akron, where The Goodyear Tire and Rubber Company produced its rubber flooring, employed more people in rubber than any other city in the world.³⁵



Image by Daniela Martinez, 2023

The first person to denounce the Putumayo atrocities was the American engineer W.E. Hardenburgh, who was working on the construction project of the Cauca Railway in Colombia. Hardenburgh traveled to the Putumayo in 1908 and was almost killed by Arana's men trying to escape the region.³⁶ The engineer brought his findings to several newspapers in Iquitos, Peru. Nevertheless, Arana was virtually untouchable in the country since he, encouraged by the Peruvian government, actively ensured Peruvian sovereignty in the Putumayo disputed territory. As it happens, his men were often involved in sanguineous confrontations with Colombians who tried

³⁵ Skrabec, Rubber: An American Industrial History.

³⁶ Hardenburg, The Putumayo: The Devil's Paradise

to occupy the region, and his actions were considered patriotic.³⁷ The drawing below was published in 1910 by the satirical newspaper from Bogotá *El Clarin* and depicts Arana and Peru's relations with a personification of Peru carrying and feeding Arana.



Source: El Clarín. El Chupo Arana. April 1910. Biblioteca Virtual, Banco de la República.

³⁷ Roger Casement, Putumayo Caucho y Sangre. Relacion al Parlamento Ingles, 1911.

Only two papers from Iquitos published Hardenburgh's denounces in 1908, *La Sancion* and *La Felpa*.³⁸ The drawings below accompanied the articles from La Felpa, picturing some of Arana's men's crimes against the natives, like mutilations, tortures, target shooting, and whipping. After that, Hardenburgh also published several articles in Truth magazine in London.³⁹ In 1912, the engineer published a book entitled "*The Putumayo: The Devil's Paradise*," Which I have been using as a primary source to describe Arana's business and practices in this paper.



Source: Diario la Felpa. Dibujos Diario La Felpa. n.d. La Red Cultural del Banco de la Republica Colombia.

³⁸ Hardenburg, The Putumayo: The Devil's Paradise

³⁹ Hardenburg, The Putumayo: The Devil's Paradise



Source: Diario la Felpa. Dibujos Diario La Felpa. n.d. La Red Cultural del Banco de la Republica Colombia.

Hardenburgh's articles in *Truth* magazine prompted a reaction from the Anti-Slavery Society in London, who worried about the participation in the Putumayo atrocities of "British subjects," the men from Barbados Arana hired in 1904, incited the British government to send an investigative commission to the region.⁴⁰ In 1910, the British government responded by sending to Putumayo the British consul in Rio de Janeiro, Sir Roger Casement who had previously investigated similar rubber-gathering practices in the Belgian Congo.⁴¹ In 1911, Casement presented his findings to the English parliament and, in 1912 issued a book entitled "Blue Book," confirming Hardenburgh's portrait of the facts. Additionally, he encouraged the world to suspend rubber imports from Putumayo for at least two years, which did not happen.⁴²

Nonetheless, Casement and Hardenburgh's publications created a scandal that appeared in major American newspapers such as the New York Times. The American consul at Iquitos, J. Fuller, also traveled to Putumayo in 1913, accompanied by Julio Cesar Arana himself, to report on the matter.⁴³ The scandal prompted the Peruvian Amazon Company to lose its British shareholders and be dissolved in 1911.⁴⁴ However, Arana did not stop operations in the area; in fact, rubber exports from Putumayo and the whole Amazon valley peaked in 1912, exporting 49,000 long tons of raw material.⁴⁵ Which would not have been possible without Arana's production. Arana was called to testify at the House of Commons in London in 1913, denied knowing about any crimes committed in Putumayo, and argued that Casement's report was biased by his likes of the

⁴⁰ John H. Harris, "The Peruvian Rubber Crime" (London, 1914), HathiTrust.

⁴¹ Roger Casement, *Putumayo Caucho y Sangre. Relacion al Parlamento Ingles*, 1911.

⁴² Thomson, *The Putumayo Red Book*.

⁴³ The Baltimore Sun, "Indians Made Slaves," 1913, ProQuest Historical Newspapers.

⁴⁴ Thomson, *The Putumayo Red Book*.

⁴⁵ United States Tariff Commission, "Crude Rubber" (Washington, DC, 1939).

Colombian government; he called the consul "Mr. Casement Colombia's lawyer."⁴⁶ The Peruvian government never punished any of the responsible for the crimes. In 1922, Arana became a senator for the Iquitos department Loreto. As a senator, he continued to defend Peruvian Sovereignty over the Putumayo region.⁴⁷

Clearly, the Peruvian government was not interested in giving up on its leading agent of keeping the Putumayo under its control. ⁴⁸ And Modernity needed rubber too much to stop its consumption over the massacre and torture of over 40.000 natives. Putumayo's case was not isolated; it was probably one of the most horrifying, but torture and lousy labor practices were standard in wild rubber gathering.

What did oust wild Rubber Exports was that in 1875 the British government offered Henry A. Wickham ten pounds per thousand Hava seeds he could smuggle out from Brazil. He managed to bring 70.000 from Manaus to London, to plant them in the British colonies in East Asia; the nucleus of the plantations was Sri Lanka, and the primary purpose was for the British to benefit from the enormous wealth rubber was bringing to rubber-producing countries.⁴⁹ Certainly, they would also benefit from avoiding paying rubber export taxes and better controlling the raw substance market prices.

⁴⁶ Arana, Las Cuestiones Del Putumayo; Declaraciones Prestadas Ante El Comité de Investigación de La Cámara de Los Comunes y Debidamente Anotadas.

⁴⁷ Julio César Arana, "Exposición Que Hace a Los Electores Del Departamento de Loreto" (Lima, 1924), HathiTrust.

⁴⁸ Colombia and Peru's limits were established in 1922, and an act of limits and navigation between Colombia, Peru, and Brazil was signed in 1925 with the conciliatory intervention on The United States.

⁴⁹ Randolph R. Resor, "Rubber in Brazil: Dominance and Collapse, 1876-1945," *The Business History Review* 51, no. 3 (Autumn 1977): 341–66.

By 1914 the Rubber plantations had spread, and trees were mature enough to produce significant quantities of latex. For the first time, plantation Rubber exports surpassed wild rubber ones, causing the raw rubber price to plummet from 121.6 cents per pound in 1912 to 65.3 in 1914 on average at the New York Spot market.⁵⁰ Plantations facilitated the collection process enormously since many trees could be planted together without the inconvenience of navigating an impenetrable forest or insects infecting workers. Competing for wild rubber gatherers with those lower prices was impossible due to their high operational costs.⁵¹ By 1939, 96.4 % of the rubber collected worldwide came from plantations in East Asia, and only 1.6 % came wild from the Amazon; Additionally, the British controlled 48.7 % of global rubber exports and the Dutch 37%, as shown in the map below by The United States Tariff Commission. During the same year, the rubber's average price at the New York Spot market was only 20.5 cents.⁵²

⁵⁰ United States Tariff Commission, "Crude Rubber" (Washington, DC, 1939).

⁵¹ Resor, "Rubber in Brazil: Dominance and Collapse, 1876-1945."

⁵² United States Tariff Commission, "Crude Rubber" (Washington, DC, 1939).



Source: United States Tariff Commission. "Crude Rubber." Washington, DC, 1939. Annotated by Daniela Martinez



Source: United States Tariff Commission. "Crude Rubber." Washington, DC, 1939. Annotated by Daniela Martinez

This demonstrates that wild rubber really did not stop, and Arana was not put out of business because of the Putumayo scandal; the modern world stopped consuming wild rubber simply because plantation rubber was cheaper. On the other hand, Colombia and Peru reached a border agreement, transferring Putumayo to Colombia only in 1922, and reached a fluvial navigation agreement in 1925.⁵³ This coincides with the period Peru lost its control agent in the area and one of the most significant sources of income for the Department of Loreto to cheaper plantation rubber.

⁵³ Ministerio de Relaciones Exteriores, "Frontera Terrestre Colombia - Perú," 2023.

Rubber is an example of a modern material accomplished through the industrial process of a natural substance first developed in America. This material has become an integral part of our current way of living and the building industry thanks to its flexibility and multiplicity of uses. Even if it needs to be recognized more in the field, Rubber marked a before and after in modern architecture and would only be possible with it. Nonetheless, as exemplified by the Putumayo case, which was not isolated and reflected a common practice in rubber collection, Modernity, and modern architecture, have their foundations in violent methods of material collection that cost the lives of thousands of people from marginalized communities. In the case of rubber, it did not change because of the awareness of its wrongdoings but because of the market logic. Even if it had a positive outcome regarding human rights, that change was the product of an act of piracy perpetuated by colonial powers, which wiped out one of the most significant sources of income for South American emerging nations at the time.

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