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The Pneumatic Tire: Air, Rubber, Road

Sources, claim mapping and reading record

Ketineni Ramarao · Companion to the book · Private review copy

How to read this companion

Every load-bearing claim in the book carries a tag such as [S14]. This file resolves each tag to its source, states what the source backs, and records how it was read. "Read in excerpt" means the source was consulted through search-served excerpts and quotation of the relevant passages; the exact figures quoted in the book are the figures stated in those excerpts, with the source's own rounding. Forecasts are labelled forecasts in both the book and this file. Where market estimates differ by scope (Smithers vs MarketLine), the book says so and both sources are listed.

Reading record and honesty notes

What was read: 65 sources, of which the great majority were read in excerpt (the relevant passages, tables and figures). Four sources were consulted at abstract/record level only: S11, S48, S53, S54; each is marked, and the book rests no load-bearing figure on them alone. S52 was read through OCR'd case text with visible character noise; the quotations used were checked against context.

What was not read: company annual reports in full (the Tyrepress ranking figures are used as compiled); the full text of the NHTSA Firestone report (front matter and contents only; the book makes no casualty-count claims from it); any paywalled market research beyond published summaries.

Known tensions: (1) 2024/2025 market size: Smithers ($282 bn, 2.6 bn units, 2025 estimate) vs MarketLine ($365.4 bn, 2.317 bn units, 2024) - scope differs; both cited. (2) Dunlop's tyre year: sources variously date the prototype work to 1887-1888; the book gives both, with the patent dates fixed (applied 23 July 1888, granted 7 December 1888). (3) The Wickham 'smuggling' legend: the book presents the traditional account and Warren Dean's correction side by side. (4) Tompkins (S53) is the standard scholarly history of the pneumatic tyre and is cited as framework only, as its full text was not retrieved.

Sources

S01 **The Dunlop tyre: Air apparent**
National Museums Scotland. https://www.nms.ac.uk/discover-catalogue/dunlop-tyre-air-apparent (accessed 1 November 2026).

Backs (chapter): Ch1, Ch2; Thomson's 1845 invention and its expense; Dunlop's 1888 practical tyre, the tricycle story, Arbroath sailcloth prototype, Hume's 1889 race, Du Cros, the 1890 patent invalidation over Thomson's France (1846)/US (1847) patents; quote: 'considered too expensive to manufacture at the time'.

Read status: Read in excerpt (museum page, search-served). **Chapters:** 1-3.

S02 **US5104A - Improvement in carriage-wheels (R.W. Thomson)**
Google Patents / USPTO. https://patents.google.com/patent/US5104A/en (accessed 1 November 2026).

Backs (chapter): Ch1; US patent granted 8 May 1847; multi-chamber inflatable tyre concept; 'so that the ground and the wheel never come into contact'.

Read status: Read in excerpt (patent page). **Chapters:** 1.

S03 **John Boyd Dunlop**
Engineering Hall of Fame. https://www.engineeringhalloffame.org/profile/john-boyd-dunlop (accessed 1 November 2026).

Backs (chapter): Ch2, Ch7, Ch12; dated biography: born 1840; patent applied 23 July 1888, granted 7 December 1888; Hume's four wins 18 May 1889; patent made over to Du Cros for 300 pounds plus 3,000 shares; 1890 invalidation; Welch patent purchase 1891; 1896 sale for 3 million pounds; death 1921, estate 9,687 pounds.

Read status: Read in excerpt (profile page). **Chapters:** 2,7,12.

S04 **The Paris-Brest et retour Road Race of 1891, and the New Pneumatic Tire**
International Cycling History Conference proceedings. https://www.ichc.biz/proceedings/ICHC-030-01.pdf (accessed 1 November 2026).

Backs (chapter): Ch3; Michelin factory background (1832 Barbier & Daubree), the punctured-cyclist anecdote, development of the detachable tyre, Terront's win, Jiel-Laval's spare-wheel Dunlops, 40-minute foreman repair, H.O. Duncan quotes.

Read status: Read in excerpt (conference PDF). **Chapters:** 3.

S05 **US497453A - Pneumatic tire (E. Michelin)**
Google Patents / USPTO. https://patents.google.com/patent/US497453A/en (accessed 1 November 2026).

Backs (chapter): Ch3; French patent 216,052 dated 11 September 1891; US patent granted 16 May 1893; object: 'rapid removal of the exterior tire for the purpose of changing or repairing the air chamber'.

Read status: Read in excerpt (patent page). **Chapters:** 3.

S06 **The Michelin Story: The power to reinvent yourself again and again**

Michelin News (UK). https://news.michelin.co.uk/articles/the-michelin-story-the-power-to-reinvent-yourself-again-and-again (accessed 1 November 2026).

Backs (chapter): Ch3, Ch6, Ch11; 1889 renaming to Michelin et Cie; first removable bicycle tyre 1891; Bibendum 1898 ('Nunc est bibendum'); first MICHELIN Guide 1900; 1990 Uniroyal-Goodrich acquisition; 1992 silica addition creating the first 'green tyre'.

Read status: Read in excerpt. **Chapters:** 3,11.

S07 **The MICHELIN Company**

Michelin Guide. https://guide.michelin.com/en/about-the-michelin-company (accessed 1 November 2026).

Backs (chapter): Ch3, Ch11; ~2,800 registered cars in France in 1900; company founded 1889; 69 production facilities; 114,000 employees; sales in 170+ countries; firsts: detachable bicycle tyre 1891, paved runway 1916, radial 1946.

Read status: Read in excerpt. **Chapters:** 3,11.

S08 **History**

Goodyear Corporate. https://corporate.goodyear.com/us/en/company/history.html (accessed 1 November 2026).

Backs (chapter): Ch1, Ch2, Ch5, Ch11; Seiberling brothers' 1898 founding in Akron; early products; named for Charles Goodyear; 1839 vulcanization discovery; 1901 straight-sided tire with braided wire bead.

Read status: Read in excerpt. **Chapters:** 1,2,5,11.

S09 **Our Heritage**

Firestone Tires. https://www.firestonetire.com/about-firestone/heritage/ (accessed 1 November 2026).

Backs (chapter): Ch11; Firestone Tire & Rubber founded 1900 in Akron; first factory 1902 with 12 men; own tires from 1903; sales past $1M by 1906; first non-skid tread designs 1908.

Read status: Read in excerpt. **Chapters:** 11.

S10 **U.S. Synthetic Rubber Program - National Historic Chemical Landmark**

American Chemical Society. https://www.acs.org/education/whatischemistry/landmarks/syntheticrubber.html (accessed 1 November 2026).

Backs (chapter): Ch5; 90% of natural rubber supply cut off; stockpile ~1M tons; consumption ~600,000 t/yr; 51 plants; GR-S output 231 tons (1941) to 70,000 tons/month (1945); Buna S 1929 + carbon black durability; 19 December 1941 patent-sharing agreement; 'Today 70 percent of the rubber used in manufacturing processes is synthetic'.

Read status: Read in excerpt (landmark page). **Chapters:** 5.

S11 **Redefining Vulcanization: Charles Goodyear, Patents, and Industrial Control, 1834-1865**

Technology and Culture (Johns Hopkins). https://doi.org/10.1353/tech.0.0437 (accessed 1 November 2026).

Backs (chapter): Ch5; original 1844 patent = heated triple compound of rubber, sulphur, white lead; 1849/1860 reissues broadening the claim; inventor-myth analysis; vulcanized rubber displacing raw by 1849.

Read status: Abstract and article record read. **Chapters:** 5.

S12 **Rubber Company v. Goodyear, 76 U.S. 788**

Cornell Legal Information Institute. https://www.law.cornell.edu/supremecourt/text/76/788 (accessed 1 November 2026).

Backs (chapter): Ch5; original patent granted 15 June 1844; reissues 1849/1860; litigation history and validity.

Read status: Read in excerpt (opinion text). **Chapters:** 5.

S13 Radial tyres

Michelin Business (UK). https://business.michelin.co.uk/by-technology/radial (accessed 1 November 2026).

Backs (chapter): Ch8; 1946 patent, steel belt and carcass threads at right angles to travel; radial construction, grip, comfort, retreadability.

Read status: Read in excerpt. **Chapters:** 8.

S14 The triumph of the radial tyre

Michelin News (UK). https://news.michelin.co.uk/articles/the-triumph-of-the-radial-tyre (accessed 1 November 2026).

Backs (chapter): Ch8, Ch9; patent registered 4 June 1946; MICHELIN X; Marius Mignol; 'fly trap' prototype nickname; bias-ply era flaws (short life, sidewall heating).

Read status: Read in excerpt. **Chapters:** 8,9.

S15 B.F. Goodrich Co. announces development of tubeless tire, May 11, 1947

History.com. https://www.history.com/this-day-in-history/may-11/b-f-goodrich-co-announces-development-of-tubeless-tire (accessed 1 November 2026).

Backs (chapter): Ch8; announcement date; 3+ years of engineering; taxi/police fleet tests; patents won 1952; standard within three years; NYT December 1954 quote ('at least 25 per cent more mileage... almost no blowouts'); U.S. Rubber's Hawkes quote.

Read status: Read in excerpt. **Chapters:** 8.

S16 Tubeless tire

Wikipedia. https://en.wikipedia.org/wiki/Tubeless_tire (accessed 1 November 2026).

Backs (chapter): Ch8; Killen Tire GB patent 329955 (applied 1928, granted 1930); Wingfoot (Goodyear) South African patent 1944; Frank Herzegh applied 1946, US 2587470 granted 1952; butyl rubber as the key; standard by 1955.

Read status: Read in excerpt. **Chapters:** 8.

S17 Raw Materials

Japan Automobile Tyre Manufacturers Association (JATMA). https://www.jatma.or.jp/english/tyre_industry/rawmaterials.html (accessed 1 November 2026).

Backs (chapter): Prologue, Ch4, Ch6, Ch7; >100 raw materials; representative composition ~50% rubber (29% natural + 18% synthetic), 25% reinforcing agent, 13% tyre cord.

Read status: Read in excerpt. **Chapters:** P,4,6,7.

S18 What are tyres made from

British Tyre Manufacturers' Association (BTMA). https://btmauk.com/about/what-are-tyres-made-from/ (accessed 1 November 2026).

Backs (chapter): Ch4, Ch5, Ch6, Ch7, Ch13; car tyre constituents: elastomers 42%, carbon black & silica 28%, steel 12%, oils 6%, textile 5%, ZnO 1%, sulphur 1%, other 5%; tyres = 70% of world natural rubber use; truck tyre ~30% NR (20-25 kg, from 200-250 m2 land), car tyre ~15%.

Read status: Read in excerpt. **Chapters:** 4-7,13.

S19 Carbon black (review)

Journal of the Society of Rubber Science and Technology, Japan (J-Stage, Gomu 82(2)). https://www.jstage.jst.go.jp/article/gomu/82/2/82_2_56/_pdf/-char/ja (accessed 1 November 2026).

Backs (chapter): Ch6; reinforcement effect discovered 1910; channel process from natural gas since 1892; oil furnace process established 1942; particle/aggregate structure.

Read status: Read in excerpt (Japanese review PDF, machine-translated excerpts). **Chapters:** 6.

S20 How Tires Are Built

Goodyear (via Internet Archive Wayback Machine). https://web.archive.org/web/20100102031427/goodyeartires.com/about/diversity/how_built.html (accessed 1 November 2026).

Backs (chapter): Ch5, Ch9; ~30 kinds of rubber; Banbury mixing; component stages; green tire; curing at over 300 degrees F for 12-25 minutes; mould engraves tread and markings.

Read status: Read in excerpt (archived page). **Chapters:** 5,9.

S21 Henry Wickham (explorer)

Wikipedia. https://en.wikipedia.org/wiki/Henry_Wickham_(explorer) (accessed 1 November 2026).

Backs (chapter): Ch4; 70,000 seeds declared 'academic specimens', arrived Kew 15 June 1876; ~2,700 germinated; 1,919 dispatched to Ceylon August 1876; Warren Dean's scepticism about the 'smuggling'; knighted 1920.

Read status: Read in excerpt. **Chapters:** 4.

S22 The Rubber Research Institute of Malaya

Nature 147 (1941). https://www.nature.com/articles/147015a0 (accessed 1 November 2026).

Backs (chapter): Ch4; Malaya 3.25 million acres under rubber (1937), exports near 500,000 tons; Kew-to-Peradeniya-to-Malaya route.

Read status: Read in excerpt. **Chapters:** 4.

S23 World ranking: Natural rubber in primary forms - Production 2024 (FAOSTAT data)

Terra Cultiva. https://terra-cultiva.com/en/rankings/natural-rubber-in-primary-forms/production/ (accessed 1 November 2026).

Backs (chapter): Ch4, Ch13; 2024 production: Thailand 4.79 Mt (32.3%), Indonesia 2.26 Mt (15.3%), Ivory Coast 1.69 Mt (11.4%), Vietnam 1.33 Mt (9.0%), China 877.6 kt, India 876.0 kt, Brazil 263.7 kt (1.8%).

Read status: Read in excerpt (ranking table). **Chapters:** 4,13.

S24 Infographic: Market Outlook for Global Tires (The Future of Global Tires to 2030)

Smithers. https://www.smithers.com/resources/2025/september/infographic-market-outlook-for-global-tires (accessed 1 November 2026).

Backs (chapter): Prologue, Ch1, Ch9, Ch13, Epilogue; market $282 bn in 2025 (estimate), forecast $367 bn by 2030 at 5.4% CAGR; volumes 2.6 bn units (2025) to 3.1 bn (2030, forecast); raw materials 57.2 Mt (2025) to 67.4 Mt (2030, forecast); tariff turbulence note.

Read status: Read in excerpt (report summary). **Chapters:** P,1,9,13,E.

S25 Global Tires & Rubber (MarketLine profile summary)

MarketLine via Dream Incubator. https://www.dri.co.jp/auto/report/marketline/250102-global-tires-rubber.html (accessed 1 November 2026).

Backs (chapter): Ch13; 2024 revenue $365.4 bn; 2,317.2 million units in 2024; regional shares: Asia-Pacific 38.8%, North America 29.6%, Europe 21.6%. NOTE: broader market scope than Smithers; figures differ by definition and are presented as such in the book.

Read status: Read in excerpt (profile summary). **Chapters:** 13.

S26 Leading tyre manufacturers (2025 ranking, FY2024 sales)

Tyrepress. https://www.tyrepress.com/leading-tyre-manufacturers/ (accessed 1 November 2026).

Backs (chapter): Ch8, Ch11, Ch13; Michelin EUR 27,193.0M (98.1% tires), Bridgestone EUR 27,168.5M (93.3%), Goodyear EUR 18,171.1M (100%), Continental group EUR 39,719.0M.

Read status: Read in excerpt (ranking page). **Chapters:** 8,11,13.

S27 **Managing End-of-Life Tires (TIP report)**

WBCSD. https://docs.wbcsd.org/2018/02/TIP/End_of_Life_Tires-Full-Report.pdf (accessed 1 November 2026).

Backs (chapter): Ch1, Ch12, Ch14; ~1 billion ELTs/year; ~4 billion in stockpiles; ~1 passenger tire per person per year discarded in the developed world; recovery >84% in Europe, US, Japan; ELT as fuel/material resource.

Read status: Read in excerpt (report PDF). **Chapters:** 1,12,14.

S28 **Advance Notice of Proposed Rulemaking on 6PPD and 6PPD-quinone**

US EPA. https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/advance-notice-proposed-rulemaking-6ppd-and-its (accessed 1 November 2026).

Backs (chapter): Ch6, Ch15; 6PPD used in tires for more than six decades; August 2023 tribal petition (Yurok, Port Gamble S'Klallam, Puyallup); granted November 2023; coho salmon lethality after hours of exposure.

Read status: Read in excerpt (EPA page). **Chapters:** 6,15.

S29 **Turning the Corner on Hazardous Tire Compounds: A Management Framework for Tire Additive Pollution**

Environmental Science & Technology Letters 12(8):869 (ACS). https://pubs.acs.org/estlcu/article/12/8/869/3677433/Turning-the-Corner-on-Hazardous-Tire-Compounds-A (accessed 1 November 2026).

Backs (chapter): Ch13, Ch14, Ch15; global tire production 23 Mt (2024); tires lose ~10-20% of mass over 4-6 year lives; TWP ~1.12 Mt/yr (US) and ~1.327 Mt/yr (EU); additives/fillers ~185 kt (US) and ~225 kt (EU) per year vs ~500 kt US pesticides; LC50 coho 41-95 ng/L; 36 million km of roads; 82/86% of passenger vehicle-km in US/EU; MF-TAP proposal.

Read status: Read in excerpt (open-access article). **Chapters:** 13-15.

S30 **Innovation at Michelin**

Tire Technology International, September 2025. https://tiretechnology.mydigitalpublication.com/articles/innovation-at-michelin (accessed 1 November 2026).

Backs (chapter): Ch16; Uptis deployed with La Poste (France) and DHL (Singapore); trials concluding end of 2025; load capability the known limitation; regulatory and manufacturing challenges; 'Going airless is a big revolution because it's so different from making a tire'.

Read status: Read in excerpt. **Chapters:** 16.

S31 **Michelin, leader in AIRLESS technology**

Michelin Magazine. https://www.michelin.com/en/media/magazine/michelin-leader-technology-airless (accessed 1 November 2026).

Backs (chapter): Ch1, Ch16; >50 patents; GFRP load-bearing structure on aluminium wheel; 2023 DHL (Singapore) and La Poste partnerships; only airless solution in open-road real-world use; >4.5 million km by end of 2023.

Read status: Read in excerpt. **Chapters:** 1,16.

S32 **Innovation: the VISION concept**

Michelin. https://www.michelin.com/en/group/activities/tires/vision-concept (accessed 1 November 2026).

Backs (chapter): Ch16; VISION: airless, connected, sustainable materials, renewable tread.

Read status: Read in excerpt. **Chapters:** 16.

S33 **Why do electric cars need special tires? Intro to EV Tires**

Michelin USA. https://www.michelinman.com/auto/auto-tips-and-advice/electric-mobility-guide/understanding-ev-tires (accessed 1 November 2026).

Backs (chapter): Ch10, Ch15, Ch16; EV challenges: battery weight (XL/HL ratings), instant torque wear, noise; rolling resistance and range.

Read status: Read in excerpt. **Chapters:** 10,15,16.

S34 An Overview

Automotive Tyre Manufacturers' Association (ATMA), India. https://www.atmaindia.org.in/an-overview/ (accessed 1 November 2026).

Backs (chapter): Ch13; India: 28 companies, 62 plants, FY2024-25 turnover est. Rs 100,000 crore (~US$12 bn), exports Rs 25,000 crore (~US$3.2 bn).

Read status: Read in excerpt. **Chapters:** 13.

S35 4 Indian tyre makers ranked among World's Top 20

The Hindu BusinessLine. https://www.thehindubusinessline.com/companies/four-indian-tyre-manufacturers-ranked-among-worlds-top-20/article70317182.ece (accessed 1 November 2026).

Backs (chapter): Ch12, Ch13; Tire Business CY2024 ranking: MRF 13th, Apollo 14th, JK Tyre 19th, CEAT 20th; MRF first in racing-tire plants, second in motorcycle and farm tire plants; ATMA-PwC 'Viksit Bharat 2047' projections (forecast: ~4x volumes, ~Rs 13 lakh crore revenue by 2047).

Read status: Read in excerpt. **Chapters:** 12,13.

S36 Indian Tyre Sector report

SMIFS Capital Markets. https://smifs.com/uploads/Indian_Tyre_Sector_Report_SMIFS_Mackertich_ONE_e4895b9837.pdf (accessed 1 November 2026).

Backs (chapter): Ch13; India sector ~Rs 1.09 lakh crore revenue on 24 crore tyres (FY24), 13.9% CAGR FY04-24; production 25.3 crore (FY25) to 35 crore by FY30E (forecast).

Read status: Read in excerpt. **Chapters:** 13.

S37 Federal Motor Vehicle Safety Standards; Tire Pressure Monitoring Systems (FMVSS 138)

Federal Register (2007). https://www.federalregister.gov/documents/2007/07/12/07-3382/federal-motor-vehicle-safety-standards-tire-pressure-monitoring-systems (accessed 1 November 2026).

Backs (chapter): Ch16; TREAD Act enacted 1 November 2000; Section 13 mandate; Public Citizen v. Mineta (2003); final rule April 2005.

Read status: Read in excerpt. **Chapters:** 16.

S38 Airless Tire Technology (CTMA project)

National Center for Manufacturing Sciences. https://ncms.org/ctma-project/airless-tire-technology/ (accessed 1 November 2026).

Backs (chapter): Ch16; SOCOM LTATV airless programme; DoD Ground Vehicle Systems Center; industry participation incl. Michelin.

Read status: Read in excerpt. **Chapters:** 16.

S39 Recycle and effectively use resources (retreading aircraft tires)

Bridgestone Corporation. https://www.bridgestone.com/responsibilities/environment/resources/action02/ (accessed 1 November 2026).

Backs (chapter): Ch7, Ch12, Ch14; retreading since 1955; four retread plants; bias main-wheel tread ~200 takeoffs/landings, radial ~350; retread up to 6x (bias) / 3x (radial); ~1,400 total landings per casing; NDT inspection.

Read status: Read in excerpt. **Chapters:** 7,12,14.

S40 MICHELIN Aircraft Tyre (selector brochure)

Michelin. https://tire-selector-aircraft.webmichelin.com/wp-content/uploads/2021/07/MICHELIN-AIRCRAFT-TYRE_2021_exe_LD.pdf (accessed 1 November 2026).

Backs (chapter): Ch12; up to 30,000 landings/day carrying >10 million people/day; up to 35 t per tire (~300x mass); -55C to +250C; up to 420 km/h; >200 raw materials; 15,000 km ground taxi per tire; tested to 4x rated pressure.

Read status: Read in excerpt (brochure PDF). **Chapters:** 12.

S41 **Aircraft Tire Maintenance and Operational Practices (AC 20-97B)**
US FAA. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC20-97B.pdf (accessed 1 November 2026).

Backs (chapter): Ch12; aircraft tires rated at 32-35% deflection and high pressures; service pattern.

Read status: Read in excerpt (advisory circular). **Chapters:** 12.

S42 **2022 Pirelli Motorsport Season presentation**
Pirelli Press. https://press.pirelli.com/2022-pirelli-motorsport-season-presentation/ (accessed 1 November 2026).

Backs (chapter): Ch11, Ch12; 1907 Peking-to-Paris (Borghese, Itala, Pirelli); 350+ series; 2022 18-inch F1 tyre programme: >10,000 hours indoor testing, >5,000 hours simulation, >70 virtual prototypes, 30 specifications, >20,000 km; blanket temperatures to 70C.

Read status: Read in excerpt. **Chapters:** 11,12.

S43 **Formula One tyres**
Wikipedia. https://en.wikipedia.org/wiki/Formula_One_tyres (accessed 1 November 2026).

Backs (chapter): Ch2, Ch7, Ch12; 1950s-60s suppliers; Dunlop R5 (1958, nylon, ~12 lb saving); Firestone slicks at 1971 Spanish GP; grooved tires 1998; Bridgestone-Goodyear tire war 1997-98; Michelin withdrawal, Bridgestone sole supplier 2007; slicks return 2009.

Read status: Read in excerpt. **Chapters:** 2,7,12.

S44 **Origin of Bridgestone's Name**
Bridgestone Blog. https://www.bridgestone.com/blog/2019082801.html (accessed 1 November 2026).

Backs (chapter): Ch11; founded 1 March 1931, Kurume; Ishibashi = 'stone bridge', reversed; 1906 tabi business; jikatabi rubber soles; 1930 first tires.

Read status: Read in excerpt. **Chapters:** 11.

S45 **History**
Bridgestone Corporation. https://www.bridgestone.com/corporate/history/ (accessed 1 November 2026).

Backs (chapter): Ch11; 1930 - tire division of Nihon Tabi produced first tires; 1983 Firestone Nashville plant; 1988 Firestone acquisition.

Read status: Read in excerpt. **Chapters:** 11.

S46 **Ford Rubber Plantations in Brazil**
The Henry Ford (museum). https://www.thehenryford.org/collections/explore/popular-research-topics/ford-rubber-plantations-in-brazil (accessed 1 November 2026).

Backs (chapter): Ch4; Fordlandia and Belterra 1928-1945; 1923 US survey; 1927 concession of 1M hectares; August 1928 Lake Ormoc/Lake Farge expedition; cafeteria riot; failure causes.

Read status: Read in excerpt. **Chapters:** 4.

S47 **From the Amazon to the Congo Valley: Violent Commodification of Labour During the Rubber Boom**
Palgrave Macmillan chapter (doi:10.1007/978-3-030-15322-9_6). https://doi.org/10.1007/978-3-030-15322-9_6 (accessed 1 November 2026).

Backs (chapter): Ch4; Casement's Putumayo estimate: at least 30,000 dead 1900-1911 for ~4,000 t of rubber; debt peonage mechanics; Congo sentries and quotas; Belgium's 1908 takeover.

Read status: Read in excerpt (chapter text). **Chapters:** 4.

S48 **Policy and Practice of Forced Labor in the Congo Free State and the Belgian Congo**
Oxford Research Encyclopaedia of African History. https://doi.org/10.1093/acrefore/9780190277734.013.846 (accessed 1 November 2026).

Backs (chapter): Ch4; Congo rubber labour regime 1890-1904 characterised as extreme exploitation; 1908 annexation.

Read status: Abstract read. **Chapters:** 4.

S49 **Innovative tech shows promise to boost rubber production in US**

Ohio State University College of Engineering (Feb 2024). https://engineering.osu.edu/news/2024/02/innovative-tech-shows-promise-boost-rubber-production-us (accessed 1 November 2026).

Backs (chapter): Ch4, Ch16; TK dandelion and guayule latex research (Katrina Cornish); ~50,000 rubber applications; US fully import-dependent for natural rubber; 10% of supply lost to disease in 2019; leaf-blight transmission risk via Brazil-China flights.

Read status: Read in excerpt. **Chapters:** 4,16.

S50 **Company History | Milestones**

Continental AG. https://www.continental.com/en/company/history/milestones/ (accessed 1 November 2026).

Backs (chapter): Ch11; founded 8 October 1871, Hanover; horse trademark 1882; first German pneumatic bicycle tires 1892; treadless automobile pneumatics 1898; 1928 merger into Continental Gummi-Werke; 1987 General Tire acquisition.

Read status: Read in excerpt. **Chapters:** 11.

S51 **Goodyear SightLine**

Goodyear. https://www.goodyearsightline.com/ (accessed 1 November 2026).

Backs (chapter): Ch16; tire intelligence: detecting conditions in real time; tire health and road-condition communication for fleets, automakers, municipalities.

Read status: Read in excerpt. **Chapters:** 16.

S52 **The Tubeless Pneumatic Tyre and Capon Heaton, Ld. v. The Trench Tubeless Tyre Company, Ld. and Others**

Reports of Patent Cases (via Oxford Academic/RPC). https://doi.org/10.1093/rpc/16.15.291 (accessed 1 November 2026).

Backs (chapter): Ch2, Ch3; early Dunlop construction (rubber-canvas-rubber, solutioned to rim); Welch wired-on and Clincher patents of 1890; Smallman's 1892 patent (No. 2782) - early tubeless concept; quote on the inner tube becoming 'useless altogether'.

Read status: Read in excerpt (OCR'd case report; some OCR noise noted). **Chapters:** 2,3.

S53 **The History of the Pneumatic Tyre (E.S. Tompkins)**

Progress in Rubber and Plastics Technology 6(3), 1990. https://doi.org/10.1177/147776069000600302 (accessed 1 November 2026).

Backs (chapter): General historical framework reference for Ch1-3.

Read status: Bibliographic record read; full text not retrieved. **Chapters:** 1-3.

S54 **Patents of Charles Goodyear: His International Contributions**

Rubber Chemistry and Technology (ACS Rubber Division). https://doi.org/10.5254/1.3525687 (accessed 1 November 2026).

Backs (chapter): Ch5; US patent 3633 (1844); complete Goodyear patent list context; 1839 discovery.

Read status: Abstract read. **Chapters:** 5.

S55 **The Amazon Rubber Boom: Labor Control, Resistance, and Failed Plantation Development Revisited**

Hispanic American Historical Review 74(2). https://read.dukeupress.edu/hahr/article/74/2/231/145833/ (accessed 1 November 2026).

Backs (chapter): Ch4; Hardenburg and the Casement Commission; Putumayo scandal's historiography; debt peonage.

Read status: Read in excerpt. **Chapters:** 4.

S56 **How was the world's first winter tire invented?**

Nokian Tyres. https://company.nokiantyres.com/about-us/history/winter-tire-85-years/winter-tire-invention/ (accessed 1 November 2026).

Backs (chapter): Ch10; Kelirengas 1934 (trucks), Hakkapeliitta 1936 (passenger); transverse tread concept; studded tire early 1960s; 1974 stud regulations; 1978 Finnish winter tire law; non-studded winter tires 1970s.

Read status: Read in excerpt. **Chapters:** 10.

S57 **Engineering Analysis Report EA00-023: Firestone Wilderness AT Tires**

NHTSA, Office of Defects Investigation (October 2001). https://www.nhtsa.gov/sites/nhtsa.gov/files/firestonereport.pdf (accessed 1 November 2026).

Backs (chapter): Timeline; the Firestone-Ford investigation's official record: ODI investigation opened May 2000, Firestone's August 2000 recall, engineering analysis.

Read status: Front matter/contents read. **Chapters:** T.

S58 **Wheels of Fortune: The Story of Rubber in Akron (U. Akron Press)**

University of Akron. https://ideaexchange.uakron.edu/uapress_publications/44/ (accessed 1 November 2026).

Backs (chapter): Ch2, Ch8, Ch9, Ch11; Goodrich 1870 arrival; 'Rubber Capital of the World'; Goodyear Heights/Firestone Park; 'to some, it stank; to others, it smelled like money'; 1980s disappearance of the industry; polymer-science rebirth.

Read status: Read in excerpt (book description). **Chapters:** 2,8,9,11.

S59 **Tire company headquarters come and go; Goodyear is steadfast**

Akron Beacon Journal. https://www.beaconjournal.com/story/business/2013/05/10/tire-company-headquarters-come-go/10338110007/ (accessed 1 November 2026).

Backs (chapter): Ch11; four major tire companies once based in Akron; 1930: nearly two-thirds of US tires made in Akron; 1941 wartime conversion.

Read status: Read in excerpt. **Chapters:** 11.

S60 **Reading a Tire Sidewall**

Tire Industry Association. https://www.tireindustry.org/resources/consumer-education/consumer-safety-overview/reading-a-tire-sidewall/ (accessed 1 November 2026).

Backs (chapter): Ch10, Glossary; P225/60R16 97V decoded element by element; DOT code and Tire Identification Number.

Read status: Read in excerpt. **Chapters:** 10,G.

S61 **Tools, Equipment and Materials (rubber/tyre manufacturing entry)**

ILO Encyclopaedia of Occupational Health and Safety. https://www.iloencyclopaedia.org/contents/part-xvi-62216/construction/tools-equipment-and-materials (accessed 1 November 2026).

Backs (chapter): Ch9; Banbury mixing operations, hundreds of components, occupational exposures and controls.

Read status: Read in excerpt. **Chapters:** 9.

S62 **Regulation (EU) 2024/1257 (Euro 7) + UNECE tyre abrasion limits adoption**

EUR-Lex / UNECE. https://eur-lex.europa.eu/eli/reg/2024/1257/oj/eng and https://unece.org/sustainable-development/press/unece-reduce-microplastic-emissions-thanks-adoption-abrasion-limits (accessed 1 November 2026).

Backs (chapter): Ch15; Euro 7 extends vehicle rules to tyre and brake particles; tyre emissions estimated as the largest source of microplastics released into the environment; UNECE abrasion limits for new car/van (C1) tyres apply from 30 June 2028.

Read status: Read in excerpt. **Chapters:** 15.

S63 **The Dynamics of Standing Still: Firestone Tire & Rubber and the Radial Revolution (HBS Working Knowledge) + NYT 1972 radial coverage**

Harvard Business School / New York Times. https://www.library.hbs.edu/working-knowledge/the-dynamics-of-standing-still-firestone-tire-rubber-and-the-radial-revolution and https://www.nytimes.com/1972/12/06/archives/goodyear-to-push-steel-radial-tires-goodyear-announces-plans-for.html (accessed 1 November 2026).

Backs (chapter): Ch8; US radial lag: Michelin's late-1960s US entry vs American makers' belted-bias response; radials 'swept Europe' in the 1960s (NYT 1972); Goodyear, the largest holdout, announced steel-belted radial lines December 1972; Firestone's costly setbacks ending in the 1988 Bridgestone acquisition.

Read status: Read in excerpt. **Chapters:** 8.

S64 **The Determinants and Effects of Mergers: The US Tire Industry case (NBER chapter c8649)**

National Bureau of Economic Research. https://www.nber.org/system/files/chapters/c8649/c8649.pdf (accessed 1 November 2026).

Backs (chapter): Ch11; 1980s US tire-industry merger wave: 75% of companies (90% of industry value) experienced a takeover bid or change of control; Goodyear's 1986 recapitalization to defeat the Goldsmith bid.

Read status: Read in excerpt. **Chapters:** 11.

S65 **Michelin tyres will be 100% sustainable by 2050**

Michelin News (UK), 23 Feb 2021. https://news.michelin.co.uk/articles/michelin-tyres-will-be-100-per-cent-sustainable-by-2050 (accessed 1 November 2026).

Backs (chapter): Ch16; Michelin's commitment: tyres entirely from renewable, recycled or bio-sourced materials by 2050; 40% by 2030 (forecast/commitment, labelled as such in the book).

Read status: Read in excerpt. **Chapters:** 16.