IGNITION

A Visual History of the **Global Match Industry**

SASHI SIVRAMKRISHNA

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FAIR

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The FAIR Team

Lead Researcher & Author | **Dr. Sashi Sivramkrishna**

Field Investigator | **Sreedhar S.**

Field Researcher | **Shiva M.**

Researcher Assistant | **Atheera Sreekumar**

Project Consultant | **Jijeesh T.**

Editor | **Dr. Preeta Nath**

Designed at

KALANISHKRITI
Udupi | Karnataka
kalanishkriti@gmail.com

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The usual caveat, however, applies. The author takes full responsibility of any errors and/or omissions in the book.

Preface

Throughout history, certain commodities have played pivotal roles in shaping the economic, social, and political landscapes of societies. The history of commodities during the period of colonization is a complex tapestry that intertwines with the evolution of contemporary supply chains and global trade. By examining the colonial past, we gain invaluable insights into the economic and social dynamics that continue to influence modern industrial production, business management and trade practices.

During colonization, commodities such as indigo, opium, rubber, tobacco, cotton, tea, coffee, and sugarcane were not merely goods to be traded; they were instruments of power and control. European empires established expansive trade networks, exploiting both the natural and human resources of colonized lands. This exploitation laid the groundwork for the global trade systems we see today, where the flow of goods often follows the same routes established during colonial times.

The supply chains that support contemporary global trade have their roots in the colonial era. The infrastructure developed for transporting commodities like cotton and sugarcane from colonies to European markets has evolved into the complex logistical networks that facilitate today's trade. Understanding the historical context of these routes helps us comprehend why certain regions remain central to global trade and why some supply chains are more resilient than others.

Colonialism also established economic patterns of production and trade that persist to this day. The division of labour, where colonies supplied raw materials and the colonizing nations provided manufactured goods, still echoes in the modern world, where developing countries are often suppliers of raw materials to industrialized nations. This historical perspective is crucial for understanding contemporary economic disparities and trade imbalances.

The institutions that govern global trade, including legal systems and financial structures, are also products of the colonial era. The policies and practices that were implemented to manage

the trade of commodities like opium and indigo have been adapted and integrated into current international trade agreements and organizations.

The colonial history of commodities provides a lens through which we can analyse and understand the intricacies of contemporary supply chains and global trade. It reveals the long-standing economic relationships and power dynamics that continue to shape our world. By studying the past, we can strive for a more equitable and sustainable future for global trade.

In this context, the global match industry offers a unique perspective. Though small and seemingly mundane, the match was a manufactured good that travelled widely—its production, branding, and distribution deeply entwined with colonial trade routes and industrial rivalry. Matchbox labels became tools of visual persuasion, reflecting national identity, corporate ambition, and consumer targeting across continents. The industry's reliance on hazardous labour, trademark disputes, and export strategies reveals how even the most ordinary objects can illuminate the complexities of global commerce and industrial design.

Through a proposed series of books and other media (including documentaries and Web resources) on the visual histories of such commodities—beginning with indigo, followed by iron smelting, and now matches—the Foundation to Aid Industrial Recovery (FAIR) seeks to educate and disseminate information that underscores the importance of historical understanding in analysing present-day industrial production, global trade and supply chains, highlighting the enduring impact of colonial commodity trade on modern economic practices.

Sashi Sivramkrishna
Ph.D. (Cornell University)
Chairman
FOUNDATION TO AID INDUSTRIAL RECOVERY
New Delhi/Bangalore, India

Introduction

The match is a paradoxical object—small, flammable, and fleeting, yet central to the industrial and visual history of the modern world. It ignited more than fire: it sparked revolutions in chemistry, branding, labour, and global trade. From the sulphurous workshops of 19th-century Europe to the bustling cottage industries of South Asia, the match industry has left behind a trail of innovation, exploitation, and aesthetic ingenuity. This book, *IGNITION: A VISUAL HISTORY OF THE GLOBAL MATCH INDUSTRY*, traces that trail through a visual and historical lens, revealing how a disposable object became a durable symbol of industrial ambition and global exchange.

The origins of the match lie in the convergence of chemical experimentation and commercial need. Early "Lucifers," developed in the early 19th century, were crude and dangerous—often igniting spontaneously or emitting toxic fumes. The invention of the "safety match" in Sweden in the 1840s marked a turning point. By separating the combustible chemicals between the match head and the striking surface, manufacturers reduced the risk of accidental ignition and created a product that could be standardized, branded, and exported. Sweden, with its abundant forests and disciplined industrial base, quickly became the epicentre of match innovation. Companies like Jönköping and Vulcan pioneered not only safer matches but also the visual language of matchbox design—using labels to assert identity, quality, and national pride.

Yet the chemical progress came at a cost. White phosphorus, widely used in early match production, was highly toxic. Workers—often women and children—exposed to its fumes suffered from *phossy* jaw, a debilitating and disfiguring condition that became emblematic of industrial neglect. The fight against white phosphorus became one of the earliest international labour and health movements, culminating in the Berne Convention of 1906, which banned its use in signatory countries. This regulatory shift forced manufacturers to adopt red phosphorus and other safer compounds, reshaping both the chemistry and branding of matches. "Safety" became not just a technical term but a marketing strategy, embedded in labels and trademarks across continents.

As the industry matured, competition intensified. Sweden's dominance was challenged by Germany, Britain, and especially Japan, which emerged in the late 19th century as a formidable exporter. Japanese manufacturers often mimicked European branding styles while undercutting prices, flooding markets in Asia, Africa, and Latin America. This global rivalry exposed the fragility of decentralized production and the volatility of commodity markets. In response, Swedish industrialist Ivan Krueger orchestrated one of the most ambitious corporate consolidations of the era. Through a series of mergers, acquisitions, and international agreements, Krueger formed the Swedish Match cartel—an attempt to stabilize prices, control trademarks, and manage global supply. For a time, the cartel succeeded, creating a vertically integrated empire that spanned forests, factories, and shipping routes.

But not all markets could be tamed. In the United States, tariff protections shielded domestic manufacturers like Diamond Match from foreign competition. The Revenue Act of 1913 imposed a punitive tax on white phosphorus matches, effectively banning them and accelerating the shift to safety matches. American firms embraced mechanization and aggressive branding, producing matchbooks and boxes that doubled as advertising space. In India, the story was more fragmented. Under colonial rule, the country imported matches from Sweden and Japan, often of varying quality. Local production began in Bengal and later expanded to Tamil Nadu, where the town of Sivakasi became a hub of cottage industry. These small-scale operations relied on manual labour, recycled materials, and regional motifs, creating a vibrant but chaotic market.

The Indian match industry, while prolific, was plagued by poor quality and cut-throat competition. Manufacturers copied each other's labels, diluted brand identity, and raced to the bottom on price. WIMCO, founded in 1923 with British capital and Swedish technology, attempted to bring order to the chaos—introducing mechanized production, standardized packaging, and Berne-compliant safety matches. Yet even WIMCO struggled to maintain market share in the face of rising imports and internal fragmentation. The matchbox became a battlefield of visual mimicry and economic survival, with labels often indistinguishable and quality uneven.

As the 20th century progressed, the match industry faced new threats—not so much from within, but from technological change. The rise of disposable lighters, fuelled by petrochemical advances and shifting consumer habits, eroded the match's dominance. Lighters were cleaner, more durable, and increasingly affordable. Match companies, once global titans, entered a period of distress. Some diversified into other products; others faded into obscurity. The visual culture of matchboxes—once a canvas for industrial pride and graphic experimentation—became a relic, preserved by collectors and historians.

This book documents that visual culture, not as nostalgia but as industrial evidence. Matchbox labels are more than decoration: they are miniature archives of branding strategy, labour history, and global trade. They reflect the aspirations of manufacturers, the identities of nations, and the tastes of consumers. Through annotated timelines, comparative tables, and curated exhibits, *IGNITION* reconstructs the match industry's evolution—from its hazardous beginnings to its cartelized peak, and finally to its decline in the face of technological disruption.

In doing so, the book also engages with broader questions: How do commodities shape global systems? How does branding mediate between product and consumer? What happens when industrial objects outlive their utility but not their meaning? The match, in its simplicity, offers complex answers. It is a tool, a symbol, and a story—one that flares briefly but leaves a lasting impression.

1

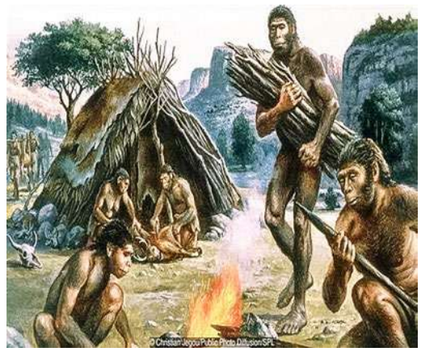
The Origins of Fire Making

Fire-Making in Prehistory

The mastery of fire marked a decisive turning point in human evolution, setting early humans apart from all other species. This elemental power enabled them to endure harsh climates, transform inedible foods into nourishment, reshape their environments, and lay the foundations of civilization.

Fire has remained a constant companion for nearly two million years, shaping the trajectory of human survival and development. Archaeological evidence suggests that cooked food dates back approximately 1.9 million years, with deliberate control of fire likely emerging around one million years ago. Neanderthals and early Homo sapiens in Europe used flint and pyrite as early as 50,000 years ago, starting fires through percussion—the method of producing sparks by striking two hard materials together, typically a piece of flint against a metal like iron pyrite. Its widespread use became especially visible between 50,000 and 100,000 years ago, accelerating during the Neolithic Revolution, when fire became essential for clearing land, managing crops, and sustaining permanent settlements.

Yet despite its centrality, the act of generating fire remained slow, laborious, and unpredictable for much of human history. This persistent challenge inspired generations of inventors, alchemists, and tinkerers to devise faster, more reliable methods of ignition—culminating in the earliest match-like tools.



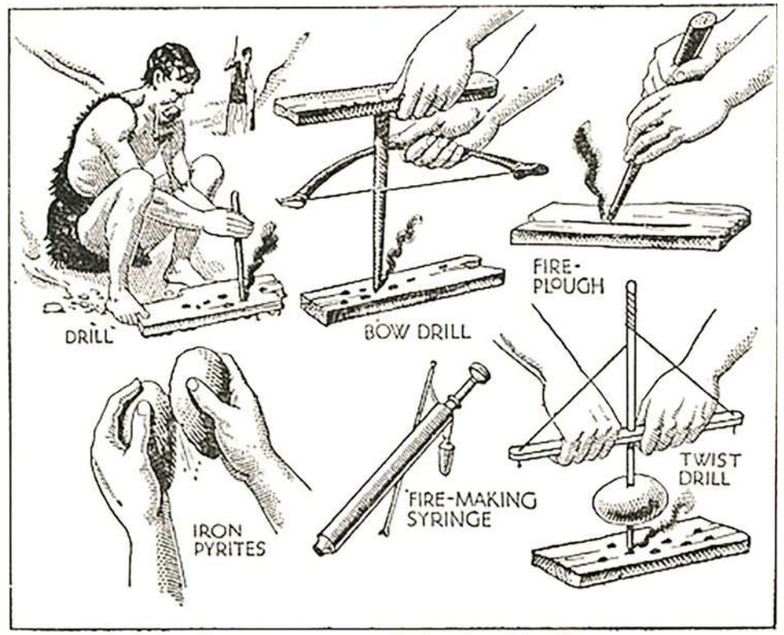
1. Prehistoric production of fire from friction; 2. Early humans making fire

Evolution of Fire-Making Methods

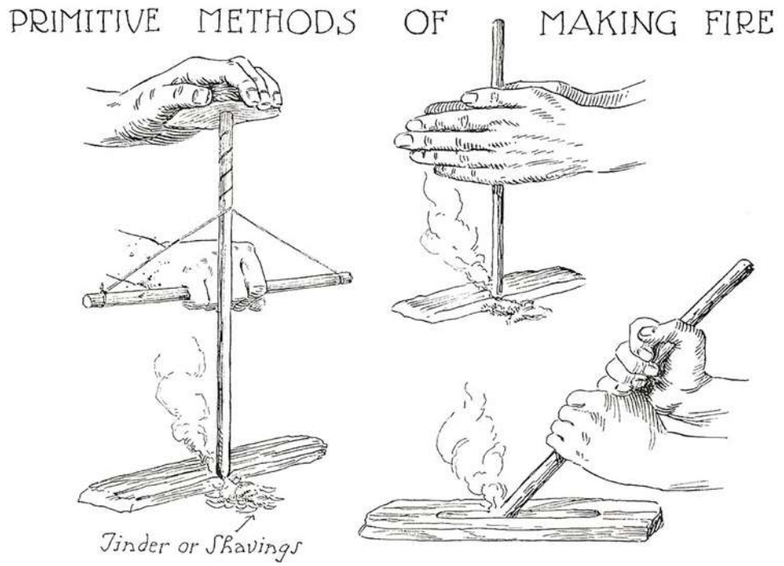
The earliest methods of fire-making across the world reflect a remarkable convergence of human ingenuity, environmental adaptation, and cultural transmission. Though techniques varied by region, most early fire-making methods relied on three core principles: percussion, friction and compression.

Table: Early Fire-Making Methods using Percussion, Friction and Compression

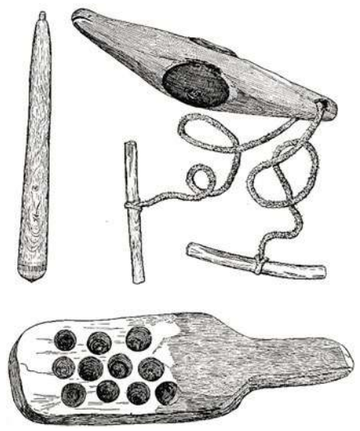
Method	Regions Used	Materials and Notes
Hand Drill	Africa, India, Americas	A straight stick twirled between palms against a wood base; simple but labour-intensive
Bow Drill	India, Africa, Europe	Cord looped around spindle; more efficient than hand drill; used by tribal and medieval cultures
Fire Plough	South America, Polynesia, Southeast Asia	Stick pushed along groove in softer wood; effective in humid climates
Thong Drill	India (tribal groups)	Leather or plant-fibre thong used to rotate spindle; variation of bow drill
Percussion (Flint & Pyrite)	Europe, Africa, Asia	Sparks struck from flint and pyrite; used by Neanderthals and Ötzi the Iceman
Tinder Fungus Ignition	Europe, Central Asia	*Fomes fomentarius* catches sparks; carried in fire kits for ember transport
Char Cloth & Tinderbox	India, Europe, Middle East	Cloth charred in closed container; stored in metal boxes with flint and steel
Fire Syringe	Southeast Asia	Piston forcefully pushed into the cylinder, compressing the air inside to raise the temperature to over 260°C, igniting the tinder.



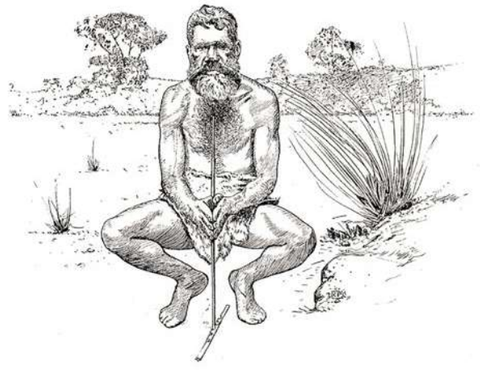
Some primitive methods of making fire.



3 & 4. Some primitive methods of making a fire



5. Sketch of fire-making apparatus; 6. Production of fire in the Americas



7- 10. Fire by friction

Indian Method of obtaining Fire by Friction.

11. Photograph of two Bapedi boys making fire in Sekhukhuneland, a region of north-east South Africa, 1938; 12. Indian method of obtaining fire by friction; 13. Photograph of two Badagas of the Nilgiri Hills in southern India making fire with a Thong Fire-drill; one holding the hearth in position with his feet and the head of the drill in position with a piece of cocoa-nut shell, the other pulling the thong backwards and forwards; the hearth of unusual length (about 2 ft) and size.

The Paniyans, who dwell in settlements at the base of the ghāts, make fire by what is known as the Malay or sawing method. A piece of bamboo, about a foot in length, in which two nodes are included, is split longitudinally into two equal parts. On one half a sharp edge is cut with a knife. In the other a longitudinal slit is made through about two-thirds of its length, which is stuffed with a piece of cotton cloth. It is then held firmly on the ground with its convex surface upwards, and the cutting edge drawn, with a gradually quickening sawing motion, rapidly to and fro across it by two men, until the cloth is ignited by the incandescent particles of wood in the groove cut by the sharp edge. The cloth is then blown with the lips into a blaze, and the tobacco or cooking fire can be lighted.

14. Paniyans in Wayanad making fire

Chinese Innovations in Fire-Extenders using Chemical Reactions

Some of the earliest precursors to modern matches emerged in China, where alchemists explored the flammable properties of sulphur. These early fire sticks were not self-igniting; they lacked the chemical sophistication of friction or phosphorus ignition. Instead, they were slender pinewood splints coated in sulphur, designed to catch and carry an existing flame.

Sulphur burns with a blue flame and has a low ignition temperature, making it ideal for catching fire quickly. It also melts and spreads, helping the flame travel along the stick's surface. However, sulphur alone cannot ignite from friction—hence the need for an external flame. Sulphur melts at a relatively low temperature of around 115°C, but it can emit toxic fumes when burned, so it's crucial to melt it safely by avoiding inhaling its fumes.

The first recorded use dates to 577 A.D., during the siege of the Northern Qi dynasty, when women of the imperial court reportedly used sulphur-coated sticks to light fires in moments of urgency. By the Five Dynasties and Ten Kingdoms period (907–960 A.D.), these tools had acquired poetic names such as "fire inch-stick" and "light-bringing slave," reflecting both their ingenuity and their growing role in domestic life.

Contemporary accounts describe how these sticks were stored for emergencies, ready to burst into flame with the slightest touch of fire—offering a quick, corn-like flare that could light lamps or stoves without delay. Their transformation from household innovation to commercial product marked an early chapter in the commodification of fire.

By 1270 A.D., sulphur matches were being sold in the bustling markets of Hangzhou, around the time of Marco Polo's visit. Known locally as *fa chu* or *tshui erh*, they were widely available and suggest a sophisticated urban demand for portable fire-making tools centuries before the invention of friction matches in Europe.

15. & 16. Ancient Chinese matches

Portable Fire-Making in the 18th and early 19th Centuries

Prior to the invention of friction matches, the 18th and 19th centuries saw a surge of experimentation aimed at improving fire-making techniques. Innovators explored a range of ignition methods—including friction, percussion, compression, and chemical reaction [1]—in pursuit of greater reliability and convenience. The table below outlines key developments in portable fire-making during this transitional period.

17. As a solid, sulfur is a characteristic lemon yellow; when burned, sulfur melts into a blood-red liquid and emits a blue flame; 18. A man carrying sulfur blocks from Kawah Ijen, a volcano in East Java, Indonesia, 2009

[1] *Solar Ignition could also be included wherein sunlight can be focused onto dry tinder using a lens or curved reflective surface to generate enough heat for ignition.*

Table: Portable Fire-Making

Method	Time Period	Ignition Mechanism	Key Material Used	Risks and Limitations	Cultural Notes and Usage
Fire Piston	Ancient–19th c. revival	Rapid air compression ignites tinder	Hollow cylinder, piston rod, char cloth	Requires precision; fragile seal; low success rate	Used in Southeast Asia; rediscovered by survivalists
Tinder Box/Bag	17th–19th c.	Flint struck against steel to spark tinder	Flint, steel striker, char cloth or amadou	Requires skill; slow; weather-sensitive	Common in homes; symbol of domestic ritual
Sulphur Matches	Late 17th–18th c.	Lit from existing flame or ember	Wooden splints dipped in melted sulphur	Not self-igniting; fragile in damp conditions	Sold in bundles; used with tinder boxes
Flint Pistol Lighter	Late 18th–early 19th c.	Spring-loaded flintlock mechanism	Flint, steel, internal tinder compartment	Mechanical failure; bulky	Popular among travellers and urban elites

19. Flintlock pistol lighter, 18th century; 20. Fire piston – Burma

21. Tinder bag. Tinder and flint would be carried inside the bag, whilst in most the steel is fixed to the bottom of the bag; 22. Sulphur matches of 3 inches length, wood, dipped after bundling; 23. Flintlock tinder lighter, c. 1800, likely England. This little gadget made the task a little easier by putting the tinder in the basket under the frizzen (striking surface) so that, when the trigger was pulled, the flint would create sparks against the frizzen and down into the tinder. This one is also equipped with a stand and a candle holder

Interest in chemical ignition intensified during the 19th century in Europe, driven by alchemical curiosity and the growing scientific understanding of combustion. A pivotal moment came with the discovery of phosphorus by German alchemist Hennig Brand in 1669. While searching for the Philosopher's Stone [2], Brandt isolated white phosphorus from urine, noting its spontaneous flammability—a property that would revolutionize fire-making.

Building on Brandt's discovery, English natural philosopher Robert Boyle conducted a series of experiments that advanced both the chemistry and practical application of phosphorus. In 1680, Boyle succeeded in manufacturing phosphorus and published the method of its preparation. He became the first

24. Discovery of phosphorous by H. Brandt; by W. Pether

[2] *The Philosopher's Stone is a legendary alchemical substance believed to transform base metals into gold and grant immortality through the Elixir of Life.*

Domestic Commerce

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25. Hennig Brand(t) – Domestic Commerce (pdf)

PHOSPHORUS — A DR. JEKYL AND MR. HYDE

By W. R. Koster

Phosphorus certainly deserves a prominent place among those versatile chemical elements that are of primary importance to modern warfare as well as to normal civilian life. The applications of phosphorus and certain phosphatic compounds in the weapons of war have placed a tremendous requirement burden upon the Nation's producers — principally because there can be very little let-up in ordinary civilian consumption, while the huge quantity requested for our own, and foreign, military machines is just that much more of a load to carry.

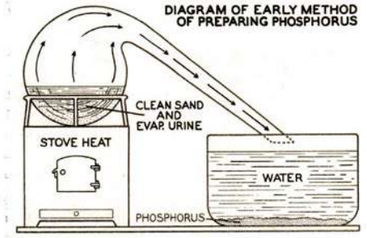
Moreover, the use of phosphatic compounds for food, pharmaceutical, and industrial purposes tends to increase at a very rapid rate. This is unfortunate in the sense that it aggravates an already difficult situation, but on the other hand it is also a promise that we will not have as great a post-war problem brought about by a greatly expanded production capacity.

Works For War and Peace

Phosphorus is not alone in its category of dual utility in both peaceful and wartime pursuits. Glycerin, a carbon compound, which is utilized by man in foods, soaps, and various industrial processes, is likewise one of his mightiest weapons in the form of nitroglycerin explosives. Other examples can be found in chlorine, sulfur, and nitrogen. Nevertheless, the great variety of phosphorous compounds, and the growing demand for them in all industry, places phosphorus among the foremost elements from the standpoint of usefulness.

Slow Development in Early Years

Literally hundreds of years elapsed between the discovery of phosphorus and the development of the large industry we have known for the last 20 or 30 years. In 1669 a German scientist, Hennig Brand, first noticed the yellow waxy substance while searching for the "phisosophers stone." He is reputed to have sold his secret method of preparation for about £37 to Dr. Kraaft who exhibited the phosphorus as "Cold Fire" — one of the wonders of nature.



In 1677 the English scientist Boyle learned from Kraaft during one of the latter's exhibitions before the court of King Charles II that phosphorus was obtained from some part of the human body. Boyle set to work immediately and soon duplicated the process of manufacture. When, in 1681, he published a full account of his experiments, it was learned that the material was obtained by distilling the residues of evaporated urine. Boyle's process was the only method known for producing phosphorus, and very high prices were obtained for it, until Scheele made it from bones in 1770 — about a hundred years after its discovery. Even then, when the cost of manufacture was drastically reduced and the availability greatly improved, there were few if any commercial uses known for the substance.

No Early Demand

No large-scale demand for phosphorus arose until the nineteenth century — 1827 to be exact — when the invention of friction matches by John Walker in England led to its use in the manufacture of match tips. In 1848, Bottger's Swedish safety matches increased the demand, especially for red phosphorus, discovered in 1845 by Schrotter. From that time there were

rapid developments in the use of phosphorus and its derivatives but the greatest advances, at least from the standpoint of consumption, have been made during the past 50 years.

Today phosphorus is derived chiefly from phosphate rock, most of which is mined in Florida, Tennessee, Idaho, and Montana, and in several other parts of the world — notably North Africa. The usual process involves the vaporization of the phosphorus in an electric furnace, purifying and collecting it under water as a solid and then either packing it for shipment or transforming it into commercial phosphorous compounds.

Present-Day Market

In spite of the wide distribution of the products that originate in the plants of phosphorus producers today, it is surprising how little is known of them outside of the industry itself. The food industry, for instance, consumes (in the form of various derivatives) about 25% of the phosphorus produced in the United States. Huge quantities of calcium and sodium phosphates are used in self-rising flour — that convenient preparation to which the newly wed housewife adds milk or water and demonstrates to her uninitiated husband her ability to bake delicious biscuits and cakes.

Similar phosphatic materials go into the baking powders, yeast, cereals, bread, and salt that come off the grocer's shelf. Phosphoric acid is employed extensively in the manufacture of soft drinks, jellies, sugar, and preserves, and ammonium phosphates are first-class yeast foods.

Found in Every Drug Store

The pharmaceutical applications include the use of various metallic phosphates in dentifrices, effervescent substances, vitamin-mineral tablets, and medicinal prescriptions.

United States Phosphoric Acid Production

Year	Pounds	Basis 50 percent
1933	24,652,505	in part P205, part H3P04
1935	45,385,991	H3P04
1937	78,250,701	H3P04
1939	153,820,000	H3P04

Figures supplied by the Bureau of the Census.

United States Production Selected Phosphates
(Short tons)

Item	1933	1935	1937	1939
Calcium:				
Moncbasic	39,326	35,860	38,708	37,038
Dibasic and Tribasic	3,010	4,729	5,138	7,313
Sodium:				
Monobasic	2,521	4,517	2,553	3,197
Dibasic	38,354	35,444	(a)9,987	(a)13,431
Tribasic	79,583	87,109	117,402	114,678
Pyro	(b)	(b)	10,288	47,587
Meta	(c)	5,147	7,748	(c)

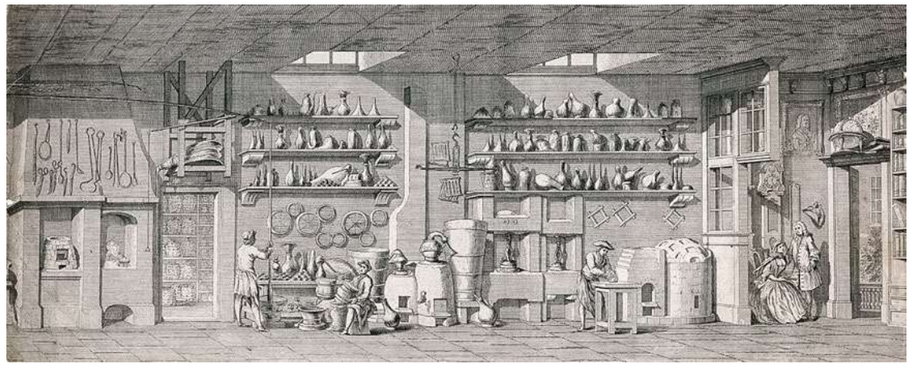
(a) Basis 100% NA2HP04.
(b) Included in Mcnobasic figures.
(c) Not available.
Figures supplied by Bureau of the Census.

to use phosphorus to ignite sulphur-tipped wooden splints—primitive precursors to modern matches. The process relied on the spontaneous combustion of phosphorus when it came into contact with air, making the sulphur-tipped splints flare up without the need for flame or friction. Though ingenious, these early matches were highly unstable and dangerous, as white phosphorus is toxic and ignites easily, limiting their practicality and safety. Boyle also improved the reaction by incorporating sand, which helped regulate the ignition process.

Ambrose Godfrey-Hanckwitz, his assistant, later commercialized phosphorus production, establishing a business that supplied the substance for scientific and industrial use.

More than a century later, in 1805, Jean-Joseph-Louis Chancel (1779–1837), working in Paris, made a fiery breakthrough that brought match

26. Portrait of Robert Boyle (1627-1691)



27. Remarkable Engraving of Ambrose Godfrey's Chemical Factory (source unknown). Stylistically Mid 1730's.

LONDON AND WESTMINSTER:

City and Suburb.

STRANGE EVENTS, CHARACTERISTICS, AND CHANGES, OF METROPOLITAN LIFE.

By JOHN TIMBS, F.S.A.

AUTHOR OF "A CENTURY OF ANECDOTE," "CLUB-LIFE OF LONDON," ETC.

IN TWO VOLUMES.—VOL. II.

LONDON:

RICHARD BENTLEY, NEW BURLINGTON STREET,

Publisher in Ordinary to Her Majesty.

1868.

28. Ambrose Godfrey-Hanckwitz - London and Westminster City and Suburb

PHOSPHORUS FIRST MADE IN COVENT-GARDEN.

Until the year 1863 there flourished in Southampton-street, Covent-Garden, the establishment of Messrs. Godfrey and Cooke, noted as the oldest chemists and druggists' shop in London, and reputed for the excellence of the drugs and chemicals there sold. The house has a handsome modernised front. *Here phosphorus was first manufactured in England;* the premises having been the house, shop, and laboratory of Ambrose Godfrey Hanckwitz, who, immediately after the discovery of phosphorus by Brandt, the alchemist, under the instructions of the celebrated Robert Boyle, succeeded in preparing an ounce of the substance, and presented it to his master. Boyle's accounts of it, and his experiments, caused a demand for phosphorus; and Hanckwitz, working under Boyle's direction, commenced to manufacture it, and produced it in larger quantities than any other person. In his advertisement he says: "For the information of the curious, he is the only one in London who makes inflammable phosphorus, which can be preserved in water. Phosphorus of Bolognian stone, flowers of phosphorus, black phosphorus, and that made with acid oil, and other varieties. All unadulterated; every description of good drugs. He sells wholesale and retail.—N.B. He sells solid phosphorus wholesale, fifty shillings an ounce, and retail, three pounds sterling the ounce."

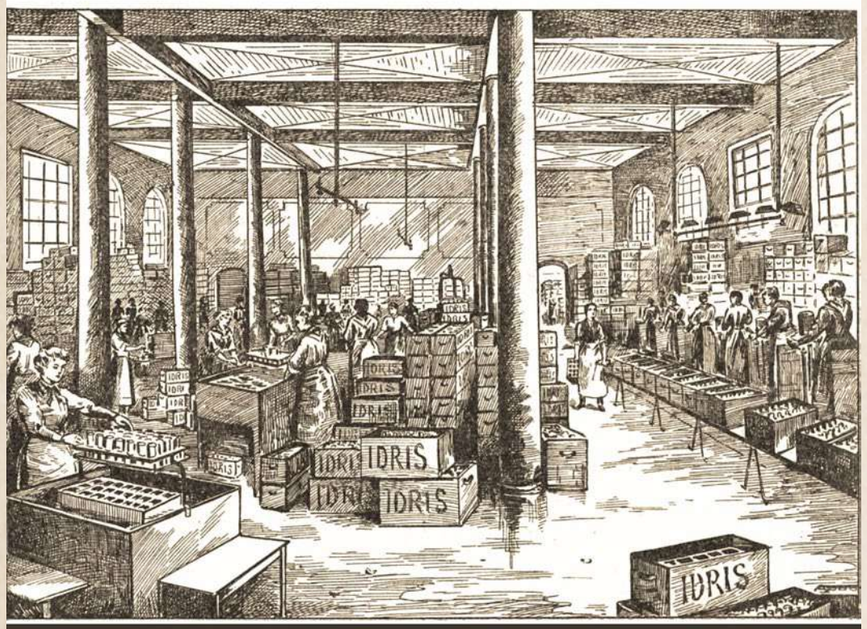
Bedford House was taken down in 1704, and Southampton-street was then commenced: here, in 1706, Hanckwitz built his premises, the business of a chemist having been carried on by him in the neighbourhood since 1680. Jacob Bell, in his *Historical Sketch of the Progress of Pharmacy in Great Britain*, tells us that

Hanckwitz "was a maker of phosphorus and other chemicals which were rare at that period, and which he sold in different parts of the country during his travels. His laboratory was a fashionable resort in the afternoon on certain occasions, when he performed popular experiments for the amusement of his friends. It opened with glass-doors into a garden, which extended as far as the Strand, but which is now built upon. Four curious old prints of the laboratory in its former state are in the possession of Messrs. Godfrey and Cooke (removed to Knightsbridge); also a portrait of Hanckwitz, engraved by Vertue (1718), which he had distributed among his customers as a keepsake." Hanckwitz died in 1741. His successors, Godfrey and Cooke, maintained the date 1680 on their premises in Southampton-street, and upon a board over the entrance to the laboratory in Maiden-lane; where the seat of the important chemical manufacture is now a potato-store! We confess that we look upon this change with a feeling of regret. Perchance some reader may say, "What care I about phosphorus!" Many a better-informed one will remember that to the utilisation of this elementary body we owe that domestic wonder—the lucifer-match, accidentally discovered by a chemist and druggist of Stockton-upon-Tees some forty years ago, and brought into general use by Faraday.

PAGEANTS OF THE NIGHTLY WATCH.

"I hold the world but as the world,
A stage, where every man must play a part."
Shakspeare.

The life of our eminent City is to be found in many a fond record of the painted pomp, the sights and shows,



29. Ambrose Godfrey-Hanckwitz - Transactions of the Pharmaceutical Meetings

THE

PHARMACEUTICAL JOURNAL

ESTABLISHED 1841.

A Weekly Record of Pharmacy and Allied Sciences.

FOURTH SERIES—VOLUME II.
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JANUARY TO JUNE, 1896.

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PHARMACEUTICAL SOCIETY OF GREAT BRITAIN,
17, BLOOMSBURY SQUARE, W.C.

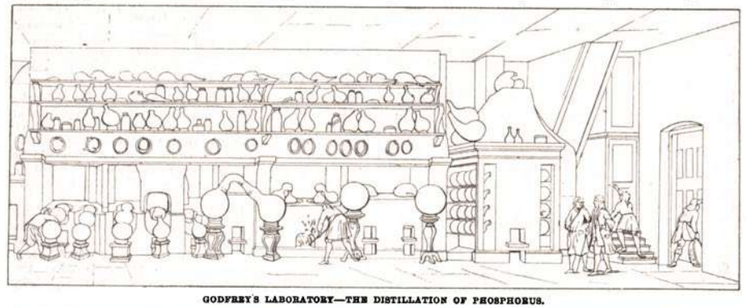
THE OLD FIRM OF GODFREY.

BY JOSEPH INCH.

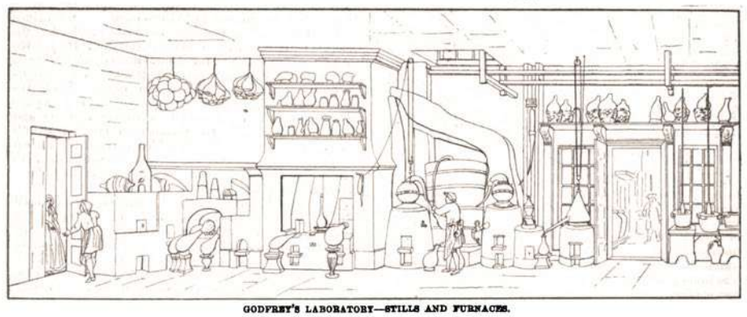
Late Director of Godfrey's Laboratory.

The mediæval history of this ancient house, dating from 1680 as a business, has been told so often,* that a brief outline of its earliest period will be sufficient. This is the story. The Honourable Robert Boyle devoted himself to the cultivation of science, particularly to the study of chemistry, natural philosophy, and theology.

On these three subjects he wrote many books, which in their day were held in great esteem.



GODFREY'S LABORATORY—THE DISTILLATION OF PHOSPHORUS.



GODFREY'S LABORATORY—STILLS AND FURNACES.

Boyle lived for six years on the Continent, which inspired him with a love of foreign travel, and on one of his wanderings he met with a young German, Ambrose Godfrey Hanckwitz. A strong bond of fellowship drew the philosopher and the youth together—both were enthusiastic workers; the latter was plodding and industrious, and though Boyle occasionally saw visions, his rare love of truth led him to distrust theories not based on experimental evidence. So Boyle brought his young German friend* to London as his assistant, and some time about the year 1660 they built between them a long, lofty, straggling laboratory which opened into Maiden Lane, and extended down towards the Strand to the westward of the site, where the houses forming Southampton Street were subsequently built. The accompanying illustrations are taken from prints representing the laboratory at a later period when it was used for manufacturing purposes. The first represents the whole process of making phosphorus. The second shows unwieldy stills and retorts in full operation, and the third represents various pharmaceutical processes.

In this last illustration the open door of a vestibule to the right discloses a spacious garden which was a fashionable resort in the afternoon, and on certain occasions popular experiments were performed for the amusement of visitors.

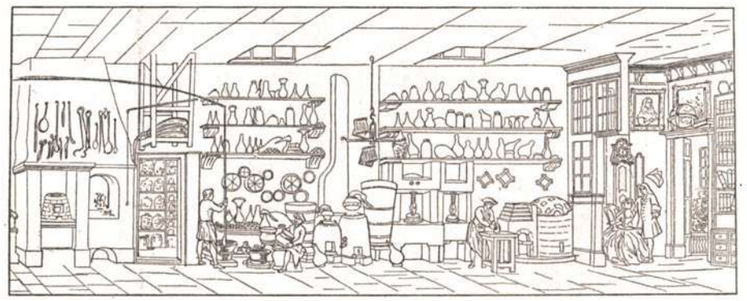
In the history of the firm of Godfrey the usual order of things was reversed, a chemical laboratory entirely up to the science of the day was established first; it was devoted exclusively to experiment and research; trade was an afterthought and an adaptation; only long afterwards was the old firm established.

* *Pharmaceutical Journal*, xviii., 126, *et seq.*

* The surname Hanckwitz being difficult to pronounce, and quite as hard to spell, it was eventually dropped.

I have been at pains to trace the exact origin of the business subsequently established, and it appears to have been this:—there was a great stir about phosphorus, heralded as one of the Arcana or mysteries of alchemy. It was the wondrous lumen, the *agens intrinsicum*, and many other things vaunted by the discoverer (Brandt) and his followers.

Boyle heard of phosphorus by "lytterall" correspondence; got a specimen from Saxony, and gave it to his head chymist, Mr. Bilger, who was to experiment and then instruct Godfrey how to make it. But Godfrey produced it first and made his fortune at the same time. He had been living in obscure lodgings in Chandos Street, with a wife, a family, and very slender income. He was immediately promoted to Boyle's friendship, and was engaged at once in the production of phosphorus. Afterwards he was sent on a travelling expedition to Holland, France, Italy and Germany, to display his specimens and to promote their sale. Then it occurred to Godfrey that science might be allied to trade, and the house in Southampton Street was built. I can find no evidence to show that Boyle had any connection whatever with its business career. He died a few years after and left his former assistant, Godfrey, in full possession of the situation.



At the time the writer of this article became acquainted with the laboratory of Godfrey, it had probably undergone much alteration from its original condition when used only for purposes of scientific experiment. In its construction whatever was wanting in symmetry was amply compensated for by height and space; ground had not risen to its modern value, hence the building was roomy and irregularly spacious, and was in time provided with two huge vats, supplied with water from the main which served as condensers to worms of similar dimension, attached to those ponderous stills, the memory of which survives in old prints. Big metal mortars were served by iron pestles, fixed to a long, wooden spring beam, suspended at the further end by a chain and ring. Much later in date came two sublimers for ammonia; one much resembling the usual form of apparatus—with a second which was an unwieldy leaden receiver, cooled by means of running water, and when possible encased with snow. Winter work was a sore trial for the men, since on all the laboratory premises there was not a solitary fireplace. On the shelves was an array of still-heads; alembics of various pattern; curious receivers and glass vessels of strange shapes, the probable use of which it was difficult to determine. Much is it to be regretted that a fire, arising from the overflowing of a spirit still, destroyed most of these antiquarian relics. Beneath the whole flooring ran the cellarage, arranged in separate arched vaults—the receptable for ammonia salts, ether, phosphorus, strong acids and essential oils—as well as for whatever might come under the denomination of dangerous chemicals.

The ground plan of the chief section of the laboratory may be traced in the church of Corpus Christi, which has been built upon the exact site; the walls have followed the old line of construction. Modern improvements swept away much that was additional and external, but the out-house, which held the larger tinctures and an extensive assortment of snakes and adders, was the last to disappear. A plane tree, which adorned the yard and cast a grateful shadow in the summer, continued to flourish in spite of its untoward surroundings, smoky and unpropitious, until cut down by ignorant hands while the present writer was abroad. Communism is not limited to Paris.

Yet a lover of the past, standing on the steps of the church in Maiden Lane, may note that the right and left entrances mark the position of the phosphorus furnaces which Boyle, Godfrey's "honoured master," built. Their fate proves the mutability of all earthly things; three on the left were demolished to make way for a coal-shed, two on the right were pulled down to accommodate a truck, the third lingered as a charcoal-burner until the business migrated to the West end, its last operation being to calcine acacia wood, which was manufactured into a *poudre dentifrice* for the then Empress of the French.

When the priest addresses his congregation he is probably not aware that the pulpit stands upon the spot once occupied by the Drying Chamber. This was a room arranged when ventilation and air currents were little understood, and it resembled, in its main features, the furnace seven times heated, of sacred history. It was equally ineffective in accomplishing the desired purpose. The modern drying-closet, one-fourth the size, offers a far better method of desiccation. The high-altar of the Church stands on the spot once appropriated to the manufacture of carmine, with rows of precipitation basins arranged on shelves and the store of silver grey cochineal. A particular feature of this room was the admission of light only from above.

It would be tedious once more to recapitulate the scientific transactions of the period between 1660 and 1741, full particulars of which will be found in the earlier numbers of the *Pharmaceutical Journal*. The record shows that Godfrey first produced sulphuric ether in saleable quantity, a circumstance pointed out to me by Professor Redwood. The statement must be taken without prejudice to the share that Sir Isaac Newton, Boyle himself and a certain Dr. Frobenius had in the discovery. Next came researches upon Ambergris, which he pronounced to be a substance analogous to, but not identical with, Amber.

The more important matter for present purposes is the date at which, in 1680, Godfrey became a business man and issued an elaborate advertisement, which will be dealt with in the next article. Then chemistry was no longer an abstract science, but bore a direct reference to the till.

There are two portraits of Godfrey extant: one by Vertue, dated 1718, is reproduced at page 168: it represents him as the "Chymist at the Sign of the Phœnix," of whom mention is made in Brande's 'Chemistry' as being the founder of "Godfrey's" in Southampton Street, Covent Garden.

(*To be continued.*)

PHOTOGRAPHY FOR CHEMISTS.

BLACK AND WHITE.

One or two queries that have been sent by correspondents, on the subject of failures in successfully reproducing black and white subjects, such as line diagrams or printed matter, either as prints or lantern slides, suggest that primarily the cause of failure lies in the making of the negative and that this point is deserving of treatment at some length.

First, as to the lens. Almost any lens may be used, even a single or landscape lens, because, as a rule, we do not use the whole of the field, merely the centre, and there distortion of marginal lines does not become apparent; on the other hand, a doublet is preferable, and undoubtedly the newer lenses, such as the Concentric, Collinear, Zeiss, Goerz, or Cooke, give superior results, because of their flatter fields and greater freedom from astigmatism. The focus of the lens is immaterial, provided always it is not so long that it will not allow of a sharp image being obtained when copying full size or nearly so, because it must be remembered that the nearer you get to your object, so the focal length for the time increases, and if you have two or more lenses the necessary distances should be calculated out so that you do not get into a difficulty by using a lens of too long focus, or one too short. The rule to find these distances is, divide the longer base of original by longer base of plate, add one, and multiply by the focus of lens; for copying, this gives the distance between lens and object. To find the distance between lens and sensitive plate, divide the distance between lens and object by the number expressing the ratio of image to object. We want to copy a diagram or page of a book measuring 9×5 ins. so that we can make a lantern slide by contact; the lantern plate measures $3\frac{1}{4} \times 3\frac{1}{4}$ ins.; $\therefore$ $9 \div 3\frac{1}{4}$ = the amount of reduction, or ratio of image to object. Using an 8-inch focus lens we have a very simple sum:—

$$[(9 \div 3\tfrac{1}{4}) + 1] \times 8 = \tfrac{49}{13} \times 8 = 30\tfrac{2}{13} \text{ ins.}$$

This is the distance from lens to object; then—

$$30\tfrac{2}{13} \div [9 \div 3\tfrac{1}{4}] = 10\tfrac{8}{9} \text{ ins.},$$

which is the distance between lens and plate. It may be added that in doublet lenses these distances should practically be measured from the diaphragm slot, and with single lenses from the front surface of the lens. There is one important point which must not be forgotten; taking the above case we find that the focus is increased to 11 ins. practically, but our diaphragms or stops, which have an important bearing on exposure, are calculated out on a basis of 8 in. focus. The result will be that they are reduced in value, and, therefore, the exposure should be proportionately lengthened; for instance, the diameter of F/8 with an 8-in. lens is obviously 1 in.; therefore, with 11 in. focus it is no longer F/8, but F/11; and as the exposures with these two apertures are as $8^2 : 11^2$, or practically as 1 : 2, it is obvious we must take this into consideration.

Now for the treatment of the object. Suppose we have a page of a book, a diagram, or engraving to copy, and it is impossible to tear it out of the book, what is the best way to go to work? As a rule one does not care to tear up one's own books, though we may not be so careful of other people's; but even they would object probably to have, perhaps, a valuable book mutilated merely because you want to copy something. Obtain two pieces of plate glass, or even old negative glasses will do, as long as they are quite clean, some stout india-rubber bands or American wooden clips. Place your book flat on the table, open at the particular leaf. Hold this leaf up straight, place one glass behind it and one in front, slip two india-rubber bands over the glasses and leaf, one near the centre of book, the other at the edge of page, and you will have a perfectly flat surface, and only need place a box or pile of books behind to keep this upright and in a position for copying.

The next point is, where is it to be copied? Naturally, we have a totally different subject to a living subject. We want no half tones, no modelling, nothing but black and white, consequently as flat and even a lighting as possible. This does not seem a very difficult thing to obtain, but it is far more difficult than one would suppose. Placing the book exactly opposite the window of the room is satisfactory as long as too short a focus lens is not used, or else the camera casts a shadow, and photography is far more sensitive to varying lighting than our eyes. If it is not possible to do this or to copy the book out of doors, then place it as nearly as possible at an angle of 45° with the window, and to equalise matters, use a good-sized bedroom mirror to reflect the light on to the side further from the window. Now set up your camera approximately at the distance found by above rule, and focus sharply with full aperture of the lens, and now look out for reflections; if you can on the ground glass see the slightest reflection you may be quite sure that it will appear in the negative and spoil your results. If you cannot get rid of them in any other way—and it will be found that it generally is possible to do it by a slight shifting of the book and camera—then you must erect a framework of tissue paper all round the book, for this breaks up the light, so that no distinct reflections are visible.

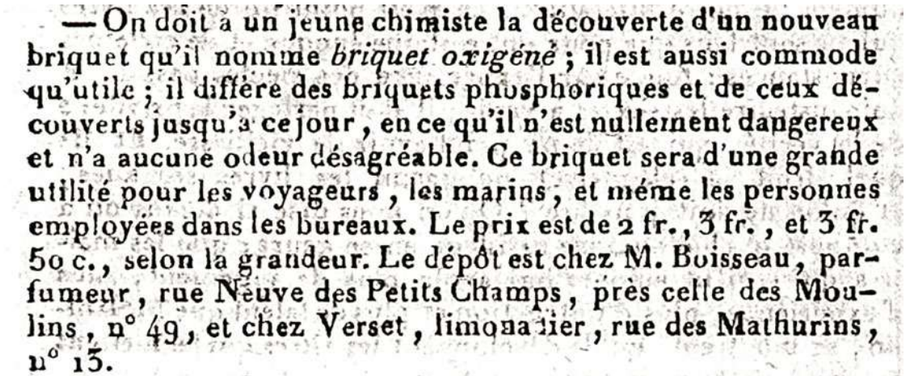
Before leaving the question of the subject, it must be distinctly understood that the camera must be parallel to the object, or parallel lines in a diagram will appear to be convergent. This is particularly important when making negatives for lantern slide work.

One of the principal advantages of rapid plates is their power of reproducing correctly the vary tones or gradations which exist in nature, but in copying black and white this very power is a great drawback, because we want no tones, no gradations, merely black and white, and, therefore, rapid plates possess a quality we do not want. The only plates to use for this work are the so-called photo-mechanical or process plates, which are specially made for the purpose, and have but little or no scale of gradation, but merely two tones.

With regard to exposure, but little help can be given, the only thing to do is to make a trial as follows:—Pull out the shutter of your dark slide, and uncap the lens for thirty seconds, cap the len

technology closer to practical reality. Chancel discovered that wooden splints coated with a mixture of potassium chlorate, sugar, and gum could ignite when dipped into concentrated sulfuric acid. His insight emerged after attending an experiment conducted by Louis Jacques Thénard, where a drop of sulfuric acid was poured onto a mixture of chlorate and soda, triggering inflammation.

Inspired by this reaction, Chancel conceived the idea of soaking a piece of wood in a blend of sulphur, potassium chlorate, and lycopodium powder (a fine, flammable spore used in pyrotechnics), then igniting it by contact with an asbestos brush soaked in sulfuric acid. He shared his concept with Thénard, who encouraged him to pursue it.



— On doit à un jeune chimiste la découverte d'un nouveau briquet qu'il nomme *briquet oxigéné* ; il est aussi commode qu'utile ; il diffère des briquets phosphoriques et de ceux découverts jusqu'à ce jour, en ce qu'il n'est nullement dangereux et n'a aucune odeur désagréable. Ce briquet sera d'une grande utilité pour les voyageurs, les marins, et même les personnes employées dans les bureaux. Le prix est de 2 fr., 3 fr., et 3 fr. 50 c., selon la grandeur. Le dépôt est chez M. Boisseau, parfumeur, rue Neuve des Petits Champs, près celle des Moulins, n° 49, et chez Verset, limonadier, rue des Mathurins, n° 13.

30. JLL Chancel, Journal de l'Empire, 12 October 1805

On October 12, 1805, the *Journal de l'Empire* announced Chancel's invention of the briquet *oxygéné* (oxygenated lighter) or what came to be known as the instantaneous light box. This device consisted of a splint soaked in sulphur and potassium chlorate, which ignited when immersed in a vial of sulfuric acid. Though hazardous by modern standards, it represented a major leap in ignition technology.

31. Instantaneous lightbox

By late 1805 and early 1806, Chancel's oxygenated lighters were commercially available in Paris. They were sold at prices of 2 francs, 3 francs, and 3 francs 50 centimes by Mr. Boisseau, a merchant-mercer-perfumer at 40 rue Neuve des Petits Champs, and Mr. Niodot, a merchant-stationer at 25 rue de Thionville. On June 20, 1806, Chancel transferred the rights to operate and distribute the oxygenated lighters to Mr. Primavesi, marking one of the earliest commercial transactions in match history.

Contract
Between Sieur Jean Joseph Louis Chancel and Sieur Charles Joseph Primavesi.

1° The Sieur Chancel cedes to the Sieur Primavesi his lighters, forty in number, the receipts for preparing them, the abandonment of his deposits, his correspondents, in a word, his collection of lighters, as well as the right to use himself in the title of his successor, in return for the sum of five hundred francs which the Sieur Primavesi has paid in cash and which the Sieur Chancel acknowledges having received.
2° Mr. Chancel promises not to communicate to anyone the way of preparing these lighters and himself not to make any more of them to make them an object of book and commerce, on pain of all damages to Mr. Primavesi.
3° The Sieur Primavesi accepts this transfer and sale of funds in good form and declares that the lighters which are in the two depots in Paris are part of his acquisition as of this day, reserving to the Sieur Chancel the right to be paid the amount of the previous sale, as well as to the depot in Boulogne.
4° The two contracting parties ratify and sign the present act, in good faith and have exchanged it between themselves.
Done twice at Paris on the twentieth day of June in the year one thousand eight hundred and six.

Charles Joseph Primavesi
J.J.L. Chancel, chemist, inventor of oxygenated lighters."

32. Contract between Chancel and Primavesi

Though Chancel's invention required a separate acid vial and was too dangerous for widespread domestic use, it laid essential groundwork for the safer friction matches that would follow in the 1820s and 1830s. His contribution stands as a critical bridge between alchemical experimentation and industrial fire-making.

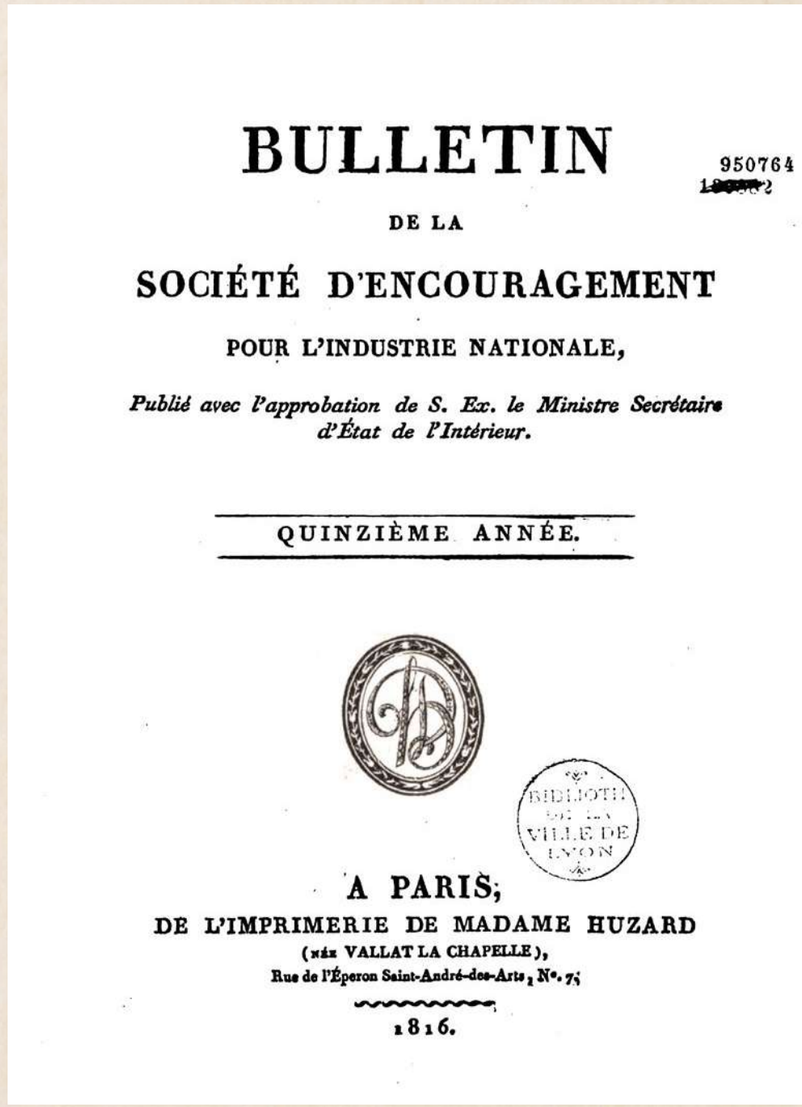
Chancel's oxygenated lighter proved impractical for daily use, as it required a separate vial of sulfuric acid and involved volatile chemicals that posed significant safety risks.

In 1816, French chemist François Derosne introduced the briquet *phosphorique* or the phosphorus bottle, a device that required scraping a sulphur-tipped match inside a tube lined with white phosphorus. The friction would ignite the phosphorus, producing flame. Though conceptually elegant and did not require carrying of liquid acid, the briquet *phosphorique* was unreliable, toxic, and short-lived—white phosphorus being both dangerously reactive and harmful to health.

33. Jean-Francois Derosne

34. &35. Briquet phosphorique used a sulphur-tipped match to scrape inside a tube coated internally with phosphorus. It was both inconvenient and unsafe; 36. Phosphorous box, 1795-1805

These inventions set the stage for future innovations that nonetheless continued to grapple with the delicate balance between portability and safety. One such innovation was the Promethean match, patented in 1828 by Samuel Jones in London. Named after Prometheus, the Greek titan who defied the gods to bring fire to humanity, this device embodied both ingenuity and risk. It consisted of a small glass bead filled with acid, wrapped in paper and coated with a flammable mixture. To ignite it, the user had to crush the bead—sometimes with pliers, sometimes with their teeth—triggering a chemical reaction that caused the paper to burst into flame. While it offered portable ignition, it was highly unstable and prone to accidental combustion. The Promethean match quickly earned a reputation for danger and novelty, and its commercial life was brief.



BULLETIN

950764

DE LA

SOCIÉTÉ D'ENCOURAGEMENT

POUR L'INDUSTRIE NATIONALE,

Publié avec l'approbation de S. Ex. le Ministre Secrétaire d'État de l'Intérieur.

QUINZIÈME ANNÉE.

BIBLIOTH DE LA VILLE DE LYON

A PARIS;

DE L'IMPRIMERIE DE MADAME HUZARD

(née VALLAT LA CHAPELLE),

Rue de l'Éperon Saint-André-des-Arts, N°. 7;

1816.

37. Charles Derosne 1816 - Bulletin de la Société d'encouragement pour l'industrie nationale

verture *g* enlève la cendre du foyer et sert à activer le feu. A mesur que le charbon se consume on presse sur la broche *i*, on dégage le déclic *o*, *o*, et par les moyens de la manivelle *s*, on fait tourner le pignon *b* et l'axe *d*, *d*, et on élève ainsi la barre *f* et la plaque mobile *g*, chargée de combustible. Lorsqu'on veut éteindre le feu, il suffit de descendre le fond mobile dans le foyer inférieur, qui, étant privé d'une communication directe avec le tuyau de cheminée, ne permet pas au charbon de brûler.

L'auteur pense qu'au lieu de faire monter le charbon dans le foyer; on pourroit établir le réservoir au-dessus ou à côté, et le faire descendre par un plan incliné.

Quant aux dimensions de ces cheminées, elles sont arbitraires; on peut les établir dans toutes les localités; elles offrent de l'économie et l'avantage de se débarrasser de la poussière noire et extrêmement ténue qui s'élève de la houille en combustion et salit les meubles des appartemens. (D.)

Note sur un nouveau briquet phosphorique; par M. Ch. Derosne.

Le nouveau briquet phosphorique, dont il est ici question, est incontestablement le plus facile à préparer, le plus économique, le plus simple et le moins dangereux de tous les nouveaux moyens inventés, depuis quelques années, pour se procurer immédiatement du feu.

Il est formé d'une très-petite quantité de phosphore, sans aucune espèce de préparation, différent en cela des anciens briquets phosphoriques dont la préparation exigeoit que le phosphore reçût une modification particulière, qui demandoit encore une certaine adresse.

L'emploi du nouveau briquet est fondé sur la propriété reconnue au phosphore de s'enflammer plus ou moins rapidement, suivant la nature et l'état des substances sur lesquelles on le frotte.

J'ai constaté que celles qui déterminent le plus facilement cette inflammation pouvoient être classées dans l'ordre suivant :

1°. Les poils d'animaux feutrés, en raison directe de leur plus grande finesse;

2°. La surface intérieure des peaux d'animaux assouplies et préparées, celle des peaux de gants par exemple;

3°. Les draps de laine serrés, les papiers de laine, les étoffes de soie, de coton et de fil velues et usées (celles qui sont lisses et lustrées ne valent rien);

4°. Le liége, le charbon léger, et en général toutes les substances animales et végétales, et même minérales, telles que l'amiante, qui sont velues et élastiques.

Tous les corps durs et lisses, tels que les bois, le parchemin, les

peaux vernies et tous les métaux, ne conviennent nullement à cet usage. Le phosphore ne s'enflamme sur ces corps que lorsque, par le frottement, eux ou le phosphore lui-même sont portés à une température voisine de celle où ce dernier s'enflamme par son contact avec l'air.

La préparation des nouveaux briquets est extrêmement simple. Il suffit de mettre environ le poids de 18 à 20 grains de phosphore dans un tube, n'importe de quelle matière. Ce tube devra avoir environ 6 lignes de diamètre, et être d'une longueur telle qu'il puisse être facilement tenu à la main. On emplit la partie inférieure de ce tube avec une substance quelconque, que l'on comprime avec un liége. On ne réserve pour le phosphore et le bouchon qu'un espace de 6 à 7 lignes, dont trois environ pour le phosphore et quatre pour le bouchon. On coupe le phosphore par petits morceaux; on les met dans la bouteille, qu'on bouche immédiatement avec un bon bouchon. En chauffant avec précaution, à une bougie, la partie où se trouve le phosphore, celui-ci se fond très-promptement; il se moule dans la bouteille en se refroidissant, et le briquet se trouve fait.

Rien de plus simple que la manière de se servir de ce briquet; il suffit de gratter légèrement, avec une allumette ordinaire, la petite couche de phosphore. Une très-petite portion adhère à l'allumette, et en la frottant ensuite légèrement, soit sur un morceau de feutre, de vieux gant, de drap, de papier de laine, ou même sur le bouchon, le phosphore s'enflamme plus ou moins rapidement, et communique le feu à l'alumette.

J'ai constaté que pour allumer cent allumettes de suite, soit sur un morceau de feutre, soit sur la face intérieure d'une peau de gant, il n'a été consommé qu'un grain et un quart de phosphore.

Ces nouveaux briquets ne sont pas dangereux comme les anciens, qui s'enflamment par le simple contact de l'air, et avec une rapidité qui a toujours quelque chose de choquant. Ils ont encore sur les anciens briquets et sur les allumettes, dites oxygénées, l'avantage de n'être point sujets à causer des brûlures ou des taches, soit par l'acide phosphorique qui se détache souvent par la combustion des premiers, soit par l'acide sulfurique dans lequel on trempe les dernières, et dont trop souvent il tombe quelque partie sur les corps environnans.

Le prix de ces briquets ne peut qu'être très-modique, et doit dépendre de la quantité de phosphore qu'ils contiennent. Celle de vingt grains, désignée ci-dessus, ne vaut pas plus de 15 à 20 centimes, et peut durer très-long-temps (1).

(1) On trouve ces briquets chez M. *Derosne*, pharmacien, rue Saint-Honoré, N°. 115, au prix de 10 à 12 sous, renfermés dans un étui de bois ordinaire.

38- 40. Promethean matches, 1828. Fire making device patented by Samuel Jones (Strand, London) 1828. Individual glass vesicles with a single drop of vitriol are sealed and wrapped in slips of paper which are coated with a mixture of chlorate of potash, finely-pounded sugar and gum Arabic. The paper is then rolled to form a spill. When light is required a pair of pliers is used to nip the end of the match, breaking the vesicle of vitriol and mixing it with the primed paper to create a flame. From the Bryant and May collection of fire making.

These transitional devices—Chancel's oxygenated lighter, Derosne's phosphorus tube and Jones's Promethean match—represent a critical phase in the evolution of fire-making: a period when chemistry outpaced safety, and invention danced precariously with combustion. They paved the way for the friction-based and safety matches of the 19th century, which would finally reconcile portability, reliability, and public health.

Table: Evolution of Portable Fire-Making

Era/ Date	Region	Tool/ Innovation	Key Features and Notes
~1.9 million BCE	Africa	Controlled fire use	Earliest evidence of cooked food; no portable ignition tools
~1 million BCE	Global	Fire maintenance	Use of embers and natural ignition sources
Prehistoric, ancient period	Global	Fire-making by friction, percussion and compression	Natural ignition sources
577 A.D.	China (Northern Qi)	Sulphur-coated pine sticks	Used during siege; earliest documented match-like tool
907–960 A.D.	China	"Fire inch-stick" / "Light-bringing slave"	Stored for emergencies; poetic names reflect domestic use and mystique
1270 A.D.	China (Hangzhou)	*Fa chu / Tshui erh* sulphur matches	Sold in markets; suggests urban demand and commercial availability
1669	Germany	Discovery of phosphorus (Hennig Brand)	Isolated white phosphorus while searching for the Philosopher's Stone
1680	England	Boyle's phosphorus-sulphur ignition	Coated paper with phosphorus and wood with sulphur; produced flame by friction
Late 17th c.	Europe	Flint and steel	Percussion method using carbon steel and flint; carried in tinderboxes
18th c.	Europe	Fire piston experiments	Compression ignition using rapid air pressure; rare but documented
1805	France	Chancel's chemical match, *briquet oxygéné* (instantaneous lightbox)	Match head dipped in sulfuric acid; dangerous and impractical for daily use
1816	France	Derosne's *briquet phosphorique* (phosphorus box)	Sulphur-tipped match scraped inside a tube coated internally with phosphorus.
1828	England	Samuel Jones' Promethean matches	Mixing vitriol with a mixture of chlorate of potash, finely-pounded sugar and gum arabic (acacia gum)

2

The Friction Match

Origins

A friction match is a small, portable fire-starting device that ignites through the mechanical action of rubbing its chemically treated head against a specially prepared surface. It represents a pivotal innovation in fire-making, combining chemical sensitivity with physical convenience. It consists of:

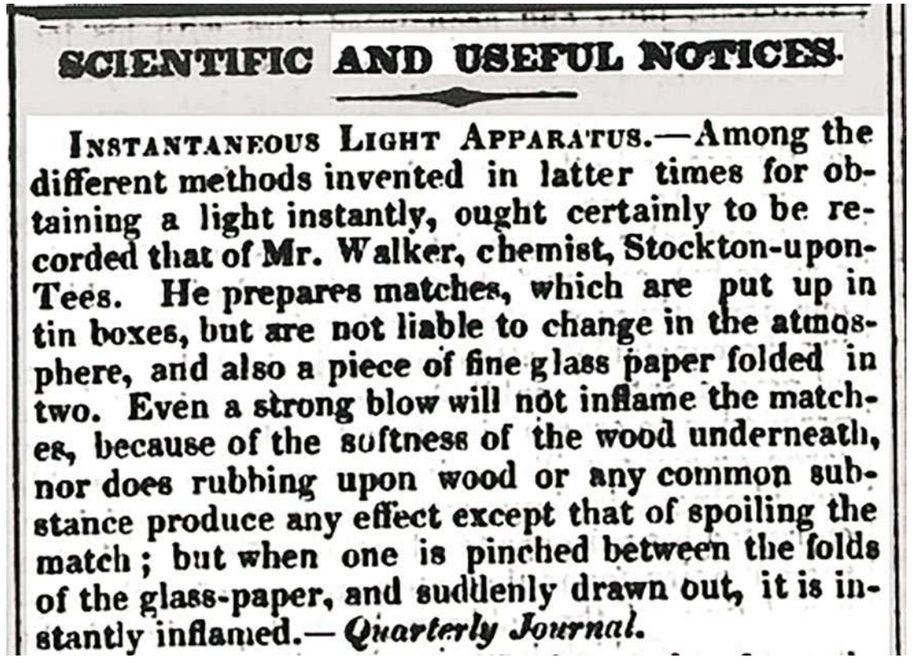
- A splint or stick, typically made of wood or cardboard.
- A match head, coated with a mixture of oxidizing agents (like potassium chlorate), combustible binders, and often red phosphorus or antimony sulphide.
- A striking surface, usually found on the matchbox or matchbook, containing complementary chemicals—often powdered glass and red phosphorus—to initiate ignition.

When the match head is dragged swiftly across the striking surface the friction generates localized heat, which in turn triggers a chemical reaction between the oxidizer and fuel components. The match ignites, producing a flame that can be used to light fires, candles, stoves, or other combustible materials.

41. John Walker

The first truly effective friction match was created in 1826 by John Walker, an English chemist and druggist based in Stockton-on-Tees. Motivated by a desire to simplify fire-making, Walker experimented with chemical mixtures known to produce sudden ignition. However, none had successfully transferred flame to a slow-burning material like wood—until a serendipitous accident changed everything. While preparing a lighting compound, Walker noticed that a match dipped in the mixture ignited when scraped against his stone hearth. Recognizing its potential, he began producing matches that ignited through friction alone.

Walker's early matches—called "friction lights"—were made from wooden splints coated in sulphur and tipped with a blend of antimony sulphide, potassium chlorate, gum arabic (acacia



SCIENTIFIC AND USEFUL NOTICES.

INSTANTANEOUS LIGHT APPARATUS.—Among the different methods invented in latter times for obtaining a light instantly, ought certainly to be recorded that of Mr. Walker, chemist, Stockton-upon-Tees. He prepares matches, which are put up in tin boxes, but are not liable to change in the atmosphere, and also a piece of fine glass paper folded in two. Even a strong blow will not inflame the matches, because of the softness of the wood underneath, nor does rubbing upon wood or any common substance produce any effect except that of spoiling the match; but when one is pinched between the folds of the glass-paper, and suddenly drawn out, it is instantly inflamed.— *Quarterly Journal.*

42. A photograph of John Walker's home (marked with an X). Image courtesy of Preston Park Museum; 43. Artist's impression of John Walker's chemist shop on Stockton High Street. Image courtesy of Preston Park Museum; 44. Announcement of John Walker's invention of the friction match or Congreve

gum), and sometimes starch. The sulphur served to transfer the flame to the wood. He sold them under the name Congreves, a tribute to Sir William Congreve, the British rocket pioneer. Each box of 50 matches cost one shilling and included a folded piece of sandpaper for striking. Walker kept the exact formula secret and, between 1827 and 1829, sold approximately 168 boxes. Despite their novelty, the matches were hazardous: a shower of sparks with molten balls could fall from the tip, igniting clothing or carpets. This led to bans in countries like France and Germany.

45. John Walker friction-lights; 46. John Walker's friction matches (made by Richard Bell & Co.)

47. John Walker's tin box of Congreves (same as friction matches); 48. John Walker's friction-lights first label (jpg)

Walker never patented his invention, reportedly dismissing its commercial potential and preferring to focus on scientific inquiry. Even encouragement from figures like Michael Faraday failed to sway him. To improve ignition and reduce odour, camphor was added to mask the acrid fumes.

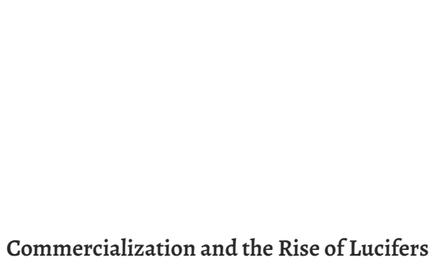
Commercialization and the Rise of Lucifers

In 1829, Scottish inventor Sir Isaac Holden developed a refined version of Walker's match and demonstrated it to students at Castle Academy in Reading. Like Walker, Holden did not patent his design. One of his pupils reportedly shared the idea with his father, Samuel Jones, a London chemist who recognized its commercial potential. Jones patented a version of Holden's match and marketed it as the Lucifer match—a name evoking fire and rebellion.

Lucifers were made by dipping splints into a mixture of potassium chlorate, sulphur, and sugar. The ignition sequence of Samuel Jones' Lucifer matches was as follows:

Striking (Friction Phase)

- The match head, coated with a mixture of potassium chlorate, antimony sulphide, and sulphur, is struck against a rough surface.
- Friction generates heat (~150–200°C), enough to trigger a rapid chemical reaction.



49- 52. S. Jones' Lucifers

ADVERTISEMENTS
COURT OF COMMONs PLEAS
TUESDAY, NOV. 22.

Mr. Justice Park sat this day at Nisi Prius, in the Committee room (No. 12) of the House of Commons.

JONES V. WATTS. - LIBEL.

Mr. Serjeant Bompas stated that this was an action against the defendant for a malicious libel, published by him in a Sunday newspaper of the dates of April 10th, 17th, 24th, and May 1st, and the nature of the libel was as follows: The plaintiff, Mr. Samuel Jones, was an experimental chemist living in the Strand, and the defendant was in the same profession. Mr. Jones had, some time ago, invented a match to produce an instantaneous light, in lieu of the use of sulphuric acid, or the vulgar and old woman's method of a tinder-box; and he had given his ingenious invention the name of 'Promethean'; and which, although an alarming name, there was nothing injurious in its construction. The plaintiff had always received a most extensive call for his new method of procuring a light, and his export trade was also very great, and the ' Promethean' became in general use. Subsequently the plaintiff invented another description of match, which he designated with the frightful name of the Lucifer, but which was equally harmless. For the 'Prometheans' he had secured himself from his invention being pirated by procuring letters patent; but for the 'Lucifers' he had not so secured his right as the patentee. The consequence was, that in about a year after- wards, when the invention of the plaintiff had been lectured upon at the London and Royal Institutions, the defendant made an exact imitation of the Lucifer Match, and represented himself to be the sole inventor, in various advertisements inserted by him in the Age newspaper of the above dates. Mr. Jones, in another advertisement, contradicted the right taken by Mr. Watts to the invention, which drew for than answer from the defendant, and which was published in the same paper, still declaring himself to be the inventor, and stating, " that he would no more imitate Jones's ' Lucifer,' than Sir Thomas Lawrence would, when he was yet alive, have resorted to the daubers in his profession to exalt his fame." (Loud laughter.) In the same advertisement the libel now complained of was contained, viz.: - "That Jones's ' Prometheans' were dangerous, and would not stand the climate." These statements had materially tended to injure the sale of the 'Prometheans,' and were a malicious libel to the injury of the plaintiff. The Learned Serjeant then called Mr. Cooper and Mr. Everett, experimental chemists, and Mr. Hennell, the chemical operator of Apothecaries' Hall, all of whom had tried experiments upon the Prometheans, and declared that they would not ignite under 415 deg. F., (nearly double the heat of boiling water,) four times hotter than any climate in the world. Mr. C. F. Oppenheim, purser of the Georgiana Fast Indiaman, proved that he had carried them loose in his pocket twice under the line, and had never found them ignite. Several other scientific witnesses were called, who proved they never considered Jones's 'Prometheans' dangerous.

Mr. Pollock having addressed the Jury for the defendant, and Mr. Serjeant Bompas having replied, Mr. Justice Park summed up.

The Jury instantly found a verdict for the plaintiff-damages to the full amount claimed, and costs.

53. Samuel Jones – The Athenaeum (Word)

Initial Combustion

- Potassium chlorate decomposes, releasing oxygen.
- Antimony sulphide and sulphur ignite in the presence of this oxygen, producing a violent burst of flame.
- The reaction is exothermic (heat-releasing) and often unpredictable—Lucifers were known to flare suddenly and erratically.

Flame Transfer

- The flame leaps from the head to the wooden splint.
- The splint, often dipped in melted sulphur to aid ignition, catches fire quickly.

Sustained Burn

- The match burns with a strong sulphurous odour, which was a signature trait of Lucifers.
- The flame lasts long enough to light tobacco or kindling, but was not always reliable for household use.

Extinction

- Once the fuel is consumed, the flame dies out.
- The matchstick chars, leaving behind a brittle residue.

Jones' early Lucifers ignited with a violent reaction, emitted harsh fumes, and produced unpredictable sparks. Lucifer matchboxes often carried warnings: "Persons whose lungs are delicate should by no means use Lucifers," reflecting the health risks posed by their combustion gases.

Despite these drawbacks, they became popular, especially among tobacco smokers. In the United States, Ezekial Byam manufactured Lucifers, and the term entered popular culture—appearing in songs like 'Pack Up Your Troubles' during World War I. Even today, Dutch and Flemish languages still refer to matches as Lucifers.

The Phosphorus Revolution: Charles Sauria, and Loco-Focos

The old Lucifers were soon eclipsed by a major innovation in 1830, when French chemist Charles Sauria replaced antimony sulphide with white or yellow phosphorus [3]. Sauria's matches ignited more reliably and burned longer, with less odour. He added gum arabic to bind the mixture and dipped wooden splints into the paste. Though effective, these matches were volatile and had to be stored in airtight metal containers to prevent spontaneous ignition.

IN the *Revue scientifique* of January 7, we learn that on October 31 a small monument was erected at the small village of Saint-Lothaire in the Jura, to Charles Marc Sauria, the original inventor of matches. The writer of the paper, Dr. Cabanès, tells us that Sauria was born in 1812, and was the son of General Sauria. He always showed a keen interest in scientific inventions of all kinds, and while studying for the medical profession at the college at Dôle, obtained some chemicals from an apothecary, and spent all his spare time in trying to make a match which would light by striking, while his fellow students were enjoying themselves. In the winter of 1830–31 his efforts were crowned with success. Sauria confided his inventions to his professor, M. Nicolet. Sauria gained but little profit from his invention, which he could not afford to patent, and spent the greater part of his days as a simple country doctor. It is interesting to learn that matches were invented independently in 1832 by Frederic Kammerer, an Austrian, who seems to have died in great poverty; and the same discovery is also attributed to the Hungarian Irinyi.

54. Charles Sauria – Nature; 55. Charles Sauria

Sauria added white phosphorus (P_4) to the match head mixture, which ignites spontaneously at relatively low temperatures (~30–50°C). When struck against a rough surface, the friction generated enough heat to ignite the phosphorus, which in turn ignited the other components—especially potassium chlorate, the oxidizer. The match head contained a volatile blend of white phosphorus (20%), potassium chlorate (30%), sulphur (15%), and chalk and glue (to stabilize and bind the mixture). The phosphorus acted as the initiator, while the chlorate released oxygen to fuel combustion, and sulphur helped sustain the flame.

In England, these matches retained the name Congreves, while in the U.S., they came to be known as Loco-Foco matches. The term Loco-Foco—originally coined for a self-igniting cigar

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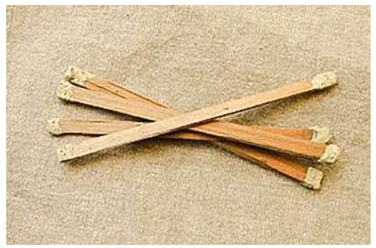
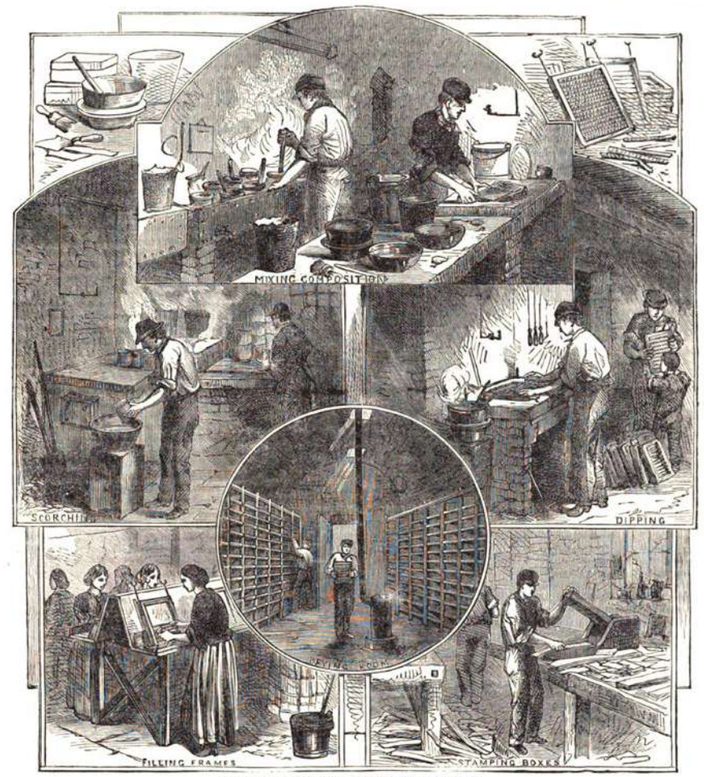
[3] *When yellow phosphorus oxidizes when exposed to air it turns pale, and called white phosphorus.*



Clockwise from the top left: 56. & 57. White phosphorous Congreve matches; 58. New patent gas camphorated Congreve lights (likely with phosphorus) without sulphur, manufactured by Bell & Black, London, c. 1851; 59. White phosphorous Lucifer matches, 1831-1906 (after which white phosphorus was banned), The white phosphorus match was invented in 1831 by Charles Sauria, who added the phosphorus to the first matches invented just 4 years before by John Walker. It results in a less violent combustion of the match; 60. A match safe; 61. Old Lucifer matchbox label



THE MANUFACTURE OF LUCIFER MATCHES.

The Lucifer Match.

It is to be regretted that the inventor of the lucifer match has failed to obtain the fame which is justly his due; for certainly a more useful invention has rarely been bestowed upon mankind. The lucifer match is a source of convenience to every one. Millions who never use telegraphs or the other wonders of modern civilization have occasion to bless the inventor of the match, and yet his very name is unknown. The greatest wonder about this singular circumstance is the fact that the match has been in use for but a few years. Men of middle age remember very clearly the day when there were no really serviceable matches; and yet we are entirely without information as to the name of the inventor of that which has within a few years become a household necessity.

Prior to the invention of the lucifer match, the flint and steel were the means most generally used for getting a light. Fire was procured in this case by means of a flint, which was sharply struck against a piece of hard steel, so as to produce a shower of sparks consisting of minute particles of metal, which, from the force with which they were separated from the original mass, became red hot. These sparks would not set fire to any thing very coarse, such as shavings, or even coarse tow. Tinder or touch-paper was required; but when these were used, a dexterous manipulation could procure a light with as much certainty and rapidity as with the lucifer. Indeed, for travelers, the flint and steel is a much more trustworthy source of light than the lucifer, and attempts were recently made to bring it into general use for the benefit of smokers. A very neat apparatus, modeled after the form used in Mexico, was thrown into market and largely sold; but from want of dexterity on the part of the users, it never became very common. Even those who dealt in the article, or, at least, many of them, had evidently never served an apprenticeship to the old tinderbox with its flint and steel. We remember a cigar-dealer in a country town who had invested in a quantity of them, but could not sell one—for the simple reason that neither himself nor any of his customers could succeed in getting a light from them. They did not know that the cotton rope which served for match or tinder takes fire far more readily after it has been ignited and then blown out, so as to leave the end slightly charred. After lighting the cord with a common match and blowing it out, no difficulty was found in causing the charred end to take fire from the spark of the flint and steel. After this slight hint, the poor fellow found no difficulty in disposing of his wares.

62. Manufacture of Lucifer matches

But the great objection to the flint and steel was, that women and children could not use it with facility. It required strength and skill, and these were sometimes wanting. So scientific men set themselves earnestly about the discovery of some more simple or at-least some more easily operated method; and it would not be stretching the truth at all to say, that a description of the various inventions which have been made with this object in view, would fill several numbers of THE MANUFACTURER AND BUILDER. It is, therefore, obvious that we can not even allude to them all, but must confine ourselves solely to the history of the modern lucifer match as it is at present found in market.

About the year 1669, Brandt, a bankrupt merchant of Hamburg, sought to mend his fortunes by the aid of alchemy, and devoted years to the pursuit in the hope of attaining to a knowledge of the philosopher's stone, or, as an old English chemist says, the idiot's stone. In making some experiment upon animal fluids, he discovered phosphorus — perhaps the most singular substance ever known to the alchemists. So profoundly impressed were they with its wonderful properties that it was called the Son of Satan, and it is said that an ounce of it was sold for the price of a snug little farm. One man, Godfrey Hanckwitz, at his laboratory in London, prepared a considerable quantity of it, and went through the country to exhibit and sell the article. After a time, however, the modern system of preparing it from bones was discovered; the price fell to a reasonable figure, and phosphorus, being no longer a curiosity, was applied to useful purposes. At first it was used for igniting the common sulphur match, which was rubbed against a little of it contained in a bottle, and then ignited by friction against the cork. In this way a very serviceable *fire-bottle*, as it was called, was made, but it was dangerous, and soon fell into disuse. The use of phosphorus for procuring a light was then entirely abandoned, and the attention of chemists was devoted to the preparation of matches tipped with mixtures, of which chlorate of potassa formed the prominent constituent. The best of these were known as the Euppyrion, and it is within the memory of many now living, that the walls in London were abundantly placarded with the notice—"Save your knuckles, time, and trouble. Use Heurtner's EUPYRION, *Price one shilling!*"

About the year 1830 or 1834, the present lucifer match was thrown on the market. It consists essentially of three things: First, a wooden splint, the ignition of which is the ultimate object of the whole arrangement; secondly, of a tip which may be easily ignited by friction, and which in all modern matches consists of phosphorus made into a paste or emulsion with glue, and colored with smalt, red lead, or some similar substance; and thirdly, of some means of enabling this phosphorus tip to ignite the wood; for, strange to say, although phosphorus burns with a most intensely hot flame, it may be ignited on wood, or even on paper, without setting it on fire. The reason of this is, that in burning, the phosphorus produces an ash which fuses and covers the wood as with a varnish, which effectually prevents it from bursting into flame. It may be charred, but it will not ignite.

The extent of the business of "match-making," in its inoffensive sense, is something wonderful. The engineer Peligot computes that the number of phosphoric matches used in France is six per diem for each individual, on the grand average. This would give 2,000,000,000 daily, for all Europe. In England, the number used per head is 8, and in Belgium 8. The manufacture of matches uses up, at a minimum, 400,000 cubic yards of wood per annum; the number of workmen employed is 500,000 and the value of the product, 250,000,000 of francs. This total is the more surprising when we reflect that the match business commenced only in 1833, until which time steel and flint, or phosphorus, were used. The greatest improvement recently introduced in the manufacture is the employment of binoxide or nitrate of lead, instead of chlorate of potassa, which involves a certain amount of danger. Germany makes the best and cheapest chemical matches in Europe. At Vienna, fifty packets, containing 3500 matches, are sold for 35 kreutzers, which puts them at nearly 250 for one of our cents. Marseilles is the great centre of the trade in France, and, cheaply as they are made there, and everywhere, the public pays about twice what the manufacturer sells them for, so great is the number of hands through which they pass *before* they reach the consumer.

A match factory in Western New-York is noted for the curious machinery used in the manufacture. 720,000 feet of pine of the best quality are used annually for the matches, and 400,000 feet of basswood for cases. The sulphur used annually for the matches is 400 barrels, and the phosphorus is 9600 pounds. The machines run night and day, and 300 hands are employed at the works. 500 pounds of paper per day are used to make the light, small boxes for holding the matches, and four tons of pasteboard per week for the larger boxes. Sixty-six pounds of flour per day are used for paste, and the penny stamps required by government on the boxes amount to the snug little sum of $1440 per day.

There are four machines in use for cutting, dipping, and delivering the matches. The two-inch pine plank is sawed up the length of the match, which is 2½ inches. These go into the machine for cutting, where at every stroke 12 matches are cut, and by the succeeding stroke pushed into slats arranged on a double chain 250 feet long, which carries them to the sulphur-vat, and from thence to the phosphorus-vat, and thus across the room and back, returning them at a point just in front of the cutting-machine, and where they are delivered in their natural order, and are gathered up by a boy into trays and sent to the packing-room. Thus, 1000 gross or 144,000 small boxes of matches are made per day. The machines for making the small, thin paper boxes and their covers are quite as wonderful and ingeniously contrived as those that make the matches. A long coil of paper, as wide as the box is long, revolves on a wheel, one end being in the machine. It first passes through rollers, where the printing is done; from thence to the paste-boxes, where the side and ends only are pasted; from thence, to the folding apparatus, where the ends are nicely folded and the whole box is pasted together and dropped into a basket. A similar machine is at work at the covers, and thus 144,000 boxes per day are manufactured. The process of manufacture is well illustrated in our engraving, and will receive further consideration in our next number.

The Cheap Forces of Nature.

THE CREATOR has given to man *mind*, and has gratuitously placed at his disposal *matter* and *motion*. Matter and motion are by the human mind made to produce useful *work*, which, philosophically considered, ought to be not only cheap, but should cost nothing. The attainment of this object is one of the very highest aims of the science of chemistry, physics, and mechanics, nearly every great discovery in which makes us progress a step in this direction. So much, unfortunately, yet remains to be done before we can hope to reach the acme of industrial perfection, that we have thought a few general remarks in regard to some of those forces of nature which are available but as yet neglected might prove not altogether useless or uninteresting.

The steam-engine, the utiliser of the radiated sun's heat concentrated in bygone ages in our coal-fields, is very far from affording us this desired result. It is an extravagant machine, which is rapidly and prodigally wasting ninety per cent of the carefully hoarded and valuable stores contained in one of nature's vast treasuries, and which, if allowed to monopolize for a few years more the supremacy of our work-shops, must eventually lead to its own forcible extinction, for want of food to satisfy its insatiable maw. There is no good reason why the vaporization of water, where nine tenths of the heat produced by combustion is consumed by the internal, invisible, and useless labor of separating molecules of water from each other, is to supersede all other methods of producing motion. This remark is especially true since we have begun to learn the doctrine, that all the forces of nature are, by some means or other, convertible, either directly or indirectly, into mechanical work. At the present time, several inventors, in different countries, are attempting to utilize the heat of the sun's rays and to construct a *sun-engine*. The heat thus to be used has reached our planet after having traversed 95,000,000 of miles of ethereal space, without losing any of its intensity. A perfectly transparent and non-reflecting medium, such as celestial space, is non-absorbing, and allows caloric to traverse it undiminished in quantity. Many people shake their heads at this innovation and ridicule the very idea of success being possible. Many of these doubters are, however, certainly unacquainted with the stupendous forces we have here at our disposal, the amount of which has been accurately computed by Pouillet and other modern philosophers.

The researches of these men of science have proved that on every square centimetre of the earth's surface no less than 231,675 centigrade units of sun heat are annually received. Forty per cent of this quantity is absorbed by the surrounding atmosphere, and sixty per cent reaches the earth. This gives us seven centigrade units received per second on each centimetre. We further know that, to convert one pound of water from 0 degrees into steam, requires 637 centigrade units of heat, so that 91 square feet of the earth's surface would receive heat enough every second for the vaporization of this quantity of water.

A further computation indicates that the annual calorific power of the sun on our earth would be equivalent to more than one hundred thousand millions of horse-power, if used to convert water into steam for the working of our engines. This heat it is which causes evaporation on the surface of the globe, without which no rain would fall, no refreshing dew deposit itself, no river flow, and the whole of our flowery and fruitful lands would become a parched and dreary desert. This heat, also, is the cause of the winds which waft our ships over the ocean; It is the mover of the zephyr which refreshes our burning brow on a summer's day; It is, combined with light, the dyer who mixes the color for the earth's livery, which is so very beautifully green that its simple reflection from the tropical forests of Brazil often casts its peculiar hue on the disk of our moon. When the "sun-engine" is perfected, we shall virtually boil water and spin cotton not only *by* but *with* the light of our glorious sun.

Atmospheric engines, since the days of Otto Guericke, in 1654, or, more properly, of Newcomen, the country blacksmith, who distinguished himself by his inventions between the years 1705 and 1720, have attracted some attention; not so much, however, as the utilization of the weight of the atmosphere which mantles our globe deserves.

If a vacuum be by any means produced in a closed vessel or cylinder, a force of 2187.66 pounds will immediately be made manifest on each square foot of its area, and may be advantageously made to drive a piston. A combination of two or more such vacuum cylinders and their pistons may readily be made to produce a satisfactory reciprocating motion, convertible into any other. We commend the study of atmospheric engines to inventors, as much remains to be done in order to make a perfect one. Caloric or hot-air engines are still unsatisfactory in many respects, but the results obtained are sufficient to warrant great hopes of their future efficiency.

The wind, as a cheap motive power, is really too much neglected. Along the coasts of continents where the wind is always felt, and in trade-wind and land and sea breeze countries, it might be of very great service, if not as a principal motor, (on account of its unreliability,) at any rate, as the most economical auxiliary to steam-power known.

For sailing-ships at sea it answers every purpose;

patented in 1834—was later applied to matches and then adopted by a radical faction of the Democratic Party. In 1835, when mainstream Democrats tried to disrupt a political meeting by turning off the gas lights, the group continued their debate by striking matches in the dark. The name Loco-Focos stuck, symbolizing their defiance and fiery rhetoric.

63. Loco-Foco matches(US)

The first American patent for a phosphorus friction match was granted in 1836 to Alonzo Dwight Phillips of Springfield, Massachusetts.

LOCO FOCO, & LUCIFER MATCHES.—A few Loco Foco Matches, a new article, and far superior to any in use, just received, and for sale, by H. A. NAGLEE,
No. 69, Jefferson Avenue,
nearly opposite the Farmers & Mechanics' Bank.
Detroit, June 30, 1835. w10

AMERICAN WAX LOCO-FOCO MATCHES, which on being lighted by friction, each match will burn for the space of five minutes. For sale wholesale and retail by
NATHAN B. GRAHAM,
dec 28-1w No. 38 Cedar st., corner of William st.

64. & 65. Loco-Foco matches(US)

42. Why are the Democrats in the States termed Loco-focos? There is a tradition, that at a night meeting of Democrats, the lights having somehow gone out, a cry for lucifer matches arose—"locofoco!"—"locofoco!"—have you got a locofoco?" Some of the opposition party, being struck with the sound, applied the term to the Democratic party, which it still retains, and, indeed, accepts the appellation. A Locofoco adopts as his emblem the Crowing Cock, while he gives the Raccoon, or 'Coon, to the Whig. A Western editor thus delivers himself on the subject.—"THE COCK AND THE 'COON.—The democratic papers announce almost every victory under the figure of the crowing rooster. We had doubtless some share ourselves, unintentionally, however of introducing this emblem of democracy when we wrote to Chapman to *crow*. Indeed, the cock is the appropriate emblem of democracy. Brave, vigilant, and sprightly, he is always on the watch. So soon as the sun, like a great loco-foco match, lightens up the world and scatters the darkness of night, the cock salutes him with his well-known cry of *loco fo-CO*. He is faithful and constant in his attachments, and loathes traitors, or those who forsake their friends. When St. Peter, like a Whig, failed to redeem the promise he had made, the cock reprimanded him three times. And throughout the Union the democratic cock reprimanded the Whigs for failing to redeem their promise of good times—'two dollars a-day and roast beef.' The 'coon or Whig ensign, is a nocturnal animal. He prowls about in the dark, and dreads the light. The blaze of a loco-foco match starts him off in alarm. He sneaks from henroost to henroost like a Whig from bank to bank on borrowed capital. At cock-crowing he puts off like an evil spirit to his murky den."

Matches, such as we call *Lucifers*, are in America *Loco-focos*; and a *radical* mob at New York having on some occasion plundered a store of such matches, the name was applied to the *illuminati*. It seems now to be adopted universally throughout the Union. Captain Marryat says:—

66. & 67. Loco-Foco Etymology

A more generic name for white phosphorus matches, from Lucifers to Congreves, was "Strike Anywhere Matches."

68. Strike Anywhere matches

Table: The Evolution of Early Matches: Lucifer, Congreve, Loco-Foco, Vestas, Fusees

Term	Timeframe	Chemistry/ Mechanism	Origin/ Branding Use	Notes & Clarification
Walker's "Congreves"	~1826– 1829	Potassium chlorate + antimony sulphide (no phosphorus)	Sold ~168 boxes by John Walker (UK)	Congreves or 'friction lights'; earliest friction matches; not patented
Holden's refinement	~1829	Improved friction formula (same chemistry)	Not branded; adopted by Samuel Jones	More reliable ignition; basis for Jones's commercial success
Jones's "Lucifers"	~1829 onward	Holden's formula (no phosphorus)	Branded by Samuel Jones (England)	First mass-marketed matches; term "Lucifer" coined for dramatic appeal

Jones's "Congreves" (later)	~1830s– 1840s	White phosphorus + potassium chlorate	Reused "Congreve" name for phosphorus-based matches	Semantic shift; used for export and domestic branding
Lucifer (generic)	~1830s– 1890s	White phosphorus-based strike-anywhere matches	Widely adopted across Europe	Term became generic for volatile matches, regardless of origin
Congreve (generic)	~1830s– 1870s	White phosphorus-based strike-anywhere matches	Common in Austria, Germany, England	Often interchangeable with "Lucifer" in commercial use
Loco-Foco	~1835– 1840s	White phosphorus-based	Used by U.S. political faction (Democratic radicals)	Matches used to relight candles during a disrupted meeting; name became political metaphor
Vesta	~1832 onward	Wax stem + phosphorus tip (strike-anywhere)	Patented by William Newton (UK); later Swan Vestas	Named after Roman goddess of fire; popular for personal use; led to ornate vesta cases
Fusee	~1832– 1860s+	Cardboard stalk soaked in nitre + phosphorus tip	Outdoor use; cigar/pipeline lighting; UK and Europe	Wind-resistant; slow-burning; sold in tearable strips; precursor to book matches

It is essential to reiterate between the earliest *Lucifer matches* sold by Samuel Jones in 1829 and the later iterations that followed. Jones's initial product was based on John Walker's friction match formula, which relied on a blend of potassium chlorate and antimony sulphide. These

Clockwise from the top left: 69. & 70. Vintage Antique Victorina Era R. Bell & Co. Wind Vestas Bromley-by-Bow, London Matches Box; 71. Swan Vestas by Bryant & May, London; 72. Paraffin Lucifers; 73. Bryant & May - Wax vestas

74. Two boxes of J. Hynam's perfumed fusee matches for lighting cigars; 75. Bryant & May fusee matches

matches ignited through friction alone—typically struck against sandpaper or glasspaper—but they emitted a harsh, acrid odour and were prone to unreliable ignition. Crucially, they did not contain white phosphorus.

While Sauria's phosphorus matches were more effective, they were also far more hazardous. White phosphorus is highly toxic and volatile, capable of spontaneous ignition in air and responsible for severe health issues among match factory workers, including the infamous "phossy jaw." Despite these dangers, the improved performance made white phosphorus matches commercially dominant for much of the 19th century.

Moreover, phosphorus tips not only gave off fumes, they were deadly if swallowed. Ingesting match heads was a common method of committing suicide and small children were often accidentally poisoned by swallowing match heads. Lucifers (with phosphorus) were also highly combustible; they were kept in match safes made of metal and hung on the wall to kept Lucifers dry, safe, and out of reach of children's fingers.
To clarify the progression:

- Original Jones Lucifers (1829):
  ~ Based on Walker's friction formula
  ~ Contained potassium chlorate and antimony sulphide
  ~ No white phosphorus
  ~ Unstable ignition and foul odour

- Later Lucifers (1830s onward):
  ~ Incorporated white phosphorus following Sauria's innovation
  ~ Improved ignition due to phosphorus and reduced odour
  ~ Widely adopted across Europe
  ~ Increased toxicity and fire risk

This transition marks a critical moment in match history—where chemical refinement outpaced safety, and the pursuit of convenience introduced new industrial hazards.
A summary is given in the table below.

Table: Comparison of Lucifers and Strike-Anywhere Matches

Match Type	Composition	Ignition Method	Safety and Issues	Time Period
Early Lucifers (S. Jones)	Potassium chlorate, antimony sulphide	Friction on rough surface like glasspaper or sandpaper	Unreliable ignition, foul odour, risk of explosion	~1829– 1830s
Later Lucifers (S. Jones + C. Sauria)	White phosphorus, potassium chlorate	Friction on any surface	Toxic fumes, *phossy jaw*, fire hazard	1830s– late 1800s
Strike-Anywhere Matches (C. Sauria + others)	White phosphorus, sulphur, glass powder	Friction on any rough surface	Improved reliability, *phossy jaw*, still toxic until red phosphorus replaced white	Mid– late 1800s onward

Refinements and Innovations (1830– 1890)

From 1830 to 1890, the basic composition of non-safety, strike anywhere matches remained largely the same, though several refinements improved usability and safety:
1843: William Ashgard substituted sulphur with beeswax, reducing acrid fumes.

Wax (usually natural like beeswax) was later substituted with petroleum-derived paraffin, also called “impregnated matches”, initially used in Vestas (1832) but then extended to friction matches. These matches featured wooden splints or tapers that were dipped in wax or paraffin, making them water-resistant and windproof, slow-burning, ideal for lighting cigars, lamps, or stoves, flexible and durable, less prone to snapping, and helped the flame travel smoothly down the stick, creating a longer, steadier burn than standard dry wood matches.

They were often paired with phosphorus-based heads (usually red or white phosphorus) and oxidizers like potassium chlorate.

Wax/paraffin-impregnated matches were often marketed as such in tropical markets as they were humidity- and damp-resistant.

1862: Charles W. Smith introduced paraffin, giving rise to parlour matches—cleaner-burning and more elegant.

1870: Manufacturers began treating splint ends with fire-retardant chemicals like alum and sodium silicate, creating the so-called drunkard’s match, designed to prevent users from burning their fingers.

Production methods evolved: early matches were cut from blocks of wood with splints still attached at the base. Later designs resembled combs, allowing individual splints to be snapped off as needed.

The Noiseless Match: János Irinyi’s Breakthrough

In 1836, Hungarian chemistry student János Irinyi made a critical advancement. Inspired by a failed classroom experiment by his professor Meissner, Irinyi replaced potassium chlorate with lead dioxide in the match head, dramatically reducing noise and volatility. He liquefied white phosphorus in warm water, granulated it, and mixed it with lead and gum arabic to form a paste. After dipping pine sticks into the mixture and drying them, he found they ignited evenly and quietly—thus inventing the noiseless match.

76. Janos Irinyi; 77. Janos Irinyi’s silent match

The Inventor of Phosphorus Matches.

Romer, Preschel, and Irinyi are variously named as inventors of phosphorus matches. From the testimony of a still living college friend, it appears that the real inventor is the Hungarian, Janos Irinyi. It was in 1835 when the latter, then 19 years old and a student at the Polytechnic School in Vienna, attended Professor Meissner’s lectures on chemistry. He became greatly impressed by a demonstration of the reaction produced on rubbing together peroxide of lead and sulphur. It struck him straightway that the reaction may be greatly intensified when substituting phosphorus for sulphur. Irinyi was not to be seen at the college for the next few days. His friend wishing to see him called at his rooms, but found the door locked, and on giving his name, received the unmistakable answer: “Geh’ weg, Schwab,’ ich mach’ eine Erfindung.” On joining his friends, Irinyi had his pockets full of matches which he struck on the walls, all of them taking fire. He prepared them by melting phosphorus in a concentrated solution of glue, and shaking until the mass became cold and all the phosphorus assumed a finely divided state. This emulsion was mixed with brown peroxide of lead, and sticks previously dipped in molten sulphur were immersed in the mixture. He sold his invention to a merchant named Romer for about 700*l*. Irinyi is said to be still living in the south of Hungary.—E. Jensch, Zeits. angew. Chem.

78. Janos Irinyi article

Irinyi sold the rights to István Rómer, a Hungarian pharmacist in Vienna, for 60 forints (roughly 22.5 ounces of silver), though some sources suggest the price may have been higher. Rómer profited greatly, while Irinyi continued his scientific work, publishing chemistry texts, founding match factories, and later playing a role in the Hungarian Revolution of 1848.

Table: Evolution of matches since the invention of the friction match

Year	Event/ Innovation	Inventor/ Contributor	Details
1826	First successful friction match	John Walker (England)	Accidental ignition; tipped with antimony sulphide, potassium chlorate, and gum. Sold as Congreves.
1827- 1829	Commercial sales begin	John Walker	Sold ~168 boxes; included sandpaper for striking. Banned in France & Germany.
1829	Improved version of Walker's match	Sir Isaac Holden (Scotland)	Demonstrated to students; idea passed to Samuel Jones. Not patented.
1830	White phosphorus match invented	Charles Sauria (France)	Replaced antimony sulphide with white phosphorus. Stored in airtight boxes.
1836	U.S. patent for phosphorus match	Alonzo Dwight Phillips (USA)	First American patent for phosphorus friction match.
1836	Noiseless match invented	János Irinyi (Hungary)	Used lead dioxide instead of potassium chlorate. Sold to István Rómer.
1843	Sulphur replaced with beeswax	William Ashgard	Reduced pungent fumes.
1862	Beeswax replaced with paraffin	Charles W. Smith	Led to parlour matches.
1870	Fireproofing of splints	–	Used alum and sodium silicate to prevent finger burns *(drunkard's match)*.
1830- 1890	Manufacturing improvements	Various	Shift from block-cut splints to comb-style matchsticks.

Key Terms & Cultural Notes

- Congreves: Walker's name for his matches, honouring Sir William Congreve.
- Lucifers: Matches commercialized by Samuel Jones; known for explosive ignition and strong fumes.
- Loco Foco: U.S. name for phosphorus matches.
- Drunkard's Match: Fireproofed splints to prevent burns.
- Lucifer (slang): Term persisted into WWI songs and still used in Dutch/Flemish today.

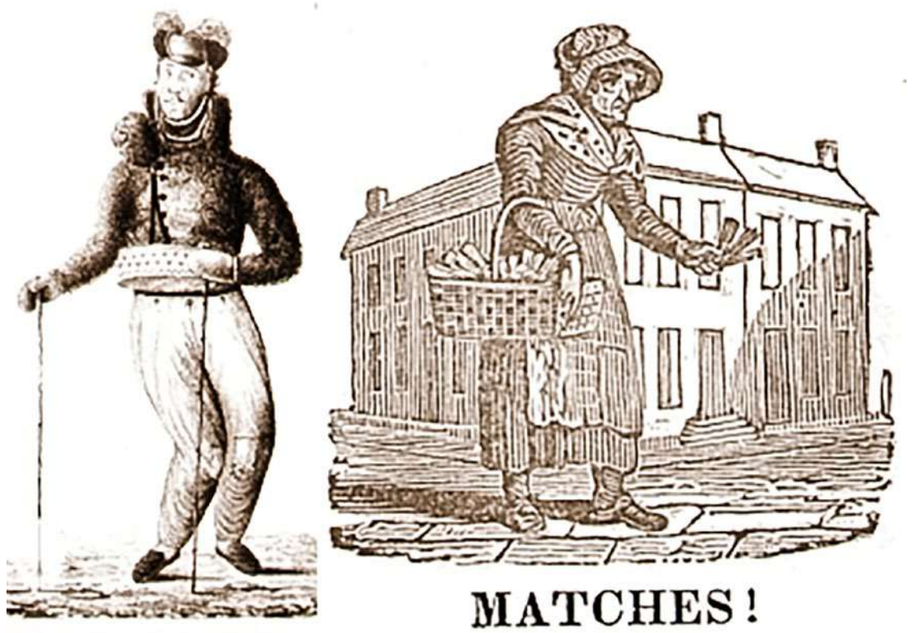
Sidebar: Early Chinese Fire Sticks vs. European Friction Matches

Feature	Chinese Sulphur Fire Sticks (6th–13th c.)	European Friction Matches (19th c.)
Ignition Method	Required external flame	Ignited by striking surface
Core Material	Pinewood coated in sulphur	Wood or cardboard with phosphorus
Self-Igniting	No	Yes
Earliest Use	577 A.D. (Northern Qi court)	1826 (John Walker, England)
Cultural Context	Alchemical, poetic, domestic	Industrial, commercial
Names Used	Fire inch-stick, light-bringing slave	Lucifer matches, safety matches
Market Presence	Hangzhou markets (1270 A.D.)	Widespread in Europe by 1850s

Making and Selling the Friction Match in the Early 1800s

The workers in the making of, and selling matches were very poor people. In the 19th century it was seen as an occupation for the disabled or the young, and others at the bottom of the heap. Match-selling overlapped with begging. The harshest commentators in Victorian London thought carrying a few splinters of wood with you was not a serious effort to earn pennies, just an attempt to avoid arrest for being a vagabond or beggar. In the social unrest of 1830s England, a more sympathetic writer described watchmen: "…who every hour, to prove their vigilance, sent in some poor wretch, beggar or match-seller, or rambling child, under the denomination of suspicious persons…" (Mary Mitford, Our Village, 1832). Many of the old brimstone match sellers made their own stock. Some moved on to selling modern "Lucifer" matches, but as these were made in factories, the trade changed.

79. A boy in Bristol, England, and a young woman in London with a ragged skirt.



80. Portrait of a real-life match seller in Trondheim, Norway, with a tray hung round his neck. Woman with basket in New York.

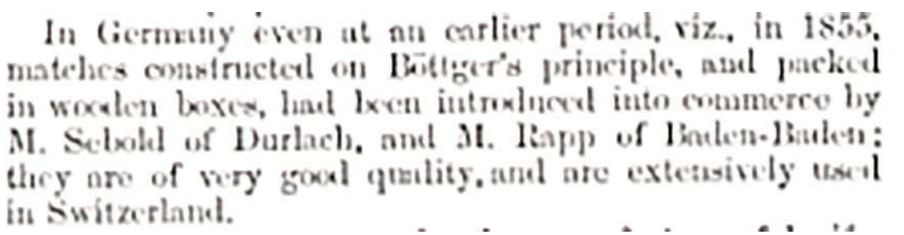
3

The Safety Match

Origins

81. Rudolf Christian Böttger, 1806-1881

While the invention of the safety match is often attributed to the Swedes, the contribution of Rudolf Christian Böttger (1806–1881), the German spark behind the invention of the safety match is often overlooked. In 1848, Böttger developed a match design that used red phosphorus—a far safer alternative to the toxic white/yellow phosphorus used in earlier matches. His key innovation was to move the phosphorus from the match head to the striking surface, separating the reactive components. This dramatically reduced the risk of accidental ignition and poisoning. Böttger's matches also included manganese dioxide and glue on the striking surface, further stabilizing the reaction.



In Germany even at an earlier period, viz., in 1855, matches constructed on Böttger's principle, and packed in wooden boxes, had been introduced into commerce by M. Sebold of Durlach, and M. Rapp of Baden-Baden; they are of very good quality, and are extensively used in Switzerland.

82. Böttger's safety match used in Switzerland

Although Böttger's version wasn't widely commercialized, it laid the chemical foundation for the Swedish safety match. Here too, the development of the safety match was not the work of a single mind, but the culmination of contributions from two Swedish scientists.

Jöns Jacob Berzelius, renowned for formalizing the modern system of chemical notation and atomic weights, was among the first to identify red phosphorus as a viable alternative to yellow. He recognized its relative harmlessness and potential for match production, but never succeeded in adapting it for practical, daily use.

TRAITÉ

DE CHIMIE

PAR J. J. BERZELIUS.

TRADUIT

PAR ME. ESSLINGER,

SUR DES MANUSCRITS INÉDITS DE L'AUTEUR,

ET SUR LA DERNIÈRE ÉDITION ALLEMANDE.

Ire PARTIE. — *CHIMIE MINÉRALE.*

Tome Troisième.

PARIS.

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M. DCCC XXXI.

83. Jöns Jacob Berzelius, 1779-1848; 84. An early work (1831) by Jöns Jacob Berzelius

The breakthrough came from his student and compatriot, Gustaf Erik Pasch—a polymath whose inventive energies spanned improved banknote paper, cement formulations for the Göta Canal in Sweden, vinegar production, silkworm cultivation, and even bassoon performance. It was Pasch who solved the dual problem of flammability and toxicity in phosphorus matches.

85. Gustav Eric Pasch, 1788-1862

While the manufacture of white phosphorus-based matches—particularly the improved Lucifer and "strike-anywhere" varieties—continued to expand rapidly throughout the 19th century, a safer alternative had already been discovered in 1844 by the Swedish professor Gustaf Erik Pasch. His invention, the safety match, directly addressed the grave dangers posed by earlier phosphorus compositions. Unlike the volatile and

toxic white (or yellow) phosphorus used in conventional matches, Pasch's design employed red phosphorus, a chemically stable and far less hazardous allotrope.

The Technology

How did the safety match work?

Red Phosphorus Needs Conversion

- Red phosphorus is stable and non-flammable under normal conditions.
- When struck, frictional heat (~260°C) converts a tiny amount of red phosphorus into white phosphorus, which is highly flammable and ignites instantly in air.

Localized Reaction

- The conversion and ignition happen in a microscopic zone—only where the match head contacts the striking surface.
- The match head contains oxidizers (like potassium chlorate) and fuels (antimony sulphide, sulphur), which react with the ignited phosphorus.
- The box itself lacks these reactive ingredients, so it doesn't sustain combustion.

Surface Composition

- The striking strip is a thin layer of red phosphorus mixed with glass powder and glue, applied to cardboard.
- This layer is designed to resist ignition unless activated by the match head's chemistry.
- The cardboard substrate has a much higher ignition point (~400–470°C), well above the temperature reached during a strike.

Safety by Separation

- The genius of the Swedish safety match lies in separating the reactive components: oxidizer and fuel in the match head and red phosphorus on the box.
- Only when combined through friction do they produce flame—making accidental ignition nearly impossible.

So yes, the red phosphorus is on the box—but it's like a locked door that only the match head's chemistry can open.

Pasch was granted a patent for his safety match in 1844, valid until 1852. Production began at S.J. Bagge's factory in Stockholm, but the venture struggled. Red phosphorus was difficult and costly to produce at the time, and the quality was inconsistent. The striking surfaces degraded quickly, rendering the matches unreliable. Commercial success eluded Pasch, and his patent expired without yielding large-scale adoption. He died in 1862, impoverished and largely unrecognized for his contribution.

86. S.J Bagge's factory in Stockholm; 87. Patented phosphorus-free striking matches, manufactured at J.S. Bagges & C:o Chemical Factory in Stockholm. Phosphorus-free striking matches, in a box. Instructions. Hold the match about 1/4 inch from the head and quickly strike it against the striking surface, preferably on the edge, as it is less likely to break than if struck with the broad side facing forward." According to patent 1845-10-30 for Gustaf Erik Pasch on striking matches with a composition of potassium chlorate, plate with red phosphorus and antimony sulphide. Box dimensions: length: 84 mm, width: 33 mm, height: 20 mm.

Factory Production

It was only later, through the efforts of Carl and Johan Lundström, that Pasch's invention reached its full potential. The Lundström brothers refined the original design and established the Jönköping match factory, which became a global leader in safety match production. Their improvements—both technical and logistical—enabled mass manufacturing and international distribution. By the late 19th century, safety matches had become a universal household item, indispensable for lighting lamps, stoves, and tobacco, and accessible across class and geography.

88. Carl Frans Lundström, 1823-1917; 89. Johan Edvard Lundström, 1815-1888

For much of the 19th century, match production remained a labour-intensive craft. The matchsticks were made from aspen wood, prized for its straight grain and ease of splitting. Remarkably, a single log of aspen could yield up to 370,000 individual matches. Yet the process was arduous: each stick was made by hand, a physically demanding and time-consuming task carried out by workers in dimly lit workshops.

Once shaped, the matchsticks were dipped in molten sulphur, a step that allowed the flame to transfer easily from the igniting head to the wooden shaft. However, this process released a pungent, acrid odour when burned. Seeking to improve both the sensory experience and combustion quality, Johan Edvard Lundström introduced a refinement: replacing sulphur with wax or paraffin, which burned cleaner and more evenly.

Table: Comparison of Wax-Coated vs. Sulphur-Coated Matches

Feature	Wax-Coated Matches (e.g. Vestas)	Sulphur-Coated Matches
Coating Material	Paraffin wax	Sulphur
Burn Characteristics	Clean, gentle flame with less odour	Stronger flame, noticeable sulphur smell
Moisture Resistance	High – wax repels moisture	Low – sulphur is brittle and moisture-sensitive
Flexibility of Coating	Smooth, thin, and flexible	Brittle when cooled
Common Use	Personal-use matches (vestas, pocket matches)	Household matches, safety matches
Historical Period	Popular from mid-19th century onward	Used from early match development into 20th century
Advertising Strategy	Marketed for portability and elegance	Sometimes advertised as "Strong Sulphur Matches"
Export Appeal	Favoured in tropical climates for moisture resistance	Familiar in colonial markets for strong ignition
Transition Over Time	Wax replaced sulphur in many personal-use matches	Sulphur persisted in some brands into mid-20th century

After this initial coating, the sticks were dipped into the match head compound—a mixture of stibnite (antimony sulphide), potassium chlorate, gum, and starch—then left to dry. The finished matches were packed into small containers, often capsules or tubes made of brass or wood shavings, each assembled by hand.

With the advent of safety matches, the Lundström brothers also revolutionized packaging. They introduced the modern matchbox design still in use today: a two-part box consisting of an

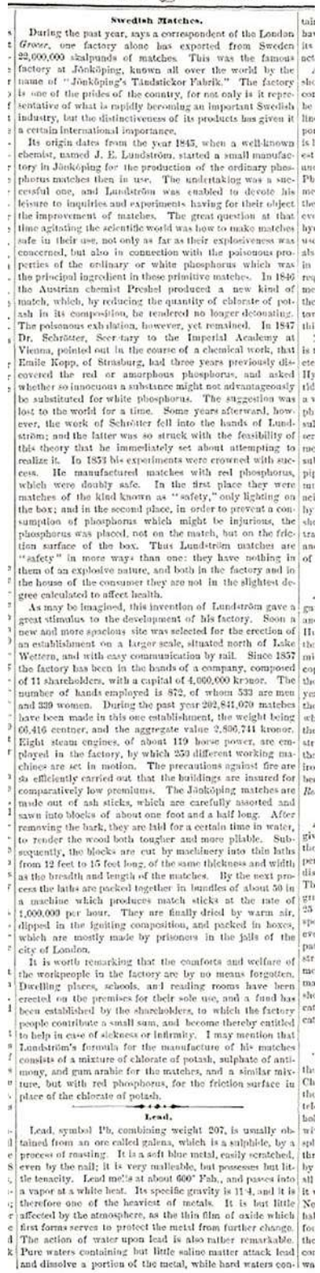
The chief objection made to the amorphous phosphorus is the greater cost which it entails; for, as it is much less inflammable than ordinary phosphorus, a larger proportion of it is required to form the igniting composition; it is found that 1 lb. of ordinary phosphorus will go as far as 3 lbs. of the amorphous variety. This objection has peculiar force in this country, where there is a strong prejudice among consumers in favour of matches heavily tipped, known in the trade and in popular phrase as the "hung dip," or "big head." English manufacturers all fear to resort to the simple expedient of reducing the size of the head (which, as shown in the beautifully made Swedish matches, now largely imported, is quite compatible with a perfect match), lest, by running counter to popular prejudice, they should incur loss. On the continent there is another objection to the use of amorphous phosphorus, arising from an exaggerated fear of the use of chlorate of potash, on account of the tendency of mixtures made with it, to explode during the process of manufacture; and it does not appear possible to make an easily igniting match with amorphous phosphorus without the use of chlorate of potash. There may, perhaps, be some danger in the use of chlorate of potash, but, nevertheless, it is in daily use in England on a very large scale.

90. JÖNKÖPING LUCIFER-MATCH Co. *Jönköping.*—Safety matches, &c.

The exhibitors manufacture all kinds of lucifer-matches for export to England and all parts of the world, warranted to stand any climate, and not to fail, known under the mark, *Jönköpings Tändstickor.* They are the largest importers to England of the celebrated match-boxes called "Swedish slides:" and the inventors of the renowned *safety matches*, which ignite only when rubbed on a surface specially prepared for the purpose. They obtained the *Silver Medal at the Paris Exhibition*, 1855.

90. The cost factor as the chief limitations to red phosphorous matches, 1865 (top); 91. Jönköping Match Co., Sweden, International Exhibition of 1862 (bottom)

THE "Swedish safety matches" were made in many German shops from Bottger's recipes about 1850, but they could not compete with the phosphorus matches. People had become accustomed to the last; they were easily lighted, and if the sandpaper was lost, fire could be got by drawing them on the wall or the trousers; while with the new matches one had always to carry his rough card phosphorized with amorphous phosphorus, without which his match was useless. The great value of the German discovery, however, became known abroad about 1860, when the Swedish engineer, Lundstrom, founded the famous factory in Jonkoping. The material of the match-head and the friction surface remained as before, but the Swedes devised a practicable method of boxing, putting the matches in the little convenient slide-boxes, and the chief hindrance to the spread of the invention was removed. The "Swedish matches," as they are now generally called, do not light of themselves so easily as the phosphorus matches, and are therefore safer; and they are, further, unpoisonous. It is, therefore, no wonder that the "Swedes" have enjoyed a triumphal march through the world, have found a home in Europe and America, and have even made their way into dark Africa. During its most prosperous period, the Jonkoping factory produced annually four million marks' worth of matches. Rivals soon rose to it in different parts of the world, and several shops in Germany are sending out excellent Bottger safety matches in Swedish dress. They have so far naturalized themselves as to make the condition of the phosphorus match trade a hard one, and in some states the prohibition of the use of the poisonous white phosphorous in matches has been contemplated.



Scientific American.

Swedish Matches.

During the past year, says a correspondent of the London *Grocer*, one factory alone has exported from Sweden 22,000,000 skalpunds of matches. This was the famous factory at Jönköping, known all over the world by the name of "Jönköping's Tändsticker Fabrik." The factory is one of the prides of the country, for not only is it representative of what is rapidly becoming an important Swedish industry, but the distinctiveness of its products has given it a certain international importance.

Its origin dates from the year 1845, when a well-known chemist, named J. E. Lundström, started a small manufactory in Jönköping for the production of the ordinary phosphorus matches then in use. The undertaking was a successful one, and Lundström was enabled to devote his leisure to inquiries and experiments having for their object the improvement of matches. The great question at that time agitating the scientific world was how to make matches safe in their use, not only as far as their explosiveness was concerned, but also in connection with the poisonous properties of the ordinary or white phosphorus which was the principal ingredient in these primitive matches. In 1846 the Austrian chemist Preshel produced a new kind of match, which, by reducing the quantity of chlorate of potash in its composition, he rendered no longer detonating. The poisonous exhalation, however, yet remained. In 1847 Dr. Schrötter, Secretary to the Imperial Academy at Vienna, pointed out in the course of a chemical work, that Emile Kopp, of Strasburg, had three years previously discovered the real or amorphous phosphorus, and asked whether so innocuous a substance might not advantageously be substituted for white phosphorus. The suggestion was lost to the world for a time. Some years afterward, however, the work of Schrötter fell into the hands of Lundström; and the latter was so struck with the feasibility of this theory that he immediately set about attempting to realize it. In 1853 his experiments were crowned with success. He manufactured matches with red phosphorus, which were doubly safe. In the first place they were matches of the kind known as "safety," only lighting on the box; and in the second place, in order to prevent a consumption of phosphorus which might be injurious, the phosphorus was placed, not on the match, but on the friction surface of the box. Thus Lundström matches are "safety" in more ways than one: they have nothing in them of an explosive nature, and both in the factory and in the house of the consumer they are not in the slightest degree calculated to affect health.

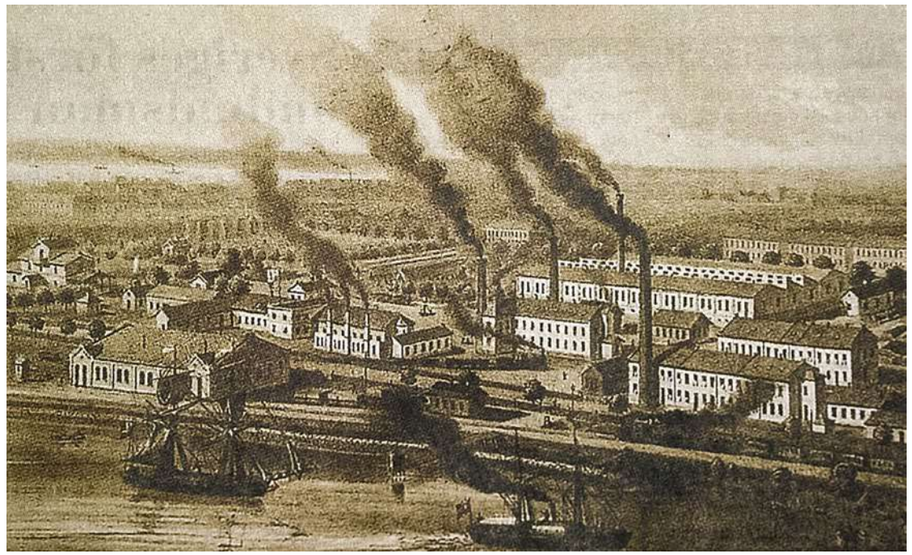
As may be imagined, this invention of Lundström gave a great stimulus to the development of his factory. Soon a new and more spacious site was selected for the erection of an establishment on a larger scale, situated north of Lake Wettern, and with easy communication by rail. Since 1857 the factory has been in the hands of a company, composed of 11 shareholders, with a capital of 4,000,000 kronor. The number of hands employed is 872, of whom 533 are men and 339 women. During the past year 202,841,020 matches have been made in this one establishment, the weight being 66,416 centner, and the aggregate value 2,896,744 kronor. Eight steam engines, of about 119 horse power, are employed in the factory, by which 250 different working machines are set in motion. The precautions against fire are so efficiently carried out that the buildings are insured for comparatively low premiums. The Jönköping matches are made out of ash sticks, which are carefully assorted and sawn into blocks of about one foot and a half long. After removing the bark, they are laid for a certain time in water, to render the wood both tougher and more pliable. Subsequently, the blocks are cut by machinery into thin laths from 12 feet to 15 feet long, of the same thickness and width as the breadth and length of the matches. By the next process the laths are packed together in bundles of about 50 in a machine which produces match sticks at the rate of 1,000,000 per hour. They are finally dried by warm air, dipped in the igniting composition, and packed in boxes, which are mostly made by prisoners in the jails of the city of London.

It is worth remarking that the comforts and welfare of the workpeople in the factory are by no means forgotten. Dwelling places, schools, and reading rooms have been erected on the premises for their sole use, and a fund has been established by the shareholders, to which the factory people contribute a small sum, and become thereby entitled to help in case of sickness or infirmity. I may mention that Lundström's formula for the manufacture of his matches consists of a mixture of chlorate of potash, sulphate of antimony, and gum arabic for the matches, and a similar mixture, but with red phosphorus, for the friction surface in place of the chlorate of potash.

Lead.

Lead, symbol Pb, combining weight 207, is usually obtained from an ore called galena, which is a sulphide, by a process of roasting. It is a soft blue metal, easily scratched, even by the nail; it is very malleable, but possesses but little tenacity. Lead melts at about 600° Fah., and passes into a vapor at a white heat. Its specific gravity is 11·4, and it is therefore one of the heaviest of metals. It is but little affected by the atmosphere, as the thin film of oxide which first forms serves to protect the metal from further change. The action of water upon lead is also rather remarkable. Pure waters containing but little saline matter attack lead and dissolve a portion of the metal, while hard waters con-

92. & 93. The cost factor as the chief limitations to red phosphorous matches, 1865



94. Jönköpings safety match factory, 1872 (top);
95. Matchbox from Jönköpings Tandsticksfabrik match factory (bottom)

Its Progress since 1855.—A survey of the progress which has been made in the preparation of lucifer matches, since 1855, shows, in the first place, that the production of matches with ordinary phosphorus has immensely increased. In proof of this, it may be observed, firstly, that, in countries where this branch of industry had already attained a high state of development, as in Germany, and more especially in Austria, new factories are continually springing up; while those which previously existed have been considerably enlarged; and, secondly, that in several states where this branch of manufacture did not previously exist, as in Belgium and Russia, factories have been established on a considerable scale.

Amorphous or Red Phosphorus Matches.—The discovery of amorphous phosphorus seemed to furnish an easy means of obviating the inconveniences attending the use and preparation of the ordinary lucifer matches; and even so far back as the year 1850, attempts were made by several manufacturers to produce matches tipped with a composition containing amorphous instead of ordinary phosphorus. Lucifers of this kind were sent to the Exhibition of 1851 by Messrs. Dixon, Son, and Co. of Manchester; but they never found favour with the public, and have of late years disappeared from the market. The principal objections to them appear to be, that they are not sufficiently inflammable, and that they burn with a sputtering flame.

96. &97. Safety matches struggle to replace Lucifers, 1851

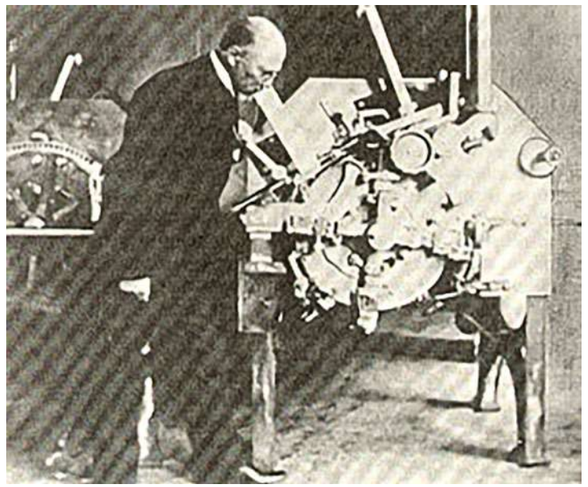
inner tray and an outer sleeve. The striking surface—coated with red phosphorus—was affixed to the sides of the outer sleeve, ensuring that ignition could only occur through deliberate friction. Even these boxes were handcrafted, reflecting the artisanal nature of early match production.

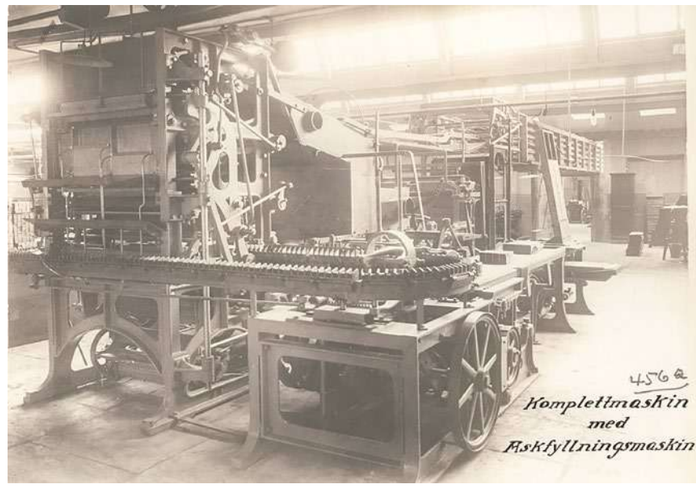
Despite the ingenuity of Pasch's safety match design, it wasn't until 1868 that the product became commercially viable. By then, the price of red phosphorus had declined, and mechanization had begun to reshape the industry. The 1860s and 1870s saw rapid development, transforming match-making from a cottage craft into a full-fledged industrial enterprise. In Sweden alone, there were as many as 155 match factories, each contributing to a growing national export economy.

98. Alexander Lagerman, 1836-1904

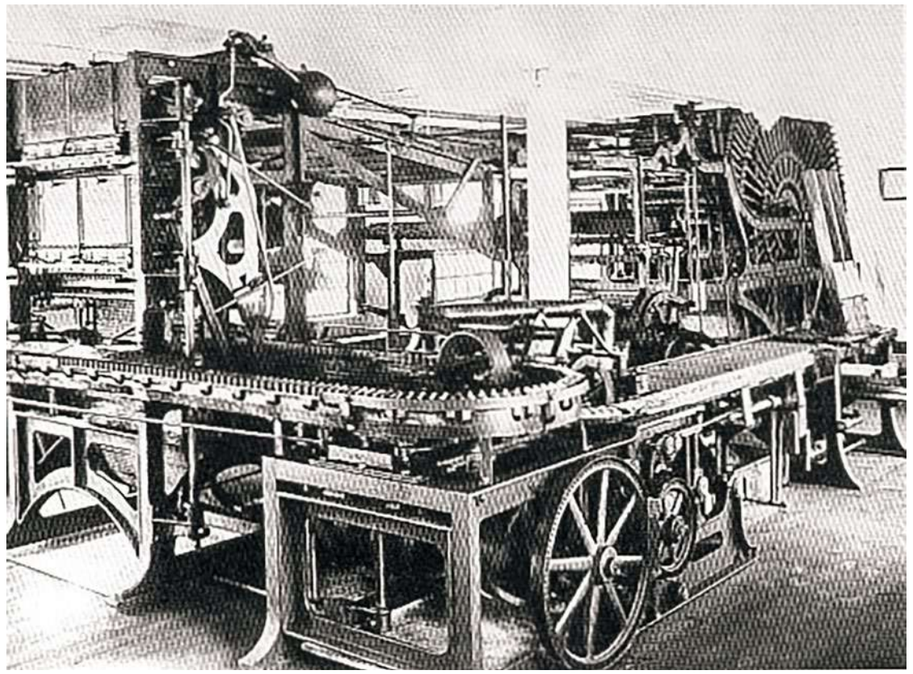
The Machines

At the forefront of this transformation was Alexander Lagerman, a mechanical innovator working at Jönköpings Tändsticksfabrik. In 1892, Lagerman introduced his complete match-making machine, a breakthrough that consolidated five separate production steps into a





99. Alexander Lagerman's operating his machine; 100. Alexander Lagerman's complete machine



101. Alexander Lagerman's complete machine

single automated process. The machine accepted pre-treated matchstick blanks at one end and produced fully finished matches at the other—dipping them in sulphur, paraffin, and the match head compound, then splitting, drying, and packing them into boxes. It was a marvel of industrial engineering.

Lagerman's invention was kept secret for twenty years before it was patented, underscoring its strategic importance. By the time the patent was filed, the machine was still considered cutting-edge. Thanks to Lagerman's designs, the Jönköping factory gained a significant lead over global competitors. With a series of pioneering machines, Jönköpings Tändsticksfabrik was poised to export Swedish safety matches worldwide.

The impact was immediate and dramatic. When the Jönköping factory first opened, it produced

approximately 4,000 boxes per year. By 1896, just four years after Lagerman's machine was introduced, annual production had soared to over seven million boxes. Swedish match manufacturing had entered its golden age—an era defined by technical ingenuity, global reach, and the quiet triumph of safety over hazard.

Sidebar: Match Compositions & Packaging Styles

Era	Compositions	Packaging Style	Striking Surface
1820s	Chlorate + antimony	Brass tubes, wood	None or improvised
1830s	White phosphorus	Paper wraps, tins	Any rough surface
1840s	Red phosphorus (Pasch)	Handmade boxes	External pad
1860s	Refined red phosphorus	Inner tray + outer sleeve	Box side (red phosphorus)
1890s	Standardized safety mix	Mass-produced matchboxes	Mechanized application

White Phosphorus Usage by Swedish Matches Manufacturers

Swedish match factories including Jönköping Tändsticksfabrik continued to produce white phosphorus matches until 1910.

In 1906, the Berne Convention was signed by several countries, including Sweden, to ban the use of white phosphorus in match production. This marked a turning point, though enforcement took time. The Jönköping factory—and the broader Swedish match industry—completely ceased production of white phosphorus matches by the early 1910s, following mounting health concerns and international pressure.

Moreover, even into the early 20th century, Swedish factories—including Jönköping—faced challenges with contaminated red phosphorus, which sometimes contained traces of white

phosphorus and led to spontaneous fires—indicating that while direct use had ended, residual risks lingered.

So, while the formal production of white phosphorus matches ended in the 1910s, the legacy of contamination and industrial hazards persisted into the 1920s.

The Role of Sulphur in Matches

Apart from phosphorous, it is also interesting and important to highlight the role of sulphur in the evolution of matches.

Sulphur was a critical ignition aid in early match formulations, especially before the refinement of phosphorus chemistry.

1820s–1830s: Friction Lights and Sulphur as Fuel

John Walker's 1827 invention used a mix of antimony sulphide, potassium chlorate, and binders. Sulphur was often added to improve flammability and consistency.

Sulphur's low ignition temperature made it ideal for coating splints or acting as a base layer beneath more volatile compounds.

It was also used in "instantaneous light-boxes", where matches were dipped into sulphuric acid to ignite.

Mid–Late 19th Century: Transition and Decline

As white phosphorus became dominant (despite its toxicity), sulphur's role shifted to a secondary fuel or was replaced entirely.

In safety matches (developed by Gustaf Erik Pasch in 1844), sulphur was largely phased out in favour of red phosphorus and potassium chlorate, which were separated between the match head and striking surface.

Sulphur's presence was often invisible to the consumer, but its chemical behaviour shaped the tactile experience of early match use—smell, ignition speed, and even the colour of the flame.

Table: Role of Sulphur in Matches

Period	Role of Sulphur	Match Type
1820s–1830s	Primary fuel in match head	Friction Lights, early Lucifers
1840s–1870s	Combustion aid, sometimes in splint	Early phosphorus matches, later Lucifers
1880s onward	Phased out or replaced	Safety matches

Some safety matches would intentionally contain sulphur as it meant reliable ignition—a match that would catch quickly and burn hot. Advertising "Sulphur Matches" reassured users that these weren't weak or experimental; they were tried-and-true fire-makers. In tropical and humid climates (like India or Southeast Asia), sulphur-tipped matches were often more effective at lighting in damp conditions. Exporters—especially Swedish and Japanese firms—tailored their branding to local expectations, where sulphur was seen as a functional advantage, not a flaw.

102. &103. Friction matches with sulphur

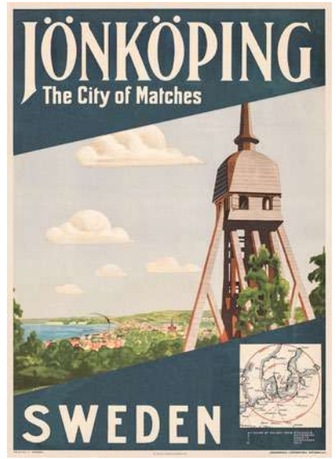
104. Congreve matches without sulphur; Walker's match was sold by Samuel Jones, an English man, under the name of "Lucifers." Further the match with pasted sandpaper on the side of matchbox was newly produced and named "Congreves" for sale. The appearance of Congreves looks almost same with one we have currently, but it was horrible because ignition ability was very poor, fires sprang all over once it started to burn, and the smell of sulphur dioxide was intolerable.

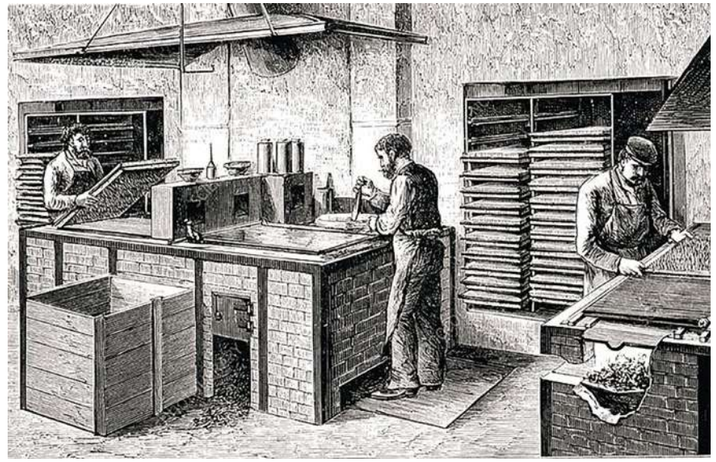
Manufacture of Lucifer-Matches without Sulphur. By R. BÖTTGER.—The author recommends the following composition for the preparation of lucifer matches:—4 parts phosphorus, 10 parts nitre, 6 parts gelatine, 5 parts red lead or ochre, and 2 parts smalt. The gelatine is soaked in a small quantity of water for 24 hours, the jelly conveyed into a mortar and warmed until it has melted, when the other ingredients are introduced, constantly applying heat, but not above 167°, until the whole forms a perfectly homogeneous mass, which cannot be drawn out into threads. To make lucifer-matches with this mass, which continue to burn after ignition, without any coating of sulphur, the extremities of the matches are held for a few seconds against a plate of iron, in order to carbonize them superficially; they are then dipped into very hot melted wax, the excess shaken off with a jerk of the arm, and dipped into the above composition.—*Ibid, from Phys. und Chem. Vorlesung.*

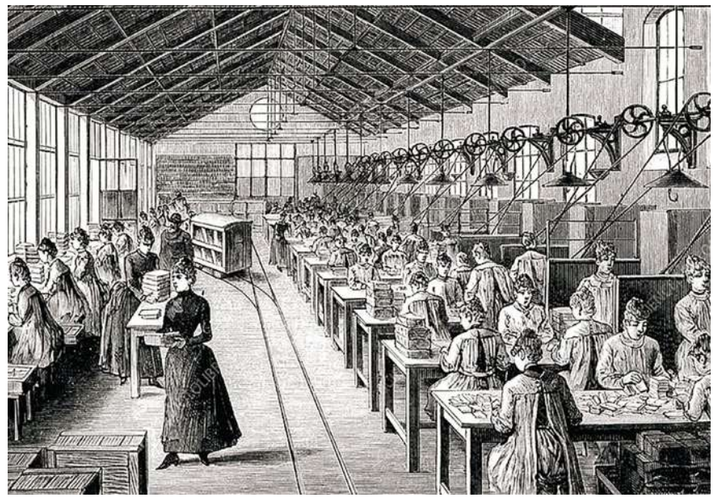
105. Rudolf Christian Böttger on Lucifer matches without sulphur, 1841; 106. 20th century safety matches by WIMCO (India) advertised as "Sulphur Matches"

The Rise of Competing Brands

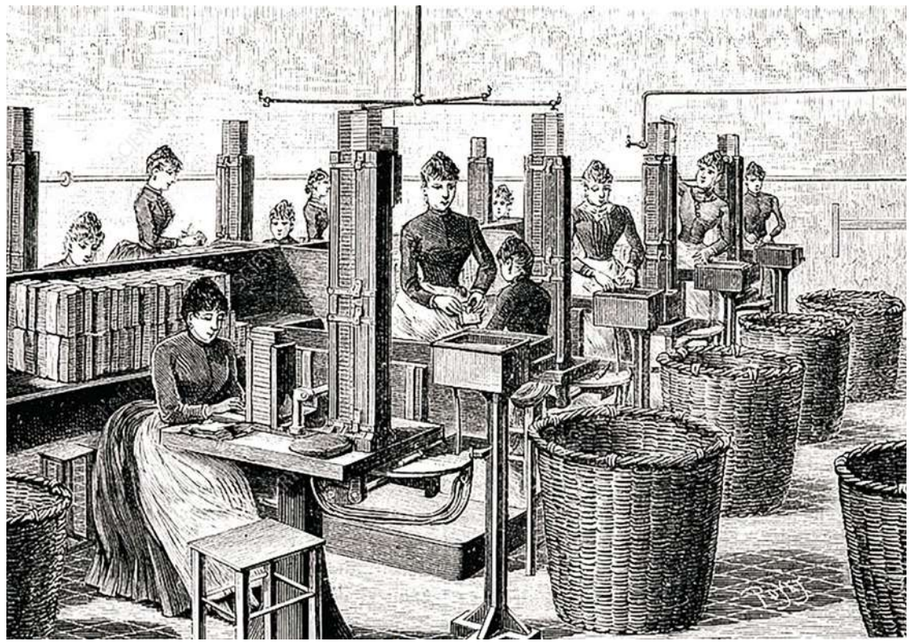
Following the introduction of the safety match by Johan Edvard Lundström in the 1850s, Jönköping rapidly emerged as the epicentre of global match production. Swedish matches—especially those manufactured in Jönköping—were celebrated for their clean-burning, non-







Clockwise from the top left:
107 . Jönköping, the City of Matches, Poster 1928; 108. Illustration of women working in a 19th Century match factory using red phosphorus. Artwork from the 14th volume (second period of 1894) of the French popular science weekly La Science Illustree; 109. 19th century match factory illustrations



110. & 111. 19th century match factory illustration

toxic, and reliable ignition, setting a new international standard. Their reputation was so strong that the term Swedish match became synonymous with quality across Europe and beyond.

This prestige created a powerful branding halo around anything labelled “Swedish matches”, particularly those bearing the name “Jönköping.” As global demand surged, opportunism followed. A wave of competition unfolded.

Domestic Brands

Within Sweden, several smaller factories began producing matches that mimicked the packaging and naming conventions of Lundström’s Jönköping brand. Names like “Jönköpings Östra” (Eastern Jönköping) and “Westervik Tändsticksfabrik” were deliberately chosen to suggest geographic proximity or implied affiliation with the original factory. These products often used inferior wood, unstable chemical compositions, and less refined packaging, yet leaned heavily on the prestige of the Jönköping name to attract buyers.

Some labels even borrowed visual motifs—such as red borders, stylized crowns, or factory illustrations—that echoed the design language of the original Jönköping boxes, further blurring the line between authentic and imitation.

Export-Oriented Replicas

Outside Sweden, the problem intensified. Manufacturers in Germany, France, Britain, and later India and Japan began producing matchboxes labelled “Jönköping,” “Swedish Safety Matches,” or “Made in Sweden”—despite having no connection to Swedish factories. These boxes often featured faux Swedish typography, invented place names, or romanticized illustrations of Scandinavian landscapes, such as fjords, pine forests, or Viking ships, to enhance the illusion of origin.

In some cases, the word “Jönköping” was misspelled or stylized to avoid legal scrutiny while still evoking the brand’s prestige. These export-oriented fakes flooded colonial markets, where consumers associated Swedish matches with safety and reliability, making them especially vulnerable to deception.

Table: Original & Major Swedish Brands

Brand Name	Founded/ Active	Notes
Jönköpings Tändsticksfabrik	1844–1853	Founded by Johan Edvard Lundström; birthplace of the safety match.
Jönköpings Nya Tändsticksfabrik	1880s	By the early 1900s, it became part of AB Jönköping-Vulcan Tändsticksfabriksaktiebolag
Vulcan Tändsticksfabrik (Tidaholm)	1868	Founded by Charles E. Bratt; later merged with Jönköping to form AB Jönköping-Vulcan.
Junebro Ash Factory	1890s	Founded by Carl Fredrik Wennberg
Jönköpings Westra Tändsticksfabrik	1880-1903	Rival factory in the same city; name mimicked the original to gain market traction.
AB Jönköping-Vulcan	1903 onward	World's largest match producer by early 20th century.
Svenska Tändsticks AB (STAB)	1917	Founded by Ivar Kreuger; consolidated the Swedish match industry.

Jönköpings Tändsticksfabrik's Major Competitors
Jönköpings Nya Tändsticksfabrik

Founded in the late 19th century, Jönköpings Nya Tändsticksfabrik ("New Matchstick Factory of Jönköping") emerged as a direct competitor to the pioneering Jönköpings Tändsticksfabrik, established by the Lundström brothers. While both factories operated in the same city—Jönköping, Sweden—the "Nya" designation signalled a fresh industrial venture, aiming to capitalize on the region's reputation for match innovation.

Its labels often mirrored the design language of its older rival: bold typography, symmetrical layouts, and export-friendly motifs. This visual mimicry was strategic, helping the brand gain traction in colonial markets where recognition was largely image-based.

Despite its ambition, Jönköpings Nya was eventually absorbed into larger industrial entities. By the early 1900s, it became part of AB Jönköping-Vulcan Tändsticksfabriksaktiebolag, and later folded into Svenska Tändsticks AB (STAB) during Ivar Kreuger's sweeping consolidation of the Swedish match industry in 1917.

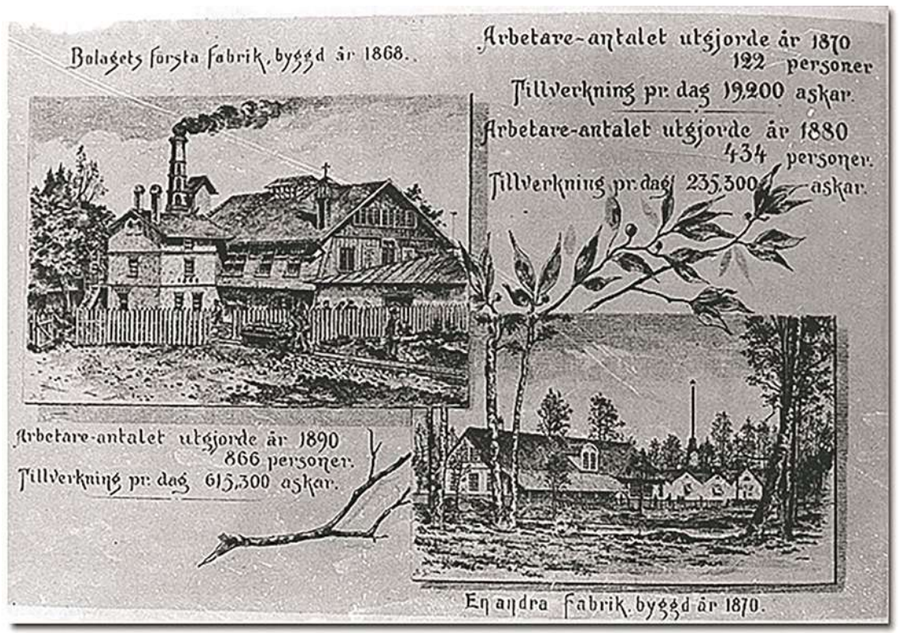
Clockwise from the top left: 112. Jönköpings Nya (New) Matchstick Factory; 113. Jönköpings Östra Tändsticksfabrik - B. Hay; 114. Jönköpings Nya (New) Matchstick Factory labels; 115. Jönköpings Nya (New) Matchstick Factory imitation label

Today, its surviving labels offer a glimpse into a fiercely competitive era—where even the smallest matchbox carried the weight of industrial rivalry, global trade, and graphic persuasion.

Vulcan Tändsticksfabrik (Tidaholm)

Founded in 1868 by Baron Hans Henrik von Essen and merchant Charles E. Bratt, Vulcan Tändsticksfabrik quickly rose from provincial obscurity to become a global powerhouse in match production. Located on the banks of the Tidan River, the factory overcame early setbacks—including devastating fires and a lack of skilled labor—to establish itself as a formidable rival to Jönköpings Tändsticksfabrik.

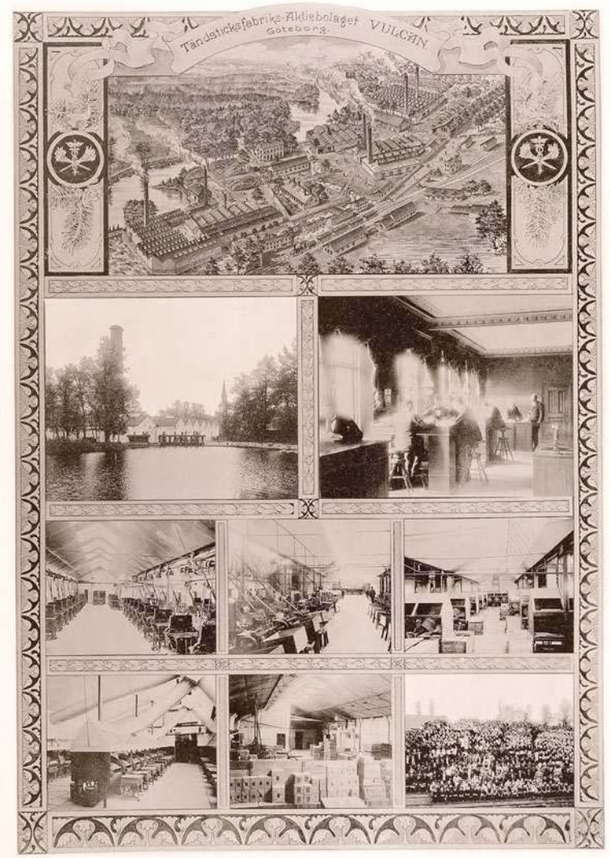
Under the leadership of George Murray and with the technical expertise of chemist Charles G. Grimes, Vulcan dramatically improved match quality and production efficiency. By the 1890s,



116. Vulcan's Tändstickor's first and second factories plus some production figures

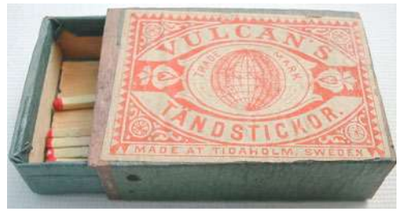
it was producing over 2.5 million boxes per day, with a workforce exceeding 1,200 employees, and had surpassed Jönköping in export volume and profitability.

Vulcan's strength lay in its flexible approach to global markets, adapting branding and packaging to suit regional tastes. It also embraced mechanization early, with over 550 machines powered by steam and water turbines. Despite fierce competition from Japanese exporters and internal tragedies—including the catastrophic 1875 fire that claimed 46 lives—Vulcan persisted and thrived.



117. Vulcan Match Company, Tidaholm, c. 1894-1907

118. Vulcan Match Company, Tidaholm, c. 1894-1907



119- 122. Vulcan matchboxes and labels

123. &124. Vulcan matchboxes and labels

By the turn of the 20th century, Vulcan was considered the largest match manufacturer in the world, and its eventual merger with Jönköping laid the groundwork for the formation of Svenska Tändsticks AB (STAB) under Ivar Kreuger's cartel strategy.

Junebro Ash Factory

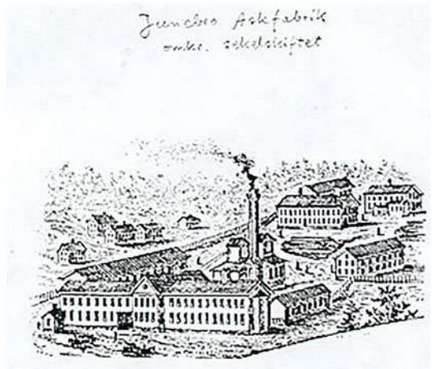
Founded by Carl Fredrik Wennberg in the 1890s, Junebro began with ash production—likely for matchboxes and chemical precursors. Leveraging the Jönköping name and recruiting talent from Jönköping-Vulcan, Junebro signalled serious intent.

Its hallmark was label artistry, including the famed penguin design, and the Maharaja of Cochin, reflecting global ambitions.

Junebro operated its own printing house, ensuring creative control. Incorporated as Junebro AB in 1907, it was acquired by Vulcan in 1913, expanding to 400 workers before closing in 1924. The site later housed the Junex Textile Factory, continuing its industrial lineage.

Jönköpings Westra (Western) Tändsticksfabrik

Established in 1881 by engineer Carl Fredrik Wennberg, Jönköpings Westra Tändsticksfabrik (JWT) quickly became a serious contender in Sweden's match industry. Backed by Jac Elliot &



125. Junebro Ash Factory; 126. Innovative packaging by Junebro; 127. Junebro matches; 128. Junebro's Maharaja of Cochin label

Co. of Göteborg, the factory expanded rapidly, employing over 680 workers by the mid-1890s and exporting matches globally under the iconic "Tre Stjärnor" (Three Stars) label.

Wennberg's technical ingenuity—designing custom machinery and streamlining production—gave JWT a competitive edge. Its export network, anchored in London and Hamburg, positioned it as a nimble rival to both Vulcan and the original Jönköping factory.

In 1903, JWT merged with its competitors to form Jönköpings och Vulcans Tändsticksfabriks AB, laying the groundwork for the later STAB cartel. Though absorbed, JWT's legacy endures in its branding finesse and its role in shaping Sweden's industrial fire-making narrative.

129. Jönköpings Westra Tändsticksfabrik factory 1930

130. Jönköpings Westra Tandsticksfabrik matchbox label

131. &132. Jönköpings Westra Tandsticksfabrik matchbox labels

AB Jönköping-Vulcan and Svenska Tändsticks AB (STAB)

In 1903, AB Jönköping-Vulcan was formed through the merger of several Swedish match factories, including the prominent Jönköpings Tändsticksfabrik and Vulcan Tändsticksfabrik in Tidaholm. This consolidation created a powerful industrial bloc known for producing high-quality matches and iconic labels like Tre Stjärnor ("Three Stars"). By 1917, amid fierce global competition and postwar economic pressures, financier Ivar Kreuger orchestrated a landmark merger between Jönköping-Vulcan and AB Förenade Tändsticksfabriker, forming Svenska Tändsticks AB (STAB). STAB became the parent company overseeing Sweden's match production, with Jönköping-Vulcan continuing as an operational arm. This move marked the beginning of Sweden's match monopoly era, enabling STAB to expand internationally while standardizing production and branding across its subsidiaries

Westervik Tändsticksfabrik

Founded in 1857 by sea captain Carl Gustaf Landström, Westervik Tändsticksfabrik was one of Sweden's early match factories. Located in Lofta parish near Västervik, the factory endured multiple setbacks—including a devastating fire in 1861 that led to Landström's bankruptcy. It was soon revived by new investors, including shipowner Albert Tenger and consul Gustaf Maechel.

By the 1880s, under the leadership of pharmacist Nils Danielsson, production tripled. After Danielsson's death in 1889, the factory was reorganized as Westerviks Tändsticksaktiebolag.

Clockwise from the top left: 133. Windproof matches Three Stars Flaming Light by Jönköping–Vulcan Tändsticksfabriken. The Three Stars brand was first introduced by Jönköpings Westra Tändsticksfabrik founded in 1881. It was passed on to Jönköping–Vulcan in a merger in 1903; 134. Superior Safety Matches by Jönköping & Vulcan Tändsticksfabriken AB; 135. Jönköping & Vulcan branding post-1903 merge; 136. Matchbox label of Svenska Tändsticks [Swedish Match]

Another fire in 1893 prompted a full rebuild, and in 1894, the city of Västervik became a major shareholder in the newly formed Västerviks Nya Tändsticksfabriksaktiebolag.
The factory modernized rapidly and became one of six match producers absorbed into Jönköpings och Vulcans Tändsticksfabriks AB in 1903, which itself became part of Svenska Tändsticks AB (STAB) in 1917, under the consolidation led by Ivar Kreuger.

Jönköpings Östra (Eastern) Matchstick Factory

Founded in 1881 by builder B.C. Carlsson with backing from Count James Hamilton, Alderman Gustav Grapengeisser, and Dr. Caspersson, Östra aimed to rival the dominant Jönköpings

137. Matchbox label of Westervik Tändsticksfabrik

Tändsticksfabrik. Initially named Jönköpings Nya, it was forced to rebrand after legal pressure from the western factory.

Östra grew rapidly, employing 400 workers and outsourcing ash production to 450 home-based labourers, many of them women and children. Technical staff were recruited from the rival factory, signalling serious intent.

But its proximity and branding provoked Bernhard Hay, who accused Östra of label piracy.

Legal battles followed, and on the same day the court ruled in Hay's favour, Östra declared bankruptcy—burdened by 800,000 kronor in debt.

Despite its short life, Östra left a mark: locals saw its smoke as a sign of opportunity, and Carlsson was celebrated for his generosity. After closure in 1885, the site evolved into a textile factory, then Jansson's Shoe Factory by 1929, continuing its industrial legacy.

Legal and Branding Challenges

During the mid-19th century, Sweden lacked robust trademark legislation, making it difficult to protect brand identity across borders. The Lundström brothers, and later AB Jönköping-Vulcan—formed through mergers in the early 20th century—attempted to combat imitation by standardizing packaging, introducing seals, and registering designs. However, enforcement was inconsistent, especially abroad.

The problem was compounded by the fact that early matchbox labels were not considered intellectual property under Swedish law. Manufacturers could legally replicate design elements, names, and even slogans. It wasn't until the late 19th century, with the rise of international trademark conventions and industrial exhibitions, that Swedish producers began to assert control over their visual identity.

Despite these challenges, the Jönköping brand endured. Its reputation was bolstered by awards at world expos, government endorsements, and the eventual consolidation of Swedish match production under Ivar Kreuger's Svenska Tändsticks AB (STAB) in the early 20th century, which helped restore brand integrity and global dominance.

4

Early Swedish Matchbox Art and Design

Early Packaging and the Role of Manufacturer Names

In the earliest phase of match production, following John Walker's invention of the friction match in England in 1826, packaging was rudimentary. Matches were sold in plain wooden boxes or paper wrappers, with little concern for graphic design.

138. Victorian Bryant & May at Bow, London, matchbox

As match manufacturing spread across Europe in the 1830s and 1840s, labels began to appear—typically typographic, sparse, and focused on one key element: the manufacturer's name. In an unregulated market, the name served as a signal of origin and a claim to reliability. These labels were not designed to be visually compelling; instead, they were designed to establish trust and differentiate one maker from another. However, the most highly regarded manufacturers—those whose reputations were already well established—often retained the prestige of their

name as the central visual element. Rather than adopting elaborate imagery, they relied on brand recognition alone, confident that their name conveyed quality without embellishment. This early emphasis on manufacturer identity laid the foundation for later tensions between originality and imitation, especially as matchbox design became more visually sophisticated.

The Swedish Safety Match and the Graphic Boom

The invention of the safety match in Sweden in 1855 by Gustaf Erik Pasch, and its refinement by Johan Edvard Lundström, marked a turning point in both match technology and packaging aesthetics. Lundström's factory in Jönköping became internationally renowned for producing high-quality safety matches, and its matchboxes began to reflect this reputation through distinctive graphic design.

139- 141. Early Swedish matchbox labels, c. 1850-1870 (top); 142- 144. Early label of Jönköpings Tändsticksfabrik matches (bottom)

Swedish matchbox labels developed a signature visual style: a central emblem or title, often flanked by ornate borders, symmetrical flourishes, decorative typography, and exhibition medals or trade fair medallions [4]. This design language became synonymous with Swedish match quality and was widely imitated across Europe and beyond.

145. Safety Matches Jönköpings Tändsticksfabrik with emblems

However, the absence of robust copyright and trademark protections during this period allowed widespread replication. Prior to the expansion of railway infrastructure, most match factories served local markets. Many producers copied Jönköping's graphic style, effectively piggybacking on its reputation to promote their own goods. Crucially, these imitations often retained the visual prominence of the manufacturer's name—either their own or a misleadingly similar one—hoping to benefit from the association with Jönköping's excellence.

With the advent of national distribution via rail, consumers encountered matchboxes of varying quality bearing nearly identical designs. This created confusion and undermined brand integrity. While the name on the box had once been a reliable indicator of origin, it now

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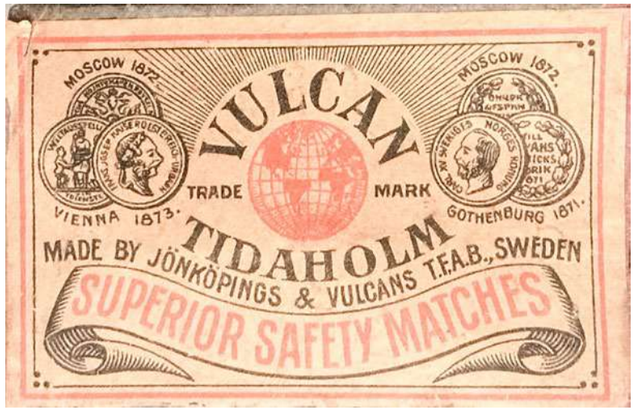
[4] *These were graphic representations of prizes or honours won at international exhibitions—such as the Paris Exposition Universelle (1889) or the World's Columbian Exposition (Chicago, 1893).*



146-148. Swedish competitor labels

became a site of manipulation. Inferior producers used similar names and designs to mislead buyers, while reputable firms saw their brand diluted.

In response, Jönköping successfully lobbied for trademark legislation in Sweden. Yet rather than develop original branding, many competitors made only superficial changes—altering borders, typefaces, or iconography—while retaining the overall aesthetic associated with Jönköping. This practice allowed them to remain legally compliant while continuing to benefit from the prestige of the original design.

From Quality Signalling to Emotional Branding

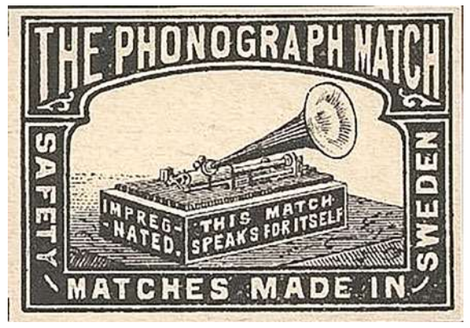
As match production became standardized and matches transitioned into mass-market commodities, the function of matchbox design evolved. Initially intended to signal product quality and manufacturer reliability—often through the prominent display of the producer's name—labels increasingly became tools of emotional branding. Manufacturers began to prioritize imagery that resonated with contemporary cultural interests, often replacing their company names with evocative symbols or themes.

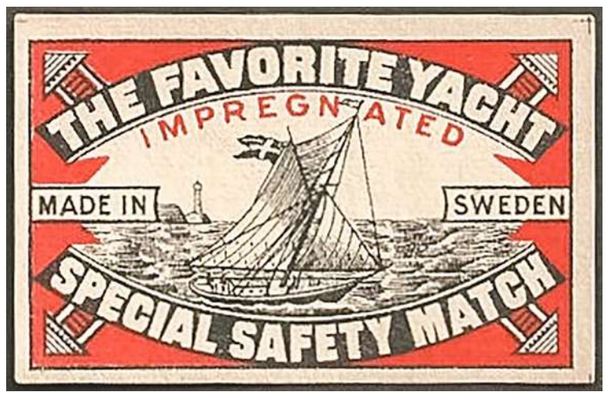
This shift rendered matchboxes a valuable lens through which to examine popular aesthetics and consumer psychology of the late 19th century. Companies selected motifs that reflected prevailing tastes, aspirations, and fascinations—effectively turning the matchbox into a miniature cultural artifact.

Thematic Trends in Late 19th-Century Matchbox Design

Several recurring themes emerged in matchbox design during this period, each reflecting broader societal interests:

Technological Modernity
Matchboxes frequently depicted innovations such as steam locomotives, telegraph systems, ironclad warships, early automobiles, and aeroplanes. These images symbolized progress and industrial advancement.

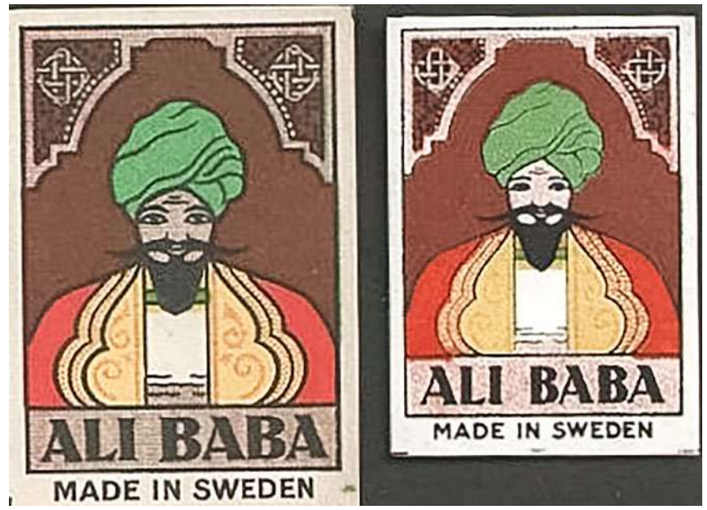




149- 154. Technology; Engine brand matches, Aeroplane matches, Automobile matches, Phonograpgh matches, The motor girl, Yatch

Public Figures and Heroic Icons

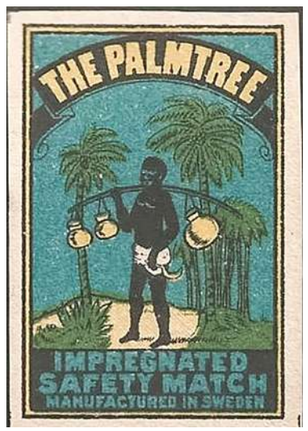
Royalty, military leaders, explorers, and sports champions were common subjects. Captain Matthew Webb, celebrated for swimming the English Channel, was a popular figure. In colonial contexts, deities and local rulers, such as Indian maharajas, were also featured.



155- 157. Public Figures and Heroic Icons, Emperor of Inida, Radja Stamboel Sultan of Turkey, Ali Baba

Exoticism and Global Exploration

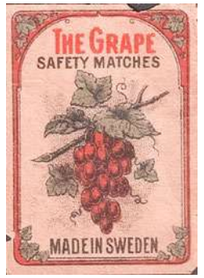
Victorian-era fascination with distant lands manifested in matchbox art through depictions of foreign animals, plants, architecture, and landscapes. While some designs veered into orientalist or caricatured representations, others conveyed genuine curiosity and admiration for global diversity.



158- 162. The Exotic and Global Exploration; Plamtree, Temptress, Dancing Girl, Flamboyant, El Indio

Fauna and Natural Motifs

Animals—particularly tigers, birds, bears, and domestic pets—were widely used. These motifs conveyed strength, elegance, or familiarity, and were often chosen for their symbolic resonance or visual appeal.



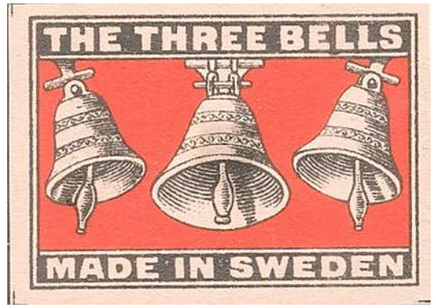
163- 168. Fauna and Natural Motifs; Tiger, Grape, Bullock, Parrot, Condor, Lion

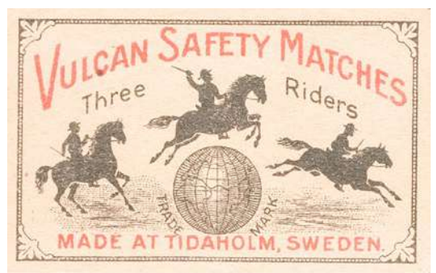
Numerical Symbolism

Surprisingly, the number three appeared frequently in matchbox design. Trios of objects, animals, or symbols were considered aesthetically pleasing and were believed to convey balance and completeness.

Sidebar: The Matchbox as a Cultural Mirror

- Technology: Trains, telegraphs, and aeroplanes symbolized progress.





169- 172. Numerical symbolism; Trimurti, Three bells, Three cats, Three riders

- Celebrity: Royalty and explorers offered heroic narratives.
- Exoticism: Llamas, pagodas, and palm trees evoked distant lands.
- Animals: Tigers and birds conveyed strength or elegance.
- Numerical symbolism: Trios of objects suggested harmony and completeness.

Table: Manufacturer Name vs. Graphic Emphasis

Matchbox Type	Manufacturer Name Usage	Graphic Emphasis	Example Motif
Early English (pre-1855)	Central and bold	Minimal or absent	"Bryant & May, London"
Jönköping originals (1860s-1880s)	Elegant, central	Shield, laurels	"Jönköping Safety Match"
Copycat Swedish brands	Imitative or misleading	Near-identical layout	
Emotional branding (1890s–1910s)	Often omitted	Thematic illustrations	Tiger, train, Captain Webb

Sidebar: Trademark Law and the Bare-Minimum Shift

When Sweden introduced trademark protections, many manufacturers made only superficial changes to avoid legal conflict. These "bare-minimum" adaptations included:

- Slight font alterations
- Border modifications
- Repositioning of central emblems
- Subtle name changes (e.g., "Jönköping Tändsticksfabrik" and "Jönköpings Nya Tändsticksfabrik")

This strategy allowed firms to remain visually close to the original while skirting infringement—preserving consumer confusion and market advantage.

Printing Technology for Swedish Matchbox Labels (Late 19th Century)

During the final decades of the 1800s, Sweden's match industry—led by firms like Jönköping and Vulcan—embraced chromolithography, a multi-color printing process that allowed for vibrant, layered imagery on matchbox labels. This technique replaced earlier woodcut and monochrome methods, enabling mass production of visually striking labels that could appeal to diverse international markets.

Swedish printers used stone plates for each color layer, often requiring 6–10 passes per label. The process was labor-intensive but yielded exceptional clarity and color harmony, which became a hallmark of Swedish match branding. Labels featured animals, royal insignia, exotic scenes, and allegorical motifs, tailored to colonial and export audiences.

According to Dr. Key-Aberg's "Sveriges Industri" for 1898 (Stockholm: Norstedt and Söner) there are at the present time in Sweden 27 match factories, employing in all about 5,500 workers, about half of whom are females. The following is the list:—

Name of Place.	Character of Matches.	Workers.
Södertelge	Safeties	123
Enköping	„	51
Barnarp	„	53
Hvetlanda	„	11
Jönköping (Gemla)	Lucifers, safeties	736
Jönköping Västra	„ „	666
Anneberg	Lucifers, paraffin, safeties	310
Junebro	„ „ „	234
Vexiö	Lucifers, safeties	263
Axebo	„ „	12
Emmaboda	Lucifers	7
Grönskåra (2)	„	17
Kalmar	Lucifers, paraffin, safeties	251
Lovers	Lucifers	51
Mönsterås	Parffin	88
Nybroköping	Lucifers, safeties, paraffin	79
Nyverk	„ „ „	10
Vesterviks	Safeties	290
Malmö	Lucifers, safeties	170
Ystad	[illegible]	—
Uddevalla	Safeties	258
Venersborg	Lucifers, safeties	193
Lidköping	Lucifers, paraffin, safeties	365
Vulcan, Tidaholm	Lucifers, safeties, &c.	1,330
Hagaräs	Lucifers	20
Krokom	„	12

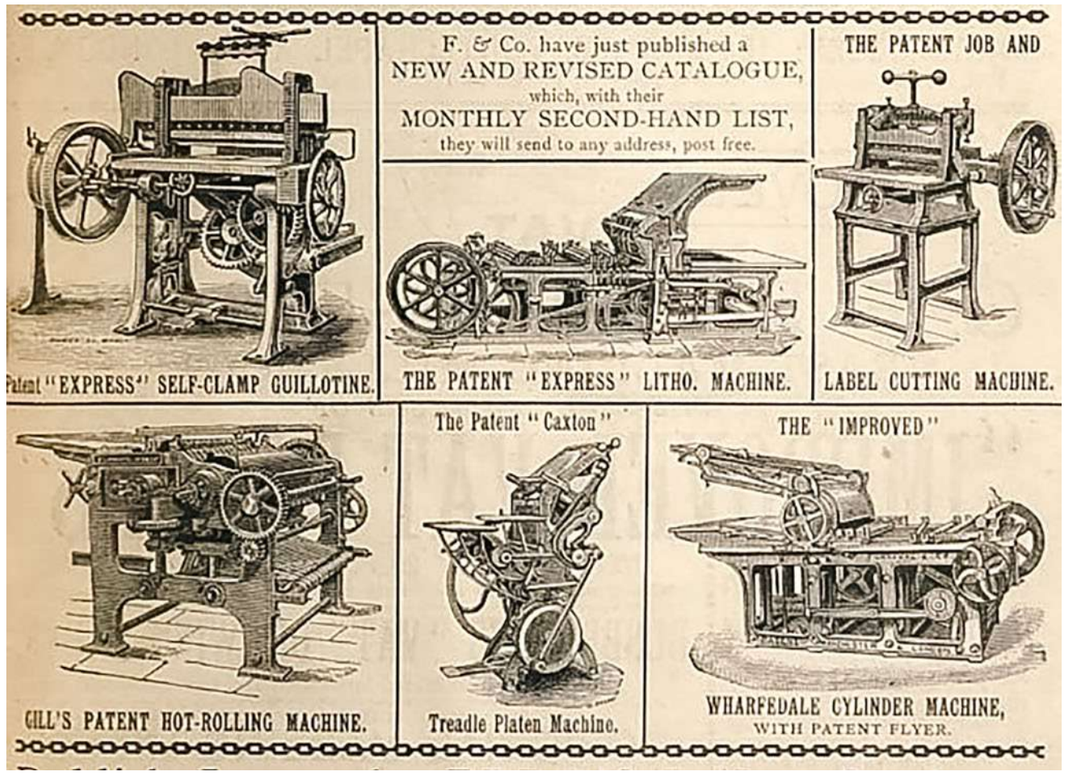
173. Competition in the Swedish match industry

LAST year, on the occasion of the celebration of the fourth centenary of the introduction of printing in Sweden, a typographic exhibition was held at Stockholm, when a composing machine, invented and constructed by Mr. Lagerman, the engineer of the Jönköping match factory, was shown. The apparatus excited the admiration of printers. Mr. Lagerman, however, was not entirely satisfied with his machine, took it back to Jönköping, improved it, and has now succeeded in producing an apparatus which was recently tried before a number of printers in the office of the *Dagblad* (Stockholm). The machine not only composes but it also distributes at the same time. Two persons are required to work it, a compositor and an assistant. At the trial of the combined composing and distributing machine it set up 52 lines of the *Dagblad* in twenty-four minutes. A compositor managed to pick up 24 lines in the same time. There is no doubt that, if the workman at the machine had been as great an expert as the quick compositor of the *Dagblad*, the number of lines would have been increased. The machine is said to space out the lines, although not perfectly, so that manual labour has to be called in to assist. One of the machines has been ordered by the proprietors of the *Dagens Nyheter*. The *Correspondent*—from which we take the above particulars—says that, if the machine were to do as much work as three compositors, it would only be able to approximately compete with them; but where would be the extra profit?

174. Printing at Jönköpings Tändsticksfabrik

By 1890, Sweden had become a global leader in match exports, and its printing houses—often integrated with match factories—played a crucial role in marketing. The labels were not just decorative; they functioned as trademarks, advertisements, and cultural signifiers, protected under emerging trademark laws.

This fusion of industrial printing and visual storytelling helped Swedish matches dominate markets from India to Africa, and laid the foundation for the label-collecting hobby known as phillumeny.



175. Some printing machines in the late 1800s

Nr. 37431. J. 1035. **Jönköpings Tändsticksfabriks Aktie Bolag,** Jönköping; Vertreter: Rechtsanwalt Dr. A. Wolffson, Hamburg. Anmeldung vom 22. 2. 99. Eintragung am 26. 4. 99.
Geschäftsbetrieb: Zündholzfabrik.
Waarenverzeichniß: Zündhölzer.

176. & 177. Jönköpings Tändsticksfabrik patented safety matches

5

The Social costs of White Phosphorous Matches

The Adverse Effects of White Phosphorus

When Samuel Jones realized "his" (rather, John Walker's) invention's commercial potential, he set up a match business in London, and cleverly named his product "Lucifers." The term persisted as slang in the 20th Century. Lucifers caught on, and following their introduction in London, tobacco smoking of all kinds greatly increased; a perfect example of "complimentary goods", often taught in a basic economics. Moreover, tobacco smoking was reported to have caused fires due to negligence.

178. The last Lucifer match

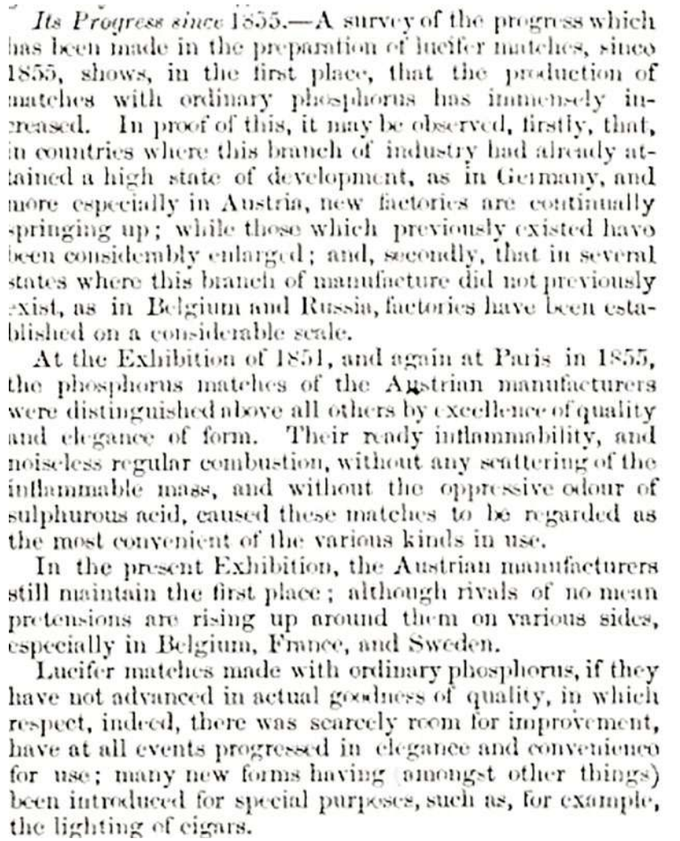
wooden platforms kept wet. The prohibition of smoking is, of course, enforced, though not without some difficulty, as even in gunpowder works, men who have acquired a mania for tobacco are mad enough to carry lucifer matches and indulge the propensity, if not strictly searched and watched. So great is this difficulty that, in his report to the Government, Professor Miller says, "Change of clothes should be enforced by legislation. It is the only method of preventing the surreptitious introduction of lucifer matches into the works, which men in the habit of smoking cannot be induced to forego."

179. Smoking in gunpowder factories; 180. Tobacco smoking and Lucifer fires

Tobacco not only hinders a great deal of productive labour, but it is indirectly destructive of property. It is impossible to compute the fires caused by smoking—fires in bedrooms, workshops, warehouses, stables, barns, ricks, churches, ships, and mines—from the hot ashes of the pipe or cigar, or from the matches used for lighting them. Dr. Ritchie, after stating that in 1860, 53 fires occurred in London alone from smoking, adds: "I have more than once seen a carpenter under a London station stop his work, light his pipe, and cast the half-burnt match among the shavings." In 1869, pipes and lucifers were taken from the pockets of 58 workmen in one day, as they were entering powder-works at Hounslow. Many explosions of gunpowder have this cause. Last July, the Government powder-magazine at Mazatlan, Mexico, was blown up with many houses round it, and over seventy lives were lost through the carelessness of a soldier who dropped his lighted cigar.[1] Cases have frequently been brought before the magistrates of miners who have incurred fines or imprisonment through taking their pipes and matches with them into dangerous coalpits. At the Blantyre explosion (July, 1879), which resulted in the death of 28 persons, the Inspector of Mines reported that near the bodies pipes had been found with tobacco partly smoked and lucifer matches.[2] This is but one instance among many. Those who work in constant peril are too apt to become reckless; but the indolent carelessness which is considered one of the charms of smoking greatly enhances the danger. Offenders have sometimes pleaded that they were not even aware that they were smoking, so unconscious were they of what is habitual.

The Lucifers were unpredictable too, giving off violent bursts of flame, and emitted an extremely noxious odor of sulphur. Boxes of Lucifers carried a printed warning: "persons whose lungs are delicate should by no means use Lucifers."

181. Leaflet of white paper advertising Samuel Jones's Lucifer Matches
Leaflet of white paper (7 3/4 x 4 ins), printed; advertising Samuel Jones's Lucifer Matches and other domestic contrivances made by him, with "Directions for Using" the Lucifers, as follows - "Place the folded part of Sand Paper next to the hand, the black end of the Match between; press moderately with the finger and thumb; then withdraw it briskly, and the effect of the friction will produce instant light. NB - If possible, avoid inhaling the gas that escapes from the combustion of the black Composition. Persons whose Lungs are delicate should by no means use the Lucifers"; also, a strongly-worded caution against imitations of Jones's Lucifers by unauthorized makers, producing "base counterfeits"; evidently issued by Jones on, or very soon after, the introduction of the Lucifer by him; probably unique; presented by Mr. Miller Christy; date probably 1830. England.



Its Progress since 1855.—A survey of the progress which has been made in the preparation of lucifer matches, since 1855, shows, in the first place, that the production of matches with ordinary phosphorus has immensely increased. In proof of this, it may be observed, firstly, that, in countries where this branch of industry had already attained a high state of development, as in Germany, and more especially in Austria, new factories are continually springing up; while those which previously existed have been considembly enlarged; and, secondly, that in several states where this branch of manufacture did not previously exist, as in Belgium and Russia, factories have been established on a considerable scale.

At the Exhibition of 1851, and again at Paris in 1855, the phosphorus matches of the Austrian manufacturers were distinguished above all others by excellence of quality and elegance of form. Their ready inflammability, and noiseless regular combustion, without any scattering of the inflammable mass, and without the oppressive odour of sulphurous acid, caused these matches to be regarded as the most convenient of the various kinds in use.

In the present Exhibition, the Austrian manufacturers still maintain the first place; although rivals of no mean pretensions are rising up around them on various sides, especially in Belgium, France, and Sweden.

Lucifer matches made with ordinary phosphorus, if they have not advanced in actual goodness of quality, in which respect, indeed, there was scarcely room for improvement, have at all events progressed in elegance and convenience for use; many new forms having (amongst other things) been introduced for special purposes, such as, for example, the lighting of cigars.

182. Lucifers using phosphorous become a reliable product (jpg)

For decades since its introduction in 1830 by Charles Sauria, white phosphorus was a staple of match production—cheap, effective, and deadly. The white/yellow phosphorus in the sticks could in greater doses could be fatal. They were sometimes used to induce abortions, with great risks for the mother. Its use also came at a terrible cost to the workers who handled it daily. The chemical was highly toxic and led to a horrific condition known as phossy jaw, or phosphorus necrosis of the jaw. This disease, a form of bone decay, primarily affected the lower jaw and was common among factory workers, particularly the "mixers," "dippers," and "boxers," who were exposed to phosphorus fumes during the manufacturing process.

The symptoms were brutal. It began with persistent toothaches and swollen gums. The infected bone would emit a ghostly greenish-white glow in the dark. Pus formed, teeth fell out, and eventually, the dead bone separated from the living tissue. In advanced cases, the entire jawbone would rot away. The only treatment was surgical removal of the jaw, leaving the patient permanently disfigured. If left untreated, the disease could spread to the brain, causing severe neurological damage, organ failure, and death.

The first documented case of phossy jaw appeared in Vienna in 1839, reported by Austrian physician Dr. Friedrich Wilhelm Lorinser. By 1844, he had recorded twenty-two cases among match workers and confirmed the link to white phosphorus exposure. Despite this, the match industry continued to grow rapidly. In fact, in spite of Dr. Lorinsor's reports of phossy jaw in Austria, the country dominated the production of Lucifers and strike-anywhere matches all through the mid-1800s.

183. Friedrich Wilhelm Lorinser, 1817-1895

Public awareness of the dangers began to grow thanks to the efforts of medical professionals, labour activists, and journalists who documented the plight of match workers. In Germany, the government took early action, banning white phosphorus matches in 1901. France, Austria, and other nations followed suit with similar legislation in the years that followed. In the United States, the Eschew Act of 1912 imposed a steep tax on white phosphorus matches, effectively driving them out of the market.

Yet the problem was not confined to any one country, and unilateral bans could not prevent the continued manufacture and export of hazardous matches. A Report submitted in 1899 by Professor G.E. Thorpe et al to the British Government surveyed match factories from across the world. The photographs taken from their report show the production process and ventilation systems in factories at that time.

All the persons engaged in the factory are thus more or less exposed to the fumes of phosphorus. The effect of this exposure is to induce a disease which, to quote the description of a medical man "is of so insidious a nature, that it is at first supposed to be common toothach, and a most serious disease of the jaw is produced before the patient is fully aware of his condition. The disease gradually creeps on until the sufferer becomes a miserable and loathsome object, spending the best period of his life in the wards of a public hospital. Many patients have died of the disease; many, unable to open their jaws, have lingered with carious and necrosed bones; others have suffered dreadful mutilations from surgical operations, considering themselves happy to escape with the loss of the greater portion of the lower jaw." I will not shock your readers with any further surgical details. I will merely remark, that at the present time, and in one factory, a young man and a young woman have resumed their work, each with the loss of the lower jaw; and I am assured that cases of such mutilation are by no means uncommon, as our hospitals and infirmaries can testify.

184. The dreaded effect of white phosphorus on the jaw

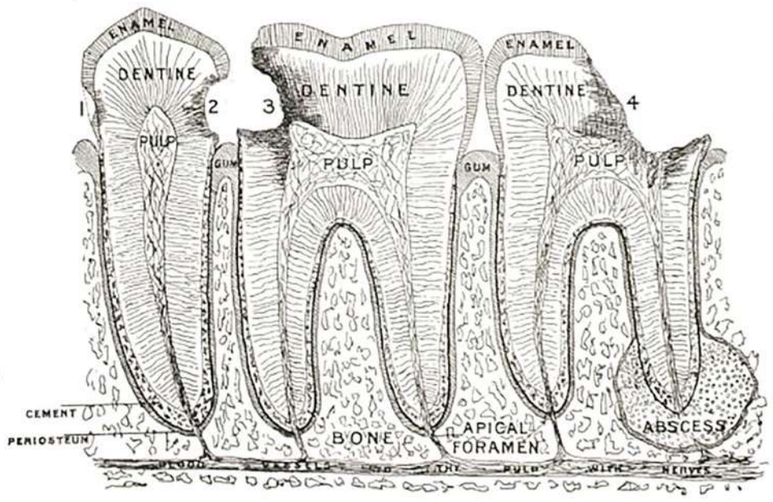
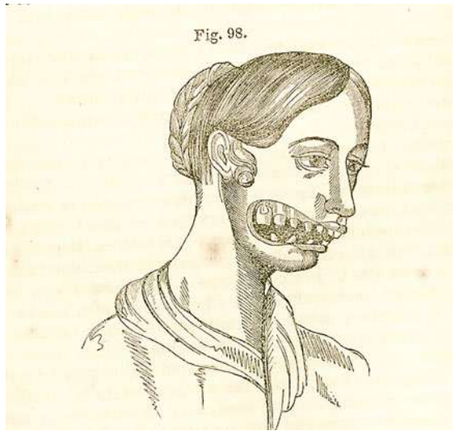


Diagram A of a lower bicuspid, & two molar teeth, Showing the four degrees of Caries.

1 & 2, Early stages of decay, 3 & 4, More advanced or pendrating Caries (Carie Pendrante.)

Appearance of patient after removal of the entire lower jaw.



185- 187. The dreaded effect of white phosphorus on the jaw

THE LUCIFER MATCH GIRL.

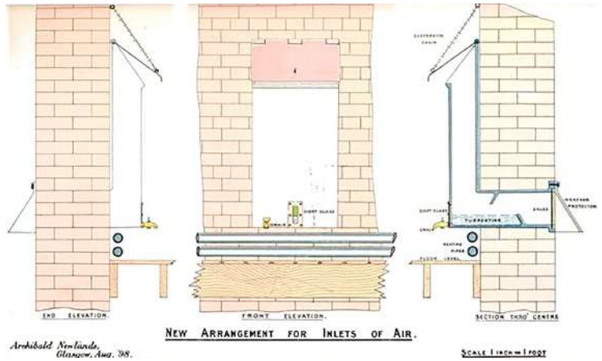
[From a Photograph.]

188. & 189. The dreaded effect of white phosphorus on the jaw

ment.[1] I have myself observed this remarkable appearance of the countenance in the dipper of a congreve match manufactory, whose jaws, however, were quite sound. The best preventives of the phosphorus jaw disease have been good ventilation of the rooms of the manufactory, and personal cleanliness. Mr. Hynam, an extensive manufacturer of congreve matches in Princes Street, Finsbury Square, tells me that no case of this malady has ever occurred among his numerous work-people, some of whom have worked there for seven, eight, or even ten years. Their freedom from the disease he ascribes to good ventilation and personal cleanliness. The dippers wear sponges before their mouths; and all the work-people employ a solution of soda[2] for washing their hands. It has been lately proposed to substitute

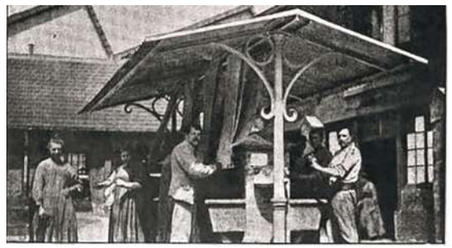
190. The importance of ventilation in the match factory to prevent occurrence of phossy jaw

BOX-FILLING TABLES AT VULCAN FACTORY, TIDAHOLM.

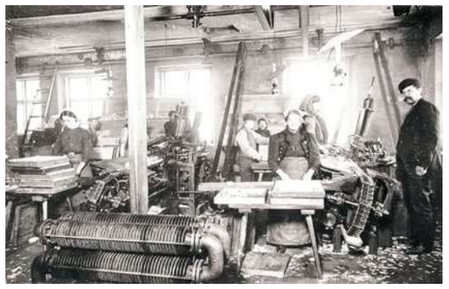


BRITISH MATCH GIRLS.
(Messrs. Bell & Co.'s Factory.)
"The Dinner Hour outside the Refectory."

FRENCH MATCH GIRLS.
"A Casual Group at the Pantin Factory."



"WASHING UP BEFORE THE DINNER HOUR."
(At the Pantin Factory.)



191- 195. Some photographs from a survey of factories from across the Western world

196. Sketch of match factory, 1889

Workers Strike at Bryant & May

By 1890, Britain was using 60 tons of white phosphorus annually in match production—half of it consumed by one company: Bryant and May. Founded in 1843, Bryant and May initially imported matches before becoming a major manufacturer. The company would later become infamous for its labour practices, especially during the 1888 Match Girls' Strike—one of Britain's earliest and most publicized industrial actions. The strike was sparked by journalist Annie Besant, who published an exposé in The Link, detailing the appalling conditions faced by female workers. She reported that women earned between 4 and 13 shillings a week, with an average of 11 shillings and 2 pence—often reduced further by

BRYANT & MAY, LONDON, E.

TRADE MARK.

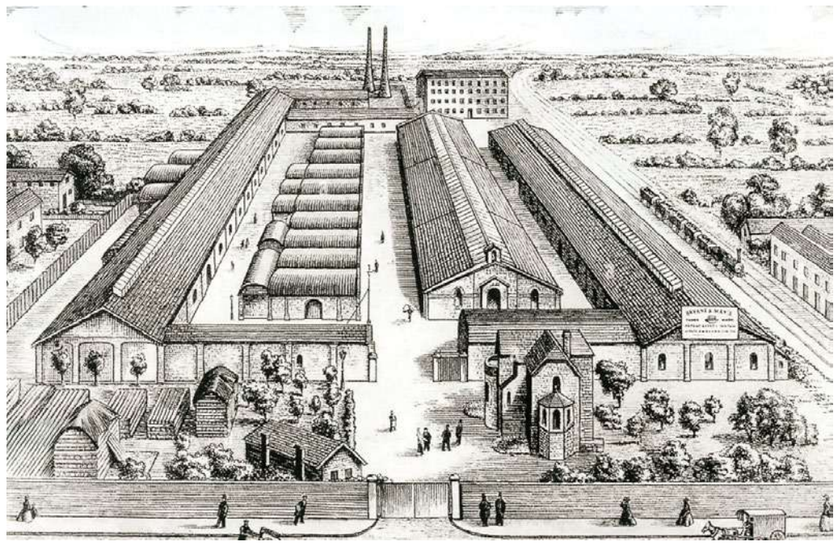
BRYANT & MAY'S
PATENT SAFETY MATCHES,

ARE NOT POISONOUS.
CONTAIN NO PHOSPHORUS.
ARE WITHOUT SMELL.
ARE VERY DAMP PROOF.
ARE NOT LIABLE TO SPONTANEOUS COMBUSTION.

LIGHT ONLY ON THE BOX.

SPECIAL NOTICE.—*Without the precaution of observing closely the address* BRYANT & MAY, *and the Trade Mark an Ark, buyers may be imposed upon with an article that does not afford protection from Fire.*

BRYANT & MAY,
Patent Safety Match Manufacturers,
FAIRFIELD WORKS, BOW AND WHITECHAPEL ROAD,
LONDON, E.
ILLUSTRATED PRICE-LISTS ON APPLICATION



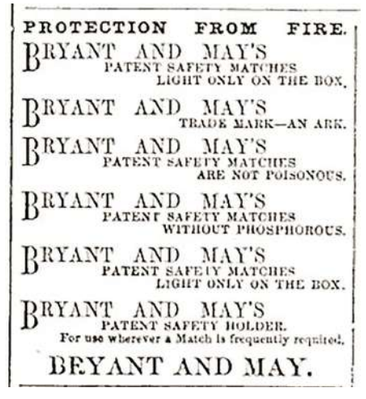
197. Bryant & May, 1870 (top); 198. BRYANT & MAY the Fairfield match making factory in Bow, south east London, about 1865 (bottom)

illegal fines and deductions. Workers ate their meals in the same rooms where phosphorus fumes lingered. “They eat disease as seasoning for their bread,” Besant wrote. When symptoms of phossy jaw appeared, foremen sent the women home without pay.

Bryant and May’s management tried to suppress the article by pressuring workers to sign a statement denying its claims. When a group refused, their leader was fired, triggering a walkout. Around 1,400 women and girls joined the strike, forming the Matchgirls’ Union and seeking Besant’s support. The movement gained traction, drawing support from figures like George Bernard Shaw and William Stead, editor of the Pall Mall Gazette. Some newspapers, such as The Times, condemned the strike’s supporters as dangerous agitators.

After three weeks, the company conceded. The dismissed worker was reinstated, the fines system abolished, and a formal complaint process introduced. Workers were also allowed to eat in separate rooms, away from the toxic fumes. Yet despite the strike’s success, Bryant and

199. An idealized view of workers at the Bryant and May match factory, from The Illustrated London News, 1871.



200. Bryant & May factory; 201. Bryant & May matches advertisement in The Economist, 1873

202. Sketches at Bryant & May’s Match Manufacture, Illustrated London News, August 4, 1888; 203. Boy selling matches in London, barefoot

204. *Member' of the Matchmaker's Union (top); 205. A demonstration of match-makers, 1871 (bottom)*

206. *Annie Beasant, 1885 (top); 207. The Match Girl's Strike Committee with Annie Besant (1888) (bottom)*

The Link

A Journal for the Servants of Man.

No. 24. SATURDAY, JULY 14, 1888. ONE HALFPENNY.

"The People are silent. I will be the advocate of this silence. I will speak for the dumb. I will speak of the small to the great, and of the feeble to the strong. ...... I will speak for all the despairing silent ones. I will interpret this stammering; I will interpret the grumblings, the murmurs, the tumults of crowds, the complaints ill-pronounced, and all those cries of beasts that, through ignorance and through suffering, man is forced to utter...... I will be the Word of the People. I will be the bleeding mouth whence the gag is snatched out. I will say everything."

TO THE SHAREHOLDERS OF THE BRYANT & MAY COMPANY, LIMITED.

LADIES AND GENTLEMEN,

I GIVE you your conventional title in now addressing you, although if there be in you any of the old feeling implied in the phrase *noblesse oblige*, I doubt if you yourselves, after reading this letter, will honestly claim any title which implies the gentlehood of true humanity, until you have purged yourselves from the soil implied in the holding of shares in the Bryant and May Company.

I am not here concerned with the degrees of blood-guiltiness. I do not care whether the original managing directors of the firm started on July 1st, 1884—Mr. Wilberforce Bryant, Mr. Frederick Carkeet Bryant, Mr. Otto Heinrich Trömmer—are more or less to blame as chief slave-drivers of your Company. I do not know whether Mr. Theodore H. Bryant, with his 3,000 shares in '84 and his 1,400 in '88; Mr. William Carkeet, with his 1,250 shares in '84; Mr. G. Bartholomew, with his 500 qualifying shares; Mr. G. B. Rix, with his 180 shares last year and his 85 this; whether any or all of these have special guilt on their consciences. To-day I am concerned with you, ordinary shareholders, whose names do not appear, as a rule, in public; you, who are quiet and unobtrusive persons, going about in society as decent respectable folk, honored as good citizens by your neighbors, nay, some of you looked up to as guides in religious matters, standing forth as teachers of a divine revelation, professing to believe in a "religion of love", and looking down with fine contempt on a poor unbeliever like myself, who tries only to discharge, strenuously and incessantly, the duties which have their root in the common Brotherhood of Man. To you I have some words to say, so that if you are ignorant of the crimes done in your name, you may stand up as honest men and women, and cleanse yourselves from the stain which dishonors, from the sin that pollutes.

Do you know that the women and girls whose labor made the 22½ per cent. dividend paid in February last are living, or dying, in Old Ford, Bromley, Tiger Bay, and other districts of East London, on wages varying from 4s. to about 13s. a week? That sometimes the wage goes even below 4s., and that a girl of sixteen years of age, a fortnight ago, was discharged with 2s. 8d. to represent the results of a week's toil? Do you know that it appears even from the miserable shuffles of your secretary, Mr. Carkeet, that the "average wage" of the "adult female workers" in your employ is only 11s. 2d. per week? And consider, the fact that there is an "average wage" of 11s. 2d. does not help women, who, like the twenty-nine-years-old wife of a dock laborer, the mother of five children, took home 5s. 6d. last Saturday week as her week's earnings. But let us take the "average wage"; how would you like, wife of a clerical shareholder in Bryant and May's, to keep house for a week on 11s. 2d.? How would you like to start for your work at half-past five a.m., and reach home again at seven p.m., having been on your feet nearly all the time, and after doing this for five days, with an additional half-day on the Saturday, to take home 11s. 2d. as a reward? And if you did not reach the average, but only got the 5s. 6d., and had been at the work for fifteen years, might you not say, like my poor friend said to me the other day, "I'm most tired of it"?

Pass the wages. Do you know that these "female hands" eat their food in the rooms in which they work, so that the fumes of the phosphorus mix with their poor meal and they eat disease as seasoning to their bread? Disease, I say: for the "phossy jaw" that they talk about means caries of the jaw, and the phosphorus poison works on them as they chew their food, and rots away the bone. Your foremen have sharp eyes. If they see a girl's face swell they know the sign, and she is sent off and gets no pay during her absence. Think of it, shareholders, as you sit in gorgeous art studio or cosy rectory. Do you not feel a twinge of pain in your own mouth as you think of these being poisoned that your table may be the more daintily spread?

Pass the poisoning. Do you know that, contrary to law, these women are mulcted of part of their miserable earnings, to pay for the material with which they work? For two years one girl has been working for you, and last Saturday week was the first pay-day on which deduction had not been made for paint and brushes. And, mind you, this is robbery, in the common sense of that ugly word. For these thievings out of the wages are illegal, and your managers can be, and ought to be, prosecuted for thus abusing their position to keep back by fraud part of the wages of the poor.

Pass the deductions. Do you know that, again contrary to law, these white slaves of yours are fined? A system of devilish ingenuity catches them in endless traps and robs them even of part of the poor wages they nominally earn. On June 25th a girl was fined 6d. by your Mr. Butler for dropping a tray. On June 23rd another girl was fined 6d. by the same man for having left under her bench a few matches she had dropped. One child was fined 6d. for three weeks running. Are you not ashamed, you priests, who read out Sunday after Sunday "Thou shalt not steal", and then pocket the results of thefts carried out for your profit?

Pass the fines. Do you know that girls are used to carry boxes on their heads till the hair is rubbed off, and the young heads are bald at fifteen years of age? Country clergyman with shares in Bryant and May's, draw down on your knee your fifteen-year-old daughter; pass your hand tenderly over the silky, clustering curls, rejoicing in the dainty beauty of the thick shining tresses. Then, like a ghastly vision, let there rise up before you the pale worn face of another man's fifteen-year-old daughter, with wistful pathetic patient eyes, and see her, as in the presence of Cunninghame Graham and Conybeare, members of your legislative House, she pulls off her battered hat and shows a head robbed of its hair by the constant rubbing of the carried boxes, robbed thereof that your dividends may be the larger, Sir Cleric, by the price of the pads that might have saved for her the grace of a womanhood already slaved out of beauty.

Enough. The weary heart-sickening tale would be too long a-telling if I told it all. And of what avail, after all, to tell it to you, who if you cared to know might have known long ago how your high dividends are earned. You do not want to know. You do not care to know. Your feeling of anger at the exposure of the White Slavery on which you fatten is not the noble indignation of the man who has been betrayed into a wrong he knew not of, and who feels the intolerable stigma of a shame unwittingly incurred. Your anger is not against Mr. Frederick Bryant and Mr. Bartholomew, not against Mr. Carkeet and Mr. Rix, not against Mr. Butler, Mr. Southey, and the rest of your agents. Your anger is against me who have exposed the wrong, instead of against those who have wrought it; you do not mind the bloodstain on your coins, but you would not that the world should see its rust. Shame on you, who so long as silence can be kept, are careless whence comes your gold; shame most of all on you who preach love and purity from your pulpits, and who practise the cruellest oppression, driving many a girl into a life of shame by paying her a wage on which she cannot live. You talk of a judgment on the other side the grave. What judgment, suppose you, would a just Judge

208. Bryant & May protests (top); 209. TAnnie Beasant's Letter to Bryant & May, 1888 (bottom)

May continued using white phosphorus until 1901. It wasn't until 1910 that Britain officially banned the substance in match production.

The tragedy is that safer alternatives existed all along. Since the 1850s, Bryant and May had been importing Swedish "safety matches," which used red phosphorus—a far less toxic compound. These matches required a special striking surface and were more expensive to produce. Bryant and May began manufacturing them in 1855, but they never gained the same popularity due to their higher cost.

In 1891, the Salvation Army opened a factory to produce safety matches under better working conditions. However, in an effort to keep prices low, they still relied on child labor for boxing the matches. Even then, their product cost three times more than traditional Lucifer matches. Eventually, the factory couldn't compete and was taken over by Bryant and May in 1901.

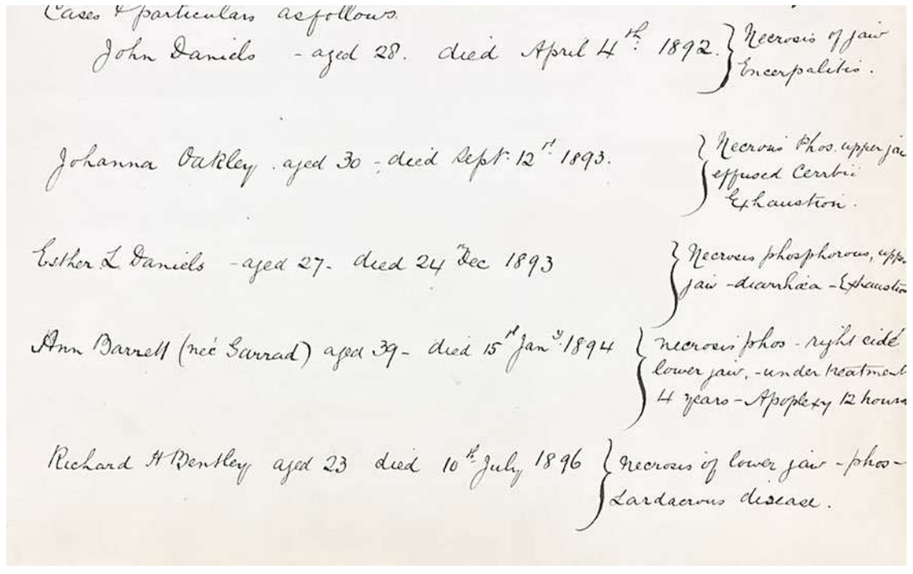
Table: Timeline of Bryant & May

Year	Event/ Product	Details
1843	Company founded	William Bryant and Francis May establish Bryant & May as a dry goods trading firm in London.
1850	Partnership with Lundström	Begin importing Swedish safety matches from Johan Edvard Lundström. First order: ~720,000 matches.
1855	Domestic production begins	Bryant & May start manufacturing matches in Britain. Sales rise to 10.8 million boxes.
1861	Bow factory established	A model factory is built on Fairfield Road, East London, specializing in safety matches.
1880	Begin producing Lucifer matches	Due to market demand, Bryant & May add white phosphorus-based Lucifers to their product line.
1884	Public listing	Company becomes publicly traded; begins exporting matches globally.
1888	Matchgirls' Strike	Workers protest poor conditions and phossy jaw risks; leads to reforms in pay and workplace practices.
1890	"Pearl" safety matches	Launch of branded safety matches using red phosphorus.
1891	Salvation Army factory opens	Competes with Bryant & May by producing safety matches; later acquired by Bryant & May in 1901.
1901	Acquisition of Diamond Match Co.	Bryant & May acquire rival to avoid trade war; gain rights to Swan Vesta brand.
1910	White phosphorus banned	Britain officially prohibits white phosphorus in match production; Bryant & May shift fully to safety matches.
1927	Merger with Swedish Match	Bryant & May merge with British subsidiary of Swedish Match to form British Match Corporation.
1934	Peak production	British Match produces 45 billion matches annually.
1979	Bow factory closes	Operations move to Liverpool; Bow site later redeveloped into housing.
Present	Brand owned by Swedish Match	Bryant & May continues as a legacy brand under Swedish Match, producing eco-friendly matches.

The End of White Phosphorus Matches

Recognizing the need for a coordinated international response, thirteen countries convened in Berne, Switzerland, in 1906. The resulting treaty—at the Berne Convention—was a landmark in labour and health legislation. It prohibited the manufacture, import, and sale of matches containing white phosphorus and encouraged the adoption of safer alternatives. The treaty entered into force in 1912 and marked one of the earliest examples of global cooperation to address occupational health hazards.

The legacy of the treaty at the Berne Convention is profound. It not only helped eliminate a deadly industrial practice but also laid the groundwork for future international labour standards. The convention demonstrated that worker protection and ethical manufacturing could transcend borders, setting a precedent for organizations like the International Labour Organization (ILO), which would emerge in the aftermath of World War I.


Cases & particulars as follows.

John Daniels - aged 28. died April 4th 1892. } Necrosis of jaw Encephalitis.

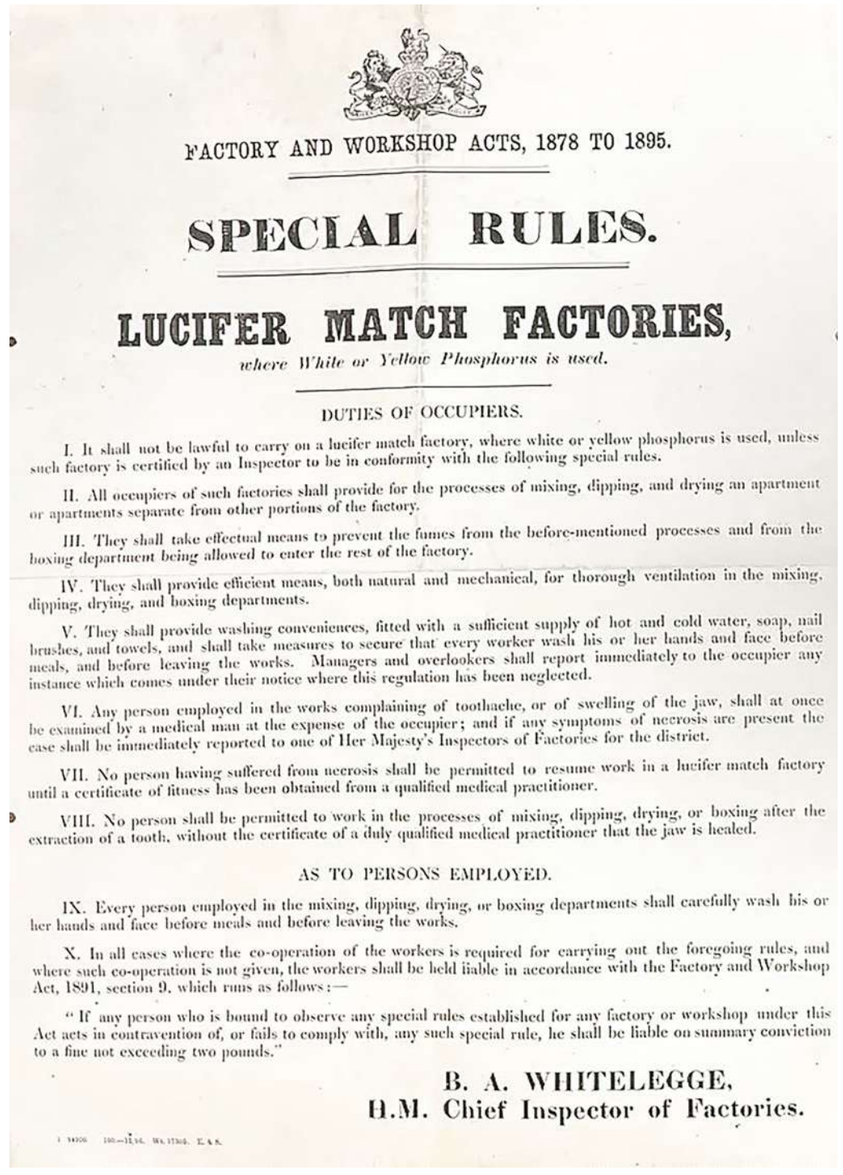
Johanna Oakley. aged 30 - died Sept: 12th 1893. } Necrosis Phos. upper jaw Effused Cerebri & Exhaustion.

Esther L Daniels - aged 27 - died 24 Dec 1893 } Necrosis phosphorous, upper jaw - diarrhœa - Exhaustion

Ann Barrell (née Sarrad) aged 39 - died 15th Jan.y 1894 } Necrosis Phos - right side lower jaw, - under treatment 4 years - Apoplexy 12 hours

Richard H Bentley aged 23 died 10th July 1896 } Necrosis of lower jaw - phosphorous Lardaceous disease.

210. 'The Little Match Girl' - the Thames Embankment with a matchgirl sleeping – 1890 (top); 211. List of five match workers who had died from phosphorus poisoning at Bryant & May, from 1892 to 1896 (bottom)


FACTORY AND WORKSHOP ACTS, 1878 TO 1895.

SPECIAL RULES.

LUCIFER MATCH FACTORIES,

where White or Yellow Phosphorus is used.

DUTIES OF OCCUPIERS.

I. It shall not be lawful to carry on a lucifer match factory, where white or yellow phosphorus is used, unless such factory is certified by an Inspector to be in conformity with the following special rules.

II. All occupiers of such factories shall provide for the processes of mixing, dipping, and drying an apartment or apartments separate from other portions of the factory.

III. They shall take effectual means to prevent the fumes from the before-mentioned processes and from the boxing department being allowed to enter the rest of the factory.

IV. They shall provide efficient means, both natural and mechanical, for thorough ventilation in the mixing, dipping, drying, and boxing departments.

V. They shall provide washing conveniences, fitted with a sufficient supply of hot and cold water, soap, nail brushes, and towels, and shall take measures to secure that every worker wash his or her hands and face before meals, and before leaving the works. Managers and overlookers shall report immediately to the occupier any instance which comes under their notice where this regulation has been neglected.

VI. Any person employed in the works complaining of toothache, or of swelling of the jaw, shall at once be examined by a medical man at the expense of the occupier; and if any symptoms of necrosis are present the case shall be immediately reported to one of Her Majesty's Inspectors of Factories for the district.

VII. No person having suffered from necrosis shall be permitted to resume work in a lucifer match factory until a certificate of fitness has been obtained from a qualified medical practitioner.

VIII. No person shall be permitted to work in the processes of mixing, dipping, drying, or boxing after the extraction of a tooth, without the certificate of a duly qualified medical practitioner that the jaw is healed.

AS TO PERSONS EMPLOYED.

IX. Every person employed in the mixing, dipping, drying, or boxing departments shall carefully wash his or her hands and face before meals and before leaving the works.

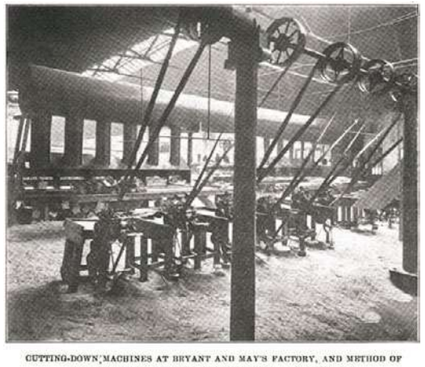
X. In all cases where the co-operation of the workers is required for carrying out the foregoing rules, and where such co-operation is not given, the workers shall be held liable in accordance with the Factory and Workshop Act, 1891, section 9, which runs as follows:—

"If any person who is bound to observe any special rules established for any factory or workshop under this Act acts in contravention of, or fails to comply with, any such special rule, he shall be liable on summary conviction to a fine not exceeding two pounds."

B. A. WHITELEGGE,
H.M. Chief Inspector of Factories.

212. Poster outlining the Special Rules for Lucifer Match Factories where white or yellow phosphorus is used, as issued by the Chief Inspector of Factories, 1893

213. *Match Girls at Bryant & Mays Factory sorting and packing matches*

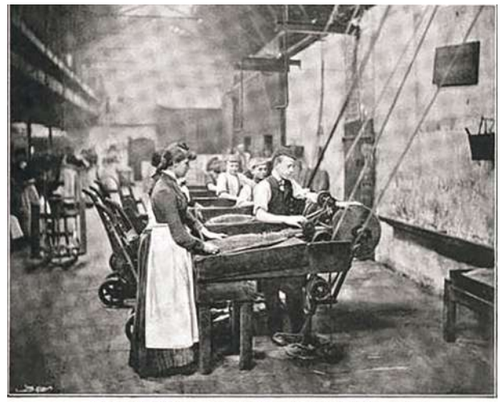


CUTTING-DOWN MACHINES AT BRYANT AND MAY'S FACTORY, AND METHOD OF REMOVING "FUME" FROM FRESHLY-DRIED DIPPED SPLINTS.

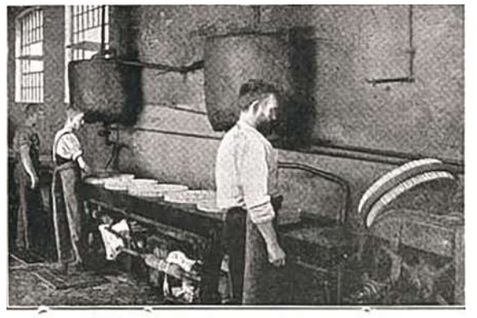
WOOD MATCHES.—BOXING ROOM, CENTRE FACTORY, FAIRFIELD WORKS.

214. & 215. *Bryant & may production line. From an official report on phosphorus match factories, 1899.*

WAX VESTAS.—TAPER MAKING.

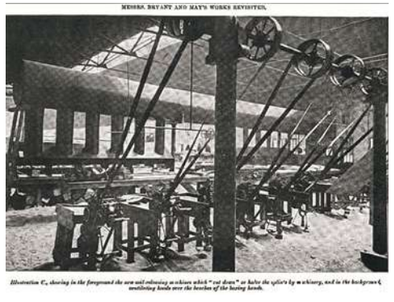


WOOD MATCHES.—EMPTYING THE LEATHER COILS.



WOOD MATCHES.—PARAFFIN DIPPING.

WOOD MATCHES.—BOXING ROOM, CENTRE FACTORY, FAIRFIELD WORKS.



216- 222. *Bryant & may production line. From an official report on phosphorus match factories, 1899.*

223- 226. Bryant & May matches- 1,2,3,4

227. Advertisement for Salvation Army matches

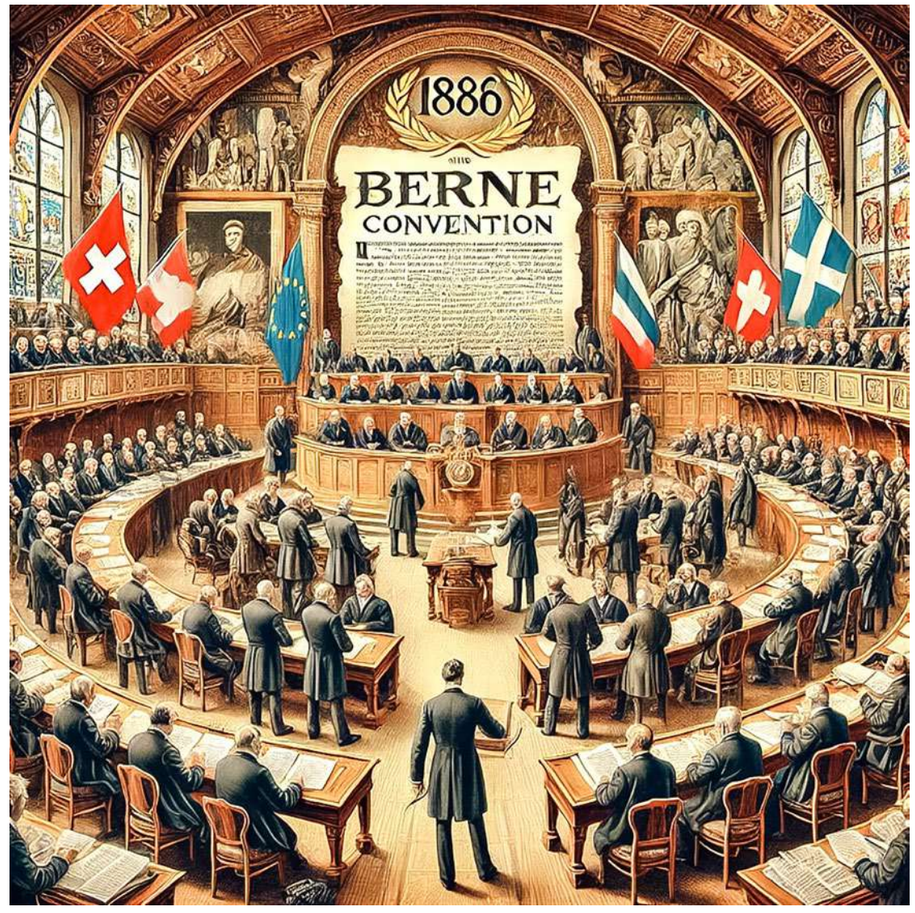
MATCH PATENT ENDED FOR HUMANITY'S SAKE

To Stop Poisoning in Factories, Diamond Match Co. Lets Competitors Use Its Method.

HEEDS APPEAL FROM TAFT

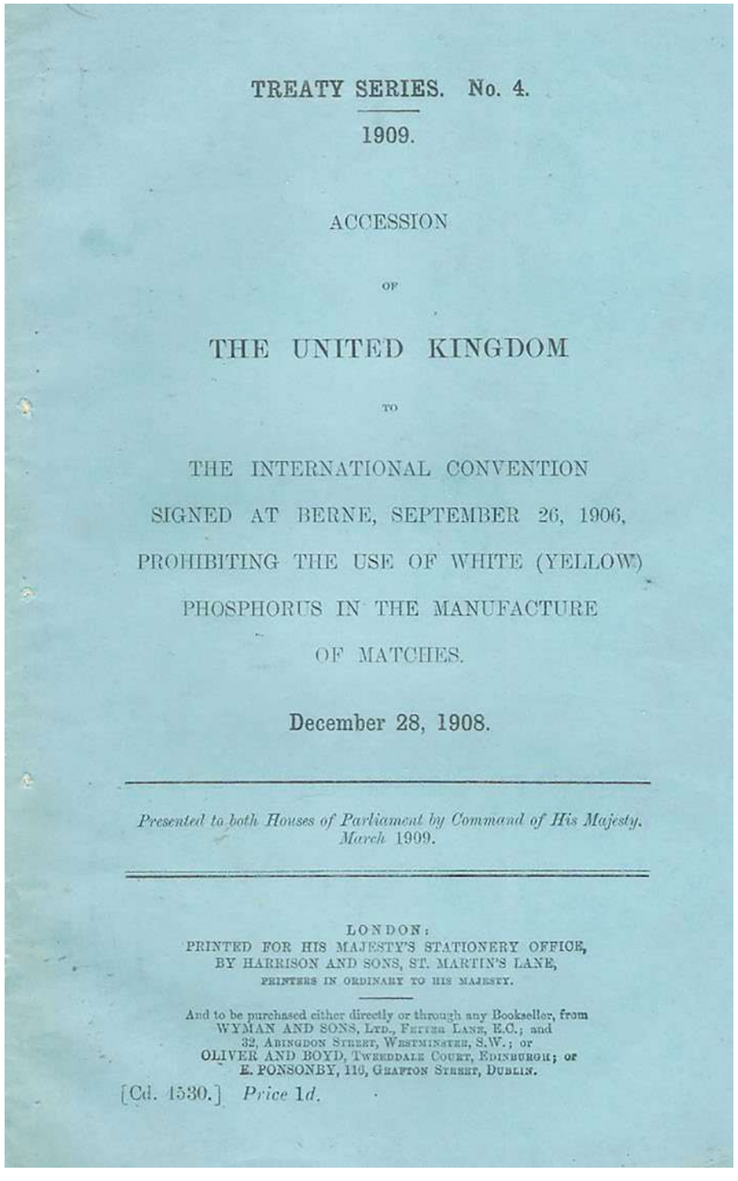
Clears the Way for a Federal Law Prohibiting Use of White Phosphorus Deadly to Workers.

228. News report on patent release by Diamond Match Co., 1911



229. A representational image of the Berne Convention of 1886

In retrospect, the story of white phosphorus in the match industry is a cautionary tale about the costs of unchecked industrialization. It reminds us that technological progress must be tempered by a commitment to human dignity and safety—and that sometimes, the spark of reform requires more than just striking a match.



TREATY SERIES. No. 4.

1909.

ACCESSION

OF

THE UNITED KINGDOM

TO

THE INTERNATIONAL CONVENTION

SIGNED AT BERNE, SEPTEMBER 26, 1906,

PROHIBITING THE USE OF WHITE (YELLOW)

PHOSPHORUS IN THE MANUFACTURE

OF MATCHES.

December 28, 1908.

Presented to both Houses of Parliament by Command of His Majesty.
March 1909.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
BY HARRISON AND SONS, ST. MARTIN'S LANE,
PRINTERS IN ORDINARY TO HIS MAJESTY.

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WYMAN AND SONS, Ltd., Fetter Lane, E.C.; and
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E. PONSONBY, 116, Grafton Street, Dublin.

[Cd. 4530.] *Price* 1*d.*

230. The Berne Convention and the end of white phosphorus matches

INDUSTRIAL POISONING BY PHOSPHORUS AND MERCURY

PHOSPHORUS NECROSIS

Historical. Since the International Convention at Berne in 1906 prohibited the use of white phosphorus in the manufacture of matches, and since this measure had received, at varying subsequent dates, the adherence of practically all the governments of civilized countries, phosphorus poisoning is mainly a subject of historic interest. The illness and suffering due in the past to this cause—the first case was reported by Lorinser of Vienna in 1838—stirred public feeling as no other industrial disease had done, and the discovery of a satisfactory substitute in the sesquisulphide of phosphorus (first utilized in French match factories in 1898) which still allowed of a 'strike anywhere' match, made prohibition possible.

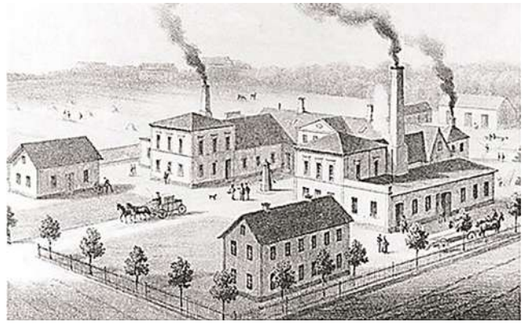
In 1898, 21 cases of phosphorus necrosis came to the knowledge of the Home Office, 15 having been contracted at one factory, all, with 3 exceptions, dating from years back but still undergoing treatment at the hands of the surgeon appointed by the firm. They had been concealed, and the firm was prosecuted for neglect to notify the cases. The occurrence led to a strong agitation for prohibition.

In the United States feeling was aroused by a report made by J. B. Andrews[1] in 1908 and 1909, under the joint auspices of the United States Bureau of Labor and of the American Association for Labor Legislation, in which, in 15 of the 16 match factories then in operation, records of over 150 cases, with 4 deaths, were collected in a short time. As the United States, on constitutional grounds, could not sign the Berne Convention, a law was passed, coming into effect in July 1913, placing a prohibitive tax of 2 cents per 100 matches made of white phosphorus, and prohibiting the importation and exportation of such matches.

231. The Berne Convention and the end of white phosphorus matches

The Växjö Match Factory Fire of 1922

In May 1922, the quiet Swedish town of Växjö was shaken by a devastating fire that tore through its match factory. At first, the blaze appeared to be a tragic but ordinary industrial accident. However, what followed turned the incident into a landmark case in chemical safety history.



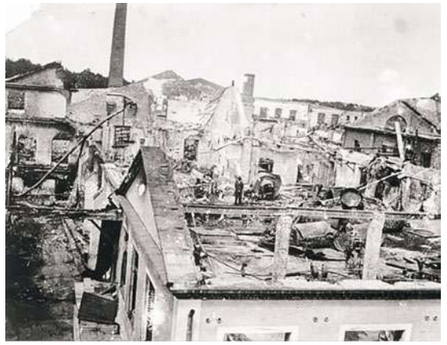
232. Växjö Match Factory, 1873; 233. Växjö Tändstickskor match label

The day after the fire, boxes of red phosphorus—moved far from the flames for safekeeping—spontaneously ignited. This unexpected combustion alarmed investigators and led to a startling discovery: the red phosphorus had been contaminated with white phosphorus, a far more volatile and dangerous substance. While red phosphorus is relatively stable and had replaced white phosphorus in match production to reduce health risks and fire hazards, the presence of even trace amounts of white phosphorus rendered it dangerously unstable.

The contamination was likely a result of poor purification during post–World War I chemical shortages, when supply chains were strained and quality control was compromised. This incident exposed the hidden vulnerabilities in industrial sourcing and the assumption that red phosphorus was entirely safe.

In response, Swedish authorities issued urgent warnings to match factories across the country. They recommended that red phosphorus be stored in hermetically sealed metal containers and kept isolated from other flammable materials. Investigations revealed that a shipment of 500 kilograms of red phosphorus had been unlawfully contaminated, prompting stricter regulations and oversight.

The Växjö fire marked a turning point in industrial chemical safety. It demonstrated that even "safe" materials could become lethal if mishandled or improperly refined. The incident reshaped how chemicals were sourced, stored, and regulated in the match industry and beyond.



234. Fire at the Växjö Match Company, 1922; 235. Splint hall, Växjö Match Company, 1922

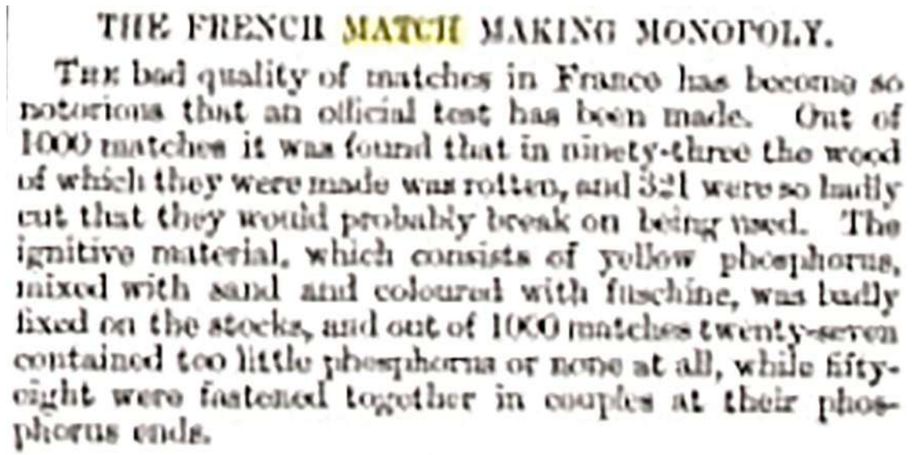
6

Locational Shifts in the Global Match Industry (1800- 1950)

Chemical Innovation and Early European Hubs (1800–1855)

The match industry between 1800 and 1950 offers a compelling lens into the interplay of chemistry, colonialism, labour, and branding. What began as a scattered artisanal craft evolved into a sprawling global enterprise, with production centres rising and falling in response to technological innovation, health reform, and imperial trade routes. This essay traces the locational shifts in match manufacturing across Europe, Asia, Africa, and the Americas, highlighting how each region's industrial identity was shaped by its engagement with fire—both literal and symbolic.

The earliest friction matches emerged in the 1820s, with British chemist John Walker's "Congreves" and Samuel Jones's "Lucifers" marking the first commercial attempts. These matches relied on potassium chlorate and antimony sulphide, igniting through friction but lacking stability. The real breakthrough came in 1830, when French chemist Charles Sauria introduced white phosphorus into the ignition mix, creating the first reliable strike-anywhere match.



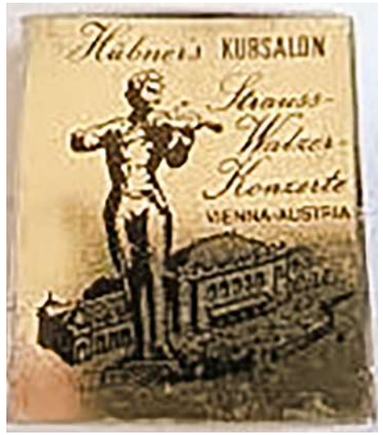
THE FRENCH MATCH MAKING MONOPOLY.

The bad quality of matches in France has become so notorious that an official test has been made. Out of 1000 matches it was found that in ninety-three the wood of which they were made was rotten, and 321 were so badly cut that they would probably break on being used. The ignitive material, which consists of yellow phosphorus, mixed with sand and coloured with fuschine, was badly fixed on the sticks, and out of 1000 matches twenty-seven contained too little phosphorus or none at all, while fifty-eight were fastened together in couples at their phosphorus ends.

236. French match industry

237. & 238. French matchbox label

Austria and Germany quickly adopted Sauria's formula, becoming early leaders in match production. Viennese factories mechanized the process, exporting white phosphorus Lucifers across Central and Eastern Europe. Austria's dominance was technical and imperial—its factories supplied matches to the Balkans and Ottoman Empire, while Germany's Saxony region refined production with precision engineering.



239- 241. Austrian matchbox labels

The matches manufactured in Austria amounted in 1849 to 50,000 cwt., of which four-fifths were consumed in the country, and one-fifth was exported. From Trieste 3,787 cwt. were shipped, viz., to

	Cwts.
Turkey – – – –	1,226
Greece – – – –	596
Malta – – – – –	432
Egypt – – – – –	382
Ionian Islands – – –	336
Naples – – – –	225
Other Countries – –	530
Total – –	3,787

That the export trade of Austria in matches is rapidly increasing, appears from the following statement of the quantities shipped on the Elbe during the last three years:—

Quantities shipped on the Elbe in	Cwts.
1848	286
1849	790
1850	1,860

As matches are not always specified in the Official Report on Commerce, it is not possible to give a detailed statement of all the quantities exported.

It is estimated that of the total production of matches in Austria, one-third is manufactured in Bohemia, and two-thirds in the factories of Vienna and its vicinity. The number of factories in Bohemia is ten; of these there are two in Prague, one of which exhibits; one at Schüttenhofen, which also exhibits; one at Budweis, one at Teplitz, one at Taus, one at Tschernosehin, one at Schönthal, one at Nahoschitz, and one at Hohenelbe. These establishments give employment to about 1,000 workpeople.

In Austria Proper there are twenty-two factories, namely, sixteen at Vienna, two of which exhibit, three at Fünfhaus, one at Schärding, one at Tulle, and one at Pottenstein; there is also one in Moravia, which likewise exhibits. The number of workpeople employed is about 2,000.

In illustration of the quantities of the different materials employed, it may be stated that a Bohemian manufactory employing 100 workpeople produces annually about 200,000 boxes, each containing 5,000 matches. It consumes annually 25 cwt. of nitre, 6½ cwt. of phosphorus, and 300 cwt. of sulphur. Calculating on these data the total amount of materials consumed in all Austria, the following numbers are obtained:—

	Cwts.
Nitre – – – – –	1,250
Phosphorus – – –	325
Sulphur – – – –	15,000

The quantity of soft wood consumed annually amounts to 5,000 *klafters* or fathoms; and it is worthy of notice that a large portion of it is manufactured into splints in Budweis, and thence sent to Vienna. About 50,000 millions of single matches are produced annually in Austria. These are made with astonishing rapidity, in consequence of the employment of a simple plane of peculiar construction; with this instrument a single workman cuts off 1,814,000 splints in a day of twelve hours.

242. Increasing production of phosphorus matches. Austria leads. Report of the Juries, Exhibition of the Works of Industry of all Nations, London, 1851

243- 245. Austrian matchbox labels

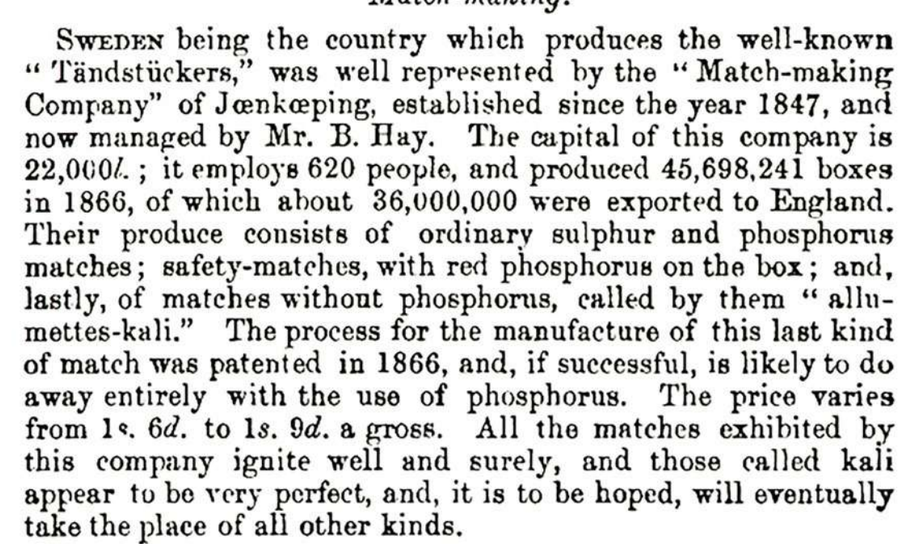
Yet this early success carried a hidden cost. White phosphorus was highly toxic, and by 1839, Austrian doctors had documented the first cases of "phossy jaw," a debilitating disease affecting match workers. The health crisis would later catalyse regulatory reform and shift production toward safer alternatives.

Industrial Expansion and Colonial Reach (1855–1890)

The invention of the safety match by Swedish chemist Johan Edvard Lundström in 1855 marked a turning point. By relocating the phosphorus to a separate striking surface and using red phosphorus instead of white, Lundström created a match that was both safer and more stable. Sweden, with its abundant timber and skilled labour, quickly became the global leader in safety match production.

Swedish firms like Jönköping Tändstickskor and Vulcan exported matches across Europe, Asia, and Africa, often customizing labels for local markets. Their lithographed designs—lions, crowns, elephants—became visual ambassadors of Swedish industrial identity.

Meanwhile, Britain's Bryant & May acquired the rights to Lundström's patent and began domestic production in London. Britain's match industry thrived on colonial logistics. Matches were exported to India, Africa, and the Caribbean, often branded with imperial motifs. Yet labour unrest simmered beneath the surface. The 1888 Matchgirls Strike exposed exploitative conditions and led to the banning of white phosphorus in Britain by 1908—a move that accelerated the shift to safety matches.



Match-making.

SWEDEN being the country which produces the well-known "Tändstückers," was well represented by the "Match-making Company" of Jœnkœping, established since the year 1847, and now managed by Mr. B. Hay. The capital of this company is 22,000*l.*; it employs 620 people, and produced 45,698,241 boxes in 1866, of which about 36,000,000 were exported to England. Their produce consists of ordinary sulphur and phosphorus matches; safety-matches, with red phosphorus on the box; and, lastly, of matches without phosphorus, called by them "allumettes-kali." The process for the manufacture of this last kind of match was patented in 1866, and, if successful, is likely to do away entirely with the use of phosphorus. The price varies from 1*s.* 6*d.* to 1*s.* 9*d.* a gross. All the matches exhibited by this company ignite well and surely, and those called kali appear to be very perfect, and, it is to be hoped, will eventually take the place of all other kinds.

246. Sweden dominating the safety match industry – 1867

Asian Emergence and Export Rivalries (1875–1930)

Japan entered the match industry in 1875, when Makoto Shimizu produced the first domestic matches in Tokyo. Inspired by a visit to Sweden's Jönköping factory, Shimizu introduced safety matches and founded firms like Seisuisha and Kouekisha. By the 1910s, Japan had become a major exporter to China, India, and Southeast Asia, rivalling Sweden in volume and label artistry.

Japanese match labels were highly adaptive, featuring crouching lions, dragons, and regional motifs tailored to each market. In India, Japanese matches were often labelled in English and Tamil, with price markings and slogans such as "Non-Poisonous Wax Safety Matches." This localization strategy helped Japan penetrate colonial markets dominated by British and Swedish firms.

Foreign matches, in future, instead of being supplied to us from Swedon, will apparently come all the way from Japan. The competition of the Orientials has already, it is said, destroyed the European match trade in India, China, and Hong-Kong, and will soon assert itself in the United States. After supplying their home market, the Japanese are able to send 2,500,000,000 boxes to the rest of the world, Asia, of course, taking most of this surplus output. Osaka, where an American syndicate has purchased one of the numerous factories engaged in the manufacture, produced last year 100,000,000 dozen boxes of matches, giving employment to 3,629 men and 9,711 women, besides thousands of children, who earn a few son per day in the work. The sticks are cut by machinery, sifted into little boxes by women, and collected and put in frames by the picayunes. The sulphur and paraffin are put on in hand-presses, and the smeared points, are then dried in the sun. The boxes and labels are made by little girls, who are extremely dexterous in the work. When it is mentioned that these little experts get from ½d. to 2½d. for twelve hours work, or an average, perhaps, of about 6d. per week, all hopes of Europeans matching the Japanese in this line must be given up.—*Financial News.*

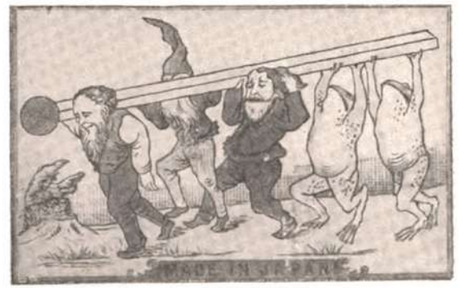
247. Sweden faces Japanese competition, 1897

JAPANESE MATCH-BOX LABELS.

EVERYONE who has read Anatole France's delightful book "Le Crime de Silvestre Bonnard," will remember the prince and princess who were so surfeited

with wealth, and all that wealth could give, that they would have found life unbearable had they not suddenly developed a taste for collecting match-boxes, or, rather, match-box labels. This gave them quite a new interest in life, and in the pursuit of a rare specimen they were ready to plunge into the most dreaded resorts of Corsican brigands.

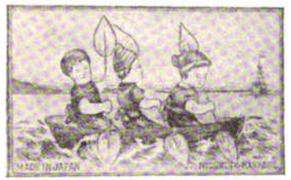
Probably when M. Anatole France wrote his novel, he never seriously contemplated the collection of match-box labels as ever likely to become a popular hobby; but, although the mania has hardly spread to England, in India, the Straits, China, and Japan there are hundreds of collectors among our countrymen of the match-box label. The art of designing pretty labels for match-boxes may be said to have originated in Sweden, for our great English manufacturers, Messrs. Bryant and May, were for years content with the appropriate but simple design of the Ark of Safety, with the well-known inscription, "Light only on the box." This sentence, by the way, a Calcutta Baboo has adopted for his family motto, probably confounding it with "Heaven's light our guide." The Japanese, however, have made the art of match-making especially their own. They commenced by barefaced and colourable imitations of the Swedish matches and marks, but they now certainly command the Eastern market. Their matches are every whit as good as the Swedish ones, and in the matter of match-box labels, with which we are more immediately concerned, they show no end of fantastic, if not artistic, imagination, as our designs will show. For the Eastern collector the Calcutta Bazaar holds out great facilities. For a very trifling sum it is possible to obtain from the vendors of matches in Canning Street a hundred or two of specimens in one day. In Calcutta the craze for these collections has spread so much that a class of match-box brokers has arisen among the natives, but they



make their living not from the sale of what we should consider rarities, but from selling European or American labels. These match-brokers board every steamer as she

248. Japanese matchbox labels, The English Illustrated Magazine, 1896

arrives in the Hughli from a Western port and chaffer with the sailors for the match-boxes they may have brought with them



from London, Glasgow, and Liverpool; and these empty boxes, for the sake of the label, often fetch in Calcutta or Bombay about one hundred times the value of the full box when it was sold in England. A collection of about one thousand different match-box labels was recently sold in Calcutta for the respectable sum of six hundred rupees, or about forty pounds. This form of "collecting" has not made much headway in England at present; but there is no knowing what may happen, and there is no doubt that the labels can be mounted in an album with far more effect than postage-stamps. Anyone who has seen a collection of the Japanese labels will acknowledge that far more pains have been taken to make the plain little match-box attractive than has ever been attempted in our country, where the article has only been considered from the useful point of view, and not from the ornamental.

The prince and princess of the romance referred to were haunted by the dread that their collection would some day be complete, and that they then would have nothing more to live for. If they had

heard of Japanese labels they might have kept their minds easy on this score, for there seems to be no end to the designs of the Japanese match-manufacturers.

Chambers's Journal
SIXTH SERIES.

'MADE IN JAPAN.'

THE wonderful trade advances that have been made by Japan since the conclusion of the war with China should make our manufacturers and merchants keep their eyes open, or they may find some morning their occupation gone in markets they thought they had secured. This enterprising people has in the past two years almost secured a monopoly in the Eastern markets of the match-trade. Some twenty or twenty-five years ago the import of matches in India and Burma was largely English and exclusively European. English imports gradually declined, being replaced by Swedish matches. These in their turn are being ousted by the Japanese match, equally good and sold at fifty per cent. lower prices. In Burma, a province which last year imported matches of a value of over five lakhs of rupees, or some £33,000, Japanese matches are almost exclusively used now. They pay an import duty of five per cent., and yet can be purchased retail in the streets of Rangoon at one anna, or about one penny, per bundle of ten boxes. The English match ten or fifteen years ago cost in Rangoon about five times as much, and at that time there was no import duty. Burma is a very damp country, with an annual rainfall varying from 100 to 200 inches. The English match in the rains was difficult to burn. If the box was kept in flannel it would ignite; but the wood of the match was thick and generally damp, and failed to keep alight. The Swedes first, and afterwards the Japanese, saw what was required, and made a thinner match, thus using less wood, and meeting the requirements of a province with a moist climate. Between them they have ousted the British match altogether; and a trade in this single Eastern province alone of a yearly value between £30,000 and £40,000, which will probably be doubled when the Rangoon and Mandalay Railway is extended to the borders of China (as it will be before the end of 1899), has been lost to England, probably never to be regained. The loss of the match-trade in India may be a small thing to grieve over, but where a single province of that great dependency takes in a year over £30,000 worth, manufacturers' profits must be something tangible over the whole area. In Burma and the surrounding countries nearly every man, woman, and child smokes, and matches are now to be found in the remotest Burman, Shan, and Karen hamlets hundreds of miles from the coast or railway communication. No jungle man or woman fails to provide himself or herself with a box of matches when they are so cheap. Their forefathers either borrowed a light from a fireplace in a neighbouring hut or procured fire by rubbing briskly two pieces of dried bamboo together, with some dried bamboo shavings—a process the writer, when foresting twenty years ago, often saw applied at an encampment on a wet night before supplies had been brought up by elephants, or when, as was often the case, the thick English match of that period was too damp to strike successfully.

Umbrellas, which were largely manufactured locally of oiled paper, are being supplanted also by Japanese articles, excellent copies of the European umbrella; and these are sold in the Rangoon bazaars at one rupee and four annas each, or about one shilling and eightpence. Similar umbrellas, before Japan took to manufacturing them, cost at least four times the price in Burma, and in this article, as in matches, no European country apparently can hope to compete with the Japanese in producing an equally good-looking and low-priced umbrella. The Burmans are largely taking to the imported umbrella, whilst their own paper umbrellas are often patronised by Europeans as a good protection against sun and rain; although they are not so convenient to carry unopened as the ordinary umbrella, as they are too bulky when closed to be used as a walking-stick. The local article can be bought for eight annas, or about eightpence, and if carefully used lasts for one rainy season.

Bicycles and sewing machines of Japanese make at half European and American prices have also

No. 11.—Vol. I. Feb. 12, 1898.

249. *Japanese competition, 1898*

been imported into Burma from the Straits. Doubtless before long we shall have Japanese merchants, and possibly a Japanese bank, established in Rangoon. Several cargoes of rice have already been sent from the Burman rice ports to Japan; and that astute people will doubtless soon realise that the best way to push their manufactures and the cheapest way to buy their rice cargoes is to have Japanese firms established at the rising capital of Rangoon, where there will soon be railway communication to the confines of China itself, with its hard-working millions of population. Japanese clocks are now sold throughout the East; and Japanese coals are highly thought of in Bombay.

Whilst Englishmen offer equal advantages to every nationality in trade with the East, it is not a pleasant sight for Englishmen to see British trade passing away into the hands of the foreigner resident in British possessions.

'A fair field and no favour' is a good motto, and one that in trade in British dependencies we have always endeavoured to carry out. If Japan can undersell us and make equally good articles, we cannot hope to persuade the consumer to buy English articles because they are English. An opposite policy has not proved such a success in Saigon and French Cochin China that we should ever think of or wish to imitate it. The British manufacturer may rest assured it is more difficult to regain a lost trade than to keep an existing one. By having trustworthy agents on the spot, and by altering his manufactures where they do not meet the wishes and wants of his customers; by being obliging and courteous, in fact; and by having his goods always up to sample, he may hope, even in these days of keen competition, to do a good trade. But he must not lose sight of the fact that times have altered a great deal in the last quarter of a century, and that he has many competitors now where formerly he enjoyed almost a monopoly. Under such circumstances, if he wishes to keep and extend his trade in the East, he must prove that he can, like his competitors, adapt himself to circumstances, and not expect his Eastern customers to alter their habits and customs to suit him. In short, the best manufactures will win the most markets, and best includes goodness of the article as well as economy in price. We have a good many brisk competitors in Germany, Belgium, and other European countries, not to speak of the Americans, all quite alive to the exigencies of the hour. But probably in the next quarter of a century we shall find articles 'Made in Japan' imported all over the East to a much greater extent than they are now; and it is to be hoped that we shall not have them (as in the match-trade) eclipsing British manufactures.

JOHN BURNET OF BARNS.

CHAPTER XIII.—OUR ADVENTURE ON THE ALPHEN ROAD.

WE rode in silence for maybe half-a-mile, while I turned over the events of the evening in my mind and tried to find some way out of the difficulties in which by my own folly I found myself placed. Nicol looked steadfastly before him and said never a word. By-and-by I found the desire for some one to speak with so overpowering that I up and asked him if he had heard aught of the events of the evening.

'Ay, sir,' said he. 'I heard ye had some kind o' stramash, but that was a'. I trust ye're weel oot o't.'

'Have you heard of my cousin Gilbert?' I asked.

'The Wastland lad wha used to come aboot the Barns? Oh ay! I've heard o' him.'

'I flung a glass at his face to-night,' said I.

'I hope, sir, that he flung anither at yourself,' he said anxiously.

'No. He swallowed the insult and left soon after. He is not the man to let me off so easily.'

'Whew,' said Nicol, 'but that's bad. Wad ye mind, laird, if I rode on afore ye?'

'Why?' I asked.

'Cousins and sodger-folk are kittle cattle,' says he. 'I wadna wonder noo but that Maister Gilbert were ahint a dyke. I've heard tell o' some o' his pliskies in his ain land, and he's no' the lad to let a midge stick in his throat.'

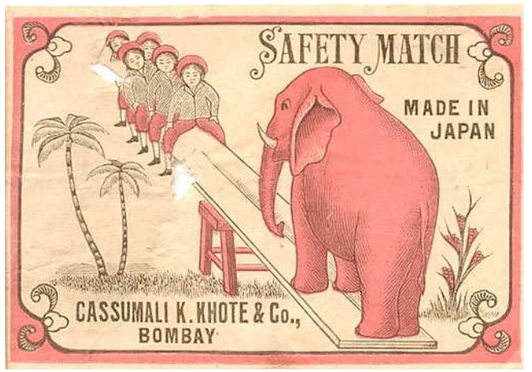
I drew up my horse angrily.

'Nicol,' I cried, 'you are intolerable. My cousin is a gentleman of birth, and do you think he is the man to kill from a dykeside? Fie on you! you have the notions of a common roost-robber.'

'Weel away then, laird,' cries he. 'So be it; but I've little faith in your Gilberts for a' their gentrice. I ken their breed ower weel. But I maun ride afore ye, for there are some gey rough bits on the road, and I'm a wee bit mair sure in the saddle than yoursel', wi' a' respect to your lairdship.'

So the wilful fellow must needs ride before me, looking sharply to the right and left as though we were in far Muscovy instead of peaceful Holland.

As for me, I felt in no humour to listen to my servant's tales or do aught than think dolefully on my own matters. The sight of my



250–255. *Japanese matchbox labels*

India itself began producing matches in the 1910s, with Japanese immigrants establishing factories in Calcutta. By the 1920s, the southern town of Sivakasi emerged as a global hub, combining cottage labour with semi-mechanized production. Indian matches were exported across Africa and the Middle East, often featuring deities, animals, and rural scenes. The matchbox even became a canvas for the freedom struggle, regional identity and economic aspiration, apart from the mundane.

Other Centres and State Monopolies (1885–1950)

South Africa's match industry began in 1885 with the opening of a factory in Port Elizabeth. The Lion Match Company, founded in 1905, became the dominant producer, integrating forestry operations to supply matchsticks. Its iconic lion logo and bold packaging made it a household name across southern Africa and Mozambique.

In Turkey, match production was initially fragmented, with imports from Austria and France. By the 1920s, the Turkish government nationalized the industry under TEKEL, creating a state monopoly that controlled branding and distribution. Labels featured crescent moons, state emblems, and uniform typography—reflecting bureaucratic centralization.

China's match industry took off in the 1920s, especially in Shanghai, where dozens of factories—many Japanese-owned—produced matches for domestic and export markets. Chinese labels often featured revolutionary imagery, folk art, and patriotic slogans. After 1949, match production was nationalized, and branding became a tool of ideological messaging.

Decline and Consolidation (1930–1950)

By the 1930s, global match production was consolidating. Swedish Match AB formed a transnational monopoly, acquiring stakes in British, Dutch, and American firms. The rise of disposable lighters and electric ignition began to erode match demand, especially in urban markets.

In Britain, the last match factory closed in 1994. In the U.S., matchbooks became advertising tools rather than essential commodities. In Japan, match production shifted toward artisanal and aroma-infused products. India remained a global leader, but automation and labour reform began reshaping its cottage industry.

The match industry's locational shifts—from Vienna to Jönköping, Tokyo to Sivakasi, Port Elizabeth to Shanghai—mirror broader patterns of industrial rise and ethical reckoning. Each region's engagement with fire reflects not just chemistry, but culture, labour, and the politics of visibility.

Table: Comparative Table: Match Industry Dominance by Era (1800–1950)

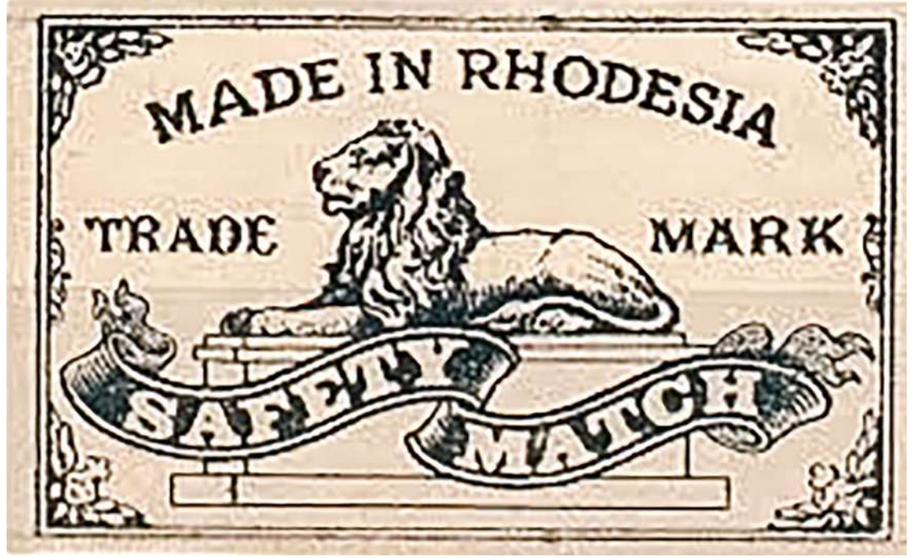
Period	Dominant Countries	Match Type	Key Drivers of Dominance
1829- 1830s	England	Early friction matches (Lucifers)	Samuel Jones commercializes Holden's formula; first branded matches
1800- 1830	France	Early friction matches	Charles Sauria's white phosphorus formula (1831)
1830- 1855	Austria, Germany	Lucifer matches (white phosphorus)	Early mechanization, imperial trade routes
1855- 1870	Sweden, Britain	Safety matches emerge	Lundström's red phosphorus safety match (1855); Bryant & May's rise
1870- 1890	Britain, Sweden, USA	Mixed production	Mass production, branding, export networks
1890- 1910	Sweden, Japan, Britain	Safety matches dominate	Swedish Match's global expansion; Japan's export boom to India & China
1910- 1930	Japan, India, Sweden	Safety matches	Japan and India dominate Asian and African markets
1930- 1950	India, South Africa, Turkey	Safety matches, state monopolies	Cottage industry, forestry integration, nationalized branding

Across the 19th and early 20th centuries, regional match industries emerged—each shaped by local resources, trade routes, and cultural aesthetics. Their trajectories reveal how matches became vessels of national aspiration, visual storytelling, and economic flux.

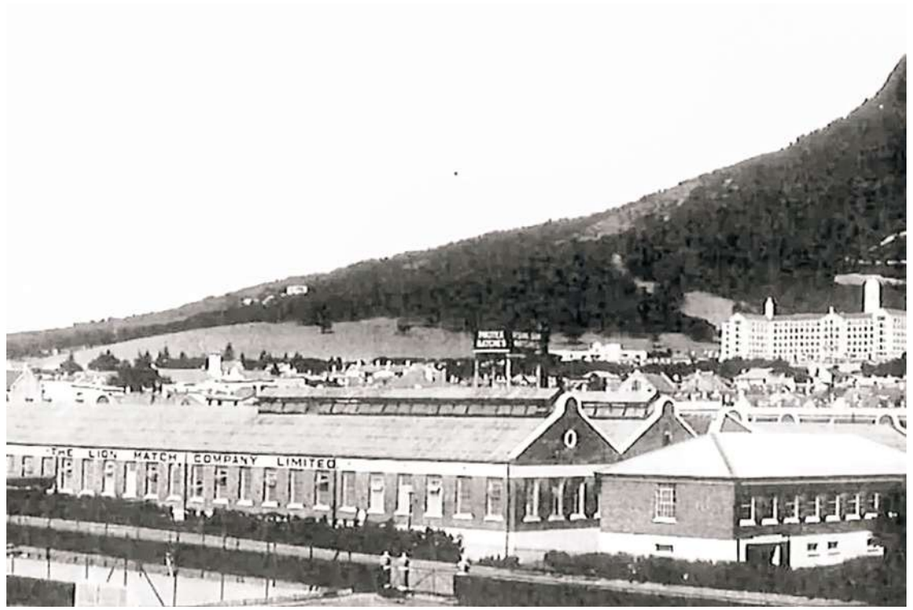
256- 258. *Dutch matchbox labels*

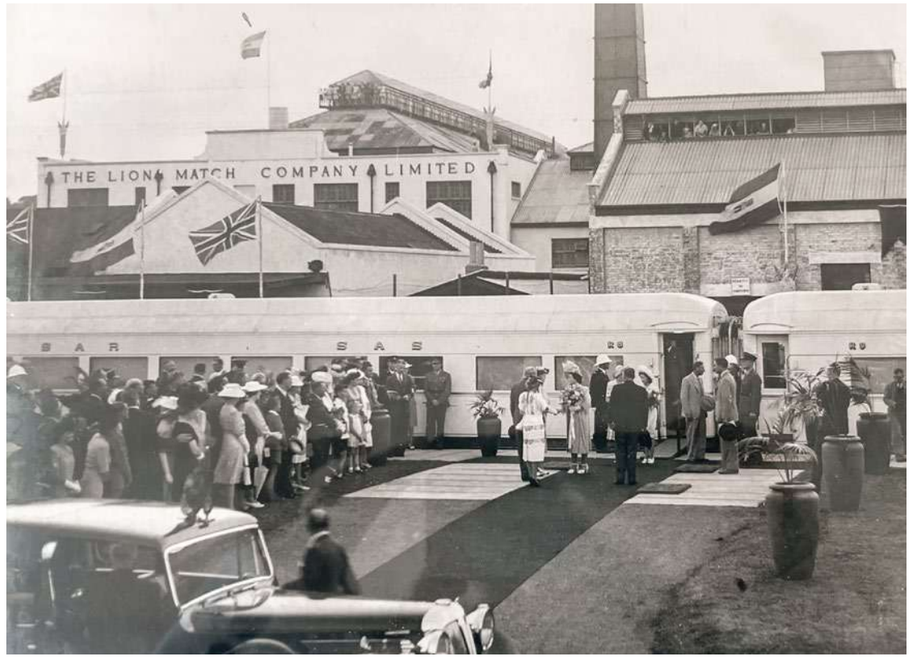
259. *Indian matchbox label*

260- 262. *Indian matchbox labels*



263. *Matchbox label - Rhodesia*





264. & 265. South Africa, The Lion Match Co. Factory

266. The Lion Match Co., South Africa – 2

267. Brazil matchbox label

Nevertheless, I am of course as desirous as any one can be to see the exports from the United States to Brazil increased as much as they profitably can be increased, and it is desirable that all who have a similar wish, and especially those who are directly engaged in trade, should have a clear view of things that tend to promote or obstruct such export business. It is a good deal a question as to how well Americans can compete with Europeans, inasmuch as at present by far the greater part of Brazilian imports are from European countries. The Brazilians, we must remember, are a Latin race. Descendants of the Portuguese, their language is the Portuguese, the construction of which is much like the French, and, next to the country of their origin, their ways of thought and habits are borrowed largely from the French. For nearly four centuries ships have been sailing between Lisbon and Brazil, over a gentle sea, favored by the trade winds, and communication with Europe is altogether more natural and common for the Brazilians than with the United States. They have occasion, probably, to think of Europe a hundred times to where they think of the United States once. Still, I do not suppose that sentiment of race or nationality has much to do with trade. The Brazilians buy considerable wine from Portugal, and for the same reason that other people do—not because they like Portugal, but because they like the wine. Probably half the Brazilians smoke cigarettes, and hence use a great quantity of matches. Every match used in Brazil is made in Sweden, though the trade returns would show they are imported from Germany. The Swedish safety match is made of light poplar wood and has no competitor. Yet probably not one Brazilian in a thousand who uses these matches knows or cares where they are made. So with the American flour, of which the hard-crusted rolls are make which in the principal seaport towns appear every morning on the breakfast table of every Brazilian, from the Emperor down—it concerns the consumer very little that they are of American flour so that they are really good. In like manner, the colored servant girl (as well as the person of fashion) who perfumes her hair with American "Florida water" does not mind its being an American product. It would be the same to her if it came from Japan or Madagascar.

National preference, however, may make some difference with those who conduct import trade. Foreign commerce is represented in the leading ports of Brazil by hundreds of Europeans to one American, who naturally are inclined to favor trade with their home countries. The Europeans, likewise, have more aptitude than Americans for foreign trade. The latter have generally found a sufficient field for their enterprise in the new States and Territories of the West. In all the North American States one language only is used. On the continent where the European was brought up a dozen different languages are used. For the purposes of trade the American has not been accustomed to know any other language than his own, but the European, both from the competition in his crowded country and from habit, has in boyhood acquired some practice in one or two foreign languages, and is for this reason better fitted than the American for engaging in foreign trade.

268. Brazil; European match companies dominate, 1886

269- 271. Türkiye TEKEL Kibriti matchbox labels

The manufacture of matches is a new industry to find a place amongst trades carried on on an extensive scale. Formerly, in Scotland at least, it used to be a handicraft practised by beggar women and old men, successors of the 'gaberlunzie' beggars of a previous age, and it was followed very much as a cover for begging. There are now match manufactories in many of the towns of Finland. The oldest of these is the match manufactory of Sofiegarten, near Björneborg, which, some twenty years ago [1863], was one of the largest establishments of the kind in Europe, and, according to Finnish report, the most renowned both for the quality and the quantity of its

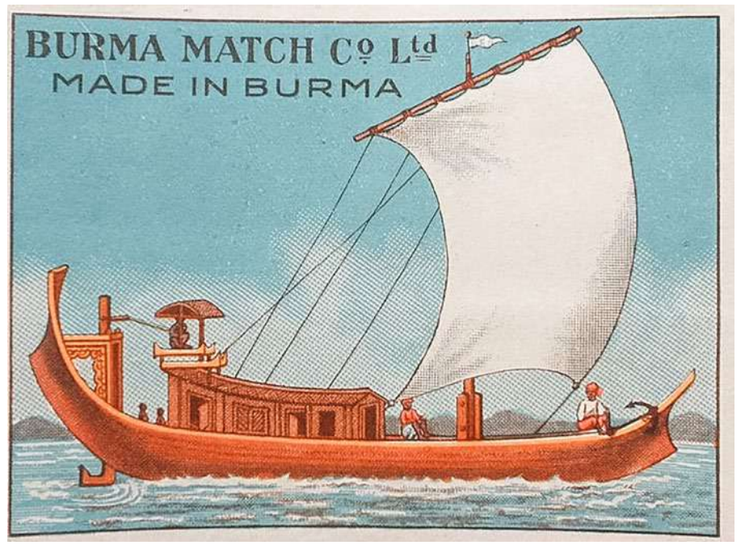
products. The Björneborg matches were formerly exported in great quantities to all countries. Previous to 1875 the manufacture had become greatly reduced. In that year there were produced 15,978 cases of 1000 boxes each of matches of all kinds, valued at 261,700 marks. The establishment gave employment to 30 men, 170 women, and 60 children under 15 years of age. The six other match manufactories then carried on—two at Tammerfors, one at Nystad, one at Jakobstad, one at Helsingfors, and one in the parish of Kupio—were on a smaller scale. These manufactories amply supplied the requirements of the country, and furnished yearly a certain quantity of products, but this has been gradually reduced. The exportations were :—

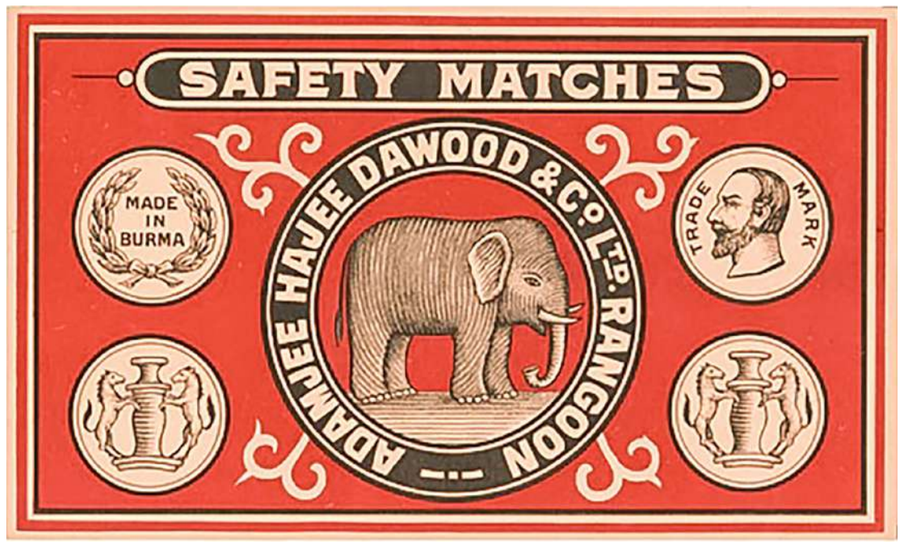
1870,	- - - -	40,167 cases.
1871,	- - - -	9,541 ,,
1872,	- - - -	13,156 ,,
1873,	- - - -	12,057 ,,
1874,	- - - -	5,550 ,,
1875,	- - - -	7,614 ,,

The value of the matches manufactured in 1873, according to the official report of the Directory of Manufactures, was 278,505 marks.

272. Finland match industry, 1883

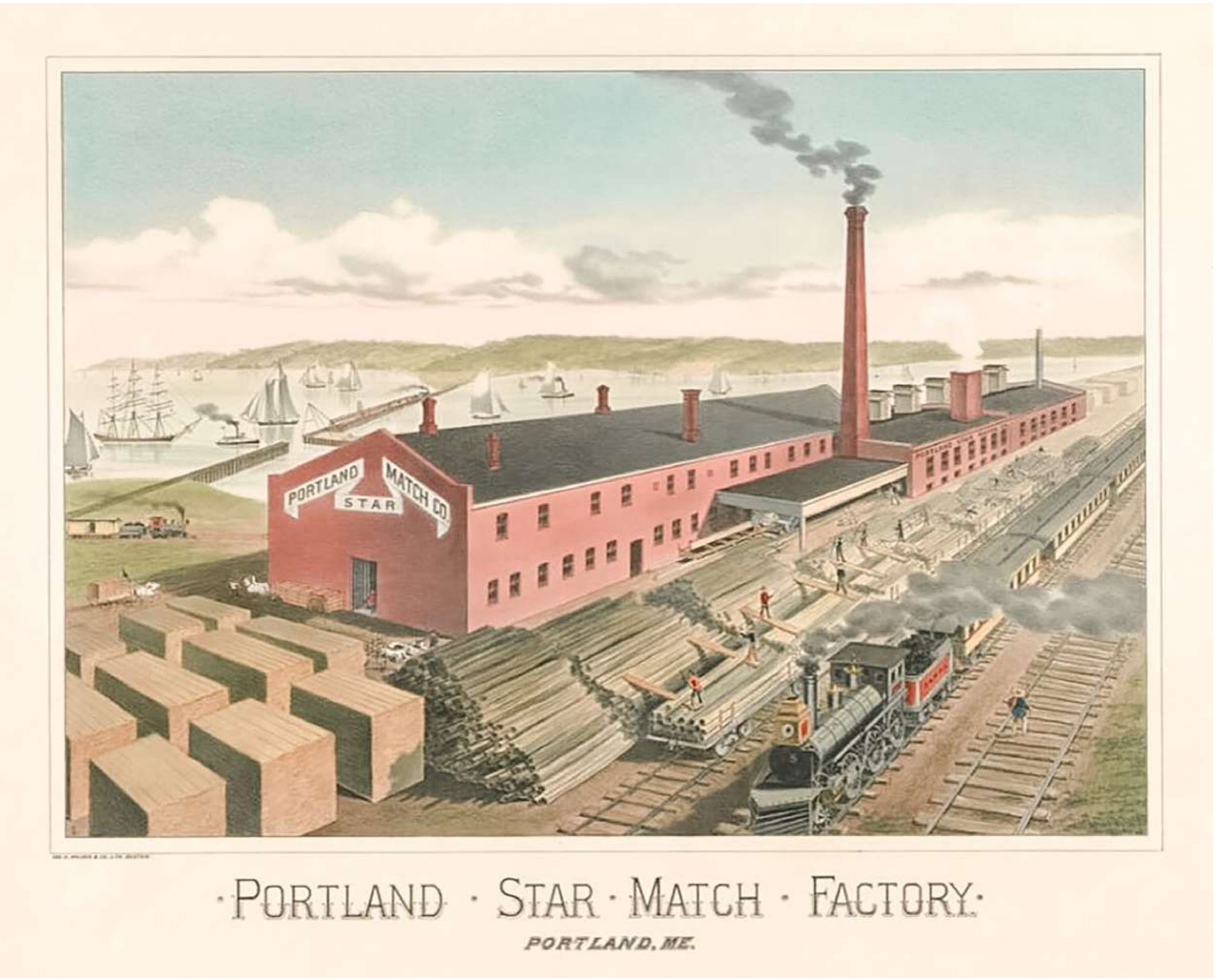
273. & 274. Finish matchbox labels





275- 277. *Burmese matchbox labels*

278- 280. *US matchbox labels*



281. The Portland Star Match Factory, 19th century. A fire destroyed the original factory near Back Cove in 1869.

282. Diamond Match Company, factory at Akron

283. & 284. Early Diamond matchbox labels

Netherlands
Dutch match production flourished in cities like Tilburg and Amsterdam, with firms such as De Zwaluw (The Swallow) exporting to colonial markets. Dutch matchboxes often featured maritime and exotic motifs, reflecting the Netherlands' global reach. Yet by the mid-20th century, Dutch firms faced consolidation pressures and were gradually eclipsed by Swedish and Asian producers.

Brazil
Brazil's match industry surged in the early 20th century, leveraging abundant timber and a growing urban consumer base. Brands like Fiat Lux ("Let there be light") blended Catholic iconography with modernist design, creating a uniquely Brazilian visual language. However, economic volatility and reliance on imported machinery led to fragmentation, and by the 1970s, many firms had folded or been absorbed.

Finland
Finland's match industry was modest in scale but rich in advertising innovation. Finnish firms embraced graphic design and promotional campaigns. The boxes weren't just functional—they were miniature billboards, often tied to national holidays or consumer promotions. Despite early adoption of Swedish safety standards and exports to Russia and the Baltics, Finland's industry declined post-WWII due to rising competition and limited mechanization.

Burma (Myanmar)
Under British colonial rule, Burma developed a small but symbolically potent match industry. Burmese matchboxes featured Buddhist imagery and local fauna, serving both domestic and regional markets. After independence, state control and lack of modernization led to stagnation, and by the 1980s, Burmese production was largely replaced by imports.
The story of matches is not confined to these countries. Almost every country in the world has a story to tell of their own match industry.

USA
Early American match production was fragmented, with dozens of small manufacturers operating across the country. By the 1860s, the industry was booming, with over 75 match plants operating nationwide. However, competition and technological advancements began to consolidate the market. Mechanization favoured larger companies, and many smaller firms struggled to survive.

Amid this consolidation, one company rose to dominate the American match industry: the Diamond Match Company. Founded in 1853 by Edward Tatnall in Wilmington, Delaware, the business gained momentum when it was acquired by O.C. Barber in 1880 and rebranded as Diamond Match in 1881. Under Barber's leadership, Diamond Match rapidly expanded, absorbing competitors and establishing factories across the country—from Ohio to New York to California.

Diamond Match became synonymous with matches in the United States. Its influence extended beyond manufacturing; Barber used the company's success to develop the city of Barberton, Ohio, and even launched the Diamond Rubber Company. By the early 20th century, Diamond had ventured into international markets and diversified into related industries, including lumber, paper products, and plastics. Today, Diamond Match remains a recognizable name, now owned by Royal Oak Enterprises, and continues to produce matches and related products.

Overseas Distribution of Matches

By the late 19th and early 20th centuries, matches had become a quintessential export commodity, distributed across Asia, Africa, and Latin America by a constellation of manufacturers. Swedish firms—most notably Jönköpings Tändsticksfabrik, Vulcan, and later Svenska Tändsticks AB (STAB)—dominated colonial markets with safety matches branded for local appeal, often featuring elephants, tigers, or ships on their labels. Japanese producers entered the fray in the 1920s, offering competitively priced matches with vibrant packaging, challenging Swedish hegemony in India and Southeast Asia. British and French manufacturers also maintained footholds, but it was the visual language of the matchbox—medal imprints, multilingual slogans, and symbolic imagery—that enabled these tiny boxes to traverse linguistic and cultural boundaries. Distribution networks relied on shipping agents, colonial intermediaries, and local wholesalers, embedding matches not just in commerce but in everyday life, ritual, and visual memory.

Matchboxes as a Medium for Product Advertisements

In the age before mass media saturation, matchboxes served as miniature billboards—portable, affordable, and visually arresting. Manufacturers used them not only to brand their own products but also to advertise everything from soap and sewing needles to bicycles and political campaigns. Their compact format and daily utility made them ideal for reaching a wide audience, especially in colonial and rural markets where literacy was limited but visual recognition was powerful. Labels featured bold typography, vivid illustrations, and multilingual slogans, often tailored to local tastes.

7

The Rise and Decline of the Swedish Match Syndicate

From Forests to Formulas

The story of the Swedish Match Syndicate [5] begins not in boardrooms, but in the quiet forests of Småland. In the mid-19th century, Sweden possessed two critical resources for match production: abundant aspen wood and a growing class of chemically literate entrepreneurs. The invention of the safety match by Johan Edvard Lundström in 1855 marked a turning point—not just for Sweden, but for global ignition and fire-making.

Unlike the toxic white phosphorus matches that dominated Europe, Lundström's design separated the reactive components: potassium chlorate in the match head, and red phosphorus on the striking surface. This innovation drastically reduced accidental ignition and worker illness, especially the dreaded "phossy jaw." Sweden's safety match was not only safer—it was marketable, and it quickly became a symbol of industrial ethics and national pride.

Early manufacturers like Jönköping Match Factory and Vulcan in Tidaholm began exporting matches across Europe and Asia. Their boxes bore ornate lithographed labels—lions, crowns, elephants—designed to appeal to foreign markets. These labels weren't just decorative; they were strategic visual identities, tailored to colonial tastes and regional symbolism.

Birth of the Syndicate

By the early 20th century, Sweden's match industry was thriving—but fragmented. Dozens of small firms competed domestically and abroad, often undercutting each other's prices. Enter Ivar Kreuger, a charismatic financier and engineer who saw in matches the perfect vehicle for industrial consolidation.

In 1917, Kreuger orchestrated the merger of Sweden's largest match producers into a single entity: Svenska Tändsticks Aktiebolaget (STAB), known internationally as Swedish Match AB. His vision was bold: to create a global monopoly on match production, controlling not just manufacturing, but distribution, branding, and even national and international supply chains. Kreuger's strategy combined financial leverage with political diplomacy. He offered loans to

[5] *Or Swedish Match Trust or Swedish Match Cartel*

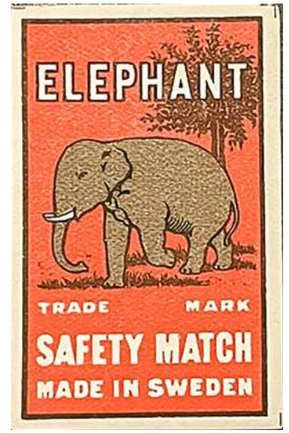
struggling governments—Germany, France, Poland, and others—in exchange for exclusive match concessions. These agreements gave Swedish Match the sole right to produce and sell matches in entire countries, effectively turning fire into a state-sanctioned commodity.

By the late 1920s, Swedish Match controlled over 60% of global match production, with factories in Europe, Asia, Africa, and the Americas. Its labels adapted to local markets: Allumettes Suédoises in France, Schwedenhölzer in Germany, Crouching Lion in Japan, and Elephant Brand in India. The matchbox became a portable ambassador of Swedish industrial identity, blending safety, quality, and visual appeal.

285. & 286. Svenska Tändsticks Aktiebolaget

287. Svenska Tändsticks Aktiebolaget; 288. Allumettes Suédoises, France

289. Allumettes Suédoises, France; 290. Schwedenhölzer, Germany



291. Crouching Lion, Japan; 292. Elephant matches, India

DEPARTMENT OF COMMERCE

R. P. LAMONT, Secretary

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

O. P. HOPKINS, Acting Director

REPRESENTATIVE INTERNATIONAL CARTELS, COMBINES AND TRUSTS

BY

WILLIAM F. NOTZ

TRADE PROMOTION SERIES—No. 81

Price 15 Cents

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1929

293. International Match Trust - Representative International Cartels, Combines and Trusts, 1929

B. INTERNATIONAL MATCH TRUST

The Swedish match trust represents a unique example of an international enterprise which controls the major part of the world's supply of a household article of general consumption.

The method of organization of this international concern is equally unique. A parent company, domiciled in Sweden, the Svenska Tändsticksfabriks A. B., forms the heart of a network of business interrelations, world-wide in extent. Through various holding companies this concern controls about 150 match factories in 35 different countries.

The whole undertaking also functions more as a combine or trust, for numerous agreements covering such matters as production, exports and imports, and prices, link together various units within the larger organization.

A third feature consists in the acquisition of monopoly concessions for the production or sale of matches in a number of countries in return for financial loans. This latter phase of its business activities is part of a policy of expansion along vertical lines and includes financial participation in banks, real estate, and mining and manufacturing enterprises. It is estimated that at the present time the combine holds an interest in from 70 to 75 per cent of the total world production of matches and that it has financial resources approximating 1,000,000,000 Swedish crowns. (Par value of krona, or Swedish crown, is 26.8 cents.)

CAUSES OF GROWTH

The phenomenal growth and influence of the Swedish match trust is attributed largely to the following three factors: An efficient and well-trained domestic labor supply, Swedish inventions, and leadership in matters of organization and finance.

In the 75 years since the match industry has been in existence in Sweden a large, skillful, and trained class of workers has grown up there who have well-developed traditions and experience in the handling of machinery used.

The Swedish match industry is located mainly in small provincial towns, where a class of skilled workers grows up. In this way the industry has become closely tied up with and is governed by local labor conditions.

PIONEER MANUFACTURERS

The names of five men are closely identified with the history of the Swedish match industry: Pasch, the inventor of the safety match; Lundström, the promoter; Hay, who gave to the plant at Jönköping its world reputation; Löwenadler, who, in 1903, merged seven of the leading manufacturing plants into the Jönköping-och Vulkan Tändsticksfabriks A. B.; and Ivar Kreuger, the founder and present head of the Swedish match trust.

COMBINES FORMED BY KREUGER

In 1913 Kreuger organized the A. B. Forenade Svenska Tändsticksfabriks, a combination of the eight plants not affiliated at that time with the above-named Jönköping concern.

During the World War the new company acquired a series of plants through which it has become self-sustaining with regard to the necessary raw materials, and on December 7, 1917, it was merged with the Jönköping concern into the Svenska Tändsticksfabriks A. B.

The latter company, which was capitalized at 45,000,000 crowns, acquired stock control of the two older concerns and was made a holding company. It ultimately became the dominant concern in the match industry of the world. This company owns or controls 20 match factories in Sweden at the present time. Its share capital now amounts to 270,000,000 crowns.

Kreuger next formed a superholding company, the A. B. Kreuger & Toll, Stockholm, which has a controlling stock interest in the earlier holding company, the Svenska Tändsticksfabriks A. B., as well as in numerous other enterprises of an international character, including Swedish power plants, Finnish construction concerns, and large real-estate undertakings.

In 1919 a subsidary, the American Kreuger & Toll Corporation, was formed, which developed into an extensive sales distribution agency not only for Swedish matches, but also for various new foreign specialties, chemicals, drugs, and other commodities.

VERTICAL EXPANSION

Prior to the World War the Swedish match industry was dependent upon foreign countries to a very large extent for its supply of raw materials, especially aspen wood and chemicals. During the war, it became necessary to develop domestic sources of supply of raw materials. The Förenade Svenska Tändsticksfabriks, for instance, built a plant of its own for manufacturing match machinery, also for lithographing, and, jointly with the Jönköping concern, established electrochemical works. It also acquired extensive forest rights and even purchased a majority of the stock of a shipping concern.

This vertical expansion was continued so that the Swedish match industry now is virtually independent of foreign supplies and, besides, has almost a monopoly in the manufacture of machinery for manufacturing matches.

MARKETING POLICY

Swedish match manufacturers have consistently followed a policy of keeping the foreign marketing of their products in their own hands. In line with this policy they have eliminated the middleman and developed their own sales organization in foreign countries, including India, where a specially well organized system has been established. Considerable capital was required for the setting up of this marketing machinery, but the resulting business expansion is said to have fully warranted this heavy investment.

FOREIGN MARKETS

The chief foreign market of the Swedish match industry is England, which in 1926 imported 7,797,564 standard gross of 10,000 matches. There is considerable reexporting from England.

FOREIGN BRANCH PLANTS

The Swedish match industry began to penetrate foreign markets and to acquire property rights in foreign plants prior to the World War. Its rapid international expansion, however, falls mainly in the years following the formation of the Svenska Tändsticksfabriks A. B., in 1917.

Prior to the war the Swedes operated branch plants in England and Finland.

GREAT BRITAIN

The English match business was originally dominated practically by two groups of interests, one of which was Bryant & May (Ltd.) and the other J. John Masters & Co. (Ltd.), owned by the Swedish match interests.

Altogether there are 17 firms engaged in the manufacture of matches in the United Kingdom. Of these, the following are affiliated with Bryant & May (Ltd.) (with plants in London, Liverpool, Glasgow, and Leeds, also in Australia, New Zealand, Canada, South Africa, and Brazil): Premier Match Co., London; G. M. Judd & Bros. (Ltd.), London; S. J. Moreland & Sons (Midland Match Works, Great Bridge); W. O. Morgan & Co., Manchester; Hunt (Ltd.), Bristol; Maguire, Paterson & Palmer (Ltd.), Liverpool and Leeds; J. Palmer & Son, London; Paterson & Co., Dublin; R. Bell & Co., London; Bristol Match Co.

The Swedish interests own the following firms: J. John Masters & Co. (Ltd.), Abbey Works, Barking (formerly the Vulcan Globe Match Co.); Hargreaves & Clegg, Heywood; Scottish Match Co., Partick, Glasgow.

During the past three years the expansion of the Swedish interests in the British market has been such that the Bryant & May group, which formerly supplied about 60 per cent of the total domestic consumption, now furnishes only about 30 per cent.

For some time past both groups have been cooperating together in the form of a trade association, known as the Society of British Match Manufacturers, which, while largely concerned with general trade matters, also dealt with prices. During 1927 negotiations were conducted between the two groups for the purpose of establishing a still closer community of interests, with the result that an agreement was reached, to take effect on January 1, 1928.

Under this agreement there will be established what practically amounts to a monopoly of production of matches in the United Kingdom. A new company is to be formed, known as the British Match Co. (Ltd.), with a capital of £6,000,000 in shares of £1 each; 4,189,548 shares are to be allotted to the existing Bryant & May

36913°—29——3

shareholders, and 1,800,000 shares are to be allotted to the Swedish Match Co. in return for the ordinary capital of J. John Masters & Co. (Ltd.). Both Bryant & May, as well as J. John Masters & Co., are to retain their separate identities, the new concern acting as a holding company. According to the preliminary announcements, the agreement provides for a close alliance in the United Kingdom, and in the British Empire outside of Asia, including manufacturing and distribution of matches.

British India.—Among the countries where the Swedish combine has gained a strong foothold is British India. That country was a large customer for Swedish matches for many years, and an elaborate marketing machinery was established there. Following the war, heavy import duties threatened to shut down foreign markets. In order to retain the profitable trade, the Swedish interests established branch plants and permitted domestic capitalists to share in this undertaking. Such plants were located at Calcutta, Ambernath, Parel, Dhubri, Mandalay, Kanaung, and Colombo. The total output of all the Indian plants was increased fourfold in 1925. Most of the wood consumed by those plants is imported from Sweden.

GERMANY

In Germany the Swedish combine, jointly with the International Match Corporation, succeeded in getting control of several of the largest match-producing concerns, which supply about 65 per cent of the entire German output. Germany's match industry totals 60 match plants, which employ about 6,000 persons.

Beginning in 1920, the Swedish interests acquired three-fourths of the shares of the Stahl & Noelke A. G. and of the Deutsche Zündholzfabriken A. G., Cassel. These two concerns are known as the "Cassel group."

In 1925 the third of the larger German concerns, the Union A. G., für Zündholzfabriken, Augsburg, the leading member of the German Association of Match Manufacturers (Verein Deutscher Zündholzfabrikanten), joined the Swedish group. Each of the three concerns has a capital stock of approximately 3,500,000 marks. Through these large concerns the Swedish trust has extended its influence gradually over some of the smaller German match-manufacturing concerns. Several of these were merged into the Mitteldeutsche Zündholzfabriken A. G., which, together with two new companies, the Süddeutsche Zündholz A. G., Munich, and the Norddeutsche Zündholz A. G., Berlin, have become affiliated with the Swedish combine. Besides, the Kreuger & Toll concern is said to hold a large share interest in the Prussian Mortgage Bank (Preussische Hypotheken Aktienbank).

On July 12, 1926, an agreement was reached between Swedish-American interests and the independent German producers, the German Government participating in the negotiations. A joint sales agency was formed, the Zündholz-Vertriebs A. G., Berlin, which has exclusive charge of all sales of matches in Germany. Under the terms of the agreement 65 per cent of the German market has been allotted to the Swedish group and 35 per cent to the German independents.

While this division of production favors the Swedish interests, the financial control of the joint sales agency (Zündholz-Vertriebs A. G.) is divided equally between the two groups. The Swedish interests hold 50 per cent of the capital stock, and an equal share is held by the German independents, who include the German Wholesale Cooperative Society and the Reichskredit Gesellschaft A. G., Berlin.

The agreement also provides that a board of directors shall fix prices, but the German Government has reserved for itself a determining influence in this matter. It may veto proposed price increases and require lower prices, if the public interest requires it. The agreement runs for 25 years.

In 1928 the German Reichstag enacted a law, the so-called Sperrgesetz, by which the establishment of new match plants is made contingent upon approval by the Government.

SWITZERLAND

In Switzerland a situation very similar to that in Germany has developed. The Swedish combine having acquired the most efficient and best-equipped Swiss plants—the Fabrique d'Allumettes Zumstein, at Wimmis, the Fabrique d'Allumettes Fleurier, and the Société de la Fabrique d'Allumettes Diamond, at Nyon—only one large concern, the J. H. Moser A. G., at Kanderbrück, besides several smaller ones, remained independent.

In order to prevent ruinous competition a committee for stabilizing the Swiss match industry was formed in 1926, which resulted in the formation of a cartel agreement between the two parties. Under this agreement production will be jointly regulated, and a central office will supervise all sales in accordance with a common selling policy.

BELGIUM

The Swedish match interests control about 70 per cent of the manufacture of matches in Belgium. In 1928 they made a cartel agreement with the independent match manufacturers and established a joint sales agency for domestic and export sales.

JAPAN

In Japan the Swedish combine holds a controlling interest in the Nippon Match Co. (capital, 1,000,000 yen), the second largest of the four principal Japanese match concerns. The Swedes also hold a large share interest in the Kabayashi and the Inonye companies, and in the Japan Chemical Co., and have successfully competed with Japanese products elsewhere.

Until 1925 the match industry of Manchuria had been in the hands of the Japanese, but since that time the Swedish combine has obtained control of all the match factories north of Mukden, including the large Kirin and the Nisshin plants.

FINLAND

In 1926 two Finnish plants, at Mäntsälä and Kuopio, were acquired, which, with the two factories already owned in that country,

gave the Swedish combine control over two-thirds of Finland's production.

In 1927 the remaining independent concerns, which belong to the Finnish cooperative societies, entered into an agreement with the Swedes whereby the bulk of the Finnish export trade in matches was allotted to the Swedish combine.

NORWAY

In 1926 the Swedish combine negotiated an agreement whereby the control of the oldest and most important match factory in Norway was acquired, the Nitedals Taendstikfabrik. Subsequently it also purchased a controlling interest in the Bryn & Halden Co., the only other Norwegian match-manufacturing concern.

MEXICO, CHILE, AND COLOMBIA

In 1926 a large match-manufacturing plant was erected in Mexico.

In Chile the Kreuger interests control the Compañía Chilena de Fosforos de Talga.

In Colombia the Swedish Match Co. controls the Compañía Fosforea Colombiana.

PALESTINE AND TURKEY

In 1927 the Swedish match combine purchased the "Nur," the only match company in Palestine, and in 1928 it acquired an interest in the company which holds a monopoly concession in Turkey.

ACQUISITION OF MONOPOLY CONCESSIONS

In addition to establishing branch manufacturing plants and operating marketing agencies of its own in foreign countries, the Swedish match combine has extended its foreign business along a third line, viz, the acquisition of match monopolies. Such monopoly concessions have been acquired in Poland, Peru, Estonia, Greece, Turkey, Ecuador, Hungary, and Yugoslavia. These monopoly rights were acquired mainly in return for loans which the combine made to the respective Governments.

With regard to this phase of its business, the annual report of the International Match Corporation for 1925 states:

> An interesting field for the activity of the company has been opened through the increase in demand for foreign loans in different countries, caused by post-war conditions. On account of the low cost of matches, considering the usefulness, this article has proved to offer great possibilities for indirect taxation, and this makes the sole concession for the manufacture and sale of matches in a country a valuable asset, well adapted to serve as security for foreign loans. There are at present a number of countries where the governments are greatly interested in propositions of this kind. The combined Swedish and American interests are particularly well equipped to take care of the technical as well as the financial side of such transactions.

POLISH CONCESSION

A loan of $6,000,000 to the Polish Government in 1925 served as a basis for granting a monopoly concession in Poland to the Swedish match combine. This loan is to run for 20 years, at 7 per cent per annum. For the purpose of operating the concession a separate company, with a capital of 5,000,000 zlotys (par value of the zloty, 19.3 cents), was formed under Polish laws, the control of which was vested in the Swedish interests. All match factories in Poland must turn their production over to this concession company. Under the terms of the agreement the Polish Government is to receive 5,000,000 zlotys annually out of the monopoly profit and the concession company itself is to receive 12 per cent on the invested capital. Profits over and above this are to be divided equally between the two parties. One-third of the Polish production is set aside for export.

ARRANGEMENT WITH PERU

An agreement along somewhat different lines was negotiated with Peru in 1925. All match factories in that country are to be shut down and the Peruvian market is to be supplied by imports from Sweden exclusively. Prior to this agreement 12 per cent of Peru's match supply came from Sweden. In return for this monopoly concession the Swedish concern annually pays £200,000 to the Government of Peru, which sum is to be used for extending Peru's system of agricultural irrigation. The Swedish combine is privileged to sell packages containing 40 matches each, at the equivalent of 18 öre. (The öre is one one-hundredth Swedish crown.) The contract runs for 20 years.

CONTRACT WITH GREECE

A similar contract was made with the Government of Greece on August 1, 1926, in connection with a loan of £1,000,000, at 8½ per cent, for 28 years. Deliveries of matches will be made chiefly from factories in Sweden.

PORTUGAL

In Portugal the Swedish interests acquired a minority interest in the match industry through holdings in the Socieda de Nacional de Fosforos, which controls all match factories in that country, and in which the Portuguese Government is also a large shareholder.

ECUADOR

A report from Ecuador states that in November, 1927, the Ecuadorian Government signed a contract with the Swedish Match Co. by which the match monopoly in Ecuador was turned over to the Swedish interests for a period of 25 years. The match company is to pay the treasury of Ecuador an annual sum of 1,000,000 sucres (par value of sucre, 20 cents) and a premium of 100,000 sucres every fifth year. All matches used in Ecuador are to be manufactured in Swedish factories. The Swedish combine agreed also to negotiate a loan of 10,000,000 sucres for the Ecuadorian Government.

HUNGARY

In 1928 the Hungarian Government made an agreement with the Swedish match combine, under which the latter promises a loan of $36,000,000 in return for a match monopoly for 50 years. The Swedish interests will take over eight factories in Hungary.

YUGOSLAVIA

In Yugoslavia the Swedish match interests were given a monopoly concession in 1928 for a period of 30 years in return for a loan of $22,000,000.

FRANCE

The Swedish match combine carried on negotiations, during 1926 and 1927, with representatives of the French Government, which finally resulted in Premier Poincaré's submitting a proposal to the French Parliament, in accordance with which the Swedish interests were to take over the French Government match monopoly. In return the French Government was to be given a loan of $75,000,000. The Chamber of Deputies refused to approve this proposal. Further negotiations led to an agreement, however, in November, 1927. It provides for a loan by the Swedish Match Co. of $75,000,00 for 40 years at 5 per cent. Of this amount the match company itself will take up $25,000,000. The remainder has been covered by a 5 per cent bond issue of $50,000,000, which was sold by the International Match Corporation. In return the match company receives the right to supply the French match monopoly with machinery for the manufacture of matches and match boxes and wood for match sticks. Furthermore, the Swedish concern is to cooperate in reorganizing the obsolete methods of production employed by the French Government match monopoly.

ESTONIA

The Estonian match industry, which comprises five match factories, has recently passed into the control of the Swedish match combine. On June 1, 1928, a holding company was formed which is to take over the assets and liabilities of the five plants, and which has been given a monopoly concession for 28 years. Under the proposed scheme the syndicate is to pay to the State in advance a sum of 300,000,000 estmarks on account of excise duties. The prices of the matches are to be fixed by a permanent mixed committee.

SWEDISH INTERESTS IN OTHER COUNTRIES

In Latvia and Lithuania the Swedish match combine has acquired a number of match factories and is negotiating for monopoly concessions. In the Netherlands a Swedish subsidiary dominates the industry. While the Italian Government has a monopoly of the sale of matches, the Swedes have factories of their own in Italy. In Czechoslovakia the Swedish combine has an agreement with the leading match-producing company, under which it handles the latter's exports. In Austria, Bulgaria, and Rumania numerous local match plants are controlled by the Swedish interests. In Africa the Kreuger & Toll interests own the Causemille Jeune & Cie. in Algiers and cooperate with the Bryant & May interests in South Africa.

FINANCING METHODS OF SWEDISH COMBINE

The financing of the international undertakings of the Kreuger & Toll group was carried out with the aid of banks and holding companies in which the Swedish parties are interested.

The initial capital of the Swedish Match Co. amounted to 45,000,000 crowns. Since the stock was paid in at the rate of 200 crowns per share, an initial reserve fund of 45,000,000 crowns was accumulated. In February, 1921, bonds to the amount of 35,000,000 crowns were floated through Swedish banks.

In November, 1922, the capital stock was doubled. Of this stock, 40 per cent was subscribed to in England. In April, 1924, the capital stock was doubled once more, in order to negotiate the above-mentioned monopoly concessions. Half of these shares were again placed in England and a large part of the remainder marketed through American banks.

In order to obviate possible control of the combine's interests by non-Swedish parties, these shares, valued at 90,000,000 crowns, were issued as B stock, each share having 1/1000 vote. Moreover, the A shares can not, under a provision of the Swedish law which governs alien holdings, be sold to foreigners without certain restrictions.

The total resources of the Swedish match combine have been estimated at 1,000,000,000 crowns. While the ultimate control of the numerous interests of the combine is centered in the Swedish parent concern, several holding companies have been formed, to which the immediate control of certain subsidiaries has been turned over. One of these, the International Match Corporation, formed in 1923, controls companies owning 90 match-manufacturing plants in various European countries outside of Sweden. Another, the Administratie Maatschappy voor Algemeene Neverheids Vaarden, in Amsterdam, also has a large number of holdings in foreign enterprises. Through a third holding company, the A. B. Sefor, in Stockholm, the ramifications extend to the Swedish Grängesberg ore concern, the Svenska Kullagerfabriken, and various banking enterprises.

The following chart indicates some of the interrelations of the Kreuger & Toll concern and its affiliated interests.

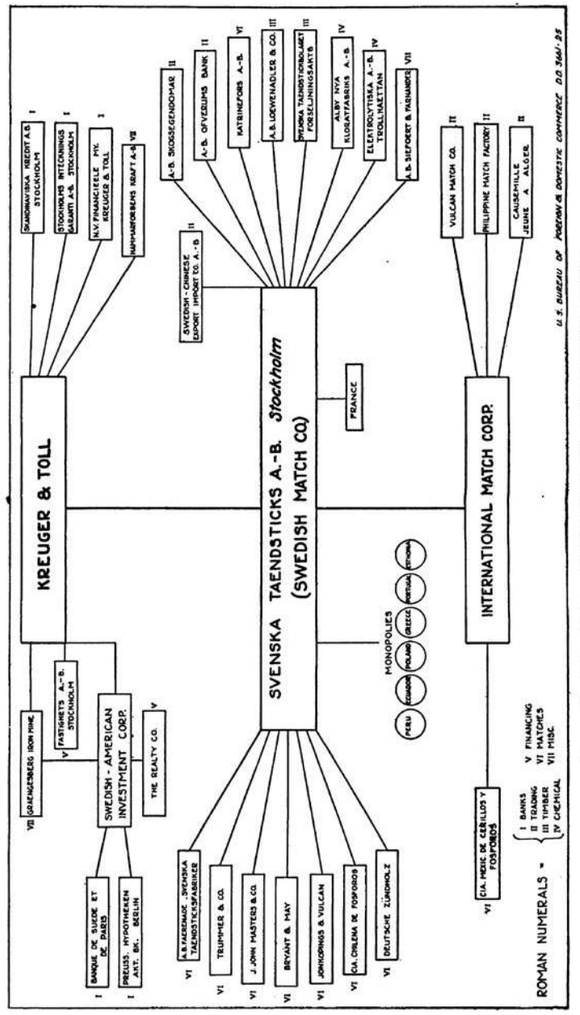


FIGURE 2.—Interrelations of interests in international match combine

PRODUCTION OF MATCHES

It is estimated that the world's consumption of matches amounts to 3,228,425,000,000 a year. Of this total supply, the major part is produced by match-manufacturing plants owned or controlled by the Swedish match combine in practically all the producing countries of the world.

The leading match-producing countries are Sweden, the United States, Japan, Germany, Norway, England, and Belgium.

Sweden's production amounted to 42,531 metric tons of matches in 1926 and 35,449 tons in 1925.

In the United States the production of matches amounted in 1913 to 22,594,000 gross standard boxes valued at $14,121,000, and in 1927 to 26,849,578 gross boxes valued at $12,210,151. Japan's production has decreased from 52,381,000 gross boxes in 1914 to 24,787,000 gross boxes in 1924. Germany's production amounted to 9,028,700 gross boxes in 1913 and to 12,338,000 gross boxes in 1924.

The match production in England dropped from 8,685,118 gross boxes in 1920 to 6,556,751 gross boxes in 1925.

WORLD TRADE IN MATCHES

Exports.—Of the 12 leading match-exporting countries, Sweden stands first, with exports totaling more than those of all other European countries combined. In 1926 Sweden exported a total of 40,592 metric tons. Belgium holds second place among European countries, and Belgian exports, amounting to 15,337 tons in 1925, also show an increase. There follow Czechoslovakia (6,588 tons), Finland (3,987 tons), Norway, Austria, Estonia, Latvia, Italy, and Poland.

Among non-European countries Japan is the largest exporter and for a number of years was the strongest competitor of Sweden. In recent years Japan's exports of matches have decreased steadily. In point of volume of exports Japan follows Belgium and holds third place in world trade in matches. Canada ranks about equal with Estonia and Latvia.

Considering the trend of the total export trade in matches during recent years, it appears that Sweden and Belgium show the largest expansion. The growth in these two countries was largely at the expense of Japan and the Austrian succession states.

Imports.—From the point of view of demand, England leads in the import of matches. Supplies come chiefly from Belgium and Finland, followed by imports from Sweden, Norway, and Czechoslovakia. These five countries in 1924 supplied five-sixths of the British imports.

French imports decreased from 5,500 tons in 1924 to 3,700 tons in 1925. Sweden and Belgium are the main sources of supply for France. The Netherlands is supplied by Sweden and Belgium, its imports averaging between 3,000 and 4,000 tons annually. The Balkan countries, especially Rumania and Greece, constitute an important importing market.

Outside of Europe, the United States and India are the largest importing countries. The United States, whose imports in 1927 totaled 6,101,736 gross, resembles Great Britain as an importing market, for most of the large exporting countries share in supplying its

demand, Sweden leading, followed by Estonia, Finland, the Netherlands, and Latvia.

The importance of the Asiatic market may be seen from the fact that the imports of Siam, which in recent years averaged between 4,000 and 5,000 tons, are about the same as those of France. British India, which formerly was a large importing market, is now supplied largely by its 20 domestic plants, which are partly controlled by Swedish interests. While its imports are still about the same as those of the United States, a steady decrease has set in. The imports come mostly from Japan and Sweden, the latter leading. China, whose imports are about one-half of those of India, is also supplied by Japan and Sweden, the former leading.

The markets of Australia and New Zealand get their supplies almost exclusively from Sweden.

It is to be noted that most of the above-mentioned importing countries have a domestic match industry and also export to smaller markets.

A considerable number of countries, whose domestic match industry is fairly able to satisfy the home demand, also have a limited export or import trade. Among the European countries falling into this class are Germany, Russia, Denmark, Switzerland, Lithuania, Bulgaria, Hungary, Yugoslavia, Spain, Portugal, and Turkey.

C. INTERNATIONAL ALUMINUM CARTEL

The aluminum industry to-day is based largely upon the reduction of aluminum from bauxite. While this mineral is of common occurrence throughout the world, yet it is found in comparatively few localities in sufficient concentration to form commercial deposits. About 60 per cent of the bauxite reserves of Europe are in France. This industry, therefore, lends itself very readily to the forming of combines or cartels.

The history of cartels in the aluminum industry goes back 25 years. The present international cartel, formed in 1926, is, in the main, a continuance of pre-war relations.

The European producers of bauxite have been united for many years in the Bauxit-Trust A. G., of Zürich, Switzerland. This concern controls extensive bauxite deposits in Hungary and Italy.

The production of aluminum is a matter of companies rather than of nations. Prior to the World War there were only 13 aluminum-producing companies in the world, with a total of 23 manufacturing plants. Various interrelations among these companies have made for a high degree of centralization and cooperation. The five French producing companies, for example, are closely united in a holding company, L'Aluminium Français. The leading European concern, the Aluminium-Industrie A. G., at Neuhausen, operates and controls four plants in Switzerland, Germany, and Austria. Three firms in England and Norway are also closely united.

FIRST INTERNATIONAL ALUMINUM CARTEL

In 1901 the five principal companies in the world which manufactured aluminum formed a syndicate for fixing prices and allotting

Apropos of the threatened Anglo-Swedish Match Syndicate, to which we referred last week, a reliable Swedish correspondent writes :—" The Match Syndicate in London having now secured some twenty-five of the principal match factories in Sweden, its directors have made overtures to the Swedish Match Company to enter the syndicate with its six factories, and a proposal to this effect is to be laid before the shareholders, who will most likely accept the same, as the objects of the two associations are identical—namely, rather to reduce the production than accept prices that are ruinous, and also to improve the quality of the matches. It is added that the amalgamation of the factories referred to is now certain, the leading London match manufacturers having found further opposition impossible, and therefore offered to work in harmony with the new syndicate."

294. Anglo-Swedish match syndicate, 1889

295. Swedish matches in USA

TARIFF HEARINGS

BEFORE THE COMMITTEE ON WAYS AND MEANS OF THE HOUSE OF REPRESENTATIVES.

SIXTIETH CONGRESS.

FIRST PRINT, No. 38.

FRIDAY, DECEMBER 18, 1908.

(EVENING SESSION.)

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1908.

296. Tariffs on Swedish matches, Tariff Hearings Before the Committee, United States

MATCHES.

THE DIAMOND MATCH COMPANY ASKS AN INCREASE IN DUTY TO MEET FOREIGN COMPETITION.

NEW YORK, *December 16, 1908.*

Hon. SERENO E. PAYNE,
Chairman Ways and Means Committee,
Washington, D. C.

DEAR SIR: We respectfully ask your consideration of that portion of the tariff law fixing the import duty on matches, paragraph 423 of which is as follows:

Matches, friction or lucifer, of all descriptions per gross of 144 boxes containing not more than 100 matches per box, 8 cents per gross; when imported otherwise than in boxes containing not more than 100 matches each, 1 cent per 1,000 matches.

We ask that this paragraph be revised to read as follows:

Matches, friction or lucifer, of all descriptions per gross of 144 boxes containing not more than 100 matches per box, 12 cents per gross; when imported otherwise than in boxes containing not more than 100 matches each, 1½ cents per 1,000 matches.

There are about 15 or 16 companies engaged in the manufacture of matches in the United States, but the business is not one that has been generally profitable. While it is true the Diamond Match Company has been successful, it has been only because its constantly increasing volume of business has more than counterbalanced the steady increase in the cost of manufacture. In the production of matches white pine is almost exclusively used for the match stick or splint, because of its free-burning nature, its quick absorption of paraffin, and generally attractive appearance to the consumer; but, by reason of the continued advance in the price of lumber and labor, the cost of the stick has increased 70 per cent in the past ten years. During the same period all other materials, as well as labor employed in the manufacture of matches, have advanced greatly. Nevertheless the Diamond Match Company has made no corresponding advance in the selling price of its matches, nor were its prices advanced at the time the present tariff law went into effect. On the other hand, the company has relied for its profit upon its increased volume of business, due to the increasing consumption of matches, for, since the year 1890, while the population of the United States has increased but about 43 per cent, the consumption of matches has, it is estimated, increased nearly 150 per cent.

Matches are manufactured extensively in Great Britain, Sweden, Denmark, France, Belgium, Germany, Austria, Switzerland, Russia, Italy, and Japan. In all countries substantially the same ingredients are used for the composition of the head. The match stick or splint, however, as well as the box containing the match, are made of different materials in different countries, depending upon the materials available, the cost of such materials, and the requirements and demands of the trade. In the match-producing countries of continental Europe aspen, from Russia, is employed almost entirely for the stick or splint, and, up to the present time, it has been possible to obtain this wood at a low price. The season during which navigation is open and during which shipments of aspen logs may be made from Russian ports is short; furthermore, the wood begins to

deteriorate very soon after it has been cut. For this reason, and for the further reason that under existing conditions it is impossible to contract for a supply for a number of years to come, The Diamond Match Company has not considered it practicable to buy aspen logs in Russia and import them into this country, nor has it felt justified in establishing a plant in Russia for the manufacture of match sticks or splints to be shipped into this country to be used in the manufacture of matches. It has, therefore, in the production of sticks or splints adhered to white pine, which costs appreciably more than the aspen used by match manufacturers in other countries. Consequently, its foreign competitors operate under a great advantage because of their ability to obtain, up to the present time, in a country comparatively near by lumber for match sticks or splints at a price much less than that which match manufacturers in this country are required to pay for the white pine they use. Even assuming, however, that it would be practicable to manufacture or buy match splints in Russia to be shipped into this country, a duty of 35 per cent would be levied thereon, as required by the existing law. In addition to the match stick or splint, the more important materials employed in the manufacture of matches are as follows:

Strawboard or box board, on which there is a duty at present of 25 per cent;

Pulp board, on which there is a duty of 25 per cent;

Wrapping paper, on which there is a duty of 25 per cent;

Glue, on which there is a duty of 2½ cents per pound when costing less than 10 cents per pound, and 25 per cent when costing more than 10 cents per pound;

Ink, on which there is a duty of 25 per cent;

Phosphorus, on which there is a duty of 18 cents per pound;

Chlorate of potash, on which there is a duty of 2½ cents per pound;

Coloring materials, on which the duties range from 25 per cent to 35 per cent;

Brimstone, on which there is a duty of $8 per ton;

Flint, on which there is a duty of 35 per cent;

Whiting, on which there is a duty of one-fourth cent per pound.

The materials other than lumber used in the manufacture of matches in the match-producing countries of continental Europe will be found to cost less in such countries than in the United States by about the amount of duty that it would be necessary to pay on such materials if imported into this country. In point of fact, some of the material used by The Diamond Match Company, in the manufacture of matches, notably glue, is imported. Scotch or Irish glue has been found to be more uniform and greatly superior to that produced in this country, due apparently to the greater care used in the selection of the stock from which it is made, and due also to the climatic conditions surrounding its manufacture.

In respect to labor, the average wage rate in match factories in the countries in continental Europe is only about 30 per cent of the wage paid in this country to the same class of operators. In England, where the wage rate is higher than on the Continent, there are over 600 girls employed in one of the prominent match factories, whose average weekly wage is 9 shillings 9 pence, whereas the average weekly wage rate of girls paid by The Diamond Match Company is about $7.50.

The match manufacturer in continental Europe, therefore, has advantages over the match manufacturer in the United States because of his ability (1) to secure lumber at a price materially less than that paid in this country for white pine; (2) to obtain other materials used in the manufacture of matches at a price less than the manufacturer in this country is required to pay by about the amount of duty on such materials; and (3) to employ labor at about 30 per cent of the price paid in this country for the same class of labor.

So far as the export trade in matches is concerned, the volume is almost negligible; from time to time The Diamond Match Company has sought to enter the field in South American countries, and while an occasional order has been secured, it has been unable to make any headway or come anywhere near meeting the prices of foreign-made matches.

We have heretofore confined our remarks to the conditions surrounding the production of matches in the match-producing countries of continental Europe. In reference now to the match situation in Japan, we invite your attention to a report of Consul John H. Snodgrass, published in the Daily Consular and Trade Reports of November 20, 1908, as follows:.

It is learned through the Osaka papers that a leading Japanese match-stick company is arranging to secure capital from the Swedish match trust. It is explained that Swedish match manufacturers, the principal match manufacturers of Europe, have cut down almost all the Scandinavian trees available for match-sticks, and that they are now getting a supply of wood from Russia, where the supply is also falling short.

The trust formed in 1906 by eighteen match manufacturing companies of Sweden for the sale of matches has been quite successful, and it has been able to overcome the Japanese match competition in India. The Swedish trust, at the opening of such a brilliant future for its business, has begun to feel anxious regarding the sources of its future supply of wood for match sticks. Learning that Japanese match manufacturers, who have repeatedly failed in attempts to form a combination, are anxious to secure foreign money, and also that there is an abundant supply of match-stick wood in Japan, the Swedish syndicate has made investigations into the position of the industry in this country. Satisfied with the result of the investigations, the trust decided to invest money in the industry in Japan, and negotiations were entered upon with several Japanese companies. A proposal was made that the Swedish trust should take half the amount of the capital of the Japanese match-stick company already referred to, but in view of the depression of business in Japan the trust hesitated to agree to the proposal. Negotiations for the combination between the trust and the Japanese company have, however, again been opened. If the combination is successfully arranged, a large export of match sticks will result, and in that case the price in Japan will rise and the match industry, which is already suffering from the depression of trade, will be reduced to an even worse position. Therefore, manufacturers outside the proposed combination have been holding conferences to consider the course to be taken.

The leading match manufacturers of Kobe and Osaka are considering a proposal to incorporate the industry into one company, and, if possible, to obtain a charter to monopolize the export of matches, this effort having been brought about by the alarming decrease of trade. There are 124 match factories in Kobe and Osaka. Of this number 13 in Osaka and 17 in Kobe have temporarily suspended operations, the output of matches falling off considerably in consequence. A local publication states on authority that the market in China and elsewhere in the Far East for Japanese matches (large sticks) has been largely encroached upon by Swedish and German matches. The export of Japanese matches so far this year shows a decrease of 40 per cent, as compared with the corresponding period of last year, and the outlook is considered almost hopeless unless united efforts are made by the companies to relieve the situation. It is expected that the amalgamation scheme will come to a successful issue. The total value of matches exported from Kobe and Osaka were as follows in 1906 and 1907: Kobe, $4,207,413 and $3,517,189 respectively; Osaka, $1,212,932 and $1,115,469, respectively.

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Up to this time, as Mr. Snodgrass states, the match industry in Japan has been disorganized, and apparently but little capital has been available for the purpose of developing it and of establishing large plants. Due to the inferior character of the match heretofore produced there, relatively few have been imported into this country, and such small quantities as have been imported from time to time have been unsatisfactory. If, however, Swedish capital be invested in the business and the well-demonstrated ability and skill of the Swedish manufacturers be utilized in developing the match industry in Japan and in manufacturing such types of matches as the trade in this country demands, Japan will, by reason of the low cost of labor and of the lumber available for the manufacture of the match stick or splint, be able to produce matches at a price so greatly less than any other country that it could sweep the markets of the United States. While the rate of wages paid in match factories in England and on the Continent appears low as compared with the wages paid in this country, they appear high in comparison with the wages paid in Japan. Lumber suitable for the manufacture of matches can be obtained in Japan for greatly less than the amount we are required to pay for white pine in this country. The possibilities of the match industry in Japan were so well appreciated at the time the tariff duties were established in the Philippine Islands that the import duty on matches was fixed by the Philippine government at a figure that will be found to be approximately four times that now imposed by the United States Government.

If, as we contend, conditions are such as to justify an advance in the present tariff against the match manufacturers of continental Europe, how much more warrant is there for this contention in the face of the likelihood of the development of the match industry in Japan?

Practically the only type of match imported into this country is the safety match; it can be bought f. o. b. New York, duty paid, packed in zinc-lined cases, for 32 cents per gross of 144 boxes, each box containing about 60 matches. This is below the factory cost (eliminating entirely administrative, selling expenses, and profit) of a similar match made in this country of white pine, in the same kind of a box, containing the same number of matches per box, and packed in zinc or tin lined cases. An advance in the duty of from 8 cents to 12 cents per gross, or about one-half cent per thousand matches, would not, in our judgment, reduce importations nor work any hardship on the consumer, nor could it affect the price of parlor and double-dip matches, which form 95 per cent or more of the consumption of matches in this country. We ask, therefore, that the tariff on matches be increased from 8 cents to 12 cents per gross when packed in boxes containing less than 100 matches per box, and from 1 cent to 1½ cents per 1,000 when imported otherwise than in boxes containing not more than 100 matches each.

Respectfully submitted.

THE DIAMOND MATCH CO.,
O. C. BARBER, *President.*

SWEDISH MATCH FACTORIES COMBINE.

[Consul Douglas Jenkins, Goteborg.]

According to an official announcement, 10 of the 12 independent match factories in Sweden, which have remained outside the so-called Swedish match trust, the Jönköping och Vulcans Tändsticksfabrik, are now to be formed into a single corporation to be known as Aktiebolaget Förenade Svenska Tändsticksfabriker, with Ivar Kreuger as managing director.

This new corporation may have a capital of 4,000,000 crowns ($1,072,000) to 12,000,000 crowns ($3,216,000), to be divided into preferred and common stock. The preferred stock will not be issued until the beginning of 1914. Of the capital subscribed, 25 per cent is to be paid in on May 2, 1913, 30 per cent on July 2, 1913, and 50 per cent on September 2, of the same year. The preferred shares are to be offered at 105 instead of par.

It is estimated that the corporation will have an annual output of 8,000,000 boxes of matches, as compared with 2,400,000 boxes now being produced by the Jönköping-Vulcan concern.

The Export Trade—Members of Combine.

Most of the factories to enter the new corporation are engaged in exporting, and it is thought that their combination will have the effect of increasing their output and earnings. The match industry is one of the most important in Sweden, and a large part of the annual production is shipped to other countries, including the United States, which took $370,247 worth of Swedish matches from the port of Goteborg alone in 1912.

The following factories are to go into Aktiebolaget Förenade Svenska Tändsticksfabriker: Aktiebolaget Kalmar och Mönsterås Tändsticksfabriker, Aktiebolaget Tänsticksfabriken Sirius, Aktiebolaget Södertelge Tändsticksfabrik, Svenska Tänsticksfabriks Aktiebolaget, Aktiebolaget Hvetlanda Tändstickor, Aktiebolaget Nybro Tändsticksfabrik, and the Warren match factories in Kalmar and Waxjo, owned by the Swedish Match Co. (Ltd.), of London—10 factories in all.

So far as can be seen, there will remain now only two independent match factories in Sweden, namely, Grantorpets Tändsticksfabrik, at Västervik, and Emmaboda Tändsticksfabrik, at Emmaboda. The location of the head offices of the new corporation have not yet been announced.

The Older Combination.

By way of comparison, it may be pointed out that there are seven factories in the older combination, the Jönköping och Vulcans, with a total capital of $2,683,752. This corporation was organized in 1903. Its head offices are at Jonkoping. The individual factories are the following: Jönköpings Tändsticksfabrik, Jönköpings Västra Tändsticksfabrik, Annebergs Tändsticksfabrik, Uddevalla Tändsticksfabrik, Västerviks Nya Tändsticksfabrik, Vulcans Tändsticksfabrik, Vänersborgs Tändsticksfabrik, and the Junebro Aktiebolag; the controlling interest in the stock of the last named, it is reported, having only recently passed into the hands of the Jönköping-Vulcan corporation.

297. Swedish match factories combine, 1913

SWEDISH MATCH TRUST OBTAINS MONOPOLY IN THE KINGDOM OF SERBS, CROATS AND SLOVENES

The Kingdom of Serbs, Croats and Slovenes has obtained a loan of $22,000,000 from the Swedish Match Syndicate, in return for which the Government granted to the syndicate control of the match industry for a period of 30 years. This concession is similar to those obtained last year by the match trust in Latvia, Estonia, and Ecuador.

JAPAN.

SWEDISH AND JAPANESE MATCH COMPANIES MAY COMBINE.

Consul John H. Snodgrass, of Kobe, reports as follows concerning the steps being taken for the reorganization of the match industry of Japan:

It is learned through the Osaka papers that a leading Japanese matchstick company is arranging to secure capital from the Swedish match trust. It is explained that Swedish match manufacturers, the principal match manufacturers of Europe, have cut down almost all the Scandinavian trees available for match sticks, and that they are now getting a supply of wood from Russia, where the supply is also falling short.

The trust formed in 1906 by 18 match-manufacturing companies of Sweden for the sale of matches has been quite successful, and it has been able to overcome the Japanese match competition in India. The Swedish trust, at the opening of such a brilliant future for its business, has begun to feel anxious regarding the sources of its future supply of wood for match sticks. Learning that Japanese match manufacturers, who have repeatedly failed in attempts to form a combination, are anxious to secure foreign money, and also that there is an abundant supply of match-stick wood in Japan, the Swedish syndicate has made investigations into the position of the industry in this country. Satisfied with the result of the investigations, the trust decided to invest money in the industry in Japan, and negotiations were entered upon with several Japanese companies. A proposal was made that the Swedish trust should take half the amount of the capital of the Japanese match-stick company already referred

to, but in view of the depression of business in Japan the trust hesitated to agree to the proposal. Negotiations for the combination between the trust and the Japanese company have, however, again been opened. If the combination is successfully arranged, a large export of match sticks will result, and in that case the price in Japan will rise and the match industry, which is already suffering from the depression of trade, will be reduced to an even worse position. Therefore, manufacturers outside the proposed combination have been holding conferences to consider the course to be taken.

COMBINATION OF MATCH MANUFACTURERS.

The leading match manufacturers of Kobe and Osaka are considering a proposal to incorporate the industry into one company, and, if possible, to obtain a charter to monopolize the export of matches, this effort having been brought about by the alarming decrease of trade. There are 124 match factories in Kobe and Osaka. Of this number 13 in Osaka and 17 in Kobe have temporarily suspended operations, the output of matches falling off considerably in consequence. A local publication states on authority that the market in China and elsewhere in the Far East for Japanese matches (large sticks) has been largely encroached on by Swedish and German matches. The export of Japanese matches so far this year shows a decrease of 40 per cent as compared with the corresponding period of last year, and the outlook is considered almost hopeless unless united efforts are made by the companies to relieve the situation. It is expected that the amalgamation scheme will come to a successful issue. The total value of matches exported from Kobe and Osaka were as follows in 1906 and 1907; Kobe, $4,207,413 and $3,517,189, respectively; Osaka, $1,212,932 and $1,115,469, respectively.

298. Swedish Match Syndicate - Serbia, Croatia, ..., 1929 (top);
299. Swedish & Japanese companies combine, 1909 (bottom)

tled political conditions which prevailed during a part of 1929, coupled with poor crops and the unsatisfactory mining situation, combined to have an unfavorable effect on shoe consumption.

The small workshops and cobblers' establishments, turning out the cheapest types of footwear, have probably suffered less from unfavorable economic conditions than have the large factories producing better qualities of footwear. The demand for better grade footwear of local manufacture is reported to have fallen off temporarily, while the market for the cheapest types has remained relatively constant.

Market Outlook for Imported Leather Footwear.

In event that no further increases are made in the tariff, it is believed that the market for high grade imported shoes will continue more or less constant. The trade in imported footwear is, of course, limited to the small well-to-do native class and to the foreign colonies, and little change is to be expected in it, unless the import duties become absolutely prohibitive, and unless the local footwear shows a further considerable improvement in quality.

In view of the highly competitive conditions prevailing in the market for imported footwear, it is extremely difficult, if not impossible, to persuade local firms to attempt to introduce makes of footwear new to the market. In short, virtually the entire trade in imported footwear is controlled by a few well-known makes of American shoes, which have been established over a long period of years, and which, having a fixed clientele among the well-to-do Mexicans and foreigners, have been able to retain a profitable, if small, volume of business.

See also—
Foreign trade opportunities.

CHEMICALS

C. C. Concannon, Chief, Chemical Division

MATCHES IN WORLD TRADE

Swedish Match Syndicate the Largest Factor in World Trade—Bulk of United States Import Consists of Safety Matches

G. Boyd, Chemical Division, based on report from Consul General John Ball Osborne, Stockholm, and other reports from representatives abroad of the State and Commerce Departments

The present rivalry in world trade in matches is principally between Sweden and Russia, the latter country having displaced Japan, which was the foremost competitor of the Swedish Match Syndicate during the war and postwar years.

Nonsafety Match Enjoys Widest Popularity in United States.

If asked what kind of matches he believed to be in greatest demand in the United States, the average American smoker on first thought would probably name the strike-on-the-box safety match. However, upon taking into account the fact that the American housewife generally prefers the large box of nonsafety matches, and with the larger use of the nonsafety match in rural districts, the bulk of the domestic output—which supplies seven-eights of the total United States consumption—is of the nonsafety match. Statistics of the United States match production, as reported by the Bureau of the Census, follow:

Statistics of United States match industry, 1927 and 1929

Item	1927	[1] 1929
Number of establishments	19	19
Average number of wage earners	3,905	3,569
Total wages paid	$4,130,988	$3,963,000
Cost of materials	$11,884,075	$12,245,000
Value of total match output	$24,845,404	$19,490,000
Quantity:		
Cases	2,280,203	2,862,000
Gross boxes	16,840,578	14,288,000
Books (thousands)	1,551,304	2,128,000
Value:		
Cases	$8,662,727	$8,507,000
Gross boxes	$12,210,151	$7,572,000
Books	$3,972,526	$3,411,000

[1] Preliminary and subject to revision.

Bulk of Import Safety Matches.

An ascending trend represents the proportion of safety matches imported from year to year. In 1927, 98.4 per cent of the total incoming shipments were of the safety variety, in 1928, 98.8 per cent, and in 1929, 99.1 per cent. The bulk of these imports originate in Sweden. Last year the United Kingdom appears to have furnished nearly half of the match import ($30,567) other than of the strike-on-the-box (safety) variety; the bulk of these shipments were probably reexports from Sweden.

United States imports of safety matches (in boxes of not more than 100)

Country of origin	1928		1929		First 6 months, 1930 [1]	
	Gross boxes	Value	Gross boxes	Value	Gross boxes	Value
Sweden	2,378,050	$1,013,774	3,963,012	$1,626,891	1,057,850	$403,932
Soviet Russia in Europe	404,800	141,105	1,018,420	332,734	625,290	227,614
Finland	686,335	266,456	1,207,550	297,477	360,747	90,561
Norway	282,765	92,874	536,410	175,041	190,065	61,519
Japan	100,312	36,582	88,171	32,007	44,934	15,614
Denmark	57,410	20,337	39,445	21,735	26,155	9,269
Other countries	1,654,335	519,359	3,765,492	808,620	820,969	237,965
Total	5,564,027	2,090,468	10,576,500	3,404,525	3,126,054	1,036,482

[1] Preliminary and subject to revision.

Swedish Match Syndicate Predominates in World Trade.

Statistics of imports by countries of origin, when shown for matches, are not as informative as with other commodities, inasmuch as such a large part of the

300. Matches in World Trade, Commerce Reports, 1930

world trade in matches is controlled by one organization, the Swedish Match Syndicate, from its various branches throughout the world, as well as from its factories in Sweden. The organization, including its subsidiaries, employs approximately 60,000 workers and produces nearly three-fourths of the match output of the entire world, according to well-informed estimates.

The Syndicate at Home.

The Swedish Match Co., as a holding concern, controls all the match factories in Sweden—13 in number—and numerous auxiliary undertakings, such as paper mills, chemical factories, sawmills, and timberland. It owns about 100,000 acres of forests in Sweden, and controls logging rights in several parts of the country, as well as organizations for the purchase of aspenwood in Finland, Russia, Poland, and the Baltic States. The company has also established factories at Alby and Trollhattan in Sweden for the manufacture of chlorate of potash and of phosphorus. The syndicate controls the Swedish Pulp Co., which comprises 10 pulp and lumber enterprises in Northern Sweden, and the Hammarsforsens Waterpower Co. The syndicate also holds a majority of the shares of the International Match Corporation, formed in the United States, which, in turn, controls companies owning 150 factories with 50,000 employees in 28 countries from Canada to the Far East. One-fifth of the total world output of matches is produced in Sweden alone, of which over 90 per cent is exported. In 1929 the match production of the syndicate at home amounted to 51,800 metric tons—an increase of 6 per cent over the 1928 figure.

Bulk of Swedish Exports Safety Matches.

Correlative with the larger domestic production, the total export of matches from Sweden in 1929 advanced to 49,260 metric tons worth over $12,250,000—the highest export figure attained since 1920. Outgoing shipments during the first half of 1930 advanced to an even higher level, totaling 23,396 metric tons, as compared with 22,890 metric tons for the first half of 1929. This was despite the drop in exports to the United States—Sweden's third largest market in 1928—from a value of $575,162 during the first half of 1929 to $371,029 for the same period of 1930. The bulk of the Swedish export consists of safety matches, the ratio of the export of the latter to that of the nonsafety matches being approximately 20 to 1.

Value of match exports from Sweden

[Thousands of dollars]

Country of destination	1920	1922	1924	1926	1928
United Kingdom	11,274	1,017	5,060	5,004	5,600
Netherland East Indies	7	1,170	636	1,253	1,790
United States	966	1,226	915	1,201	882
China	93	179	229	246	835
Netherlands	1,367	1,099	538	589	598
France	160	216	228	137	345
Greece	478	479	391	270	244
Turkey (Europe)	74	103			134
Other countries	4,632	4,056	181	606	338
Total	19,041	9,535	8,488	9,308	10,766
Quantity in metric tons	34,757	24,969	25,050	36,762	45,063

Foreign Concessions of the Swedish Match Syndicate.

Probably there is no better example of branch-factory control than is portrayed by the extensive ramifications of the Swedish Match Syndicate, accomplished in large measure by the securing of exclusive concessions from foreign governments in return for loans.

Certain of the foreign loans of the Swedish Match Syndicate, as of February, 1929

Country	Nominal value	Interest per cent	Rate of issue	Actual proceeds of issue	Yearly income of interest
France [1]	$75,000,000	5	93.5	$70,120,000	$3,750,000
Hungary	36,000,000	5	92	33,120,000	1,800,000
Rumania	30,000,000	7	100	30,000,000	2,100,000
Yugoslavia	22,000,000	6¼	90	19,800,000	1,370,000
Poland	6,000,000	7		6,000,000	420,000
Latvia	6,000,000	6	92	5,220,000	360,000
Ecuador	2,000,000	8		2,000,000	160,000
Greece	4,861,520	6	94	4,569,829	292,200
Estonia	1,876,000	6		1,876,000	112,560

[1] According to an agreement made in the early part of 1930, the French loan was to be repurchased on June 30 by the French Government.

Beside the concessions listed in the foregoing table, agreements concluded since February, 1929, with Germany, Lithuania, and Guatemala are worthy of note. A match monopoly in Germany was secured by the syndicate in October, 1929, in consideration for the promise of a loan of approximately $125,000,000; the contract will expire upon repayment of the loan within 50 years, but is to last at least for 32 years. By an agreement reached on April 12, 1930, the Government of Lithuania granted a monopoly to the Swedish syndicate for the manufacture and wholesaling of matches and match sticks for a period of 35 years, in return for the promise of the syndicate to buy as much as $6,000,000 worth of 93 per cent bonds issued by the Lithuanian Government. The Guatemalan monopoly extends over a period of 30 years, and is in consideration for a loan of $2,500,000. There are several other agreements to which the Swedish syndicate is an indirect party.

Swedish Syndicate Has Double Hold in Brazilian Trade.

Brazil is an important example of a country the match industry and trade of which is controlled indirectly by the Swedish syndicate, and not through an exclusive governmental concession. Three Brazilian factories belong to the organization known as the Fiat Lux Co. (a former subsidiary of Bryant & May, of England), and are located at Nictheroy, Sao Paulo, and Curityba. The latter is the site of one of the largest match factories in Brazil. About three years ago competition in the Brazilian match market became so keen that some concerns sent salesmen out on the streets of the cities selling matches by the gross and half gross to the small tobacco shops. However, the situation was soon ameliorated by the formation of the Cia. Brazileira de Phosphoros—financed by foreign capital to the amount of approximately $4,200,000—which purchased 22 Brazilian factories and immediately ceased the operations of nearly half of these units. It is reported that the Cia. Brazileira de Phosphoros is a subsidiary of the International Match Corporation, and it is evident, therefore, that this arm of the parent Swedish organization makes the penetration of the Brazilian market by the syndicate doubly secure.

England, Point of Transshipment for Matches.

The bulk of the large export of matches from Sweden to England is not for consumption at the destination given, but is for transshipment to countries all over the world. In 1929, it was estimated that over 80 per cent of the Swedish match output was

being shipped through London. Cooperation between the Swedish Match Co. and the leading British match enterprise, Bryant & May (Ltd.), existed for a number of years—particularly in the form of a joint purchasing organization for wood and other raw materials—prior to July 1, 1927, when the branch of the Swedish Match Syndicate in England and the British company signed an agreement to combine their interests in Great Britain, excepting, however, the Swedish company's enterprises in India and other parts of Asia. The new company, under the name of the British Match Corporation (Ltd.), was capitalized at 6,000,000 pounds sterling ($29,220,000), and took over all the common stock in Bryant & May (Ltd.), all the shares in J. John Masters & Co. (Ltd.), and certain other manufacturing and sales interests within the British Empire previously owned by the Swedish Match Co. The Swedish Match Syndicate received 1,800,000 shares of one pound sterling each in the British Match Corporation (Ltd.), equivalent to 30 per cent of the entire capital. The remaining 70 per cent was divided among the former holders of common stock in Bryant & May (Ltd.). Through its subsidiary companies the combine acquired factories not only in Great Britain and Ireland, but also in Canada, Australia, New Zealand, South Africa, and Brazil.

Japan Formerly Strongest Competitor of Syndicate.

During the World War the match markets of the Far East were largely taken over by Japanese match manufacturers, who for a time were the strongest competitors of the Syndicate in world trade. To-day, however, Japan's export trade in matches is less than one-half of what it was before the war, whereas Sweden is reported to have regained its pre-war sales volume in the Far East. Owing to the introduction of high import duties abroad, Japan has lost several of its most important sales territories. In decided contrast to the organization of the Swedish industry, Japan's match industry comprises a large number of small enterprises, which, in consequence of the lack of centralization, are unable to finance the means of circumventing tariff barriers. For a time, in 1927, Japan's match manufacturers succeeded in effecting a retrenchment, and total exports for the year registered an increase over the preceding year, but in 1928 outgoing shipments again fell off, and the decending trend continued during 1929. The decline in Japan's export trade in matches is clearly demonstrated by the following figures showing outgoing shipments from Osaka and Kobe, the center of the domestic match industry, and the point of shipment for the bulk of the exports: 1921—22,468,000 gross boxes ($7,876,000); 1926—12,190,000 gross boxes ($3,230,000); 1927—the year of the recovery—13,569,000 gross boxes (3,872,000); 1928—7,009,000 gross boxes ($2,377,000); 1929—5,693,000 gross boxes ($1,713,000).

The Swedish Match Syndicate has extended its efforts toward amalgamation into the Japanese industry. In September, 1927, the Nippon Match Co., the Koyekisha Match Co. and the Tokyo Match Co. (which was formerly Japan's largest match-making enterprise) combined to form the Daido Match Co. having a share capital of 6,000,000 yen ($2,998,000); the latter organization is reported to be linked with the Swedish Syndicate.

Russia Now Strongest Competitor.

Reports from many quarters of the foreign field during 1929–30 confirm advices from Moscow that the export of Russian matches is on the increase, offering increasingly serious competition to the Swedish Match Syndicate in world markets. The Soviet Customs Bureau reports a doubling of exports (to 18,050 metric tons, or approximately 1,500,000 cases) during the fiscal year, 1928–29, as compared with the preceding year, when outgoing shipments totaled 9,182 metric tons (732,689 cases). In the fiscal year, 1928–29, Germany—which had been a minor market in the preceding year—advanced to a predominantly leading position, receiving half of the total exports. Evidently the concession granted by Germany to the Swedish Syndicate in October, 1929, did not go into effect immediately, as during October and November Germany maintained its position as the best market for Russian matches, receiving 3,483 metric tons of the total two-months Russian exports of 6,129 metric tons. Other important markets for Russian matches during the fiscal year, 1928–29, with the quantities (in metric tons) that were received follow: United Kingdom, 1,338; Persia, 1,689; United States, 1,473; Latvia, 744; Belgium, 418; Turkey, 396; Egypt, 370; Denmark, 301.

In any prediction of the future status of the Russian match in world trade, Russia's large raw material supplies, in the form of extensive aspen forests, should be taken into consideration. In 1926 even Sweden began to import large quantities of matchwood from Russia, but in 1929 these shipments were discontinued.

Russia Secures Larger Participation in United States Market.

During the first five months of 1930 Russia maintained a front-rank position as a supplier of matches to the United States. The totals for the first three months of this year show that among the suppliers of matches to the United States Russia led by a slight margin. In April, however, Russian matches failed to maintain their position among the abnormally large imports, nearly half of which originated in Sweden. Total imports of matches from Russia during May were still high, amounting to 176,770 gross boxes, valued at $64,420, but in June these imports fell to 46,825 gross boxes, worth $18,380.

Bulk of United States Match Export Marketed in Western Hemisphere.

Approximately three-fifths of the value of the United States export trade in matches is consigned to markets in the Western Hemisphere. A large part of the remaining trade proceeds to the United Kingdom—our second leading market. Taking the United States export of 641,897 pounds, valued at $77,235 during the first half of 1930 as a criterion, it would seem that total outgoing shipments this year will surpass last year's total (1,131,407 pounds, valued at $137,537) by an appreciable margin. This is largely in consequence of expansion in our best market—Canada—although this gain is partially offset by a decline in 1930 shipments to the United Kingdom. Leading markets for United States matches in the order of their importance during the first half of 1930 follow: Canada, the United Kingdom, Honduras, Philippine Islands, other British West Indies, Haiti, Virgin Islands, and the Netherlands.

See also—
Cable review, Far East: Australian conditions unimproved.
Tariffs and trade regulations:
Australia considers applications for higher duties.
British Honduras abolishes import duty on weed killer.
Canadian import duties increased.
Foreign trade opportunities.

The Matchbox as Cultural Artifact

Swedish Match understood that matches weren't just tools—they were objects of daily ritual, seen and handled multiple times a day. The company invested heavily in graphic design, commissioning artists to create labels that resonated with local consumers.

In Africa, labels featured lions, camels, and tribal motifs. In Asia, dragons, deities, and calligraphy adorned the boxes. In Europe, medals and crests signalled quality and heritage. These designs weren't arbitrary—they were carefully curated semiotic systems, embedding Swedish products into the visual lexicon of foreign cultures.

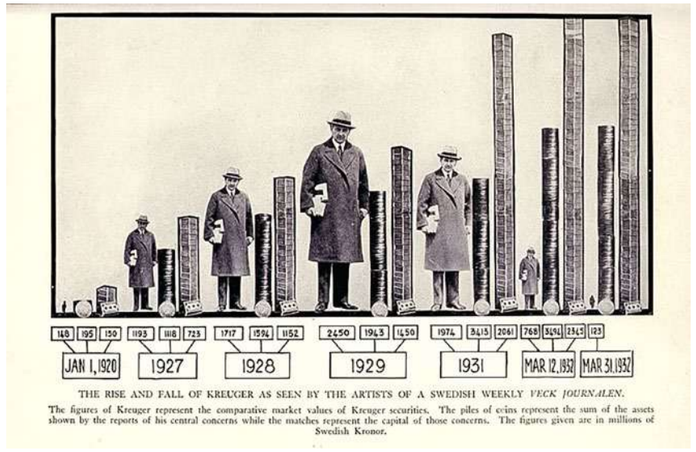
The company also standardized its packaging: rectangular boxes, striking surfaces on the side, and consistent wood quality. This uniformity reinforced brand trust, while the label diversity allowed for regional customization. Swedish Match became a master of glocalization—global production with local branding.

Monopoly Meets Mortality

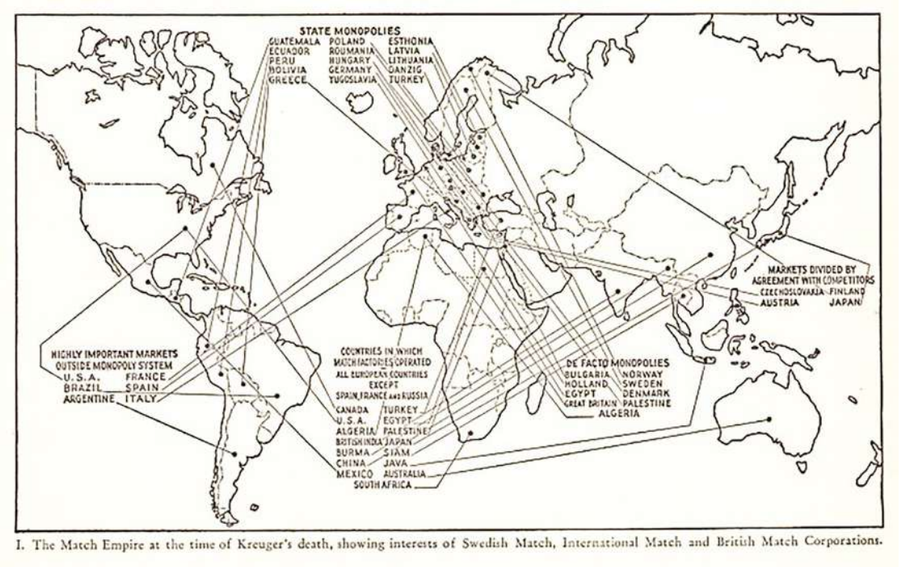
The meteoric rise of Swedish Match was inseparable from the personality of Ivar Kreuger. Dubbed the "Match King," he was admired for his financial acumen and feared for his monopolistic ambition. But his empire was built on complex debt structures, and when the global economy faltered in the early 1930s, cracks began to show.

In 1932, Kreuger died under mysterious circumstances—officially ruled a suicide, though speculation persists. His death triggered a financial collapse, revealing that many of his loans were unsecured or fictitious. Governments revoked match concessions, and Swedish Match lost its grip on several key markets.

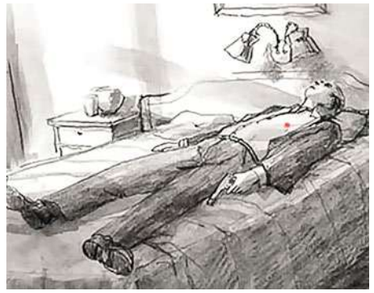
The company survived, but the dream of a global monopoly died with Kreuger. Swedish Match was restructured, and its operations became more decentralized. The post-Kreuger era saw a shift from imperial ambition to regional resilience, with the company focusing on quality, branding, and niche markets.



301. Ivar Krueger, c. 1920; 302. Market value of Ivar Krueger's securities



303. Ivar Krueger's match empire networks, 1932



The New York Times.

LATE CITY EDITION • 2CENTS — NEW YORK, MONDAY, MARCH 14, 1932

THE MATCH KING IS DEAD

Ivar Kreuger was discovered today by his personal assistant, a bullet through his heart and a gun by his hand. The financier and popular hero, whose empire was built on his international match monopoly, had shot himself in his Paris hotel.

Ivar Kreuger, "The Match King"

WIELDING POWER IN SECRET

ENDS LIFE IN PARIS

Letters Tell of His Plan to Die Because of Poor Health and Reverses.

ASSOCIATES AWAITED HIM

Body Is Found Fully Clothed on Bed With Pistol Wound Under Heart.

HIS STOCKS SOLD HERE

A FAMOUS MATCH MAGNATE

EFFECT IN SWEDEN

PANIC HITS LEADING BANKS

Following Ivar Kreuger's suicide, the world's leading bankers nervously await news on some forged Italian bonds.

SWEDEN AUTHORIZES PRIVATE MORATORIA

ACTS TO AID KREUGER FIRMS

Stockholm Stock Exchange to Be Closed Tomorrow and Possibly Longer.

304. &305. Ivar Krueger suicide, 1932
The murder of Kreuger: Several people who investigated Kreuger's death claim that he was actually murdered. There is a lot that is fishy about his death. He was found in his bedroom in Paris shot in the chest and with a gun in his left hand. The gun was found in Kreuger's left hand, but he was actually right-handed. That he would also not be able to shoot himself in the chest with one hand and then after his death hold the gun is quite clear. His brother Torsten spoke to him the day before and describes the conversation as follows: "Ivar Kreuger was calm and optimistic when I spoke to him on the phone the day before his death." In retrospect, economic analyses of his company show that he had much more capital to draw on if he had needed to. The company's finances were solid despite the attacks. Kreuger had a scheduled meeting with the Governor of Sweden's Riksbank just a few hours after his death. Why would he book an important meeting if he was going to kill himself anyway?

Much has been written about the circumstances of his death. In short, you can say that there were definitely motives for murder. Technical evidence speaks for murder and really nothing speaks for suicide.

The Postwar Landscape

After World War II, the match industry faced new challenges. The rise of disposable lighters, electric stoves, and automated ignition systems reduced demand for matches. In urban areas, matches became increasingly redundant, while in rural zones, cheaper imports from India and China flooded the market.

Swedish Match responded by diversifying. It entered the lighter business, acquired tobacco companies, and invested in industrial chemicals. Match production continued, but it was no longer the company's core identity.

By the 1970s, many of its overseas factories had closed or been sold. In India, Sivakasi's cottage industry outpaced Swedish imports. In Japan, domestic firms like Kouekisha and Seisuisha dominated. In Africa, state monopolies and local producers took over.

Yet Swedish Match retained its symbolic power. Its labels—especially the Three Stars, Solstickan, and Crown—became collector's items, preserved in museums and phillumenic archives. The matchbox, once a tool of empire, became a cultural artifact, evoking nostalgia, design history, and industrial memory.

Fire as Identity

The rise and fall of the Swedish Match Syndicate is more than a business story—it's a meditation on how mundane objects carry extraordinary meaning. Matches bridged chemistry and culture, labour and branding, safety and symbolism.

Swedish Match succeeded not just because it made good matches, but because it understood the semiotics of fire. It turned a daily necessity into a visual language, embedding Swedish identity into the hands of millions across continents.

Its decline was inevitable—technological shifts, ethical reckonings, and global competition made monopoly unsustainable. But its legacy endures in the labels, boxes, and stories that remain. In every vintage matchbox lies a flicker of industrial ambition, a spark of design ingenuity, and a quiet testament to the power of fire.

306- 308. Some Swedish Match brands across the world today

8

The Rise and Decline of the Indian Match Industry

Imported Fire and Early Imitation

In the early 20th century, India's match industry was not yet its own. Matches were imported from Sweden, Germany, and Japan, often arriving in boxes adorned with lions, elephants, and imperial crests. Swedish firms like Jönköping Tändstickskor, and later the Swedish Match AB dominated the market, exporting safety matches labelled *Allumettes Suédoises* or *Elephant Brand*, tailored to colonial tastes and regional symbolism.

These imports were more than commodities—they were visual ambassadors of foreign industrial identity, and their labels often featured Tamil, Bengali, or Hindi script, despite being manufactured thousands of miles away. The matchbox became a site of cultural translation, where European safety standards met Indian consumer ritual.

Yet beneath this visual diplomacy lay a growing desire for Swadeshi production. The nationalist movement, especially after 1905, called for the rejection of foreign goods. Matches, being both ubiquitous and symbolic, became a target. By the 1910s, small-scale production began in Calcutta, reportedly influenced by Japanese immigrants who introduced semi-mechanized techniques. These early factories were rudimentary, but they sparked a revolution.

Match Manufacturing in India

Founded in 1875 in Ahmedabad, the Gujarat Islam Match Manufacturing Company is recognized as India's earliest known match factory. It emerged during a period when the country was heavily reliant on imported matches—primarily from Sweden, Japan, and other European nations.

Despite its pioneering status, the factory struggled to achieve commercial viability. The broader Indian match industry did not gain momentum until the 1920s, due to challenges like insufficient capital, lack of skilled labor, and limited infrastructure.

A notable episode occurred during World War I, when the factory petitioned the British colonial government for permission to resume the use of white phosphorus—a highly toxic but effective ignition agent—in its match production. The request was denied, reflecting growing global concerns over phosphorus-related health hazards.

Although Gujarat Islam Match Factory did not evolve into a major industrial force, its early efforts laid the groundwork for later developments. It remains a symbol of pre-independence industrial ambition, and its legacy is occasionally referenced in discussions of India's phillumenic heritage.

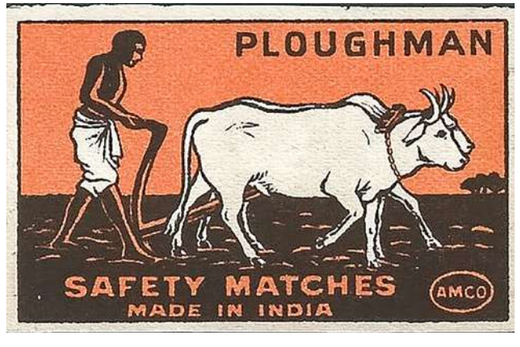
The other early developments in Indian match manufacturing are given in the table below.

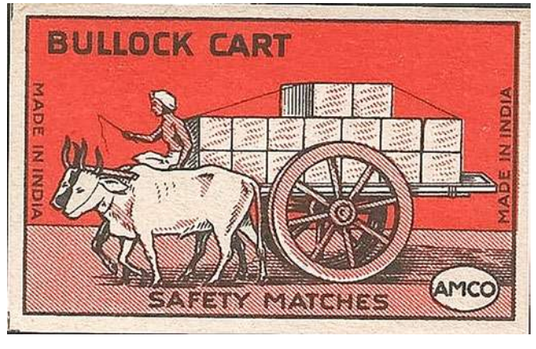
Table: Early Match Factories in India and Burma (1923–1930s)

Factory Name	*Location*	*Founded*	*Ownership/ Notes*
Esavi India Match Manufacturing Co.	Calcutta	1923	Indian-owned; part of post-WWI indigenous industrial push
Adamjee Dawood & Company	Rangoon (Pazundaung)	1923- 1924	Founded by Sir Adamjee Haji Dawood; employed ~1,400 workers; German/Japanese machinery
Mahalaksmi Match Factory	Lahore	1925- 1926	Equipped with modern machinery
Bareilly Match Works	Bareilly	1925- 1926	Technically advanced; part of domestic expansion
Swedish Match Company	Ambernath, Calcutta, Parel, Burma, Mandalay	1924- 1926	Swedish-owned; later absorbed into WIMCO
Assam Match Company (AMCO)	Dhubri	1925/ 1926	Operated independently; later absorbed into WIMCO; employed ~500 workers
Sivakasi Match Industry	Sivakasi, Tamil Nadu	1930s onward	Indigenous, decentralized; became India's largest match-producing region post-1950s

309. Gujarat Islam Match Manufacturing Company matchbox label; 310. Sir Adamjee Haji Dawood, 1880-1948

311- 313. Adamjee Haji Dawood & Co. matchbox labels





314. & 315. Adamjee Haji Dawood & Co. matchbox labels

Sivakasi and the Rise of Cottage Industry

The true ignition of India's match industry came from the south. In 1923, two enterprising brothers—A. Shanmuga Nadar and Ayya Nadar—visited Calcutta and observed Japanese-style match production. Inspired, they returned to Sivakasi, a small town in Tamil Nadu, and established the first match factory using imported machinery and local labour.

316. P. Ayya Nadar & Janaki Ammal

Sivakasi's rise was meteoric. By the 1940s, it had become the epicentre of Indian match-making, combining cottage labour, family-run units, and semi-mechanized production. The region's dry climate, access to timber, and entrepreneurial networks made it ideal for match manufacturing.

Matchboxes from Sivakasi were visually rich—featuring gods, animals, bicycles, pressure cookers, and political slogans. These labels weren't just decorative; they were narratives of aspiration, reflecting both rural life and modernity.

317. Sivakasi match factories

From Monopoly to Margins

Sweden's role in the Indian match industry evolved from dominance to partnership. In the early 20th century, Swedish Match AB exported heavily to India, often through colonial intermediaries. Their labels—Elephant Brand, Three Stars, Crouching Lion—became household names.

But as Indian production grew, Swedish firms adapted. They began licensing their brands to Indian manufacturers, allowing local firms to produce matches under Swedish trademarks. This hybrid model preserved brand prestige while supporting domestic labour.

However, Sweden's influence waned after Ivar Kreuger's death in 1932 and the collapse of his financial empire. The global match monopoly unravelled, and Indian producers—especially in Sivakasi—filled the vacuum. By the 1950s, India had become largely self-sufficient, with Swedish imports relegated to niche markets.

Mid-Century Boom

Post-independence, the Indian government recognized the match industry's potential for employment generation and rural development. Policies incentivized small-scale units, and match-making became a state-supported cottage industry. Tamil Nadu, Andhra Pradesh, and

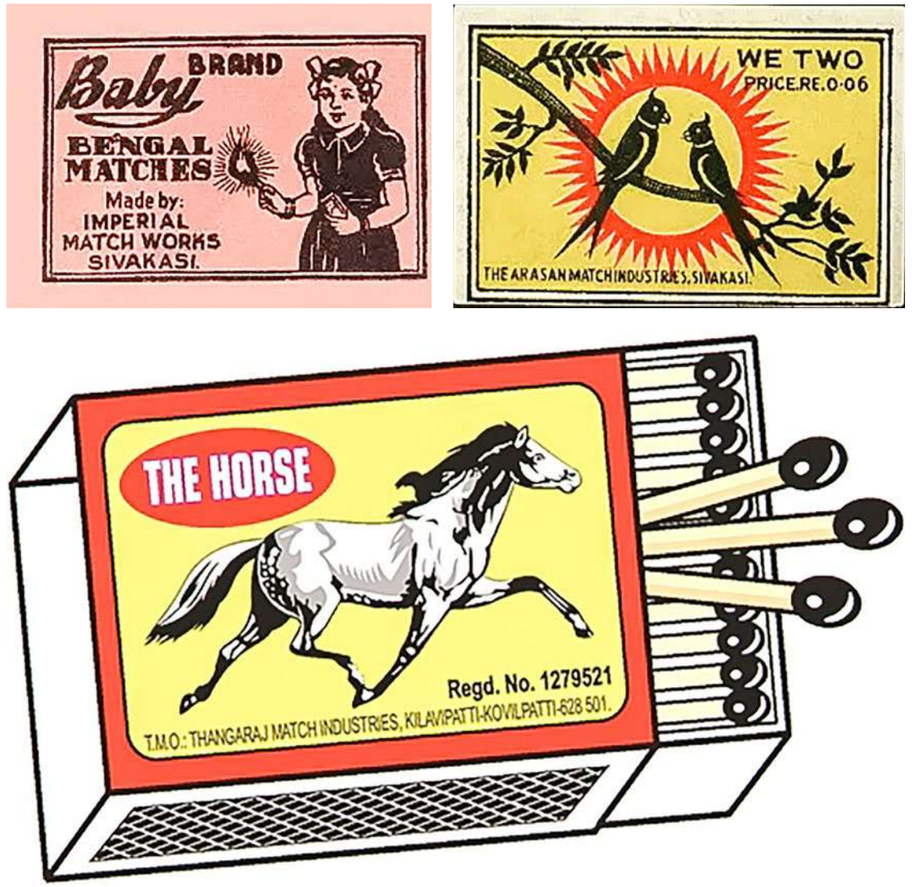
Kerala saw thousands of family-run factories emerge, often employing women and children. By the 1970s, India was one of the largest match producers in the world, exporting to Africa, Southeast Asia, and the Middle East. Brands like Anil, Baby, We Two, and Horse Brand became export staples, often customized for regional markets.

Yet this boom carried contradictions. The industry was labour-intensive, with low wages and minimal safety standards. Child labour was widespread, and environmental concerns grew over deforestation and chemical exposure. The matchbox, once a symbol of Swadeshi pride, became a site of ethical reckoning.

318- 320. India's freedom movement theme on matchbox labels

The Lighter Era

The late 20th century brought new challenges. The rise of disposable lighters, gas stoves, and electric ignition systems eroded match demand—especially in urban areas. Imports from China and Indonesia flooded the market, offering cheaper alternatives with slick packaging.



321- 323. Some local popular matchbox brands

Indian match producers struggled to compete. Raw material costs rose—red phosphorus, potassium chlorate, and timber became volatile commodities. Labor unrest and regulatory pressures added to the burden. Many small factories closed, and others shifted to semi-automation to survive.

Sivakasi, once the heart of the industry, saw a gradual decline. While some firms diversified into fireworks and printing, match production became a secondary activity. The matchbox, once a daily ritual, faded from urban life.

The Matchbox as Archive

Despite its decline, the Indian matchbox remains a cultural artifact. Collectors, designers, and historians have begun to preserve its legacy—not as a commodity, but as a visual archive of industrial India.

Labels from the 1950s to 1980s capture a unique blend of folk art, commercial branding, and political messaging. They feature everything from Shiva and Gandhi to tractors and telephones, reflecting the aspirations of a newly independent nation.

Survival and Reinvention

Today, the Indian match industry survives in geographical pockets. Tamil Nadu still hosts active factories, though many have shifted to eco-friendly practices, using plantation wood and synthetic alternatives. Some firms produce long-burning matches, waterproof variants, or aroma-infused boxes for niche markets.

Export continues, especially to Nigeria, Kenya, and Sri Lanka, where matches remain essential. But the domestic market is shrinking, and competition from lighters and imports remains fierce.

Efforts to modernize include:

- Semi-automation to reduce labour dependency
- Skill development programs for workers
- Branding campaigns that highlight heritage and quality
- Diversification into related products like incense sticks and fire starters

Yet the industry's future is uncertain. Without sustained investment, ethical reform, and market adaptation, the matchbox may remain more museum piece than marketplace item.

Fire, Labor, and Identity

The Indian match industry is more than a tale of production—it's a story of labour, identity, and visual culture. From Swedish imports to Swadeshi pride, from cottage factories to export empires, matches have lit more than stoves—they've illuminated the contours of a changing nation.

Its decline is not just economic—it's symbolic. As fire becomes automated, the rituals of striking a match fade. But in every vintage label, in every worn box, there remains a spark of memory—a testament to the hands that made them, the stories they carried, and the quiet dignity of industrial craft.

Year	Brand/ Company	Region	Notes & Significance
1923	National Match Works	Calcutta (West Bengal)	Among India's earliest domestic producers; inspired by Japanese semi-mechanized models.
1930s	Elephant Brand (Swedish Match India)	Imported via Madras & Calcutta	Swedish export label tailored for Indian market; later licensed to Indian producers.
1940s	Anil Match Works	Sivakasi (Tamil Nadu)	One of the first major cottage units; famous for squirrel motif and rural branding.
1950s	Baby Brand	Sivakasi	Popular domestic label; known for playful imagery and mass-market appeal.
1960s	We Two	Sivakasi	Introduced gendered branding; often featured couple imagery and domestic motifs.
1970s	Horse Brand	Andhra Pradesh	Strong rural distribution; known for bold animal iconography and export variants.

1980s	WIMCO Ship / Sun / Crane	Pan-India (WIMCO factories)	Mechanized production; clean design; legacy of Swedish industrial aesthetics.
1990s	Aim / IKNO / Homelite	ITC-acquired brands	Repackaged WIMCO labels under ITC; distributed nationally via FMCG channels.
2000s	Matchwell / KTC / KTC Gold	Sivakasi & Kerala	Regional brands with export focus; often featured religious and patriotic motifs.
2010s	Eco Match / Aroma Match	Tamil Nadu	Niche innovations—long-burning, scented, waterproof matches for urban and export markets.
2020s	Revived Legacy Labels	Outsourced via ITC	Brands like *Ship* and *Aim* still sold, but produced by small-scale units in Tamil Nadu.

Table: Matchbox Prices in India (1920s–2020s)

Decade	Estimated Retail Price	Context & Notes
1920s	₹0.01 – ₹0.02 (1–2 paise)	Mostly imported from Sweden/Japan; matchboxes were a luxury for rural households.
1930s	₹0.02 – ₹0.03	Domestic production begins; Calcutta and Sivakasi emerge; Swadeshi movement grows.
1940s	₹0.03 – ₹0.05	WWII disruptions; rise in local manufacturing; inflation due to wartime economy.
1950s	₹0.05	Confirmed price point; matchboxes become widely accessible across India.
1960s	₹0.05 – ₹0.10	Stable pricing; expansion of cottage industry; branding flourishes.
1970s	₹0.10 – ₹0.20	Gradual inflation; matchboxes remain essential in rural and urban households.
1980s	₹0.20 – ₹0.25	Industrial diversification; WIMCO and Sivakasi dominate; price stability persists.
1990s	₹0.25 – ₹0.50	First major hike in **1995**, doubling price from 25 paise to 50 paise.
2000s	₹0.50 – ₹1.00	Second hike in **2007**, price doubles again due to rising raw material costs.
2010s	₹1.00	Price remains stable for 14 years; matchboxes still dominant in rural India.
2020s	₹2.00	Price doubled in **2021** due to pandemic, inflation, and supply chain issues.

9

Wimco – Sweden's Industrial Spark in India

Imported Fire and Industrial Ambition

The story of WIMCO—the Western India Match Company—begins in 1923, at a time when India's match industry was still in its infancy. Matches were largely imported from Sweden, Germany, and Japan, with boxes bearing lions, elephants, and imperial crests. Swedish Match AB, led by the ambitious financier Ivar Kreuger, dominated global production and saw India as a promising market for expansion.

WIMCO was established as a joint venture between Swedish Match and Indian industrialists, notably the Jatia Group, who would later become key stakeholders. Headquartered in Mumbai, WIMCO was envisioned not as a cottage enterprise, but as a fully mechanized factory, modelled on European industrial standards. It was the first of its kind in India—a bold transplant of Scandinavian precision into colonial infrastructure.

Building a National Network

Unlike the handmade matches of Sivakasi, WIMCO's production relied on automated machinery, chemical control, and standardized packaging. Its early labels—*Ship, Crane, Sun, Three Stars*—were either direct imports or licensed reproductions of Swedish designs. These boxes carried not just fire, but the visual and technological imprint of Sweden's industrial ethos. Over the next four decades, WIMCO expanded its footprint across India.

Table: WIMCO plants across India

Location	State	Established	Key Features
Ambernath	Maharashtra	1940s	Chlorate plant, mechanized production, R&D hub
Bareilly	Uttar Pradesh	1950s	Cardboard matchbox production, large-scale mechanization
Chennai (Madras)	Tamil Nadu	1960s	Southern distribution hub, semi-mechanized units

Calcutta	West Bengal	1950s	Eastern market access, export-oriented production
Dhubri	Assam	1960s	Northeast outreach, small-scale mechanized unit

These factories were vertically integrated, with chlorate plants, glue factories, and even paper mills. WIMCO also pioneered cardboard matchboxes, reducing reliance on wood and introducing more sustainable packaging. At its peak, WIMCO contributed nearly 18% of India's match production, setting the benchmark for quality and consistency.

324- 328. WIMCO matchbox labels

329. &330. WIMCO matchbox labels

From Swedish Minimalism to Indian Mass Appeal

WIMCO's matchboxes were iconic. They featured clean typography, bold symbols, and often bilingual labelling. Unlike the folk-art style of Sivakasi labels, WIMCO's designs leaned toward modernist minimalism, reflecting its European lineage. Yet the company also adapted to Indian tastes, launching brands like *Ship, Sun, and Crane*, which became household names.

These boxes were distributed across India and exported to Africa, Southeast Asia, and the Middle East, often competing directly with Japanese and Chinese imports. WIMCO's branding strategy emphasized clarity, safety, and industrial trust, positioning its products as superior alternatives to cottage-made matches.

Diversification and Strategic Shifts

In the 1970s and 1980s, WIMCO diversified into salt production, packaging machinery, and fruit processing. It even set up a bromine recovery plant and partnered with Swedish firms to recover industrial gases from chlorate production. These ventures reflected a broader ambition to become a multi-sector industrial player, not just a match manufacturer.

However, the 1990s brought new challenges. The rise of disposable lighters, gas stoves, and electric ignition systems eroded match demand—especially in urban areas. Imports from China and Indonesia flooded the market, offering cheaper alternatives with slick packaging. WIMCO struggled to compete with low-cost cottage producers and foreign brands.

331. WIMCO Factory; 332. WIMCO Matches Dhubri site

Ownership Transitions: From Swedish Match AB to ITC

In October 2000, Swedish Match AB reacquired a 21.89% stake in WIMCO from the Jatia Group, but by 2005, it decided to exit India entirely. The global match monopoly was unravelling, and WIMCO's mechanized model was no longer sustainable.

Enter ITC Limited, one of India's largest FMCG conglomerates. Through its subsidiary Russell Credit, ITC acquired a 74% stake in WIMCO in 2005, and later consolidated its ownership to 96.82% by 2011, making WIMCO a direct subsidiary.

This move allowed ITC to:

- Expand its footprint in the safety match segment
- Consolidate brands like Ship, Aim, IKNO, and Homelite
- Leverage WIMCO's legacy and distribution networks

However, ITC did not continue WIMCO's mechanized production. Instead, it outsourced match manufacturing to small-scale units in Tamil Nadu, preserving the brand names but transforming the production model.

333. Homelites WIMCO; 334. Homelites ITC

From Factory to Archive

Despite ITC's acquisition, WIMCO's original factories—located in Ambernath, Bareilly, Chennai, Calcutta, and Dhubri—were all shut down, the last one closing in the 2010s. Rising production costs, labour unrest, and changing consumer habits made mechanized match-making unviable.

Today, WIMCO-branded matches are still sold, but they are produced by outsourced cottage units, often in Sivakasi. The labels—Ship, Aim, IKNO—remain familiar, but the industrial infrastructure behind them has vanished.

The Match is dead, long live the Match

The match industry once lit the world—literally and symbolically. From the flick of a splint came fire for hearths, factories, and rituals. But behind each flame lay a trail of timber, chemicals, and labour. Forests were felled for softwood splints, soil and water bore the scars of phosphorus compounds, and packaging waste piled up with every exported crate.

In Sweden, Russia, and India, match production shaped landscapes and livelihoods. White phosphorus, once essential, poisoned workers and ecosystems until global bans forced safer alternatives. Timber extraction, especially in boreal[6] and tropical zones, strained local ecologies. Even the humble matchbox—designed for disposability—became a quiet contributor to global waste.

Yet matches survive. Not in the gleam of modern kitchens, but in the quiet persistence of rural homes, roadside stalls, and devotional spaces[7]. In Tamil Nadu, small-scale units still dip and box by hand, some embracing solar drying and recycled paper. Others cling to tradition, balancing survival with sustainability.

Technology dimmed the match's dominance, but not its dignity. The industry adapted—not with grand reinvention, but with quiet resilience. Today, matches light incense, lamps, and memory. Their environmental story is one of extraction and endurance, but also of transformation.

The flame may be smaller, but it still burns.

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[6] *Boreal refers to the North or North regions of the world.*

[7] *In devotional spaces, even the hand drill and bow drill continue to survive.*

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Ignition: A Visual History of the Global Match Industry explores the story of fire-making, charting its evolution from primitive techniques to the industrial age of friction matches. By the mid19th century, match production spread rapidly across Europe, the United States, and Japan, turning a simple flame into a global commodity. Sweden rose as the leader, pioneering safety matches and exporting billions of boxes whose colorful labels became trademarks and miniature artworks. Colonial markets such as India and Burma absorbed vast imports before developing their own factories, while Sivakasi in Tamil Nadu grew into a matchmaking hub. Illustrated with archival photographs of labels, factories, and innovators, this book captures the interplay of technology, commerce, and culture in the age of fire and light.

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